

Academic Reading in Science

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1 Preface

- 1. General Service Word list**
- 2. Academic Word List**
- 3. Extensive Reading**

1.1 The General Service Word List

The General Service Word List is a list of 2284 words considered to be most useful to a student of English. Each of the words in the list is a headword representing many similar words of a family. Although the list is rather long, especially considering that each word on the list represents other words, a student of academic reading should already have a good knowledge of these words. Even if you believe you know all of the words on the list, you should still review them from time to time.

John Bauman and Brent Culligan created the list in 1995.

a	ambition	aunt	better	bundle
ability	ambitious	autumn	between	burn
able	among	avenue	beyond	burst
about	amongst	average	bicycle	bury
above	amount	avoid	big	bus
abroad	amuse	avoidance	bill	bush
absence	ancient	awake	bind	business
absent	and	away	bird	businesslike
absolute	anger	awkward	birth	businessman
accept	angle	axe	bit	busy
accident	angry	baby	bite	but
accord	animal	back	bitter	butter
account	annoy	backward	black	button
accuse	annoyance	bad	blade	buy
accustom	another	bag	blame	by
ache	answer	baggage	bleed	cage
across	anxiety	bake	bless	cake
act	anxious	balance	blind	calculate
action	any	ball	block	calculation
active	anybody	band	blood	calculator
actor	anyhow	bank	blow	call
actress	anyone	bar	blue	calm
actual	anything	barber	board	camera
add	anyway	bare	boast	camp
address	anywhere	bargain	boat	can
admire	apart	barrel	body	canal
admission	apology	base	boil	cap
admit	appear	basic	bold	cape
adopt	appearance	basin	bone	capital
adoption	applaud	basis	book	captain
advance	applause	basket	border	car
advantage	apple	bath	borrow	card
adventure	application	bathe	both	care
advertise	apply	battle	bottle	carriage
advice	appoint	bay	bottom	carry
advise	approve	be	bound	cart
affair	arch	beak	boundary	case
afford	argue	beam	bow	castle
afraid	arise	bean	bowl	cat
after	arm	bear	box	catch
afternoon	army	beard	boy	cattle
again	around	beast	brain	cause
against	arrange	beat	branch	caution
age	arrest	beauty	brass	cautious
agency	arrive	because	brave	cave
agent	arrow	become	bravery	cent
ago	art	bed	bread	center
agree	article	bedroom	breadth	century
agriculture	artificial	before	break	ceremony
ahead	as	beg	breakfast	certain
aim	ash	begin	breath	certainty
air	ashamed	behave	breathe	chain
airplane	aside	behavior	bribe	chair
alike	ask	behind	bribery	chairman
alive	asleep	being	brick	chalk
all	association	belief	bridge	chance
allow	astonish	believe	bright	change
allowance	at	bell	brighten	character
almost	attack	belong	bring	charge
alone	attempt	below	broad	charm
along	attend	belt	broadcast	cheap
aloud	attention	bend	brother	cheat
already	attentive	beneath	brown	check
also	attract	berry	brush	cheer
although	attraction	beside	bucket	cheese
altogether	attractive	besides	build	chest
always	audience	best	bunch	chicken

chief	compose	cry	descent	doubt
child	composition	cultivate	describe	down
childhood	concern	cultivation	description	dozen
chimney	condition	cultivator	desert	drag
choice	confess	cup	deserve	draw
choose	confession	cupboard	desire	drawer
Christmas	confidence	cure	desk	dream
church	confident	curious	despair	dress
circle	confidential	curl	destroy	drink
circular	confuse	current	destruction	drive
citizen	confusion	curse	destructive	drop
city	congratulate	curtain	detail	drown
civilize	congratulation	curve	determine	drum
claim	connect	cushion	develop	dry
class	connection	custom	devil	duck
classification	conquer	customary	diamond	due
classify	conqueror	customer	dictionary	dull
clay	conquest	cut	die	during
clean	conscience	daily	difference	dust
clear	conscious	damage	different	duty
clerk	consider	damp	difficult	each
clever	contain	dance	difficulty	eager
cliff	content	danger	dig	ear
climb	continue	dare	dine	early
clock	control	dark	dinner	earn
close	convenience	darken	dip	earnest
cloth	convenient	date	direct	earth
clothe	conversation	daughter	direction	ease
cloud	cook	day	director	east
club	cool	daylight	dirt	eastern
coal	copper	dead	disagree	easy
coarse	copy	deaf	disappear	eat
coast	cork	deafen	disappearance	edge
coat	corn	deal	disappoint	educate
coffee	corner	dear	disapprove	education
coin	correct	death	discipline	educator
cold	correction	debt	discomfort	effect
collar	cost	decay	discontent	effective
collect	cottage	deceit	discover	efficiency
collection	cotton	deceive	discovery	efficient
collector	cough	decide	discuss	effort
college	could	decision	discussion	egg
colony	council	decisive	disease	either
color	count	declare	disgust	elastic
comb	country	decrease	dish	elder
combine	courage	deed	dismiss	elect
come	course	deep	disregard	election
comfort	court	deepen	disrespect	electric
command	cousin	deer	dissatisfaction	electrician
commerce	cover	defeat	dissatisfy	elephant
commercial	cow	defend	distance	else
committee	coward	defendant	distant	elsewhere
common	cowardice	defense	distinguish	empire
companion	crack	degree	district	employ
companionship	crash	delay	disturb	employee
company	cream	delicate	ditch	empty
compare	creature	delight	dive	enclose
comparison	creep	deliver	divide	enclosure
compete	crime	delivery	division	encourage
competition	criminal	demand	do	end
competitor	critic	department	doctor	enemy
complain	crop	depend	dog	engine
complaint	cross	dependence	dollar	engineer
complete	crowd	dependent	donkey	English
completion	crown	depth	door	enjoy
complicate	cruel	descend	dot	enough
complication	crush	descendant	double	enter

entertain	fame	foreign	governor	heighten
entire	familiar	forest	grace	hello
entrance	family	forget	gradual	help
envelope	fan	forgive	grain	here
envy	fancy	fork	grammar	hesitate
equal	far	form	grammatical	hesitation
escape	farm	formal	grand	hide
especially	fashion	former	grass	high
essence	fast	forth	grateful	highway
essential	fasten	fortunate	grave	hill
even	fat	fortune	gray	hinder
evening	fate	forward	grease	hindrance
event	father	frame	great	hire
ever	fatten	framework	greed	history
everlasting	fault	free	green	hit
every	favor	freedom	greet	hold
everybody	favorite	freeze	grind	hole
everyday	fear	frequency	ground	holiday
everyone	feast	frequent	group	hollow
everything	feather	fresh	grow	holy
everywhere	feed	friend	growth	home
evil	feel	friendly	guard	homecoming
exact	fellow	friendship	guess	homemade
examine	fellowship	fright	guest	homework
example	female	frighten	guide	honest
excellence	fence	from	guilt	honesty
excellent	fever	front	gun	honor
except	few	fruit	habit	hook
exception	field	fry	hair	hope
excess	fierce	full	half	horizon
excessive	fight	fun	hall	horizontal
exchange	figure	funeral	hammer	horse
excite	fill	funny	hand	hospital
excuse	film	fur	handkerchief	host
exercise	find	furnish	handle	hot
exist	fine	furniture	handshake	hotel
existence	finger	further	handwriting	hour
expect	finish	future	hang	house
expense	fire	gaiety	happen	how
expensive	firm	gain	happy	however
experience	first	gallon	harbor	human
experiment	fish	game	hard	humble
explain	fit	gap	harden	hunger
explode	fix	garage	hardly	hunt
explore	flag	garden	harm	hurrah
explosion	flame	gas	harvest	hurry
explosive	flash	gate	haste	hurt
express	flat	gather	hasten	husband
expression	flatten	gay	hat	hut
extend	flavor	general	hate	I
extension	flesh	generous	hatred	ice
extensive	float	gentle	have	idea
extent	flood	gentleman	hay	ideal
extra	floor	get	he	idle
extraordinary	flour	gift	head	if
extreme	flow	girl	headache	ill
eye	flower	give	headdress	imaginary
face	fly	glad	heal	imaginative
fact	fold	glass	health	imagine
factory	follow	glory	heap	imitate
fade	fond	go	hear	imitation
fail	food	goat	heart	immediate
failure	fool	god	heat	immense
faint	foot	gold	heaven	importance
fair	for	golden	heavenly	important
faith	forbid	good	heavy	impossible
fall	force	govern	height	improve

in	knife	load	membership	nation
inch	knock	loaf	memory	native
include	knot	loan	mend	nature
inclusive	know	local	mention	near
increase	knowledge	lock	merchant	neat
indeed	lack	lodge	mercy	necessary
indoor	ladder	log	mere	necessity
industry	lady	lonely	merry	neck
influence	lake	long	message	need
influential	lamp	look	messenger	needle
inform	land	loose	metal	neglect
ink	landlord	loosen	middle	neighbor
inn	language	lord	might	neighborhood
inquire	large	lose	mild	neither
inquiry	last	loss	mile	nephew
insect	late	lot	milk	nest
inside	lately	loud	mill	net
instant	latter	love	mind	network
instead	laugh	lovely	mine	never
instrument	laughter	low	mineral	new
insult	law	loyal	minister	news
insurance	lawyer	loyalty	minute	newspaper
insure	lay	luck	miserable	next
intend	lazy	lump	misery	nice
intention	lead	lunch	miss	niece
interest	leadership	lung	mistake	night
interfere	leaf	machine	mix	no
interference	lean	machinery	mixture	noble
international	learn	mad	model	nobody
interrupt	least	madden	moderate	noise
interruption	leather	mail	moderation	none
into	leave	main	modern	noon
introduce	left	make	modest	nor
introduction	leg	male	modesty	north
invent	lend	man	moment	northern
invention	length	manage	momentary	nose
inventor	lengthen	mankind	money	not
invite	less	manner	monkey	note
inward	lessen	manufacture	month	notebook
iron	lesson	many	moon	nothing
island	let	map	moonlight	notice
it	letter	march	moral	noun
jaw	level	mark	more	now
jealous	liar	market	moreover	nowadays
jealousy	liberty	marriage	morning	nowhere
jewel	librarian	marry	most	nuisance
join	library	mass	mother	number
joint	lid	master	motherhood	numerous
joke	lie	mat	motherly	nurse
journey	life	match	motion	nursery
joy	lift	material	motor	nut
judge	light	matter	mountain	oar
juice	lighten	may	mouse	obedience
jump	like	maybe	mouth	obedient
just	likely	meal	move	obey
justice	limb	mean	much	object
keep	limit	meantime	mud	objection
key	line	meanwhile	multiplication	observe
kick	lip	measure	multiply	occasion
kill	lipstick	meat	murder	ocean
kind	liquid	mechanic	music	of
king	list	mechanism	musician	off
kingdom	listen	medical	must	offend
kiss	literary	medicine	mystery	offense
kitchen	literature	meet	nail	offer
knee	little	melt	name	office
kneel	live	member	narrow	officer

official	pastry	pool	prove	regret
often	path	poor	provide	regular
oil	patience	popular	public	rejoice
old	patient	population	pull	relate
old-fashioned	patriotic	position	pump	relation
omission	pattern	possess	punctual	relative
omit	pause	possession	punish	relief
on	paw	possessor	pupil	relieve
once	pay	possible	pure	religion
one	peace	post	purple	remain
only	pearl	postpone	purpose	remark
onto	peculiar	pot	push	remedy
open	pen	pound	put	remember
operate	pencil	pour	puzzle	remind
operation	penny	poverty	qualification	rent
operator	people	powder	qualify	repair
opinion	per	power	quality	repeat
opportunity	perfect	practical	quantity	repetition
oppose	perfection	practice	quarrel	replace
opposite	perform	praise	quart	reply
opposition	performance	pray	quarter	report
or	perhaps	preach	queen	represent
orange	permanent	precious	question	representative
order	permission	prefer	quick	reproduce
ordinary	permit	preference	quiet	reproduction
organ	person	prejudice	quite	republic
organize	persuade	prepare	rabbit	reputation
origin	persuasion	presence	race	request
ornament	pet	present	radio	rescue
other	photograph	preserve	rail	reserve
otherwise	photography	president	railroad	resign
ought	pick	press	rain	resist
ounce	picture	pressure	raise	resistance
out	piece	pretend	rake	respect
outline	pig	pretense	rank	responsible
outside	pigeon	pretty	rapid	rest
outward	pile	prevent	rare	restaurant
over	pin	prevention	rate	result
overcome	pinch	price	rather	retire
overflow	pink	pride	raw	return
owe	pint	priest	ray	revenge
own	pipe	print	razor	review
ownership	pity	prison	reach	reward
pack	place	private	read	ribbon
package	plain	prize	ready	rice
pad	plan	probable	real	rich
page	plant	problem	realize	rid
pain	plaster	procession	reason	ride
paint	plate	produce	reasonable	right
pair	play	product	receipt	ring
pale	pleasant	production	receive	ripe
pan	please	profession	recent	ripen
paper	pleasure	profit	recognition	rise
parcel	plenty	program	recognize	risk
pardon	plow	progress	recommend	rival
parent	plural	promise	record	rivalry
park	pocket	prompt	red	river
part	poem	pronounce	redden	road
particle	poet	pronunciation	reduce	roar
particular	point	proof	reduction	roast
partner	poison	proper	refer	rob
party	police	property	reference	robbery
pass	polish	proposal	reflect	rock
passage	polite	propose	reflection	rod
passenger	political	protect	refresh	roll
past	politician	protection	refuse	roof
paste	politics	proud	regard	room

root	secret	silent	south	strengthen
rope	secretary	silk	sow	stretch
rot	see	silver	space	strict
rotten	seed	simple	spade	strike
rough	seem	simplicity	spare	string
round	seize	since	speak	strip
row	seldom	sincere	special	stripe
royal	self	sing	speech	stroke
royalty	selfish	single	speed	strong
rub	sell	sink	spell	struggle
rubber	send	sir	spend	student
rubbish	sense	sister	spill	study
rude	sensitive	sit	spin	stuff
rug	sentence	situation	spirit	stupid
ruin	separate	size	spit	subject
rule	separation	skill	spite	substance
run	serious	skin	splendid	succeed
rush	servant	skirt	split	success
rust	serve	sky	spoil	such
sacred	service	slave	spoon	suck
sacrifice	set	slavery	sport	sudden
sad	settle	sleep	spot	suffer
sadden	several	slide	spread	sugar
saddle	severe	slight	spring	suggest
safe	sew	slip	square	suggestion
safety	shade	slippery	staff	suit
sail	shadow	slope	stage	summer
sailor	shake	slow	stain	sun
sake	shall	small	stair	supper
salary	shallow	smell	stamp	supply
sale	shame	smile	stand	support
salesman	shape	smoke	standard	suppose
salt	share	smooth	star	sure
same	sharp	snake	start	surface
sample	sharpen	snow	state	surprise
sand	shave	so	station	surround
satisfaction	she	soap	stay	suspect
satisfactory	sheep	social	steady	suspicion
satisfy	sheet	society	steam	suspicious
sauce	shelf	sock	steel	swallow
saucer	shell	soft	steep	swear
save	shelter	soften	steer	sweat
saw	shield	soil	stem	sweep
say	shilling	soldier	step	sweet
scale	shine	solemn	stick	sweeten
scarce	ship	solid	stiff	swell
scatter	shirt	solution	stiffen	swim
scene	shock	solve	still	swing
scenery	shoe	some	sting	sword
scent	shoot	somebody	stir	sympathetic
school	shop	somehow	stock	sympathy
science	shore	someone	stocking	system
scientific	short	something	stomach	table
scientist	shorten	sometime	stone	tail
scissors	should	sometimes	stop	tailor
scold	shoulder	somewhere	store	take
scorn	shout	son	storm	talk
scrape	show	song	story	tall
scratch	shower	soon	stove	tame
screen	shut	sore	straight	tap
screw	sick	sorrow	straighten	taste
sea	side	sorry	strange	tax
search	sight	sort	strap	taxi
season	sign	soul	straw	tea
seat	signal	sound	stream	teach
second	signature	soup	street	tear
secrecy	silence	sour	strength	telegraph

telephone	tooth	valuable	wherever	yield
tell	top	value	whether	you
temper	total	variety	which	young
temperature	touch	various	whichever	youth
temple	tough	veil	while	
tempt	tour	verb	whip	
tend	toward	verse	whisper	
tender	towel	very	whistle	
tent	tower	vessel	white	
term	town	victory	whiten	
terrible	toy	view	who	
test	track	village	whoever	
than	trade	violence	whole	
thank	train	violent	whom	
that	translate	virtue	whose	
the	translation	visit	why	
theater	translator	visitor	wicked	
theatrical	trap	voice	wide	
then	travel	vote	widen	
there	tray	vowel	widow	
therefore	treasure	voyage	widower	
these	treasury	wage	width	
they	treat	waist	wife	
thick	tree	wait	wild	
thicken	tremble	waiter	will	
thief	trial	wake	win	
thin	tribe	walk	wind	
thing	trick	wall	window	
think	trip	wander	wine	
thirst	trouble	want	wing	
this	true	war	winter	
thorn	trunk	warm	wipe	
thorough	trust	warmth	wire	
those	truth	warn	wisdom	
though	try	wash	wise	
thread	tube	waste	wish	
threat	tune	watch	with	
threaten	turn	water	within	
throat	twist	wave	without	
through	type	wax	witness	
throw	ugly	way	woman	
thumb	umbrella	we	wonder	
thunder	uncle	weak	wood	
thus	under	weaken	wooden	
ticket	underneath	wealth	wool	
tide	understand	weapon	woolen	
tidy	union	wear	word	
tie	unit	weather	work	
tight	unite	weave	world	
tighten	unity	weed	worm	
till	universal	week	worry	
time	universe	weekday	worse	
tin	university	weekend	worship	
tip	unless	weigh	worth	
tire	until	weight	would	
title	up	welcome	wound	
to	upon	well	wrap	
tobacco	upper	west	wreck	
today	uppermost	western	wrist	
toe	upright	wet	write	
together	upset	what	wrong	
tomorrow	urge	whatever	yard	
ton	urgent	wheat	year	
tongue	use	wheel	yellow	
tonight	usual	when	yes	
too	vain	whenever	yesterday	
tool	valley	where	yet	

1.2 The Academic Word List

There are 570 word families in the Academic Word List (Coxhead). These words are divided into 10 sublists, and ranked in order of frequency of their occurrence in academic texts. The most frequent academic words are in sublist 1, and the least frequent words are in sublist 10. Words within a sublist are ordered alphabetically rather than order of frequency. The words in the list below are the most frequent words of each family only. (For a list of family words, see Appendix 8.2).

Coxhead, Averil. (2000). A new academic word list. *TESOL Quarterly*, 34, 213-238.

Sublist 1

analysis	constitutional	established	indicate	occur	role
approach	context	estimate	individual	percent	section
area	contract	evidence	interpretation	period	sector
assessment	create	export	involved	policy	significant
assume	data	factors	issues	principle	similar
authority	definition	financial	labour	procedure	source
available	derived	formula	legal	process	specific
benefit	distribution	function	legislation	required	structure
concept	economic	identified	major	research	theory
consistent	environment	income	method	response	variable

Sublist 2

achieve	community	design	institute	potential	restricted
acquisition	complex	distinction	investment	previous	security
administration	computer	elements	items	primary	sought
affect	conclusion	equation	journal	purchase	select
appropriate	conduct	evaluation	maintenance	range	site
aspects	consequences	features	normal	region	strategies
assistance	construction	final	obtained	regulations	survey
categories	consumer	focus	participation	relevant	text
chapter	credit	impact	perceived	resident	traditional
commission	cultural	injury	positive	resources	transfer

Sublist 3

alternative	convention	emphasis	interaction	philosophy	sex
circumstances	coordination	ensure	justification	physical	shift
comments	core	excluded	layer	proportion	specified
compensation	corporate	framework	link	published	sufficient
components	corresponding	funds	location	reaction	task
consent	criteria	illustrated	maximum	registered	technical
considerable	deduction	immigration	minorities	reliance	techniques
constant	demonstrate	implies	negative	removed	technology
constraints	document	initial	outcomes	scheme	validity
contribution	dominant	instance	partnership	sequence	volume

Sublist 4

access	communication	error	internal	parallel	resolution
adequate	concentration	ethnic	investigation	parameters	retained
annual	conference	goals	job	phase	series
apparent	contrast	granted	label	predicted	statistics
approximated	cycle	hence	mechanism	principal	status
attitudes	debate	hypothesis	obvious	prior	stress
attributed	despite	implementation	occupational	professional	subsequent
civil	dimensions	implications	option	project	sum
code	domestic	imposed	output	promote	summary
commitment	emerged	integration	overall	regime	undertaken

Sublist 5

academic	consultation	evolution	licence	orientation	styles
adjustment	contact	expansion	logic	perspective	substitution
alter	decline	exposure	marginal	precise	sustainable
amendment	discretion	external	medical	prime	symbolic
aware	draft	facilitate	mental	psychology	target
capacity	enable	fundamental	modified	pursue	transition
challenge	energy	generated	monitoring	ratio	trend
clause	enforcement	generation	network	rejected	version
compounds	entities	image	notion	revenue	welfare
conflict	equivalent	liberal	objective	stability	whereas

Sublist 6

abstract	capable	exceed	incidence	migration	recovery
accurate	cited	expert	incorporated	minimum	revealed
acknowledged	cooperative	explicit	index	ministry	scope
aggregate	discrimination	federal	inhibition	motivation	subsidiary
allocation	display	fees	initiatives	neutral	tapes
assigned	diversity	flexibility	input	nevertheless	trace
attached	domain	furthermore	instructions	overseas	transformation
author	edition	gender	intelligence	preceding	transport
bond	enhanced	ignored	interval	presumption	underlying
brief	estate	incentive	lecture	rational	utility

Sublist 7

adaptation	contrary	empirical	identical	phenomenon	submitted
adults	converted	equipment	ideology	priority	successive
advocate	couple	extract	inferred	prohibited	survive
aid	decades	file	innovation	publication	thesis
channel	definite	finite	insert	quotation	topic
chemical	deny	foundation	intervention	release	transmission
classical	differentiation	global	isolated	reverse	ultimately
comprehensive	disposal	grade	media	simulation	unique
comprise	dynamic	guarantee	mode	solely	visible
confirmed	eliminate	hierarchical	paradigm	somewhat	voluntary

Sublist 8

abandon	clarity	deviation	induced	plus	tension
accompanied	conformity	displacement	inevitably	practitioners	termination
accumulation	commodity	dramatic	infrastructure	predominantly	theme
ambiguous	complement	eventually	inspection	prospect	thereby
appendix	contemporary	exhibit	intensity	radical	uniform
appreciation	contradiction	exploitation	manipulation	random	vehicle
arbitrary	crucial	fluctuations	minimised	reinforced	via
automatically	currency	guidelines	nuclear	restore	virtually
bias	denote	highlighted	offset	revision	widespread
chart	detected	implicit	paragraph	schedule	visual

Sublist 9

accommodation	commenced	duration	mature	preliminary	sphere
analogous	incompatible	erosion	mediation	protocol	subordinate
anticipated	concurrent	ethical	medium	qualitative	supplementary
assurance	confined	format	military	refine	suspended
attained	controversy	founded	minimal	relaxed	team
behalf	conversely	inherent	mutual	restraints	temporary
bulk	device	insights	norms	revolution	trigger
ceases	devoted	integral	overlap	rigid	unified
coherence	diminished	intermediate	passive	route	violation
coincide	distortion	manual	portion	scenario	vision

Sublist 10

adjacent	compiled	enormous	invoked	odd	reluctant
albeit	conceived	forthcoming	levy	ongoing	so-called
assembly	convinced	inclination	likewise	panel	straightforward
collapse	depression	integrity	nonetheless	persistent	undergo
colleagues	encountered	intrinsic	notwithstanding	posed	whereby

1.3 Reading for Pleasure

Why should I read for pleasure?

Experimental studies have shown that people who read regularly for fun increase their reading fluency, learn and develop reading strategies, increase vocabulary knowledge, and also gain motivation to continue to read. Consequently, students who read regularly for fun not only increase their reading proficiency, but also listening, speaking and writing proficiency, too. These scientific studies have shown the clear benefits of reading for pleasure, so why don't you consider spending a little of your free time in reading for fun? After all, it's easy and it's fun!

What should I read?

It's up to you, as long as you choose something not too difficult nor too easy. Ideally, you should understand at least ninety-five percent of the words that you are reading. Then, you will enjoy reading and also learn, too. If you understand all of the words, you may not develop reading strategies, such as guessing the meaning of a word from its context, so please make sure that your chosen text is also not too easy. What you read should be entirely up to you, although asking your teacher or friends for suggestions may be a good idea if you don't know where to start.

How much should I read and how often?

The more you practice, the better you will be. The benefits of reading for pleasure do not come in the short term, but you should consider the long term benefits justify the commitment needed. If you read for thirty minutes a day, every day, you will likely succeed. If you record how much you read, you will be able to chart your progress.

1.3 Reading for Pleasure Record

	Date	What did you read?	How many pages?	How many minutes or hours?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
			TOTAL	hours

1.3 Reading for Pleasure Record

	Date	What did you read?	How many pages?	How many minutes or hours?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
			TOTAL	hours

2 Analyzing Text

- 1. Topics and Main Ideas**
- 2. Logical Connectors and the Development of Ideas**
- 3. Text Organization**

2.1 Topics and Main Ideas

What is a paragraph?

A paragraph is a series of sentences which discuss a single topic. There is no limit to the number of sentences a paragraph may have, and even one long sentence may be considered a paragraph. Many paragraphs are between five and fifteen sentences, but more important than the number of actual sentences is that a paragraph relates to just one idea or single topic. A paragraph is also organized as a block of text so as to distinguish it from previous and subsequent paragraphs.

For example, the sentences below are a paragraph because they discuss a single topic (science), and because they are organized as a single block of text.

Science, in the broadest sense of the term, refers to any system of knowledge attained by verifiable means. In a more restricted sense, science refers to a system of acquiring knowledge based on empiricism, experimentation, and methodological naturalism, as well as to the organized body of knowledge humans have gained by such qualified research.

The importance of topic sentences in paragraphs

A paragraph is a series of sentences which discuss a single topic. Consequently, there should be two questions that you ask yourself when you read a paragraph. The first is, "What is the topic of the paragraph?", and the second is "How is this topic being discussed?" In other words, you should be looking for the topic and the main idea. In most texts, the topic and main idea are usually expressed together in a single sentence that we refer to as the topic sentence. An important skill in reading, therefore, is to be able to find the most important sentence of a paragraph, the topic sentence.

What is a topic sentence?

A topic sentence is the most important sentence of a paragraph. It is a complete sentence, and it has two main functions. The first is to introduce the topic, and the second is to tell the reader the main idea, or why or for what purpose the writer is writing about such a topic.

Where is the topic sentence to be found?

A topic sentence can occur anywhere in the paragraph. It can be at the beginning, the middle, or the end. On some occasions, there may be no topic sentence, but even so, the writer will always imply a topic and a main idea in a paragraph because every paragraph, by definition, discusses a single topic. Fortunately, in academic writing, the topic sentence is often the first sentence of the paragraph, but you should remember that this is not always the case.

Here is an example paragraph.

The liver is a vital organ present in vertebrates and some other animals.

It has a wide range of functions, including detoxification, protein synthesis, and production of biochemicals necessary for digestion. The liver is necessary for survival; there is currently no way to compensate for the absence of liver function.

topic: The liver

topic sentence or main idea: The liver is a vital organ present in vertebrates and some other animals.

2.1 Topic and Main Idea Exercises

Read the paragraphs below. What is the topic? What is the main idea?

Example

A topic sentence is the most important sentence of a paragraph. It is a complete sentence, and it has two main functions. The first is to introduce the topic, and the second is to tell the reader the main idea, or why or for what purpose the writer is writing about such a topic.

topic: topic sentences

topic sentence or main idea: A topic sentence is the most important sentence of a paragraph.

- 1 A computer is a programmable machine that receives input, stores and manipulates data, and provides output in a useful format. Although mechanical examples of computers have existed through much of recorded human history, the first electronic computers were developed in the mid-20th century (1940–1945). These were the size of a large room, consuming as much power as several hundred modern personal computers (PCs). Modern computers based on integrated circuits are millions to billions of times more capable than the early machines, and occupy a fraction of the space. Simple computers are small enough to fit into small pocket devices, and can be powered by a small battery. Personal computers in their various forms are icons of the Information Age and are what most people think of as “computers”. The embedded computers found in many devices from MP3 players to fighter aircraft and from toys to industrial robots are however the most numerous.

<http://en.wikipedia.org/wiki/Computer>

topic:

topic sentence or main idea:

.....

- 2 Geometry (Ancient Greek: geo- “earth”, -metria “measurement”) “Earth-Measuring” is a part of mathematics concerned with questions of size, shape, relative position of figures, and the properties of space. Geometry is one of the oldest sciences. Initially a body of practical knowledge concerning lengths, areas, and volumes, in the 3rd century BC, geometry was put into an axiomatic

form by Euclid, whose treatment—Euclidean geometry—set a standard for many centuries to follow. The field of astronomy, especially mapping the positions of the stars and planets on the celestial sphere, served as an important source of geometric problems during the next one and a half millennia. A mathematician who works in the field of geometry is called a geometer.

<http://en.wikipedia.org/wiki/Geometry>

topic:

topic sentence or main idea:

.....

- 3 Ecology is the interdisciplinary scientific study of the interactions between organisms and their environment. Ecology is also the study of ecosystems. Ecosystems describe the web or network of relations among organisms at different scales of organization. Since ecology refers to any form of biodiversity, ecologists research everything from tiny bacteria's role in nutrient recycling to the effects of tropical rain forest on the Earth's atmosphere. The discipline of ecology emerged from the natural sciences in the late 19th century. Ecology is not synonymous with environment, environmentalism, or environmental science. Ecology is closely related to the disciplines of physiology, evolution, genetics and behavior.

<http://en.wikipedia.org/wiki/Ecology>

topic:

topic sentence or main idea:

.....

- 4 Pure white marble is the result of metamorphism of very pure limestones. The characteristic swirls and veins of many colored marble varieties are usually due to various mineral impurities such as clay, silt, sand, iron oxides, or chert which were originally present as grains or layers in the limestone. Green coloration is often due to serpentine resulting from originally high magnesium limestone or dolostone with silica impurities. These various impurities have been mobilized and recrystallized by the intense pressure and heat of the metamorphism.

<http://en.wikipedia.org/wiki/Marble>

topic:

topic sentence or main idea:

.....

- 5 Some of the greatest mathematical minds of all ages, from Pythagoras and Euclid in ancient Greece, through the medieval Italian mathematician Leonardo of Pisa and the Renaissance astronomer Johannes Kepler, to present-day scientific figures such as Oxford physicist Roger Penrose, have spent endless hours over this simple ratio and its properties. But the fascination with the golden ratio is not confined just to mathematicians. Biologists, artists, musicians, historians, architects, psychologists, and even mystics have pondered and debated the basis of its ubiquity and appeal. In fact, it is probably fair to say that the golden ratio has inspired thinkers of all disciplines like no other number in the history of mathematics.

http://en.wikipedia.org/wiki/Golden_ratio

topic:

topic sentence or main idea:

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- 6 In physics, tension is the magnitude of the pulling force exerted by a string, cable, chain, or similar object on another object. It is the opposite of compression. As tension is the magnitude of a force, it is measured in newtons (or sometimes pounds-force) and is always measured parallel to the string on which it applies. There are two basic possibilities for systems of objects held by strings. Either acceleration is zero and the system is therefore in equilibrium or there is acceleration and therefore a net force is present. Note that a string is assumed to have negligible mass.

[http://en.wikipedia.org/wiki/Tension_\(physics\)](http://en.wikipedia.org/wiki/Tension_(physics))

topic:

topic sentence or main idea:

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- 7 Elementary particles are particles for which there is no known way of dividing them into smaller units. Theoretical and experimental studies have shown that the spin possessed by such particles cannot be explained by postulating that they are made up of even smaller particles rotating about a common center of mass (see classical electron radius); as far as can be determined, these elementary particles are true point particles. The spin of an elementary particle is a truly intrinsic physical property, akin to the particle's electric charge and rest mass.

[http://en.wikipedia.org/wiki/Spin_\(physics\)](http://en.wikipedia.org/wiki/Spin_(physics))

topic:

topic sentence or main idea:

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- 8 The Coriolis effect on Earth is due to this fact: the Earth is rotating fastest at the equator, and rotates not at all at the poles (in km/hr). A bird flying N away from the equator, carries this faster motion with it (or, equivalently, the earth under the bird is rotating more slowly than it was) - and the bird's flight curves eastward slightly (though its heading stays straight N). In general: objects moving away from the equator curve eastward; objects moving towards the equator curve westward. Moving away from the equator, the land underneath rotates more slowly, and vice-versa. An object gains or loses relative speed over ground as it moves away from, or towards, the equator, respectively.

http://en.wikipedia.org/wiki/Coriolis_effect

topic:

topic sentence or main idea:

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- 9 It is still a challenge for scientists and philosophers to define life in unequivocal terms. Any definition must be sufficiently broad to encompass all life with which we are familiar, and it should be sufficiently general that, with it, scientists would not miss life that may be fundamentally different from earthly life. Defining life is difficult — in part — because life is a process, not a pure substance.

<http://en.wikipedia.org/wiki/Life>

topic:

topic sentence or main idea:

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- 10 Genetics (from Ancient Greek: genesis, “origin”), a discipline of biology, is the science of heredity and variation in living organisms. The fact that living things inherit traits from their parents has been used since prehistoric times to improve crop plants and animals through selective breeding. However, the modern science of genetics, which seeks to understand the process of inheritance, only began with the work of Gregor Mendel in the mid-nineteenth century. Although he did not know the physical basis for heredity, Mendel observed that organisms inherit traits via discrete units of inheritance, which are now called genes.

<http://en.wikipedia.org/wiki/Genetics>

topic:

topic sentence or main idea:

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- 11 In biochemistry, metabolic pathways are series of chemical reactions occurring within a cell. In each pathway, a principal chemical is modified by chemical reactions. Enzymes catalyze these reactions, and often require dietary minerals, vitamins, and other cofactors in order to function properly. Because of the many chemicals that may be involved, pathways can be quite elaborate. In addition, many pathways can exist within a cell. This collection of pathways is called the metabolic network. Pathways are important to the maintenance of homeostasis within an organism.

http://en.wikipedia.org/wiki/Metabolic_pathways

topic:

topic sentence or main idea:

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- 12 Evidence from radiometric dating indicates that the Earth is about 4.570 billion years old. The geological or deep time of Earth’s past has been organized into various units according to events which took place in each period. Different spans of time on the time scale are usually delimited by major geological or paleontological events, such as mass extinctions. For example, the boundary between the Cretaceous period and the Paleogene period is defined by the Cretaceous–Tertiary extinction event, which marked the demise of the dinosaurs and of many marine species. Older periods which predate the reliable fossil record are defined by absolute age.

http://en.wikipedia.org/wiki/Geologic_time_scale

topic:

topic sentence or main idea:

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- 13 Romans are generally famous for their advanced engineering accomplishments, although some of their own inventions were improvements on older ideas, concepts and inventions. Technology for bringing running water into cities was developed in the east, but transformed by the Romans into a technology inconceivable in Greece. The architecture used in Rome was strongly influenced by Greek and Etruscan sources. Roads were common at that time, but the Romans improved their design and perfected the construction to the extent that many of their roads are still in use today. Their accomplishments surpassed most other civilizations of the time, and many of their structures have withstood the test of time to inspire others, especially during the Renaissance. Moreover, their contributions were described in some detail by authors such as Vitruvius, Frontinus and Pliny the Elder, so there is a printed record of their many inventions and achievements.

http://en.wikipedia.org/wiki/Roman_engineering

topic:

topic sentence or main idea:

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- 14 Natural numbers have two main purposes: counting (“there are 6 coins on the table”) and ordering (“this is the 3rd largest city in the country”). These purposes are related to the linguistic notions of cardinal and ordinal numbers, respectively. A more recent notion is that of a nominal number, which is used only for naming.

http://en.wikipedia.org/wiki/Natural_numbers

topic:

topic sentence or main idea:

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- 15 The Doppler effect (or Doppler shift), named after Austrian physicist Christian Doppler who proposed it in 1842, is the change in frequency of a wave for an observer moving relative to the source of the wave. It is commonly heard when a vehicle sounding a siren or horn approaches, passes, and recedes from an observer. The received frequency is higher (compared to the emitted frequency) during the approach, it is identical at the instant of passing by, and it is lower during the recession.

http://en.wikipedia.org/wiki/Doppler_effect

topic:

topic sentence or main idea:

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- 16 Stars with more than about 10 solar masses after burning their hydrogen become red supergiants during their helium-burning phase. These stars have

very cool surface temperatures (3500–4500 K), and enormous radii. The five largest known red supergiants in the Galaxy are VY Canis Majoris, VV Cephei A, V354 Cephei, RW Cephei and KW Sagittarii, which all have radii about 1500 times that of the sun (about 7 astronomical units, or 7 times as far as the Earth is from the sun). The radius of most red giants is between 200 and 800 times that of the sun.

http://en.wikipedia.org/wiki/Red_supergiants

topic:

topic sentence or main idea:

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- 17 Plants are the base of the food chain, and need sunlight and nutrients if they are to grow. In the ocean these plants are mainly a type of plankton, microscopic phytoplankton which drift in the water column. They need sunlight for photosynthesis, which powers carbon fixation, so they are found only in the surface waters. But they also need nutrients. Phytoplankton rapidly use any nutrients in the surface waters, and in the tropics these nutrients are not usually replaced because of the thermocline.

http://en.wikipedia.org/wiki/Coral_reef

topic:

topic sentence or main idea:

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- 18 Researchers rarely survey the entire population for two reasons: (1) The cost is too high and (2) The population is dynamic, i.e., the component of population could change over time. There are three main advantages of sampling: (1) The cost is lower, (2) Data collection is faster, and (3) It is possible to ensure homogeneity and to improve the accuracy and quality of the data because the data set is smaller.

[http://en.wikipedia.org/wiki/Sampling_\(statistics\)](http://en.wikipedia.org/wiki/Sampling_(statistics))

topic:

topic sentence or main idea:

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- 19 The presence of ocean blooms is usually seasonal, responding to prey availability and increasing with temperature and sunshine. Ocean currents tend to congregate jellyfish into large swarms or “blooms”, consisting of hundreds or thousands of individuals. In addition to sometimes being concentrated by ocean currents, blooms can result from unusually high populations in some years. Bloom formation is a complex process that depends on ocean currents, nutrients, temperature and oxygen concentrations. Jellyfish are better able to survive in oxygen-poor water than competitors, and thus can thrive on plankton without competition. Jellyfish may also benefit from saltier waters, as saltier waters contain more iodine, which is necessary for polyps to turn into jellyfish. Rising sea temperatures caused by climate change may also contribute to jellyfish blooms, because many species of jellyfish are better able to survive in warmer waters. Jellyfish are likely to stay in blooms that are quite large and can reach up to 100,000 in each.

<http://en.wikipedia.org/wiki/Jellyfish>

topic:

topic sentence or main idea:

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- 20 The term chiral in general is used to describe an object that is non-superposable on its mirror image. Achiral (not chiral) objects are objects that are identical to their mirror image. Human hands are perhaps the most universally recognized example of chirality: The left hand is a non-superposable mirror image of the right hand; no matter how the two hands are oriented, it is impossible for all the major features of both hands to coincide. This difference in symmetry becomes obvious if someone attempts to shake the right hand of a person using his left hand, or if a left-handed glove is placed on a right hand. The term chirality is derived from the Greek word for hand. It is a mathematical approach to the concept of “handedness”.

[http://en.wikipedia.org/wiki/Chirality_\(chemistry\)](http://en.wikipedia.org/wiki/Chirality_(chemistry))

topic:

topic sentence or main idea:

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- 21 The general public sometimes confuses computer science with careers that deal with computers (such as information technology), or think that it relates to their own experience of computers, which typically involves activities such as gaming, web-browsing, and word-processing. However, the focus of computer science is more on understanding the properties of the programs used to implement software such as games and web-browsers, and using that understanding to create new programs or improve existing ones.

http://en.wikipedia.org/wiki/Computer_science

topic:

topic sentence or main idea:

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- 22 Over half of Costa Rica's existing forest cover today is under the protection of national parks, biological reserves, or wildlife refuges. However, the major problem in regards to deforestation is the privately owned plots which occupy the other half. Lenient laws on land and amendments to forestry law makes it easy to obtain logging concessions as owners exploit the land to maximise income. As logging companies enter these forests to exploit them, they require access roads to transport the timber. While cattle ranching is by far the primary cause of deforestation in Costa Rica, banana plantations have also significantly contributed to the problem. Lowland rainforest has been most affected where 130,000 acres of previously forested land (primarily in the Atlantic and Northern regions) have been removed. Such industries have been synonymous with health risks, notably the high levels of toxic pesticides which affected thousands of plantation workers throughout Central America in the 1970s. Pesticides used to grow bananas and other fruits such as mangoes and citrus fruit may enter the hydrological systems and contaminate the water. The removal of the forest to make way for these fruit plantations may also disrupt the nutrient balance in the soil and through monoculture exhaust the soils and render them unsustainable.

http://en.wikipedia.org/wiki/Deforestation_in_Costa_Rica

topic:

topic sentence or main idea:

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- 23 The International Union for Conservation of Nature now lists global warming as the most significant threat to the polar bear, primarily because the melting of its sea ice habitat reduces its ability to find sufficient food. The IUCN states, "If climatic trends continue, polar bears may become extirpated from most of their range within 100 years." On 14 May 2008, the United States Department of the Interior listed the polar bear as a threatened species under the Endangered Species Act.

http://en.wikipedia.org/wiki/Polar_bear

topic:

topic sentence or main idea:

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- 24 Researchers at the University of Warwick and University College London have found that lack of sleep can more than double the risk of death from cardiovascular disease, but that too much sleep can also be associated with a doubling of the risk of death, though not primarily from cardiovascular disease. Professor Francesco Cappuccio said, "Short sleep has been shown to be a risk factor for weight gain, hypertension, and Type 2 diabetes, sometimes leading to mortality; but in contrast to the short sleep-mortality association, it appears that no potential mechanisms by which long sleep could be associated with increased mortality have yet been investigated. Some candidate causes for this include depression, low socioeconomic status, and cancer-related fatigue. ...In terms of prevention, our findings indicate that consistently sleeping around seven hours per night is optimal for health, and a sustained reduction may predispose to ill health."

<http://en.wikipedia.org/wiki/Sleep>

topic:

topic sentence or main idea:

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- 25 Philosophers in antiquity used the concept of force in the study of stationary and moving objects and simple machines, but thinkers such as Aristotle and Archimedes retained fundamental errors in understanding force, due to an incomplete understanding of the sometimes non-obvious force of friction, and a consequently inadequate view of the nature of natural motion. When the Age of Enlightenment began, Sir Isaac Newton corrected these misunderstandings with mathematical insight that remained unchanged for nearly three hundred years. By the early 20th century, Einstein developed a theory of relativity that correctly predicted the action of forces on objects with increasing momenta near the speed of light, and also provided insight into the “forces” produced by gravitation and inertia.

