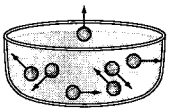
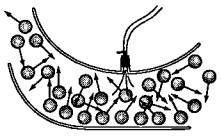
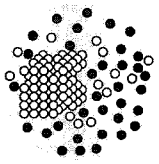
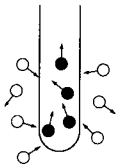
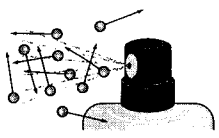
BLM 5A-1 Energy and Chemical Change

1. gravitational potential
2. kinetic mechanical
3. no; Something has potential energy only if it can fall some distance.
4. energy of motion or action
5. mechanical kinetic energy
6. no; For something to have kinetic energy, it must be moving or giving off heat or light.
7. chemical
8. yes; The apple has chemical energy in its food chemicals.
9. potential; kinetic

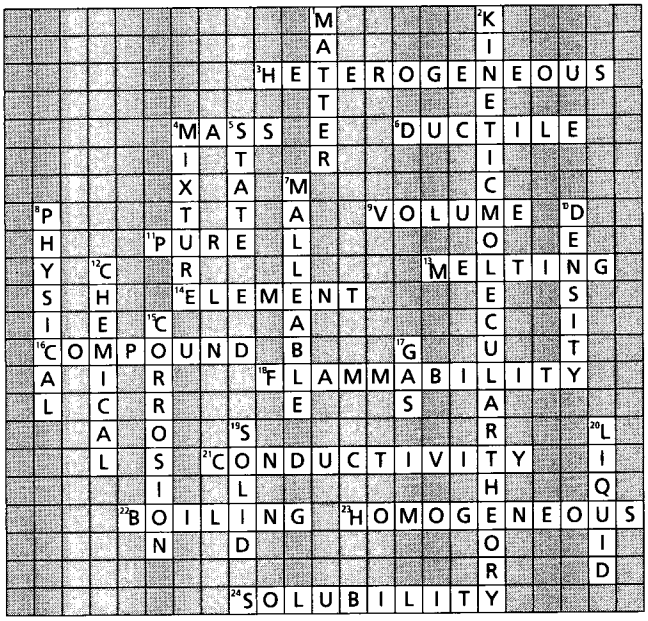
BLM 5.4-1 Big Picture, Little Picture

1.

Macroscopic	Microscopic
Hot Soup – feels hot – can burn the tongue	 Particles are moving around very rapidly. The energy is mechanical rather than heat energy.
Inflating a bicycle tire – As the pump is used, the tire gets harder and harder.	 Each time the pump works, a new "batch" of particles is added to the same volume, increasing the total number in the space, and their motion pushes on the tire.
Dissolving sugar – When sugar is added to water, it seems to disappear from sight, but its sweetness can be tasted.	 When solid sugar is added to water, the motion of the water particles begins to "dislodge" the sugar particles, freeing them to mix with the water particles.
Thermometer rising Heat makes the material increase in volume and it rises in the thermometer rise. A scale shows the temperature.	 The heat makes the particles of the material in the thermometer move more quickly, which causes them to move farther and increases the spaces between them.
Smelling cologne The smell of cologne can be smelled even when you are not near the source. It seems to travel invisibly through the air.	 The particles of the cologne are fast moving and enter the air moving in straight lines. They bounce around in the air until some of the particles can be found in all parts of the room.

2. No. The particle does not have heat, since thermal energy is the motion of particles. It is really kinetic mechanical energy at a microscopic level.
3. The motion of a greater number of particles pushes with greater pressure on the tire. If too many particles are pushed into the tire, the tire can rupture or even explode.
4. No. "Dissolve" does mean disappear if by disappear we mean "can't be seen." But it does not mean that the sugar is gone, it has just become separated into particles too small to be seen.
5. When the temperature drops, the particles of the fluid in the thermometer lose energy to the outside and slow down. This means that they take up less space, and the fluid in the thermometer moves to a lower point on the scale.
6. You sense the particles of the cologne itself. This means that when you smell a poisonous material, the bad chemical is entering your nose!

