APPENDIX 2.2 ROOT WORDS USED FREQUENTLY IN CHEMISTRY

root		*meaning*	*example*	*explanation*
-ane	-	single covalent bond	alkane, propane	alkanes have only single bonds
-ene	-	double covalent bond	alkene, polypropylene	alkenes have one or more double bonds
-ion	L	process	fusion	the process of combing or fusing nuclei to form a heavier nucleus
-oid	G	like, form	metalloid	some properties are like those of metals
-yne	-	triple covalent bond	alkyne, ethyne	alkynes have one or more triple bonds
-meter	G	measure	calorimeter	measures heats of reactions
a-	G	not, without	amorphous carbon	carbon without crystalline shape
acid	L	sour, sharp	hydrochloric acid	acids stimulate the sour taste buds
alkali	Ar	soda ash, alkali	alkali lake	alkali lakes have very high mineral content
allo, -io	G	other, different	allotrope	one of the two or more forms of an element that have the same physical state
alpha	G	1st letter of Greek alphabet	alpha particle	designated by the letter "alpha"
amin	N	ammonia	amine, amino acid	an ammonia base in which one or more of the three hydrogens is replaced by an alkyl group
amph, -i, -o	G	double, on both sides	amphoteric, amphibian	amphoteric species react either as acids or bases
anti	G	against, opposite	antiseptic	substance that works against microbes
aqua	L	water	aqueous solution	water based solution
baro	G	pressure	barometer, bar	barometer measures pressure
beta	G	second letter of Greek alphabet	beta particle	designated by the letter beta
bi	L	two	binary compounds	compound made of two elements
bio	G	life	biochemistry	chemistry of living systems
carb, -o, -on	L	coal, carbon	carbohydrate	compound made of carbon, hydrogen, and oxygen $(CH_2O)_n$
chem	G	chemistry	chemical kinetics	the kinetics of a chemical reaction
co, -l, m, -n	L	with, together	coefficient, colligative	number that appears with a formula in a chemical equation
com	L	with, together	composition reaction	A reaction in which molecules are assembled
conjug	L	joined together	conjugate acid, conjugal	acid formed from its conjugate base by the addition of a proton
cosm,-o	G	the world or universe	cosmic rays, cosmos	high energy rays from space (the cosmos)
cry, -mo, -o	G	cold	crystal	crystals form when solutions are cooled
de	L	down, without, from	decomposition, denature, dehydrate	a reaction in which materials are broken down

		from	denature, dehydrate	
dens	L	thick	density, dense	density is a measure of how "thick" a fluid is (how much mass per unit volume)
di	G	separate, double, across,	disaccharide	two monosaccharides tied together
dis	G	separate, apart	dissociation	separation of ions when dissolving
duc, -t	L	lead	ductile	able to be pulled or led through a small opening to produce a wire
e	L	out, without, from	evaporation	the process of vapor leaving from
ef	L	out, from, away	effervescence	rapid escape of gas from a liquid in which it is dissolved
electr, -i, -o	G	electrode	electrolyte	dissolves in water to give a solution that conducts an electric current
elem	L	basic	elements	can't be broken down into more basic substances by normal chemical means
empir, -o	G	experienced	empirical	based upon experience or observation
en	G	in, into	endothermic	a reaction which takes in heat
equ	L	equal	equilibrium	a dynamic condition in which two opposing reactions occur at equal rates
erg	G	work	energy, erg	energy is the ability to perform work
exo	G	out, outside, without	exothermic	exothermic reactions give heat to the outside environment
ferr, -o	L	iron	ferromagnetism	strongly attracted to a magnet, like iron
fiss, -i, -ur	L	cleft, split	fission	the splitting of nuclei
flu	L	flow	fluids	gases and liquids are fluids because they flow
fract	L	break, broken	fractional distillation	distillation in which the components of a mixture are "broken down" and separated by different boiling points
gamma	G	3rd letter of the Greek alphabet	gamma rays	high energy electromagnetic waves identified by the Greek letter gamma
gen	G	bear, produce, beginning	gene	a section of a DNA chain that codes for a particular protein that the organism can produce
glyc, -er, -o	G	sweet	glycogen, glycolysis, glycolipid	a sugar (glucose) based polymer that stores energy in animals
graph, -o, -y	G	write, writing	graphite	form of carbon used in pencils
halo-	G	salt	halogens	halogens (*e.g.* F, Cl, Br) are often found in salts (e.g. NaF, NaCl, KBr)
hetero-	G	other, different	heterogeneous mixture	a mixture in which properties and composition differ from point to point
hom, eo, -o	G	same, alike	homogeneous mixture	a mixture in which properties and composition are the same throughout
hybrid	L	a mongrel, hybrid, combination	hybrid orbital	orbitals produced by the combination of two or more orbitals of the same atom.
hydr, -a, -i, -o	G	water	hydrolysis	the breaking of bonds using water.
hyper	G	over, above, excessive	*(hy)*perchloric acid	the oxidation state of chlorine in perchloric acid is above what it is in chloric acid