<http://en.wikipedia.org/wiki/Force>

topic:

topic sentence or main idea:

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- 26 The effects of calcium on human cells are specific, meaning different types of cells respond in different ways. However, in certain circumstances its action may be more general. Ca^{2+} ions are one of the most widespread second messengers used in signal transduction. They make their entrance into the cytoplasm either from outside the cell through the cell membrane via calcium channels (such as Calcium-binding proteins or voltage-gated calcium channels), or from some internal calcium storages such as the endoplasmic reticulum and mitochondria. Levels of intracellular calcium are regulated by transport proteins that remove it from the cell. For example, the sodium-calcium exchanger uses energy from the electrochemical gradient of sodium by pumping calcium out of the cell in exchange for the entry of sodium. Additionally, the plasma membrane Ca^{2+} ATPase (PMCA) obtains energy to pump calcium out of the cell by hydrolyzing adenosine triphosphate (ATP). In neurons, voltage-dependent, calcium-selective ion channels are important for synaptic transmission through the release of neurotransmitters into the synaptic cleft by vesicle fusion of synaptic vesicles.

http://en.wikipedia.org/wiki/Calcium_in_biology



topic:

topic sentence or main idea:

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- 27 From its discovery in 1930 until 2006, Pluto was considered the Solar System's ninth planet. In the late 1970s, following the discovery of minor planet 2060 Chiron in the outer Solar System and the recognition of Pluto's very low mass, its status as a major planet began to be questioned. Later, in the early 21st century, many objects similar to Pluto were discovered in the outer Solar System, notably the scattered disc object Eris, which is 27% more massive than Pluto. On August 24, 2006, the International Astronomical Union (IAU) defined the term "planet" for the first time. This definition excluded Pluto as a planet, and added it as a member of the new category "dwarf planet" along with Eris and Ceres. After the reclassification, Pluto was added to the list of minor planets and given the number 134340. Even so, a number of scientists continue to hold that Pluto should be classified as a planet.

<http://en.wikipedia.org/wiki/Pluto>

topic:

topic sentence or main idea:

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- 28 From the age of about twelve until he was seventeen, Newton was educated at The King's School, Grantham (where his signature can still be seen upon a library window sill). He was removed from school, and by October 1659, he was to be found at Woolsthorpe-by-Colsterworth, where his mother, widowed by now for a second time, attempted to make a farmer of him. He hated farming. Henry Stokes, master at the King's School, persuaded his mother to send him back to school so that he might complete his education. Motivated partly by a desire for revenge against a schoolyard bully, he became the top-ranked student.

http://en.wikipedia.org/wiki/Isaac_Newton

topic:

topic sentence or main idea:

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- 29 Chlorofluorocarbons (CFCs) were invented by Thomas Midgley in the 1920s. They were used in air conditioning/cooling units, as aerosol spray propellants prior to the 1980s, and in the cleaning processes of delicate electronic equipment. They also occur as by-products of some chemical processes. No significant natural sources have ever been identified for these compounds — their presence in the atmosphere is due almost entirely to human manufacture. When such ozone-depleting chemicals reach the stratosphere, they are dissociated by ultraviolet light to release chlorine atoms. The chlorine atoms act as a catalyst, and each can break down tens of thousands of ozone molecules before being removed from the stratosphere. Given the longevity of CFC molecules, recovery times are measured in decades. It is calculated that a CFC molecule takes an average of 15 years to go from the ground level up to the upper atmosphere, and it can stay there for about a century, destroying up to one hundred thousand ozone molecules during that time.

http://en.wikipedia.org/wiki/Ozone_depletion

topic:

topic sentence or main idea:

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- 30 Around sunset and sunrise the Martian sky is pinkish-red in color, but in the vicinity of the setting sun it is blue. This is the exact opposite of the situation on Earth. However, during the day the sky is a yellow-brown “butterscotch” color. On Mars, Rayleigh scattering is usually a very small effect. It is believed that the color of the sky is caused by the presence of 1% by volume of magnetite in the dust particles. Twilight lasts a long time after the Sun has set and before it rises, because of all the dust in Mars’s atmosphere. At times, the Martian sky takes on a violet color, due to scattering of light by very small water ice particles in clouds.

http://en.wikipedia.org/wiki/Astronomy_on_Mars

topic:



topic sentence or main idea:

.....

2.2 Logical Connectors

What is a logical connector?

A logical connector is a word or phrase that connects two ideas and shows the relationship between the two ideas. Logical connectors are also known as signal words because they signal the relationship of the ideas to the reader.

What kinds of logical connectors are there?

There are four basic types of logical connectors: coordinating conjunctions, subordinating conjunctions, sentence conjunctions, and prepositions.

Coordinating conjunctions

Coordinating conjunctions are also called coordinators. A coordinating conjunction connects two or more words, phrases or independent clauses of equal importance within a sentence. The most common coordinating conjunctions are *for*, *and*, *not*, *but*, *or*, *yet*, and *so*. (If you wish, you can remember these seven common coordinating conjunctions by their acronym, FANBOYS).

Example:

Halley's Comet or Comet Halley is the best-known of the short-period comets, and is visible from Earth every 75 to 76 years.

The first coordinating conjunction in the sentence above is *or*. *Or* can be used to show an alternative, a condition, a contrast, or an effect. In the case above, it shows an alternative. (Halley's Comet is also known as Comet Halley). The second coordinating conjunction is *and*. *And* can show addition or time. In the sentence above, *and* shows addition, and tells us that the two clauses (Halley's Comet is the best-known of the short-period comets. Halley's Comet is visible from Earth every 75 to 76 years) are of equal importance.

Subordinating conjunctions

Subordinating conjunctions are also called subordinators. A subordinating conjunction connects an independent clause to a dependant clause. A subordinating conjunction always comes before the dependent clause. Examples of subordinating conjunctions are *after*, *before*, *even though*, *if*, *since*, *though*, and *unless*. (For more examples, see Appendix 8.3).

Example: Peaches are considered self-fertile because a commercial crop can

be produced without cross-pollination, though cross-pollination usually gives a better crop.

In the example above, the first subordinating conjunction *because* is used to show cause. It shows the reason why peaches are considered self-fertile. The second subordinating conjunction is *though*. *Though* is used to show the contrast between self-pollinated peaches and cross-pollinated peaches.

Sentence conjunctions

Sentence conjunctions are also called sentence connectors. A sentence conjunction connects two sentences and shows the relationship between the ideas of the two sentences. Examples of sentence conjunctions are *alternatively*, *consequently*, *eventually*, *furthermore*, *in summary*, *likewise*, and *nevertheless*. (For more examples, see Appendix 8.3).

Example: Galileo reported that stars appeared as mere blazes of light, essentially unaltered in appearance by the telescope, and contrasted them to planets which the telescope revealed to be disks. However, in later writings he described the stars as also being disks, whose sizes he measured. According to Galileo, stellar disk diameters typically measured a tenth the diameter of the disk of Jupiter (one five-hundredth the diameter of the sun), although some were somewhat larger and others substantially smaller.

In the example above, the sentence conjunction is *however*. The function of *however* is to show contrast. In the first sentence, Galileo reported that stars were blazes of light and seemingly without shape. *However* introduces the second sentence and expresses the contrast; In Galileo's later writings he reported that stars had shape and also size.

Prepositions

A preposition introduces a noun or a noun phrase and occurs within a sentence or clause. The function of a preposition is to illustrate the relationship between the object of the prepositional phrase and the other words of the clause or sentence. Some common prepositions are *after*, *as a result of*, *besides*, *contrary to*, *like*, *prior to*, and *regardless of*. (For more examples, see Appendix 8.3).

Example: For most smaller species of dolphin, only a few larger species of shark such as the bull shark, dusky shark, tiger shark and great white shark are a potential risk, especially for calves.

In the example above, the preposition is *such as*. The function of *such as* is to show an example. In this case the examples of potential risk to dolphins are bull sharks, dusky sharks, tiger sharks, and great white sharks.

2.2 Logical Connector Exercises

Functions of logical connectors

addition	alternative	cause	clarification
comparison	condition	contrast	effect
emphasis	example	purpose	sequence
summary	time		

For more information about the functions of logical connectors, see Appendix 8.3.

Example

Read the paragraphs below. What are the functions of the highlighted logical connectors? What is the topic? What is the main idea? Write the main idea as a question that the paragraph answers.

Optical fiber can be used **as** a medium **for** telecommunication **because** it is flexible **and** can be bundled **as** cables. It is especially advantageous **for** long-distance communications **because** light propagates through the fiber with little attenuation compared to electrical cables. This allows long distances to be spanned with few repeaters. **Additionally**, the per-channel light signals propagating in the fiber have been modulated at rates as high as 111 gigabits per second by NTT, **although** 10 or 40 Gb/s is typical in deployed systems.

http://en.wikipedia.org/wiki/Fiber-optic_communication

logical connector	function
as	purpose
for	purpose
because	cause
and	addition
as	purpose
for	purpose
because	cause
additionally	addition
although	contrast

Topic: optical fiber

Main idea as a question: Why can optical fiber be used as a medium for telecommunication?

Exercise

- 1 Generally, dolphins sleep with only one brain hemisphere in slow-wave sleep at a time, **thus** maintaining enough consciousness to breathe **and** to watch for possible predators **and** other threats. Earlier sleep stages can occur simultaneously in both hemispheres. In captivity, dolphins seemingly enter a fully asleep state where both eyes are closed **and** there is no response to mild external stimuli. Respiration is automatic; a tail kick reflex keeps the blowhole above the water if necessary. Anesthetized dolphins initially show a tail kick reflex. **Though** a similar state has been observed with wild sperm whales, it is not known **if** dolphins in the wild reach this state. The Indus river dolphin has a different sleep method from other dolphin species. Living in water with strong currents **and** potentially dangerous floating debris, it must swim continuously to avoid injury. **As a result**, this species sleeps in very short bursts which last between 4 and 60 seconds.

<http://en.wikipedia.org/wiki/Dolphin>

logical connector	function
thus	
and	
and	
and	
though	
if	
and	
as a result	

Topic:

Main idea as a question:

.....

- 2 Zinc-64 is an isotope of zinc. It makes up 48.3% of the zinc naturally occurring, **despite the fact that** it is radioactive. Zinc-64 has an exceptionally long half-life of over 2300 million billion years, much longer than the age of the Universe, **and** is, over all reasonable time periods, stable.

<http://www.ask.com/wiki/Zinc-64>

logical connector	function
despite the fact that	
and	

Topic:

Main idea as a question:

.....

- 3 Karachi features an arid climate, **albeit** a more moderate version of an arid climate. Karachi is located on the coast **and as a result** has a relatively mild climate. The level of precipitation is low for most of the year. **However**, due to the city’s proximity to the sea, humidity levels usually remain high throughout the year. The city enjoys mild winters **and** warm summers. Karachi **also** receives the tail end of the monsoon rains. **Since** summer temperatures (the end of April through the end of August) are approximately 30 to 35 degrees Celsius, the winter months (November through March) are the best time to visit Karachi.

http://en.wikipedia.org/wiki/Climate_of_Karachi

logical connector	function
albeit	
and as a result	
however	
and	
also	
since	

Topic:

Main idea as a question:

.....

- 4 Mars is the fourth planet from the Sun in the Solar System. The planet is named after Mars, the Roman god of war. It is **also** referred to **as** the “Red Planet” **because of** its reddish appearance, **due to** iron oxide prevalent on its surface. Mars is a terrestrial planet with a thin atmosphere, having surface features reminiscent **both** of the impact craters of the Moon **and** the volcanoes, valleys, deserts and polar ice caps of Earth. **Unlike** the Earth, Mars is now a geologically inactive planet with no known tectonic activity. It is the site of Olympus Mons,

the highest known mountain in the Solar System, **and** of Valles Marineris, the largest canyon. **In addition** to its geographical features, Mars' rotational period and seasonal cycles are **likewise** similar to those of the Earth.

<http://en.wikipedia.org/wiki/Mars>

logical connector	function
also	
as	
because of	
due to	
both ... and ...	
unlike	
and	
in addition	
likewise	

Topic:

Main idea as a question:

.....

- 5 Sponges are known for regenerating from fragments that are broken off, **although** this only works **if** the fragments include the right types of cells. A few species reproduce by budding. **When** conditions deteriorate, **for example as** temperatures drop, many freshwater species **and** a few marine ones produce gemmules, "survival pods" of unspecialized cells that remain dormant **until** conditions improve **and then either** form completely new sponges **or** recolonize the skeletons of their parents.

<http://en.wikipedia.org/wiki/Sponge>

logical connector	function
although	
if	
when	
for example	
as	
and	
until	

and then	
either ... or	

Topic:

Main idea as a question:

.....

- 6 **Despite** Edison’s contempt for capital punishment, the war against AC led him to become involved in the development **and** promotion of the electric chair (using AC current) **as** an attempt to portray AC to have greater lethal potential than DC. Edison went on to carry out a brief but intense campaign to ban the use of AC **or** to limit the allowable voltage **for** safety purposes. **As** part of this campaign, Edison’s employees publicly electrocuted animals to demonstrate the dangers of AC; AC electric currents are slightly more dangerous **in that** frequencies near 60 Hz have a markedly greater potential for inducing fatal heart attacks than do DC currents. On one of the more notable occasions, in 1903, Edison’s workers electrocuted Topsy the elephant at Luna Park, near Coney Island, **after** she had killed several men **and** her owners wanted her put to death. His company filmed the electrocution.

http://en.wikipedia.org/wiki/Thomas_Edison

logical connector	function
despite	
and	
as	
or	
for	
as	
in that	
after	
and	

Topic:

Main idea as a question:

.....

- 7 Chemical classification systems attempt to classify elements **or** compounds

according to certain chemical functional **or** structural properties. **Whereas** the structural properties are largely intrinsic, functional properties **and** the derived classifications depend to a certain degree on the type of chemical interaction partners on which the function is exerted. Sometimes other criteria **like** purely physical ones (**e.g.** molecular weight) **or - on the other hand** - functional properties above the chemical level are **also** used for building chemical taxonomies.

http://en.wikipedia.org/wiki/Chemical_classification

logical connector	function
or	
or	
whereas	
and	
like	
e.g.	
or	
on the other hand	
also	

Topic:

Main idea as a question:

.....

- 8 The Internet Protocol Suite (commonly known **as** TCP/IP), **like** many protocol suites, may be viewed **as** a set of layers. Each layer solves a set of problems involving the transmission of data, **and** provides a well-defined service to the upper layer protocols based on using services from some lower layers. Upper layers are logically closer to the user **and** deal with more abstract data, relying on lower layer protocols to translate data into forms that can **eventually** be physically transmitted.

http://en.wikipedia.org/wiki/Internet_Protocol_Suite

logical connector	function
as	
like	
as	
and	

and	
eventually	

Topic:

Main idea as a question:

.....

- 9 **Prior to** the 20th century, **and also** into its early decades, the pace of discovery of new species of bird was fast; during this period, with numerous collecting expeditions into species-rich areas not previously visited by western ornithologists, up to several hundred new species per decade were being described. **Since then**, the pace has slowed, **and** new species are generally only being found in remote areas, **or** among cryptic **or** secretive groups of species. **Nonetheless**, several tens of species were described for the first time **during** the 1990s.

http://en.wikipedia.org/wiki/Bird_species_new_to_science

logical connector	function
prior to	
and also	
since then	
and	
or	
or	
nonetheless	
during	

Topic:

Main idea as a question:

.....

- 10 A cloud is a visible mass of droplets, **in other words**, little drops of water or frozen crystals suspended in the atmosphere above the surface of the Earth **or** another planetary body. A cloud is **also** a visible mass attracted by gravity, **such as** masses of material in space called interstellar clouds **and** nebulae. Clouds are studied in the nephology **or** cloud physics branch of meteorology.

<http://en.wikipedia.org/wiki/Cloud>

logical connector	function
in other words	
or	
also	
such as	
and	
or	

Topic:

Main idea as a question:

.....

- 11 Electricity is by its nature difficult to store **and** has to be available on demand. **Consequently, unlike** other products, it is not possible, under normal operating conditions, to keep it in stock, ration it or have customers queue for it. **Furthermore,** demand and supply vary continuously. **Therefore,** there is a physical requirement for a controlling agency, the transmission system operator, to coordinate the dispatch of generating units to meet the expected demand of the system across the transmission grid. **If** there is a mismatch between supply **and** demand, the generators speed up **or** slow down, causing the system frequency (**either** 50 **or** 60 hertz) to increase **or** decrease. **If** the frequency falls outside a predetermined range, the system operator will act to add **or** remove **either** generation **or** load.

http://en.wikipedia.org/wiki/Electricity_market

logical connector	function
and	
consequently	
unlike	
furthermore	
therefore	
if	
and	
or	
either ... or ...	
or	

if	
or	
either ... or ...	

Topic:

Main idea as a question:

.....

- 12 Genome projects are scientific endeavours that **ultimately** aim to determine the complete genome sequence of an organism (be it an animal, a plant, a fungus, a bacterium, an archaean, a protist **or** a virus). The genome sequence for any organism requires the DNA sequences for each of the chromosomes in an organism to be determined. For bacteria, which usually have just one chromosome, a genome project will aim to map the sequence of that chromosome. Humans, with 22 pairs of autosomes and 2 sex chromosomes, will require 46 separate chromosome sequences **in order to** represent the completed genome.

http://en.wikipedia.org/wiki/Genome_project

logical connector	function
ultimately	
or	
in order to	

Topic:

Main idea as a question:

.....

- 13 **As** Roman imperial authority effectively ended in the West **during** the 5th century, Western Europe entered the Middle Ages with great difficulties that affected the continent’s intellectual production dramatically. Most classical scientific treatises of classical antiquity written in Greek were unavailable, leaving only simplified summaries and compilations. **Notwithstanding**, with the beginning of the Renaissance of the 12th century, interest in natural investigation was renewed. Science developed in this golden period of Scholastic philosophy focused on logic **and** advocated empiricism, perceiving nature **as** a coherent system of laws that could be explained in the light of reason. With this view the medieval men of science went in search of explanations for the phenomena of the universe **and** achieved important advances in areas **such**

as scientific methodology **and** physics, among many others. These advances, **however**, were suddenly interrupted by the Black Plague **and** are virtually unknown to the lay public of today, partly **because** most theories advanced in medieval science are today obsolete, and partly **because of** the stereotype of Middle Ages as supposedly “Dark Ages”.

http://en.wikipedia.org/wiki/Science_in_Medieval_Western_Europe

logical connector	function
as	
during	
notwithstanding	
and	
as	
and	
such as	
and	
however	
and	
because	
because of	

Topic:

Main idea as a question:

.....

- 14 Protein–protein interactions involve **not only** the direct-contact association of protein molecules **but also** longer range interactions through the electrolyte, aqueous solution medium surrounding neighbor hydrated proteins over distances from less than one nanometer to distances of several tens of nanometers. **Furthermore**, such protein–protein interactions are thermodynamically linked functions of dynamically bound ions **and** water that exchange rapidly with the surrounding solution by comparison with the molecular tumbling rate (or correlation times) of the interacting proteins. Protein associations are **also** studied from the perspectives of biochemistry, quantum chemistry, molecular dynamics, signal transduction and other metabolic or genetic/epigenetic networks. **Indeed**, protein–protein interactions are at the core of the entire interactomic system of any living cell.

http://en.wikipedia.org/wiki/Protein–protein_interaction

logical connector	function
not only... but also	
furthermore	
and	
also	
indeed	

Topic:

Main idea as a question:

.....

- 15 **Although** procedures vary from one field of inquiry to another, identifiable features distinguish scientific inquiry from other methodologies of knowledge. Scientific researchers propose hypotheses **as** explanations of phenomena, **and** design experimental studies to test these hypotheses. These steps must be repeatable **in order to** dependably predict any future results. Theories that encompass wider domains of inquiry may bind many independently-derived hypotheses together in a coherent, supportive structure. This in turn may help form new hypotheses **or** place groups of hypotheses into context.

http://en.wikipedia.org/wiki/Scientific_method

logical connector	function
although	
as	
and	
in order to	
or	

Topic:

Main idea as a question:

.....

2.3 Text Organization Structures

What does text organization mean?

In the previous unit, you learned that logical connectors connect ideas and show the relationship between these ideas. Logical connectors can connect ideas within a sentence and between sentences. Even a single sentence can have several logical connectors to show the relationships between ideas within a sentence. Understanding these sentences is an important skill in reading. However, in order to understand the overall message of a text, we need to be aware of how the sentences and paragraphs are organized. How these sentences and paragraphs are arranged and presented, the pattern of organization, is what we usually refer to as text organization, but it can also mean the organization of even larger texts such as chapters and books.

How can I recognize the pattern of text organization?

One way to recognize the pattern of organization of a paragraph is to locate the topic sentence. The topic sentence will tell you the topic and main idea, and from this it may be possible to anticipate the type of pattern of organization of the paragraph. Another way to recognize the pattern of a text, either a paragraph or longer, is to focus on the logical connectors which show the relationships between the ideas. These logical connectors, together with other key phrases, are sometimes called signal words because they signal to the reader how the ideas relate. These signal words will also indicate the pattern of organization of the text.

What are signal words?

Signal words are logical connectors and other phrases which signal to the reader the organization of the text and the relationships of the ideas. Signal words include coordinating conjunctions such as *and* or *but*, subordinating conjunctions such as *albeit* or *because*, prepositions such as *as a result of* or *because of*, and sentence conjunctions such as *accordingly* or *by and large*. (For more information about the functions of logical connectors, see Appendix 8.3). Signal words include other phrases which are not logical connectors, but nonetheless help to show the structure of the text.

What types of text structure are there?

There are six kinds of text structure that you will usually find in scientific texts. They are:

- 1) *Definition* - This pattern of text organization is common in science textbooks. The first sentence will often be a topic sentence, and the rest of the paragraph, or paragraphs, will elaborate with examples or details.
- 2) *Classification or Enumeration* - For this type of organization, the subject is classified into items or groups, or ordered as a list. These

groups are of equal value and the order in which they are presented is of no importance.

- 3) *Comparison and Contrast* - The purpose of this type of text is to show the similarities (comparison) or differences (contrast) between two or more things.
- 4) *Time Order or Sequence* - Time order or sequence texts show how a series of events relate to time or order, and are organized in sequence or the order in which they happen. You may see this pattern of organization if you are reading a biography of a famous person, for example. In science texts, you will probably see this pattern of organization if you are reading about a process such as how to conduct an experiment.
- 5) *Cause and Effect* - Cause and effect texts refer to the causal relationships of events or processes. Cause and effect is a very common type of pattern of organization in scientific texts because many scientists are interested in understanding the causes and effects of natural phenomena.
- 6) *Complex* - Complex text organization refers to any text which has a mixture of two or more patterns of organization.

Signal words and text structure

Here is a list of signal words that will help you to identify the text structure: (Words in bold are Academic Word List words).

1) *Definition*

is called	is characterized by	is concerned with	concerns
is defined as	denotes	describes	indicates
involves	is	is known as	means
refers to	stands for	term	

2) *Classification or Enumeration*

1 (one)	2 (two)	3 (three)	also
another	categories	categorize	classes
consists of	constitutes	distinct	divided into
element(s)	factor(s)	finally	first
includes	kind(s)	lastly	many

most	number	other(s)	second
several	some	third	type(s)

3) Comparison

alike	also	as ... as	both
common	comparable	equally	equivalent
identical	in the same way	like	likewise
parallel	resembles	same	similar
similarities	similarity	similarly	

Contrast

...er	admittedly	after all	albeit
alternatively	although	but	contradict
contrary	contrast	conversely	despite
difference	different	differentiate	differs from
discriminate	distinction	distinguish	even so
even though	however	in spite of	instead
less	more	nevertheless	nonetheless
notwithstanding	on the other hand	opposed to	rather than
regardless	still	though	unlike
whereas	while	yet	

4) Time Order or Sequence

after	at <i>time</i>	before	begin
by	conclude	during	(in the) end
eventually	final(ly)	first	for
from	in <i>month, year</i>	in turn	initially
last(ly)	later	meanwhile	next
now	on <i>date</i>	once	originally
period	prior (to)	process	second
sequence	since	so far	(as) soon (as)
stage(s)	start	step(s)	subsequently
then	till	time	ultimately
up to	when	whenever	

5) Cause

(on) account (of)	as	because	by
cause	is caused by	consequence	due to
in that	in view of	inasmuch as	now that
reason(s)	results from	since	works by

Effect

effect	gives rise to	(the) result	results in
so (that)	thereby	therefore	thus

2.3 Text Organization Structure Exercises

Exercise

Read the texts below. What is the topic and main idea for each text? What are the signal words, and therefore, what is the pattern of organization of the text?

Example

Aspirin **causes** several different **effects** in the body, mainly the reduction of inflammation, analgesia (relief of pain), and the prevention of clotting, and the reduction of fever. Much of this is believed to be **due to** decreased production of prostaglandins and thromboxanes. Aspirin's ability to suppress the production of prostaglandins and thromboxanes is **due to** its irreversible inactivation of the cyclooxygenase (COX) enzyme. Cyclooxygenase is required for prostaglandin and thromboxane synthesis. Aspirin acts as an acetylating agent where an acetyl group is covalently attached to a serine residue in the active site of the COX enzyme. This makes aspirin different from other NSAIDs (such as diclofenac and ibuprofen), which are reversible inhibitors. However, other **effects** of aspirin, such as uncoupling oxidative phosphorylation in mitochondria, and the modulation of signaling through NF- κ B, are also being investigated.

<http://en.wikipedia.org/wiki/Aspirin>

Topic: aspirin

Main idea: What are the effects of aspirin in the body?

Text structure: cause and effect

- 1 Units of measure are not limited to physical categories. Examples of physical categories are: linear measure, area, volume, mass, velocity, time duration. Examples of non-physical categories are: currency, quality indicator, color intensity.

[http://en.wikipedia.org/wiki/Dimension_\(metadata\)](http://en.wikipedia.org/wiki/Dimension_(metadata))

Topic:

Main idea:

Text structure:

- 2 While the term "backcountry" is roughly comparable to the term "wilderness",

they are not necessarily equivalent. "Wilderness" implies more the condition whereas "backcountry" implies more the position. Backcountry is similar to hinterland. There is some debate about the accessibility of people by means other than human power. While wilderness is a state of mind that implies pristine and untouched landscapes, backcountry serves as areas of land explored exclusively by human power. Wilderness exists in many places, including the backcountry.

<http://en.wikipedia.org/wiki/Backcountry>

Topic:

Main idea:

Text structure:

- 3 All mammals except the monotremes, the xenarthrans, the pangolins, and the cetaceans have up to four distinct types of teeth, with a maximum number for each. These are the incisor (cutting), the canine, the premolar, and the molar (grinding). Mammals that have distinct types of teeth are heterodont; others are homodont.

<http://en.wikipedia.org/wiki/Dentition>

Topic:

Main idea:

Text structure:

- 4 The greenhouse effect is caused by an atmosphere containing gases that absorb and emit infrared radiation. Greenhouse gases trap heat within the surface-troposphere system, causing heating at the surface of the planet or moon. This mechanism is fundamentally different from that of an actual greenhouse, which works by isolating warm air inside the structure so that heat is not lost by convection. The greenhouse effect was discovered by Joseph Fourier in 1824, first reliably experimented on by John Tyndall in 1858, and first reported quantitatively by Svante Arrhenius in 1896.

http://en.wikipedia.org/wiki/Greenhouse_effect

Topic:

Main idea:

Text structure:

- 5 The beginning of the 20th century brought the start of a revolution in physics. The long-held theories of Newton were shown not to be correct in all circumstances. Beginning in 1900, Max Planck, Albert Einstein, Niels Bohr and others developed quantum theories to explain various anomalous experimental results, by introducing discrete energy levels. Not only did quantum mechanics show that the laws of motion did not hold on small scales, but even more disturbingly, the theory of general relativity, proposed by Einstein in 1915, showed that the fixed background of spacetime, on which both Newtonian mechanics and special relativity depended, could not exist. In 1925, Werner Heisenberg and Erwin Schrödinger formulated quantum mechanics, which explained the preceding quantum theories. The observation by Edwin Hubble in 1929 that the speed at which galaxies recede positively correlates with their distance, led to the understanding that the universe is expanding, and the formulation of the Big Bang theory by Georges Lemaître.

http://en.wikipedia.org/wiki/History_of_science

Topic:

Main idea:

Text structure:

- 6 The two most important types of spacetime singularities are curvature singularities and conical singularities. Singularities can also be divided according to whether they are covered by an event horizon or not (naked singularities). According to general relativity, the initial state of the universe, at the beginning of the Big Bang, was a singularity. Another type of singularity predicted by general relativity is inside a black hole: any star collapsing beyond a certain point would form a black hole, inside which a singularity (covered by an event horizon) would be formed, as all the matter would flow into a certain point (or a circular line, if the black hole is rotating). These singularities are also known as curvature singularities.

http://en.wikipedia.org/wiki/Gravitational_singularity

Topic:

Main idea:

Text structure:

- 7 Ocean Engineering is an ambiguously defined discipline, but may refer to Oceanographic Engineering, a term describing marine electronics engineering applied to supporting the work of oceanographers; or, may refer to offshore engineering, or maritime engineering, which is the branch of engineering allied to civil engineering, and concerned with the technical aspects of fixed and floating offshore marine structures and systems related to harnessing ocean resources. These include offshore oil and gas and the rapidly expanding area of ocean renewable energy, as well as other ocean resource activities such as sub-sea mining and aquaculture.

http://en.wikipedia.org/wiki/Ocean_engineering

Topic:

Main idea:

Text structure:

- 8 Microorganisms are very diverse; they include bacteria, fungi, archaea, and protists; microscopic plants (called green algae); and animals such as plankton and the planarian. Some microbiologists also include viruses, but others consider these as non-living. Most microorganisms are unicellular (single-celled), but this is not universal, since some multicellular organisms are microscopic, while some unicellular protists and bacteria, like *Thiomargarita namibiensis*, are macroscopic and visible to the naked eye.

<http://en.wikipedia.org/wiki/Microorganism>

Topic:

Main idea:

Text structure:

- 9 The sunlit sky appears blue because air scatters short-wavelength light more than longer wavelengths. Since blue light is at the short wavelength end of the visible spectrum, it is more strongly scattered in the atmosphere than long wavelength red light. The result is that the human eye perceives blue when looking toward parts of the sky other than the sun. Near sunrise and sunset, most of the light we see comes in nearly tangent to the Earth's surface, so that the light's path through the atmosphere is so long that much of the blue and even green light is scattered out, leaving the sun rays and the clouds it illuminates red. Therefore, when looking at the sunset and sunrise, you will see the color red more than any of the other colors.

http://en.wikipedia.org/wiki/Diffuse_sky_radiation

Topic:

Main idea:

Text structure:

- 10 A binary star is a star system consisting of two stars orbiting around their common center of mass. The brighter star is called the primary and the other is its companion star, or secondary. Research between the early 1800s and today suggests that many stars are part of either binary star systems or star systems with more than two stars, called multiple star systems. The term double star may be used synonymously with binary star, but more generally, a double star may be either a binary star or an optical double star which consists of two stars with no physical connection but which appear close together in the sky as seen from the Earth. A double star may be determined to be optical if its components have sufficiently different proper motions or radial velocities, or if parallax measurements reveal its two components to be at sufficiently different distances from the Earth. Most known double stars have not yet been determined to be either bound binary star systems or optical doubles.

http://en.wikipedia.org/wiki/Binary_star

Topic:

Main idea:

Text structure:

- 11 Although Mars is smaller (11% by mass) and 50% further away from the Sun than the Earth, its climate has important similarities, such as the polar ice caps, seasonal changes and the observable presence of weather patterns. It has attracted sustained study from planetologists and climatologists. Although Mars's climate has similarities to Earth's, including seasons and periodic ice ages, there are also important differences such as the absence of liquid water (though frozen water exists) and much lower thermal inertia. Mars' atmosphere has a scale height of approximately 11 km (36,000 ft), 60% greater than that on Earth. The climate is of considerable relevance to the question of whether life is or was present on the planet, and briefly received more interest in the news due to NASA measurements indicating increased sublimation of the south polar icecap leading to some popular press speculation that Mars was undergoing a parallel bout of global warming.

http://en.wikipedia.org/wiki/Climate_of_Mars

Topic:

Main idea:

Text structure:

- 12 In somatic cell nuclear transfer, the nucleus, which contains the organism's DNA, of a somatic cell (a body cell other than a sperm or egg cell) is removed and the rest of the cell discarded. At the same time, the nucleus of an egg cell is removed. The nucleus of the somatic cell is then inserted into the enucleated egg cell. After being inserted into the egg, the somatic cell nucleus is reprogrammed by the host cell. The egg, now containing the nucleus of a somatic cell, is stimulated with a shock and will begin to divide. After many mitotic divisions in culture, this single cell forms a blastocyst (an early stage embryo with about 100 cells) with almost identical DNA to the original organism.

http://en.wikipedia.org/wiki/Somatic_cell_nuclear_transfer

Topic:

Main idea:

Text structure:

- 13 The arms of orangutans are twice as long as their legs. Much of the arm's length has to do with the length of the radius and the ulna rather than the humerus. Their fingers and toes are curved, allowing them to better grip onto branches. Orangutans have less restriction in the movements of their legs than humans and other primates, due to the lack of a hip joint ligament which keeps the femur held into the pelvis. Unlike gorillas and chimpanzees, orangutans are not true knuckle-walkers, and are instead fist-walkers.

<http://en.wikipedia.org/wiki/Orangutan>

Topic:

Main idea:

Text structure:

- 14 Predation in its zoological sense is the killing and consumption of another organism, which excludes bacteria and parasites from the apex predator concept. Predation has been defined in this sense since 1932. The apex predator concept is commonly applied in wildlife management and conservation, as well as eco-tourism. In these contexts it has been defined in terms of trophic levels. Trophic levels are "hierarchical strata of a food web characterized by organisms which are the same number of steps removed from the primary producers." Primary, secondary, tertiary, and higher level consumers occupy successive trophic levels. One study of marine food webs defined apex predators as greater than trophic level four.

http://en.wikipedia.org/wiki/Apex_predator

Topic:

Main idea:

Text structure:

- 15 Wolves differ from domestic dogs in a more varied nature. Anatomically, wolves have smaller orbital angles than dogs (over 53 degrees for dogs, under 45 degrees for wolves) and a comparatively larger brain capacity. Larger paw size, yellow eyes, longer legs, and bigger teeth further distinguish adult wolves from other canids, especially dogs. Also, a supracaudal gland is present at the base of the tail in wolves but not in many dogs.

http://en.wikipedia.org/wiki/Gray_wolf

Topic:

Main idea:

Text structure:

- 16 The Cretaceous–Tertiary extinction event, which occurred approximately 65.5 million years ago (Ma), was a large-scale mass extinction of animal and plant species in a geologically short period of time. Widely known as the K–T extinction event, it is associated with a geological signature known as the K–T boundary, usually a thin band of sedimentation found in various parts of the world. K is the traditional abbreviation for the Cretaceous Period derived from the German name Kreidezeit, and T is the abbreviation for the Tertiary Period (a historical term for the period of time now covered by the Paleogene and Neogene periods). The event marks the end of the Mesozoic Era and the beginning of the Cenozoic Era. With “Tertiary” being discouraged as a formal time or rock unit by the International Commission on Stratigraphy, the K–T event is now called the Cretaceous–Paleogene (or K–Pg) extinction event by many researchers.

Topic:

Main idea:

Text structure:

- 17 Comparisons between the Microsoft Windows and Linux computer operating systems are a common topic of discussion among their users. Currently, Windows is the dominant proprietary operating system for personal desktop use (in terms of desktop installations), while Linux is the most prominent free software operating system. Both operating systems not only compete for user base in the personal computer market but are also rivals in the server and



embedded systems markets.

http://en.wikipedia.org/wiki/Comparison_of_Windows_and_Linux

Topic:

Main idea:

Text structure:

- 18 Chloroplasts are organelles found in plant cells and other eukaryotic organisms that conduct photosynthesis. Chloroplasts capture light energy to conserve free energy in the form of ATP and reduce NADP to NADPH through a complex set of processes called photosynthesis. The word chloroplast is derived from the Greek words chloros, which means green, and plast, which means form or entity. Chloroplasts are members of a class of organelles known as plastids.

<http://en.wikipedia.org/wiki/Chloroplast>

Topic:

Main idea:

Text structure:

- 19 Two kinds of solar time, apparent solar time and mean solar time, are among the three kinds of time that were recognized and measured by astronomers up to the 1950s (the third traditional kind of time being sidereal time, time according to the apparent rotation of the stars). The measures of all these three kinds of time depend on the rotation of the earth. Nowadays both kinds of solar time, along with sidereal time, stand in contrast to newer kinds of time measurement, introduced from the 1950s onwards (starting with ephemeris time), which were designed to be independent of earth rotation.

http://en.wikipedia.org/wiki/Solar_time

Topic:

Main idea:

Text structure:

- 20 A Turing machine is a theoretical device that manipulates symbols contained on a strip of tape. Despite its simplicity, a Turing machine can be adapted to simulate the logic of any computer algorithm, and is particularly useful in explaining the functions of a CPU inside of a computer. The “Turing” machine was described by Alan Turing in 1937, who called it an “a(automatic)-machine”. Turing machines are not intended as a practical computing technology, but rather as a thought experiment representing a computing machine. They help computer scientists understand the limits of mechanical computation.

http://en.wikipedia.org/wiki/Turing_machine

Topic:

Main idea:

Text structure:

- 21 The most common perception of a volcano is of a conical mountain, spewing lava and poisonous gases from a crater at its summit. This describes just one of many types of volcano, and the features of volcanoes are much more complicated. The structure and behavior of volcanoes depends on a number of factors. Some volcanoes have rugged peaks formed by lava domes rather than a summit crater, whereas others present landscape features such as massive plateaus. Vents that issue volcanic material (lava, which is what magma is called once it has escaped to the surface, and ash) and gases (mainly steam and magmatic gases) can be located anywhere on the landform. Many of these vents give rise to smaller cones such as Puu Oo on a flank of Hawaii’s Kīlauea.

<http://en.wikipedia.org/wiki/Volcano>

Topic:

Main idea:

Text structure:

- 22 Peptides have recently received prominence in molecular biology for several reasons. The first and most important is that peptides allow the creation of peptide antibodies in animals without the need to purify the protein of interest. This involves synthesizing antigenic peptides of sections of the protein of interest. These will then be used to make antibodies in a rabbit or mouse against the protein. Another reason is that peptides have become instrumental in mass spectrometry, allowing the identification of proteins of interest based on peptide masses and sequence. In this case the peptides are most often generated by in-gel digestion after electrophoretic separation of the proteins. Finally, peptides have recently been used in the study of protein structure and function. For example, synthetic peptides can be used as probes to see where protein-peptide interactions occur. Inhibitory peptides are also used in clinical research to examine the effects of peptides on the inhibition of cancer proteins and other diseases.

<http://en.wikipedia.org/wiki/Peptide>

Topic:

Main idea:

Text structure:

- 23 The DNA content of a cell is duplicated at the start of the cell reproduction process. Prior to DNA replication, the DNA content of a cell can be represented as the amount Z (the cell has Z ribosomes). After the DNA replication process, the amount of DNA in the cell is $2Z$ (multiplication: $2 \times Z = 2Z$). During binary fission and mitosis the duplicated DNA content of the reproducing parental cell is separated into two equal halves that are destined to end up in the two daughter cells. The final part of the cell reproduction process is cell division, when daughter cells physically split apart from a parental cell. During meiosis, there are two cell division steps that together produce the four daughter cells.

http://en.wikipedia.org/wiki/Cell_growth

Topic:

Main idea:

Text structure:

- 24 Although photosynthesis can happen in different ways in different species, some features are always the same. For example, the process always begins when energy from light is absorbed by proteins called photosynthetic reaction centers that contain chlorophylls. In plants, these proteins are held inside organelles called chloroplasts, while in bacteria they are embedded in the plasma membrane. Some of the light energy gathered by chlorophylls is stored in the form of adenosine triphosphate (ATP). The rest of the energy is used to remove electrons from a substance such as water. These electrons are then used in the reactions that turn carbon dioxide into organic compounds. In plants, algae and cyanobacteria this is done by a sequence of reactions called the Calvin cycle, but different sets of reactions are found in some bacteria, such as the reverse Krebs cycle in chlorobium. Many photosynthetic organisms have adaptations that concentrate or store carbon dioxide. This helps reduce a wasteful process called photorespiration that can consume part of the sugar produced during photosynthesis.

<http://en.wikipedia.org/wiki/Photosynthesis>

Topic:

Main idea:

Text structure:

- 25 The history of thermodynamics as a scientific discipline generally begins with Otto von Guericke who, in 1650, built and designed the world's first vacuum pump and demonstrated a vacuum using his Magdeburg hemispheres. Guericke was driven to make a vacuum in order to disprove Aristotle's long-held supposition that "nature abhors a vacuum". Shortly after Guericke, the Irish physicist and chemist Robert Boyle had learned of Guericke's designs and, in 1656, in coordination with English scientist Robert Hooke, built an air pump. Using this pump, Boyle and Hooke noticed a correlation between pressure, temperature, and volume. In time, Boyle's Law was formulated, which states that pressure and volume are inversely proportional. Then, in 1679, based on these concepts, an associate of Boyle's named Denis Papin built a bone digester, which was a closed vessel with a tightly fitting lid that confined steam until a high pressure was generated.

<http://en.wikipedia.org/wiki/Thermodynamics>



Topic:

Main idea:

Text structure:

- 26 Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) between the start and the end of the 20th century. The Intergovernmental Panel on Climate Change (IPCC) concludes that most of the observed temperature increase since the middle of the 20th century was very likely caused by increasing concentrations of greenhouse gases resulting from human activity such as fossil fuel burning and deforestation. The IPCC also concludes that variations in natural phenomena such as solar radiation and volcanic eruptions had a small cooling effect after 1950. These basic conclusions have been endorsed by more than 40 scientific societies and academies of science, including all of the national academies of science of the major industrialized countries.

http://en.wikipedia.org/wiki/Global_warming

Topic:

Main idea:

Text structure:

- 27 In mathematics, an implicit function is a function in which the dependent variable has not been given "explicitly" in terms of the independent variable. To give a function f explicitly is to provide a prescription for determining the output value of the function y in terms of the input value x : $y = f(x)$. By contrast, the function is implicit if the value of y is obtained from x by solving an equation of the form: $R(x,y) = 0$. That is, it is defined as the level set of a function in two variables: one variable or the other may determine the other, but one is not given an explicit formula for one in terms of the other.

http://en.wikipedia.org/wiki/Implicit_and_explicit_functions

Topic:



Main idea:

Text structure:

- 28 A skipping tornado is a vaguely defined term which refers to a tornado which has a discontinuous damage path. This may be due to several factors:
- 1) The tornado actually lifting from the surface (which technically makes the two damage paths separate tornadoes).
 - 2) The tornado passing over a portion of land where there are no structures or vegetation capable of showing damage
 - 3) The tornado temporarily weakening so that the winds are below the damage threshold of the structures or vegetation being affected.

http://en.wikipedia.org/wiki/Skipping_tornado

Topic:

Main idea:

Text structure:

- 29 Many species of animals use paralyzing toxins in order to capture prey, evade predation, or both. One famous example is the tetrodotoxin of fish species such as *Takifugu rubripes*, the famously lethal pufferfish of Japanese fugu. This toxin works by binding to sodium channels in nerve cells, preventing the cells' proper function. A non-lethal dose of this toxin results in temporary paralysis. This toxin is also present in many other species ranging from toads to nemerteans. Another interesting use of paralysis in the natural world is the behavior of some species of wasp. In order to complete the reproductive cycle, the female wasp first paralyzes a prey item such as a grasshopper and then places it into her nest. Eggs are then laid on the paralyzed insect, which is devoured by the larvae after they hatch. Many snakes also exhibit powerful neurotoxins that can cause non-permanent paralysis or death.

<http://en.wikipedia.org/wiki/Paralysis>

Topic:

Main idea:

Text structure:

- 30 Historically, galaxies have been categorized according to their apparent shape (usually referred to as their visual morphology). A common form is the elliptical galaxy, which has an ellipse-shaped light profile. Spiral galaxies are disk-shaped assemblages with dusty, curving arms. Galaxies with irregular or unusual shapes are known as peculiar galaxies, and typically result from disruption by the gravitational pull of neighboring galaxies. Such interactions between nearby galaxies, which may ultimately result in galaxies merging, may induce episodes of significantly increased star formation, producing what is called a starburst galaxy. Small galaxies that lack a coherent structure could also be referred to as irregular galaxies.