WS 5.0-1 Matter and Change Crossword



Chapter 5 Quiz

Part A: Matching

1. A: (g), B: (d), C: (f), D: (j), E: (e), F: (b), G: (h), H: (i), I: (a), J: (c)

Part B: Sentence Completion

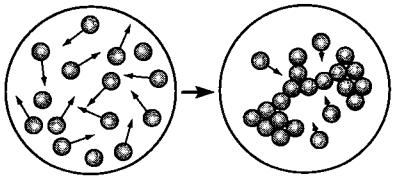
2. less
3. past
4. do not
5. snow
6. physical; chemical
7. malleable; physical
8. corrosion; chemical

Part C: Multiple Choice

9. (d); 10. (d); 11. (c); 12. (b); 13. (c); 14. (b); 15. (a); 16. (b)

Part D: Short Answer

17. There might be several answers, but two sensible suggestions could be
    (a) Put all the mixture in water or warm water, pour off, and save the liquid. Wash the sand, saving each washing with the other liquid. Dry the sand. Evaporate the other liquid, leaving the salt.
    (b) Use a magnifying glass and tweezers to separate the salt crystals from the sand crystals. Use ultraviolet light, if necessary, to show the difference between the salt and sand. Alternatively, the salt could be dissolved in water, and then recrystallized by evaporating the water.
18. Answers will vary, but essentially the water cools the fire initially and as it is turned into steam. This will, hopefully, cool the chemicals below their ignition temperature. The steam is denser than oxygen and so displaces the oxygen from the flames, preventing the burning.
19. As the gas particles cool, they slow down and the attraction between them increases, so that they begin to join together to form a solid. The size and shape of the particles determines the structure of the crystals.



20. (a) high internal reflection (sparkle and fire), hardness
    (b) hardness

WS 6.1-1 History of Chemistry Word Scramble

1. Chemistry
2. Metals
3. Metallurgy
4. Middle Ages
5. Spiritual
6. Philosopher's Stone
7. Alloys
8. Elements
9. Compounds
10. Proportion

WS 6.2-1 "It's So Elementary."

Materials	Colour	Lustre	Malleability	Ductility	Tendency to form gases at room temperature
liquid bromine	reddish–brown	no	no	no	moderate
carbon	black	no	no	no	very high
oxygen	none	no	no	no	very high
nitrogen	none	no	no	no	very high
sulfur crystals	yellow	no	no	no	nil
H2 filled balloon	none	no	no	no	very high
aluminum foil	grey	yes	yes	yes	nil
sheet of iron	grey	yes	yes	yes	nil
copper wire	reddish–brown	yes	yes	yes	nil
zinc	grey	yes	yes	yes	nil
calcium	grey	yes	yes	yes	nil
magnesium	grey	yes	yes	yes	nil
silicon	grey blue	yes	no	no	nil
germanium	grey white	yes	no	no	nil

Hydrogen: Burns very rapidly; it creates a large "bang."
Calcium: Reacts with water to form hydrogen gas; the smaller amount in the test tube makes a "pop."
Potassium: Reacts vigorously with water to make potassium hydroxide and hydrogen. The reaction is so exothermic, it ignites the hydrogen and the potassium appears to burn.

BLM 6.2-1 Element Puns

1. act, actinium, Ac
2. iron, Fe
3. tongue, tungsten, W
4. arsonist, arsenic, As
5. kryptonite, krypton, Kr
6. boring, boron, B
7. zirconium, Zr
8. geranium, germanium, Gr; rhododendron, rhodium, Rh
9. neon, Ne
10. copper, Cu
11. California, californium, Cf
12. techie, technetium, Tc
13. Nobel Prize, nobelium, No
14. einsteinium, Es
15. neptunium, Np
16. Xena, xenon, Xe
17. sink, zinc, Zn
18. Titanic, titanium, Ti
19. half, hafnium, Hf
20. calcium, Ca; iron, Fe
21. Tin Man, tin, Sn
22. plutonium, Pu
23. sell fur, sulfur, S
24. silly con, silicon, Si
25. bro o' mine, bromine, Br
26. are gone, argon, Ar
27. Auntie Mony, antimony, Sb
28. sewed 'em, sodium, Na
29. curium, Cm; helium, He; barium, Ba
30. palladium, Pd; samarium, Sm
31. you rope 'em, europium, Eu
32. rains, uranium, U
33. tellurium, Te
34. nitrogen, N
35. Sam I Am, samarium, Sm

