

# AP CHEMISTRY

## TOPIC 1: CHEMICAL FOUNDATIONS, MORE REVIEW

Day 9:

1) Would you expect the following atoms to gain or lose electrons when forming ions? If so, how many would be gained or lost (and indicate the charge for each)?

**Answers:**

- a) Ca (*lose 2, +2*)    b) Cs (*lose 1, +1*)    c) N (*gain 3, -3*)    d) Fr (*lose 1, +1*)  
e) Br (*gain 1, -1*)    f) Ga (*lose 3, +3*)    g) Se (*gain 2, -2*)    h) I (*gain 1, -1*)

2) Convert  $5.89 \times 10^{34}$  ng to pounds (1 lbs. = 454 grams)

**Answer:**

$$\frac{5.89 \times 10^{34} \text{ ng}}{10^9 \text{ ng}} \times \frac{1 \text{ g}}{10^3 \text{ g}} \times \frac{1 \text{ lbs}}{454 \text{ g}} = 1.30 \times 10^{23} \text{ lbs}$$

3) Calculate  $4.67 \times 10^5$  liters to cubic yards. (1 inch = 2.54 cm,  $1 \text{ cm}^3 = 1 \text{ mL}$ )

**Answer:**

$$\frac{4.67 \times 10^5 \text{ L}}{1 \text{ L}} \times \frac{10^3 \text{ mL}}{1 \text{ mL}} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} \times \frac{(1 \text{ in})^3}{(2.54 \text{ cm})^3} \times \frac{(1 \text{ yd})^3}{(36 \text{ in})^3} = 611 \text{ yd}^3$$

4) Write the correct name for the following compounds:

- a. HBr                      *hydrobromic acid*  
b. AgOH                    *silver hydroxide*  
c.  $(\text{NH}_4)_3\text{PO}_2$             *ammonium hypophosphite*  
d.  $\text{P}_4\text{O}_8$                     *tetra-phosphorus octa-oxide*  
e.  $\text{H}_2\text{CrO}_4$                 *chromic acid*  
f.  $\text{Ba}(\text{ClO}_4)_2$             *barium perchlorate*  
f.  $\text{Al}(\text{C}_2\text{H}_3\text{O}_2)_3$         *aluminum acetate*  
h.  $\text{Zn}(\text{NO}_2)_2$             *zinc nitrite*  
i.  $\text{Ca}_3\text{N}_2$                  *calcium nitride*

5) Write the correct formula for each of the following compounds:

- a. hydrosulfuric acid             $\text{H}_2\text{S}$   
b. tungsten(V) hypophosphite     $\text{W}_3(\text{PO}_2)_5$   
c. cobalt(III) iodate               $\text{Co}(\text{IO}_3)_3$   
d. copper(II) hydroxide             $\text{Cu}(\text{OH})_2$   
e. manganese(IV) perchlorate     $\text{Mn}(\text{ClO}_4)_4$   
f. gold(I) sulfate                  $\text{Au}_2\text{SO}_4$   
g. hexa-phosphorus tri-bromide     $\text{P}_6\text{Br}_3$   
h. hypochlorous acid               $\text{HClO}$   
i. iron(II) carbonate                $\text{FeCO}_3$

6) Calculate the molar mass for the following compounds:

a.  $C_{14}H_{28}O_4$

**Answer:**

$$14 \left(12.01 \frac{g}{mol}\right) + 28 \left(1.008 \frac{g}{mol}\right) + 4 \left(16.00 \frac{g}{mol}\right) = 260.364 \frac{g}{mol}$$

b.  $CuSO_4 \cdot 5 H_2O$

**Answer:**

$$63.55 \frac{g}{mol} + 32.06 \frac{g}{mol} + 4 \left(16.00 \frac{g}{mol}\right) + 5 \times \left(2 \left(1.008 \frac{g}{mol}\right) + \left(16.00 \frac{g}{mol}\right)\right) = 249.69 \frac{g}{mol}$$

c. chromium(III) hypochromite

**Answer:**

$$Cr_2(CrO_2)_3 : 2 \left(52.00 \frac{g}{mol}\right) + 3 \left(52.00 \frac{g}{mol}\right) + 6 \left(16.00 \frac{g}{mol}\right) = 356.00 \frac{g}{mol}$$

d. hydro-iodic acid

**Answer:**

$$HI : 1.008 \frac{g}{mol} + 126.91 \frac{g}{mol} = 127.918 \frac{g}{mol}$$

7) A sample of nickel(III) acetate has a mass of 58.22 g. Calculate the number of atoms for carbon in this sample?

**Answer:**

$$\frac{58.22 \text{ g } Ni(C_2H_3O_2)_3}{236.002 \text{ g}} \times \frac{1 \text{ mol}}{1 \text{ mol } Ni(C_2H_3O_2)_3} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ molecule } Ni(C_2H_3O_2)_3} \times \frac{6 \text{ atoms of carbon}}{1 \text{ molecule } Ni(C_2H_3O_2)_3} = 8.911 \times 10^{23} \text{ atoms}$$

8) Calculate the number of milligrams of manganese(II) chlorate that are in  $5.87 \times 10^{27}$  molecules of manganese(II) chlorate?

