

Name: KEK Date: _____ Hour: _____

Molarity, Molality, and % by mass problems

Explain how you would make the following solutions. (You should tell how many grams of the substance you need to make the solution, since balances do not read in moles!).

- 1) 2 L of 6 M HCl

$$\frac{2\cancel{L}}{1} \times \frac{6\text{ mol HCl}}{1\cancel{L}} \times \frac{36.5\text{ g HCl}}{1\text{ mol HCl}} = \boxed{438\text{ g HCl}}$$

- 2) 1.5 L of 2 M NaOH

$$\frac{1.5\cancel{L}}{1} \times \frac{2\text{ mol NaOH}}{1\cancel{L}} \times \frac{40\text{ g NaOH}}{1\text{ mol NaOH}} = \boxed{120\text{ g NaOH}}$$

- 3) 0.75 L of 0.25 M Na₂SO₄

$$\frac{.75\cancel{L}}{1} \times \frac{.25\text{ mol Na}_2\text{SO}_4}{1\cancel{L}} \times \frac{142\text{ g Na}_2\text{SO}_4}{1\text{ mol Na}_2\text{SO}_4} = \boxed{26.63\text{ g Na}_2\text{SO}_4}$$

- 4) Calculate the molality when 75.0 grams of MgCl₂ is dissolved in 500.0 g of solvent.

$$\frac{75\text{ g MgCl}_2}{1} \times \frac{1\text{ mol MgCl}_2}{96\text{ g MgCl}_2} = \frac{.78125\text{ mol}}{.5\text{ kg}} = \boxed{1.56\text{ m MgCl}_2}$$

- 5) 100.0 grams of sucrose (C₁₂H₂₂O₁₁, mol. wt. = 342.3 g/mol) is dissolved in 1.50 L of water. What is the molality?

$$\frac{100.0\text{ g C}_{12}\text{H}_{22}\text{O}_{11}}{1} \times \frac{1\text{ mol C}_{12}\text{H}_{22}\text{O}_{11}}{342.3\text{ g}} = \frac{.292\text{ mol}}{1.5\text{ kg}} = \boxed{.195\text{ m C}_{12}\text{H}_{22}\text{O}_{11}}$$

- 6) 49.8 grams of KI is dissolved in 1.00 kg of solvent. What is the molality?

$$\frac{49.8\text{ g KI}}{1} \times \frac{1\text{ mol KI}}{166\text{ g KI}} = \frac{.3\text{ mol}}{1.00\text{ kg}} = \boxed{.3\text{ m}}$$

- 7) Determine the molal concentration of a solution in which 320 grams of glucose C₆H₁₂O₆ are dissolved in 4000 grams of water.

$$\frac{320\text{ g C}_6\text{H}_{12}\text{O}_6}{1} \times \frac{1\text{ mol C}_6\text{H}_{12}\text{O}_6}{180.1548\text{ g C}_6\text{H}_{12}\text{O}_6} = \frac{1.7763\text{ mol}}{4\text{ kg}} = \boxed{.444\text{ m}}$$

- 8) How many grams MgCl₂ will be needed to prepare 3000 grams of a 0.8 molal solution?

? g MgCl₂

$$\frac{.8\text{ mol MgCl}_2}{1\text{ kg H}_2\text{O}}$$

$$\frac{.8\text{ mol MgCl}_2}{1} \times \frac{95.2\text{ g MgCl}_2}{1\text{ mol MgCl}_2} =$$

76.16 g MgCl₂

3000 g = 5 MgCl₂ + 5 H₂O

76.16 g
1000 g solvent

9) Find the mass percent of sodium acetate in each of the following solutions:

a. 5.00g of sodium acetate in 25.0 g of water

$$\frac{5.00\text{g}}{30.0\text{g}} = 16.7\%$$

b. 10.0g of sodium acetate in 25.0 g of water

$$\frac{10\text{g}}{35\text{g}} = 28.6\%$$

10) Calculate the mass, in grams, of NaCl present in each of the following solutions.

a. 11.5g of 6.25% NaCl solution

$$11.5\text{g} \times .0625 = \boxed{.719\text{g}}$$

b. 6.25 g of 11.5% NaCl solution

$$6.25\text{g} \times .115 = \boxed{.719\text{g}}$$

c. 54.3 g of 0.91% NaCl solution

$$54.3\text{g} \times .0091 = \boxed{.494\text{g}}$$

11) For a 15.0% (by mass) NaCl solution, calculate:

a. the mass of NaCl in 150g of the solution

$$.15 \times 150\text{g} = \boxed{22.5\text{g}}$$

b. the amount of solution needed to obtain 35.0g NaCl

$$.15 \times 35\text{g} = \boxed{5.25\text{g}} \quad \boxed{233.5\text{g}}$$

c. the mass of NaCl needed to make 1000. g of the solution

$$\frac{.15 \times 1000}{150\text{g}}$$