Chapter 6 Quiz

Part A: Matching

1. A: (m), B: (f), C: (h), D: (e), E: (c), F: (k), G: (b), H: (d), I: (g), J: (a), K: (j), L: (i), M: (l)

Part B: Multiple Choice

2. (d); 3. (c); 4. (a); 5. (c); 6. (b); 7. (a); 8. (d); 9. (b); 10. (d); 11. (d); 12. (a); 13. (c); 14.(b)

Part C: Sentence Completion

15. mercury
16. increasing
17. lead, plumbum

Part D: Short Answer

18. Metals are used because they are ductile and they conduct electricity.
19. (a) C, Cr, Ca, Cm, Cd, Ce, Cn
    (b) Only Cn or Cm can still be used.
20. (a) Any one of scandium, germanium, and gallium
    (b) Mendeleev was confident that the family properties were more indicative of proper placement of the elements than atomic mass alone.

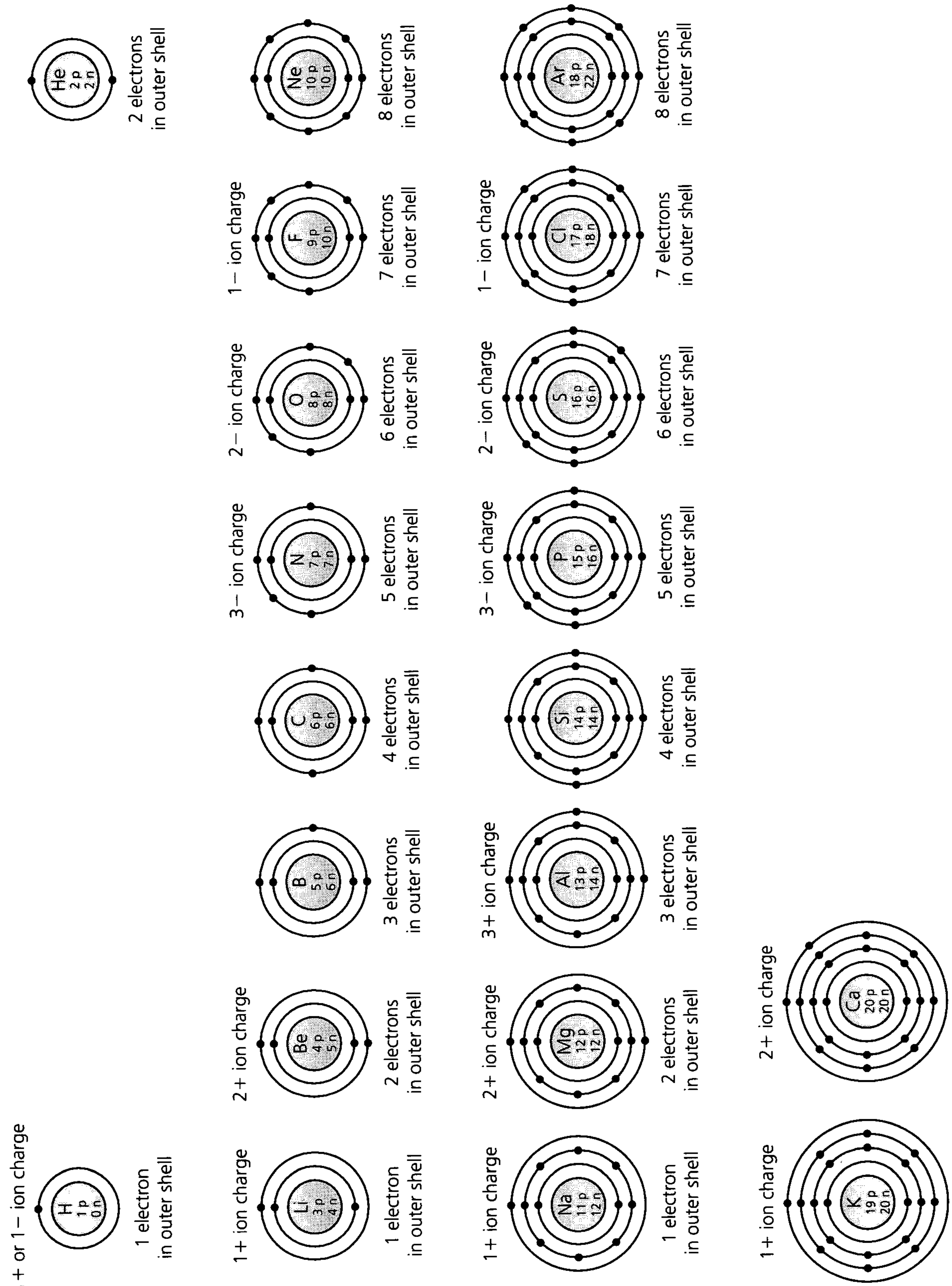
WS 7.1-1 Atomic Theories

Atomic theory	Nickname/ visual image	Differences from previous theory	Similarities to previous theory
Dalton	billiard ball	• Each element has its own type of atom. • All atoms of an element are identical. • An atom is indivisible. • Compounds are formed when two or more atoms are joined together.	• Matter is made of atoms.
Thomson	raisin bun	• Most of the atom is a positive mass. • Negative electrons are evenly distributed throughout.	• Matter is made of atoms. • Each element has its own type of atom. • All atoms of an element are identical. • Compounds are formed when two or more atoms are joined together.
Rutherford	planetary model	• Positive protons and neutral neutrons are in the nucleus. • The nucleus is a very small space in the centre of the atom and makes up most of the mass. • Electrons orbit around the nucleus like satellites around a planet. • Elements can have several isotopes.	• Matter is made of atoms. • Each element has its own type of atom. • Compounds are formed when two or more atoms are joined together.