<http://en.wikipedia.org/wiki/Galaxy>

Topic:

Main idea:

Text structure:

3 Word Reading Strategies

- 1. Restatements**
- 2. Definitions**
- 3. Prefixes, roots and suffixes**
- 4. Context**

3.1 Restatements

What are restatements?

Restatements are pronouns and other phrases using determiners that are used to replace previous words or phrases within a text.

Why are restatements used?

Restatements are used as a means of establishing cohesion within a text, either by **omitting**, **referring to**, **substituting for**, or **summarizing** previous words, phrases, or sentences. Restatements help to maintain the flow of ideas.

How are pronouns used to make restatements?

Pronouns are words that stand for other words. Pronouns replace subjects, objects or possessives. Pronouns can be used in place of nouns, noun phrases, sentences, paragraphs, or even groups of paragraphs. Pronouns must agree in number (singular or plural) with the word or words that they replace, and like must replace like; a subject pronoun must replace a subject, and an object pronoun must replace an object. The common pronouns of scientific texts are the, it, they, this, that, these, those and which.

Example 1; In typical usage, water refers only to its liquid form or state, but the substance also has a solid state, ice, and a gaseous state, water vapor or steam. Water covers 71% of the Earth's surface. On Earth, it is found mostly in oceans and other large water bodies, with 1.6% of water below ground in aquifers and 0.001% in the air as vapor, clouds (formed of solid and liquid water particles suspended in air), and precipitation.

In this example, "it" refers to "water".

Example 2: Although all penguin species are native to the southern hemisphere, they are not found only in cold climates, such as Antarctica. In fact, only a few species of penguin live so far south. Several species are found in the temperate zone, and one species, the Galápagos Penguin, lives near the equator.

In this example, "they" refers to "penguin species".

How are determiners used to make restatements?

Restatements can also be made by employing pronouns that function as determiners; the, this, that, these, and those.

There are three main ways a writer may use these determiners to make restatements;

1 **Omission**

this / that / these / those *with* **(nothing)**

Omission is used for brevity and style, and when there is no need for repetition.

Example 1; The most prominent feature of the walrus is the long tusks. These are elongated canines, which are present in both sexes and can reach a length of 1 metre and weigh up to 5.4 kilograms.

In this example, "these" refers to "long tusks". "Tusks" is the only plural word of the previous sentence, so there is no ambiguity.

Example 2; There are, however, a number of respects in which the structure of the cerebellum is compartmentalized. There are large compartments that are generally known as zones; these can be decomposed into smaller compartments known as microzones.

In this example, "these" refers to "large compartments that are generally known as zones".

2 **Referral**

the / this / that / these / those *with* **previous noun**

Referral restatements are used for clarity of expression.

Example 1; The strings of string theory are one-dimensional oscillating lines, but they are no longer considered fundamental to the theory, which can be formulated in terms of points or surfaces too.

In this example, "the theory" refers to "string theory".

Example 2; Fossil fuels are fuels formed by natural resources such as anaerobic decomposition of buried dead organisms. The age of the organisms and their resulting fossil fuels is typically millions of years, and sometimes exceeds 650 million years. These fuels contain a high percentage of carbon and hydrocarbons.

In this example, "these fuels" refers to "fossil fuels".

3 **Substitution**

the / this / that / these / those *with* **new noun**

New nouns are employed stylistically to avoid repetition, and to show the semantic relationships between the two words, phrases or ideas.

Example 1; In environments which are potentially lethal to the cell, an amoeba may become dormant by forming itself into a ball and secreting a protective

membrane to become a microbial cyst. The cell remains in this state until it encounters more favorable conditions.

In this example, "this state" refers to "dormancy", or "being dormant".

Example 2; As a motivation technique (usually called Innovation Time Off), all Google engineers are encouraged to spend 20% of their work time (one day per week) on projects that interest them. Some of Google's newer services, such as Gmail, Google News, Orkut, and AdSense originated from these independent endeavors.

In this example, "these independent endeavors" refers to "projects that interest Google engineers"

4 **Summary**

the / this / that / such / these / those *with* **a general word or phrase**

Summary restatements summarize concepts or ideas.

Example 1; For isolated systems, entropy never decreases. This fact has several important consequences in science: first, it prohibits "perpetual motion" machines; and second, it suggests an arrow of time.

In this example, "this fact" refers to "entropy never decreases".

Example 2; Coastal limestones are often eroded by organisms which bore into the rock by various means. This process is known as bioerosion.

In this example, "this process" refers to "Coastal limestones are often eroded by organisms which bore into the rock by various means".

3.1 Restatement Exercises

Exercise

Read the texts below. What do the highlighted words refer to?

- 1 Fossil fuels are fuels formed by natural resources such as anaerobic decomposition of buried dead organisms. The age of the organisms and their resulting fossil fuels is typically millions of years, and sometimes exceeds 650 million years. **These fuels** contain a high percentage of carbon and hydrocarbons.

http://en.wikipedia.org/wiki/Fossil_fuel

Answer:

- 2 Acetic acid, CH₃COOH, also known as ethanoic acid, is an organic acid, which gives vinegar its sour taste and pungent smell. **It** is a weak acid, in that it is only a partially dissociated acid in an aqueous solution.

http://en.wikipedia.org/wiki/Acetic_acid

Answer:

- 3 Cancer is fundamentally a disease of regulation of tissue growth. In order for a normal cell to transform into a cancer cell, genes which regulate cell growth and differentiation must be altered. Genetic changes can occur at many levels, from gain or loss of entire chromosomes to a mutation affecting a single DNA nucleotide. There are two broad categories of genes which are affected by **these changes**.

<http://en.wikipedia.org/wiki/Cancer>

Answer:

- 4 Prolonged intake of flavonol-rich cocoa has been linked to cardiovascular health benefits, though it should be noted that **this** refers to raw cocoa and to a lesser extent, dark chocolate, since flavonoids degrade during cooking and alkalizing processes.

http://en.wikipedia.org/wiki/Cocoa_bean

Answer:

- 5 The state of water on a planet depends on ambient pressure, which is determined by the planet's gravity. If a planet is sufficiently massive, the water on **it** may be solid even at high temperatures, because of the high pressure caused by gravity.

<http://en.wikipedia.org/wiki/Water>

Answer:

- 6 Sharks (superorder Selachimorpha) are a type of fish with a full cartilaginous skeleton and a highly streamlined body. The earliest known sharks date from more than 420 million years ago, before the time of the dinosaurs. Since **that time**, sharks have diversified into 440 species, ranging in size from the small dwarf lanternshark, *Etmopterus perryi*, a deep sea species of only 17 centimeters in length, to the whale shark, *Rhincodon typus*, the largest fish, which reaches approximately 12 metres and which feeds only on plankton, squid, and small fish through filter feeding.

<http://en.wikipedia.org/wiki/Shark>

Answer:

- 7 Depression affects 20-30% of people who have dementia, and about 20% have anxiety. Psychosis (often delusions of persecution) and agitation/aggression also often accompany dementia. Each of **these** needs to be assessed and treated independent of the underlying dementia.

<http://en.wikipedia.org/wiki/Dementia>

Answer:

- 8 It is an almost universal attribute of polyps to reproduce asexually by the method of budding. This mode of reproduction may be combined with sexual reproduction, or may be the sole method by which the polyp produces offspring, in which case the polyp is entirely without sexual organs. In many cases the buds formed do not separate from the parent but remain in continuity with **it**, thus forming colonies or stocks, which may reach a great size and contain a vast number of individuals. Slight differences in the method of budding produce great variations in the form of the colonies. The reef-building corals are polyp-colonies, strengthened by the formation of a firm skeleton.

<http://en.wikipedia.org/wiki/Polyp>

Answer:

- 9 What "classical physics" refers to depends on the context. When discussing special relativity, **it** refers to the Newtonian physics which preceded relativity, i.e. the branches of physics based on principles developed before the rise of relativity and quantum mechanics. When discussing general relativity, **it** refers to the result of modifying Newtonian physics to incorporate special relativity. When discussing quantum mechanics, **it** refers to non-quantum physics, often including even general relativity. In other words, **it** is the physics preceding the physics of interest in one's discussion.

http://en.wikipedia.org/wiki/Classical_physics

Answer:

- 10 Both males and females defend the pride against intruders. Some individual lions consistently lead the defense against intruders, while others lag behind. Lions tend to assume specific roles in the pride. Those lagging behind may provide other valuable services to the group. An alternative hypothesis is that there is some reward associated with being a leader who fends off intruders and the rank of lionesses in the pride is reflected in **these responses**.

<http://en.wikipedia.org/wiki/Lion>

Answer:

- 11 In the heart of lungfish, the septum extends part-way into the ventricle. This allows for some degree of separation between the de-oxygenated bloodstream destined for the lungs and the oxygenated stream that is delivered to the rest of the body. The absence of such a division in living amphibian species may be at least partly due to the amount of respiration that occurs through the skin in **such species**; thus, the blood returned to the heart through the vena cavae is, in fact, already partially oxygenated. As a result, there may be less need for a finer division between the two bloodstreams than in lungfish or other tetrapods.

<http://en.wikipedia.org/wiki/Heart>

Answer:

- 12 The strength of the depletion zone electric field increases as the reverse-bias voltage increases. Once the electric field intensity increases beyond a critical level, the p-n junction depletion zone breaks-down and current begins to flow, usually by either the Zener or avalanche breakdown processes. Both of **these breakdown processes** are non-destructive and are reversible, so long as the amount of current flowing does not reach levels that cause the semiconductor material to overheat and cause thermal damage.

http://en.wikipedia.org/wiki/P-n_junction

Answer:

- 13 A great deal of research on biological clocks was done in the latter half of the 20th century. It is now known that the molecular circadian clock can function within a single cell; i.e., it is cell-autonomous. At the same time, different cells may communicate with each other resulting in a synchronized output of electrical signaling. **These** may interface with endocrine glands of the brain to result in periodic release of hormones.

http://en.wikipedia.org/wiki/Circadian_rhythm

Answer:

- 14 The first approved drug for the causative treatment of sickle-cell anaemia,

hydroxyurea, was shown to decrease the number and severity of attacks in a study in 1995 (Charache et al.) and shown to possibly increase survival time in a study in 2003 (Steinberg et al.). **This** is achieved, in part, by reactivating fetal hemoglobin production in place of the hemoglobin S that causes sickle-cell anaemia.

http://en.wikipedia.org/wiki/Sickle-cell_disease

Answer:

- 15 A model organism is a non-human species that is extensively studied to understand particular biological phenomena, with the expectation that discoveries made in the organism model will provide insight into the workings of other organisms. In particular, model organisms are widely used to explore potential causes and treatments for human disease when human experimentation would be unfeasible or unethical. **This strategy** is made possible by the common descent of all living organisms, and the conservation of metabolic and developmental pathways and genetic material over the course of evolution. Studying model organisms can be informative, but care must be taken when generalizing from one organism to another.

http://en.wikipedia.org/wiki/Model_organism

Answer:

- 16 An understanding of the relationship between electricity and magnetism began in 1819 with work by Hans Christian Oersted, a professor at the University of Copenhagen, who discovered more or less by accident that an electric current could influence a compass needle. This landmark experiment is known as Oersted's Experiment. Several other experiments followed, with André-Marie Ampère, Carl Friedrich Gauss, Michael Faraday, and others finding further links between magnetism and electricity. James Clerk Maxwell synthesized and expanded these insights into Maxwell's equations, unifying electricity, magnetism, and optics into the field of electromagnetism. In 1905, Einstein used **these laws** in motivating his theory of special relativity, requiring that the laws held true in all inertial reference frames.

<http://en.wikipedia.org/wiki/Magnetism>

Answer:

- 17 Several theories have been offered as to why the Spanish flu may have been "forgotten" by historians and the public over so many years. The rapid pace of the pandemic, which killed most of its victims in the United States, for example, within a period of less than nine months, resulted in limited media coverage in a given area. The general population was also familiar with patterns of pandemic disease in the late 19th and early 20th centuries: typhoid, yellow fever, diphtheria, and cholera all occurred near the same time period. **These outbreaks** probably lessened the significance of the influenza pandemic for the public.

http://en.wikipedia.org/wiki/1918_flu_pandemic

Answer:

- 18 After completing his theory of special relativity, Albert Einstein realized that forces felt by objects undergoing constant proper acceleration are actually feeling themselves being accelerated, so that, for example, a car's acceleration forwards would result in the driver feeling a slight pressure between herself and her seat. In the case of gravity, which Einstein concluded is not actually a force, this is not the case; acceleration due to gravity is not felt by an object in free-fall. **This** was the basis for his development of general relativity, a relativistic theory of gravity.

<http://en.wikipedia.org/wiki/Acceleration>

Answer:

- 19 Louis de Broglie postulated that all particles with momentum have a wavelength; $\lambda = h/p$, where h is Planck's constant, and p is the magnitude of the momentum of the particle. **This hypothesis** was at the basis of quantum mechanics. Nowadays, this wavelength is called the de Broglie wavelength. For example, the electrons in a CRT display have a de Broglie wavelength of about 10^{-13} m.

<http://en.wikipedia.org/wiki/Wave>

Answer:

(λ is pronounced "lambda". See 8.2 symbols).

- 20 Computer analysis of viral and host DNA sequences is giving a better understanding of the evolutionary relationships between different viruses and may help identify the ancestors of modern viruses. To date, **such analyses** have not helped to decide on which of these hypotheses are correct. However, it seems unlikely that all currently known viruses have a common ancestor and viruses have probably arisen numerous times in the past by one or more mechanisms.

<http://en.wikipedia.org/wiki/Virus>

Answer:

- 21 The evolutionary perspective offers an alternative approach to understand what happiness or quality of life is about. Briefly, the questions to be answered are: What features are included in the brain that allows humans to distinguish between positive and negative states of mind, and how do these features improve the survivability of humans? Answering these questions points towards an understanding of what happiness is about and how to best exploit the capacities of the brain with which humans are endowed. **The perspective** is presented in detail by the evolutionary biologist Bjørn Grinde in his book Darwinian Happiness, as well as in a more formal way.

<http://en.wikipedia.org/wiki/Happiness>

Answer:

- 22 A supernova (pl. supernovae) is a stellar explosion that is more energetic than a nova. Supernovae are extremely luminous and cause a burst of radiation that often briefly outshines an entire galaxy, before fading from view over several weeks or months. During **this short interval** a supernova can radiate as much energy as the Sun is expected to emit over its entire life span. The explosion expels much or all of a star's material at a velocity of up to 30,000 km/s (a tenth the speed of light), driving a shock wave into the surrounding interstellar medium. This shock wave sweeps up an expanding shell of gas and dust called a supernova remnant.

<http://en.wikipedia.org/wiki/Supernova>

Answer:

- 23 The human body is anywhere from 55% to 78% water depending on body size. To function properly, the body requires between one and seven liters of water per day to avoid dehydration; the precise amount depends on the level of activity, temperature, humidity, and other factors. Most of this is ingested through foods or beverages other than drinking straight water. It is not clear how much water intake is needed by healthy people, though most advocates agree that 6–7 glasses of water (approximately 2 liters) daily is the minimum to maintain proper hydration. Medical literature favors a lower consumption, typically 1 liter of water for an average male, excluding extra requirements due to fluid loss from exercise or warm weather. For **those** who have healthy kidneys, it is rather difficult to drink too much water, but (especially in warm humid weather and while exercising) it is dangerous to drink too little. People can drink far more water than necessary while exercising, however, putting them at risk of water intoxication (hyperhydration), which can be fatal. The "fact" that a person should consume eight glasses of water per day cannot be traced back to a scientific source. There are other myths such as the effect of water on weight loss and constipation that have been dispelled.

<http://en.wikipedia.org/wiki/Water>

Answer:

- 24 A major impact of desertification is biodiversity loss and loss of productive capacity, for example, by transition from land dominated by shrublands to non-native grasslands. In the semi-arid regions of southern California, many coastal sage scrub and chaparral ecosystems have been replaced by non-native, invasive grasses due to the shortening of fire return intervals. **This** can create a monoculture of annual grass that cannot support the wide range of animals once found in the original ecosystem. In Madagascar's central highland plateau, 10% of the entire country has been lost to desertification due to slash and burn agriculture by indigenous peoples.

<http://en.wikipedia.org/wiki/Desertification>

Answer:

- 25 One characteristic of Java is portability, which means that computer programs written in the Java language must run similarly on any supported hardware/operating-system platform. **This** is achieved by compiling the Java language code to an intermediate representation called Java bytecode, instead of directly to platform-specific machine code. Java bytecode instructions are analogous to machine code, but are intended to be interpreted by a virtual machine (VM) written specifically for the host hardware. End-users commonly use a Java Runtime Environment (JRE) installed on their own machine for standalone Java applications, or in a Web browser for Java applets.

[http://en.wikipedia.org/wiki/Java_\(programming_language\)](http://en.wikipedia.org/wiki/Java_(programming_language))

Answer:

- 26 A genetically modified organism (GMO) or genetically engineered organism (GEO) is an organism whose genetic material has been altered using genetic engineering techniques. These techniques, generally known as recombinant DNA technology, use DNA molecules from different sources, which are combined into one molecule to create a new set of genes. This DNA is then transferred into an organism, giving **it** modified or novel genes. Transgenic organisms, a subset of GMOs, are organisms which have inserted DNA that originated in a different species. Some GMOs contain no DNA from other species and are therefore not transgenic but cisgenic.

http://en.wikipedia.org/wiki/Genetically_modified_organism

Answer:

- 27 Most of the muscle in an alligator’s jaw is intended for biting and gripping prey. The muscles that close the jaws are exceptionally powerful, however the muscles for opening their jaws are relatively weak in comparison. As a result, an adult man can hold an alligator’s jaws shut with his bare hands. In general, a strip of duct tape is enough to prevent an adult alligator from opening its jaws and is one of the most common methods used when alligators are to be captured and/or transported. Alligators are generally timid towards humans and tend to walk or swim away if one approaches. Unfortunately, **this** has led some people to the practice of approaching alligators and their nests in a way that may provoke the animals into attacking. In the state of Florida, it is illegal to feed wild alligators at any time. If fed, the alligators will eventually lose their fear of humans and will learn to associate humans with food, thereby becoming a greater danger to people.

<http://en.wikipedia.org/wiki/Alligator>

Answer:



28 Carbon nanotubes (CNTs) are allotropes of carbon with a cylindrical nanostructure. Nanotubes have been constructed with length-to-diameter ratio of up to 132,000,000:1, which is significantly larger than any other material. **These** have novel properties that make them potentially useful in many applications in nanotechnology, electronics, optics and other fields of materials science, as well as potential uses in architectural fields. They exhibit extraordinary strength and unique electrical properties, and are efficient thermal conductors. Their final usage, however, may be limited by their potential toxicity and controlling their property changes in response to chemical treatment.

http://en.wikipedia.org/wiki/Carbon_nanotube

Answer:

29 A wave is a disturbance that propagates through space and time, usually with transference of energy. A mechanical wave is a wave that propagates or travels through a medium due to the restoring forces it produces upon deformation. For example, when a sound wave is traveling through the air, air molecules slam into their neighbors, which pushes their neighbors into their neighbors (and so on); but when air molecules collide with their neighbors, they also bounce away from them back in the direction they came from. **These collisions** provide a restoring force that keeps the molecules from actually traveling with the wave.

<http://en.wikipedia.org/wiki/Wave>

Answer:

30 The scientific consensus expressed in the 2007 Intergovernmental Panel on Climate Change (IPCC) Summary for Policymakers is for the water cycle to continue to intensify throughout the 21st century, though this does not mean that precipitation will increase in all regions. In subtropical land areas — places that are already relatively dry — precipitation is projected to decrease during the 21st century, increasing the probability of drought. The drying is projected to be strongest near the poleward margins of the subtropics (for example, the Mediterranean Basin, South Africa, southern Australia, and the Southwestern United States). Annual precipitation amounts are expected to increase in near-equatorial regions that tend to be wet in the present climate, and also at high latitudes. **These large-scale patterns** are present in nearly all of the climate model simulations conducted at several international research centers as part of the 4th Assessment of the IPCC.

http://en.wikipedia.org/wiki/Water_cycle

Answer:

3.2 Definitions

Which words are defined in scientific texts?

Technical words - words that are rare but which are specific to their subject or domain - are often defined in scientific texts.

Why are technical words defined in scientific texts?

Scientific texts contain many words that are rare and perhaps even so exclusive to a domain of science that they are not even listed in a regular dictionary. Despite their rarity, however, these scientific words need to be defined because they are essential terminology within their context or field.

How do I notice the technical terms?

Writers of scientific articles will usually try to make the important technical words stand out in some way. There are three basic ways that a writer can highlight the text: **bold**, *italic*, or ***bold italic***. Writers will define the key technical terms using defining verbs such as *denotes*, *indicates*, *involves*, or *is defined as*. Writers can also employ punctuation such as parentheses, semi-colons, dashes, commas or quotation marks. Finally, writers will often clarify or explain technical words using restatement signals such as "that is", "ie;" or "or".

1 highlighted text

bold	<i>italic</i>	<i>bold italic</i>
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2 Defining verbs

concerns	denotes	describes
indicates	involves	is
is called	is characterized by	is concerned with
is defined as	is known as	means
refers to	stands for	term

3 Punctuation

()	:	— —	,	" "	\ ' /
parentheses	colon	dashes	comma	quotation marks	

4 Restatement signals

that is	ie:	or
---------	-----	----

Examples

- 1 The term **ecosystem** refers to the combined physical and biological components of an environment.

technical term: ecosystem

definition: the combined physical and biological components of an environment

hint: term, **bold**, refers to

- 2 The **kinetic energy** of an object is the extra energy which it possesses due to its motion. It is defined as *the work needed to accelerate a body of a given mass from rest to its current velocity*.

technical term: kinetic energy

definition: the extra energy of an object due to its motion / the work needed to accelerate a body of a given mass from rest to its current velocity

hint: **bold**, is..., is defined as, *italic*

- 3 Alzheimer's disease has been identified as a protein misfolding disease (proteopathy), caused by accumulation of abnormally folded A-beta and tau proteins in the brain.

a **technical term:** Alzheimer's disease

definition: a protein misfolding disease caused by accumulation of abnormally folded A-beta and tau proteins in the brain

hint: has been defined as

b **technical term:** proteopathy

definition: a protein misfolding disease

hint: ()

- 4 **Angina pectoris**, commonly known as **angina**, is severe chest pain due

to ischemia (a lack of blood and hence oxygen supply) of the heart muscle, generally due to obstruction or spasm of the coronary arteries (the heart's blood vessels).

a **technical term:** angina pectoris / angina

definition: severe chest pain due to ischemia

hint: **bold**, known as, is

b **technical term:** ischemia

definition: a lack of blood and hence oxygen supply

hint: ()

c **technical term:** coronary arteries

definition: the heart's blood vessels

hint: ()

3.2 Definition Exercises

Exercise

Read the texts below. Each text contains technical terms and definitions for you to identify.

- 1 **Solid-state physics**, the largest branch of condensed matter physics, is the study of rigid matter, or solids, through methods such as quantum mechanics, crystallography, electromagnetism and metallurgy. Solid-state physics considers how the large-scale properties of solid materials result from their atomic-scale properties. Solid-state physics thus forms the theoretical basis of materials science, as well as having direct applications, for example in the technology of transistors and semiconductors.

http://en.wikipedia.org/wiki/Solid-state_physics

technical term:

definition:

.....

hint:

- 2 **Stigma** — is the receptive tip of the carpel, which receives pollen at pollination and on which the pollen grain germinates. The stigma is adapted to catch and trap pollen, either by combining pollen of visiting insects or by various hairs, flaps, or sculpturings.

[http://en.wikipedia.org/wiki/Stigma_\(botany\)](http://en.wikipedia.org/wiki/Stigma_(botany))

technical term:

definition:

.....

hint:

- 3 The result of breathing elevated concentrations of oxygen is *hyperoxia*, an excess of oxygen in body tissues.

http://en.wikipedia.org/wiki/Oxygen_toxicity

technical term:

definition:

.....

hint:

- 4 **Statistics** is the science of making effective use of numerical data relating to groups of individuals or experiments. It deals with all aspects of this, including not only the collection, analysis and interpretation of such data, but also the planning of the collection of data, in terms of the design of surveys and experiments.

<http://en.wikipedia.org/wiki/Statistics>

technical term:

definition:

.....

hint:

- 5 The term *blood pressure* usually refers to the pressure measured at a person's upper arm. It is measured on the inside of an elbow at the brachial artery, which is the upper arm's major blood vessel that carries blood away from the heart. A person's BP is usually expressed in terms of the systolic pressure and diastolic pressure, for example 120/80.

http://en.wikipedia.org/wiki/Blood_pressure

technical term:

definition:

.....

hint:

- 6 **Nuclear power** is power (generally electrical) produced from controlled (i.e., non-explosive) nuclear reactions. Commercial plants in use to date use nuclear fission reactions. Electric utility reactors heat water to produce steam, which is then used to generate electricity. In 2009, 15% of the world's electricity came from nuclear power, despite concerns about safety and radioactive waste management. More than 150 naval vessels using nuclear propulsion have been built.

http://en.wikipedia.org/wiki/Nuclear_power

technical term:

definition:

.....

hint:

- 7 The **asteroid belt** is the region of the Solar System located roughly between the orbits of the planets Mars and Jupiter. It is occupied by numerous irregularly shaped bodies called asteroids or minor planets. The asteroid belt region is also termed the **main belt** to distinguish it from other concentrations of minor planets within the Solar System, such as the Kuiper belt and scattered disc.

http://en.wikipedia.org/wiki/Asteroid_belt

technical term:

definition:

.....

hint:

- 8 A **peptide bond** (amide bond) is a chemical bond formed between two molecules when the carboxyl group of one molecule reacts with the amine group of the other molecule, thereby releasing a molecule of water (H₂O). This is a dehydration synthesis reaction (also known as a condensation reaction), and usually occurs between amino acids. The resulting CO-NH bond is called a peptide bond, and the resulting molecule is an amide.

http://en.wikipedia.org/wiki/Peptide_bond

technical term:

definition:

.....

hint:

- 9 The half-life of caffeine — the time required for the body to eliminate one-half of the total amount of caffeine — varies widely among individuals according to such factors as age, liver function, pregnancy, some concurrent medications, and the level of enzymes in the liver needed for caffeine metabolism. In healthy adults, caffeine's half-life is approximately 4.9 hours. In women taking oral contraceptives, this is increased to 5–10 hours, and in pregnant women the

half-life is roughly 9–11 hours. Caffeine can accumulate in individuals with severe liver disease, increasing its half-life up to 96 hours. In infants and young children, the half-life may be longer than in adults; half-life in a newborn baby may be as long as 30 hours. Other factors such as smoking can shorten caffeine’s half-life. Fluvoxamine reduced the clearance of caffeine by 91.3%, and prolonged its elimination half-life by 11.4-fold (from 4.9 hours to 56 hours).

<http://en.wikipedia.org/wiki/Caffeine>

technical term:

definition:

.....

hint:

- 10 A **mule** is the offspring of a male donkey and a female horse. Horses and donkeys are different species, with different numbers of chromosomes. Of the two F1 hybrids between these two species, a mule is easier to obtain than a hinny (the offspring of a male horse and a female donkey). All male mules and most female mules are infertile.

<http://en.wikipedia.org/wiki/Mule>

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

- 11 The science of color is sometimes called **chromatics**. It includes the perception of color by the human eye and brain, the origin of color in materials, color theory in art, and the physics of electromagnetic radiation in the visible range (that is, what we commonly refer to simply as *light*).

<http://en.wikipedia.org/wiki/Color>



technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

- 12 The **CMYK color model**, referred to as **process color** or sometimes four color, is a subtractive color model, used in color printing, also used to describe the printing process itself. **CMYK** refers to the four inks used in most color printing: **c**yan, **m**agenta, **y**ellow, and **k**ey black. Though it varies by print house, press operator, press manufacturer and press run, ink is typically applied in the order of the abbreviation.

http://en.wikipedia.org/wiki/CMYK_color_model

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

- 13 A **lunar phase** or **phase of the moon** refers to the appearance of the illuminated portion of the Moon as seen by an observer, usually on Earth. The lunar phases vary cyclically as the Moon orbits the Earth, according to the changing relative positions of the Earth, Moon and Sun. One half of the lunar surface is always illuminated by the Sun (except during lunar eclipses), and hence is bright, but the portion of the illuminated hemisphere that is visible to

an observer can vary from 100% (full moon) to 0% (new moon). The boundary between the illuminated and unilluminated hemispheres is called the terminator.

http://en.wikipedia.org/wiki/Lunar_phase

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

- 14 A **cyanide** is any chemical compound that contains the cyano group ($C\equiv N$), which consists of a carbon atom triple-bonded to a nitrogen atom. Inorganic cyanides are generally salts of the anion CN^- . Organic compounds that have a $-C\equiv N$ functional group are called nitriles. Of the many kinds of cyanide compounds, some are gases; others are solids or liquids. Those that can release the cyanide ion CN^- are highly toxic to animals.

<http://en.wikipedia.org/wiki/Cyanide>

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

- 15 The general term "**ice age**" or, more precisely, "**glacial age**" denotes a

geological period of long-term reduction in the temperature of the Earth's surface and atmosphere, resulting in an expansion of continental ice sheets, polar ice sheets and alpine glaciers. An ice age is a natural system. Within a long-term ice age, individual pulses of extra cold climate are termed "glacial periods" (or alternatively "glacials" or "glaciations"), and intermittent warm periods are called "interglacials". Glaciologically, ice age implies the presence of extensive ice sheets in the northern and southern hemispheres; by this definition we are still in the ice age that began at the start of the Pleistocene (because the Greenland and Antarctic ice sheets still exist).

http://en.wikipedia.org/wiki/Ice_age

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

technical term:

definition:

.....

hint:

3.3 Prefixes, Roots and Suffixes

Why should I study prefixes, roots and suffixes?

Over half of the words in the English language are derived from Greek or Latin roots. Many scientific terms are also based on these two languages. A good knowledge of Greek and Latin prefixes, roots and suffixes will help you understand words without having to rely too much on a dictionary. Consequently, if you learn these prefixes, roots and suffixes, not only will your vocabulary improve but also your reading fluency. It is therefore important to spend some time studying prefixes, roots, and suffixes.

Which prefixes, roots and suffixes should I learn?

Appendices 5 and 6 contain many useful prefixes, roots and suffixes.

How should I study prefixes, roots and suffixes?

You should, first of all, be aware of the major prefixes, roots and suffixes. Appendices 5 and 6 have most of the ones you will need to know. You should also learn to recognize these prefixes, roots, and suffixes while you are reading. These prefixes, roots and suffixes are combined with other words or partial words to make new words. If you can guess the meaning of these words and partial words, then you may be able to understand new words without relying too much on your dictionary. Furthermore, even if you think that this method of learning is too slow initially, in the long run you will probably benefit, as your understanding and appreciation of words and their semantic relationships with other words will be deeper and richer.

Example: What do the highlighted words in the text below mean?

Fermentation is the process of deriving energy from the **oxidation** of organic **compounds**, such as **carbohydrates**, and using an endogenous electron acceptor, which is usually an organic compound, as opposed to respiration where electrons are donated to an exogenous electron acceptor, such as oxygen, via an electron transport chain. Fermentation does not necessarily have to be carried out in an **anaerobic** environment. For example, even in the presence of abundant oxygen, yeast cells greatly prefer fermentation to oxidative phosphorylation, as long as sugars are readily available for **consumption**.

[http://en.wikipedia.org/wiki/Fermentation_\(biochemistry\)](http://en.wikipedia.org/wiki/Fermentation_(biochemistry))

Word	Prefixes, Roots, Suffixes	Meaning
oxidation	oxygen, -ation	action of oxygen
compounds	com, ?	with ?
carbohydrates	carbon, hydro	CH ₂ O

anaerobic	an, aerobic	not aerobic
consumption	consume, -ion	noun for consume

As you can see, many words can be guessed at without having to use a dictionary. Of course you may still use your dictionary just to check, and this is okay so long as you don't overdo it. From the above table, you will probably need to look up the meaning of "compound" (if you don't already know its meaning). Actually, "compound" is one of the words in the 570 word families of the Academic Word List. You can find the meaning of this word in the Academic Word List concise dictionary in Appendix 8.1 (a substance made up of two or more elements).

You should also bear in mind that many words are difficult to break down into smaller parts because some word prefixes and suffixes either have no clear meaning or perhaps have more than one possible meaning.

For example, "flammable" means a liquid which can be burned (able to make a flame). You might therefore think that "inflammable" would mean "not able to make a flame, since "in" means "not" in some words. As a matter of fact, "inflammable" means burnable, too. Therefore, please be flexible (don't be inflexible), when doing the following exercises.

3.3 Prefix, Root and Suffix Exercises

Exercise

Read the texts below. Use appendices 5 and 6. What do the highlighted words mean?

- 1 Electromagnetic radiation (often abbreviated E-M radiation or EMR) is a phenomenon that takes the form of self-propagating waves in a vacuum or in matter. It consists of electric and magnetic field **components** which oscillate in phase perpendicular to each other and perpendicular to the direction of energy propagation. Electromagnetic radiation is classified into several types according to the frequency of its wave; these types include (in order of increasing frequency and decreasing wavelength): radio waves, microwaves, **terahertz** radiation, **infrared** radiation, visible light, **ultraviolet** radiation, X-rays and gamma rays. A small and somewhat variable window of frequencies is sensed by the eyes of various organisms; this is what is called the visible spectrum, or light.

http://en.wikipedia.org/wiki/Electromagnetic_radiation

Word	Prefixes, Roots, Suffixes	Meaning
components		
terahertz		
infrared		
ultraviolet		

- 2 The blood vessels are the part of the **circulatory** system that **transport** blood throughout the body. There are three major types of blood vessels: the arteries, which carry the blood away from the heart; the capillaries, which **enable** the actual **exchange** of water and chemicals between the blood and the tissues; and the veins, which carry blood from the capillaries back towards the heart.

http://en.wikipedia.org/wiki/Blood_vessel

Word	Prefixes, Roots, Suffixes	Meaning
circulatory		
transport		
enable		
exchange		

- 3 Waste management is the collection, transport, processing, **recycling** or **disposal**, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to **reduce** their effect on health, the environment or aesthetics. Waste management is also carried out to recover **resources** from it. Waste management can involve solid,

liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

http://en.wikipedia.org/wiki/Waste_management

Word	Prefixes, Roots, Suffixes	Meaning
recycling		
disposal		
reduce		
resources		

- 4 Animals are a major group of mostly **multicellular**, eukaryotic organisms of the kingdom Animalia or Metazoa. Their body plan eventually becomes fixed as they develop, although some undergo a process of **metamorphosis** later on in their life. Most animals are **motile**, meaning they can move **spontaneously** and independently. All animals are also heterotrophs, meaning they must ingest other organisms for sustenance.

<http://en.wikipedia.org/wiki/Animal>

Word	Prefixes, Roots, Suffixes	Meaning
multicellular		
metamorphosis		
motile		
spontaneously		

- 5 Since the water molecule is not **linear** and the oxygen atom has a higher **electronegativity** than hydrogen atoms, it carries a slight negative charge, whereas the hydrogen atoms are slightly positive. As a result, water is a polar molecule with an electrical **dipole** moment. The net interactions between the dipoles on each molecule cause an effective skin effect at the interface of water with other substances, or air at the surface, the latter given rise to water's high surface tension. This dipolar nature contributes to water molecules' tendency to form hydrogen bonds which cause water's many special properties. The **polar** nature also favors adhesion to other materials.

http://en.wikipedia.org/wiki/Properties_of_water

Word	Prefixes, Roots, Suffixes	Meaning
linear		
electronegativity		
dipole		
polar		

- 6 **Bioinformatics** is the application of information technology and computer science to the field of molecular biology. The term bioinformatics was coined

by Paulien Hogeweg in 1979 for the study of informatic processes in **biotic** systems. Its primary use since at least the late 1980s has been in **genomics** and **genetics**, particularly in those areas of genomics involving large-scale DNA sequencing. Bioinformatics now entails the creation and advancement of databases, algorithms, computational and statistical techniques, and theory to solve formal and practical problems arising from the management and analysis of biological data.

<http://en.wikipedia.org/wiki/Bioinformatics>

Word	Prefixes, Roots, Suffixes	Meaning
bioinformatics		
biotic		
genomics		
genetics		

- 7 **Autism** is a **disorder** of neural development characterized by impaired social **interaction** and communication, and by restricted and repetitive behavior. These signs all begin before a child is three years old. Autism affects information processing in the brain by altering how nerve cells and their synapses connect and organize; how this occurs is not well understood. The two other autism spectrum disorders (ASD) are Asperger syndrome, which lacks delays in **cognitive** development and language, and PDD-NOS, diagnosed when full criteria for the other two disorders are not met.

<http://en.wikipedia.org/wiki/Autism>

Word	Prefixes, Roots, Suffixes	Meaning
autism		
disorder		
interaction		
cognitive		

- 8 Insects (from Latin: insectum, translation of Greek: entomon - threaded) are a class within the **arthropods** that have a chitinous **exoskeleton**, a three-part body (head, thorax, and abdomen), three pairs of jointed legs, compound eyes, and two **antennae**. They are among the most diverse group of animals on the planet and include more than a million described species and represent more than half of all known living organisms. The number of extant species is estimated at between six and ten million, and potentially represent over 90% of the differing metazoan life forms on Earth. Insects may be found in nearly all environments, although only a small number of species occur in the oceans, a habitat dominated by another arthropod group, the **crustaceans**.

<http://en.wikipedia.org/wiki/Insect>

Word	Prefixes, Roots, Suffixes	Meaning
arthropod		
exoskeleton		
antennae		
crustacean		

- 9 Modern **synthetic** chemistry has reached the point where it is possible to prepare small molecules to almost any structure. These methods are used today to **manufacture** a wide variety of useful chemicals such as pharmaceuticals or commercial **polymers**. This ability raises the question of extending this kind of control to the next-larger level, seeking methods to assemble these single molecules into **supramolecular** assemblies consisting of many molecules arranged in a well defined manner.

<http://en.wikipedia.org/wiki/Nanotechnology>

Word	Prefixes, Roots, Suffixes	Meaning
synthetic		
manufacture		
polymer		
supramolecular		

- 10 Cancers are caused by **abnormalities** in the genetic material of the **transformed** cells. These abnormalities may be due to the effects of carcinogens, such as tobacco smoke, radiation, chemicals, or infectious agents. Other cancer-promoting genetic abnormalities may randomly occur through errors in DNA replication, or are inherited, and thus present in all cells from birth. The heritability of cancers is usually affected by **complex interactions** between carcinogens and the host's genome.

<http://en.wikipedia.org/wiki/Cancer>

Word	Prefixes, Roots, Suffixes	Meaning
abnormalities		
transformed		
complex		
interactions		

3.4 Context

What is context?

Context, in its most broadest sense begins with the reader and his or her background and experiences, expectations and purpose for reading. Within any particular text, context can refer to the whole text, a group of paragraphs, a paragraph, sentence, or single word.

How can context help the reader understand a text?

An ability to identify the topic and main idea of a text, whether it is a paragraph or longer, is an important skill in reading (see unit 2.1 about identifying topics, topic sentences and main ideas) The distribution of logical connectors can help a reader to understand the development of ideas (see unit 2.2 on logical connectors and the development of ideas). The type and frequency of logical connectors may suggest the kind of text organization there is (see unit 2.3 for information about text organization). A knowledge of pronouns and determiners is helpful in understanding coherence (see unit 3.1 on restatements). The methods writers employ to define words is also clearly very useful (see 3.2 about definitions). Finally, a good understanding of prefixes and suffixes will help the reader to guess the meaning of a new word (see 3.3 on prefixes, roots and suffixes). All of these skills can help the reader understand a text.

How can I use context to understand the meaning of a new word?

First of all you should decide what part of speech the word is. Is it a verb, a noun, a pronoun, an adjective, an adverb, a preposition, or a conjunction or an interjection? Secondly, you should look at the context of the word. What words surround the word you want to know? Are there any hints, such as definitions, restatements, or logical connectors which may suggest what the word means? Thirdly, you should analyze the parts of the word for hints about the meaning. Next, you should guess the meaning of the word. Can you substitute your word for the new word within the sentence and the sentence still retain its meaning? Finally, if you need to, you should use your dictionary to see if your guess was a good one. You may wonder why you can't just use your dictionary straight away, and this is a fair point. However, if you want to develop good reading skills, please consider taking the longer route first. In the end, your understanding will be richer and it may actually save time.

Examples

Read the texts below. What are the meanings of the highlighted words?

- 1 A solar eclipse occurs when the Moon passes between the Sun and the Earth, and the Moon fully or partially covers the Sun as viewed from some location on Earth. This can only happen during a new moon, when the Sun and Moon are in conjunction as seen from Earth. At least two, and up to five, solar eclipses occur each year; no more than two can be total eclipses. Total solar eclipses are nevertheless rare at any particular location because totality exists only along a narrow path traced by the Moon's **umbra**.

part of speech: noun

word parts: nothing

my definition: a narrow path made by the moon can only mean shadow

dictionary definition: a region of complete shadow

- 2 Radioactive decay is the process in which an unstable atomic nucleus spontaneously loses energy by emitting ionizing particles and radiation. This decay, or loss of energy, results in an atom of one type, called the parent nuclide transforming to an atom of a different type, named the daughter nuclide. For example: a carbon-14 atom (the "parent") emits radiation and transforms to a nitrogen-14 atom (the "daughter"). This is a **stochastic** process on the atomic level, in that it is impossible to predict when a given atom will decay, but given a large number of similar atoms the decay rate, on average, is predictable.

part of speech: adjective

word parts: "-ic" suggests an adjective

my definition: impossible to predict at an atomic level, but predictable in large numbers

dictionary definition: describes a process or system that is connected with random probability

- 3 Animals are a major group of mostly multicellular, **eukaryotic** organisms of the kingdom Animalia or Metazoa. Their body plan eventually becomes fixed as they develop, although some undergo a process of metamorphosis later on in their life. Most animals are motile, meaning they can move spontaneously and independently. All animals are also heterotrophs, meaning they must ingest other organisms for sustenance.

part of speech: adjective

word parts: "eu" means good, well, true, "-ic" means adjective

my definition: mostly multicellular?

dictionary definition: having cells with 'good' or membrane-bound nuclei

3.4 Context Exercises

Exercise

Read the texts below. What are the meanings of the highlighted words?

- 1 The term cloud is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network, and later to depict the Internet in computer network diagrams as an abstraction of the underlying **infrastructure** it represents. Typical cloud computing providers deliver common business applications online which are accessed from a web browser, while the software and data are stored on servers.

http://en.wikipedia.org/wiki/Cloud_computing

part of speech:

word parts:

my definition:

dictionary definition:

- 2 **Hypertension** can be classified as either essential (primary) or secondary. Essential or primary hypertension means that no medical cause can be found to explain the raised blood pressure. It is common. About 90-95% of hypertension is essential hypertension. Secondary hypertension indicates that the high blood pressure is a result of (i.e., secondary to) another condition, such as kidney disease or tumours (adrenal adenoma or pheochromocytoma).

<http://en.wikipedia.org/wiki/Hypertension>

part of speech:

word parts:

my definition:

dictionary definition:

- 3 **Hypoglycemia** can produce a variety of symptoms and effects but the principal problems arise from an inadequate supply of glucose as fuel to the brain, resulting in impairment of function (neuroglycopenia). Effects can range from

vaguely “feeling bad” to seizures, unconsciousness, and (rarely) permanent brain damage or death.

