STOICHIOMETRY PRACTICE

1. How many moles are in each of the substances listed below?

a. 2.41×10^{24} molecules of NaCl

2.41×10^{24} molecules $\times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ molecules}} =$ **4 mole**

b. 9.03×10^{24} atoms of Hg

9.03×10^{24} atoms $\times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ atoms}} =$ **15 moles**

2. How many atoms or molecules are in each of the substances below:

a. 3.6 moles NO_2

3.6 moles $\times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} =$ **2.2×10^{24} molecules**

b. 1.4 moles Br

1.4 moles $\times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mole}} =$ **8.4×10^{23} atoms**

3. Calculate the Molar Mass and the mass in grams of a 0.25 mol sample of each of the following compounds:

a. Sucrose ($C_{12}H_{22}O_{11}$)

Molar Mass 342 g. $C_{12} = 144$ $H_{22} = 22$ $O_{11} = 176$

Mass in Grams:

0.25 mol sucrose $\times \frac{342 \text{ g}}{1 \text{ mole sucrose}} =$ **85.5 g.**

b. Potassium permanganate ($KMnO_4$)

Molar Mass 158 g $K = 39$ $Mn = 55$ $O_4 = 64$

Mass in Grams:

0.25 mol $\times \frac{158 \text{ g}}{1 \text{ mole } KMnO_4} =$ **39.5 g.**

c. Ammonium hydroxide (NH_4OH)

Molar Mass 35 g. $N = 14$ $H_4 = 4$ $O = 16$ $H = 1$

Mass in Grams:

0.25 mol $\times \frac{35 \text{ g}}{1 \text{ mole } NH_4OH} =$ **8.75 g**

4. How many moles are in each of the following?

a. 15.5 g SiO_2 molar mass = 60

15.5 g $SiO_2 \times \frac{1 \text{ mole}}{60 \text{ g } SiO_2} =$ **0.258 moles**

b. 79.3g Cl_2 molar mass = 71 g

79.3 g $Cl_2 \times \frac{1 \text{ mole}}{71 \text{ g } Cl_2} =$ **1.12 moles**

c. 0.8 g Ca molar mass = 40 g.

0.8 g Ca $\times \frac{1 \text{ mole}}{40 \text{ g Ca}} =$ **.02 moles**

5. Calculate the percent composition of each element in NaOH: %Na 57.5% %O 40% %H 2.5%

molar mass NaOH = 40 g $Na = \frac{23}{40} \times 100$ $O = \frac{16}{40} \times 100$ $H = \frac{1}{40} \times 100$

6. Calculate the percent composition of FeO when 13.3 g of Fe combine completely with 5.7g O.

%Fe 77.8% %O 22.2%

$Fe = \frac{56}{72} \times 100$ $O = \frac{16}{72} \times 100$ molar mass FeO = 72 g

7. How many moles of CO are in a sample that weighs 79 grams?

$79\text{ g CO} \times \frac{1\text{ mole}}{28\text{ g}} = \boxed{2.82\text{ moles}}$

a. How many molecules of CO would that sample have?

$2.82\text{ moles} \times \frac{6.02 \times 10^{23}\text{ molecules}}{1\text{ mole}} = \boxed{1.70 \times 10^{24}\text{ molecules CO}}$

8. If I had 350g of silver, how many moles of silver make up that sample?

$350\text{ g Ag} \times \frac{1\text{ mol}}{108\text{ g}} = \boxed{3.24\text{ moles}}$

9. How many molecules of salt are in a single serving sample (one serving is 0.4g)?

$0.4\text{ g NaCl} \times \frac{1\text{ mol}}{58.5\text{ g}} \times \frac{6.02 \times 10^{23}\text{ molecules}}{1\text{ mole}} = \boxed{4.1 \times 10^{21}\text{ molecules}}$

10. How many molecules of aspirin are you consuming if you take one recommended dose? (The formula for aspirin is $C_9H_8O_4$ and one adult dose is 0.325g)? Molar Mass = 180 g

$0.325\text{ g} \times \frac{1\text{ mole}}{180\text{ g}} \times \frac{6.02 \times 10^{23}\text{ molecules}}{1\text{ mole}} = \boxed{1.09 \times 10^{21}\text{ molecules aspirin}}$

11. Ammonia is produced by the reaction of hydrogen and nitrogen: ____ N_2 + 3 H_2 → 2 NH_3

a. Calculate the molar mass of N_2 28 g H_2 2 g NH_3 17 g

b. Balance the equation and determine how many moles of H_2 are needed to react with 1.0 mole of N_2?

3 moles H_2

c. How many moles of NH_3 are produced when 8.4 moles of H_2 react?

$8.4\text{ moles } H_2 \times \frac{2\text{ mol } NH_3}{3\text{ mol } H_2} = \boxed{5.6\text{ moles } NH_3}$

d. If I start with 6.2 grams of hydrogen gas (H_2), how many grams of ammonia (NH_3) can I produce?

$6.2\text{ g } H_2 \times \frac{1\text{ mol } H_2}{2\text{ g } H_2} \times \frac{2\text{ mol } NH_3}{3\text{ mol } H_2} \times \frac{17\text{ g}}{1\text{ mol } NH_3} = \boxed{35.13\text{ g } NH_3}$

12. In an acetylene torch, acetylene gas (C_2H_2) burns in oxygen to produce carbon dioxide and water:

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$$

a. Calculate the molar mass of C_2H_2 26 g. O_2 80 CO_2 44 g H_2O 18 g

b. How many moles of O_2 are needed to react with 7 moles of C_2H_2?

$7\text{ moles } C_2H_2 \times \frac{5\text{ mol } O_2}{2\text{ mol } C_2H_2} = \boxed{17.5\text{ moles}}$

c. How many grams of CO_2 are produced when 3.5 moles of C_2H_2 react?

$3.5\text{ moles } C_2H_2 \times \frac{4\text{ mol } CO_2}{2\text{ mol } C_2H_2} \times \frac{44\text{ g } CO_2}{1\text{ mol } CO_2} = \boxed{308\text{ g } CO_2}$

d. If I start with 100 g. of Oxygen gas (O_2), how many grams of H_2O will be produced?

$100\text{ g } O_2 \times \frac{1\text{ mol } O_2}{32\text{ g } O_2} \times \frac{2\text{ mol } H_2O}{5\text{ mol } O_2} \times \frac{18\text{ g}}{1\text{ mol } H_2O} = \frac{3600}{160} = \boxed{22.5\text{ g } H_2O}$