Bohr	solar system	• Electrons orbit the nucleus in specific, allowed orbits or shells. • Electrons absorb or emit energy to move between shells. • There is a maximum number of electrons that can occupy each shell (2/8/8 for the first 20 elements).	• Matter is made of atoms. • Each element has its own type of atom. • Compounds are formed when two or more atoms are joined together. • Positive protons and neutral neutrons are in the nucleus. • The nucleus is a very small space in the centre of the atom, and makes up most of the mass. • Elements can have several isotopes.

WS 7.2-1 Subatomic Particles

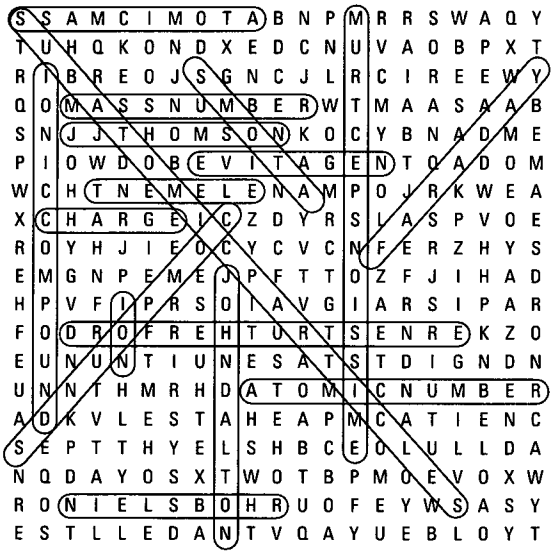
Element name	Atomic number	Mass number	Standard atomic notation	Number of protons	Number of electrons	Number of neutrons
aluminum	13	27	$^{27}_{13}Al$	13	13	14
argon	18	40	$^{40}_{18}Ar$	18	18	22
beryllium	4	9	$^{9}_{4}Be$	4	4	5
boron	5	11	$^{11}_{5}B$	5	5	6
calcium	20	40	$^{40}_{20}Ca$	20	20	20
carbon	6	12	$^{12}_{6}C$	6	6	6
chlorine	17	35	$^{35}_{17}Cl$	17	17	18
fluorine	9	19	$^{19}_{9}F$	9	9	10
helium	2	4	$^{4}_{2}He$	2	2	2
hydrogen	1	1	$^{1}_{1}H$	1	1	0
lithium	3	7	$^{7}_{3}Li$	3	3	4
magnesium	12	24	$^{24}_{12}Mg$	12	12	12
neon	10	20	$^{20}_{10}Ne$	10	10	10
nitrogen	7	14	$^{14}_{7}N$	7	7	7
oxygen	8	16	$^{16}_{8}O$	8	8	8
phosphorus	15	31	$^{31}_{15}P$	15	15	16
potassium	19	39	$^{39}_{19}K$	19	19	20
silicon	14	28	$^{28}_{14}Si$	14	14	14
sulfur	16	32	$^{32}_{16}S$	16	16	16
sodium	11	23	$^{23}_{11}Na$	11	11	12

