$M = \frac{n}{V}$

Name: KEY

Date: _____

Chemistry
Concentration of Solutions WS 1 (Molarity)

I. *Complete the following problems, showing all work and circling your answer:*

1. A 3 M (molar) solution means there are 3 moles of solute dissolved for every 1 liter of solvent.

   a. How many moles (n) of solute would there be in 2 liters (V) of a 3 M (M) solution?

   $M = \frac{n}{V}$ $\quad n = M \times V = (3\ M)(2\ L) = \boxed{6\ mol}$

   b. How many moles (n) of solute would there be in 0.25 liters (V) of a 3 M (M) solution?

   $n = M \times V = (3\ M)(0.25\ L) = \boxed{0.75\ mol}$

2. What is the molar concentration (M) of 0.575 mol (n) NaCl dissolved in 2.00 L (V) of water?

   $M = \frac{n}{V} = \frac{0.575\ mol\ NaCl}{2.00\ L} = \boxed{0.288\ M\ NaCl}$

3. What is the molar concentration (M) of 46.5 g (mass) KBr dissolved in 1.50 L (V) H_2O?

   need n: $\frac{46.5\ g\ KBr}{119.002\ g\ KBr} \left| \frac{1\ mol\ KBr}{} \right. = 0.391\ mol\ KBr$ $\quad M = \frac{0.391\ mol\ KBr}{1.50\ L} = \boxed{0.260\ M\ KBr}$

4. What is the molar concentration (M) of 202.9 g (mass) $CaCl_2$ dissolved in 4.5 L (V) H_2O?

   same as above...

   $\frac{202.9\ g\ CaCl_2}{110.984\ g\ CaCl_2} \left| \frac{1\ mol\ CaCl_2}{} \right. = 1.83\ mol\ CaCl_2$ $\quad M = \frac{n}{V} = \frac{1.83\ mol\ CaCl_2}{4.5\ L} = \boxed{0.41\ M\ CaCl_2}$

5. What is the molar concentration (M) of 65.5 g (mass) of copper (I) sulfate dissolved in 2.4 L (V) of H_2O?

   copper (I) sulfate: Cu^{+} + SO_4^{2-} → Cu_2SO_4

   $\frac{65.5\ g\ Cu_2SO_4}{223.155\ g\ Cu_2SO_4} \left| \frac{1\ mol\ Cu_2SO_4}{} \right. = 0.294\ mol\ Cu_2SO_4$ $\quad M = \frac{n}{V} = \frac{0.294\ mol\ Cu_2SO_4}{2.4\ L} = \boxed{0.12\ M\ Cu_2SO_4}$

6. How many moles (n) of LiCl would be needed to make 0.450 L (V) of a 3.0 M (M) solution?

   typo - should be LiCl

   $n = M \times V = (3.0\ M)(0.450\ L) = \boxed{1.4\ mol\ LiCl}$

7. How many moles (n) of KSO_3 (typo, should be K_2SO_3) would be needed to make 1.5 L (V) of a 0.04 M (M) solution?

$n = M \times V = (0.04\ M)(1.5\ L) =$ **6 mol K_2SO_3**

8. How many grams of NaOH would be needed to make 0.750 L (V) of a 0.50 M (M) solution? (find n, then convert)

$n = M \times V = (0.50\ M)(0.750\ L) = 0.375\ mol\ NaOH \times \frac{39.997\ g\ NaOH}{1\ mol\ NaOH} =$ **15.0 g NaOH**

9. How many grams of copper (II) nitrate would be needed to make 400. mL (V = 0.400 L) of a 2.00 M (M) solution? (find n, then convert)

Copper (II) nitrate: Cu^{2+} $(NO_3)^-_2$ → $Cu(NO_3)_2$

$n = M \times V = (2.0\ M)(0.400\ L) = 0.80\ mol\ Cu(NO_3)_2 \times \frac{187.556\ g\ Cu(NO_3)_2}{1\ mol\ Cu(NO_3)_2} =$ **150. g $Cu(NO_3)_2$**

10. How many grams of sodium sulfate are required to prepare a 250. mL (V = 0.250 L) solution with a concentration of 0.683 M? (M)

Sodium sulfate: Na^+ SO_4^{2-} → Na_2SO_4

$n = M \times V = (0.683\ M)(0.250\ L) = 0.171\ mol\ Na_2SO_4 \times \frac{142.042\ g\ Na_2SO_4}{1\ mol\ Na_2SO_4} =$ **24.3 g Na_2SO_4**

11. How many grams of ethanol (C_2H_5OH) are present in 85.0 mL (V = 0.0850 L) of a 0.451 M (M) ethanol solution?

$n = M \times V = (0.451\ M)(0.0850\ L) = 0.0383\ mol\ C_2H_5OH \times \frac{46.068\ g\ C_2H_5OH}{1\ mol\ C_2H_5OH} =$ **1.77 g C_2H_5OH**

12. What is the mass of NaOH required to prepare 4.50 x 10^2 mL (V) of solution with a concentration 2.80 M? (M)

$n = M \times V = (2.80\ M)(0.450\ L) = 1.26\ mol\ NaOH \times \frac{39.997\ g\ NaOH}{1\ mol\ NaOH} =$ **50.4 g NaOH**

13. What is the molarity (M) of a phosphoric acid (H_3PO_4) solution containing 150. grams (mass) of the acid in 750. mL (V = 0.750 L) of solution?

$M = \frac{n}{V}$ (need n)

$150.\ g\ H_3PO_4 \times \frac{1\ mol\ H_3PO_4}{97.995\ g\ H_3PO_4} = 1.53\ mol\ H_3PO_4$

$M = \frac{n}{V} = \frac{1.53\ mol\ H_3PO_4}{0.750\ L} =$ **2.04 M H_3PO_4**