Answer KEY.

CHAPTER 15 REVIEW

Honors Chemistry

1. Generally, how do you express the solubility of a substance? How much solute/solvent? $\frac{\text{g Solute}}{\text{100-g } H_2O}$
2. What happens to the solubility of a solid while the temperature of the solution increases or decreases?
3. Which things make a substance dissolve faster in a solvent?
4. Using Henry's law, how can you solve for S_1, P_1, S_2, and P_2?
5. What happens to the solubility of a gas as the pressure of gas above a liquid increases or decreases?
6. What is the difference between saturated, supersaturated, and unsaturated solutions?
7. How does a solution become more diluted or less diluted?
8. Compare concentrated and dilute salt water. What is the difference in terms of molarity?
9. What is a supersaturated solution and how does it form?
10. How does a seed crystal affect a supersaturated solution?
11. How do you solve for Molarity given volume and moles?
12. If you have different amounts of the same molarity solution, is there a difference between them? Explain.
13. How do you solve for grams given molarity and volume?
14. How do you solve for volume given molarity and moles?
15. What is the difference between percent (m/m) and percent (v/v)?
16. What happens to the solubility of a gas as temperature increases or decreases?
17. What occurs if solute is added to a solution at dynamic equilibrium?
18. In a dilution, why is M_1 considered the stock solution?
19. Using the formula for a dilution, solve for V_1 given M_1, M_2, and V_2?
20. Why can't you use molarity to distinguish between the strengths of two different solutions?
21. What is thermal pollution and why is it bad for the environment?
22. What is a colligative property?
23. What are the 3 colligative properties?
24. Describe how vapor pressure changes in a solution changes the boiling point.
25. Compare solutions, suspensions, & colloids? Which can be filtered?
26. Compare homogeneous and heterogeneous mixtures? Use suspensions, colloids, solutions as examples.
27. How does each colligative property increase or decrease?

28. How many particles are released into solution during the solvation process if you have 1-L of the following:

a. 2.0-*M* Na_2O b. 3.5-*M* $MgCl_2$ c. 2.3-*M* $AlCl_3$ d. 2.0-*M* sugar e. 2.0-*M* Li_3N

$2\text{ mol} \times (6.02\times10^{23}) \times 3\text{ particles} = 3.6\times10^{24}$

$3.5\text{ mol} \times (6.02\times10^{23}) \times 3\text{ particles} = 6.32\times10^{24}$

$2.3\text{ mol}\,(6.02\times10^{23}) \times 4\text{ particles} = 5.54\times10^{24}$

$2\text{ mol}\,(6.02\times10^{23}) \times 1\text{ particle} = 1.20\times10^{24}$

$2\text{ mol}\,(6.02\times10^{23}) \times 4\text{ particles} = 4.82\times10^{24}$

29. If 310.0-grams of H_2SO_4 are dissolved to make 500.0-mLof sulfuric acid, what is the molarity?

$$\frac{310\text{ g } H_2SO_4}{1} \times \frac{1\text{ mol } H_2SO_4}{98\text{ g } H_2SO_4} = 3.16\text{ mol} \qquad M = \frac{3.16\text{ mol}}{.5\text{ L}} = \boxed{6.3\text{ M}}$$

30. At 25º, you can dissolve 12.0 g/L of oxygen gas at 288.0-kPa. If temperature remains constant, what is the solubility of oxygen gas *(in g/L)* if the pressure is raised to 466.0-kPa?

$$\frac{S_1}{P_1} = \frac{S_2}{P_2} \qquad \frac{12}{288} = \frac{S_2}{466} \qquad \boxed{S_2 = 19.49\text{ g/L}}$$

31. What mass of NaCl *(in grams)* is required to make 700.0-mL of 6.0-*M* salt water solution?

$$\frac{6.0\text{ mol}}{\text{L}} \times .7\text{ L} = 4.2\text{ mol} \qquad \frac{4.2\text{ mol NaCl}}{1} \times \frac{58.5\text{ g NaCl}}{1\text{ mol NaCl}} = \boxed{245.7\text{ g}}$$

32. A 4.50-L solution of methanol contains 650-mL of methanol? What is its percent volume of methanol?

$$\frac{650\text{ mL}}{4500\text{ mL}} = 14.4\%\left(\frac{v}{v}\right)$$

33. You mixed 3.5-L of 4.0 *M* HCl, 5.0-L of 5.0 *M* HCl, and 9.5-L of water in one large container. What is the molarity of the mixture?

total volume = $3.5 + 5 + 9.5 = 18$ L total mol: $14 + 25 = 39$ mol

$$\frac{4\text{ mol}}{\text{L}} \times 3.5\text{ L} = 14\text{ mol} \qquad \frac{5\text{ mol}}{\text{L}} \times 5\text{ L} = 25\text{ mol} \qquad M = \frac{39\text{ mol}}{18\text{ L}} = \boxed{2.2\text{ M}}$$

34. How many grams of NaCl are dissolved in 346.0-mL of 33% (m/m) NaCl solution?

$$.33 = \frac{x}{346\text{g}} \qquad \boxed{\text{mass of NaCl} = 114.2\text{ g}}$$

35. You are using a 16.0-M stock solution of HCl to make 4.0-L of 3.0-M HCl? After determining the amount of stock solution needed, how much water was added to make the diluted solution?