WS 7.4-1 Bohr Diagram (Templates): First 20 Elements



Note: These Bohr diagrams include the number of neutrons for the most common isotope of the element. This information is optional: Bohr diagrams are often drawn with only the chemical symbol in the centre, or with only the chemical symbol and the number of protons.

WS 7.0-1 Atomic Theory Word Search



Chapter 7 Quiz

Part A: Modified True/False

1. False, J.J. Thomson
2. False, electron
3. False, 8 electrons
4. True

Part B: Sentence Completion

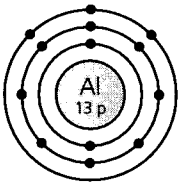
5. the number of protons, or the atomic number
6. becomes less negative/becomes smaller
7. ionic bonds/ionic compounds
8. 18th/last

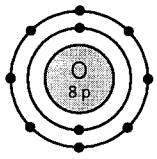
Part C: Multiple Choice

9. (b); 10. (b); 11. (a); 12. (d); 13.(c); 14. (a); 15. (b)

Part D: Short Answer

16. When a non-metal forms an ion, it must acquire extra electrons to fill the vacancies in its outer electron shell, up to the maximum allowed for that shell. The number of extra electrons acquired equals the amount of negative charge on the ion.
17. (a) The minimum number of electrons that must be transferred is 6.
    (b) There must be 3 magnesium ions for every 2 nitride ions.
18. Sodium has only 1 electron in its outer shell, whereas magnesium has 2 electrons in its outer shell. To react and form a compound, the metal atoms must shed the electrons from their outer shell. Less energy is required to remove sodium's 1 outer electron than to remove the 2 outer electrons from a magnesium atom.
19. (a) (b)

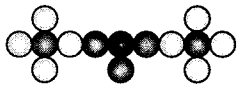
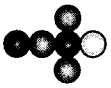
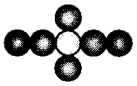




20. The Bohr theory holds that electrons will be found only in specific allowed orbits around the nucleus. When atoms absorb energy, electrons move up to higher orbits. When electrons fall back down, eventually, atoms emit light energy. Within an allowed orbit, the electrons do not emit light energy. There are a maximum number of electrons that can exist in any one orbit or shell.

WS 8.1-1 Writing and Visualizing Chemical Formulas

1.

$(NH_4)_2CO_3$	
Al_2O_3	
Mg_3P_2	
FeF_2	
$KHCO_3$	
Na_2SO_4	

2.

