Name: KEY

WP Practice
Exam 5: Chemistry Quantitation, Empirical and Molecular Formulas
(Also review pretest packet for Unit 7: The Mole)

1. How many molecules are present in 6.88 moles of N_2O_3?

$$6.88\,\text{mol}\,N_2O_3 \times \frac{6.02\times10^{23}\,\text{molecules}\,N_2O_3}{1\,\text{mol}\,N_2O_3} = \boxed{4.14\times10^{24}\,\text{molecules}}$$

2. How many molecules of F_2 are present in 59.0 g of F_2?

$$59.0\,\text{g}\,F_2 \times \frac{1\,\text{mol}\,F_2}{38.00\,\text{g}\,F_2} \times \frac{6.02\times10^{23}\,\text{molecules}\,F_2}{1\,\text{mol}\,F_2} = \boxed{9.35\times10^{23}\,\text{molecules}}$$

3. How many atoms of oxygen are in one molecule of H_2CO_3?

$$1\,\text{molecule}\,H_2CO_3 = \boxed{3\,\text{atoms O}}$$

4. How many moles of hydrogen are in 0.50 mole of $(NH_4)_2O$

$$0.50\,\text{mol}\,(NH_4)_2O \times \frac{8\,\text{mol H}}{1\,\text{mol}\,(NH_4)_2O} = \boxed{4.0\,\text{mol H}}$$

5. Calculate the mass, in grams, of 6.2×10^{23} aluminum atoms.

$$6.2\times10^{23}\,\text{atoms Al} \times \frac{1\,\text{mol Al}}{6.02\times10^{23}\,\text{atoms Al}} \times \frac{26.98\,\text{g Al}}{1\,\text{mol Al}} = \boxed{28\,\text{g}}$$

6. Determine the total number of atoms in 30.0 grams of C_2H_4 (Hint: consider the definition of an atom vs. a molecule).

$$30.0\,\text{g}\,C_2H_4 \times \frac{1\,\text{mol}\,C_2H_4}{28.06\,\text{g}\,C_2H_4} \times \frac{6.02\times10^{23}\,\text{molecules}\,C_2H_4}{1\,\text{mol}\,C_2H_4} \times \frac{6\,\text{atoms}}{1\,\text{molecule}\,C_2H_4} = \boxed{3.86\times10^{24}\,\text{atoms}}$$

7. Calculate the molar mass of $MgCO_3$.

$24.31 + 12.01 + 3(16.00) = \boxed{84.32\ g}$

8. Calculate the molar mass of copper(II) nitrate.

$Cu(NO_3)_2$

$63.55 + 2(14.01) + 6(16.00) = \boxed{187.57\ g}$

9. Calculate the density, in g/L, of krypton gas at STP (1 mole of gas at STP occupies 22.4 L).

$$d = \frac{m}{V} = \frac{83.80\ g}{22.4\ L} = \boxed{3.74\ g/L}$$

10. A compound is comprised of 50.05% sulfur and 49.94% oxygen and has a molar mass of 64.07 g/mol.
    a. Determine the compounds empirical formula.

$$50.05\ g\ S \times \frac{1\ mol\ S}{32.06\ g\ S} = 1.561\ mol\ S$$

$$49.94\ g\ O \times \frac{1\ mol\ O}{16.00\ g\ O} = \frac{3.121\ mol\ O}{1.561\ mol\ S} \approx \frac{2\ mol\ O}{1\ mol\ S}$$

empirical formula: $\boxed{SO_2}$

    b. Determine the compound's molecular formula.

$$n = \frac{64.07\ g}{64.06\ g} \approx 1$$

$32.06 + 2(16.00) = 64.06\ g$

empirical mass

$1(SO_2) \Rightarrow \boxed{SO_2}$

molecular formula