

Wednesday/Thursday, October 2 & 3, 2019 –Atoms, Ions, and Molecules Practice

I. Warm-Up –

1. On the blank periodic table, indicate where the metals, nonmetals, and metalloids are found. Also show which columns are the noble gases, alkali metals, alkaline earth metals, halogens, and transition metals.

1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium 101.07	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	58 Ce Cerium 140.12	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967	
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 Uu Ununennium (269)	111 Cu Copper (272)	112 Cn Copernicium (277)	113 Nh Nihonium (284)	114 Fl Flerovium (289)				

2. Phenomena (Truncated)

What patterns do you notice in the data samples below?

58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Substance X	Mass of A	Mass of B		Mass of A	Mass of B
Sample 1	0.86 g	1.96 g	Substance Y	0.86 g	0.98 g
Sample 2	4.26 g	9.73 g	Substance Z	0.43 g	0.25 g
Sample 3	32.8 g	74.9 g			

Law of Conservation of Mass

Law of Definite Proportions

Law of Multiple Proportions

3. How was the homework?
Chapter 2: 28,42,90,91

How do we know there are atoms?

4. Compound X₂Y is 60% X by mass. Calculate the percent Y by mass of the compound X₂Y₂.

II. Ions

1. Predict the charge if the following elements were in their ionic form.

- a. Li b. Ca c. Ga
d. N e. S f. B
g. Ag h. Cd i. V

Atoms will gain or lose electrons until they have the same number of electrons as

A positively charged ion is called a _____ They are formed by elements on the _____ of the periodic table.

A negatively charged ion is called an _____ They are formed by elements on the _____ of the periodic table.

III. Naming Compounds

2. Name the following compounds:

- NiNO₃ N₂O₅

AgBr (NH₄)₂CO₃

H₂SO₃ (aq) SF₆

Types of Compounds

Molecular Compound –

Ionic Compound –

V. Practice

3. For each of the following determine the number of protons, neutrons and electrons:
a. ⁴⁷Ti b. ⁹⁰Sr²⁺ c. ³²P³⁻

6. Which of the following represents a pair of isotopes?

- a. ³²S and ³²S²⁻ b. O₂ and O₃
c. ¹⁵₇N and ¹⁵₈O d. ¹²₆C and ¹³₆C
e. ¹⁸₈O and ¹⁹₉F

4. Fill in the following table

Symbol	³⁷ Cl ⁻			
# of Protons		11		92
# of neutrons		12	46	
# of electrons		10	36	86
Mass number			81	226

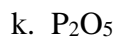
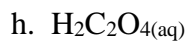
5. An element's most stable ion forms an ionic compound with chlorine having the formula XCl₂. If the mass number of the ion is 24 and it has 10 electrons, what is the element and how many neutrons does it have?

7. Here are some common names that you're expected to know – write the chemical formula.

- a. Water
b. methane
c. ammonia`

- IV. Name the following compounds:

- a. LiHCO₃
b. Na₂SO₃
c. (NH₄)₃PO₄
d. Fe(OH)₃
e. SnS₂
f. HF_(g)
g. HClO_(aq)



V. What are the names of the following elements: Mo, Mg, and Sn?

VI. Predict the formula for the following:

a. calcium cyanide

b. aluminum sulfate

c. lead(IV) oxalate

d. hydrosulfuric acid

e. sulfuric acid

f. phosphorous acid

g. sulfur trioxide

h. carbon tetrachloride

VII. Which one of the following statements about atomic structure is false?

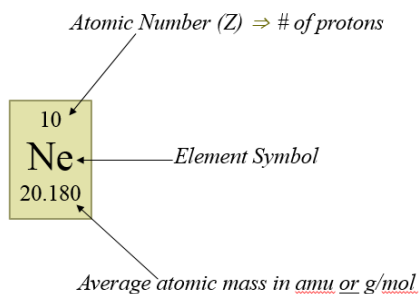
a. The protons and neutrons in the nucleus are very tightly packed.

b. The electrons occupy a very large volume compared to the nucleus.

c. The number of protons and the number of neutrons are always the same in the neutral atom.