<http://en.wikipedia.org/wiki/Hypoglycemia>

part of speech:

word parts:

my definition:

dictionary definition:

- 4 The habitat of the beaver is the riparian zone, inclusive of stream bed. The actions of beavers for hundreds of thousands of years in the Northern Hemisphere have kept these watery systems healthy and in good repair, although a human observing all the downed trees might think that the beavers were doing just the opposite. The beaver works as a **keystone** species in an ecosystem by creating wetlands that are used by many other species. Next to humans, no other extant animal appears to do more to shape its landscape.

<http://en.wikipedia.org/wiki/Beaver>

part of speech:

word parts:

my definition:

dictionary definition:

- 5 Coral reefs cover just under one percent of the surface of the world’s ocean, yet they support over one-quarter of all marine species. This huge number of species results in complex food webs, with large predator fish eating smaller forage fish that eat yet smaller zooplankton and so on. However, all food webs eventually depend on plants, which are the primary producers. And the primary productivity on a coral reef is very high, resulting in a typical **biomass** production of 5-10g C m⁻² day⁻¹.

http://en.wikipedia.org/wiki/Coral_reef

part of speech:

word parts:

my definition:

dictionary definition:

Note: 5-10g C m⁻² day⁻¹ is read "five to ten grams of carbon per square meter per day".

- 6 The emission spectrum can be used to determine the composition of a material, since it is different for each element of the periodic table. One example is astronomical spectroscopy: identifying the composition of stars by analysing the received light. The emission spectrum characteristics of some elements are plainly visible to the naked eye when these elements are heated. For example, when platinum wire is dipped into a strontium nitrate solution and then inserted into a flame, the strontium atoms emit a red color. Similarly, when copper is inserted into a flame, the flame becomes green. These definite characteristics allow elements to be identified by their atomic emission spectrum. Not all lights emitted by the spectrum are viewable to the naked eye, it also includes ultra violet rays and infra red lighting, an emission is formed when an excited gas is viewed directly through a **spectroscope**.

http://en.wikipedia.org/wiki/Emission_spectrum

part of speech:

word parts:

my definition:

dictionary definition:

- 7 In chemistry and physics, atomic theory is a theory of the nature of matter, which states that matter is composed of **discrete** units called atoms, as opposed to the obsolete notion that matter could be divided into any arbitrarily small quantity. It began as a philosophical concept in ancient Greece and India and entered the scientific mainstream in the early 19th century when discoveries in the field of chemistry showed that matter did indeed behave as if it were made up of particles.

http://en.wikipedia.org/wiki/Atomic_theory

part of speech:

word parts:

my definition:

dictionary definition:

- 8 Gravitation, or gravity, is one of the four fundamental interactions of nature, and is the means by which objects with mass attract one another. In everyday life, gravitation is most familiar as the agent that lends weight to objects with mass and causes them to fall to the ground when dropped. Gravitation causes dispersed matter to **coalesce**, thus accounting for the existence of the Earth, the Sun, and most of the macroscopic objects in the universe. It is responsible for keeping the Earth and the other planets in their orbits around the Sun; for keeping the Moon in its orbit around the Earth; for the formation of tides; for convection, by which fluid flow occurs under the influence of a density gradient and gravity; for heating the interiors of forming stars and planets to very high temperatures; and for various other phenomena observed on Earth.

<http://en.wikipedia.org/wiki/Gravitation>

part of speech:

word parts:

my definition:

dictionary definition:

- 9 The class Gastropoda or gastropods (also previously known as univalves and sometimes also spelled Gasteropoda) form a major part of the phylum Mollusca. **Gastropods** are more commonly known as snails and slugs, and include those that live in the sea, in freshwater and on land. This class of animals is second only to the insects in its number of known species. Its fossil history goes back to the Late Cambrian.

<http://en.wikipedia.org/wiki/Gastropoda>

part of speech:

word parts:

my definition:

dictionary definition:



- 10 Temperature control (thermoregulation) is part of a **homeostatic** mechanism that keeps the organism at optimum operating temperature, as it affects the rate of chemical reactions. In humans the average oral temperature is 36.8 °C (98.2 °F), though it varies among individuals, as well as cycling regularly through the day, as controlled by one's circadian rhythms with the lowest temperature occurring about two hours before one normally wakes up.

http://en.wikipedia.org/wiki/Normal_human_body_temperature

part of speech:

word parts:

my definition:

dictionary definition:

4 Portfolio Management

What is the purpose of making a portfolio?

There are two main reasons why you should manage a portfolio. The first is to carry on practicing the kind of reading skills that you have already started in this textbook. The more you practice, the better you will be. The second reason is to make the selection of reading materials your own. Now is the time to choose texts that you are really interested in!

What should my portfolio contain?

You should choose articles that are related either to your major or your personal interests.

How should I manage my portfolio?

Your portfolio should contain 10 articles*. You should number each article, and for each article, you should highlight all the academic words (those which appear in the Academic Word List 570). Then, you should identify the technical words and write a definition of these words, or translate them into your first language. You should also indicate the text structure of the article. Finally, in your own words, you should write a one paragraph accurate summary of about six or seven sentences, and you should include a personal comment.

*The length of your articles should be at least 700 words.

Please remember to do the following;

- a) Choose relevant and interesting articles of appropriate length.
- b) Choose articles which are new and not recycled.
- c) Highlight the AWL 570 words.
- d) Identify the technical words.
- e) Indicate the text structure.
- f) Make notes to demonstrate your active interest in the text.
- g) Write an accurate summary.
- h) Include a personal comment.
- i) Take pride in the organization and appearance of your portfolio.

5 Academic Words Gap-Fill Exercises

5.1 Academic Words Gap-Fill Exercises

This unit contains paragraphs that have already appeared in previous units of the textbook.

5.2 Academic Words Gap-Fill Exercises

This unit contains paragraphs that are not to be found in any other unit of the textbook.

5 Academic Words Gap-Fill Exercises

Which words do I need to know?

There are two main groups of words in English; those you know, and those you don't know. The words you know are very important to you, as they will help you to understand texts, and also help you to understand the words that you don't know.

The words that you don't know can be divided into three groups; the words that you never need to know, the words that you can get to know if you wish, and the words that you have to know.

The words that you never need to know contain by far the greatest number of words. The only reason why you may need to know these words is when they occasionally appear on English tests. Apart from that, you never need to know them.

The words that you can get to know if you wish, depends on you. These words include words of your major and your interests. How hard you work will determine how many of these words you will eventually get to know.

The final group of words are the words that you have to know. These words are so common in academic texts that you simply can't avoid them. If you get to know these words, your reading will improve dramatically. These words, the 570 words and their families, are the academic word list.

Welcome to the Academic Word List.

The paragraph below appears in unit 2.2 of this textbook. It is about the scientific method. The words in bold are all from the Academic Word List.

Although **procedures vary** from one field of inquiry to another, **identifiable features** distinguish scientific inquiry from other **methodologies** of knowledge. Scientific **researchers** propose **hypotheses** as explanations of **phenomena**, and **design** experimental studies to test these **hypotheses**. These steps must be repeatable in order to dependably **predict** any future results. **Theories** that encompass wider **domains** of inquiry may bind many independently-derived **hypotheses** together in a **coherent**, supportive **structure**. This in turn may help form new **hypotheses** or place groups of **hypotheses** into **context**.

As you can see, the Academic Word List words are everywhere. You must learn these words, so please make time to do so.

5.1 Academic Words Gap-Fill Exercises

This unit contains paragraphs that have already appeared in previous units of the textbook. This time, the academic words have all been blanked out.

Exercise

Read the texts below. Fill in the blanks from the Academic Word List words below.

- 1 Geometry (Ancient Greek: geo- "earth", -metria "measurement") "Earth-Measuring" is a part of mathematics concerned with questions of size, shape, relative position of figures, and the properties of space. Geometry is one of the oldest sciences. a body of practical knowledge concerning lengths,, and, in the 3rd century BC, geometry was put into an axiomatic form by Euclid, whose treatment—Euclidean geometry—set a standard for many centuries to follow. The field of astronomy, especially mapping the positions of the stars and planets on the celestial, served as an important of geometric problems during the next one and a half millennia. A mathematician who works in the field of geometry is called a geometer.

<http://en.wikipedia.org/wiki/Geometry>

areas	initially	source	sphere	volumes
-------	-----------	--------	--------	---------

- 2 Some of the greatest mathematical minds of all ages, from Pythagoras and Euclid in ancient Greece, through the medieval Italian mathematician Leonardo of Pisa and the Renaissance astronomer Johannes Kepler, to present-day scientific figures such as Oxford physicist Roger Penrose, have spent endless hours over this simple and its properties. But the fascination with the golden is not

just to mathematicians. Biologists, artists, musicians, historians, architects, ...
, and even mystics have pondered and
 the basis of its ubiquity and appeal. In fact, it is probably fair to say that the
 golden has inspired thinkers of all disciplines like no other
 number in the history of mathematics.

http://en.wikipedia.org/wiki/Golden_ratio

confined	debated	psychologists	ratio	ratio
ratio				

- 3 In physics, is the magnitude of the pulling force exerted by a string, cable, chain, or object on another object. It is the opposite of compression. As is the magnitude of a force, it is measured in newtons (or sometimes pounds-force) and is always measured to the string on which it applies. There are two basic possibilities for systems of objects held by strings. Either acceleration is zero and the system is therefore in equilibrium or there is acceleration and therefore a net force is present. Note that a string is to have negligible mass.

[http://en.wikipedia.org/wiki/Tension_\(physics\)](http://en.wikipedia.org/wiki/Tension_(physics))

assumed	parallel	similar	tension	tension
---------	----------	---------	---------	---------

- 4 Elementary particles are particles for which there is no known way of dividing them into smaller units. and experimental studies have shown that the spin possessed by such particles cannot be explained by postulating that they are made up of even smaller particles rotating about a common center of mass (see electron radius); as far as can be determined, these elementary particles are true point particles. The spin

of an elementary particle is a truly
 property, akin to the particle's electric charge and rest mass.

[http://en.wikipedia.org/wiki/Spin_\(physics\)](http://en.wikipedia.org/wiki/Spin_(physics))

classical	intrinsic	physical	theoretical	
-----------	-----------	----------	-------------	--

- 5 Genetics (from Ancient Greek: genesis, "origin"), a discipline of biology, is the science of heredity and in living organisms. The fact that living things inherit traits from their parents has been used since prehistoric times to improve crop plants and animals through breeding. However, the modern science of genetics, which to understand the of inheritance, only began with the work of Gregor Mendel in the mid-nineteenth century. Although he did not know the basis for heredity, Mendel observed that organisms inherit traits units of inheritance, which are now called genes.

<http://en.wikipedia.org/wiki/Genetics>

discrete	physical	process	seeks	selective
variation	via			

- 6 The Doppler effect (or Doppler), named after Austrian physicist Christian Doppler who proposed it in 1842, is the change in frequency of a wave for an observer moving relative to the of the wave. It is commonly heard when a sounding a siren or horn, passes, and recedes from an observer. The received frequency is higher (compared to the emitted frequency) during the it is at the instant of passing by, and it is lower during the recession.

http://en.wikipedia.org/wiki/Doppler_effect

approach	approaches	identical	shift	source
vehicle				

7 The presence of ocean blooms is usually seasonal, to prey and increasing with temperature and sunshine. Ocean currents tend to congregate jellyfish into large swarms or "blooms", of hundreds or thousands of In addition to sometimes being by ocean currents, blooms can result from unusually high populations in some years. Bloom formation is a that depends on ocean currents, nutrients, temperature and oxygen concentrations. Jellyfish are better able to in oxygen-poor water than competitors, and thus can thrive on plankton without competition. Jellyfish may also from saltier waters, as saltier waters contain more iodine, which is necessary for polyps to turn into jellyfish. Rising sea temperatures caused by climate change may also to jellyfish blooms, because many species of jellyfish are better able to in warmer waters. Jellyfish are likely to stay in blooms that are quite large and can reach up to 100,000 in each.

<http://en.wikipedia.org/wiki/Jellyfish>

availability	benefit	complex	concentrated	consisting
contribute	individuals	process	responding	survive
survive				

8 The International Union for Conservation of Nature now lists warming as the most threat to the polar bear, because the melting of its sea ice habitat reduces its

ability to find food. The IUCN states, "If climatic continue, polar bears may become extirpated from most of their within 100 years." On 14 May 2008, the United States Department of the Interior listed the polar bear as a threatened species under the Endangered Species Act.

http://en.wikipedia.org/wiki/Polar_bear

global	primarily	range	significant	sufficient
trends				

- 9 From its discovery in 1930 until 2006, Pluto was considered the Solar System's ninth planet. In the late 1970s, following the discovery of planet 2060 Chiron in the outer Solar System and the recognition of Pluto's very low mass, its as a planet began to be questioned. Later, in the early 21st century, many objects to Pluto were discovered in the outer Solar System, notably the scattered disc object Eris, which is 27% more massive than Pluto. On August 24, 2006, the International Astronomical Union (IAU) the term "planet" for the first time. This Pluto as a planet, and added it as a member of the new "dwarf planet" along with Eris and Ceres. After the reclassification, Pluto was added to the list of planets and given the number 134340. Even so, a number of scientists continue to hold that Pluto should be classified as a planet.

<http://en.wikipedia.org/wiki/Pluto>

category	defined	definition	excluded	major
minor	minor	similar	status	

10 Generally, dolphins sleep with only one brain hemisphere in slow-wave sleep at a time, thus enough consciousness to breathe and to watch for possible predators and other threats. Earlier sleep stages can simultaneously in both hemispheres. In captivity, dolphins seemingly enter a fully asleep state where both eyes are closed and there is no to mild stimuli. Respiration is; a tail kick reflex keeps the blowhole above the water if necessary. Anesthetized dolphins show a tail kick reflex. Though a state has been observed with wild sperm whales, it is not known if dolphins in the wild reach this state. The Indus river dolphin has a different sleep from other dolphin species. Living in water with strong currents and dangerous floating debris, it must swim continuously to avoid As a result, this species sleeps in very short bursts which last between 4 and 60 seconds.

<http://en.wikipedia.org/wiki/Dolphin>

automatic	external	initially	injury	maintaining
method	occur	potentially	response	similar

11 Zinc-64 is an isotope of zinc. It makes up 48.3% of the zinc naturally the fact that it is radioactive. Zinc-64 has an exceptionally long half-life of over 2300 million billion years, much longer than the age of the Universe, and is, over all reasonable time

<http://www.ask.com/wiki/Zinc-64>

despite	occurring	periods	stable	
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12 Karachi an arid climate, a more moderate of an arid climate. Karachi is on the coast and as a result has a relatively mild climate. The level of precipitation is low for most of the year. However, due to the city's proximity to the sea, humidity levels usually remain high throughout the year. The city enjoys mild winters and warm summers. Karachi also receives the tail end of the monsoon rains. Since summer temperatures (the end of April through the end of August) are 30 to 35 degrees Celsius, the winter months (November through March) are the best time to visit Karachi.

http://en.wikipedia.org/wiki/Climate_of_Karachi

albeit	approximately	features	located	version
--------	---------------	----------	---------	---------

13 Mars is the fourth planet from the Sun in the Solar System. The planet is named after Mars, the Roman god of war. It is also referred to as the "Red Planet" because of its reddish appearance, due to iron oxide prevalent on its surface. Mars is a terrestrial planet with a thin atmosphere, having surface reminiscent both of the craters of the Moon and the volcanoes, valleys, deserts and polar ice caps of Earth. Unlike the Earth, Mars is now a geologically inactive planet with no known tectonic activity. It is the of Olympus Mons, the highest known mountain in the Solar System, and of Valles Marineris, the largest canyon. In addition to its geographical Mars' rotational and seasonal are to those of the Earth.

<http://en.wikipedia.org/wiki/Mars>

cycles	features	features	impact	likewise
--------	----------	----------	--------	----------



period	similar	site		
--------	---------	------	--	--

14 to the 20th century, and also into its early , the pace of discovery of new species of bird was fast; during this , with numerous collecting expeditions into species-rich not visited by western ornithologists, up to several hundred new species per were being described. Since then, the pace has slowed, and new species are generally only being found in remote , or among cryptic or secretive groups of species. , several tens of species were described for the first time during the 1990s.

http://en.wikipedia.org/wiki/Bird_species_new_to_science

areas	areas	decades	decades	nonetheless
period	previously	prior		

15 Aspirin causes several different effects in the body, mainly the reduction of inflammation, analgesia (relief of pain), and the prevention of clotting, and the reduction of fever. Much of this is believed to be due to decreased production of prostaglandins and thromboxanes. Aspirin’s ability to suppress the production of prostaglandins and thromboxanes is due to its inactivation of the cyclooxygenase (COX) enzyme. Cyclooxygenase is for prostaglandin and thromboxane synthesis. Aspirin acts as an acetylating agent where an acetyl group is covalently to a serine residue in the active of the COX enzyme. This makes aspirin different from other NSAIDs (such as diclofenac and ibuprofen), which are inhibitors. However, other effects of aspirin, such as uncoupling oxidative phosphorylation in mitochondria, and the modulation of signaling through NF-κB, are also being



<http://en.wikipedia.org/wiki/Aspirin>

attached	investigated	irreversible	required	reversible
site				

- 16 The greenhouse effect is caused by an atmosphere containing gases that absorb and emit infrared radiation. Greenhouse gases trap heat within the surface-troposphere system, causing heating at the surface of the planet or moon. This is different from that of an actual greenhouse, which works by warm air inside the so that heat is not lost by convection. The greenhouse effect was discovered by Joseph Fourier in 1824, first experimented on by John Tyndall in 1858, and first reported quantitatively by Svante Arrhenius in 1896.

http://en.wikipedia.org/wiki/Greenhouse_effect

fundamentally	isolating	mechanism	reliably	structure
---------------	-----------	-----------	----------	-----------

- 17 The two most important types of spacetime singularities are curvature singularities and conical singularities. Singularities can also be divided according to whether they are covered by an event horizon or not (naked singularities). According to general relativity, the state of the universe, at the beginning of the Big Bang, was a singularity. Another type of singularity by general relativity is inside a black hole: any star beyond a certain point would form a black hole, inside which a singularity (covered by an event horizon) would be formed, as all the matter would flow into a certain point (or a circular line, if the black hole is rotating). These singularities are also known as curvature singularities.

http://en.wikipedia.org/wiki/Gravitational_singularity

collapsing	initial	predicted		
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18 A binary star is a star system of two stars orbiting around their common center of mass. The brighter star is called the and the other is its companion star, or secondary. between the early 1800s and today suggests that many stars are part of either binary star systems or star systems with more than two stars, called multiple star systems. The term double star may be used synonymously with binary star, but more generally, a double star may be either a binary star or an optical double star which of two stars with no connection but which appear close together in the sky as seen from the Earth. A double star may be determined to be optical if its have different proper motions or radial velocities, or if parallax measurements its two to be at different distances from the Earth. Most known double stars have not yet been determined to be either bound binary star systems or optical doubles.

http://en.wikipedia.org/wiki/Binary_star

components	components	consisting	consists	physical
primary	research	reveal	sufficiently	sufficiently

19 In somatic cell, the nucleus, which contains the organism’s DNA, of a somatic cell (a body cell other than a sperm or egg cell) is and the rest of the cell discarded. At the same time, the nucleus of an egg cell is The nucleus of the somatic cell is then into the enucleated egg cell. After being into the egg, the somatic cell nucleus is reprogrammed by the host cell. The egg, now containing the nucleus of a



somatic cell, is stimulated with a shock and will begin to divide. After many mitotic divisions in, this single cell forms a blastocyst (an early stage embryo with about 100 cells) with almost DNA to the original organism.

http://en.wikipedia.org/wiki/Somatic_cell_nuclear_transfer

culture	identical	inserted	inserted	nuclear
removed	removed	transfer		

20 Wolves differ from dogs in a more nature. Anatomically, wolves have smaller orbital angles than dogs (over 53 degrees for dogs, under 45 degrees for wolves) and a comparatively larger brain Larger paw size, yellow eyes, longer legs, and bigger teeth further distinguish wolves from other canids, especially dogs. Also, a supracaudal gland is present at the base of the tail in wolves but not in many dogs.

http://en.wikipedia.org/wiki/Gray_wolf

adult	capacity	domestic	varied	
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21 Chloroplasts are organelles found in plant cells and other eukaryotic organisms that photosynthesis. Chloroplasts capture light to conserve free in the form of ATP and reduce NADP to NADPH through a set of called photosynthesis. The word chloroplast is from the Greek words chloros, which means green, and plast, which means form or Chloroplasts are members of a class of organelles known as plastids.

<http://en.wikipedia.org/wiki/Chloroplast>



complex	conduct	derived	energy	energy
entity	processes			

22 Two kinds of solar time, solar time and mean solar time, are among the three kinds of time that were recognized and measured by astronomers up to the 1950s (the third kind of time being sidereal time, time according to the rotation of the stars). The measures of all these three kinds of time depend on the rotation of the earth. Nowadays both kinds of solar time, along with sidereal time, stand in to newer kinds of time measurement, introduced from the 1950s onwards (starting with ephemeris time), which were to be independent of earth rotation.

http://en.wikipedia.org/wiki/Solar_time

apparent	apparent	contrast	designed	traditional
----------	----------	----------	----------	-------------

23 The most common of a volcano is of a conical mountain, spewing lava and poisonous gases from a crater at its summit. This describes just one of many types of volcano, and the of volcanoes are much more complicated. The and behavior of volcanoes depends on a number of Some volcanoes have rugged peaks formed by lava domes rather than a summit crater, others present landscape such as massive plateaus. Vents that volcanic material (lava, which is what magma is called once it has escaped to the surface, and ash) and gases (mainly steam and magmatic gases) can be anywhere on the landform. Many of these vents give rise to smaller cones such as Puu Oo on a flank of Hawaii's Kīlauea.

<http://en.wikipedia.org/wiki/Volcano>

factors	features	features	issue	located
perception	structure	whereas		

24 Many species of animals use paralyzing toxins in order to capture prey, evade predation, or both. One famous example is the tetrodotoxin of fish species such as Takifugu rubripes, the famously lethal pufferfish of Japanese fugu. This toxin works by binding to sodium in nerve cells, preventing the cells' proper A non-lethal dose of this toxin results in paralysis. This toxin is also present in many other species from toads to nemerteans. Another interesting use of paralysis in the natural world is the behavior of some species of wasp. In order to complete the reproductive, the female wasp first paralyzes a prey such as a grasshopper and then places it into her nest. Eggs are then laid on the paralyzed insect, which is devoured by the larvae after they hatch. Many snakes also powerful neurotoxins that can cause non-permanent paralysis or death.

<http://en.wikipedia.org/wiki/Paralysis>

channels	cycle	exhibit	function	item
ranging	temporary			

25 Historically, galaxies have been according to their shape (usually referred to as their morphology). A common form is the elliptical galaxy, which has an ellipse-shaped light profile. Spiral galaxies are disk-shaped assemblages with dusty, curving arms. Galaxies with irregular or unusual shapes are known as peculiar galaxies, and typically result from disruption by the gravitational pull of neighboring galaxies. Such between nearby galaxies,

which may result in galaxies merging, may episodes of increased star formation, producing what is called a starburst galaxy. Small galaxies that lack a could also be referred to as irregular galaxies.

<http://en.wikipedia.org/wiki/Galaxy>

apparent	categorized	coherent	induce	interactions
significantly	structure	ultimately	visual	

5.2 Academic Words Gap-Fill Exercises

This unit contains paragraphs that are not to be found in any other unit of the textbook. The academic words have all been blanked out.

Exercise

Read the texts below. Fill in the blanks from the Academic Word List words below.

- 1 Silicon is the most common metalloid. It is a, which has the Si and atomic number 14. A tetravalent metalloid, silicon is less than its analog carbon.

<http://en.wikipedia.org/wiki/Silicon>

chemical	element	reactive	symbol
----------	---------	----------	--------

- 2 Gorillas are the largest of the living primates. They are ground-dwelling and herbivorous. They inhabit the forests of central Africa. Gorillas are divided into two species and (still under as of 2008) either four or five subspecies. The DNA of gorillas is 98 to 99 to that of a human, and they are the next closest living relatives to humans after the two chimpanzee species.

<http://en.wikipedia.org/wiki/Gorilla>

debate	identical	percent	predominantly
--------	-----------	---------	---------------

- 3 A photovoltaic module or photovoltaic panel is a packaged interconnected of photovoltaic cells, also known as solar cells. The photovoltaic module, known more commonly as the solar, is then used as a in a larger photovoltaic system to offer

electricity for commercial and applications.

http://en.wikipedia.org/wiki/Solar_panel

assembly	component	panel	residential
----------	-----------	-------	-------------

- 4 Physics is a natural science; it is the study of matter and its motion through spacetime and all that from these, such as and force. More broadly, it is the general of nature in order to understand how the world and universe behave.

<http://en.wikipedia.org/wiki/Physics>

analysis	conducted	derives	energy
----------	-----------	---------	--------

- 5 Robotics is the engineering science and of robots, and their, manufacture, application, and disposition. Robotics is related to electronics, mechanics, and software. The word robot was introduced to the public by Czech writer Karel Čapek in his play R.U.R. (Rossum's Universal Robots), in 1920. The term "robotics" was coined by Isaac Asimov in his 1941 science fiction short-story "Liar!"

<http://en.wikipedia.org/wiki/Robotics>

design	published	structural	technology
--------	-----------	------------	------------

- 6 Sesame (*Sesamum indicum*) is a flowering plant in the genus *Sesamum*. Numerous wild relatives in Africa and a smaller number in India. It is widely naturalized in tropical around the world and is cultivated for its edible seeds, which grow in pods. The flowers of the sesame seed plant are yellow, though they can in colour with some being blue or purple. It is an plant growing to 50 to 100 cm

tall, with opposite leaves 4 to 14 cm long.

<http://en.wikipedia.org/wiki/Sesame>

annual	occur	regions	vary
--------	-------	---------	------

- 7 Wine is an alcoholic beverage typically made of fermented grape juice. The natural balance of grapes is such that they can ferment without the addition of sugars, acids, enzymes or other nutrients. Wine is produced by fermenting crushed grapes using various types of yeast. Yeast the sugars found in the grapes and them into alcohol. Different varieties of grapes and strains of yeasts are used depending on the type of wine being produced. The word "wine" from the Latin vinum, "wine" or "grape vine."

<http://en.wikipedia.org/wiki/Wine>

chemical	consumes	converts	derives
----------	----------	----------	---------

- 8 Apple Inc. is an American multinational that and manufactures electronics and software products. The company's best-known hardware products include Macintosh, the iPod, the iPhone and the iPad.

http://en.wikipedia.org/wiki/Apple_Inc.

computer	computers	consumer	corporation	designs
----------	-----------	----------	-------------	---------

- 9 When leaves appear green, it is because they contain an abundance of chlorophyll. Chlorophyll masks other pigment colors. Anthocyanins, in turn, mask carotenoids. As summer turns to autumn, decreasing light levels cause chlorophyll production to slow. However, the decomposition rate of chlorophyll remains, so the green color will fade from the leaves. At the

same time, anthocyanin production in leaves increases, in to surging sugar concentrations. Leaves containing anthocyanins will appear red. Leaves with good amounts of both anthocyanins and carotenoids will appear orange. Leaves with carotenoids but little or no anthocyanins will appear yellow. In the absence of these pigments, other plant also can leaf color. An example includes tannins, which are responsible for the brownish color of some oak leaves.

http://en.wikipedia.org/wiki/Autumn_leaf_color

affect	chemicals	constant	primarily	response
--------	-----------	----------	-----------	----------

- 10 Cheese is a generic term for a group of milk-based food products. Cheese is produced throughout the world in wide-ranging flavors, textures, and forms.

Cheese of proteins and fat from milk, usually the milk of cows, buffalo, goats, or sheep. It is produced by coagulation of the milk protein casein. Typically, the milk is acidified and addition of the enzyme rennet causes coagulation. The solids are separated and pressed into form. Some cheeses have molds on the rind or throughout. Most cheeses melt at cooking temperature.

Hundreds of types of cheese are produced. Their, textures and flavors depend on the origin of the milk (including the animal’s diet), whether they have been pasteurized, the butterfat content, the bacteria and mold, the, and aging. Herbs, spices, or wood smoke may be used as flavoring agents.

<http://en.wikipedia.org/wiki/Cheese>

consists	diverse	final	processing	styles
----------	---------	-------	------------	--------

11 Chocolate a number of raw and foods produced from the seed of the tropical *Theobroma cacao* tree. Cacao has been cultivated for at least three millennia in Mexico, Central and South America, with its earliest use around 1100 BC. The of the Mesoamerican peoples made chocolate beverages, including the Aztecs, who made it into a beverage known as *xocolātl*, a Nahuatl word meaning “bitter water”. The seeds of the cacao tree have an bitter taste, and must be fermented to develop the flavor.

<http://en.wikipedia.org/wiki/Chocolate>

comprises	documented	intense	majority	processed
-----------	------------	---------	----------	-----------

12 In most birds, reptiles, insects, and fish, an egg (Latin, *ovum*) is the zygote, resulting from fertilization of the ovum. To incubation the egg is usually kept within a favourable temperature as it nourishes and protects the growing embryo. When the embryo is developed it breaks out of the egg in the of hatching. Some embryos have a egg tooth with which to crack or pip the eggshell or covering.

[http://en.wikipedia.org/wiki/Egg_\(biology\)](http://en.wikipedia.org/wiki/Egg_(biology))

adequately	enable	process	range	temporary
------------	--------	---------	-------	-----------

13 All organisms have many genes to many different biological traits, some of which are immediately, such as eye color or number of limbs, and some of which are not, such as blood type or increased risk for diseases, or the thousands of basic biochemical



..... that life.

<http://en.wikipedia.org/wiki/Gene>

comprise	corresponding	processes	specific	visible
----------	---------------	-----------	----------	---------

- 14 Instinct is the disposition of a living organism toward a particular behavior. The fixed action patterns are unlearned and inherited. The stimuli can be due to imprinting in a sensitive or also genetically fixed. Examples of instinctual fixed action patterns can be observed in the behavior of animals, which perform various activities (sometimes) that are not based upon experience, such as reproduction, and feeding among insects.

<http://en.wikipedia.org/wiki/Instinct>

complex	inherent	period	prior	variable
---------	----------	--------	-------	----------

- 15 The Parthenon is a temple of the Greek goddess Athena whom the people of Athens considered their protector. Its began in 447BC and completed in 432BC on the Athenian Acropolis, although decorations of the Parthenon continued until 431BC. It is the most important building of Greece, generally considered to be the culmination of the development of the Doric order. Its decorative sculptures are considered one of the high points of Greek art. The Parthenon is regarded as an enduring of ancient Greece and of Athenian democracy, and one of the world's greatest monuments.

<http://en.wikipedia.org/wiki/Parthenon>

Classical	construction	cultural	surviving	symbol
-----------	--------------	----------	-----------	--------

- 16 Acid rain is rain or any other form of precipitation that is unusually acidic, i.e.

elevated levels of hydrogen ions (low pH). It has harmful effects on plants, aquatic animals, and Acid rain is mostly caused by emissions of of sulfur, nitrogen, and carbon which with the water molecules in the atmosphere to produce acids. However, it can also be caused naturally by the splitting of nitrogen by the produced by lightning strikes, or the of sulfur dioxide into the atmosphere by phenomena of volcano eruptions.

http://en.wikipedia.org/wiki/Acid_rain

compounds	compounds	energy	infrastructure	react
release				

- 17 The biosphere is the of all ecosystems. It can also be called the zone of life on Earth. From the broadest biophysiological point of view, the biosphere is the ecological system all living beings and their relationships, including their with the of the lithosphere, hydrosphere, and atmosphere.

<http://en.wikipedia.org/wiki/Biosphere>

elements	global	global	integrating	interaction
sum				

- 18 Galileo Galilei (15 February 1564 - 8 January 1642) was an Italian physicist, mathematician, astronomer, and who played a in the Scientific His include improvements to the telescope and astronomical observations, and support for Copernicanism.

http://en.wikipedia.org/wiki/Galileo_Galilei

achievements	consequent	major	philosopher	Revolution
role				

19 Though once abundant over much of Eurasia and North America, the gray wolf inhabits a very small of its former because of destruction of its territory, human encroachment, and the resulting human-wolf that sparked broad extirpation. Even so, the gray wolf is regarded as being of least concern for extinction according to the International Union for Conservation of Nature, when the entire gray wolf population is considered as a whole. Today, wolves are protected in some, hunted for sport in others, or may be subject to extermination as threats to livestock and pets.

http://en.wikipedia.org/wiki/Gray_wolf

areas	encounters	perceived	portion	range
widespread				

20 Ozone (O₃) is a triatomic molecule, of three oxygen atoms. It is an allotrope of oxygen that is much less than the diatomic allotrope (O₂). Ozone in the lower atmosphere is an air pollutant with harmful effects on the respiratory systems of animals; however, the ozone in the upper atmosphere is, preventing damaging ultraviolet light from reaching the Earth's surface. Ozone is present in low concentrations throughout the Earth's atmosphere. It has many industrial and applications.

<http://en.wikipedia.org/wiki/Ozone>

beneficial	consisting	consumer	layer	potentially
stable				

21 Blood is a specialized bodily fluid that delivers necessary substances to the body's cells – such as nutrients and oxygen – and waste products away from those same cells.

In vertebrates, it is composed of blood cells in a liquid called blood plasma. Plasma, which 55% of blood fluid, is mostly water (90% by volume), and contains dissolved proteins, glucose, mineral ions, hormones, carbon dioxide, platelets and blood cells themselves. The blood cells present in blood are mainly red blood cells and white blood cells, including leukocytes and platelets. The most abundant cells in vertebrate blood are red blood cells. These contain hemoglobin, an iron-containing protein, which of oxygen by reversibly binding to this respiratory gas and greatly increasing its solubility in blood. In, carbon dioxide is almost entirely extracellularly dissolved in plasma as bicarbonate ion.

<http://en.wikipedia.org/wiki/Blood>

comprises	contrast	facilitates	suspended	transportation
transported	transports			

22 Bones are organs that form part of the endoskeleton of vertebrates. They to move, support, and protect the various organs of the body, produce red and white blood cells and store minerals. Bone tissue is a type of dense connective tissue. Because bones come in a variety of shapes and have a and they are lightweight, yet strong and hard, in addition to fulfilling their many other

<http://en.wikipedia.org/wiki/Skeleton>

complex	external	function	functions	internal
rigid	structure			

23 Deoxyribonucleic acid (DNA) is a nucleic acid that contains the genetic used in the development and of all known living organisms and some viruses. The main of DNA molecules is the long-term storage of information. DNA is often compared to a set of blueprints or a recipe, or a, since it contains the needed to other of cells, such as proteins and RNA molecules.

<http://en.wikipedia.org/wiki/DNA>

code	components	construct	functioning	instructions
instructions	role			

24 Leonardo di ser Piero da Vinci, (April 15, 1452 – May 2, 1519), was an Italian polymath: painter, sculptor, architect, musician, scientist, mathematician, engineer, inventor, anatomist, geologist, botanist and writer. Leonardo has often been described as the archetype of the Renaissance man, a man whose unquenchable curiosity was equaled only by his powers of invention. He is widely considered to be one of the greatest painters of all time and perhaps the most talented person ever to have lived. According to art historian Helen Gardner, the and depth of his interests were without and "his mind and personality seem to us superhuman, the man himself mysterious and remote". Marco Rosci points out, however, that while there is much speculation about the man himself, Leonardo's of the world is essentially rather than mysterious, and that the he employed were unusual for his time.

http://en.wikipedia.org/wiki/Leonardo_da_Vinci

diversely	empirical	logical	methods	precedent
scope	vision			

25 The 2009 flu pandemic is a outbreak of a new strain of H1N1 influenza virus, often referred to colloquially as “swine flu”. Although the virus, first in April 2009, contains a combination of genes from swine, avian (bird), and human influenza viruses, it cannot be spread by eating pork or pork products. The outbreak began in the state of Veracruz, Mexico, with that there had been an epidemic for months before it was officially recognized as such. The Mexican government closed most of Mexico City’s public and private in an attempt to contain the spread of the virus. However the virus continued to spread, clinics in some were overwhelmed by people infected, and the World Health Organization (WHO) and US Centers for Disease Control (CDC) stopped counting cases and in June declared the outbreak to be a pandemic.

http://en.wikipedia.org/wiki/2009_flu_pandemic

areas	detected	evidence	facilities	global
globally	ongoing			

26 Yeasts are eukaryotic micro-organisms classified in the kingdom Fungi, with about 1,500 species currently described; they fungal in the oceans. Most reproduce asexually by budding, although a few do so by binary fission. Yeasts are unicellular, although some species with yeast forms may become multicellular through the formation of a string of connected budding cells known as pseudohyphae, or false hyphae as seen in most molds. Yeast size can greatly depending on the species, typically measuring 3–4 µm in diameter, although some yeasts can reach over



40 μm.

The yeast species *Saccharomyces cerevisiae* has been used in baking and fermenting alcoholic beverages for thousands of years. It is also extremely important as a model organism in modern cell biology, and is one of the most thoroughly eukaryotic microorganisms. have used it to gather information about the biology of the eukaryotic cell and human biology. Other species of yeast, such as *Candida albicans*, are opportunistic pathogens and can cause infections in humans. Yeasts have recently been used to electricity in microbial fuel cells, and produce ethanol for the biofuel industry.

<http://en.wikipedia.org/wiki/Yeast>

diversity	dominate	generate	research	researched
researchers	ultimately	vary		

Note: "μm" stands for micrometre or micron. It equals 1×10^{-6} m. (See appendix 8.7)

27 Electromagnetism is the physics of the electromagnetic field, a field that exerts a force on charged particles and is reciprocally by the presence and motion of such particles. A changing magnetic field produces an electric field (this is the of electromagnetic, the basis of operation for electrical generators, motors, and transformers)., a changing electric field a magnetic field. The magnetic field is produced by the motion of electric charges, i.e., electric current. The magnetic field causes the magnetic force associated with magnets. The of electromagnetism led to the development of special relativity by Albert Einstein in 1905; and from this it was shown that magnetic fields and electric fields are with relative

motion as a four vector.

<http://en.wikipedia.org/wiki/Electromagnetism>

affected	convertible	generates	implications	induction
induction	phenomenon	similarly	theoretical	

28 The Large Hadron Collider (LHC) is the world's largest and highest-
..... particle accelerator, intended to collide opposing particle
beams of either protons at an of 7 TeV per particle, or lead
nuclei at an of 574 TeV per nucleus. It is expected that it will
address the most questions of physics, hopefully allowing
progress in understanding the deepest laws of nature. The LHC lies in a tunnel
27 kilometres in circumference, as much as 175 metres beneath the Franco-
Swiss border near Geneva, Switzerland.

The Large Hadron Collider was built by the European Organization for
..... (CERN) with the intention of testing
various of high-energy physics, including the existence of
the Higgs boson and of the large family of new particles
..... by supersymmetry. It is by and built in
collaboration with over 10,000 scientists and engineers from over 100 countries
as well as hundreds of universities and laboratories.

http://en.wikipedia.org/wiki/Large_Hadron_Collider

energy	energy	energy	fundamental	funded
hypothesized	Nuclear	predicted	predictions	Research

Note: "TeV" stands for tera electron volt. Tera means 10^{12} . (See appendix 8.7)

29 π (sometimes written pi) is an number, which means that

its value cannot be expressed exactly as a fraction m/n , where m and n are integers., its decimal representation never ends or repeats. It is also a transcendental number, which, among other things, that no of algebraic operations on integers (powers, roots,, etc.) can be equal to its value; proving this was a late in mathematical history and a result of 19th century German mathematics. Throughout the history of mathematics, there has been much effort to determine π more and to understand its nature; fascination with the number has even carried over into non-mathematical

The Greek letter π , often spelled out pi in a, was adopted for the number from the Greek word for perimeter, first by William Jones in 1707, and popularized by Leonhard Euler in 1737.

<http://en.wikipedia.org/wiki/Pi>

accurately	achievement	consequently	culture	finite
implies	irrational	sequence	significant	sums
text				

30 Marie Skłodowska Curie (7 November 1867 – 4 July 1934) was a physicist and chemist of Polish upbringing and,, French citizenship. She was a pioneer in the field of radioactivity, the first person honored with two Nobel Prizes, receiving one in physics and later, one in chemistry. She was the first woman to serve as professor at the University of Paris.

She was born Maria Skłodowska in Warsaw (then Vistula Land, Russian Empire; now Poland) and lived there until she was twenty-four years old. In 1891 she followed her elder sister, Bronisława, to study in Paris, where she her higher degrees and her



scientific work. She the Curie in Paris and Warsaw. Her husband, Pierre Curie, was a Nobel co-laureate of hers, being awarded a Nobel prize in physics at the same time. Her daughter, Irène Joliot-Curie, and son-in-law, Frédéric Joliot-Curie, also received Nobel prizes.

Her include the of a of radioactivity, for radioactive isotopes, and the discovery of two new, polonium and radium.

http://en.wikipedia.org/wiki/Marie_Curie

achievements	conducted	creation	elements	founded
Institutes	isolating	obtained	subsequent	subsequently
techniques	theory			



6 Academic Word Definitions Matching - Sublist 1A

Match these words to their definitions.

1	analysis	.....	a	an abstract or general idea
2	approach	.....	b	to send goods to another country
3	area	.....	c	one or more reasons for believing something
4	assessment	.....	d	information from which conclusions may be drawn
5	assume	.....	e	able to be used
6	authority	.....	f	facts which contribute to the result of something
7	available	.....	g	the purpose of something, or the duty of a person
8	benefit	.....	h	the conditions one lives in and their effects
9	concept	.....	i	when you decide the value or quality of something
10	consistent	.....	j	a legal agreement between people or groups
11	constitutional	.....	k	relating to the laws and principles of a government
12	context	.....	l	relating to money or trade
13	contract	.....	m	formed or developed from something else
14	create	.....	n	relating to the management of money
15	data	.....	o	a detailed investigation of the parts of something
16	definition	.....	p	an explanation of a word or phrase
17	derived	.....	q	the situation in which something exists or happens
18	distribution	.....	r	to make something new or invent something
19	economic	.....	s	a standard way of making or doing something
20	environment	.....	t	an advantage or good effect
21	established	.....	u	an expert on a subject
22	estimate	.....	v	the way in which things or people are spread about
23	evidence	.....	w	in agreement with expectations or other facts
24	export	.....	x	accept something to be true without questioning it
25	factors	.....	y	recognized something by saying what it is
26	financial	.....	z	a way of considering or doing something
27	formula	.....	α	conventional or conforming to accepted standards
28	function	.....	β	a guess of the size, number or amount of something
29	identified	.....	γ	money earned by doing work or gained by investing
30	income	.....	δ	a subject or specialization, or part of it

6 Academic Word Definitions Matching - Sublist 1B

Match these words to their definitions.

1	indicate	.....	a	an answer or reaction to a question or statement
2	individual	.....	b	in proportion to a hundred
3	interpretation	.....	c	noticeable, meaningful or important
4	involved	.....	d	to happen, often naturally or unexpectedly
5	issues	.....	e	a geographic or economic area
6	labor	.....	f	to show, point out, or make clear
7	legal	.....	g	a single person or thing when compared to a group
8	legislation	.....	h	almost but not exactly the same
9	major	.....	i	more important than others of the same type
10	method	.....	j	the way parts of a system or object are arranged
11	occur	.....	k	an organized system of accepted knowledge
12	percent	.....	l	relating to one thing and not others
13	period	.....	m	a function or part performed in a specific process
14	policy	.....	n	a series of actions taken to achieve a result
15	principle	.....	o	the cause of something or place it comes from
16	procedure	.....	p	practical work which involves physical effort
17	process	.....	q	related to or allowed by law
18	required	.....	r	a basic generalization that is accepted as true
19	research	.....	s	a course of action intended to achieve a result
20	response	.....	t	any length of time
21	role	.....	u	an established practice or plan of what to do
22	section	.....	v	a way of doing something
23	sector	.....	w	a law or laws created by a government
24	significant	.....	x	a detailed study of a subject
25	similar	.....	y	needed or made necessary
26	source	.....	z	problems that people are thinking or talking about
27	specific	.....	α	an explanation or opinion of what something means
28	structure	.....	β	one among a group of things which may change
29	theory	.....	γ	complicated or difficult to understand
30	variable	.....	δ	a distinct part of something

6 Academic Word Definitions Matching - Sublist 2A

Match these words to their definitions.