		excessive		acid is above what it is in chloric acid.
hypo	G	under, beneath	hypochlorous acid	the oxidation state of chlorine in hypochlorous acid is below the oxidation sate of chlorine in chlorous acid
im	L	not	immiscible	not mutually soluble (not miscible)
in	L	in, into	intrinsic physical properties	properties inherent to a substance, and not upon the amount present
iso	G	equal	isomers	compounds that have the same molecular formula, but different structures
kilo	G	thousand	kilogram	1000 grams
kine	G	move, moving, movement	kinetic energy	energy of motion
lip, -o	G	fat	lipoprotein	fatty acid combined with protein
liqu, -e, -i	L	fluid, liquid	liquefy	the process of becoming a liquid
lys, -io, -is, -io	G	loose, loosening, breaking	hydrolysis	the breaking apart of a substance by an electric current
macr, -o	G	large, long	macromolecule	macromolecules are large organic molecules
malle, -o, -us	L	hammer	malleable	ability to bend and shape when hit by a hammer
mer, -e, -i,-o	G	a part	dimer	made of two parts
met, -a	G	between, change	metabolism	reactions that change biochemicals from one form to another
meter	G	measure	calorimeter	measures heat energy (calories)
mill -e, -i, -o	L	one thousand	milliliter	one thousandth of a liter
misc	L	mix	miscible	when two solvents dissolve (mix evenly) in each other
mon -a, -er, -o	G	single, one	monomer	single molecular units that can join to form a polymer
morph, -a, -o	G	form	amorphous sulfur	sulfur without definite crystals or shape
neo	G	new, recent	neoprene	a synthetic (new) rubber
neutr	L	neither	neutral	neither positive nor negative
nom, -en, -in	G	name	nomenclature	system of assigning names
non	L	not, ninth	nonpolar	does not have polar characteristics
nuc, -ell, -i	L	nut, center	nucleus	center of the atom
oct, -i, -o	L	eight	octet rule	tendency to acquire a total of 8 electrons in highest energy level
orbi, -t, to	L	circle	orbital	electrons travel around the nucleus in patterns known as orbitals
oxid	F	oxygen	oxide	compound containing oxide ion
photo		light	photochemical smog	air pollutants transformed by sunlight
polar, -i	L	of the pole, polarity	polar covalent	one pole of the bond has a more negative character, and the other a more positive character
poly	G	many	polymer	many molecules bound together to make a new, longer molecule molecule

pro	G	forward, positive, for, in front of	proton	positively charged particle
quant	L	how much	quantum	refers to a discrete amount of energy
radi, -a, -o,	L	spoke, ray, radius	radioactive	produces rays of electromagnetic energy
sacchar, -o	G	sugar	monosaccharide	single sugar unit
sal, -i	L	salt	salinity	referring to the amount of salt in solution
solu-	L	dissolve	solubility	refers to the tendency to dissolve
spect	L	see, look at	spectator ions	ions that "watch" but are not involved in a reaction
super	L	above, over	superheated	retaining liquid properties beyond the normal boiling point
syn	G	together, with	photosynthesis	molecules are put together with energy derived from light.
therm, -o	G	heat	thermochemistry	the study of changes in heat energy accompanying chemical and physical changes
thesis	G	an arranging, statement	hypothesis	a testable statement
tran, -s	L	across, through	transition elements	elements through which you pass when going from the right to left side of the periodic table
un	L	not	unsaturated	bonds that are not saturated
vapor, -i	L	steam, vapor	vaporization	the process of changing a liquid into a vapor
vulcan	L	fire	vulcanized	vulcanized rubber has been treated with heat

