Chemistry Ch.10 Review

6.02×10^{23} 1.   Number of particles in one mole

mole   2.   the SI unit used to measure amount of substance

% composition   3.   the percent by mass of each element in a compound

empirical formula   4.   the smallest whole number ratio of the atoms in a compoun

Practice

Identify the choice that best completes the statement or answers the question.

5. How many moles of Iron atoms are in 4.8×10^{25} of Iron?

X   omit

$$\frac{4.8 \times 10^{25} \text{ atoms Fe}}{} \Bigg| \frac{1 \text{ mol Fe}}{6.02 \times 10^{23} \text{ atoms Fe}} = \boxed{80. \text{ mol Fe}}$$

or

$\boxed{8.0 \times 10^1 \text{ mol Fe}}$

6. How many atoms are in 0.075 mol of Lithium?

$$\frac{0.075 \text{ mol Li}}{} \Bigg| \frac{6.02 \times 10^{23} \text{ atoms Li}}{1 \text{ mol Li}} = \boxed{4.5 \times 10^{22} \text{ atoms Li}}$$

7. How many pencil sharpeners would be in one mole of pencil sharpeners?

6.02×10^{23}

8. molecular formula shows the actual number of each element in a compound while empirical formula shows the lowest ratio of the elements in a compound.

9. _____ would be the noble gas which would have the *smallest* mass from 1.00 moles.

Helium

10. What is the molar mass of $AlCl_3$? $\boxed{133.33 \text{ g/mol}}$

11. What is the molar mass of $(NH_4)_2CO_3$?

$\boxed{96.11 \text{ g/mol}}$

12. What is the mass in grams of 5.90 mol C_6H_{12}?

$$\frac{5.90 \text{ mol } C_6H_{12}}{} \Bigg| \frac{84.18 \text{ g } C_6H_{12}}{1 \text{ mol } C_6H_{12}} = \boxed{497 \text{ g } C_6H_{12}}$$

13. What is the number of moles in 432 g $Mg(NO_3)_2$?

$$\frac{432 \text{ g } Mg(NO_3)_2}{} \Bigg| \frac{1 \text{ mol } Mg(NO_3)_2}{148.33 \text{ g } Mg(NO_3)_2} = \boxed{2.91 \text{ mol } Mg(NO_3)_2}$$

14. Give the conditions at standard temperature and pressure, STP

$0°C$ $1 atm$

15. If 60.2 grams of Hg combines completely with 24.0 grams of Br to form a compound, what is the percent composition of Hg in the compound?

Br 24.0
Hg 60.2
――――
84.2

$\dfrac{24.0}{84.2} \times 100 = \boxed{28.5\% \ Br}$ $\dfrac{60.2}{84.2} \times 100 = \boxed{71.5\% \ Hg}$

16. Which of the following compounds have the same empirical formula?

a. CO_2 and SO_2

b. C_7H_{14} and $C_{10}H_{20}$ ⟵ (circled)

c. C_4H_{10} and $C_{10}H_4$

d. C_6H_{12} and C_6H_{14}

17. The mass of 2.0 mol of Fluorine atoms is… (CAREFUL ~ BrINClHOF!!!)

$\dfrac{2.0 \ mol \ F_2}{} \Big| \dfrac{6.02 \times 10^{23} \ atoms \ F_2}{1 \ mol \ F_2} = \boxed{1.2 \times 10^{24} \ atoms \ F_2}$

18. Find the empirical formula for a compound composed of 69.9% Iron and 30.1% Oxygen.

$\boxed{Fe_2O_3}$

$\dfrac{69.9 \ g \ Fe}{} \Big| \dfrac{1 \ mol \ Fe}{55.85 \ g \ Fe} = 1.25 \ mol \ Fe$ $\dfrac{1.25}{1.25} = 1 \to 2$

$\dfrac{30.1 \ g \ O}{} \Big| \dfrac{1 \ mol \ O}{16.00 \ g \ O} = \dfrac{1.88}{1.25} = 1.5 \to 3$
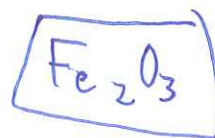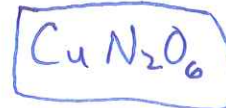
19. Find the empirical formula for a compound composed of 33.9% Copper, 14.9% Nitrogen, and the remainder Oxygen.

$\boxed{Cu N_2 O_6}$

$\dfrac{33.9 \ g \ Cu}{} \Big| \dfrac{1 \ mol \ Cu}{63.55 \ g \ Cu} = \dfrac{0.533}{0.533} = 1$

$\dfrac{14.9 \ g \ N}{} \Big| \dfrac{1 \ mol \ N}{14.01 \ g \ N} = \dfrac{1.06}{0.533} = 2$

$\dfrac{51.2 \ g \ O}{} \Big| \dfrac{1 \ mol \ O}{16.00 \ g \ O} = \dfrac{3.2}{0.533} = 6$

20. A compound that is 22% Aluminum, 25.5% Phosphorus, and 52.5% Oxygen.

$\boxed{Al \ PO_4}$

$\dfrac{22 \ g \ Al}{} \Big| \dfrac{1 \ mol \ Al}{26.98 \ g \ Al} = \dfrac{0.82}{0.82} = 1$

$\dfrac{25.5 \ g \ P}{} \Big| \dfrac{1 \ mol \ P}{30.97 \ g \ P} = \dfrac{0.82}{0.82} = 1$

$\dfrac{52.5 \ g \ O}{} \Big| \dfrac{1 \ mol \ O}{16.00 \ g \ O} = \dfrac{3.28}{0.82} = 4$

Find the percent composition of the following:

21. Magnesium Hydroxide (**be sure to write correct formula!)

✗   OMIT

22. $Ba(NO_3)_2$

✗   OMIT

Go Vikings!!!