Ions combined		Formula
1 calcium	1 carbonate	$CaCO_3$
1 lead	2 nitrate	$Pb(NO_3)_2$
2 lithium	1 sulphate	Li_2SO_4
1 chromium	1 phosphate	$CrPO_4$
1 magnesium	1 carbonate	$MgCO_3$
3 chromium	2 phosphate	$Cr_3(PO_4)_2$
2 sodium	1 carbonate	Na_2CO_3
1 ammonium	1 hydroxide	NH_4OH
1 barium	1 oxide	BaO
1 barium	2 nitrate	$Ba(NO_3)_2$
1 aluminum	3 fluoride	AlF_3
1 lead	4 chloride	$PbCl_4$
3 lead	4 phosphate	$Pb_3(PO_4)_4$
3 sodium	1 phosphide	Na_3P
2 lithium	1 oxide	Li_2O

WS 8.2-1 Writing Formulas for Ionic Compounds

1.	$ZnBr_2$	11.	$(NH_4)_2Cr_2O_7$	21.	$CuCl_2$	31.	$Mn_3(PO_4)_4$
2.	Na_2O	12.	$AgCH_3COO$	22.	Fe_2O_3	32.	$Fe(NO_3)_2$
3.	$LiOH$	13.	$Na_2Cr_2O_4$	23.	$Mn(NO_3)_2$	33.	$CuCO_3$
4.	CaF_2	14.	Li_2S	24.	$PbBr_4$	34.	$Zn(ClO_3)_2$
5.	Ag_2S	15.	$AlCl_3$	25.	$Cr_2(CO_3)_3$	35.	FeO
6.	$(NH_4)_2S$	16.	$Ca(NO_3)_2$	26.	$Sn(CrO_4)_2$	36.	$HgSO_4$
7.	MgC_2O_4	17.	$(NH_4)_2O$	27.	$PbSO_4$	37.	PbS_2
8.	$BaSO_4$	18.	K_2S	28.	NH_4MnO_4	38.	$Fe_2(CO_3)_3$
9.	$KClO_2$	19.	Ag_2CO_3	29.	$Ag_2C_2O_4$	39.	$K_2C_2O_4$
10.	$Al(NO_3)_3$	20.	$Mg_3(PO_4)_2$	30.	$Fe(OH)_3$	40.	MnS

WS 8.3-1 Naming Ionic Compounds

1.	potassium chloride	21.	lithium oxide
2.	sodium sulphide	22.	sodium cyanide
3.	aluminum chloride	23.	silver chromate
4.	barium oxide	24.	calcium chlorate
5.	silver sulphide	25.	ammonium bicarbonate
6.	aluminum oxide	26.	zinc iodide
7.	lithium fluoride	27.	potassium permanganate
8.	zinc fluoride	28.	barium bromide
9.	magnesium bromide	29.	calcium phosphate
10.	calcium sulphide	30.	sodium dichromate
11.	potassium nitrate	31.	lithium nitrate
12.	magnesium sulphate	32.	magnesium sulphide
13.	zinc hydroxide	33.	sodium hypochlorite
14.	ammonium iodide	34.	potassium monohydrogen phosphate
15.	sodium carbonate	35.	calcium hydroxide
16.	magnesium hydrogen sulphate	36.	ammonium phosphate
17.	silver hydroxide	37.	aluminum dihydrogen phosphate
18.	zinc phosphate	38.	silver chloride
19.	ammonium sulphate	39.	potassium sulphite
20.	aluminum hydrogen sulphide	40.	sodium perchlorate

WS 8.3-2 Naming Ionic Compounds with Multivalent Metal Ions

1.	iron(II) oxide	21.	calcium hydroxide
2.	tin(IV) sulphide	22.	chromium(III) chloride
3.	lead(II) sulphate	23.	chromium(II) carbonate
4.	chromium(III) sulphide	24.	silver sulphate
5.	copper(II) nitrate	25.	ammonium fluoride
6.	iron(III) sulphate	26.	iron(III) dichromate
7.	tin(II) fluoride	27.	lead(II) sulphide
8.	mercury(II) sulphate	28.	copper(II) permanganate
9.	copper(II) phosphate	29.	chromium(III) sulphate
10.	manganese(II) permanganate	30.	copper(II) fluoride
11.	iron(II) hydroxide	31.	chromium(III) hydrogen carbonate
12.	lead(IV) chromate	32.	iron(III) phosphate
13.	copper(I) chloride	33.	sodium sulphide
14.	manganese(IV) oxide	34.	lead(IV) chloride
15.	tin(II) oxalate	35.	mercury(II) nitrate
16.	iron(II) chlorate	36.	chromium(II) oxide
17.	mercury(I) bromide	37.	mercury(I) nitrate
18.	copper(II) hydrogen sulphide	38.	calcium oxalate
19.	manganese(IV) carbonate	39.	barium phosphate
20.	lead(IV) nitrite	40.	tin(IV) sulphate

BLM 8.4-1 Chemical Families Study Guide

Students' responses should be similar to the following sample. Students should complete a chart for each chemical family.