APPENDIX 2.3 ETYMOLOGY OF THE NAMES OF THE ELEMENTS

Actinium	Ac	89	1900	Greek: *aktis*, ray
Aluminum	Al	13	1825	Latin: *alumen*, substance with astringent taste
Americium	Am	95	1944	English: *America*
Antimony	Sb	51	1400s	Greek: *antimonos*, opposite to solitude
Argon	Ar	18	1894	Greek: *argos*, inactive
Arsenic	As	33	1200s	Greek: *arsenikon*, valiant
Astatine	At	85	1940	Greek: *astatos*, unstable
Barium	Ba	56	1808	Greek: *barys*, heavy
Berkelium	Bk	97	1949	English: University of California *Berkeley*
Beryllium	Be	4	1797	Greek: *beryllos*, a mineral
Bismuth	Bi	83	1400s	German: *bisemutum*, white mass
Boron	B	5	1808	Arabic: *bawraq*, white, borax
Bromine	Br	35	1826	Greek :*bromos*, a stench
Cadmium	Cd	48	1817	Latin: *cadmia*, calamine, a zinc ore
Calcium	Ca	20	1808	Latin: *calcis*, lime
Californium	Cf	98	1950	English: State and University of *California*
Carbon	C	6	prehistoric	Latin: *carbo*, coal
Cerium	Ce	58	1804	English: The asteroid *Ceres*, discovered 1803
Cesium	Cs	55	1860	Latin: *caesius*, sky blue
Chlorine	Cl	17	1808	Greek: *chloros*, grass green
Chromium	Cr	24	1797	Greek: *chroma*, color
Cobalt	Co	27	1735	Greek: *kobolos*, a goblin
Copper	Cu	29	prehistoric	Latin: *cuprum*, copper
Curium	Cm	96	1944	French: Marie & Pierre *Curie*
Dysprosium	Dy	66	1886	Greek: *dysprositos*, hard to get at
Einsteinium	Es	99	1952	German: *Albert Einstein*
Erbium	Er	68	1843	Swedish: *Ytterby*, town in Sweden where discovered
Europium	Eu	63	1900	English: Europe
Fermium	Fm	100	1953	Italian: Enrico *Fermi*
Fluorine	F	9	1886	Latin: *fluere*, to flow
Francium	Fr	87	1939	French: *France*
Gadolinium	Gd	64	1886	Finnish: Johan *Gadolin*, Finnish chemist
Gallium	Ga	31	1875	Latin: *Gaul*, or France
Germanium	Ge	32	1886	German: Germany
Gold	Au	79	prehistoric	Anglo-Saxon: for gold; symbol from Latin *aurum* for gold
Hafnium	Hf	72	1922	Latin: *Hafnia*, the city of Copenhagen, Denmark
Helium	He	2	1895	Greek: *helios*, the sun
Holmium	Ho	67	1879	Latin: *Holmia*, the city Stockholm, Sweden
Hydrogen	H	1	1766	Greek *hydro genes*, water former
Indium	In	49	1863	Latin: *indicum*, produces an indigo-blue spectrum line
Iodine	I	53	1811	Greek: *iodes*, produces a violet-like *spectrum line*
Iridium	Ir	77	1804	Latin: *iridis*, rainbow
Iron	Fe	26	prehistoric	Anglo Saxon: *iren*, symbol from Latin *ferrum*
Krypton	Kr	36	1898	Greek: *kryptos*, hidden
Lanthanum	La	57	1839	Greek: *lanthanien*, to be concealed
Lawrencium	Lw	103	1961	English: Earnest *Lawrence*, inventor of cyclotron
Lead	Pb	82	prehistoric	Anglo Saxon: *lead*; symbol from Latin: *plumbum*
Lithium	Li	3	1817	Greek: *lithos*, stone
Lutetium	Lu	71	1905	Latin: *Lutetia*, ancient name of Paris
Magnesium	Mg	12	1774	Latin: *magnes*, magnet
Mendelevium	Md	101	1955	Russian: Dmitri *Mendeleev*, devised periodic table
Mercury	Hg	80	prehistoric	Latin: *Mercury*, messenger; Symbol *Hydrarygus*, liquid silver
Molybdenum	Mo	42	1782	Greek: *molybdos*, lead
Neodymium	Nd	60	1885	Greek: *neos*, new and *didymos*, twin
Neon	Ne	10	1898	Greek: *neos*, new

