Chapter Test

Chapter: Solutions

PART I  In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

1. Molecules whose water solutions can carry electric current
   a. are nonpolar.
   b. ionize in water.
   c. do not dissolve in water.
   d. decompose in water.

2. Which of the following does not increase the rate at which a solid dissolves in water?
   a. raising the temperature of the water
   b. stirring the solution
   c. using large pieces of the solid
   d. crushing the solid

3. When the energy released by the formation of solvent-solute attractions is greater than the energy absorbed by overcoming solute-solute and solvent-solvent attractions, the dissolving process
   a. has a negative enthalpy of solution.
   b. has a positive enthalpy of solution.
   c. is endothermic.
   d. does not occur.

4. Henry's law relates
   a. pressure to gas-liquid solubility.
   b. temperature to gas-liquid solubility.
   c. pressure to temperature.
   d. pressure to liquid-solid solubility.

5. Raising the temperature of a solvent causes solvent-solvent collisions to become
   a. less frequent and more energetic.
   b. more frequent and more energetic.
   c. less frequent and less energetic.
   d. more frequent and less energetic.

6. The rate at which a solid dissolves is
   a. directly related to solubility.
   b. inversely related to solubility.
   c. related to the square of the solubility.
   d. not related to solubility.
7. Effervescence is the
   a. dissolving of a gas in a liquid.
   b. escape of a liquid from a liquid-liquid solution.
   c. escape of a solid from a solid-liquid solution.
   d. escape of a gas from a gas-liquid solution.

8. A solution that contains a large concentration of solute but can hold even more solute is
   a. unsaturated and dilute.
   b. saturated and dilute.
   c. unsaturated and concentrated.
   d. saturated and concentrated.

PART II  Write the correct term (or terms) in the space provided.

9. As temperature increases, the solubility of gases in liquids generally
   ____________________________.

10. The substance dissolved in a homogeneous mixture is the
    ____________________________.

11. A mixture that can be identified because it scatters light is
    a(n) ____________________________.

12. When a solute dissolves and recrystallizes at the same rate, the solution is at
    ____________________________.

13. A substance that does not dissolve in a polar solvent is probably
    ____________________________.

14. To carry an electric current, a solution must contain
    ____________________________.

15. A solution that contains more dissolved solute than a saturated solution contains under the same conditions is called a(n)
    ____________________________.

16. Mixtures are classified according to their ____________________________.

17. A homogeneous mixture that contains particles in a dispersed phase that do not settle out is a(n) ____________________________.
18. Dissolution processes with negative enthalpies of solution are
   ____________________________ processes.

19. ____________________________ is the solution process with water as the solvent.

20. Liquid solutes and solvents that are not soluble in each other are
    ____________________________.

21. A solute molecule that is surrounded by solvent molecules is
    ____________________________.

22. CuSO₄·5H₂O is a crystalline compound referred to as a(n)
    ____________________________.

23. The solubility of CuCl₂(s) would ____________________________ with increasing solvent temperature.

24. A(n) ____________________________ is a solution whose solute and solvent are both solid metals.

PART III  Write the answers to the following questions in the space provided.

25. Explain the meaning of the phrase “like dissolves like” in terms of polar and nonpolar substances.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

26. What do molarity and molality measure and how do the two terms differ?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
27. Compare the properties of solutions, suspensions, and colloids.

28. Ethanol dissolves in water, but carbon tetrachloride does not. What can you conclude about ethanol and carbon tetrachloride?

PART IV Write the answers to the following questions on the line to the left, and show your work in the space provided.

29. Exactly 15.0 g of a substance can be dissolved in 150.0 g of water. What is the solubility of the substance in grams per 100 g of water?

30. What mass of water must be used to make a 1.35 m solution that contains 8.20 mol NaOH?

31. The solubility of a substance is 12.0 g per 100. g of water at 20.0°C. It is 18.0 g per 100. g of water at 60.0°C. How many grams of the substance can crystallize from a saturated solution that contains 200. g of water at 60.0°C if the solution is cooled to 20.0°C?
32. How many grams of MgCl₂ (molar mass = 95.20 g/mol) will be formed from 25.6 mL of a 0.100 M HCl solution reacting with excess magnesium metal? (The other product is hydrogen gas.)

33. What mass of iodine, I₂ (molar mass = 253.80 g/mol), must be used to prepare a 0.960 m solution if 100.0 g of ethanol, C₂H₅OH, is used?

34. What is the molarity of a solution composed of 8.210 g of potassium chromate, K₂CrO₄ (molar mass = 194.20 g/mol), dissolved in enough water to make 0.500 L of solution?

35. What volume of 1.50 M NaCl (molar mass = 58.44 g/mol) is needed for a reaction that requires 146.3 g of NaCl?

36. What is the molal concentration of a solution made by dissolving 34.2 g of sucrose, C₁₂H₂₂O₁₁ (molar mass = 342.34 g/mol), in 125 g of water.
26. According to the kinetic-molecular theory, the particles in a liquid can change relative positions but still are influenced by attractive forces. Their ability to move about explains the fluidity of liquids and their ability to diffuse. As some particles at the surface of a liquid gain energy, they overcome the attractive force and vaporize.

27. In ionic crystals, monatomic or polyatomic positive and negative ions are arranged in a regular pattern. In metallic crystals, metal atoms are surrounded by a sea of valence electrons. The electrons are donated by the metal atoms and belong to the crystal as a whole.

28. a. 10.7 kJ   b. 28.9 kJ
29. 9.83 kJ
30. 0.766 kJ

Equilibrium vapor pressure is the pressure exerted by a vapor in equilibrium with its corresponding liquid at a given temperature.

a. A liquid boils when its equilibrium vapor pressure is equal to atmospheric pressure. At high elevations, there is lowered atmospheric pressure. This means that the equilibrium vapor pressure will equal the lowered atmospheric pressure at a lower temperature.

b. Increasing the temperature of a liquid increases its average kinetic energy. That in turn increases the number of molecules that have enough energy to escape from the liquid phase into the vapor phase. This increased evaporation rate increases the concentration of molecules in the vapor phase, which increases the equilibrium vapor pressure.

11 Gases, pp. 93–103

TEST A
1. b   2. c
3. b   4. d
5. d   6. a
7. a   8. a
9. a   10. b
11. b   12. b
13. d   14. a

12 Solutions, pp. 104–113

TEST A
1. c   2. c
3. b   4. c
5. a   6. b
7. c   8. c
9. c   10. a

TEST B
1. b 2. c 3. a 4. a 5. b 6. d 7. d 8. c

26. Both terms are ways of expressing the concentration of a solution. Molarity is the number of moles of solute per liter of solution. Molality is the number of moles of solute per kilogram of solvent.

27. Solutions are homogeneous mixtures. Suspensions and colloids are heterogeneous mixtures. Solutions have the smallest particle size, followed by the size of colloid particles and suspension particles. Solutions and colloids do not settle out on standing, but suspensions do. Solutions and colloids cannot be separated by filtration, but suspensions can be. Solutions do not scatter light. Colloids scatter light. Suspensions may scatter light, but they are not transparent.

28. Ethanol must be polar, since it dissolves in water, which is a polar substance. Carbon tetrachloride must be nonpolar, since it does not dissolve in water.

29. 10.0 g/100 g H₂O
30. 6.07 kg H₂O
31. 12.0 g
32. 0.122 g MgCl₂
33. 24.4 g I₂
34. 0.0846 M
35. 1.67 L NaCl
36. 0.799 m C₁₂H₂₂O₁₁

13 Ions in Aqueous Solutions and Colligative Properties, pp. 114–124

TEST A

TEST B

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