$M_1 = 16M$ $V_1 = ?$ $M_2 = 3M$ $V_2 = 4L$

$M_1V_1 = M_2V_2$

$(16)V_1 = (3)(4)$

$V_1 = 0.75\ L$

$4\ L - 0.75\ L =$ **3.25 L H_2O added**

36. What is the percent (m/m) if 45.6-grams of $MgCl_2$ is dissolved in 345.0-mL of solution?

$$\frac{45.6\ g}{345\ g} = 13.2\%\ \left(\frac{m}{m}\right)$$

37. What is the percent (v/v) if 120.0-mL of ethanol is in 3.3-L of solution?

$$\frac{120\ mL}{3300\ mL} = 3.6\%\ \left(\frac{v}{v}\right)$$

38. Calculate the molality when 5.1-g of KCl was added to 250-g of water.

$$\frac{5.1\ g\ KCl}{1} \times \frac{1\ mol\ KCl}{74.5\ g\ KCl} = .068\ mol$$

$$m = \frac{.068\ mol}{.25\ kg} = .272\ \frac{mol}{kg}$$

39. Calculate the final concentration if 5.0-L of 2.50-*M* NaCl, 6.5-L of 3.75-*M* NaCl and 7.00-L of water are mixed.

total volume $= 5 + 6.5 + 7 = 18.5\ L$

total mol: $12.5 + 24.4 = 36.9\ mol$

$$\frac{2.5\ mol}{L} \times 5\ L = 12.5\ mol \qquad \frac{3.75\ mol}{L} \times 6.5\ L = 24.4\ mol$$

$$M = \frac{36.9\ mol}{18.5\ L} = 2.0\ M$$

40. How many grams of $Ca(OH)_2$ are needed to make 350.0-mL of 1.63-*M* solution?

$$\frac{1.63\ mol}{L} \times .35\ L = .57\ mol$$

$$\frac{.57\ mol\ Ca(OH)_2}{1} \times \frac{74\ g\ Ca(OH)_2}{1\ mol\ Ca(OH)_2} = 42.2\ g$$

41. What is the molarity of a solution containing 258.0-g of H_3PO_4 in 600.0-mL of solution?

$$\frac{258\ g\ H_3PO_4}{1} \times \frac{1\ mol\ H_3PO_4}{98\ g\ H_3PO_4} = 2.63\ mol$$

$$M = \frac{2.63\ mol}{.6\ L} = \boxed{4.4\ \frac{mol}{L}}$$

42. A solution is made by adding 8.3 moles of KCl to 3000.0-g of water. What is the percent mass of KCl?

$$\frac{8.3\ mol\ KCl}{1} \times \frac{74.5\ g\ KCl}{1\ mol\ KCl} = 618.35\ g$$

$$\%\ mass = \frac{618.35}{3618.35} = \boxed{17.1\%\ (\tfrac{m}{m})}$$

43. What is the mole fraction of HCl in an aqueous solution containing 40.2% HCl by mass?

$$40.2\ g\ HCl \left| \frac{1\ mol\ HCl}{36.5\ g\ HCl} \right. = 1.1\ mol\ HCl \qquad X_{HCl} = \frac{1.1}{1.1+3.3} = \boxed{0.25}$$

$$59.8\ g\ H_2O \left| \frac{1\ mol\ H_2O}{18\ g\ H_2O} \right. = 3.3\ mol\ H_2O$$

44. If you added 608.5-g of $NaNO_3$ to 850.0-mL of water, what is the molality?

$$\frac{608.5\ g\ NaNO_3}{1} \times \frac{1\ mol\ NaNO_3}{85\ g\ NaNO_3} = 7.16\ mol$$

$$m = \frac{7.16\ mol}{.85\ kg} = \boxed{8.4\ \frac{mol}{kg}}$$

45. What mass of water must be added to 657.0-g of NaCl to make a 27.6% salt water solution?

$$.276 = \frac{657\ g\ NaCl}{?} \qquad \text{total mass of solution} = \frac{657}{.276} = 2380.4\ g$$

$$\text{mass of } H_2O = 2380.4 - 657 = \boxed{1723.4\ g}$$

46. A stock solution of 12.0-*M* NaOH is used to make 950.0-mL of 3.25-*M* solution. After determining the volume of stock solution needed, how much water (in mL) is added to it?

$M_1 = 12\ M$
$V_1 = ?$
$M_2 = 3.25\ M$
$V_2 = 950\ mL$

$(12)V_1 = (3.25)(950)$

$\boxed{V_1 = 257.3\ mL}$

$950 - 257.3 = \boxed{692.7\ mL\ H_2O\ added}$