Chemical Family		**Properties That Are Shared by All Members of the Family**
Noble gases		• tasteless, colourless, odourless gas • non-reactive
Element Symbol	**Atomic Number**	**Properties That Are Different from Those of Other Family Members**
He	2	–less dense than air
Ne	10	–bright red emission spectrum –similar density to air
Ar	18	–less reactive than Kr, Xe, Ra
Kr	36	–brilliant green and orange spectral lines
Xe	54	–blue emission spectrum
Ra	86	–radioactive

Chapter 8 Quiz

Part A: Modified True/False

1. False, (one of) lithium, sodium, potassium, rubidium, cesium, or francium
2. False, 1+
3. True
4. True

Part B: Sentence Completion

5. alkali metals
6. similar
7. 3+
8. 1, 2, 6

Part C: Multiple Choice

9. (a); 10. (d); 11. (b); 12. (c); 13. (b); 14. (c); 15. (d)

Part D: Short Answer

16. (a) $CuCl_2$
    (b) Na_2CO_3
    (c) $Fe(NO_3)_3$
    (d) $(NH_4)_2CO_3$
    (e) $PbBr_4$
17. (a) copper(I) iodide
    (b) zinc nitrate
    (c) manganese(IV) carbonate
    (d) calcium phosphate
    (e) sodium fluoride
18. The gases will be produced in a ratio of 1:1.
19. The ratio of the elements nitrogen:hydrogen:phosphorous:oxygen will be 2:9:1:4.
20. The Roman numerals indicate the different charges of the copper ions. The copper(I) ion has a charge of 1+, and the copper(II) ion has a charge of 2+. The two ions will have slightly different properties: for instance, the copper(II) ion has a blue–green colour in solution, and the copper(I) ion is colorless in solution.
21. Calcium and barium are in the same chemical family, the alkaline earth metals. Therefore, they should form compounds in the same manner (same ion charge), and the ratio of calcium to oxygen atoms will be 1:1.
22. Bravo chloride will be a white powder that is soluble in water, and alpha carbonate will be a green powder that is insoluble in water.

Unit B Quiz

Part A: Modified True/False

1. False, chemical
2. True
3. False, neutrons
4. False, electrons

Part B: Sentence Completion

5. chemical family
6. full
7. Niels Bohr
8. physical
9. mixture

Part C: Multiple Choice

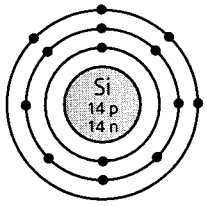
10. (d); 11. (b); 12. (a); 13. (d); 14. (c); 15. (a); 16. (a); 17. (b); 18. (c); 19. (a)

Part D: Matching

20. (b); 21. (d); 22. (g); 23. (c)

Part E: Short Answer

24. atomic number 12, atomic mass 24.31, ion charge 2+
25.



26. Neon does not normally form ions because its outer shell is already full, with 8 electrons.
27. (a) sodium carbonate
    (b) ammonium chloride
    (c) iron(III) phosphate
    (d) lead(IV) oxide
    (e) chromium(III) carbonate
28. (a) NH_4OH
    (b) $Mg(HS)_2$
    (c) $Fe_2(C_{r2}O_7)_3$
    (d) KCl
    (e) SnO
29. Calcium sulfide will not dissolve easily in water, as calcium and magnesium are in the same chemical family (alkaline earth metals) and, therefore, will form similar compounds.
30. Lithium, sodium, potassium, rubidium, cesium, francium. Properties are that they react with water to form hydrogen gas and a base, they are low density, they are soft, they conduct heat and electricity, and they have lustre.