Math of Chemistry Review Worksheet Name: Key

Show your calculations for each of the following. Remember to use significant figures and units in your answers.

1. Find the molar mass of the following:
   a) NH_3 17.0 g/mol b) $Fe(NO_3)_2$ 179.8 g/mol

2. How many moles are in 30.5 g Al_2S_3? $30.5\text{ g } Al_2S_3 \times \frac{1\text{ mol}}{150.3\text{ g}} = 0.203\text{ mol}$

3. How many molecules are in 1.71 moles of Ne? $1.71\text{ mol Ne} \times \frac{6.02\times10^{23}\text{ molecules}}{1\text{ mol Ne}} = 1.03\times10^{24}\text{ molecules}$

4. How many grams are in 4.80 moles of sodium chloride? $4.80\text{ mol NaCl} \times \frac{58.5\text{ g}}{1\text{ mol NaCl}} = 280.8\text{ g} = 281\text{ g NaCl}$

5. What volume (in liters) would a 3.00 mole sample of O_2 occupy at STP? $3.00\text{ mol } O_2 \times \frac{22.4\text{ L}}{1\text{ mol}} = 67.2\text{ L}$

6. A sample of a compound contains 2.57×10^{24} molecules. How many moles are in the sample? $2.57\times10^{24}\text{ molecules} \times \frac{1\text{ mol}}{6.02\times10^{23}\text{ molecules}} = 4.27\text{ mol}$

7. A balloon holds 3.75 liters of a gas at STP. How many moles of the gas are in the balloon? $3.75\text{ L} \times \frac{1\text{ mol}}{22.4\text{ L}} = 0.167\text{ mol}$

8. What volume (in liters) would 20.0 g of nitrogen gas occupy at STP? $20.0\text{ g } N_2 \times \frac{1\text{ mol}}{28.0\text{ g } N_2} \times \frac{22.4\text{ L}}{1\text{ mol}} = 16.0\text{ L}$

9. What is the mass (in grams) of 0.555 moles of NH_4NO_3? $0.555\text{ mol} \times \frac{80.0\text{ g}}{1\text{ mol}} = 44.4\text{ g}$

10. A certain gas has a density of 0.92 g/L at STP. What is the molar mass of the gas? $0.92\text{ g/L} = \frac{x}{22.4\text{ L/mol}}$ $x = 21\text{ g/mol}$

11. What is the density of CO_2 gas at STP? $D = \frac{44.0\text{ g/mol}}{22.4\text{ L/mol}} = 1.96\text{ g/L}$

12. Calculate the percent by weight of oxygen in $CaCO_3$. $\frac{48.0\text{ g O}}{100.1\text{ g } CaCO_3} \times 100 = 48.0\%\text{ O}$

13. Calculate the percent by weight of water in $Fe(NO_3)_3 \cdot 6H_2O$. $\frac{108.0\text{ g } H_2O}{241.8\text{ g } Fe(NO_3)_3\cdot6H_2O} \times 100 = 44.7\%\ H_2O$

14. Calculate the empirical formula of a substance containing 42.1% Cl and 57.9% Pt.
   $42.1\text{ g Cl} \times \frac{1\text{ mol}}{35.5\text{ g}} = 1.19\text{ mol Cl} \div .297 \approx 4$ | $57.9\text{ g Pt} \times \frac{1\text{ mol}}{195.1\text{ g Pt}} = 0.297\text{ mol Pt} \div .297 = 1$ | $PtCl_4$

15. Calculate the empirical formula of a substance containing 75.8% As and 24.2 % O.
   $75.8\text{ g As} \times \frac{1\text{ mol}}{74.9\text{ g As}} = 1.01\text{ mol As}$ | $24.2\text{ g O} \times \frac{1\text{ mol O}}{16.0\text{ g O}} = 1.51\text{ mol O}$ | 1:1.5 is same as 2:3 | As_2O_3

16. Calculate the molecular formula for a compound consisting of 80% carbon and 20% hydrogen with a molecular weight of 30.1 g/mol.
   $80\text{ g C} \times \frac{1\text{ mol}}{12.0\text{ g}} = 6.67\text{ mol C} \div 6.67 = 1\text{ mol C}$
   $20\text{ g H} \times \frac{1\text{ mol}}{1.0\text{ g}} = 20\text{ mol H} \div 6.67 = 3\text{ mol H}$
   empirical Formula CH_3 ← Mass = 15.0 g/mol
   $\frac{30.1\text{ g/mol}}{15.0\text{ g/mol}} = 2$
   C_2H_6 = molecular formula