1	achieve	.....	a	an act of helping to complete a task
2	acquisition	.....	b	an opinion one reaches after careful consideration
3	administration	.....	c	a specific difference between two similar things
4	affect	.....	d	a plan of something or how its parts are arranged
5	appropriate	.....	e	to organize and perform a specific task
6	aspects	.....	f	the basic principles of a subject of study
7	assistance	.....	g	last
8	categories	.....	h	the act of building something
9	chapter	.....	i	a method of managing the affairs of an organization
10	commission	.....	j	the important or typical parts of something
11	community	.....	k	a statement showing the equivalence of two things
12	complex	.....	l	difficult to understand because of its many parts
13	computer	.....	m	the parts of a problem, situation or task
14	conclusion	.....	n	the groups by which something is classified
15	conduct	.....	o	a powerful effect that something has on a situation
16	consequences	.....	p	a person who buys goods or services
17	construction	.....	q	a special group chosen to consider something
18	consumer	.....	r	to recognize a person's contribution to a task
19	credit	.....	s	damage to a person's body after an accident or attack
20	cultural	.....	t	the center of interest, activity, or attention
21	design	.....	u	to influence or cause something to change
22	distinction	.....	v	a social group of people who live in a particular area
23	elements	.....	w	the undesired results of a particular act or situation
24	equation	.....	x	relating to the customs and beliefs of a certain group
25	evaluation	.....	y	to succeed in reaching a target or aim
26	features	.....	z	the process of getting something
27	final	.....	α	a part of a book or period of time
28	focus	.....	β	suitable or right for a particular purpose or situation
29	impact	.....	γ	a machine which performs calculations automatically
30	injury	.....	δ	judgment of the value or quality of something

6 Academic Word Definitions Matching - Sublist 2B

Match these words to their definitions.

1	institute	.....	a	ordinary or usual
2	investment	.....	b	protection of a person, property or organization
3	items	.....	c	the words printed on a page other than the headings
4	journal	.....	d	a series of questions used to gather personal data
5	maintenance	.....	e	the usual ways or customs of a group of people
6	normal	.....	f	buy
7	obtained	.....	g	to choose, especially after careful consideration
8	participation	.....	h	saw, or generally recognized or believed to be true
9	perceived	.....	i	rules issued by an authority
10	positive	.....	j	a person who lives at a particular place
11	potential	.....	k	the act of taking part or being involved in something
12	previous	.....	l	detailed plans or methods for achieving success
13	primary	.....	m	a geographical or physical area
14	purchase	.....	n	simple past and past participle of seek
15	range	.....	o	came into possession of
16	region	.....	p	with limitations, or available only to a select few
17	regulations	.....	q	a place where something was, is, or will be
18	relevant	.....	r	the act of spending time or money in pursuit of gain
19	resident	.....	s	certain about something
20	resources	.....	t	the act of keeping something in its present state
21	restricted	.....	u	more important than anything else
22	security	.....	v	a publication with a focus on a particular subject
23	sought	.....	w	occurring or existing before something or someone else
24	select	.....	x	correct or suitable for a particular purpose
25	site	.....	y	the capacity to develop, succeed or achieve
26	strategies	.....	z	the upper and lower limits of something
27	survey	.....	α	the things which are part of a list or group
28	text	.....	β	to move from one place to another
29	traditional	.....	γ	money, valuable possessions, or natural materials
30	transfer	.....	δ	an organization that does scientific or educational work

6 Academic Word Definitions Matching - Sublist 3A

Match these words to their definitions.

1	alternative	.....	a	the central or most important part of a system or thing
2	circumstances	.....	b	spoken or written words to express an opinion
3	comments	.....	c	conditions that limit the freedom of a system or thing
4	compensation	.....	d	money received for the loss or damage of something
5	components	.....	e	voluntary agreement or permission
6	consent	.....	f	all the individual parts of a system or thing
7	considerable	.....	g	movement of the body, or management of a group
8	constant	.....	h	unchanging, or happening frequently
9	constraints	.....	i	something different, or a choice of something else
10	contribution	.....	j	an occurrence of something
11	convention	.....	k	to record the details of a process or event
12	coordination	.....	l	the act of finding a logical answer or opinion
13	core	.....	m	existing or occurring at the beginning
14	corporate	.....	n	money available for a specific purpose
15	corresponding	.....	o	large or of noticeable importance
16	criteria	.....	p	similar to or anticipated
17	deduction	.....	q	an outline or basic description of a complex process
18	demonstrate	.....	r	stronger than others of the same group or type
19	document	.....	s	made clear with pictures or examples
20	dominant	.....	t	the act of arriving at a country in order to live there
21	emphasis	.....	u	the conditions which make a situation the way it is
22	ensure	.....	v	money given or part played to achieve a group aim
23	excluded	.....	w	the rules or guidelines to test or evaluate something
24	framework	.....	x	relating to a group, company or corporation
25	funds	.....	y	deliberately didn't include something
26	illustrated	.....	z	a conference, or the accepted way of doing something
27	immigration	.....	α	to show or explain how something works
28	implies	.....	β	suggests something without saying directly
29	initial	.....	γ	the importance or special consideration of something
30	instance	.....	δ	to make certain that something will happen

6 Academic Word Definitions Matching - Sublist 3B

Match these words to their definitions.

1	interaction	.....	a	place, position or coordinates of something
2	justification	.....	b	a relationship involving close cooperation
3	layer	.....	c	of the body, or having material existence
4	link	.....	d	an upper limit of something
5	location	.....	e	bad, less than zero, contradictory, or inconclusive
6	maximum	.....	f	a connection between two things
7	minorities	.....	g	a distinct band, thickness, or level of something
8	negative	.....	h	the end results or consequences of a particular event
9	outcomes	.....	i	the state of being either female or male
10	partnership	.....	j	stated clearly or described accurately
11	philosophy	.....	k	a change in position, direction or conditions
12	physical	.....	l	as much as is needed for a particular purpose
13	proportion	.....	m	a series, or the order in which things are arranged
14	published	.....	n	acceptance or meaningfulness based on reason
15	reaction	.....	o	an organized plan, or an outline of a system or thing
16	registered	.....	p	ways of doing an activity that requires skill
17	reliance	.....	q	behavior or action as a result of a particular event
18	removed	.....	r	groups of people who differ from the larger group
19	scheme	.....	s	the size of something when compared to the whole
20	sequence	.....	t	a system of beliefs that guide one's behavior
21	sex	.....	u	took away
22	shift	.....	v	recorded and accepted by a group or organization
23	specified	.....	w	a piece of work that is either difficult or unpleasant
24	sufficient	.....	x	the tendency to trust in someone or something
25	task	.....	y	a book which is published periodically or as a series
26	technical	.....	z	to explain or show that something is right or fair
27	techniques	.....	α	made known to the public through writing
28	technology	.....	β	the study of practical uses of scientific discoveries
29	validity	.....	γ	communication, or the action of things on each other
30	volume	.....	δ	relating to specialized words of a specific subject

6 Academic Word Definitions Matching - Sublist 4A

Match these words to their definitions.

1	access	.....	a	happening once a year
2	adequate	.....	b	the realization of a plan, idea or policy
3	annual	.....	c	mistake or wrong decision
4	apparent	.....	d	the ability to get to or enter somewhere or something
5	approximated	.....	e	willingness to spend time or energy on something
6	attitudes	.....	f	aspects, or the length, width and height of something
7	attributed	.....	g	able to be understood, or seeming to exist
8	civil	.....	h	gave or allowed someone to do something
9	code	.....	i	without taking notice of or being influenced by
10	commitment	.....	j	of a national, racial, religious or linguistic group
11	communication	.....	k	forced a rule, or made someone accept an idea
12	concentration	.....	l	combination of two or more things into a coherent whole
13	conference	.....	m	a meeting or event with talks about a specific subject
14	contrast	.....	n	therefore, this is the reason why
15	cycle	.....	o	regulations, or a set of symbols that mean something
16	debate	.....	p	relating to home or country
17	despite	.....	q	aims, purposes or targets
18	dimensions	.....	r	feelings or opinions about someone or something
19	domestic	.....	s	a serious discussion involving many people
20	emerged	.....	t	became known, or appeared out of something
21	error	.....	u	the possible consequences an event may bring
22	ethnic	.....	v	indicated the cause of something
23	goals	.....	w	enough or barely enough
24	granted	.....	x	the ability to think or focus carefully about one thing
25	hence	.....	y	came near to, or estimated
26	hypothesis	.....	z	a series of events which repeat in a predictable order
27	implementation	.....	α	an obvious difference between two or more things
28	implications	.....	β	the way living things send messages to each other
29	imposed	.....	γ	an idea based on observation but not yet proven
30	integration	.....	δ	relating to the ordinary people of a country

6 Academic Word Definitions Matching - Sublist 4B

Match these words to their definitions.

1	internal	.....	a	kept or continued to have
2	investigation	.....	b	easy to understand
3	job	.....	c	relating to work
4	label	.....	d	a short description of the main points of something
5	mechanism	.....	e	work or a study of a subject over a period of time
6	obvious	.....	f	a detailed study of examination of a problem or crime
7	occupational	.....	g	to raise someone or something to a higher level
8	option	.....	h	a process or sequence of steps within a system
9	output	.....	i	regular work, a piece of work, a responsibility or a task
10	overall	.....	j	relating to or existing inside
11	parallel	.....	k	coming before something else in time or importance
12	parameters	.....	l	the end product, or the amount of something produced
13	phase	.....	m	a branch of applied mathematics that analyzes data
14	predicted	.....	n	a period of time, especially as part of a series
15	principal	.....	o	the relative position of someone or something
16	prior	.....	p	relating to or conforming to the standards of work
17	professional	.....	q	in general, considering everything
18	project	.....	r	the facts or rules which limit how something is done
19	promote	.....	s	a sequence of similar or related things
20	regime	.....	t	the first, main, or most important
21	resolution	.....	u	the total number or amount of things added together
22	retained	.....	v	to give emphasis or special attention to something
23	series	.....	w	information about the object it is fixed to
24	statistics	.....	x	said that something would happen in the future
25	status	.....	y	a particular government or controlling group or system
26	stress	.....	z	a course of action which is decided purposefully
27	subsequent	.....	α	happening after something else
28	sum	.....	β	something available as a choice, or the right to choose
29	summary	.....	γ	done or committed to do with responsibility or effort
30	undertaken	.....	δ	similar, or of equal distance apart along two lengths

6 Academic Word Definitions Matching - Sublist 5A

Match these words to their definitions.

1	academic	.....	a	the maximum that can be contained or produced
2	adjustment	.....	b	substances made up of two or more elements
3	alter	.....	c	a picture in the mind or formed by a mirror or lens
4	amendment	.....	d	relating to or existing outside
5	aware	.....	e	communication, or when people or things touch
6	capacity	.....	f	a gradual process of change, or Darwin's theory
7	challenge	.....	g	to make something possible, practical or easy to do
8	clause	.....	h	things, real or abstract, which exist independently
9	compounds	.....	i	relating to school, college, study or theory
10	conflict	.....	j	making small changes, or becoming suitable
11	consultation	.....	k	to change the form or character of something
12	contact	.....	l	to get weaker or diminish, or to refuse something
13	decline	.....	m	basic, central, or more important than anything else
14	discretion	.....	n	being affected by something in a particular place
15	draft	.....	o	act of forcing something to happen or be accepted
16	enable	.....	p	to make something easy or easier to do
17	energy	.....	q	fighting, or disagreement between people or ideas
18	enforcement	.....	r	a group of words with a meaning, or a legal document
19	entities	.....	s	being equal to or effectively the same as
20	equivalent	.....	t	a change made to the words of a text
21	evolution	.....	u	careful consideration for others, or the right to choose
22	expansion	.....	v	something needing effort in order to be done well
23	exposure	.....	w	a piece of text or plan which is not in its final form
24	external	.....	x	caused something to exist
25	facilitate	.....	y	an increase in size of something
26	fundamental	.....	z	people of the same age, or the production of energy
27	generated	.....	α	power or ability to be physically or mentally active
28	generation	.....	β	having knowledge or being conscious of something
29	image	.....	γ	a meeting to discuss something or seek advice
30	liberal	.....	δ	open minded and tolerant of others, or generous

6 Academic Word Definitions Matching - Sublist 5B

Match these words to their definitions.

1	license	.....	a	to follow, try to get, or try to discover information
2	logic	.....	b	the main or most important, or the best quality
3	marginal	.....	c	a way of looking at or considering something
4	medical	.....	d	able to be continued or maintained
5	mental	.....	e	the replacement of one thing by another
6	modified	.....	f	types, expressions, or ways of doing something
7	monitoring	.....	g	fashion, or change in people's behavior or attitude
8	network	.....	h	income that a company or government receives
9	notion	.....	i	changed just a little and usually for the better
10	objective	.....	j	observing, recording or detecting using instruments
11	orientation	.....	k	financial help to the poor, or health and happiness
12	perspective	.....	l	of the mind
13	precise	.....	m	direction or arrangement, aims, training or preparation
14	prime	.....	n	relating to the study or practice of medicine
15	psychology	.....	o	a process or period in which something changes
16	pursue	.....	p	a legal document giving permission to do or own
17	ratio	.....	q	aim or purpose
18	rejected	.....	r	exact or careful and accurate
19	revenue	.....	s	a way of thinking based on reason
20	stability	.....	t	study of how the mind works and affects behavior
21	styles	.....	u	aim, thing to be aimed at, or who something is for
22	substitution	.....	v	small in amount or effect, or barely acceptable
23	sustainable	.....	w	idea, opinion or belief
24	symbolic	.....	x	refused to accept, make use of, or give affection to
25	target	.....	y	resistance to change, or constancy of character
26	transition	.....	z	a system of things or people which are interconnected
27	trend	.....	α	a comparison of two things expressed as a number
28	version	.....	β	but, compared with the fact that
29	welfare	.....	γ	specific variety, different from others or the original
30	whereas	.....	δ	representing something else, or ineffective

6 Academic Word Definitions Matching - Sublist 6A

Match these words to their definitions.

1	abstract	.....	a	correct and without any mistakes
2	accurate	.....	b	gave someone a task, or sorted something into groups
3	acknowledged	.....	c	biased and unfair treatment of a person or group
4	aggregate	.....	d	a share of something for a specific purpose
5	allocation	.....	e	condition of being male or female
6	assigned	.....	f	all of a person's property or wealth
7	attached	.....	g	added or fixed something to something else
8	author	.....	h	gave no attention to someone or something
9	bond	.....	i	writer
10	brief	.....	j	in addition
11	capable	.....	k	a written summary of the important points of a text
12	cited	.....	l	an amount of money paid for a piece of work or service
13	cooperative	.....	m	having the ability or qualities to do something
14	discrimination	.....	n	relating to a central government
15	display	.....	o	ability to bend, change or be changed
16	diversity	.....	p	short in time, or expressed in a few words
17	domain	.....	q	a person with great skill or knowledge of a subject
18	edition	.....	r	something that encourages or motivates a person to do
19	enhanced	.....	s	show, or arrange something to be seen
20	estate	.....	t	a physical link, or a close social connection
21	exceed	.....	u	to be more than a number, amount or allowed limit
22	expert	.....	v	the total of all the parts
23	explicit	.....	w	clear and detailed, not implicit
24	federal	.....	x	recognized, admitted the truth, or expressed thanks
25	fees	.....	y	willing to help, or involving joint activity
26	flexibility	.....	z	an area of interest, or an area controlled by someone
27	furthermore	.....	α	variety of opinions, styles, social groups or living things
28	gender	.....	β	a version or a batch of a publication in a series
29	ignored	.....	γ	quoted as an example to support an argument
30	incentive	.....	δ	improved in quality, intensity, or value

6 Academic Word Definitions Matching - Sublist 6B

Match these words to their definitions.

1	incidence	.....	a	a lower limit of something
2	incorporated	.....	b	showed or made known
3	index	.....	c	recordings of sound or pictures
4	inhibition	.....	d	an attitude based on probability rather than proof
5	initiatives	.....	e	despite this, nonetheless, notwithstanding
6	input	.....	f	a complete change or the process of change
7	instructions	.....	g	return to normal, or getting back something lost
8	intelligence	.....	h	contribution, or something that goes into a process
9	interval	.....	i	to find or discover by careful searching or research
10	lecture	.....	j	a short period of time between one event and the next
11	migration	.....	k	fundamental, implicit but not obvious, prior
12	minimum	.....	l	reference list arranged alphabetically, or scale
13	ministry	.....	m	movement of a group from one region to another
14	motivation	.....	n	range covered, or opportunity
15	neutral	.....	o	logical or based on reason
16	nevertheless	.....	p	without bias or favoritism, or having no charge
17	overseas	.....	q	an educational speech before an audience or class
18	preceding	.....	r	enthusiasm or reason for doing something
19	presumption	.....	s	abroad, or to, from or in other countries
20	rational	.....	t	occurrence or rate of occurrence of something
21	recovery	.....	u	capacity to acquire and apply knowledge
22	revealed	.....	v	a government department, or the service of a minister
23	scope	.....	w	of lesser importance, a business owned by a parent company
24	subsidiary	.....	x	to carry from one place to another
25	tapes	.....	y	the process of slowing down, restraining, or stopping
26	trace	.....	z	coming before something or someone else
27	transformation	.....	α	usefulness, or public service such as gas or water
28	transport	.....	β	as a corporation, or combined into one thing
29	underlying	.....	γ	information about how to do something
30	utility	.....	δ	introductory steps

6 Academic Word Definitions Matching - Sublist 7A

Match these words to their definitions.

1	adaptation	.....	a	necessary items for a particular activity or purpose
2	adults	.....	b	a way through which something moves or is transmitted
3	advocate	.....	c	to refuse, not admit, or say that something is not true
4	aid	.....	d	based on observation or experiment
5	channel	.....	e	fundamental principle, or establishment
6	chemical	.....	f	traditional, or belonging to ancient Rome or Greece
7	classical	.....	g	to publicly recommend or support something
8	comprehensive	.....	h	to help or support
9	comprise	.....	i	the process of getting rid of something
10	confirmed	.....	j	to classify things or people by quality, rank or level
11	contrary	.....	k	classified by rank or grade
12	converted	.....	l	to get from source, pull out, or get by force
13	couple	.....	m	countable, or having an end or limit
14	decades	.....	n	people or living things that are fully grown or developed
15	definite	.....	o	including many things or everything that is necessary
16	deny	.....	p	changed form, function or opinion
17	differentiation	.....	q	to include or consist of
18	disposal	.....	r	to get rid of, remove, or leave out
19	dynamic	.....	s	a substance with a distinct molecular composition
20	eliminate	.....	t	periods of ten years, or a long time
21	empirical	.....	u	modification to suit new conditions or environment
22	equipment	.....	v	to store in order or record officially
23	extract	.....	w	proved true, or made certain
24	file	.....	x	to link together
25	finite	.....	y	relating to energy, motion, or change
26	foundation	.....	z	certain or clear
27	global	.....	α	relating to the whole world
28	grade	.....	β	to promise or make certain
29	guarantee	.....	γ	not in agreement with, or opposite
30	hierarchical	.....	δ	the process of making something different

6 Academic Word Definitions Matching - Sublist 7B

Match these words to their definitions.

1	identical	.....	a	process of passing or sending something invisible
2	ideology	.....	b	invention or new idea or way of doing something
3	inferred	.....	c	to let go or let out
4	innovation	.....	d	to continue to live or exist
5	insert	.....	e	completely different from anything else
6	intervention	.....	f	prevented, or refused to allow
7	isolated	.....	g	only and exclusively
8	media	.....	h	subject of a text or discussion
9	mode	.....	i	television, radio, newspapers or magazines
10	paradigm	.....	j	what someone has said or written
11	phenomenon	.....	k	model of the essential features of a process or thing
12	priority	.....	l	following in sequence and without a break
13	prohibited	.....	m	conclude from evidence or logical thinking
14	publication	.....	n	become involved in a situation in order to improve it
15	quotation	.....	o	something important that comes first or before others
16	release	.....	p	system of beliefs or principles
17	reverse	.....	q	opposite or back
18	simulation	.....	r	done willingly and without external force
19	solely	.....	s	the same in every way
20	somewhat	.....	t	something unusual or amazing which can be sensed
21	submitted	.....	u	conceptual framework, or an example of something
22	successive	.....	v	presented for consideration, or gave in to
23	survive	.....	w	able to be seen
24	thesis	.....	x	separated, or found the cause of something
25	topic	.....	y	finally and after much trouble or discussion
26	transmission	.....	z	to put something into something else
27	ultimately	.....	α	printed item such as a book, magazine or journal
28	unique	.....	β	manner, way or form
29	visible	.....	γ	long academic paper based on original research
30	voluntary	.....	δ	slightly or rather

6 Academic Word Definitions Matching - Sublist 8A

Match these words to their definitions.

1	abandon	.....	a	movement of people or thing away from a place
2	accompanied	.....	b	to indicate, or act as a symbol for
3	accumulation	.....	c	difference from the norm or what is usual or expected
4	ambiguous	.....	d	collection or process of collecting
5	appendix	.....	e	without need for help, or without thinking
6	appreciation	.....	f	to make better when combined
7	arbitrary	.....	g	good use of resources, or unfair use of people
8	automatically	.....	h	disagreement or incompatibility of two or more things
9	bias	.....	i	existing now, or of the same period
10	chart	.....	j	based on chance rather than reason
11	clarity	.....	k	emphasized or marked as important
12	conformity	.....	l	unfair preference, or distortion of statistics
13	commodity	.....	m	information to aid or advise people about something
14	complement	.....	n	supplementary material at the end of a book
15	contemporary	.....	o	exciting, outstanding, or very sudden
16	contradiction	.....	p	agreement in form or opinion, or doing as others do
17	crucial	.....	q	extremely important
18	currency	.....	r	irregular variations, or rises and falls
19	denote	.....	s	went or came with someone or something
20	detected	.....	t	something that can be bought or sold
21	deviation	.....	u	money or acceptance
22	displacement	.....	v	understood without being said
23	dramatic	.....	w	noticed, or discovered using instruments
24	eventually	.....	x	to show, display or reveal
25	exhibit	.....	y	finally, or ultimately
26	exploitation	.....	z	to leave forever, or to stop something in progress
27	fluctuations	.....	α	to watch carefully or record in detail
28	guidelines	.....	β	recognition of value, or expression of thanks
29	highlighted	.....	γ	not clear, or having two or more possible interpretations
30	implicit	.....	δ	clearness of expression, thought, sound or image

6 Academic Word Definitions Matching - Sublist 8B

Match these words to their definitions.

- | | | | | |
|----|----------------|-------|---|---|
| 1 | induced | ..... | a | relating to a nucleus |
| 2 | inevitably | ..... | b | caused to happen, or persuaded to do |
| 3 | infrastructure | ..... | c | basic organization of a system, or public services |
| 4 | inspection | ..... | d | existing or happening in many places |
| 5 | intensity | ..... | e | without pattern or plan |
| 6 | manipulation | ..... | f | a plan of activities organized by time |
| 7 | minimized | ..... | g | people involved in an activity or job requiring skill |
| 8 | nuclear | ..... | h | a change of the words of a text |
| 9 | offset | ..... | i | to return to a previous condition or position |
| 10 | paragraph | ..... | j | relating to vision or sight |
| 11 | plus | ..... | k | careful or critical viewing or examination |
| 12 | practitioners | ..... | l | reduced to a minimum, or made unimportant |
| 13 | predominantly | ..... | m | as expected, or in a way that can not be avoided |
| 14 | prospect | ..... | n | almost or practically |
| 15 | radical | ..... | o | nervousness or uneasiness |
| 16 | random | ..... | p | by way of, or by means of |
| 17 | reinforced | ..... | q | strength of concentration of something |
| 18 | restore | ..... | r | gave support to something |
| 19 | revision | ..... | s | always the same |
| 20 | schedule | ..... | t | to counterbalance or compensate one thing for another |
| 21 | tension | ..... | u | mainly or mostly |
| 22 | termination | ..... | v | and also, or more, added to |
| 23 | theme | ..... | w | influence, or control of something using hands |
| 24 | thereby | ..... | x | end of something, or process of ending something |
| 25 | uniform | ..... | y | method, or any form of land transport |
| 26 | vehicle | ..... | z | topic of speech or writing |
| 27 | via | ..... | α | as a result of this |
| 28 | virtually | ..... | β | anticipation, or probability of a favorable outcome |
| 29 | widespread | ..... | γ | fundamental or extreme |
| 30 | visual | ..... | δ | group of sentences which discuss a single topic |

6 Academic Word Definitions Matching - Sublist 9A

Match these words to their definitions.

- | | | | | |
|----|---------------|-------|---|---|
| 1 | accommodation | ..... | a | personal interest, benefit or representation |
| 2 | analogous | ..... | b | achieved or gained by effort |
| 3 | anticipated | ..... | c | morally right |
| 4 | assurance | ..... | d | between two extremes or in the middle |
| 5 | attained | ..... | e | gave time or effort to a purpose, activity or person |
| 6 | behalf | ..... | f | relating to, involving or done with hands |
| 7 | bulk | ..... | g | similar or comparable in some ways |
| 8 | ceases | ..... | h | adjustment, agreement, or living place |
| 9 | coherence | ..... | i | started |
| 10 | coincide | ..... | j | made smaller in size or importance |
| 11 | commenced | ..... | k | necessary or important to complete a whole |
| 12 | incompatible | ..... | l | happening at the same time |
| 13 | concurrent | ..... | m | gradual weakening or damage caused by nature |
| 14 | confined | ..... | n | scheme or thing invented for a specific purpose |
| 15 | controversy | ..... | o | limited or enclosed |
| 16 | conversely | ..... | p | existing as a natural and basic part of something |
| 17 | device | ..... | q | majority, or large size or weight of something |
| 18 | devoted | ..... | r | stops something or comes to an end |
| 19 | diminished | ..... | s | period of time that something lasts |
| 20 | distortion | ..... | t | discoveries or clear understandings of a complex issue |
| 21 | duration | ..... | u | unable to exist or work together effectively |
| 22 | erosion | ..... | v | in the opposite way, on the other hand |
| 23 | ethical | ..... | w | to happen at the same time, or be similar |
| 24 | format | ..... | x | change of shape, or inaccurate description or reporting |
| 25 | founded | ..... | y | logical consistency, or integration of parts |
| 26 | inherent | ..... | z | arrangement, layout or plan |
| 27 | insights | ..... | α | brought into existence, or based an idea on something |
| 28 | integral | ..... | β | promise or confidence |
| 29 | intermediate | ..... | γ | expected something to happen |
| 30 | manual | ..... | δ | disagreement or argument about an important topic |

6 Academic Word Definitions Matching - Sublist 9B

Match these words to their definitions.

1	mature	.....	a	prior to or in preparation for the main activity or event
2	mediation	.....	b	set of rules and procedures
3	medium	.....	c	completely grown or developed, or like an adult
4	military	.....	d	improve something through small changes
5	minimal	.....	e	action that breaks the rules
6	mutual	.....	f	very small, the smallest possible, or barely enough
7	norms	.....	g	part or share of a whole
8	overlap	.....	h	relating to quality
9	passive	.....	i	correspond or coincide in part with something
10	portion	.....	j	of less importance or lower status
11	preliminary	.....	k	cause, or set off an action or series of actions
12	protocol	.....	l	limitations or controls of the freedom of something
13	qualitative	.....	m	a sudden or important change in a situation
14	refine	.....	n	organized group of people who work cooperatively
15	relaxed	.....	o	negotiation between groups in conflict with each other
16	restraints	.....	p	for a limited period
17	revolution	.....	q	stiff and fixed, or not able to be changed or persuaded
18	rigid	.....	r	sight, mental image, or ability to anticipate the future
19	route	.....	s	means of transmitting, transporting, or communicating
20	scenario	.....	t	imagined event, or model of expected outcomes
21	sphere	.....	u	felt or shared by each other or all
22	subordinate	.....	v	extra, or supplying what is lacking
23	supplementary	.....	w	accepting without resistance, or not active
24	suspended	.....	x	stopped something temporarily or permanently
25	team	.....	y	made rules or controls less severe
26	temporary	.....	z	relating to war or armed forces
27	trigger	.....	α	area of interest, knowledge or control
28	unified	.....	β	way between places, or method of achieving something
29	violation	.....	γ	brought together or combined as a whole
30	vision	.....	δ	accepted or usual standards or ways

6 Academic Word Definitions Matching - Sublist 10

Match these words to their definitions.

1	adjacent	.....	a	used law or power to improve a situation
2	albeit	.....	b	next to, near, or touching
3	assembly	.....	c	met unexpectedly, or experienced something undesired
4	collapse	.....	d	very big
5	colleagues	.....	e	to impose or collect a tax
6	compiled	.....	f	despite this, nevertheless, nonetheless
7	conceived	.....	g	happening soon
8	convinced	.....	h	unwilling or hesitant
9	depression	.....	i	commonly or falsely called
10	encountered	.....	j	although, even though
11	enormous	.....	k	despite this, nevertheless, notwithstanding
12	forthcoming	.....	l	unusual, not even, or irregular
13	inclination	.....	m	basic and essential, or by itself
14	integrity	.....	n	put together from various sources
15	intrinsic	.....	o	to experience or endure
16	invoked	.....	p	people who work or study together at the same place
17	levy	.....	q	unhappiness, or a period of little business activity
18	likewise	.....	r	asked formally, caused a problem, or stayed in position
19	nonetheless	.....	s	a regular meeting of people, or putting parts together
20	notwithstanding	.....	t	gave birth, imagined, or invented
21	odd	.....	u	continuing for a long time, or refusing to give up
22	ongoing	.....	v	by which or through which
23	panel	.....	w	a small group of people chosen to give their opinions
24	persistent	.....	x	in progress or happening now
25	posed	.....	y	persuaded or lead someone to believe or do something
26	reluctant	.....	z	similarly, also
27	so-called	.....	α	easy to understand, or honest and frank
28	straightforward	.....	β	fall down or fail suddenly
29	undergo	.....	γ	slope, or the way a person feels about something
30	whereby	.....	δ	wholeness, honesty, or having principles

7 Supplementary Reading

Read the paragraphs below. What is the topic? What is the main idea?

- 1 A supermassive black hole is the largest type of black hole in a galaxy, on the order of hundreds of thousands to billions of solar masses. Most, if not all galaxies, including the Milky Way, are believed to contain supermassive black holes at their centers.

http://en.wikipedia.org/wiki/Supermassive_black_hole

topic:

topic sentence or main idea:

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- 2 A hydrogen bond is the attractive interaction of a hydrogen atom with an electronegative atom, like nitrogen, oxygen or fluorine. The hydrogen must be covalently bonded to another electronegative atom to create the bond. These bonds can occur between molecules (intermolecularly), or within different parts of a single molecule (intramolecularly). The hydrogen bond (5 to 30 kJ/mole) is stronger than a van der Waals interaction, but weaker than covalent or ionic bonds. This type of bond occurs in both inorganic molecules such as water and organic molecules such as DNA.

http://en.wikipedia.org/wiki/Intermolecular_force

Topic:

Topic sentence or main idea:

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- 3 In mathematics, computer science, and related subjects, an algorithm is an effective method for solving a problem using a finite sequence of instructions. Algorithms are used for calculation, data processing, and many other fields.

<http://en.wikipedia.org/wiki/Algorithm>

Topic:

Topic sentence or main idea:

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- 4 Earth science (also known as geoscience, the geosciences or the Earth sciences), is an all-embracing term for the sciences related to the planet Earth. It is arguably a special case in planetary science, the Earth being the only known life-bearing planet. There are both reductionist and holistic approaches to Earth sciences. The formal discipline of Earth Sciences may include the study of the atmosphere, oceans and biosphere, as well as the solid earth. Typically Earth Scientists will use tools from physics, chemistry, biology, chronology and mathematics to build a quantitative understanding of how the Earth system works, and how it evolved to its current state.

http://en.wikipedia.org/wiki/Earth_science

Topic:

Topic sentence or main idea:

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- 5 Green tea contains polyphenols which are thought to improve health, particularly catechins, the most abundant of which is epigallocatechin gallate. In vitro and animal studies as well as preliminary observational and clinical studies of humans suggest that green tea can reduce the risk of cardiovascular disease and cancer as well as beneficially impact bone density, cognitive function, dental cavities, and kidney stones. However, the human studies are sometimes mixed and inconsistent. Green tea also contains carotenoids, tocopherols, ascorbic acid (vitamin C), minerals such as chromium, manganese, selenium or zinc, and certain phytochemical compounds. It is a more potent antioxidant than black tea, although black tea has substances which green tea does not such as theaflavin.

http://en.wikipedia.org/wiki/Green_tea

Topic:

Topic sentence or main idea:

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- 6 The Fibonacci sequence was well known in ancient India, where it was applied to the metrical sciences (prosody), before it was known in Europe. Developments have been attributed to Pingala (200 BC), Virahanka (6th century AD), Gopāla (c.1135 AD), and Hemachandra (c.1150 AD). The motivation came from Sanskrit prosody, where long syllables have duration 2 and short syllables have duration 1. Any pattern of duration n can be formed by adding a short syllable to a pattern of duration $n - 1$, or a long syllable to a pattern of duration $n - 2$; thus the prosodists showed that the number of patterns of duration n is the sum of the two previous numbers in the sequence. Later authors gave algorithms for ranking and unranking these patterns (e.g. finding the k th pattern of duration n), and discovered the higher-order Fibonacci numbers. In the West, the sequence was studied by Leonardo of Pisa, known as Fibonacci, in his Liber Abaci (1202). He considers the growth of an idealised (biologically unrealistic) rabbit population, assuming that: a newly-born pair of rabbits, one male, one female, are put in a field; rabbits are able to mate at the age of one month so that at the end of its second month a female can produce another pair of rabbits; rabbits never die and a mating pair always produces one new pair (one male, one female) every month from the second month on. The puzzle that Fibonacci posed was: how many pairs will there be in one year?

http://en.wikipedia.org/wiki/Fibonacci_number

Topic:

Topic sentence or main idea:

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- 7 In physics, the wavelength of a sinusoidal wave is the spatial period of the wave – the distance over which the wave’s shape repeats. It is usually determined by

considering the distance between consecutive corresponding points of the same phase, such as crests, troughs, or zero crossings, and is a characteristic of both traveling waves and standing waves, as well as other spatial wave patterns. Wavelength is commonly designated by the Greek letter lambda (λ). The concept can also be applied to periodic waves of non-sinusoidal shape. The term wavelength is also sometimes applied to modulated waves, and to the sinusoidal envelopes of modulated waves or waves formed by interference of several sinusoids.

<http://en.wikipedia.org/wiki/Wavelength>

Topic:

Topic sentence or main idea:

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- 8 The Standard Model of particle physics is a theory of three of the four known fundamental interactions and the elementary particles that take part in these interactions. These particles make up all visible matter in the universe. Every high energy physics experiment carried out since the mid-20th century has eventually yielded findings consistent with the Standard Model. Still, the Standard Model falls short of being a complete theory of fundamental interactions because it does not include gravitation, dark matter, or dark energy. It is not quite a complete description of leptons either, because it does not describe nonzero neutrino masses, although simple natural extensions do.

http://en.wikipedia.org/wiki/Standard_Model

Topic:

Topic sentence or main idea:

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- 9 The invention of highly effective "pure distillation" is credited to Arabic and Persian chemists in the Middle East from the 8th century. They produced

distillation processes to isolate and purify chemical substances for industrial purposes such as isolating natural esters (perfumes) and producing pure alcohol. The first among them was Jabir ibn Hayyan, in the 8th century, who is credited with the invention of numerous chemical apparatus and processes that are still in use today. In particular, his alembic was the first still with retorts which could fully purify chemicals, a precursor to the pot still, and its design has served as inspiration for modern micro-scale distillation apparatus such as the Hickman stillhead. The isolation of ethanol (alcohol) as a pure compound through distillation was first achieved by the Arab chemist Al-Kindi. Petroleum was first distilled by the Persian alchemist Muhammad ibn Zakariya Rāzi in the 9th century, for producing kerosene, while steam distillation was invented by Avicenna in the early 11th century, for producing essential oils.

<http://en.wikipedia.org/wiki/Distillation>

Topic:

Topic sentence or main idea:

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- 10 The reason for a green flash lies in refraction of light (as in a prism) in the atmosphere: light moves more slowly in the lower, denser air than in the thinner air above, so sunlight rays follow paths that curve slightly, in the same direction as the curvature of the Earth. Higher frequency light (green/blue) curves more than lower frequency light (red/orange), so green/blue rays from the upper limb of the setting sun remain visible after the red rays are obstructed by the curvature of the earth.

http://en.wikipedia.org/wiki/Green_flash

Topic:

Topic sentence or main idea:

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- 11 In biology, epigenetics is the study of changes in phenotype (appearance) or gene expression caused by mechanisms other than changes in the underlying DNA sequence, hence the name epi- (Greek: over, above) -genetics. These changes may remain through cell divisions for the remainder of the cell's life and may also last for multiple generations. However, there is no change in the underlying DNA sequence of the organism; instead, non-genetic factors cause the organism's genes to behave (or express themselves) differently.

<http://en.wikipedia.org/wiki/Epigenetics>

Topic:

Topic sentence or main idea:

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- 12 In aerobic organisms, the citric acid cycle is part of a metabolic pathway involved in the chemical conversion of carbohydrates, fats and proteins into carbon dioxide and water to generate a form of usable energy. Other relevant reactions in the pathway include those in glycolysis and pyruvate oxidation before the citric acid cycle, and oxidative phosphorylation after it. In addition, it provides precursors for many compounds including some amino acids and is therefore functional even in cells performing fermentation.

http://en.wikipedia.org/wiki/Citric_acid_cycle

Topic:

Topic sentence or main idea:

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- 13 Like extant organisms, fossils vary in size from microscopic, such as single bacterial cells only one micrometer in diameter, to gigantic, such as dinosaurs and trees many meters long and weighing many tons. A fossil normally preserves only a portion of the deceased organism, usually that portion that was partially mineralized during life, such as the bones and teeth of vertebrates,

or the chitinous exoskeletons of invertebrates. Preservation of soft tissues is rare in the fossil record. Fossils may also consist of the marks left behind by the organism while it was alive, such as the footprint or feces (coprolites) of a reptile. These types of fossil are called trace fossils (or ichnofossils), as opposed to body fossils. Finally, past life leaves some markers that cannot be seen but can be detected in the form of biochemical signals; these are known as chemofossils or biomarkers.

<http://en.wikipedia.org/wiki/Fossil>

Topic:

Topic sentence or main idea:

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- 14 Language acquisition is the process by which humans acquire the capacity to perceive, produce and use words to understand and communicate. This capacity involves the picking up of diverse capacities including syntax, phonetics, and an extensive vocabulary. This language might be vocal as with speech or manual as in sign. Language acquisition usually refers to first language acquisition, which studies infants' acquisition of their native language, rather than second language acquisition that deals with acquisition in both children and adults of additional languages.

http://en.wikipedia.org/wiki/Language_acquisition

Topic:

Topic sentence or main idea:

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- 15 The most widely known anecdote about Archimedes tells of how he invented a method for determining the volume of an object with an irregular shape. According to Vitruvius, a new crown in the shape of a laurel wreath had been made for King Hiero II, and Archimedes was asked to determine whether it

was of solid gold, or whether silver had been added by a dishonest goldsmith. Archimedes had to solve the problem without damaging the crown, so he could not melt it down into a regularly shaped body in order to calculate its density. While taking a bath, he noticed that the level of the water in the tub rose as he got in, and realized that this effect could be used to determine the volume of the crown. For practical purposes water is incompressible, so the submerged crown would displace an amount of water equal to its own volume. By dividing the weight of the crown by the volume of water displaced, the density of the crown could be obtained. This density would be lower than that of gold if cheaper and less dense metals had been added. Archimedes then took to the streets naked, so excited by his discovery that he had forgotten to dress, crying "Eureka!", meaning "I have found it!"

<http://en.wikipedia.org/wiki/Archimedes>

Topic:

Topic sentence or main idea:

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- 16 No clear relationship has been proven between diet and gallstone formation. However, low-fibre, high-cholesterol diets, and diets high in starchy foods have been suggested as contributing to gallstone formation. Other nutritional factors that may increase risk of gallstones include rapid weight loss, constipation, eating fewer meals per day, eating less fish, and low intakes of the nutrients folate, magnesium, calcium, and vitamin C. On the other hand, wine and whole grain bread may decrease the risk of gallstones.

<http://en.wikipedia.org/wiki/Gallstone>

Topic:

Topic sentence or main idea:

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- 17 A typical neutron star has a mass between 1.35 and about 2.1 solar masses, with a corresponding radius of about 12 km. In contrast, the Sun's radius is about 60,000 times that. Neutron stars have overall densities of 2.6×10^{14} to 4.1×10^{14} times the density of the sun, which compares with the approximate density of an atomic nucleus of 3×10^{17} kg/m³. The neutron star's density varies from below 1×10^9 kg/m³ in the crust increasing with depth to above 6×10^{17} or 8×10^{17} kg/m³ deeper inside. This density is approximately equivalent to the mass of the entire human population compressed into the size of a sugar cube.

http://en.wikipedia.org/wiki/Neutron_star

Topic:

Topic sentence or main idea:

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- 18 Primary production is the production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis, with chemosynthesis being much less important. All life on earth is directly or indirectly reliant on primary production. The organisms responsible for primary production are known as primary producers or autotrophs, and form the base of the food chain. In terrestrial ecoregions, these are mainly plants, while in aquatic ecoregions algae are primarily responsible. Primary production is distinguished as either net or gross, the former accounting for losses to processes such as cellular respiration, the latter not.

http://en.wikipedia.org/wiki/Primary_production

Topic:

Topic sentence or main idea:

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- 19 The Fermi paradox is a conflict between an argument of scale and probability and a lack of evidence. A more complete definition could be stated thus: The

apparent size and age of the universe suggests that many technologically advanced extraterrestrial civilizations ought to exist. However, this hypothesis seems inconsistent with the lack of observational evidence to support it. The first aspect of the paradox, "the argument by scale", is a function of the raw numbers involved: there are an estimated 250 billion (2.5×10^{11}) stars in the Milky Way and 70 sextillion (7×10^{22}) in the visible universe. Even if intelligent life occurs on only a minuscule percentage of planets around these stars, there should still be a great number of civilizations extant in the Milky Way galaxy alone. This argument also assumes the mediocrity principle, which states that Earth is not special, but merely a typical planet, subject to the same laws, effects, and likely outcomes as any other world.

http://en.wikipedia.org/wiki/Fermi_paradox

Topic:

Topic sentence or main idea:

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- 20 In the past, it was most commonly supposed that fleas had evolved from the flies (Diptera), based on similarities of the larvae. Genetic and morphological evidence indicates that they are descendants of the Scorpionfly family Boreidae, which are also flightless; accordingly it is possible that they will eventually be reclassified as a suborder within the Mecoptera. In any case, all these groups seem to represent a clade of closely related insect lineages, for which the names Mecopteroidea and Antliophora have been proposed.