Neptunium	Np	93	1940	English: planet Neptune
Nickel	Ni	28	1750	German: *kupfernickel*:, false copper
Niobium	Nb	41	1801	Greek: *Niobe*, mythological daughter of Tantalus
Nitrogen	N	7	1772	Latin: *nitro*, native soda and *gen*, born
Nobelium	No	102	1957	Swedish: Alfred *Nobel*, discoverer of dynamite
Osmium	Os	76	1804	Greek: *osme*, odor of volatile tetroxide
Oxygen	O	8	1774	Greek: *oxys*, sharp, and *gen*, born
Palladium	Pd	46	1803	English: planetoid *Pallas*, discovered 1801
Phosphorus	P	15	1669	Greek: *phosphoros*, light bringer
Platinum	Pt	78	1735	Spanish: *plata*, silver
Plutonium	Pu	94	1940	English: *Pluto* the planet
Polonium	Po	84	1898	Polish: *Poland*, country of co-discoverer Marie Curie
Potassium	K	19	1807	English: *potash*; symbol Latin *kalium*
Praseodymium	Pr	59	1885	Greek: *Praseos*, leek green and *didymos*, a twin
Promethium	Pm	61	1947	Greek: *Prometheus*, fire bringer in Greek mythology
Protactinium	Pa	91	1917	Greek: *protos* first
Radium	Ra	88	1898	Latin: *radius*, ray
Radon	Rn	86	1900	Latin: comes from *radium*
Rhenium	Re	75	1924	Latin: *Rhenus*, Rhine province of Germany
Rhodium	Rh	45	1804	Greek: *rhodon*, a rose
Rubidium	Rb	37	1860	Latin: *rubidus*, red
Ruthenium	Ru	44	1845	Latin: *Ruthenia*, Russia
Samarium	Sm	62	1879	Russian: *Samarski*, a Russian engineer
Scandium	Sc	21	1879	Scandinavian: *Scandinavia*
Selenium	Se	34	1817	Greek: *selene*, moon
Silicon	Si	14	1823	Latin: silex, flint
Silver	Ag	47	prehistoric	Anglo-Saxon, *siolful*; symbol Latin: *argentum*
Sodium	Na	11	1807	Latin: *sodanum* for headache remedy; symbol Latin: *natrium*
Strontium	Sr	38	1808	Scottish: town of *Strontian*, Scotland
Sulfur	S	16	prehistoric	Latin: *sulphur,* sulfur
Tantalum	Ta	73	1802	Greek: *Tantalus* of Greek mythology
Technetium	Tc	43	1937	Greek: *technetos*, artificial
Tellurium	Te	52	1782	Latin: *tellus*, the earth
Terbium	Tb	65	1843	Swedish: *Ytterby*, town in Sweden
Thallium	Tl	81	1862	Greek: *thallos*, a young shoot
Thorium	Th	90	1819	Scandinavian: *Thor* from Scandinavian mythology
Thulium	Tm	69	1879	Latin: *Thule*, northerly part of habitable world
Tin	Sn	50	prehistoric	Latin: Etruscan god, Tinia; symbol Latin: *stannum*
Titanium	Ti	22	1791	Greek: Greek mythology, *Titans* first sons of the earth
Tungsten	W	74	1783	Swedish: *tung sten*, heavy stone, symbol German: *worfram*
Uranium	U	92	1789	English: Planet *Uranus*
Vanadium	V	23	1830	Scandinavian: goddess *Vanadis* of Scandinavian mythology
Xenon	Xe	54	1898	Greek: *xenos*, strange
Ytterbium	Yb	70	1905	Scandinavian: Ytterby, a town in Sweden
Yttrium	Y	39	1843	Scandinavian: Ytterby, a town in Sweden
Zinc	Zn	30	prehistoric	German: *Zink*, akin to *Zinn*, tin
Zirconium	Zr	40	1824	named for the mineral, *zircon*

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