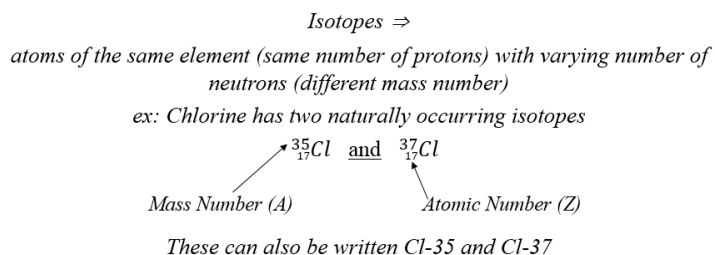
d. Almost all of the mass of the atom is concentrated in the nucleus.

e. All of the above statements are true.



Mass Number (A) \Rightarrow sum of protons and neutrons

Note that mass number is NOT on the periodic table



Naming Ionic Compounds

1. metals with fixed charges (Grps 1, 2, Al, Ga, Ag, Zn and Cd – see diagram below) \Rightarrow use the elements name as is
2. metals with varying charges (all other metals) \Rightarrow use the elements name and a Roman numeral (denotes the charge)
3. NH_4^+ \Rightarrow ammonium

The second name is the anion:

1. monoatomic \Rightarrow elements name with the suffix -ide
2. polyatomic \Rightarrow you'll eventually memorize these names

1⁻ charge

hydroxide \Rightarrow OH⁻
 cyanide \Rightarrow CN⁻
 nitrite \Rightarrow NO₂⁻
 nitrate \Rightarrow NO₃⁻
 hypochlorite \Rightarrow ClO⁻
 chlorite \Rightarrow ClO₂⁻
 chlorate \Rightarrow ClO₃⁻
 perchlorate \Rightarrow ClO₄⁻
 acetate \Rightarrow C₂H₃O₂⁻
 hydrogen carbonate \Rightarrow HCO₃⁻
 dihydrogen phosphate \Rightarrow H₂PO₄⁻
 hydrogen sulfite \Rightarrow HSO₃⁻
 hydrogen sulfate \Rightarrow HSO₄⁻
 permanganate \Rightarrow MnO₄⁻
 thiocyanate \Rightarrow SCN⁻
 bromate \Rightarrow BrO₃⁻
 bromite \Rightarrow BrO₂⁻

2⁻ charge

sulfite \Rightarrow SO₃²⁻
 sulfate \Rightarrow SO₄²⁻
 carbonate \Rightarrow CO₃²⁻
 oxalate \Rightarrow C₂O₄²⁻
 hydrogen phosphate \Rightarrow HPO₄²⁻
 chromate \Rightarrow CrO₄²⁻
 dichromate \Rightarrow Cr₂O₇²⁻

3⁻ charge

borate \Rightarrow BO₃³⁻
 phosphite \Rightarrow PO₃³⁻
 phosphate \Rightarrow PO₄³⁻
 arsenate \Rightarrow AsO₄³⁻

Trends for Ionic Charge

+1										0	
1 H Hydrogen											2 He Helium
	+2										
3 Li Lithium		4 Be Beryllium									
11 Na Sodium		12 Mg Magnesium									
19 K Potassium		20 Ca Calcium									
37 Rb Rubidium		38 Sr Strontium									
55 Cs Cesium		56 Ba Barium									
87 Fr Francium		88 Ra Radium									

Additional charge trends shown in the diagram:
 +3 above Al (13), Ga (31), In (49), Tl (81)
 -3 above N (7), P (15), As (33), Sb (51), Bi (83)
 -2 above O (8), S (16), Se (34), Te (52), Po (84)
 -1 above F (9), Cl (17), Br (35), I (53), At (85)
 +1 above Ag (47), Au (79), Hg (80)
 +2 above Zn (30), Cd (48), Hg (80)

Naming Acids

1. Acids without oxygen:

- Add prefix hydro to the anion's name
- Change suffix to *ic acid* ex: HCN \Rightarrow hydrocyanic acid or H₂S \Rightarrow hydrosulfuric acid

2. Acids with oxygen:

- Change suffix of anion in the acid
- ate \Rightarrow *ic acid*
 ite \Rightarrow *ous acid*
- ex: HNO₂ \Rightarrow nitrous acid vs. HNO₃ \Rightarrow nitric acid

Naming Molecular Compounds

- Add a Greek prefix to the first element's name when there's 2 or more
- Always add a Greek prefix to the 2nd element and change the suffix to *-ide* ex: NF₃ \Rightarrow nitrogen trifluoride

Greek prefixes

1-mono 2-di 3-tri 4-tetra 5-penta 6-hexa 7-hepta 8-octa 9-nona 10-deca