<http://en.wikipedia.org/wiki/Flea>

Topic:

Topic sentence or main idea:

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- 21 The question of how many quantum numbers are needed to describe any given

system has no universal answer, although for each system one must find the answer for a full analysis of the system. The dynamics of any quantum system are described by a quantum Hamiltonian, H . There is one quantum number of the system corresponding to the energy, i.e., the eigenvalue of the Hamiltonian. There is also one quantum number for each operator O that commutes with the Hamiltonian (i.e. satisfies the relation $OH = HO$). These are all the quantum numbers that the system can have. Note that the operators O defining the quantum numbers should be independent of each other. Often there is more than one way to choose a set of independent operators. Consequently, in different situations different sets of quantum numbers may be used for the description of the same system.

http://en.wikipedia.org/wiki/Quantum_number

Topic:

Topic sentence or main idea:

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- 22 In 1916, G.N. Lewis proposed that a chemical bond forms by the interaction of two shared bonding electrons, with the representation of molecules as Lewis structures. In 1927 the Heitler-London theory was formulated which for the first time enabled the calculation of bonding properties of the hydrogen molecule H_2 based on quantum mechanical considerations. Specifically, Walter Heitler determined how to use Schrödinger's wave equation (1925) to show how two hydrogen atom wavefunctions join together, with plus, minus, and exchange terms, to form a covalent bond. He then called up his associate Fritz London and they worked out the details of the theory over the course of the night. Later, Linus Pauling used the pair bonding ideas of Lewis together with Heitler-London theory to develop two other key concepts in valence bond theory: resonance (1928) and orbital hybridization (1930). According to Charles Coulson, author of the noted 1952 book *Valence*, this period marks the start of "modern valence bond theory", as contrasted with older valence bond theories, which are essentially electronic theories of valence couched in pre-wave-mechanical terms. Resonance theory was criticized as imperfect by Soviet chemists during the 1950's.

http://en.wikipedia.org/wiki/Chemical_bond

Topic:

Topic sentence or main idea:

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- 23 Fish oil is oil derived from the tissues of oily fish. It is recommended for a healthy diet because it contains the omega-3 fatty acids, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), precursors to eicosanoids that reduce inflammation throughout the body. Fish do not actually produce omega-3 fatty acids, but instead accumulate them from either consuming microalgae that produce these fatty acids, as is the case with fish like herring and sardines, or, as is the case with fatty predatory fish, by eating prey fish that have accumulated omega-3 fatty acids from microalgae. Such fatty predatory fish like mackerel, lake trout, flounder, albacore tuna and salmon may be high in omega-3 fatty acids, but due to their position at the top of the food chain, these species can accumulate toxic substances (see biomagnification). For this reason, the FDA recommends limiting consumption of certain (predatory) fish species (e.g. albacore tuna, shark, and swordfish) due to high levels of toxic contaminants such as mercury, dioxin, PCBs and chlordane. More than 50 percent of the world fish oil production is fed to farmed salmon. There are DHA Omega-3 vegetarian products, made from algae, available if toxic contaminants are of concern.

http://en.wikipedia.org/wiki/Fish_oil

Topic:

Topic sentence or main idea:

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- 24 In organic chemistry, the structures of some rings of atoms are unexpectedly stable. Aromaticity is a chemical property in which a conjugated ring of unsaturated bonds, lone pairs, or empty orbitals exhibit a stabilization stronger than would be expected by the stabilization of conjugation alone. It can also be considered a manifestation of cyclic delocalization and of resonance.

<http://en.wikipedia.org/wiki/Aromaticity>

Topic:

Topic sentence or main idea:

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25 Each chemical species (for example, "water molecules", "sodium ions", "electrons", etc.) has an electrochemical potential (a number with units of energy) at any given location, that represents how easy or difficult it is to add more of that species to that location. If possible, a species will try to move from areas with higher electrochemical potential to areas with lower electrochemical potential; in equilibrium, the electrochemical potential will be constant everywhere for each species (it may have a different value for different species). For example, if a glass of water has sodium ions (Na^+) dissolved uniformly in it, and an electric field is applied across the water, then the sodium ions will tend to get pulled by the electric field towards one side. We say the ions have electric potential energy, and are moving to lower their potential energy. Likewise, if a glass of water has a lot of dissolved sugar on one side and none on the other side, each sugar molecule will randomly diffuse around the water, until there is equal concentration of sugar everywhere. We say that the sugar molecules have a "chemical potential" which is higher in the high-concentration areas, and the molecules move to lower their chemical potential. These two examples show that an electrical potential and a chemical potential can both give the same result: A redistribution of the chemical species. Therefore it makes sense to combine them into a single "potential", the electrochemical potential, which can directly give the net redistribution taking both into account.

http://en.wikipedia.org/wiki/Electrochemical_potential

Topic:

Topic sentence or main idea:

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26 For most human tasks, real numbers (or even rational numbers) offer an adequate description of data. Fractions such as $\frac{2}{3}$ and $\frac{1}{8}$ are meaningless to a person counting stones, but essential to a person comparing the sizes of different collections of stones. Negative numbers such as -3 and -5 are



meaningless when measuring the mass of an object, but essential when keeping track of monetary debits and credits. Similarly, imaginary numbers have essential concrete applications in a variety of sciences and related areas such as signal processing, control theory, electromagnetism, quantum mechanics, cartography, vibration analysis, and many others.

http://en.wikipedia.org/wiki/Imaginary_number

Topic:

Topic sentence or main idea:

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- 27 On 7 January 1610 Galileo observed with his telescope what he described at the time as “three fixed stars, totally invisible by their smallness,” all close to Jupiter, and lying on a straight line through it. Observations on subsequent nights showed that the positions of these “stars” relative to Jupiter were changing in a way that would have been inexplicable if they had really been fixed stars. On 10 January Galileo noted that one of them had disappeared, an observation which he attributed to its being hidden behind Jupiter. Within a few days he concluded that they were orbiting Jupiter: He had discovered three of Jupiter’s four largest satellites (moons): Io, Europa, and Callisto. He discovered the fourth, Ganymede, on 13 January. Galileo named the four satellites he had discovered Medicean stars, in honour of his future patron, Cosimo II de’ Medici, Grand Duke of Tuscany, and Cosimo’s three brothers. Later astronomers, however, renamed them the Galilean satellites in honour of Galileo himself.

http://en.wikipedia.org/wiki/Galileo_Galilei

Topic:

Topic sentence or main idea:

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- 28 In physical chemistry, the van der Waals force (or van der Waals interaction),

named after Dutch scientist Johannes Diderik van der Waals, is the attractive or repulsive force between molecules (or between parts of the same molecule) other than those due to covalent bonds or to the electrostatic interaction of ions with one another or with neutral molecules. The term includes: 1) force between permanent dipole and a corresponding induced dipole, and 2) instantaneous induced dipole-dipole forces (London dispersion force). It is also sometimes used loosely as a synonym for the totality of intermolecular forces. Van der Waals forces are relatively weak compared to normal chemical bonds, but play a fundamental role in fields as diverse as supramolecular chemistry, structural biology, polymer science, nanotechnology, surface science, and condensed matter physics. Van der Waals forces define the chemical character of many organic compounds. They also define the solubility of organic substances in polar and non-polar media. In low molecular weight alcohols, the properties of the polar hydroxyl group dominate the weak intermolecular forces of van der Waals. In higher molecular weight alcohols, the properties of the nonpolar hydrocarbon chain(s) dominate and define the solubility. Van der Waals forces grow with the length of the nonpolar part of the substance.

http://en.wikipedia.org/wiki/Van_der_Waals_force

Topic:

Topic sentence or main idea:

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- 29 High oil prices, competing demands between foods and other biofuel sources, and the world food crisis, have ignited interest in algaculture (farming algae) for making vegetable oil, biodiesel, bioethanol, biogasoline, biomethanol, biobutanol and other biofuels, using land that is not suitable for agriculture. Algal fuels have many attractive characteristics: they do not affect fresh water resources, can be produced using ocean and wastewater, and are biodegradable and relatively harmless to the environment if spilled. Algae cost more per unit mass yet can yield over 30 times more energy per unit area than other, second-generation biofuel crops. One biofuels company has claimed that algae can produce more oil in an area the size of a two car garage than a football field of soybeans, because almost the entire algal organism can use sunlight to produce lipids, or oil. The United States Department of Energy estimates that if algae fuel replaced all the petroleum fuel in the United States, it would require 15,000 square miles (40,000 km²). This is less than 1/7 the area of corn harvested in the United States in 2000.

http://en.wikipedia.org/wiki/Algae_fuel

Topic:

Topic sentence or main idea:

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- 30 Most photoluminescent events, in which a chemical substrate absorbs and then re-emits a photon of light, are fast, on the order of 10 nanoseconds. However, for light to be absorbed and emitted at these fast time scales, the energy of the photons involved (i.e. the wavelength of the light) must be carefully tuned according to the rules of quantum mechanics to match the available energy states and allowed transitions of the substrate. In the special case of phosphorescence, the absorbed photon energy undergoes an unusual intersystem crossing into an energy state of higher spin multiplicity (see term symbol), usually a triplet state. As a result, the energy can become trapped in the triplet state with only classically "forbidden" transitions available to return to the lower energy state. These transitions, although "forbidden", will still occur in quantum mechanics but are kinetically unfavored and thus progress at significantly slower time scales. Most phosphorescent compounds are still relatively fast emitters, with triplet lifetimes on the order of milliseconds. However, some compounds have triplet lifetimes up to minutes or even hours, allowing these substances to effectively store light energy in the form of very slowly degrading excited electron states. If the phosphorescent quantum yield is high, these substances will release significant amounts of light over long time scales, creating so-called "glow-in-the-dark" materials.

<http://en.wikipedia.org/wiki/Phosphorescence>

Topic:

Topic sentence or main idea:

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8 Appendices

- 1. Academic Word List Concise Dictionary**
- 2. Academic Word List Family Words**
- 3. Logical Connectors**
- 4. Signal Words**
- 5. Prefixes and Roots**
- 6. Suffixes**
- 7. Symbols, Units and Constants**

8.1 Academic Word List Concise Dictionary

The Academic Word List words defined here are the most frequent words of each family only, and defined for one function only. All definitions are short. Please bear in mind that many words may have additional meanings to the concise definitions below, and may serve as another function to the one shown below. You should use this dictionary for the purpose it was intended - as a quick reference guide only.

For ease of use, words in bold are the most frequent words of each Academic Word List family. Words in italic are less frequent words of the Academic Word List families.

WORD	DEFINITION	AWL FUNCTION
abandon	to leave forever, or to stop something in progress	8 verb
abstract	a written summary of the important points of a text	6 noun
academic	relating to school, college, study or theory	5 adjective
access	the ability to get to or enter somewhere or something	4 noun
accommodation	adjustment , agreement, or living place	9 noun
accompanied	went or came with someone or something	8 verb
accumulation	collection or process of collecting	8 noun
accurate	correct and without any mistakes	6 adjective
achieve	to succeed in reaching a target or aim	2 verb
acknowledged	recognized, admitted the truth, or expressed thanks	6 verb
acquisition	the process of getting something	2 noun
adaptation	<i>modification</i> to suit new conditions or environment	7 noun
adequate	enough or barely enough	4 adjective
adjacent	next to, near, or touching	10 adjective
adjustment	making small changes, or becoming suitable	5 noun
administration	a method of managing the affairs of an organization	2 noun
adults	people or living things that are fully grown or developed	7 noun
advocate	to publicly recommend or support something	7 verb
affect	to influence or cause something to change	2 verb
aggregate	the total of all the parts	6 noun
aid	to help or support	7 verb
albeit	although, even though	10 conjunction
allocation	a share of something for a specific purpose	6 noun
alter	to change the form or character of something	5 verb
alternative	something different, or a choice of something else	3 noun
ambiguous	not clear, or having two or more possible <i>interpretations</i>	8 adjective
amendment	a change made to the words of a text	5 noun
analogous	similar or comparable in some ways	9 adjective
analysis	a detailed investigation of the parts of something	1 noun
annual	happening once a year	4 adjective
anticipated	expected something to happen	9 verb
apparent	able to be understood, or seeming to exist	4 adjective
appendix	supplementary material at the end of a book	8 noun

appreciation	recognition of value, or expression of thanks	8	noun
approach	a way of considering or doing something	1	noun
appropriate	suitable or right for a particular purpose or situation	2	adjective
approximated	came near to, or <i>estimated</i>	4	verb
arbitrary	based on chance rather than reason	8	adjective
area	a subject or specialization, or part of it	1	noun
aspects	the parts of a problem, situation or task	2	noun
assembly	a regular meeting of people, or putting parts together	10	noun
assessment	when you decide the value or quality of something	1	noun
assigned	gave someone a task , or sorted something into groups	6	verb
assistance	an act of helping to complete a task	2	noun
assume	accept something to be true without questioning it	1	verb
assurance	promise or confidence	9	noun
attached	added or fixed something to something else	6	verb
attained	<i>achieved</i> or gained by effort	9	verb
attitudes	feelings or opinions about someone or something	4	noun
attributed	<i>indicated</i> the cause of something	4	verb
author	writer	6	noun
authority	an expert on a subject	1	noun
automatically	without need for help, or without thinking	8	adverb
available	able to be used	1	adjective
aware	having knowledge or being conscious of something	5	verb
behalf	personal interest, benefit or representation	9	noun
benefit	an advantage or good effect	1	noun
bias	unfair preference, or distortion of statistics	8	noun
bond	a physical link , or a close social connection	6	noun
brief	short in time, or expressed in a few words	6	adjective
bulk	<i>majority</i> , or large size or weight of something	9	noun
capable	having the ability or qualities to do something	6	adjective
capacity	the maximum that can be contained or produced	5	noun
categories	the groups by which something is classified	2	noun
ceases	stops something or comes to an end	9	verb
challenge	something needing effort in order to be done well	5	noun
channel	a way through which something moves or is <i>transmitted</i>	7	noun
chapter	a part of a book or period of time	2	noun
chart	to watch carefully or record in detail	8	verb
chemical	a substance with a <i>distinct</i> molecular composition	7	noun
circumstances	the conditions which make a situation the way it is	3	noun
cited	<i>quoted</i> as an example to support an argument	6	verb
civil	relating to the ordinary people of a country	4	adjective
clarity	clearness of expression, thought, sound or image	8	noun
classical	traditional , or belonging to ancient Rome or Greece	7	adjective
clause	a group of words with a meaning, or a legal document	5	noun
code	regulations , or a set of <i>symbols</i> that mean something	4	noun
coherence	<i>logical consistency</i> , or integration of parts	9	noun
coincide	to happen at the same time, or be similar	9	verb
collapse	fall down or fail suddenly	10	verb
colleagues	people who work or study together at the same place	10	noun
commenced	started	9	verb
comments	spoken or written words to express an opinion	3	noun

commission	a special group chosen to consider something	2	noun
commitment	willingness to spend time or energy on something	4	noun
commodity	something that can be bought or sold	8	noun
communication	the way living things send messages to each other	4	noun
community	a social group of people who live in a particular area	2	noun
compensation	money received for the loss or damage of something	3	noun
compiled	put together from various <i>sources</i>	10	verb
complement	to make better when combined	8	verb
complex	difficult to understand because of its many parts	2	adjective
components	all the individual parts of a system or thing	3	noun
compounds	substances made up of two or more elements	5	noun
comprehensive	including many things or everything that is necessary	7	adjective
comprise	to include or consist of	7	verb
computer	a machine which performs calculations automatically	2	noun
conceived	gave birth, imagined, or invented	10	verb
concentration	the ability to think or focus carefully about one thing	4	noun
concept	an abstract or general idea	1	noun
conclusion	an opinion one reaches after careful consideration	2	noun
concurrent	happening at the same time	9	adjective
conduct	to organize and perform a specific task	2	verb
conference	a meeting or event with talks about a specific subject	4	noun
confined	limited or enclosed	9	verb
confirmed	proved true, or made certain	7	verb
conflict	fighting, or disagreement between people or ideas	5	noun
conformity	agreement in form or opinion, or doing as others do	8	noun
consent	voluntary agreement or permission	3	noun
consequences	the undesired results of a particular act or situation	2	noun
considerable	large or of noticeable importance	3	adjective
consistent	in agreement with expectations or other facts	1	adjective
constant	unchanging, or happening frequently	3	adjective
constitutional	relating to the laws and <i>principles</i> of a government	1	adjective
constraints	conditions that limit the freedom of a system or thing	3	noun
construction	the act of building something	2	noun
consultation	a meeting to discuss something or <i>seek</i> advice	5	noun
consumer	a person who buys goods or services	2	noun
contact	communication , or when people or things touch	5	noun
contemporary	existing now, or of the same period	8	adjective
context	the situation in which something exists or happens	1	noun
contract	a legal agreement between people or groups	1	noun
contradiction	disagreement or <i>incompatibility</i> of two or more things	8	noun
contrary	not in agreement with, or opposite	7	adjective
contrast	an obvious difference between two or more things	4	noun
contribution	money given or part played to achieve a group aim	3	noun
controversy	disagreement or argument about an important topic	9	noun
convention	a conference , or the accepted way of doing something	3	noun
conversely	in the opposite way, on the other hand	9	adverb
converted	changed form, function or opinion	7	verb
convinced	persuaded or lead someone to believe or do something	10	verb
cooperative	willing to help, or <i>involving</i> joint activity	6	adjective
coordination	movement of the body, or management of a group	3	noun

core	the central or most important part of a system or thing	3	noun
corporate	relating to a group, company or corporation	3	adjective
corresponding	similar to or anticipated	3	adjective
couple	to link together	7	verb
create	to make something new or invent something	1	verb
credit	to recognize a person's contribution to a task	2	verb
criteria	the rules or guidelines to test or <i>evaluate</i> something	3	noun
crucial	extremely important	8	adjective
cultural	relating to the customs and beliefs of a certain group	2	adjective
currency	money or acceptance	8	noun
cycle	a series of events which repeat in a <i>predictable</i> order	4	noun
data	information from which <i>conclusions</i> may be drawn	1	noun
debate	a serious discussion <i>involving</i> many people	4	noun
decades	<i>periods</i> of ten years, or a long time	7	noun
decline	to get weaker or <i>diminish</i> , or to refuse something	5	verb
deduction	the act of finding a <i>logical</i> answer or opinion	3	noun
definite	certain or clear	7	adjective
definition	an explanation of a word or phrase	1	noun
demonstrate	to show or explain how something works	3	verb
denote	to indicate , or act as a <i>symbol</i> for	8	verb
deny	to refuse, not admit, or say that something is not true	7	verb
depression	unhappiness, or a period of little business activity	10	noun
derived	formed or developed from something else	1	adjective
design	a plan of something or how its parts are arranged	2	noun
despite	without taking notice of or being influenced by	4	preposition
detected	noticed, or discovered using instruments	8	verb
deviation	difference from the <i>norm</i> or what is usual or expected	8	noun
device	scheme or thing invented for a specific purpose	9	noun
devoted	gave time or effort to a purpose, activity or person	9	verb
differentiation	the process of making something different	7	noun
dimensions	aspects , or the length, width and height of something	4	noun
diminished	made smaller in size or importance	9	verb
discretion	careful consideration for others, or the right to choose	5	noun
discrimination	<i>biased</i> and unfair treatment of a person or group	6	noun
displacement	movement of people or thing away from a place	8	noun
display	show, or arrange something to be seen	6	verb
disposal	the process of getting rid of something	7	noun
distinction	a specific difference between two similar things	2	noun
distortion	change of shape, or <i>inaccurate</i> description or reporting	9	noun
distribution	the way in which things or people are spread about	1	noun
diversity	variety of opinions, styles , social groups or living things	6	noun
document	to record the details of a process or event	3	verb
domain	an area of interest, or an area controlled by someone	6	noun
domestic	relating to home or country	4	adjective
dominant	stronger than others of the same group or type	3	adjective
draft	a piece of text or plan which is not in its final form	5	noun
dramatic	exciting, outstanding, or very sudden	8	adjective
duration	period of time that something lasts	9	noun
dynamic	relating to energy , motion, or change	7	adjective
economic	relating to money or trade	1	adjective

edition	a version or a batch of a publication in a series	6	noun
elements	the basic <i>principles</i> of a subject of study	2	noun
eliminate	to get rid of, <i>remove</i> , or leave out	7	verb
emerged	became known, or appeared out of something	4	verb
emphasis	the importance or special consideration of something	3	noun
empirical	based on observation or experiment	7	adjective
enable	to make something possible, practical or easy to do	5	verb
encountered	met unexpectedly, or experienced something undesired	10	verb
energy	power or ability to be <i>physically</i> or <i>mentally</i> active	5	noun
enforcement	act of forcing something to happen or be accepted	5	noun
enhanced	improved in quality, intensity , or value	6	adjective
enormous	very big	10	adjective
ensure	to make certain that something will happen	3	verb
entities	things, real or abstract , which exist independently	5	noun
environment	the conditions one lives in and their effects	1	noun
equation	a statement showing the <i>equivalence</i> of two things	2	noun
equipment	necessary items for a particular activity or purpose	7	noun
equivalent	being equal to or effectively the same as	5	adjective
erosion	gradual weakening or damage caused by nature	9	noun
error	mistake or wrong decision	4	noun
established	<i>conventional</i> or <i>conforming</i> to accepted standards	1	adjective
estate	all of a person's property or wealth	6	noun
estimate	a guess of the size, number or amount of something	1	noun
ethical	morally right	9	adjective
ethnic	of a national, racial, religious or linguistic group	4	adjective
evaluation	judgment of the value or quality of something	2	noun
eventually	<i>finally</i> , or ultimately	8	adverb
evidence	one or more reasons for believing something	1	noun
evolution	a gradual process of change, or Darwin's theory	5	noun
exceed	to be more than a number, amount or allowed limit	6	verb
excluded	deliberately didn't include something	3	verb
exhibit	to show, display or <i>reveal</i>	8	verb
expansion	an increase in size of something	5	noun
expert	a person with great skill or knowledge of a subject	6	noun
explicit	clear and detailed, not implicit	6	adjective
exploitation	good use of resources , or unfair use of people	8	noun
export	to send goods to another country	1	verb
exposure	being <i>affected</i> by something in a particular place	5	noun
external	relating to or existing outside	5	adjective
extract	to get from source , pull out, or get by force	7	verb
facilitate	to make something easy or easier to do	5	verb
factors	facts which <i>contribute</i> to the result of something	1	noun
features	the important or typical parts of something	2	noun
federal	relating to a central government	6	adjective
fees	an amount of money paid for a piece of work or service	6	noun
file	to store in order or record officially	7	verb
final	last	2	adjective
financial	relating to the management of money	1	adjective
finite	countable, or having an end or limit	7	adjective
flexibility	ability to bend, change or be changed	6	noun

fluctuations	irregular <i>variations</i> , or rises and falls	8	noun
focus	the center of interest, activity, or attention	2	noun
format	arrangement, layout or plan	9	noun
formula	a standard way of making or doing something	1	noun
forthcoming	happening soon	10	adjective
foundation	fundamental principle , or <i>establishment</i>	7	noun
founded	brought into existence, or based an idea on something	9	verb
framework	an outline or basic description of a complex process	3	noun
function	the purpose of something, or the duty of a person	1	noun
fundamental	basic, central, or more important than anything else	5	adjective
funds	money available for a specific purpose	3	noun
furthermore	in addition	6	adverb
gender	condition of being male or female	6	noun
generated	caused something to exist	5	verb
generation	people of the same age, or the production of energy	5	noun
global	relating to the whole world	7	adjective
goals	aims, purposes or <i>targets</i>	4	noun
grade	to classify things or people by quality, rank or level	7	verb
granted	gave or allowed someone to do something	4	verb
guarantee	to promise or make certain	7	verb
guidelines	information to aid or advise people about something	8	noun
hence	therefore, this is the reason why	4	adverb
hierarchical	classified by rank or grade	7	adjective
highlighted	<i>emphasized</i> or marked as important	8	verb
hypothesis	an idea based on observation but not yet proven	4	noun
identical	the same in every way	7	adjective
identified	recognized something by saying what it is	1	verb
ideology	system of beliefs or <i>principles</i>	7	noun
ignored	gave no attention to someone or something	6	verb
illustrated	made clear with pictures or examples	3	verb
image	a picture in the mind or formed by a mirror or lens	5	noun
immigration	the act of arriving at a country in order to live there	3	noun
impact	a powerful effect that something has on a situation	2	noun
implementation	the realization of a plan, idea or policy	4	noun
implications	the possible consequences an event may bring	4	noun
implicit	understood without being said	8	adjective
implies	suggests something without saying directly	3	verb
imposed	forced a rule, or made someone accept an idea	4	verb
incentive	something that encourages or <i>motivates</i> a person to do	6	noun
incidence	<i>occurrence</i> or rate of <i>occurrence</i> of something	6	noun
inclination	slope, or the way a person feels about something	10	noun
income	money earned by doing work or gained by <i>investing</i>	1	noun
incompatible	unable to exist or work together effectively	9	adjective
incorporated	as a <i>corporation</i> , or combined into one thing	6	adjective
index	reference list arranged alphabetically, or scale	6	noun
indicate	to show, point out, or make clear	1	verb
individual	a single person or thing when compared to a group	1	noun
induced	caused to happen, or persuaded to do	8	verb
inevitably	as expected, or in a way that can not be avoided	8	adverb
inferred	<i>conclude</i> from evidence or <i>logical</i> thinking	7	verb

infrastructure	basic organization of a system, or public services	8	noun
inherent	existing as a natural and basic part of something	9	adjective
inhibition	the process of slowing down, <i>restraining</i> , or stopping	6	noun
initial	existing or <i>occurring</i> at the beginning	3	adjective
initiatives	introductory steps	6	noun
injury	damage to a person's body after an accident or attack	2	noun
innovation	invention or new idea or way of doing something	7	noun
input	contribution , or something that goes into a process	6	noun
insert	to put something into something else	7	verb
insights	discoveries or clear understandings of a complex issue	9	noun
inspection	careful or critical viewing or examination	8	noun
instance	an <i>occurrence</i> of something	3	noun
institute	an organization that does scientific or educational work	2	noun
instructions	information about how to do something	6	noun
integral	necessary or important to complete a whole	9	adjective
integration	combination of two or more things into a <i>coherent</i> whole	4	noun
integrity	wholeness, honesty, or having <i>principles</i>	10	noun
intelligence	capacity to <i>acquire</i> and apply knowledge	6	noun
intensity	strength of concentration of something	8	noun
interaction	communication , or the action of things on each other	3	noun
intermediate	between two extremes or in the middle	9	adjective
internal	relating to or existing inside	4	adjective
interpretation	an explanation or opinion of what something means	1	noun
interval	a short period of time between one event and the next	6	noun
intervention	become involved in a situation in order to improve it	7	noun
intrinsic	basic and essential, or by itself	10	adjective
investigation	a detailed study of examination of a problem or crime	4	noun
investment	the act of spending time or money in <i>pursuit</i> of gain	2	noun
invoked	used law or power to improve a situation	10	verb
involved	complicated or difficult to understand	1	adjective
isolated	separated, or found the cause of something	7	verb
issues	problems that people are thinking or talking about	1	noun
items	the things which are part of a list or group	2	noun
job	regular work, a piece of work, a responsibility or a task	4	noun
journal	a publication with a focus on a particular subject	2	noun
justification	to explain or show that something is right or fair	3	noun
label	information about the object it is fixed to	4	noun
labor	practical work which <i>involves</i> physical effort	1	noun
layer	a <i>distinct</i> band, thickness, or level of something	3	noun
lecture	an educational speech before an audience or class	6	noun
legal	related to or allowed by law	1	adjective
legislation	a law or laws <i>created</i> by a government	1	noun
levy	to <i>impose</i> or collect a tax	10	verb
liberal	open minded and tolerant of others, or generous	5	adjective
license	a legal document giving permission to do or own	5	noun
likewise	<i>similarly</i> , also	10	adverb
link	a connection between two things	3	noun
location	place, position or <i>coordinates</i> of something	3	noun
logic	a way of thinking based on reason	5	noun
maintenance	the act of keeping something in its present state	2	noun

major	more important than others of the same type	1	adjective
manipulation	influence, or control of something using hands	8	noun
manual	relating to, <i>involving</i> or done with hands	9	adjective
marginal	small in amount or effect, or barely acceptable	5	adjective
mature	completely grown or developed, or like an <i>adult</i>	9	adjective
maximum	an upper limit of something	3	noun
mechanism	a process or sequence of steps within a system	4	noun
media	television, radio, newspapers or magazines	7	noun
mediation	negotiation between groups in conflict with each other	9	noun
medical	relating to the study or practice of medicine	5	adjective
medium	means of <i>transmitting, transporting, or communicating</i>	9	noun
mental	of the mind	5	adjective
method	a way of doing something	1	noun
migration	movement of a group from one region to another	6	noun
military	relating to war or armed forces	9	adjective
minimal	very small, the smallest possible, or barely enough	9	adjective
minimized	reduced to a minimum , or made unimportant	8	verb
minimum	a lower limit of something	6	noun
ministry	a government department, or the service of a <i>minister</i>	6	noun
minorities	groups of people who differ from the larger group	3	noun
mode	manner, way or form	7	noun
modified	changed just a little and usually for the better	5	verb
monitoring	observing, recording or <i>detecting</i> using instruments	5	noun
motivation	enthusiasm or reason for doing something	6	noun
mutual	felt or shared by each other or all	9	adjective
negative	bad, less than zero, <i>contradictory, or inconclusive</i>	3	adjective
network	a system of things or people which are interconnected	5	noun
neutral	without bias or favoritism, or having no charge	6	adjective
nevertheless	despite this, nonetheless, notwithstanding	6	adverb
nonetheless	despite this, nevertheless, notwithstanding	10	adverb
normal	ordinary or usual	2	adjective
norms	accepted or usual standards or ways	9	noun
notion	idea, opinion or belief	5	noun
notwithstanding	despite this, nevertheless, nonetheless	10	adverb
nuclear	relating to a nucleus	8	adjective
objective	aim or purpose	5	noun
obtained	came into possession of	2	verb
obvious	easy to understand	4	adjective
occupational	relating to work	4	adjective
occur	to happen, often naturally or unexpectedly	1	verb
odd	unusual, not even, or irregular	10	adjective
offset	to counterbalance or <i>compensate</i> one thing for another	8	verb
ongoing	in progress or happening now	10	adjective
option	something available as a choice, or the right to choose	4	noun
orientation	direction or arrangement, aims, training or preparation	5	noun
outcomes	the end results or consequences of a particular event	3	noun
output	the end product, or the amount of something produced	4	noun
overall	in general, considering everything	4	adverb
overlap	<i>correspond</i> or coincide in part with something	9	verb
overseas	abroad, or to, from or in other countries	6	adverb

panel	a small group of people chosen to give their opinions	10	noun
paradigm	<i>conceptual framework</i> , or an example of something	7	noun
paragraph	group of sentences which discuss a single topic	8	noun
parallel	similar , or of equal distance apart along two lengths	4	adjective
parameters	the facts or rules which limit how something is done	4	noun
participation	the act of taking part or being involved in something	2	noun
partnership	a relationship <i>involving</i> close <i>cooperation</i>	3	noun
passive	accepting without resistance, or not active	9	adjective
perceived	saw, or generally recognized or believed to be true	2	verb
percent	in proportion to a hundred	1	noun
period	any length of time	1	noun
persistent	continuing for a long time, or refusing to give up	10	adjective
perspective	a way of looking at or considering something	5	noun
phase	a period of time, especially as part of a series	4	noun
phenomenon	something unusual or amazing which can be sensed	7	noun
philosophy	a system of beliefs that guide one's behavior	3	noun
physical	of the body, or having material existence	3	adjective
plus	and also, or more, added to	8	preposition
policy	an established practice or plan of what to do	1	noun
portion	part or share of a whole	9	noun
posed	asked formally, caused a problem, or stayed in position	10	verb
positive	certain about something	2	adjective
potential	the capacity to develop, succeed or achieve	2	noun
practitioners	people involved in an activity or job <i>requiring</i> skill	8	noun
preceding	coming before something or someone else	6	adjective
precise	exact or careful and accurate	5	adjective
predicted	said that something would happen in the future	4	verb
predominantly	mainly or mostly	8	adverb
preliminary	prior to or in preparation for the main activity or event	9	adjective
presumption	an <i>attitude</i> based on probability rather than proof	6	noun
previous	<i>occurring</i> or existing before something or someone else	2	adjective
primary	more important than anything else	2	adjective
prime	the main or most important, or the best quality	5	adjective
principal	the first, main, or most important	4	adjective
principle	a basic generalization that is accepted as true	1	noun
prior	coming before something else in time or importance	4	adjective
priority	something important that comes first or before others	7	noun
procedure	a course of action intended to achieve a result	1	noun
process	a series of actions taken to achieve a result	1	noun
professional	relating to or <i>conforming</i> to the standards of work	4	adjective
prohibited	prevented, or refused to allow	7	verb
project	work or a study of a subject over a period of time	4	noun
promote	to raise someone or something to a higher level	4	verb
proportion	the size of something when compared to the whole	3	noun
prospect	<i>anticipation</i> , or probability of a favorable <i>outcome</i>	8	noun
protocol	set of rules and <i>procedures</i>	9	noun
psychology	study of how the mind works and <i>affects</i> behavior	5	noun
publication	printed <i>item</i> such as a book, magazine or journal	7	noun
published	made known to the public through writing	3	verb
purchase	buy	2	verb

pursue	to follow, try to get, or try to discover information	5	verb
qualitative	relating to quality	9	adjective
quotation	what someone has said or written	7	noun
radical	fundamental or extreme	8	adjective
random	without pattern or plan	8	adjective
range	the upper and lower limits of something	2	noun
ratio	a comparison of two things expressed as a number	5	noun
rational	<i>logical</i> or based on reason	6	adjective
reaction	behavior or action as a result of a particular event	3	noun
recovery	return to normal , or getting back something lost	6	noun
refine	improve something through small changes	9	verb
regime	a particular government or controlling group or system	4	noun
region	a geographical or physical area	2	noun
registered	recorded and accepted by a group or organization	3	adjective
regulations	rules <i>issued</i> by an authority	2	noun
reinforced	gave support to something	8	verb
rejected	refused to accept, make use of, or give affection to	5	verb
relaxed	made rules or controls less severe	9	verb
release	to let go or let out	7	verb
relevant	correct or suitable for a particular purpose	2	adjective
reliance	the tendency to trust in someone or something	3	noun
reluctant	unwilling or hesitant	10	adjective
removed	took away	3	verb
required	needed or made necessary	1	verb
research	a detailed study of a subject	1	noun
resident	a person who lives at a particular place	2	noun
resolution	a course of action which is decided purposefully	4	noun
resources	money, valuable possessions, or natural materials	2	noun
response	an answer or reaction to a question or statement	1	noun
restore	to return to a previous condition or position	8	verb
restraints	limitations or controls of the freedom of something	9	noun
restricted	with limitations, or available only to a select few	2	adjective
retained	kept or continued to have	4	verb
revealed	showed or made known	6	verb
revenue	income that a company or government receives	5	noun
reverse	opposite or back	7	noun
revision	a change of the words of a text	8	noun
revolution	a sudden or important change in a situation	9	noun
rigid	stiff and fixed, or not able to be changed or persuaded	9	adjective
role	a function or part performed in a specific process	1	noun
route	way between places, or method of <i>achieving</i> something	9	noun
scenario	imagined event, or model of expected outcomes	9	noun
schedule	a plan of activities organized by time	8	noun
scheme	an organized plan, or an outline of a system or thing	3	noun
scope	range covered, or opportunity	6	noun
section	a <i>distinct</i> part of something	1	noun
sector	a geographic or economic area	1	noun
security	protection of a person, property or organization	2	noun
select	to choose, especially after careful consideration	2	verb
sequence	a series , or the order in which things are arranged	3	noun

series	a sequence of similar or related things	4	noun
sex	the state of being either female or male	3	noun
shift	a change in position, direction or conditions	3	noun
significant	noticeable, meaningful or important	1	adjective
similar	almost but not exactly the same	1	adjective
simulation	model of the essential features of a process or thing	7	noun
site	a place where something was, is, or will be	2	noun
so-called	commonly or falsely called	10	adjective
solely	only and exclusively	7	adverb
somewhat	slightly or rather	7	adverb
sought	simple past and past participle of <i>seek</i>	2	verb
source	the cause of something or place it comes from	1	noun
specific	relating to one thing and not others	1	adjective
specified	stated clearly or described <i>accurately</i>	3	verb
sphere	area of interest, knowledge or control	9	noun
stability	resistance to change, or <i>constancy</i> of character	5	noun
statistics	a branch of applied mathematics that <i>analyzes data</i>	4	noun
status	the relative position of someone or something	4	noun
straightforward	easy to understand, or honest and frank	10	adjective
strategies	detailed plans or <i>methods</i> for <i>achieving</i> success	2	noun
stress	to give emphasis or special attention to something	4	verb
structure	the way parts of a system or object are arranged	1	noun
styles	types, expressions, or ways of doing something	5	noun
submitted	presented for consideration, or gave in to	7	verb
subordinate	of less importance or lower status	9	adjective
subsequent	happening after something else	4	adjective
subsidiary	of lesser importance, business owned by parent company	6	adjective
substitution	the replacement of one thing by another	5	noun
successive	following in sequence and without a break	7	adjective
sufficient	as much as is needed for a particular purpose	3	adjective
sum	the total number or amount of things added together	4	noun
summary	a short description of the main points of something	4	noun
supplementary	extra, or supplying what is lacking	9	adjective
survey	a series of questions used to gather personal data	2	noun
survive	to continue to live or exist	7	verb
suspended	stopped something <i>temporarily</i> or permanently	9	verb
sustainable	able to be continued or <i>maintained</i>	5	adjective
symbolic	representing something else, or ineffective	5	adjective
tapes	recordings of sound or pictures	6	noun
target	aim, thing to be aimed at, or who something is for	5	noun
task	a piece of work that is either difficult or unpleasant	3	noun
team	organized group of people who work <i>cooperatively</i>	9	noun
technical	relating to specialized words of a specific subject	3	adjective
techniques	ways of doing an activity that <i>requires</i> skill	3	noun
technology	the study of practical uses of scientific discoveries	3	noun
temporary	for a limited period	9	adjective
tension	nervousness or uneasiness	8	noun
termination	end of something, or process of ending something	8	noun
text	the words printed on a page other than the headings	2	noun
theme	topic of speech or writing	8	noun

theory	an organized system of accepted knowledge	1	noun
thereby	as a result of this	8	adverb
thesis	long academic paper based on original research	7	thesis
topic	subject of a text or discussion	7	noun
trace	to find or discover by careful searching or research	6	verb
traditional	the usual ways or customs of a group of people	2	adjective
transfer	to move from one place to another	2	verb
transformation	a complete change or the process of change	6	noun
transition	a process or period in which something changes	5	noun
transmission	process of passing or sending something <i>invisible</i>	7	noun
transport	to carry from one place to another	6	verb
trend	fashion, or change in people's behavior or <i>attitude</i>	5	noun
trigger	cause, or set off an action or series of actions	9	verb
ultimately	<i>finally</i> and after much trouble or discussion	7	adverb
undergo	to experience or endure	10	verb
underlying	fundamental, implicit but not obvious, prior	6	adjective
undertaken	done or <i>committed</i> to do with responsibility or effort	4	verb
unified	brought together or combined as a whole	9	verb
uniform	always the same	8	adjective
unique	completely different from anything else	7	adjective
utility	usefulness, or public service such as gas or water	6	noun
validity	acceptance or meaningfulness based on reason	3	noun
variable	one among a group of things which may change	1	noun
vehicle	method , or any form of land transport	8	noun
version	specific variety, different from others or the original	5	noun
via	by way of, or by means of	8	preposition
violation	action that breaks the rules	9	noun
virtually	almost or practically	8	adverb
visible	able to be seen	7	adjective
vision	sight, mental image , or ability to <i>anticipate</i> the future	9	noun
visual	relating to <i>vision</i> or sight	8	adjective
volume	a book which is published <i>periodically</i> or as a series	3	noun
voluntary	done willingly and without external force	7	adjective
welfare	financial help to the poor, or health and happiness	5	noun
whereas	but, compared with the fact that	5	conjunction
whereby	by which or through which	10	adverb
widespread	existing or happening in many places	8	adjective

8.2 Academic Word List Family Words

The Academic Word List is a list of 570 headwords and their families that are found frequently in academic texts. For convenience, the list is divided into ten sublists arranged by frequency of occurrence in academic texts. Words within a sublist are arranged alphabetically. These words have been grouped into families; the headword is in *italics* in the column on the left, and its derivations are in the columns to the right. If you know the meaning of the headword, and have a little knowledge of English word suffixes, then you should be able to guess the meaning of most of the words in its family. Each word family has one word that is written in **bold**. This word is the one most commonly found in academic texts compared to others in the same family. Therefore, the most important words of each family are the words in *italic* and **bold**.