Name:
Date: CALVIN
Hour:

Chemistry ~ Ch.10 Outrageousness

1) **Find the number of moles in 84.1 g of Silver Nitrate**

$$\frac{84.1 \text{ g } AgNO_3}{} \left| \frac{1 \text{ mol } AgNO_3}{169.88 \text{ g } AgNO_3} \right. = \boxed{0.495 \text{ mol } AgNO_3}$$

2) **Find the mass of 6.26 moles of Nickel (III) Carbonate**

$$\frac{6.26 \text{ mol } Ni_2(CO_3)_3}{} \left| \frac{297.45 \text{ g } Ni_2(CO_3)_3}{1 \text{ mol } Ni_2(CO_3)_3} \right. = \boxed{1860 \text{ g } Ni_2(CO_3)_3}$$

3) **Determine the percent composition for:**

   a) **Silver Nitrate**

$Ag(NO_3)$

   Ag $1 \times 107.87 = 107.87$

   N $1 \times 14.01 = 14.01$

   O $3 \times 16.00 = 48.00$

   169.88

$\frac{107.87}{169.88} \times 100 = \boxed{63.5\% \ Ag}$ $\frac{14.01}{169.88} \times 100 = \boxed{8.25\% \ N}$

$\frac{48.00}{169.88} \times 100 = \boxed{28.3\% \ O}$

   b) **Magnesium Hydroxide**

$Mg(OH)_2$

   Mg $1 \times 24.31 = 24.31$

   O $2 \times 16.00 = 32.00$

   H $2 \times 1.01 = 2.02$

   58.33

$\frac{24.31}{58.33} \times 100 = \boxed{41.7\% \ Mg}$

$\frac{32.00}{58.33} \times 100 = \boxed{54.9\% \ O}$ $\frac{2.02}{58.33} \times 100 = \boxed{3.5\% \ H}$

   c) **Strontium Phosphate**

$Sr_3(PO_4)_2$

   Sr $3 \times 87.62 = 262.86$

   P $2 \times 30.97 = 61.94$

   O $8 \times 16.00 = 128.00$

   452.80

$\frac{262.86}{452.80} \times 100 =$

$\frac{61.94}{452.80} \times 100 =$

$\frac{128.00}{452.80} \times 100 =$

4) **Find the molar mass of Potassium Sulfate (formula 1ˢᵗ!).** K_2SO_4 $\boxed{174.26 \text{ g/mol}}$

5) **Indicate the number of each element in the following:**

   a) Na_2CO_3 Ex. Na ~ 2   C ~ 1   O ~ 3

   b) $3 C_6H_{12}O_6$ C ~ 18   H ~ 36   O ~ 18

   c) $6 CH_3Br$ C ~ 6   H ~ 18   Br ~ 6

   d) $4 (NH_4)_2(SO_3)$ N ~ 8   H ~ 32   S ~ 4   O ~ 12

   e) $5 Al_2(O_2)_3$ Al ~ 10   O ~ 30

Name:
Date: CALVIN
Hour:

Chemistry Ch.10 ~ Empirical/Molecular Formulas

→ **Empirical formula** chemical formula shown with subscripts in smallest whole number ratio

→ **Molecular formula** chemical formula showing types and numbers of atoms in a compound

(Empirical formula and molecular formula *may* be identical...)

**Finding empirical formula

1) Find the number of moles from each element.
   (convert to grams if given in percent form...)

2) Divide calculated moles by *the smallest number of moles*

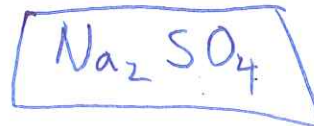3) Use this ratio of moles to find appropriate subscripts
   (* may need to multiply to reach <u>whole</u> numbers)
   (* .333, .5, and .25 should stick out to you)

4) Write finished formula showing correct subscripts

Example #1 Quantitative analysis shows that a compound contains 32.8% Sodium, 22.65% Sulfur, and 44.99% Oxygen. Find the empirical formula of this compound.

$$\frac{32.8g\ Na}{} \left| \frac{1\ mol\ Na}{22.99\ g\ Na} \right. = \frac{1.43}{0.706} \approx 2$$

$$\frac{22.65g\ S}{} \left| \frac{1\ mol\ S}{32.06\ g\ S} \right. = \frac{0.706}{0.706} \approx 1$$

$$\frac{44.99\ g\ O}{} \left| \frac{1\ mol\ O}{16.00\ g\ O} \right. = \frac{2.81}{0.706} \approx 4$$

$$\boxed{Na_2SO_4}$$

Example #2 Analysis of a 10.15 g sample of a compound known to contain only Phosphorus and Oxygen indicates a Phosphorus content of 4.43 g. What is the empirical formula of this compound?

$$\frac{4.43g\ P}{} \left| \frac{1\ mol\ P}{30.97\ g\ P} \right. = \frac{0.143\ mol}{0.143} \approx 1 \to 2$$

$$\frac{5.72g\ O}{} \left| \frac{1\ mol\ O}{16.00\ g\ O} \right. = \frac{0.358\ mol}{0.143} \approx 2.5 \to 5$$

$$\boxed{P_2O_5}$$