**Answer:**

$$\frac{5.87 \times 10^{27} \text{ molecules } Mn(ClO_3)_2}{6.02 \times 10^{23} \text{ molecules}} \times \frac{1 \text{ mol } Mn(ClO_3)_2}{1 \text{ mol } Mn(ClO_3)_2} \times \frac{221.84 \text{ g}}{1 \text{ mol } Mn(ClO_3)_2} \times \frac{10^3 \text{ mg}}{1 \text{ g}} = 2.16 \times 10^9 \text{ mg}$$

9) A certain metal contains the following isotopes: 5.8% has a mass of 54 amu, 91.72% has a mass of 56 amu, 2.2% has a mass of 57 amu, and 0.28% has a mass of 58 amu. First determine the average atomic mass and then identify the element.

**Answer:**

<b>0.0580</b>	<b>x</b>	<b>54.0</b>	<b>=</b>	<b>3.132 amu</b>
<b>0.9172</b>	<b>x</b>	<b>56.0</b>	<b>=</b>	<b>51.363 amu</b>
<b>0.0220</b>	<b>x</b>	<b>57.0</b>	<b>=</b>	<b>1.254 amu</b>
<b>0.0028</b>	<b>x</b>	<b>58.0</b>	<b>=</b>	<b>0.162 amu</b>

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**55.911 amu**

**Iron, Fe**

10) Determine the empirical formula for a compound that contains 53.73% iron and 46.27% sulfur.

Answer:

$$\text{Fe: } \frac{53.73 \text{ g}}{55.85 \text{ g}} \times \frac{1 \text{ mol Fe}}{1} = 0.9620 \text{ mol} \quad \frac{0.9620 \text{ mol}}{0.9620 \text{ mol}} = 1 \times 2 = 2 \quad \mathbf{2 : 3 \text{ ratio}}$$

$$\text{S: } \frac{46.27 \text{ g}}{32.06 \text{ g}} \times \frac{1 \text{ mol S}}{1} = 1.443 \text{ mol} \quad \frac{1.443 \text{ mol}}{0.9620 \text{ mol}} = 1 \frac{1}{2} \times 2 = 3 \quad \mathbf{Fe_2S_3}$$

11) Determine the empirical formula of a compound that contains 8.70 grams of potassium, 8.77 grams of selenium and 7.10 grams of oxygen? When writing the formula - write the symbols in the order given.

Answer:

$$\text{K: } \frac{8.70 \text{ g}}{39.10 \text{ g}} \times \frac{1 \text{ mol K}}{1} = 0.2225 \text{ mol} \quad \frac{0.2225 \text{ mol}}{0.1111 \text{ mol}} = 2 \quad \mathbf{2 : 1 : 4 \text{ ratio}}$$

$$\text{Se: } \frac{8.77 \text{ g}}{78.96 \text{ g}} \times \frac{1 \text{ mol Se}}{1} = 0.1111 \text{ mol} \quad \frac{0.1111 \text{ mol}}{0.1111 \text{ mol}} = 1 \quad \mathbf{K_2SeO_4}$$

$$\text{O: } \frac{7.10 \text{ g}}{16.00 \text{ g}} \times \frac{1 \text{ mol O}}{1} = 0.4438 \text{ mol} \quad \frac{0.4438 \text{ mol}}{0.1111 \text{ mol}} = 4$$

12) A certain hydrocarbon contains 84.2% carbon, and 15.8% hydrogen. The molecular mass for this compound is 114 g/mol - Determine the molecular formula for this compound?

Answer:

$$\text{C: } \frac{84.2 \text{ g}}{12.01 \text{ g}} \times \frac{1 \text{ mol C}}{1} = 7.011 \text{ mol} \quad \frac{7.011 \text{ mol}}{7.011 \text{ mol}} = 1 \times 4 = 4 \quad \mathbf{4 : 9 \text{ ratio}}$$

$$\text{H: } \frac{15.8 \text{ g}}{1.008 \text{ g}} \times \frac{1 \text{ mol H}}{1} = 15.675 \text{ mol} \quad \frac{15.675 \text{ mol}}{7.011 \text{ mol}} = 2 \frac{1}{4} \times 4 = 9 \quad \mathbf{E.F.: C_4H_9}$$

$$\mathbf{E.F.M. = (4) 12.011\text{g} + (9) 1.008\text{g} = 57.116 \text{ g}}$$

$$\mathbf{Molecular Formula = (C_4H_9)_n} \quad n = \frac{114 \text{ g}}{57.116 \text{ g}} = 2 = \mathbf{(C_4H_9)_2 = C_8H_{18}}$$

13) Fill in the missing information:

Symbol	Number of Protons in Nucleus	Number of Neutrons in Nucleus	Number of Electrons	Net Charge
$^{205}_{80}\text{Hg}^{+2}$	80	125	<b>78</b>	+2
$^{187}_{74}\text{W}^{+5}$	<b>74</b>	<b>113</b>	<b>69</b>	<b>+5</b>
$^{60}_{28}\text{Ni}^{+2}$	28	32	26	<b>+2</b>