Sublist 1

1	<i>analyze</i>	analyses analytical analyzers	analysis analytically analyzes	analyst analyze analyzing	analysts analyzed	analytic analyzer
2	approach	approachable	approached	approaches	approaching	unapproachable
3	area	areas				
4	<i>assess</i>	assessable assessments unassessed	assessed reassess	assesses reassessed	assessing reassessing	assessment reassessment
5	assume	assumed	assumes	assuming	assumption	assumptions
6	authority	authoritative	authorities			
7	available	availability	unavailable			
8	benefit	beneficial benefits	beneficiary	beneficiaries	benefited	benefiting
9	concept	conception conceptualized	concepts conceptualizes	conceptual conceptualizing	conceptualization conceptually	conceptualize
10	<i>consist</i>	consisted consists	consistency inconsistencies	consistent inconsistency	consistently inconsistent	consisting
11	<i>constitute</i>	constituencies constitutes constitutions	constituency constituting constitutive	constituent constitution unconstitutional	constituents constitutional	constituted constitutionally
12	context	contexts	contextual	contextualize	contextualized	contextualizing
13	contract	contracted	contracting	contractor	contractors	contracts
14	create	created creative recreate	creates creatively recreated	creating creativity recreates	creation creator recreating	creations creators
15	data					
16	<i>define</i>	definable definitions undefined	defined redefine	defines redefined	defining redefines	definition redefining
17	<i>derive</i>	derivation derives	derivations deriving	derivative	derivatives	derived
18	<i>distribute</i>	distributed	distributing	distribution	distributional	distributions

		distributive	distributor	distributors	redistribute	redistributed
		redistributes	redistributing	redistribution		
19	<i>economy</i>	economic	economical	economically	economics	economies
		economist	economists	uneconomical		
20	environment	environmental	environmentalist	environmentalists	environmentally	environments
21	<i>establish</i>	disestablish	disestablished	disestablishes	disestablishing	disestablishment
		established	establishes	establishing	establishment	establishments
22	estimate	estimated	estimates	estimating	estimation	estimations
		over-estimate	overestimate	overestimated	overestimates	overestimating
		underestimate	underestimated	underestimates	underestimating	
23	<i>evident</i>	evidenced	evidence	evidential	evidently	
24	export	exported	exporter	exporters	exporting	exports
25	<i>factor</i>	factored	factoring	factors		
26	<i>finance</i>	financed	finances	financial	financially	financier
		financiers	financing			
27	formula	formulae	formulas	formulate	formulated	formulating
		formulation	formulations	reformulate	reformulated	reformulating
		reformulation	reformulations			
28	function	functional	functionally	functioned	functioning	functions
29	<i>identify</i>	identifiable	identification	identified	identifies	identifying
		identities	identity	unidentifiable		
30	income	incomes				
31	indicate	indicated	indicates	indicating	indication	indications
		indicative	indicator	indicators		
32	individual	individualized	individuality	individualism	individualist	individualists
		individualistic	individually	individuals		
33	<i>interpret</i>	interpretation	interpretations	interpretative	interpreted	interpreting
		interpretive	interprets	misinterpret	misinterpretation	misinterpretations
		misinterpreted	misinterpreting	misinterprets	reinterpret	reinterpreted
		reinterprets	reinterpreting	reinterpretation	reinterpretations	
34	<i>involve</i>	involved	involvement	involves	involving	uninvolved
35	<i>issue</i>	issued	issues	issuing		
36	labor	labor	labored	labors	labored	laboring
		labors				
37	legal	illegal	illegality	illegally	legality	legally
38	<i>legislate</i>	legislated	legislates	legislating	legislation	legislative
		legislator	legislators	legislature		
39	major	majorities	majority			
40	method	methodical	methodological	methodologies	methodology	methods
41	occur	occurred	occurrence	occurrences	occurring	occurs
		reoccur	reoccurred	reoccurring	reoccurs	
42	percent	percentage	percentages			
43	period	periodic	periodical	periodically	periodicals	periods
44	policy	policies				
45	principle	principled	principles	unprincipled		
46	<i>proceed</i>	procedural	procedure	procedures	proceeded	proceeding
		proceedings	proceeds			
47	process	processed	processes	processing		
48	<i>require</i>	required	requirement	requirements	requires	requiring
49	research	researched	researcher	researchers	researches	researching
50	<i>respond</i>	responded	respondent	respondents	responding	responds

		response	responses	responsive	responsiveness	unresponsive
51	role	roles				
52	section	sectioned	sectioning	sections		
53	sector	sectors				
54	significant	insignificant	insignificantly	significance	significantly	signified
		signifies	signify	signifying		
55	similar	dissimilar	similarities	similarity	similarly	
56	source	sourced	sources	sourcing		
57	specific	specifically	specification	specifications	specificity	specifics
58	structure	restructure	restructured	restructures	restructuring	structural
		structurally	structured	structures	structuring	unstructured
59	theory	theoretical	theoretically	theories	theorist	theorists
60	<i>vary</i>	invariable	invariably	variability	variable	variables
		variably	variance	variant	variants	variation
		variations	varied	varies	varying	

Sublist 2

61	achieve	achievable	achieved	achievement	achievements	achieves
		achieving				
62	<i>acquire</i>	acquired	acquires	acquiring	acquisition	acquisitions
63	<i>administrate</i>	administrates	administration	administrations	administrative	administratively
		administrator	administrators			
64	affect	affected	affecting	affective	affectively	affects
		unaffected				
65	appropriate	appropriately	appropriateness	inappropriacy	inappropriate	inappropriately
66	<i>aspect</i>	aspects				
67	<i>assist</i>	assistance	assistant	assistants	assisted	assisting
		assists	unassisted			
68	<i>category</i>	categories	categorization	categorize	categorized	categorizes
		categorizing				
69	chapter	chapters				
70	commission	commissioned	commissioner	commissioners	commissioning	commissions
71	community	communities				
73	complex	complexities	complexity			
73	<i>compute</i>	computation	computational	computations	computable	computer
		computed	computerized	computers	computing	
74	<i>conclude</i>	concluded	concludes	concluding	conclusion	conclusions
		conclusive	conclusively	inconclusive	inconclusively	
75	conduct	conducted	conducting	conducts		
76	<i>consequent</i>	consequence	consequences	consequently		
77	<i>construct</i>	constructed	constructing	construction	constructions	constructive
		constructs	reconstruct	reconstructed	reconstructing	reconstruction
		reconstructs				
78	<i>consume</i>	consumed	consumer	consumers	consumes	consuming
		consumption				
79	credit	credited	crediting	creditor	creditors	credits
80	<i>culture</i>	cultural	culturally	cultured	cultures	uncultured
81	design	designed	designer	designers	designing	designs
82	<i>distinct</i>	distinction	distinctions	distinctive	distinctively	distinctly
		indistinct	indistinctly			
83	<i>element</i>	elements				

84	<i>equate</i>	equated	equates	equating	equation	equations
85	<i>evaluate</i>	evaluated evaluative reevaluation	evaluates reevaluate	evaluating reevaluated	evaluation reevaluates	evaluations reevaluating
86	<i>feature</i>	featured	features	featuring		
87	final	finality finally	finalize finals	finalized	finalizes	finalizing
88	focus	focused refocus refocuses	focuses refocused refocusing	focusing refocuses	focused refocusing	focusing refocused
89	impact	impacted	impacting	impacts		
90	<i>injure</i>	injured uninjured	injures	injuries	injuring	injury
91	institute	instituted institutionalize institutions	institutes institutionalized	instituting institutionalizes	institution institutionalizing	institutional institutionally
92	<i>invest</i>	invested investors reinvestment	investing invests reinvests	investment reinvest	investments reinvested	investor reinvesting
93	<i>item</i>	itemization items	itemize	itemized	itemizes	itemizing
94	journal	journals				
95	<i>maintain</i>	maintained	maintaining	maintains	maintenance	
96	normal	abnormal normalized	abnormally normalizes	normality normalizing	normalization normally	normalize
97	<i>obtain</i>	obtainable	obtained	obtaining	obtains	unobtainable
98	<i>participate</i>	participant participation	participants participatory	participated	participates	participating
99	<i>perceive</i>	perceived	perceives	perceiving	perception	perceptions
100	positive	positively				
101	potential	potentially				
102	previous	previously				
103	primary	primarily				
104	purchase	purchased	purchaser	purchasers	purchases	purchasing
105	range	ranged	ranges	ranging		
106	region	regional	regionally	regions		
107	<i>regulate</i>	deregulated regulates regulators	deregulates regulating regulatory	deregulating regulation unregulated	deregulation regulations	regulated regulator
108	relevant	irrelevance	irrelevant	relevance		
109	<i>reside</i>	resided resides	residence residing	resident	residential	residents
110	<i>resource</i>	resourced under-resourced	resourceful	resources	resourcing	unresourceful
111	<i>restrict</i>	restricted restrictively	restricting restricts	restriction unrestricted	restrictions unrestrictive	restrictive
112	<i>secure</i>	insecure secures	insecurities securing	insecurity securities	secured security	securely
113	<i>seek</i>	seeking	seeks	sought		
114	select	selected selectively	selecting selector	selection selectors	selections selects	selective

115	site	sites				
116	<i>strategy</i>	strategic	strategies	strategically	strategist	strategists
117	survey	surveyed	surveying	surveys		
118	text	texts	textual			
119	<i>tradition</i>	non-traditional	traditional	traditionalist	traditionally	traditions
120	transfer	transferable	transference	transferred	transferring	transfers

Sublist 3

121	alternative	alternatively	alternatives			
122	<i>circumstance</i>	circumstances				
123	<i>comment</i>	commentaries	commentary	commentator	commentators	commented
		commenting	comments			
124	<i>compensate</i>	compensated	compensates	compensating	compensation	compensations
		compensatory				
125	<i>component</i>	components				
126	consent	consensus	consented	consenting	consents	
127	considerable	considerably				
128	constant	constancy	constantly	constants	inconstancy	inconstantly
129	<i>constrain</i>	constrained	constraining	constrains	constraint	constraints
		unconstrained				
130	<i>contribute</i>	contributed	contributes	contributing	contribution	contributions
		contributor	contributors			
131	<i>convene</i>	convention	convenes	convened	convening	conventional
		conventionally	conventions	unconventional		
132	<i>coordinate</i>	coordinated	coordinates	coordinating	coordination	coordinator
		coordinators				
133	core	cores	coring	cored		
134	corporate	corporate	corporation	corporations		
135	<i>correspond</i>	corresponded	correspondence	corresponding	correspondingly	corresponds
136	criteria	criterion				
137	<i>deduce</i>	deduced	deduces	deducing	deduction	deductions
138	demonstrate	demonstrable	demonstrably	demonstrated	demonstrates	demonstrating
		demonstration	demonstrations	demonstrative	demonstratively	demonstrator
		demonstrators				
139	document	documentation	documented	documenting	documents	
140	<i>dominate</i>	dominance	dominant	dominated	dominates	dominating
		domination				
141	emphasis	emphasize	emphasized	emphasizes	emphasizing	emphatic
		emphatically				
142	ensure	ensured	ensures	ensuring		
143	<i>exclude</i>	excluded	excludes	excluding	exclusion	exclusionary
		exclusionist	exclusions	exclusive	exclusively	
144	framework	frameworks				
145	<i>fund</i>	funded	funder	funders	funding	funds
146	<i>illustrate</i>	illustrated	illustrates	illustrating	illustration	illustrations
		illustrative				
147	<i>immigrate</i>	immigrant	immigrants	immigrated	immigrates	immigrating
		immigration				
148	<i>imply</i>	implied	implies	implying		
149	initial	initially				
150	instance	instances				

151	<i>interact</i>	interacted interactively	interacting interacts	interaction	interactions	interactive
152	<i>justify</i>	justifiable justifies	justifiably justifying	justification unjustified	justifications	justified
153	layer	layered	layering	layers		
154	link	linkage	linkages	linked	linking	links
155	<i>locate</i>	located relocated	locating relocates	location relocating	locations relocation	relocate
156	<i>maximize</i>	max maximizing	maximization maximum	maximize	maximized	maximizes
157	<i>minor</i>	minorities	minority	minors		
158	<i>negate</i>	negative negatives	negated	negates	negating	negatively
159	<i>outcome</i>	outcomes				
160	<i>partner</i>	partners	partnership	partnerships		
161	philosophy	philosopher philosophize	philosophers philosophized	philosophical philosophizes	philosophically philosophizing	philosophies
162	physical	physically				
163	proportion	disproportion proportionate	disproportionate proportionately	disproportionately proportions	proportional	proportionally
164	<i>publish</i>	published unpublished	publisher	publishers	publishes	publishing
165	<i>react</i>	reacted reactionary reactor	reacts reactions reactors	reacting reactive	reaction reactivate	reactionaries reactivation
166	<i>register</i>	deregister registered	deregistered registering	deregistering registers	deregisters registration	deregistration
167	<i>rely</i>	reliability relied	reliable relies	reliably relying	reliance unreliable	reliant
168	<i>remove</i>	removable removing	removal	removals	removed	removes
169	scheme	schematic	schematically	schemed	schemes	scheming
170	sequence	sequenced	sequences	sequencing	sequential	sequentially
171	sex	sexes	sexism	sexual	sexuality	sexually
172	shift	shifted	shifting	shifts		
173	<i>specify</i>	specifiable	specified	specifies	specifying	unspecified
174	sufficient	sufficiency	insufficient	insufficiently	sufficiently	
175	task	tasks				
176	technical	technically				
177	<i>technique</i>	techniques				
178	technology	technological	technologically			
179	<i>valid</i>	invalidate validation	invalidity validity	validate validly	validated	validating
180	volume	vol	volumes			

Sublist 4

181	access	accessed inaccessible	accesses	accessibility	accessible	accessing
182	adequate	adequacy inadequately	adequately	inadequacies	inadequacy	inadequate
183	annual	annually				

184	apparent	apparently				
185	<i>approximate</i>	approximated approximations	approximately	approximates	approximating	approximation
186	<i>attitude</i>	attitudes				
187	<i>attribute</i>	attributable	attributed	attributes	attributing	attribution
188	civil					
189	code	coded	codes	coding		
190	<i>commit</i>	commitment	commitments	commits	committed	committing
191	<i>communicate</i>	communicable communications	communicated communicative	communicates communicatively	communicating uncommunicative	communication
192	<i>concentrate</i>	concentrated	concentrates	concentrating	concentration	
193	<i>confer</i>	conference	conferences	conferred	conferring	confers
194	contrast	contrasted	contrasting	contrastive	contrasts	
195	cycle	cycled	cycles	cyclic	cyclical	cyclling
196	debate	debatable	debated	debates	debating	
197	despite					
198	<i>dimension</i>	dimensional	dimensions	multidimensional		
199	domestic	domestically	domesticate	domesticated	domesticating	domestics
200	<i>emerge</i>	emerged	emergence	emergent	emerges	emerging
201	error	erroneous	erroneously	errors		
202	ethnic	ethnicity				
203	<i>goal</i>	goals				
204	<i>grant</i>	granted	granting	grants		
205	hence					
206	hypothesis	hypotheses hypothetical	hypothesize hypothetically	hypothesized	hypothesizes	hypothesizing
207	<i>implement</i>	implementation	implemented	implementing	implements	
208	<i>implicate</i>	implicated	implicates	implicating	implication	implications
209	<i>impose</i>	imposed	imposes	imposing	imposition	
210	<i>integrate</i>	integrated	integrates	integrating	integration	
211	internal	internalize	internalized	internalizes	internalizing	internally
212	<i>investigate</i>	investigated investigative	investigates investigator	investigating investigators	investigation	investigations
213	job	jobs				
214	label	labeled	labeling	labeled	labeling	labels
215	mechanism	mechanisms				
216	obvious	obviously				
217	<i>occupy</i>	occupancy occupations occupying	occupant occupied	occupants occupier	occupation occupiers	occupational occupies
218	option	optional	options			
219	output	outputs				
220	overall					
221	parallel	paralleled	paralleling	parallels	unparalleled	
222	<i>parameter</i>	parameters				
223	phase	phased	phases	phasing		
224	<i>predict</i>	predictability prediction	predictable predictions	predictably predicts	predicted unpredictability	predicting unpredictable
225	principal	principally				
226	prior					
227	professional	professionally	professionals	professionalism		

228	project	projected	projecting	projection	projections	projects
229	promote	promoted	promoter	promoters	promotes	promoting
		promotion	promotions			
230	regime	regimes				
231	<i>resolve</i>	resolution	resolved	resolves	resolving	unresolved
232	<i>retain</i>	retained	retaining	retainer	retainers	retains
		retention	retentive			
233	series					
234	<i>statistic</i>	statistician	statisticians	statistical	statistically	statistics
235	status					
236	stress	stressed	stresses	stressful	stressing	unstressed
237	subsequent	subsequently				
238	sum	summation	summed	summing	sums	
239	summary	summaries	summarization	summarizations	summarize	summarized
		summarizes	summarizing			
240	<i>undertake</i>	undertaken	undertakes	undertaking	undertook	

Sublist 5

241	<i>academy</i>	academia	academic	academically	academics	academies
242	<i>adjust</i>	adjusted	adjusting	adjustment	adjustments	adjusts
		readjust	readjusted	readjusting	readjustment	readjustments
		readjusts				
243	alter	alterable	alteration	alterations	altered	altering
		alternate	alternating	alters	unalterable	unaltered
244	<i>amend</i>	amended	amending	amendment	amendments	amends
245	aware	awareness	unaware			
246	capacity	capacities	incapacitate	incapacitated		
247	challenge	challenged	challenger	challengers	challenges	challenging
248	clause	clauses				
249	<i>compound</i>	compounded	compounding	compounds		
250	conflict	conflicted	conflicting	conflicts		
251	<i>consult</i>	consultancy	consultant	consultants	consultation	consultations
		consultative	consulted	consults	consulting	
252	contact	contactable	contacted	contacting	contacts	
253	decline	declined	declines	declining		
254	<i>discrete</i>	discretely	discretion	discretionary	indiscrete	indiscretion
255	<i>draft</i>	drafted	drafting	drafts	redraft	redrafted
		redrafting	redrafts			
256	enable	enabled	enables	enabling		
257	energy	energetic	energetically	energies		
258	<i>enforce</i>	enforced	enforcement	enforces	enforcing	
259	<i>entity</i>	entities				
260	equivalent	equivalence				
261	<i>evolve</i>	evolution	evolved	evolving	evolves	evolutionary
		evolutionist	evolutionists			
262	<i>expand</i>	expanded	expanding	expands	expansion	expansionism
		expansive				
263	<i>expose</i>	exposed	exposes	exposing	exposure	exposures
264	external	externality	externalization	externalize	externalized	externalizes
		externalizing	externally			
265	facilitate	facilitated	facilitates	facilities	facilitating	facilitation

		facilitator	facilitators	facility		
266	fundamental	fundamentally				
267	<i>generate</i>	generated	generates	generating		
268	generation	generations				
269	image	imagery	images			
279	liberal	liberalism	liberalization	liberalize	liberalized	liberalizes
		liberalizing	liberally	liberals	liberate	liberated
		liberates	liberating	liberation	liberations	liberator
		liberators				
271	license	licenses	license	licensed	licensing	licenses
		unlicensed				
272	logic	illogical	illogically	logical	logically	logician
		logicians				
273	<i>margin</i>	marginal	marginally	margins		
274	medical	medically				
275	mental	mentality	mentally			
276	<i>modify</i>	modification	modifications	modified	modifies	modifying
		unmodified				
277	<i>monitor</i>	monitored	monitoring	monitors	unmonitored	
278	network	networked	networking	networks		
279	notion	notions				
280	objective	objectively	objectivity			
281	<i>orient</i>	orientate	orientated	orientates	orientation	orientating
		oriented	orienting	orients	reorient	reorientation
282	perspective	perspectives				
283	precise	imprecise	precisely	precision		
284	prime	primacy				
285	psychology	psychological	psychologically	psychologist	psychologists	
286	pursue	pursued	pursues	pursuing	pursuit	pursuits
287	ratio	ratios				
288	<i>reject</i>	rejected	rejecting	rejection	rejects	rejections
289	revenue	revenues				
290	<i>stable</i>	instability	stability	stabilization	stabilize	stabilized
		stabilizes	stabilizing	unstable		
291	<i>style</i>	styled	styles	styling	stylish	stylize
		stylized	stylizes	stylizing		
292	<i>substitute</i>	substituted	substitutes	substituting	substitution	
293	<i>sustain</i>	sustainable	sustainability	sustained	sustaining	sustains
		sustenance	unsustainable			
294	<i>symbol</i>	symbolic	symbolically	symbolism	symbolize	symbolized
		symbolizes	symbolizing	symbols		
295	target	targeted	targeting	targets		
296	<i>transit</i>	transited	transiting	transition	transitional	transitions
		transitory	transits			
297	trend	trends				
298	version	versions				
299	welfare					
300	whereas					

Sublist 6

301	abstract	abstraction	abstractions	abstractly	abstracts
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302	accurate	accuracy	accurately	inaccuracy	inaccuracies	inaccurate
303	<i>acknowledge</i>	acknowledged	acknowledges	acknowledging	acknowledgement	acknowledgements
304	aggregate	aggregated	aggregates	aggregating	aggregation	
305	<i>allocate</i>	allocated	allocates	allocating	allocation	allocations
306	<i>assign</i>	assigned	assigning	assignment	assignments	assigns
		reassign	reassigned	reassigning	reassigns	unassigned
307	<i>attach</i>	attached	attaches	attaching	attachment	attachments
		unattached				
308	author	authored	authoring	authors	authorship	
309	bond	bonded	bonding	bonds		
310	brief	brevity	briefed	briefing	briefly	briefs
311	capable	capabilities	capability	incapable		
312	<i>cite</i>	citation	citations	cited	citing	cites
313	<i>cooperate</i>	cooperated	cooperates	cooperating	cooperation	cooperative
		cooperatively				
314	<i>discriminate</i>	discriminated	discriminates	discriminating	discrimination	
315	display	displayed	displaying	displays		
316	<i>diverse</i>	diversely	diversification	diversified	diversifies	diversify
		diversifying	diversity			
317	domain	domains				
318	<i>edit</i>	edited	editing	edition	editions	editor
		editorial	editorials	editors	edits	
319	<i>enhance</i>	enhanced	enhancement	enhances	enhancing	
320	estate	estates				
321	exceed	exceeded	exceeding	exceeds		
322	expert	expertise	expertly	experts		
323	explicit	explicitly				
324	federal	federation	federations			
325	<i>fee</i>	fees				
326	<i>flexible</i>	flexibility	inflexible	inflexibility		
327	furthermore					
328	gender	genders				
329	<i>ignorant</i>	ignorance	ignore	ignored	ignores	ignoring
330	incentive	incentives				
331	incidence	incident	incidentally	incidents		
332	<i>incorporate</i>	incorporated	incorporates	incorporating	incorporation	
333	index	indexed	indexes	indexing		
334	<i>inhibit</i>	inhibited	inhibiting	inhibition	inhibitions	inhibits
335	<i>initiate</i>	initiated	initiates	initiating	initiation	initiations
		initiative	initiatives	initiator	initiators	
336	input	inputs				
337	<i>instruct</i>	instruction	instructed	instructing	instructions	instructive
		instructor	instructors	instructs		
338	<i>intelligent</i>	intelligence	intelligently	unintelligent		
339	interval	intervals				
340	lecture	lectured	lecturer	lecturers	lectures	lecturing
341	<i>migrate</i>	migrant	migrants	migrated	migrates	migrating
		migration	migrations	migratory		
342	minimum					
343	ministry	ministered	ministering	ministerial	ministries	
344	<i>motive</i>	motivate	motivated	motivates	motivating	motivation

345	neutral	motivations neutrality neutralizing	motives neutralization	unmotivated neutralize	neutralized	neutralizes
346	nevertheless					
347	overseas					
348	<i>precede</i>	preceded unprecedented	precedence	precedent	precedes	preceding
349	<i>presume</i>	presumably presumptions	presumed presumptuous	presumes	presuming	presumption
350	rational	irrational rationalize	rationalism rationalized	rationality rationalizes	rationalization rationalizing	rationalizations rationally
351	<i>recover</i>	recoverable	recovered	recovering	recovers	recovery
352	<i>reveal</i>	revealed	revealing	reveals	revelation	revelations
353	scope					
354	<i>subsidy</i>	subsidiary subsidizing	subsidies	subsidize	subsidized	subsidizes
355	<i>tape</i>	taped	tapes	taping		
356	trace	traceable	traced	traces	tracing	
357	<i>transform</i>	transformation	transformations	transformed	transforming	transforms
358	transport	transportation transports	transported	transporter	transporters	transporting
359	<i>underlie</i>	underlay	underlies	underlying		
360	<i>utilize</i>	utilities utilizes	utility utilizing	utilization	utilize	utilized

Sublist 7

361	<i>adapt</i>	adaptability adapting	adaptable adaptive	adaptation adapts	adaptations	adapted
362	<i>adult</i>	adulthood	adults			
363	advocate	advocacy	advocated	advocates	advocating	
364	aid	aided	aiding	aids	unaided	
365	channel	channeled	channeling	channels		
366	chemical	chemically	chemicals			
367	<i>classic</i>	classical	classics			
368	comprehensive	comprehensively				
369	comprise	comprised	comprises	comprising		
370	<i>confirm</i>	confirmation	confirmed	confirming	confirms	
371	contrary	contrarily				
372	<i>convert</i>	conversion converts	conversions	converted	convertible	converting
373	couple	coupled	coupling	couples		
374	<i>decade</i>	decades				
375	definite	definitely	definitive	indefinite	indefinitely	
376	deny	deniable denying	denial undeniable	denials	denied	denies
377	<i>differentiate</i>	differentiated	differentiates	differentiating	differentiation	
378	<i>dispose</i>	disposable	disposal	disposed	disposes	disposing
379	dynamic	dynamically	dynamics			
380	eliminate	eliminated	eliminates	eliminating	elimination	
381	empirical	empirically	empiricism			
382	<i>equip</i>	equipment	equipped	equipping	equips	

383	extract	extracted	extracting	extraction	extracts	
384	file	filed	files	filing		
385	finite	infinite	infinitely			
386	foundation	foundations				
387	<i>globe</i>	global	globally	globalization	globalization	
388	grade	graded	grades	grading		
389	guarantee	guaranteed	guaranteeing			
390	<i>hierarchy</i>	hierarchical	hierarchies			
391	identical	identically				
392	ideology	ideological	ideologically	ideologies		
393	<i>infer</i>	inference	inferences	inferred	inferring	infers
394	<i>innovate</i>	innovation	innovated	innovates	innovating	innovations
		innovative	innovator	innovators		
395	insert	inserted	inserting	insertion	inserts	
396	<i>intervene</i>	intervened	intervenes	intervening	intervention	interventions
397	<i>isolate</i>	isolated	isolates	isolating	isolation	isolationism
398	media					
399	mode	modes				
400	paradigm	paradigms				
401	phenomenon	phenomena	phenomenal			
402	priority	priorities	prioritization	prioritize	prioritized	prioritizes
		prioritizing				
403	<i>prohibit</i>	prohibited	prohibiting	prohibition	prohibitions	prohibitive
		prohibits				
404	publication	publications				
405	<i>quote</i>	quotation	quotations	quoted	quotes	quoting
406	release	released	releases	releasing		
407	reverse	reversal	reversed	reverses	reversible	reversing
		reversals	irreversible			
408	<i>simulate</i>	simulated	simulates	simulating	simulation	
409	<i>sole</i>	solely				
410	somewhat					
411	<i>submit</i>	submission	submissions	submits	submitted	submitting
412	<i>successor</i>	succession	successions	successive	successively	successors
413	survive	survival	survived	survives	surviving	survivor
		survivors				
414	thesis	theses				
415	topic	topical	topics			
416	<i>transmit</i>	transmission	transmissions	transmitted	transmitting	transmits
417	<i>ultimate</i>	ultimately				
418	unique	uniquely	uniqueness			
419	visible	visibility	visibly	invisible	invisibility	
420	voluntary	voluntarily	volunteer	volunteering	volunteered	volunteers

Sublist 8

421	abandon	abandoned	abandoning	abandonment	abandons	
422	<i>accompany</i>	accompanied	accompanies	accompaniment	accompanying	unaccompanied
423	<i>accumulate</i>	accumulated	accumulating	accumulation	accumulates	
424	ambiguous	ambiguities	ambiguity	unambiguous	unambiguously	
425	<i>append</i>	appendix	appended	appends	appending	appendices
		appendixes				

426	<i>appreciate</i>	appreciable appreciation	appreciably unappreciated	appreciated	appreciates	appreciating
427	arbitrary	arbitrariness	arbitrarily			
428	<i>automate</i>	automatic automation	automated	automates	automating	automatically
429	bias	biased	biases	biasing	unbiased	
430	chart	charted	charting	charts	uncharted	
431	<i>clarify</i>	clarification	clarified	clarifies	clarifying	clarity
432	commodity	commodities				
433	complement	complementary	complemented	complementing	complements	
434	<i>conform</i>	conformability conforming nonconformist	conformable conformist nonconformists	conformance conformists nonconformity	conformation conformity	conformed conforms
435	contemporary	contemporaries				
436	<i>contradict</i>	contradicted contradicts	contradicting	contradiction	contradictions	contradictory
437	crucial	crucially				
438	currency	currencies				
439	denote	denotation	denotations	denoted	denotes	denoting
440	<i>detect</i>	detectable detectives	detected detector	detecting detectors	detection detects	detective
441	<i>deviate</i>	deviated	deviates	deviating	deviation	deviations
442	<i>displace</i>	displaced	displacement	displaces	displacing	
443	<i>drama</i>	dramas dramatization dramatizing	dramatic dramatizations	dramatically dramatize	dramatist dramatized	dramatists dramatizes
444	<i>eventual</i>	eventuality	eventually			
445	exhibit	exhibited	exhibiting	exhibition	exhibitions	exhibits
446	<i>exploit</i>	exploitation	exploited	exploiting	exploits	
447	<i>fluctuate</i>	fluctuated	fluctuates	fluctuating	fluctuation	fluctuations
448	<i>guideline</i>	guidelines				
449	<i>highlight</i>	highlighted	highlighting	highlights		
450	implicit	implicitly				
451	<i>induce</i>	induced	induces	inducing	induction	
452	<i>inevitable</i>	inevitability	inevitably			
453	infrastructure	infrastructures				
454	<i>inspect</i>	inspected inspectors	inspecting inspects	inspection	inspections	inspector
455	<i>intense</i>	intensely intensify intensively	intenseness intensifying	intensification intension	intensified intensity	intensifies intensive
456	<i>manipulate</i>	manipulated manipulative	manipulates	manipulating	manipulation	manipulations
457	<i>minimize</i>	minimized	minimizes	minimizing		
458	nuclear					
459	offset	offsets	offsetting			
460	paragraph	paragraphing	paragraphs			
461	plus	pluses				
462	<i>practitioner</i>	practitioners				
463	<i>predominant</i>	predominance predominating	predominantly	predominate	predominated	predominates

464	prospect	prospective	prospects			
465	radical	radically	radicals			
466	random	randomly	randomness			
467	<i>reinforce</i>	reinforced	reinforcement	reinforcements	reinforces	reinforcing
468	restore	restoration	restored	restores	restoring	
469	<i>revise</i>	revised	revises	revising	revision	revisions
470	schedule	reschedule	rescheduled	reschedules	rescheduling	scheduled
		schedules	scheduling	unscheduled		
471	<i>tense</i>	tension	tensely	tenser	tensest	tensions
472	<i>terminate</i>	terminal	terminals	terminated	terminates	terminating
		termination	terminations			
473	theme	themes	thematic	thematically		
474	thereby					
475	uniform	uniformity	uniformly			
476	vehicle	vehicles				
477	via					
478	<i>virtual</i>	virtually				
479	visual	visualization	visualize	visualized	visualizing	visually
480	widespread					

Sublist 9

481	<i>accommodate</i>	accommodated	accommodates	accommodating	accommodation	
482	<i>analogy</i>	analogies	analogous			
483	<i>anticipate</i>	anticipated	anticipates	anticipating	anticipation	unanticipated
484	<i>assure</i>	assurance	assurances	assured	assuredly	assures
		assuring				
485	<i>attain</i>	attainable	attained	attaining	attainment	attainments
		attains	unattainable			
486	behalf					
487	bulk	bulky				
488	<i>cease</i>	ceased	ceaseless	ceases	ceasing	
489	<i>coherent</i>	coherence	coherently	incoherent	incoherently	
490	coincide	coincided	coincides	coinciding	coincidence	coincidences
		coincident	coincidental			
491	<i>commence</i>	commenced	commences	commencement	commencing	recommences
		recommended	recommencing			
492	<i>compatible</i>	compatibility	incompatibility	incompatible		
493	concurrent	concurrently				
494	<i>confine</i>	confined	confines	confining	unconfined	
495	controversy	controversies	controversial	controversially	uncontroversial	
496	<i>converse</i>	conversely				
497	device	devices				
498	<i>devote</i>	devoted	devotedly	devotes	devoting	devotion
		devotions				
499	<i>diminish</i>	diminished	diminishes	diminishing	diminution	undiminished
500	<i>distort</i>	distorted	distorting	distortion	distortions	distorts
501	duration					
502	<i>erode</i>	eroded	erodes	eroding	erosion	
503	<i>ethic</i>	ethical	ethically	ethics	unethical	
504	format	formatted	formatting	formats		
505	<i>found</i>	founded	founder	founders	founding	unfounded

506	inherent	inherently				
507	<i>insight</i>	insightful	insights			
508	integral					
509	intermediate					
510	manual	manually	manuals			
511	mature	immature matures	immaturity maturing	maturation maturity	maturational	matured
512	<i>mediate</i>	mediated	mediates	mediating	mediation	
513	medium					
514	military					
515	minimal	minimalist	minimalistic	minimalists	minimally	
516	mutual	mutually				
517	<i>norm</i>	norms				
518	overlap	overlapped	overlapping	overlaps		
519	passive	passively	passivity			
520	portion	portions				
521	preliminary	preliminaries				
522	protocol	protocols				
523	qualitative	qualitatively				
524	refine	refined	refinement	refinements	refines	refining
525	<i>relax</i>	relaxation	relaxed	relaxes	relaxing	
526	<i>restrain</i>	restrained unrestrained	restraining	restrains	restraint	restraints
527	revolution	revolutionaries revolutionized	revolutionary revolutionizing	revolutionist revolutions	revolutionists	revolutionize
528	rigid	rigidities	rigidity	rigidly		
529	route	routed	routes	routing		
530	scenario	scenarios				
531	sphere	spheres	spherical	spherically		
532	subordinate	subordinates	subordination			
533	<i>supplement</i>	supplementary	supplemented	supplementing	supplements	
534	<i>suspend</i>	suspended	suspending	suspends	suspension	
535	team	teamed	teaming	teams		
536	temporary	temporarily				
537	trigger	triggered	triggering	triggers		
538	<i>unify</i>	unification	unified	unifies	unifying	
539	<i>violate</i>	violated	violates	violating	violation	violations
540	vision	visions				

Sublist 10

541	adjacent					
542	albeit					
543	<i>assemble</i>	assembled	assembles	assemblies	assembling	assembly
544	collapse	collapsed	collapses	collapsible	collapsing	
545	<i>colleague</i>	colleagues				
546	<i>compile</i>	compilation	compilations	compiled	compiles	compiling
547	<i>conceive</i>	conceivable inconceivable	conceivably inconceivably	conceived	conceives	conceiving
548	<i>convince</i>	convinced	convinces	convincing	convincingly	unconvinced
549	<i>depress</i>	depressed	depresses	depressing	depression	
550	<i>encounter</i>	encountered	encountering	encounters		

551	enormous	enormity	enormously			
552	forthcoming					
553	<i>incline</i>	inclination	inclinations	inclined	inclines	inclining
554	integrity					
555	intrinsic	intrinsically				
556	<i>invoke</i>	invoked	invokes	invoking		
557	levy	levies				
558	likewise					
559	nonetheless					
560	notwithstanding					
561	odd	odds				
562	ongoing					
563	panel	paneled	paneling	panels		
564	<i>persist</i>	persisted persists	persistence	persistent	persistently	persisting
565	<i>pose</i>	posed	poses	posing		
566	<i>reluctance</i>	reluctant	reluctantly			
567	so-called					
568	straightforward					
569	undergo	undergoes	undergoing	undergone	underwent	
570	whereby					

8.3 Logical Connectors

(The words in **bold** are also on the Academic Word List).

		Coordinating and Correlating Conjunctions	Subordinating Conjunctions
1	Addition	and, and also, nor, not only ... but also, neither ... nor, both ... and	besides, in addition to, not to mention
2	Alternative	and, or, either ... or ...	
3	Cause		as, as long as, because, due to the fact that, for, in that, in view of the fact that, inasmuch as, now that, since
4	Clarification	(comma), (dash), (parentheses), (semicolon),	
5	Comparison		as, as ... as, the same ... as
6	Condition	either ... or ..., or, or else	as long as, even if, if, if ... then ..., in case, provided that, unless, whether, whether or not
7	Contrast	but, or, yet	...er / more / less ... than, albeit , although, despite the fact that, even though, in spite of the fact that, regardless of, though, whereas , while
8	Effect	and as a result, so, or, or else	
9	Emphasis		
10	Example	(colon), (dash)	
11	Purpose		in order that, in order to, so that, such that
12	Sequence	(see time)	(see time)
13	Summary		
14	Time	and, and then	after, as, as long as, as soon as, at the time, before, by the time (that), during, every time (that), now that, once, prior to, since, so long as, until, up to the time (that), when, whenever, while

8.3 Logical Connectors

(The words in **bold** are also on the Academic Word List).

		Sentence Conjunctions	Prepositions
1	Addition	above all, actually, also, as a matter of fact, as well, besides, certainly, furthermore , in addition, in fact, moreover, what is more	along with, besides, in addition to
2	Alternative	alternatively	
3	Cause		as a result of, because of, due to, for, in view of, on account of
4	Clarification	I mean, in other words, that is, i.e.,	
5	Comparison	in the same way, likewise , similarly	like
6	Condition	otherwise	in case of, regardless of
7	Contrast	admittedly, after all, alternatively, conversely , even so, however, in contrast , in spite of this, instead, nevertheless , nonetheless , notwithstanding , on the contrary , on the other hand, regardless, still, though	contrary to , despite , different from, different to, in contrast to , in spite of, instead of, regardless of, unlike
8	Effect	accordingly, as a result, consequently , hence , therefore, thus	
9	Emphasis	above all, certainly, in fact, indeed, more than anything else, most of all, of course,	
10	Example	as an example, e.g., especially, for example, for instance, in particular, the point is, to illustrate	like, such as
11	Purpose	for this purpose, with this in mind	as, for
12	Sequence	finally, first, first of all, in the first place, in the second place, in turn, lastly, next, secondly, then, to begin with, to start with	(see time)
13	Summary	all in all, as has been mentioned, as has been said, briefly, in short, in conclusion , in summary , overall , to conclude , to summarize	
14	Time	at first, after that, at last, at present, eventually , finally, first, first of all, in the end, in the first place, in the second place, in turn, initially , last, lastly, later, meanwhile, next, now, once, originally, secondly, since then, soon, so far, subsequently , then, to begin with, to conclude, to start with, ultimately	after, as of, before, by, during, for, from, prior to , since, until, up to, within

8.4 Signal Words

Here is a list of signal words that will help you to identify the pattern of text organization: (Words in bold are Academic Word List words).

1) *Definition*

is called	is characterized by	is concerned with	concerns
is defined as	denotes	describes	indicates
involves	is	is known as	means
refers to	stands for	term	

2) *Classification or Enumeration*

1 (one)	2 (two)	3 (three)	also
another	categories	categorize	classes
consists of	constitutes	distinct	divided into
element(s)	factor(s)	finally	first
includes	kind(s)	lastly	many
most	number	other(s)	second
several	some	third	type(s)

3) *Comparison*

alike	also	as ... as	both
common	comparable	equally	equivalent
identical	in the same way	like	likewise
parallel	resembles	same	similar
similarities	similarity	similarly	

Contrast

...er	admittedly	after all	albeit
alternatively	although	but	contradict
contrary	contrast	conversely	despite
difference	different	differentiate	differs from
discriminate	distinction	distinguish	even so
even though	however	in spite of	instead
less	more	nevertheless	nonetheless
notwithstanding	on the other hand	opposed to	rather than
regardless	still	though	unlike
whereas	while	yet	

8.4 Signal Words

Here is a list of signal words that will help you to identify the pattern of text organization: (Words in bold are Academic Word List words).

4) *Time Order or Sequence*

after	at <i>time</i>	before	begin
by	conclude	during	(in the) end
eventually	final(ly)	first	for
from	in <i>month, year</i>	in turn	initially
last(ly)	later	meanwhile	next
now	on <i>date</i>	once	originally
period	prior (to)	process	second
sequence	since	so far	(as) soon (as)
stage(s)	start	step(s)	subsequently
then	till	time	ultimately
up to	when	whenever	

5) *Cause*

(on) account (of)	as	because	by
cause	is caused by	consequence	due to
in that	in view of	inasmuch as	now that
reason(s)	results from	since	works by

Effect

effect	gives rise to	(the) result	results in
so (that)	thereby	therefore	thus

8.5 Prefixes and Roots

Words in bold are the most common words of each of the 570 families of the Academic Word List. Words in italic are less common words of the 570 word families of the Academic Word List. Words that are neither in bold, nor in italic, are part of the General Service Word List. Words that are in parentheses are words that are neither on the GSL nor the AWL.

Prefix or Root	Meaning	Example
a, an	not, without	(abiotic), (anaerobic), <i>asexual</i> , (atheist)
ab, abs	away from	<i>abnormal</i> , abstract , <i>abstraction</i> , absence, absent
act, agi	do, act, drive	action, active, actor, actress, actual, (agile), (agitate), <i>interact</i> , interaction , <i>react</i> , reaction
alter	change, other	alter , alternative
am, amor	love, like	(amorous), (amiable), (amicable)
ambul	walk	(amble), (ambulance)
amphi	both or all sides	(amphibian)
anim	life, mind, soul	animal, (animate), (animation), (animosity)
ann, annu, enni	yearly	(anniversary), annual , (biannual), (perennial)
ante, ant	before, front	(anterior), <i>anticipate</i> , anticipated , (antipasto), (antique)
anthrop	human	(anthropology), (anthropologist)
anti, ant	against, opposite	(antibody), (antisocial), (antifreeze)
aqua, aque	water	(aquamarine), (aquarium), (aquatic), (aqueduct)
arch	chief, leader, ruler	arch, (archenemy), <i>hierarchy</i> , hierarchical , (matriarch), (patriarch)
arthro	joint	(arthritis), (arthropod)
auc, aug	increase	(auction), (augment)
aud, audi, aur	hear	audience, (audible), (audiovisual), (audition)
author	master, originate	author , authority , <i>authoritative</i> , <i>authorize</i>
auto, aut	self, same, from within	(autism), (autobiography), (automobile), <i>automatic</i> , automatically
bene	good, well	<i>beneficial</i> , (benevolent), benefit
bi, bin	two	bicycle, (bilingual), (binary), (bivalve)
biblio	book	(bibliography)
bio, bi	life	(autobiography), (biography), (biology), (biosphere)
brev	short	(abbreviate), brief , <i>brevity</i>
cap	take, hold, seize	capable , capacity , (captivate), (capture)
cat, cata	down	(catalogue), <i>category</i> , categories , (catastrophe)
cede, ceed, cess, cease	go, yield	access , excess, preceding , procedure , process , (recess), (recessive), success, successive
cent	hundred	cent, (centimeter), century, percent , <i>percentage</i>
centr	center	<i>concentrate</i> , concentration , (centrifuge), (egocentric), (ethnocentric)
chrom	color	(chromosome), (monochrome), (polychrome)
chron	time	(chronic), (chronicle), (chronology)
cid	kill	(homicide), (suicide), (genocide)
circum, circu	around	(circuit), (circulation), (circumference), <i>circumstance</i> , circumstances
claim, clam	shout	(acclaim), claim, (clamor), (exclaim), (proclaim)
clin	lean, bend	decline , <i>incline</i> , inclination
clud, claus, clos, clus	close, shut	clause , <i>conclude</i> , conclusion , excluded , enclose, enclosure, <i>exclusive</i> , include, inclusive
cogn, gnos	know, learn	(diagnose), ignored , <i>ignorant</i> , <i>ignorance</i> , recognize

co, cog, col, com, con cor	together, with	coherence , <i>coherent</i> , coincide , <i>coincidence</i> , <i>colleague</i> , colleagues , collect, combine, <i>commit</i> , commitment , community , <i>communicate</i> , communication , <i>compatible</i> , <i>compile</i> , compiled , <i>component</i> , components , <i>conceive</i> , conceived , <i>concentrate</i> , concentration , constant , contract , <i>cooperate</i> , cooperative , incompatible
contra, counter	against, opposite	<i>contradict</i> , contradiction , contrary , contrast , controversy , <i>encounter</i> , encountered
corp	body	corporate , <i>corporation</i> , <i>incorporate</i> , incorporated
cour, cur, curr, curs	run	course, current, concurrent , currency , (<i>curriculum</i>)
crac, crat	rule, ruler	(<i>bureaucrat</i>), (<i>democracy</i>)
cresc, cret, crease	grow	create , (<i>concrete</i>), <i>creature</i> , (<i>crescent</i>), decrease, increase
cred	believe	(<i>credible</i>), credit , (<i>incredible</i>)
cruc	cross	crucial
crusta	shell	(<i>crustacean</i>)
crypt	hidden	(<i>crypt</i>), (<i>cryptic</i>)
culp	blame	(<i>culpable</i>), (<i>culprit</i>)
cycl	circle, wheel	<i>bicycle</i> , cycle , <i>recycle</i>
de	from, away from, down, off	decline , decrease, descend, descendant, descent, destruct, destruction, deny , <i>depress</i> , depression , <i>deregister</i> , <i>deregulate</i> , <i>derive</i> , derived , <i>deviate</i> , deviation
dec	ten	(<i>decimal</i>), <i>decade</i> , decades
dei, div	God	(<i>divine</i>), (<i>divinity</i>), (<i>deity</i>)
demo	people	(<i>democracy</i>), (<i>endemic</i>), (<i>epidemic</i>), (<i>pandemic</i>)
dent	tooth	(<i>dentist</i>), (<i>dental</i>)
derm	skin	(<i>dermatology</i>), (<i>epidermis</i>)
di	two	divide, division, (<i>dilemma</i>), (<i>dioxide</i>)
dia	across, between, through	(<i>diagnosis</i>), (<i>diagonal</i>), (<i>dialogue</i>), (<i>diameter</i>)
dic, dict, dit	say, speak	<i>contradict</i> , contradiction , dictionary, (<i>dictation</i>), indicate , <i>predict</i> , predicted , (<i>verdict</i>)
dis, di, dif, dys	apart, away, from	difference, different, <i>differentiate</i> , differentiation , <i>diminish</i> , diminished , disagree, disappear, disappoint, disapprove, discipline, discomfort, discontent, <i>discrete</i> , discretion , <i>discriminate</i> , discrimination , discuss, <i>disestablish</i> , dismiss, <i>displace</i> , displacement , display , <i>dispose</i> , disposal , <i>disproportionate</i> , disregard, disrespect, dissatisfy, <i>dissimilar</i> , distance, distant, <i>distinct</i> , distinction , distinguish, <i>distort</i> , distortion , <i>distribute</i> , distribution , district, disturb
doc, doct	teach, prove	doctor, document
dog, dox	belief, opinion	(<i>dogma</i>), (<i>orthodox</i>), (<i>paradox</i>)
du, duo	two	(<i>duel</i>), (<i>duet</i>), (<i>duo</i>)
duc, duct	lead, bring, draw out	conduct , <i>deduce</i> , deduction , <i>induce</i> , induced , introduce, introduction, produce, reduce, reproduction
dynam	power	(<i>aerodynamics</i>), dynamic , (<i>dynamite</i>)
ecto	outside, external	(<i>ectoplasm</i>)
ego	self	(<i>egocentric</i>), (<i>egoism</i>), (<i>egotistical</i>)
en, em	in, at, cause, cover, make, provide	emphasis , enable , energy , <i>enforce</i> , enforcement , ensure

endo	inside, within	(endoscope)
epi	at, over, upon, in addition	(epicenter), (epidemic), (epilogue)
eu	good, well, true	(eukaryote), (euphoria), (euthanasia),
equ	equal	adequate , equal, <i>equate</i> , equation , equivalent
ex, exo, extra	beyond, outside, outward	exceed , <i>exclude</i> , excluded , exhibit , <i>expand</i> , expansion , explicit , <i>exploit</i> , exploitation , export , <i>expose</i> , exposure , extend, extension, extensive, external , extract , extra, extreme, extraordinary
fac	make, do	facilitate , <i>factor</i> , factors , factory, manufacture
fer	bear, bring, carry	<i>confer</i> , conference , difference, different, <i>differentiate</i> , differentiation , <i>infer</i> , inferred , interfere, interference, offer, prefer, preference, refer, reference, suffer, transfer
fid	belief, faith	confidence, confident, confidential, (fidelity)
fil	thread, string	(filament), file , (profile)
flect, flex	bend	<i>flexible</i> , flexibility , reflect, reflection, (reflex)
flict	strike	(affliction), conflict , (inflict)
flu, fluct, flux	flow	<i>fluctuate</i> , fluctuations , (fluid), influence, influential, (influx), (reflux)
form	shape, appearance	<i>conform</i> , conformity , formal, format , formula , inform, (information), perform, performance, <i>transform</i> , transformation , uniform
fort, forc	power, strength	comfort, discomfort, <i>enforce</i> , enforcement , effort, force, <i>reinforce</i> , reinforced
fract, frag	break	(fraction), (fracture), (fragment)
frater	brother	(fraternal), (fraternity)
fuge	flee	(centrifuge), (fugitive), (refugee)
gam	marriage	(bigamy), (gamete), (monogamy), (polygamy)
gastro	stomach	(gastroenteritis), (gastronomy), (gastropod)
gen, gin	give birth, origin	gender , <i>generate</i> , generated , generation , (gene), (genetics)
geo	earth	(geography), (geology)
giga	billion (10 ⁹), large	(gigabyte), (gigantic)
graph, gram, graf	write, draw	paragraph , grammar, gramatical, photograph, photography, program, telegraph
gym	naked	(gymnasium), (gymnosperm)
hemo, hema, hem	blood	(hemoglobin), (hemophilia)
hetero	other	(heterogeneous), (heterophyte)
hex, sex	six	(hexagon), (hexadecimal), (sextuplets)
holo	whole, entire	(holocaust), (hologram)
homo	human	human, (Homo sapiens)
homo, homeo	same, similar	(homogenous), (homosexual), (homozygous)
hydro, hydr	water	(dehydrate), (hydraulics), (hydroelectric), (hydrogen)
hyper	above, over, high	(hyperactive), (hypersensitive), (hypertension)
hypo	below, low, under	(hypocrite), (hypothermia), hypothesis
in, im	into, toward, within	<i>immigrate</i> , immigration , <i>incorporate</i> , incorporated , <i>inhibit</i> , inhibition , input , insert , <i>insight</i> , insights , internal , intrinsic

in, im, ig, il, ir	not	<i>ignore, ignored, ignorant, illegal, illogical, immature, impossible, imprecise, incapacitate, incoherent, incompatible, inconceivable, inconclusive, inconstantly, indiscrete, infinite, instability, invalidate, invariable, invisible, irrational, irrelevant, irreversible</i>
infra	below	(infrared), infrastructure
inter	between, among	<i>interact, interaction, interfere, intermediate, (Internet), interpret, interpretation, interrupt, interval, intervene, intervention</i>
intro	into, within	introduce, (introspection), (introvert)
iso	equal, identical	(isomer), (isosceles), (isotherm)
jac, ject	throw	(eject), (inject), object, objective, project, reject, rejected , subject
jud	judge	judge, prejudice
jug, junct, just	join	<i>adjust, adjustment</i> , (conjugation), (conjunction), (junction)
kilo	thousand (10 ³)	(kilobyte), (kilogram), (kilometer)
lect, leg, lig	choose, gather, read, select	collect, elect, lecture, neglect , reflect, select
lex, leag, leg	law	college, legal, legislation
liter	letter	literacy, literature
loc	place, area	<i>allocate</i> , allocation , local, <i>locate</i> , location
log	say, speech, word, reason, study	analogous , apology, logic
luc	light	(elucidate), (lucid)
magn	large	(magnate), (magnificent), (magnify)
mal	bad, badly	(dismal), (malfunction)
man, manu	hand, make, do	manage, <i>manipulate</i> , manipulation, manual , manufacture
mar	sea	(marine), (mariner)
mater	mother	(maternal), (maternity)
mega	million (10 ⁶), great	(megabyte), (megaphone)
mem	recall, remember	memory, (commemorate), remember
ment	mind	mental , (dementia)
mer	part, segment	(isomer), (monomer), (polymer)
meta	beyond, change	(metabolism), (metamorphosis), (metaphor)
metri, meter	measure	(metric), <i>parameter</i> , parameters , (thermometer)
micro	millionth (10 ⁻⁶), small	(microgram), (microscope)
mill	thousand	(millennium)
milli	thousandth	(milligram), (millisecond), (millivolt)
min	small	<i>diminish, diminished, minimal, minimize, minimized, minimum, minor, minority, minorities</i> , (minuscule), minute
mis	bad, wrong	(misconduct), miserable, misery, miss, mistake
mit, miss	cause, go, send	admit, admission, commission , <i>commit</i> , committee, commitment , dismiss, omission, omit, permission, permit, promise, <i>submit</i> , submitted , <i>transmit</i> , transmission
mob, mot, mov	move	(mobile), <i>motive, motivate</i> , motivation , motion, motor, move, promote, remove, removed
mono	one	(monologue), (monopoly), (monorail)
mor, mort	death	(immortality), (mortal), (mortician)
morph	form, structure	(amorphous), (metamorphosis), (morphology)

multi	many	(multicellular), <i>multi-dimensional</i> , multiply, multiplication
mut	change	(mutant), (mutation)
nano	billionth (10 ⁻⁹)	(nanosecond), (nanoparticles), (nanotechnology)
nasc, nat, gnant	birth	(denature), (nascent), nation, native, nature, (pregnant)
neuro	nerve	(neurology), (neuroscience)
nom, nym	name, word	(anonymous), (nominate), (pseudonym), (synonym)
non	nine	(nonagon)
non	not	(nonalcoholic), <i>nonconformist</i> , (nonessential), (non-governmental organization), (nonlinear), (nonmetallic), (nonsmoker), <i>nontraditional</i>
nov	new	<i>innovate</i> , innovation , (novel), (novice)
oct	eight	(octopus), (octagon), (octave)
omni	all	(omnibus), (omnivore)
oper	work	<i>cooperate</i> , cooperative , <i>cooperation</i> , operate, operation, operator
ortho	straight, correct	(orthodox), (orthodontist), (orthopedic)
over	excessive, above	overall , <i>overestimate</i> , overcome, overflow, overlap , overseas
pac	peace	(Pacific Ocean), (pacifist), (pacify)
para	beside	paradigm , paragraph , parallel , <i>parameter</i> , parameters
pat, pass, path	feel, suffer	(apathy), <i>compatible</i> , (empathy), incompatible , passive , patience, patient, (psychopath), sympathetic, sympathy
pater	father	(paternal), (paternity), (patriotic)
ped, pod	foot	(pedal), (gastropod), (podium)
pel, puls	drive, push	(pulse), (repel)
pend	hang, weigh	<i>append</i> , appendix , <i>suspend</i> , suspended , (pendant), (pending)
penta, quint	five	(pentagon), (quintet)
per	through, across, by	percent , <i>perceive</i> , perceived , perfect, permission, <i>persist</i> , persistent , perspective , persuade
peri	around	period , <i>periodic</i> , (perimeter)
phan, phas, phen, fan	show, make visible	emphasis , fancy, (phantom), phenomenon
phil	love	<i>philosopher</i> , philosophy
phon	sound	(microphone), (phonics), telephone
phot	light	photograph, (photon), (photosynthesis)
pict	paint, show, draw	(depict), picture
plan	flat	(planar), (plane)
pli, plex, ply	fold, bend	application, apply, complicate, complication, complex , explicit , <i>implicate</i> , implications , implicit , implies , <i>imply</i> , multiplication, multiply, reply
pneum	lung	(pneumatic), (pneumonia)
pod	foot	(gastropod), (podium)
poly	many	(polyethylene), (polygon), (polymer)
pon, pos	put, place, set	<i>component</i> , components , compose, composition, (decompose), (depose), (deposit), <i>dispose</i> , disposal , <i>expose</i> , exposure , <i>impose</i> , imposed , oppose, opposite, opposition, <i>pose</i> , posed , positive , position, post, (poster), postpone, propose, suppose
port	carry	export , (import), importance, important, (porter), report, (reporter), transport , support

post	after, behind	(postgraduate), (postmortem), postpone, (postscript)
pot, poss	power, ability	impossible, possess, possession, possessor, possible, (potent), potential
pre	before, first	<i>precede</i> , preceding , <i>predict</i> , predicted , <i>predominant</i> , predominantly , prefer, preference, preliminary , prepare, (prescribe), (prescription), present, (presentation), preserve, president, <i>presume</i> , presumption , pretend, prevent, prevention, (preview), previous
prim	first, chief, foremost	prime , (primitive), (prime minister), (prime number), primary
pro	for, forward	<i>proceed</i> , procedure , process , program, progress, project , promise, promote , prospect
psych	mind	psychology
quat, quad	four	(quadrangle), square
que, qui	ask	<i>acquire</i> , acquisition , inquire, inquiry, question, request, <i>require</i> , required
re	back, again	<i>react</i> , reaction , <i>readjust</i> , <i>reassess</i> , <i>reassign</i> , <i>recommence</i> , <i>reconstruct</i> , <i>recover</i> , recovery , <i>recreate</i> , <i>redefine</i> , <i>redistribute</i> , <i>redraft</i> , <i>reevaluate</i> , refine , reflect, reflection, <i>refocus</i> , <i>reformulate</i> , refuse, <i>reinforce</i> , reinforced , <i>reinterpret</i> , <i>reinvest</i> , <i>reject</i> , rejected , release , <i>relocate</i> , remind, <i>remove</i> , removed , <i>reoccur</i> , <i>reorient</i> , repeat, replace, reply, resolution , <i>resolve</i> , <i>respond</i> , response , restore , <i>restrain</i> , restraints , <i>restrict</i> , restricted , <i>retain</i> , retained , reverse , review, <i>revise</i> , revision
retro	backwards	(retroactive), (retrospect)
rupt	break	(corrupt), (disrupt), interrupt, interruption, (rupture)
sanct	holy	(saint), (sanction), (sanctuary)
scent, scend	climb	(ascent), descend, descent, descendant
sci, scio	know	conscience, conscious, science, scientist, scientific
sciss	cut	scissors
scrib, script	write	(conscript), describe, description, (manuscript), (prescribe), (scribble)
se	apart, move away from	(dissect), section , sector , select
sed, sess	sit	(sedentary), (session)
semi	half	(semiconductor), (semifinal)
sent, sens	feel, think	(biosensor), consent , sense, sensitive, (sentimental), (sensation)
sept	seven	(septennial), (septet)
sequ, secu	follow	(consecutive), <i>consequence</i> , consequences , sequence , subsequent , (sequel)
serv	watch, maintain, protect	(conserve), deserve, observe, preserve, reserve, servant, serve, service
simil	same	(assimilate), (facsimile), similar
soci	join, companion	association, (sociable), social, society, (sociology)
sol	alone	<i>isolate</i> , isolated , <i>sole</i> , solely , (solitary), (solo)
sol	sun	(parasol), (solar), (solstice)
solv, solu, solut	loosen, explain	absolute, <i>resolve</i> , resolution , (soluble), solution, solve
son	sound	(resonate), (sonar), (unison)

soph	wisdom, knowledge	<i>philosopher</i> , philosophy , (sophisticated), (sophomore)
spec, spic	look, see	<i>aspect</i> , aspects , <i>inspect</i> , inspection , perspective , prospect , specific , <i>specify</i> , specified , (spectator), (speculate)
spir	breath, soul	(inspire), (respiration)
spir	coil	(spiral)
spond, spons	promise, answer for	<i>correspond</i> , corresponding , <i>respond</i> , response , responsible
spont	by one's own force	(spontaneous)
sta, stan, stat	place, put, stand, stay	<i>assist</i> , assistance , <i>circumstance</i> , circumstances , constant , <i>establish</i> , established , estate , instance , <i>stable</i> , stability , stage, stand, station, statistics , status
stru, struct, stroy, stry	build	<i>construct</i> , construction , (destroy), destruction, destructive, (industry), infrastructure , <i>instruct</i> , instructions , ministry , structure
sub	under, below, from	<i>submit</i> , submitted , (submarine), subordinate , (subtitles), (subway)
sup, super, supra	over, above,	(superior), <i>supplement</i> , supplementary , (supernatural)
sym, syn	together, at the same time	(photosynthesis), sympathy, sympathetic, (synthesis), (syndicate)
tact, tang, tig, ting	touch	contact , (contiguous), (contingent), (tangible), touch
tain, ten, tent, tin	hold, keep, have	<i>attain</i> , attained , attentive, contain, content, discontent, entertain, <i>maintain</i> , maintenance , <i>obtain</i> , obtained , <i>retain</i> , retained , <i>sustain</i> , sustainable
tect, teg	cover	<i>detect</i> , detected , protect, protection
tele	distance, from afar	telegraph, telephone, television
temp	time	contemporary , temporary
tend, tens	stretch	<i>intense</i> , intensity , <i>tense</i> , tension
tera	trillion (10 ¹²)	(terabyte)
term	end, boundary, limit	(midterm), term, <i>terminate</i> , termination
terr	Earth	(subterranean), (terrain), (terrestrial)
test	see, witness	(attest), (testify)
theo, the	God	(polytheist), (theology)
therm	heat	(thermal), (thermodynamics), (thermometer)
tor, tors, tort	twist	<i>distort</i> , distortion , (torsion), (torture)
tract	drag, draw, pull	abstract , attract, attractive, attraction, contract , extract , (subtract), (tractor)
trans	across, beyond, change	transfer , <i>transform</i> , transformation , translate, translation, translator, transition , <i>transmit</i> , transmission , transport
tri	three	(triangle), (triglyceride), (triple)
ultra	beyond	(ultramicroscope), (ultrasound), (ultraviolet)

un	not, against, opposite	<i>unaccompanied, unaffected, unaided, unaltered, unalterable, unambiguous, unanticipated, unappreciated, unapproachable, unassigned, unassisted, unattached, unattainable, unavailable, unaware, unbiased, uncharted, uncommunicative, unconfined, unconstitutional, unconstrained, uncontroversial, unconventional, unconvinced, uncultured, undefined, undeniable, undiminished, uneconomical, unethical, unfounded, unidentifiable, uninjured, unintelligent, uninvolved, unjustified, unlicensed, unmodified, unmonitored, unmotivated, unobtainable, unparalleled, unprecedented, unpredictability, unpredictable, unprincipled, unpublished, unregulated, unreliable, unresolved, unresponsive, unrestrained, unrestricted, unrestrictive, unscheduled, unspecified, unstable, unstressed, unstructured, unsustainable</i>
uni	one	unified , <i>unify</i> , uniform , unique , union, unit, unite, unity, universal, universe, university
vac	empty	(vacant), (vacation), (vacuous), (vacuum)
veh, vect	carry	(convection), (vector), vehicle
ven, vent	come	adventure, avenue, <i>convene</i> , convenience, convenient, convention , event, <i>eventual</i> , eventually , <i>intervene</i> , intervention , invent, invention, inventor, prevent, prevention, revenge, revenue
ver	truth	(veracity), (verify), (verity)
vers, vert	turn, change	controversy , conversation, <i>converse</i> , conversely , <i>convert</i> , converted , reverse , version
vid, vie, vis	see	<i>evident</i> , evidence , review, <i>revise</i> , revision , visible , vision , (video), visual , view, visit, visitor
vit, viv	life	(revitalize), (revive), (vital), (vitality), (vitamins)
voc, voke	call	advocate , <i>invoke</i> , invoked , (vocabulary), (vocal), (revoke)
vol	roll, turn	<i>evolve</i> , evolution , <i>involve</i> , involved , (revolve), (revolver), revolution , volume

8.6 Suffixes

Words that are in **bold** are the most common words of each of the 570 word families of the Academic Word List. Words that are in *italic* are less common words of the 570 word families of the Academic Word List. Words that are neither in bold nor italic are common English words. They are all on the General Service Word List which comprises the most common 2284 English words. Words that are in parentheses are rare words that are neither on the General Service List nor on the Academic Word List.

Suffix	Example	Function
-able, -ible	<i>achievable, adaptable, alterable, appreciable, approachable, assessable, attainable, attributable, available, capable, collapsible, communicable, compatible, computable, conceivable, conformable, considerable, contactable, convertible, debatable, definable, demonstrable, deniable, detectable, disposable, flexible, identifiable, inaccessible, incapable, incompatible, inconceivable, inevitable, inflexible, invariable, invisible, irreversible, justifiable, obtainable, predictable, recoverable, reliable, removable, reversible, specifiable, sustainable, traceable, transferable, unalterable, unapproachable, unattainable, unavailable, undeniable, unidentifiable, unobtainable, unpredictable, unreliable, unstable, unsustainable, variable, visible</i>	Adjective
-age	image , <i>linkage, percentage</i>	Noun
-al, -ial, -ical	<i>abnormal, analytical, annual, beneficial, chemical, classical, coincidental, computational, conceptual, constitutional, contextual, controversial, conventional, crucial, cultural, cyclical, dimensional, distributional, economical, empirical, environmental, ethical, eventual, evidential, external, federal, final, financial, functional, fundamental, global, hierarchical, hypothetical, identical, ideological, illegal, illogical, incidental, individual, initial, institutional, integral, internal, irrational, legal, liberal, logical, manual, marginal, maturational, medical, mental, methodical, methodological, minimal, ministerial, multi-dimensional, mutual, neutral, non-traditional, normal, occupational, optional, phenomenal, philosophical, physical, potential, principal, procedural, professional, proportional, psychological, radical, rational, regional, residential, sequential, sexual, spherical, statistical, structural, technical, technological, terminal, textual, theoretical, topical, traditional, transitional, uncontroversial, unconventional, uneconomical, unethical, virtual, visual</i>	Adjective
-an	<i>logician, statistician</i>	Noun - person

-ance, -ence	assistance, assurance, circumstance, coherence, coincidence, conference, conformance, consequence, correspondence, dominance, emergence, equivalence, evidence, ignorance, incidence, inference, instance, intelligence, irrelevance, maintenance, occurrence, persistence, precedence, predominance, relevance, reliance, reluctance, residence, sequence, significance, sustenance, transference, variance	Noun
-ant, -ent	<i>assistant, consultant, immigrant, migrant, occupant, participant, resident, respondent</i>	Noun - person
-ant, -ent	<i>adjacent, apparent, coherent, concurrent, consistent, constant, consequent, dominant, emergent, equivalent, evident, ignorant, incoherent, inherent, insignificant, insufficient, intelligent, irrelevant, persistent, predominant, relevant, reliant reluctant, significant, subsequent, sufficient, unintelligent, variant</i>	Adjective
-ar, -ary, -ory	arbitrary, compensatory, complementary, contemporary, contradictory, contrary, discretionary, dissimilar, evolutionary, exclusionary, migratory, military, nuclear, participatory, preliminary, primary, reactionary, regulatory, revolutionary, similar, supplementary, temporary, transitory, voluntary	adjective
-ate	accurate, adequate, appropriate, approximate, corporate, disproportionate, inaccurate, inadequate, intermediate, proportionate, ultimate	Adjective
-ate	<i>accommodate, accumulate, administrate, advocate, aggregate, allocate, alternate, anticipate, appreciate, appropriate, approximate, automate, communicate, concentrate, cooperate, coordinate, create, debate, demonstrate, deregulate, deviate, differentiate, discriminate, domesticate, dominate, eliminate, equate, estimate, evaluate, facilitate, fluctuate, formulate, generate, illustrate, immigrate, implicate, incapacitate, incorporate, indicate, initiate, innovate, integrate, invalidate, investigate, isolate, legislate, liberate, locate, manipulate, mediate, migrate, motivate, negate, orientate, participate, predominate, overestimate, underestimate, reactivate, recreate, reevaluate, reformulate, regulate, relocate, simulate, subordinate, terminate, validate, violate</i>	Verb
-ation	accommodation, accumulation, adaptation, administration, aggregation, allocation, alteration, anticipation, appreciation, approximation, automation, categorization, citation, clarification, communication, compensation, compilation, computation, concentration, conceptualization, confirmation, conformation, consultation, cooperation, coordination, corporation, creation, demonstration, denotation, deregistration, deregulation, derivation, deviation, differentiation, discrimination, diversification, documentation, domination, dramatization, duration, elimination, equation, estimation, evaluation, exploitation, externalization, facilitation, federation, fluctuation, formulation, foundation, generation, globalization, identification, illustration, immigration, implementation,	Noun

-ation	<i>implication, inclination, incorporation, indication, initiation, innovation, integration, intensification, interpretation, investigation, isolation, itemization, justification, legislation, liberalization, liberation, location, manipulation, maturation, maximization, mediation, modification, misinterpretation, motivation, neutralization, normalization, occupation, orientation, participation, prioritization, publication, quotation, rationalization, reactivation, reevaluation, reformulation, registration, regulation, reinterpretation, relaxation, relocation, reorientation, restoration, revelation, simulation, specification, stabilization, subordination, summation, summarization, termination, transformation, transportation, unification, utilization, validation, variation, violation, visualization</i>	Noun
-cy	<i>accuracy, adequacy, advocacy, consistency, constancy, constituency, consultancy, currency, inaccuracy, inadequacy, inappropriacy, inconsistency, inconstancy, insufficiency, occupancy, policy, primacy, sufficiency</i>	Noun
-ed	<i>abandoned, accessed, accommodated, accompanied, accumulated, achieved, acknowledged, acquired, adapted, adjusted, advocated, affected, aggregated, aided, allocated, altered, amended, analyzed, anticipated, appended, appreciated, approached, approximated, assembled, assessed, assigned, assisted, assumed, assured, attached, attained, attributed, authored, automated, benefited, biased, bonded, briefed, categorized, ceased, challenged, channeled, charted, cited, clarified, coded, coincided, collapsed, commenced, commented, commissioned, committed, communicated, compensated, complied, complemented, compounded, comprised, computed, conceived, concentrated, conceptualized, concluded, conducted, conferred, confined, confirmed, conflicted, conformed, consented, consisted, constituted, constrained, constructed, consulted, consumed, contacted, contracted, contradicted, contrasted, contributed, convened, converted, convinced, cooperated, coordinated, cored, corresponded, coupled, created, credited, cycled, debated, declined, deduced, defined, demonstrated, denoted, denied, depressed, deregistered, deregulated, derived, designed, detected, deviated, devoted, differentiated, diminished, discriminated, disestablished, displaced, displayed, disposed, distorted, distributed, diversified, documented, domesticated, dominated, drafted, dramatized, edited, eliminated, emerged, emphasized, enabled, encountered, enforced, enhanced, ensured, equated, equipped, eroded, established, estimated, evaluated, evidenced, evolved, exceeded, excluded, exhibited, expanded, exploited, exported, exposed, externalized, extracted, facilitated, factored, featured, filed, finalized, financed, fluctuated, focused, formatted, formulated, founded, functioned, funded, generated, graded, granted, guaranteed, highlighted, hypothesized, identified, ignored, illustrated, immigrated,</i>	Verb

-ed	<p><i>impacted, implemented, implicated, implied, imposed, incapacitated, inclined, incorporated, indexed, indicated, individualized, induced, inferred, inhibited, initiated, injured, innovated, inserted, inspected, instituted, instructed, integrated, intensified, interacted, internalized, interpreted, intervened, invested, investigated, invoked, involved, isolated, issued, itemized, justified, labeled, labored, layered, lectured, legislated, liberalized, liberated, licensed, linked, located, maintained, manipulated, matured, maximized, mediated, migrated, minimized, ministered, misinterpreted, modified, monitored, motivated, negated, networked, neutralized, normalized, obtained, occupied, occurred, orientated, oriented, overestimated, overlapped, paneled, paralleled, participated, perceived, persisted, phased, philosophized, posed, preceded, predicted, predominated, presumed, prioritized, proceeded, processed, prohibited, projected, promoted, published, purchased, pursued, quoted, ranged, rationalized, reacted, readjusted, reassessed, reassigned, recommenced, reconstructed, recovered, recreated, redefined, redistributed, redrafted, reevaluated, refined, refocused, reformulated, registered, regulated, reinforced, reinterpreted, reinvested, rejected, relaxed, released, relied, relocated, removed, reoccurred, required, rescheduled, researched, resided, resolved, resourced, responded, restored, restrained, restricted, restructured, retained, revealed, reversed, revised, revolutionized, routed, schemed, sectioned, secured, selected, sequenced, shifted, signified, simulated, sourced, specified, stabilized, stressed, structured, styled, stylized, submitted, subsidized, substituted, summed, summarized, supplemented, surveyed, survived, suspended, sustained, symbolized, taped, targeted, teamed, terminated, traced, transferred, transformed, transited, transmitted, transported, triggered, underestimated, unified, utilized, validated, varied, violated, visualized, volunteered</i></p>	Verb
-ed	<p><i>abandoned, achieved, acknowledged, acquired, adjusted, affected, altered, amended, anticipated, appreciated, assembled, assigned, assisted, assumed, assured, attached, attained, automated, biased, bonded, categorized, challenged, clarified, coded, collapsed, commissioned, committed, compensated, compounded, computerized, conceived, concentrated, confined, confirmed, conflicted, converted, contracted, coordinated, cored, coupled, cultured, defined, depressed, derived, devoted, diminished, disposed, distorted, distributed, edited, eliminated, enhanced, expanded, established, exposed, featured, formatted, formulated, generated, graded, guaranteed, highlighted, illustrated, incapacitated, inclined, incorporated, injured, integrated, isolated, labored, layered, licensed, modified, motivated, neutralized, orientated, oriented, paneled, perceived, principled, processed, projected, published, recycled, refined, reformulated, registered, reinforced, relaxed, removed, required, resolved, restored, restrained, restricted, restructured, revised, stressed, structured, styled, stylized, subsidized, substituted,</i></p>	Adjective

-ed	suspended , <i>taped, transformed, transmitted, transported, unaccompanied, unaffected, unaided, unaltered, unanticipated, unappreciated, unassigned, unassisted, unattached, unbiased, uncharted, unconfined, unconstrained, unconvinced, uncultured, undiminished, unfounded, uninjured, uninvolved, unjustified, unlicensed, unmodified, unmonitored, unmotivated, unparalleled, unprecedented, unprincipled, unpublished, unregulated, unresolved, unrestrained, unrestricted, unscheduled, unspecified, unstressed, unstructured, varied</i>	Adjective
-en	brighten, darken, deafen, deepen, fatten, flatten, frighten, harden, heighten, lengthen, lessen, lighten, loosen, madden, redden, ripen, sadden, sharpen, shorten, soften, stiffen, straighten, strengthen, sweeten, thicken, threaten, tighten, weaken, whiten, widen	Verb
-en	golden, wooden, woolen	Adjective
-er, -or	alter , author , <i>confer, deregister, encounter, infer, layer, recover, register, transfer, trigger, volunteer</i>	Verb
-er, -or	<i>administrator, analyzer, challenger, commentator, commissioner, consumer, contractor, contributor, coordinator, creator, creditor, demonstrator, designer, distributor, editor, exporter, facilitator, financier, founder, funder, innovator, inspector, instructor, investor, investigator, lecturer, legislator, liberator, occupier, philosopher, practitioner, promoter, publisher, purchaser, regulator, researcher, selector, successor, survivor, volunteer</i>	Noun - person
-er, -or	<i>analyzer, (Challenger), computer, detector, indicator, reactor, transporter</i>	Noun - thing
-est	best, earnest, honest, modest, <i>tensest</i>	Adjective
-fold	(twofold), (fourfold), (sevenfold)	Adverb
-ful	grateful, <i>insightful, resourceful, stressful</i>	Adjective
-ify	<i>clarify, diversify, identify, intensify, justify, modify, signify, specify, unify</i>	Verb
-ia	<i>academia</i> , criteria , media	Noun
-ic	academic , <i>analytic, automatic, classic, cyclic, domestic, dramatic, dynamic, economic, emphatic, energetic, ethnic, individualistic, intrinsic, periodic, schematic, specific, strategic, symbolic, thematic</i>	Adjective
-ics	<i>classics, dynamics, economics, ethics, politics, statistics</i>	Noun - subject

-ing	<p><i>abandoning, accessing, accommodating, accompanying, accumulating, achieving, acknowledging, acquiring, adapting, adjusting, advocating, affecting, aggregating, aiding, allocating, altering, alternating, amending, analyzing, anticipating, appending, appreciating, approaching, approximating, assembling, assessing, assigning, assisting, assuming, assuring, attaching, attaining, attributing, authoring, automating, benefiting, biasing, bonding, briefing, categorizing, ceasing, challenging, channeling, charting, citing, clarifying, coding, coinciding, collapsing, commencing, commenting, commissioning, committing, communicating, compensating, compiling, complementing, compounding, comprising, computing, conceiving, concentrating, conceptualizing, concluding, conducting, conferring, confining, confirming, conflicting, conforming, consenting, consisting, constituting, constraining, constructing, consulting, consuming, contacting, contextualizing, contracting, contradicting, contrasting, contributing, convening, converting, convincing, cooperating, coordinating, coring, corresponding, coupling, creating, crediting, cycling, debating, declining, deducing, defining, demonstrating, denoting, denying, depressing, deregistering, deregulating, deriving, designing, detecting, deviating, devoting, differentiating, diminishing, discriminating, disestablishing, displacing, displaying, disposing, distorting, distributing, diversifying, documenting, domesticating, dominating, drafting, dramatizing, editing, eliminating, emerging, emphasizing, enabling, encountering, enforcing, enhancing, ensuring, equating, equipping, eroding, establishing, estimating, evaluating, evolving, exceeding, excluding, exhibiting, expanding, exploiting, exporting, exposing, externalizing, extracting, facilitating, factoring, featuring, filing, finalizing, financing, fluctuating, focusing, formatting, formulating, founding, functioning, funding, generating, grading, granting, guaranteeing, highlighting, hypothesizing, identifying, ignoring, illustrating, immigrating, impacting, implementing, implicating, implying, imposing, inclining, incorporating, indexing, indicating, inducing, inferring, inhibiting, initiating, injuring, innovating, inserting, inspecting, instituting, institutionalizing, instructing, integrating, intensifying, interacting, internalizing, interpreting, intervening, investing, investigating, invoking, involving, isolating, issuing, itemizing, justifying, labeling, laboring, layering, lecturing, legalizing, liberalizing, liberating, licensing, linking, locating, maintaining, manipulating, maturing, maximizing, mediating, migrating, minimizing, ministering, misinterpreting, modifying, monitoring, motivating, negating, networking, neutralizing, normalizing, obtaining, occupying, occurring, offsetting, orientating, orienting, overestimating, overlapping, paneling, paragraphing, participating, perceiving, persisting, phasing, philosophizing, posing, preceding, predicting, predominating, presuming, prioritizing, proceeding, processing, prohibiting, projecting, promoting, publishing, purchasing, pursuing,</i></p>	Verb - present participle
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-ing	<p><i>quoting, ranging, rationalizing, reacting, readjusting, reassessing, reassigning, recommencing, reconstructing, recovering, recreating, redefining, redistributing, redrafting, reevaluating, refocusing, reformulating, registering, regulating, reinforcing, reinterpreting, reinvesting, rejecting, relaxing, releasing, relocating, relying, removing, reoccurring, requiring, rescheduling, researching, residing, resolving, resourcing, responding, restoring, restraining, restricting, restructuring, retaining, revealing, reversing, revising, revolutionizing, routing, scheduling, scheming, sectioning, securing, seeking, selecting, sequencing, shifting, signifying, simulating, sourcing, specifying, stabilizing, stressing, structuring, styling, stylizing, submitting, subsidizing, substituting, summing, summarizing, supplementing, surveying, surviving, suspending, sustaining, symbolizing, taping, targeting, teaming, terminating, tracing, transferring, transforming, transiting, transmitting, transporting, triggering, undergoing, underlying, underestimating, undertaking, unifying, utilizing, validating, varying, violating, visualizing, volunteering</i></p>	Verb - present participle
-ion	<p><i>abstraction, accommodation, accumulation, acquisition, adaptation, administration, aggregation, allocation, alteration, anticipation, appreciation, approximation, assumption, attribution, automation, categorization, citation, clarification, commission, communication, compensation, compilation, computation, concentration, conception, conceptualization, conclusion, confirmation, conformation, constitution, construction, consultation, contradiction, contribution, convention, conversion, cooperation, coordination, corporation, creation, criterion, deduction, definition, demonstration, denotation, depression, deregistration, deregulation, derivation, detection, deviation, devotion, differentiation, dimension, diminution, discretion, disproportion, distinction, distortion, distribution, diversification, documentation, domination, dramatization, duration, edition, elimination, equation, erosion, estimation, evaluation, evolution, exclusion, exhibition, expansion, expansionism, exploitation, externalization, extraction, facilitation, federation, fluctuation, formulation, foundation, function, generation, globalization, identification, illustration, immigration, implementation, implication, imposition, inclination, incorporation, indication, induction, indiscretion, inhibition, initiation, innovation, insertion, inspection, institution, instruction, integration, intensification, intension, interaction, interpretation, intervention, investigation, isolation, itemization, justification, legislation, liberalization, liberation, location, manipulation, maturation, maximization, mediation, migration, mineralization, modification, motivation, neutralization, normalization, notion, occupation, option, orientation, participation, perception, portion, precision, prediction, presumption, prioritization, prohibition,</i></p>	Noun

-ion	<i>projection, promotion, proportion, publication, quotation, rationalization, reaction, region, reconstruction, redistribution, reevaluation, reformulation, registration, reinterpretation, rejection, relaxation, relocation, reorientation, resolution, restoration, restriction, retention, revelation, revision, revolution, section, selection, simulation, specification, stabilization, submission, subordination, substitution, succession, summation, summarization, suspension, tension, termination, tradition, transformation, transition, transmission, transportation, unification, utilization, validation, variation, version, violation, vision, visualization</i>	Noun
-ish	<i>English, stylish</i>	Adjective
-ism	<i>empiricism, expansionism, individualism, isolationism, liberalism, mechanism, professionalism, rationalism, sexism, symbolism</i>	Noun
-ist	<i>environmentalist, evolutionist, exclusionist, individualist, minimalist, psychologist, revolutionist, scientist, strategist, theorist, traditionalist</i>	Noun - person
-ity	<i>accessibility, adaptability, ambiguity, authority, availability, brevity, capability, capacity, clarity, commodity, community, compatibility, complexity, conformability, conformity, creativity, diversity, enormity, entity, ethnicity, eventuality, externality, facility, finality, flexibility, illegality, immaturity, incompatibility, inflexibility, identity, individuality, inevitability, insecurity, instability, intensity, integrity, intensity, invalidity, invisibility, legality, majority, maturity, mentality, minority, neutrality, nonconformity, normality, objectivity, passivity, predictability, priority, rationality, reliability, rigidity, security, sexuality, similarity, specificity, stability, sustainability, uniformity, unpredictability, utility, validity, variability, visibility</i>	Noun
-ive	<i>adaptive, administrative, affective, alternative, communicative, comprehensive, conclusive, constitutive, constructive, consultative, contrastive, cooperative, creative, definitive, demonstrative, derivative, distinctive, distributive, evaluative, exclusive, expansive, illustrative, inconclusive, indicative, innovative, instructive, intensive, interactive, interpretative, interpretive, investigative, legislative, manipulative, negative, objective, passive, positive, prohibitive, prospective, qualitative, reactive, responsive, restrictive, retentive, selective, successive, uncommunicative, unresponsive, unrestrictive</i>	Adjective
-ize, -ise	<i>categorize, comprise, conceptualize, contextualize, civilize, dramatize, emphasize, externalize, finalize, hypothesize, institutionalize, internalize, itemize, liberalize, maximize, minimize, neutralize, normalize, organize, philosophize, prioritize, rationalize, realize, recognize, revise, revolutionize, stabilize, stylize, subsidize, summarize, symbolize, utilize, visualize</i>	Verb
-less	<i>ceaseless, (colorless), (defenseless), (homeless), (jobless)</i>	Adjective

-ly	<i>abnormally, abstractly, academically, accurately, adequately, administratively, affectively, alternatively, analytically, annually, apparently, appreciably, appropriately, approximately, arbitrarily, assuredly, automatically, briefly, chemically, coherently, communicatively, comprehensively, conceivably, conceptually, conclusively, concurrently, consequently, considerably, consistently, constantly, constitutionally, contrarily, controversially, conventionally, conversely, convincingly, cooperatively, correspondingly, creatively, crucially, culturally, definitely, demonstrably, demonstratively, devotedly, discretely, disproportionately, distinctively, distinctly, diversely, domestically, dramatically, dynamically, economically, emphatically, empirically, energetically, enormously, environmentally, erroneously, ethically, eventually, evidently, exclusively, expertly, explicitly, finally, financially, inappropriately, infinitely, functionally, fundamentally, globally, hypothetically, identically, ideologically, illegally, illogically, implicitly, inadequately, incidentally, incoherently, inconceivably, inconclusively, inconstantly, indefinitely, indistinctly, individually, inevitably, inherently, initially, insignificantly, institutionally, insufficiently, intelligently, intensely, intensively, interactively, internally, intrinsically, invariably, justifiably, legally, liberally, logically, manually, marginally, medically, mentally, minimally, mutually, negatively, normally, objectively, obviously, passively, periodically, persistently, philosophically, physically, positively, potentially, precisely, predictably, predominantly, presumably, previously, primarily, principally, professionally, proportionally, proportionately, psychologically, qualitatively, radically, randomly, rationally, regionally, reluctantly, reliably, restrictively, rigidly, schematically, securely, selectively, sequentially, sexually, significantly, similarly, solely, specifically, spherically, statistically, strategically, structurally, subsequently, successively, sufficiently, symbolically, technically, technologically, temporarily, tensely, thematically, theoretically, traditionally, unambiguously, ultimately, uniformly, uniquely, validly, variably, virtually, visibly, visually, voluntarily</i>	Adverb
-ment	<i>abandonment, accompaniment, achievement, acknowledgement, adjustment, amendment, assessment, assignment, attachment, attainment, commencement, comment, commitment, complement, disestablishment, displacement, document, element, enforcement, enhancement, environment, equipment, establishment, implement, investment, involvement, readjustment, reassessment, refinement, reinforcement, requirement, reinvestment, supplement</i>	Noun
-ness	<i>appropriateness, arbitrariness, awareness, intensesness, randomness, responsiveness, uniqueness</i>	Noun
-ology	<i>(biology), (cosmology), (ecology), ideology, methodology, psychology, technology, (zoology)</i>	Noun

-ous	ambiguous , ambitious, analogous , anxious, cautious, conscious, curious, enormous , <i>erroneous</i> , obvious , precious, previous , serious, suspicious, <i>unambiguous</i> , various	Adjective
-ship	<i>authorship</i> , companionship, fellowship, friendship, leadership, membership, ownership, partnership , worship	Noun
-ure	adventure, agriculture, creature, <i>culture</i> , enclosure, exposure , failure, figure, <i>feature</i> , furniture, future, infrastructure , lecture , <i>legislature</i> , literature, manufacture, measure, mixture, nature, picture, pleasure, pressure, <i>procedure</i> , signature, structure , temperature, treasure	Noun
-ward	awkward, backward, forward, inward, outward, straightforward , toward	Adverb

8.7 Symbols, Units, and Constants

The Greek Alphabet

Greek letters are used as symbols for constants and special functions in science, engineering and mathematics.

alpha	A	α	iota	I	ι	rho	Ρ	ρ
beta	B	β	kappa	K	κ	sigma	Σ	σ
gamma	Γ	γ	lambda	Λ	λ	tau	Τ	τ
delta	Δ	δ	mu	Μ	μ	upsilon	Υ	υ
epsilon	Ε	ε	nu	Ν	ν	phi	Φ	φ
zeta	Z	ζ	xi	Ξ	ξ	chi	Χ	χ
eta	Η	η	omicron	Ο	ο	psi	Ψ	ψ
theta	Θ	θ	pi	Π	π	omega	Ω	ω

SI Prefixes

The International System of Units is the standard metric system used in science.

Name	Symbol	Factor		Name	Symbol	Factor
yotta	Y	10^{24}		deci	d	10^{-1}
zetta	Z	10^{21}		centi	c	10^{-2}
exa	E	10^{18}		milli	m	10^{-3}
peta	P	10^{15}		micro	μ	10^{-6}
tera	T	10^{12}		nano	n	10^{-9}
giga	G	10^9		pico	p	10^{-12}
mega	M	10^6		femto	f	10^{-15}
kilo	k	10^3		atto	a	10^{-18}
hecto	h	10^2		zepto	z	10^{-21}
deka	da	10^1		yocto	y	10^{-24}

8.7 Symbols, Units, and Constants

SI Units

There are seven fundamental units.

Name	Symbol	Measure
meter	m	length
kilogram	kg	mass
second	s	time
ampere	A	electric current
kelvin	k	temperature
mole	mol	amount of substance
candela	cd	luminous intensity

Science Constants

Constant	Symbol	Value in SI units
acceleration of free fall	g	9.80665 m s ⁻²
Avogadro constant	L, N _A	6.0221417 × 10 ²³ mol ⁻¹
Boltzmann constant	k, k _B	1.3806503 × 10 ⁻²³ m ² kg s ⁻² K ⁻¹
Permittivity of free space	ε ₀	8.8541878 × 10 ⁻¹² F m ⁻¹
electron rest mass	m _e	9.1093897 × 10 ⁻³¹ kg
elementary charge	e	1.6021764 × 10 ⁻¹⁹ C
Faraday constant	F	9.6485339 × 10 ⁷ C mol ⁻¹
gas constant	R	8.3144722 J K ⁻¹ mol ⁻¹
gravitational constant	G	6.67428 × 10 ⁻¹¹ m ³ kg ⁻¹ s ⁻²
Loschmidt's number	n ₀	2.6867774 × 10 ²⁵ m ⁻³
magnetic constant	μ ₀	4 × (pi) × 10 ⁻⁷ NA ⁻²
Planck constant	h	6.6260689 × 10 ⁻³⁴ J s
speed of light	c	2.99792458 × 10 ⁸ m s ⁻¹
Stefan-Boltzmann constant	ρ	5.6704004 × 10 ⁻⁸ W m ⁻² K ⁻⁴

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