Chapter 12/ Solutions

Q1) Multiple Choice

__c__ 1. To conduct electricity, a solution must contain
    a. nonpolar molecules.   c. ions
    b. polar molecules.   d. free electrons.

__d__ 2. Two immiscible substances are
    a. water and ammonia.   c. carbon tetrachloride and benzene.
    b. water and ethanol.   d. benzene and water.

__d__ 3. Sugar is soluble in water because sugar molecules are
    a. Massive   c. nonpolar
    b. large   d. polar

__a__ 4. A solubility table shows that almost all compounds of Group 1 metals
    are soluble in water. This general rule tells you that
    a. KI is soluble.   c. $CaCl_2$ is soluble.
    b. $RbNO_3$ is insoluble.   d. CO_2 is soluble.

__a__ 5. All of the KBr that will dissolve in a solution has dissolved, and several
    undissolved crystals remain on the bottom of the beaker. The solution is
    a. saturated   c. supersaturated
    b. unsaturated   d. at the incorrect pressure to dissolve the
                                   solid.

__d__ 6. The enthalpy of solution for solid $AgNO_3$ is positive. What does this tell you
    about the formation of a $AgNO_3$ solution?
    a. $AgNO_3$ will not form a solution.
    b. Energy is released during the solution process.
    c. $AgNO_3$ will dissolve only under high pressure.
    d. Energy is absorbed during the solution process.

__d__ 7. Which statement correctly represents the equilibrium between gas
    molecules entering and leaving the liquid phase of a solution?

               A. Gas + solution $\longleftrightarrow$ Solvent
               B. Gas + solvent $\longrightarrow$ solution
               C. Gas $\longleftarrow$ solvent + solution
               D. Gas + solvent $\longleftrightarrow$ solution

__c__ 8. When preparing 500. mL of a 1.35 M aqueous solution of NaCl, what
should you do after adding the correct amount of solute to a large
beaker?
  a. Add 500. mL of water, and stir until solute dissolves.
  b. Add 500. mL of water, dissolve solute, and add to a volumetric flask
  c. Add 400 mL of water, dissolve solute, add to a volumetric flask, add water
     to
     500. mL mark, and mix thoroughly.
  d. Add 400. mL of water, dissolve solute, add to a volumetric flask, add 100.
     mL of water, mix thoroughly, and transfer to another container.

__d__ 9. Which of the following statements about concentration is true?
  a. A concentrated solution may be saturated.
  b. A saturated solution may be dilute.
  c. A dilute solution may be unsaturated.
  d. All of the above

__d__ 10. How many grams of CaCl2 (molar mass = 110.98 g/mol) are needed to prepare
1.00 L of a 1.00 M solution?
  a. 1.00 g   c. 75.53 g
  b. 40.08 g   d. 110.98 g

__a__ 11. You know the mass of solute and the volume of solution. What is the first step
in finding the molarity of the solution?
  a. Divide the mass by molar mass to determine number of moles.
  b. Divide the mass by the volume of solution.
  c. Divide the volume of solution by its mass.
  d. Divide the number of moles by the volume of solution.

__d__ 12. A 0.15 M solution of HCl reacts with an excess of calcium carbonate, CaCl3. A
volume of 25.0 mL of HCl is used. To determine the number of moles of
CaCl2 produced, you need to know
  a. the amount of the other product produced.
  b. the molar mass of HCl.
  c. the molar mass of CaCl2
  d. the balanced chemical equation for the reaction.

__b__ 13. A 0.100 M solution of copper (II) nitrate reacts with an excess of iron. What do
you need to know to calculate the number of moles of iron (II) nitrate
produced?
  a. the amount of the other product produced.
  b. the volume of solution
  c. the molar mass of copper (II) nitrate
  d. the molar mass of iron (II) nitrate

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_b_14. What is the concentration of a 100. mL aqueous solution that contains 1.00 g
KCl (molar mass = 74.55 g/mol)?
    a. 1.34 M KCl   c. 0.0134 M KCl
    b. 0.134 M KCl   d. 0.001 34 M KCl

_b_15. What is the molarity of a solution that contains 0.202 mol KCl (molar
mass = 74.55 g/mol) in 7.98 L of solution?
    a. 0.0132 M KCl   c. 0.459 M KCl
    b. 0.0253 M KCl   d. 1.36 M KCl

_c_16. In 100 mL of cold water, 35 g of NaCl will dissolve, but 70 g will not. This
observation implies that
    a. solubility depends on temperature.
    b. in order to dissolve more NaCl, you must increase the pressure.
    c. solubility depends on the amounts of solute and solvent present.
    d. NaCl is not easily hydrated.

_a_17. If the temperature stays the same, the solubility of gases in liquids
    a. increases with increasing pressure.
    b. cannot reach equilibrium.
    c. decreases with increasing pressure.
    d. does not depend on pressure.

_c_18. Which solution would be least likely to carry an electric current?
    a. NaCl   c. $C_6H_{12}O_6$
    b. HCl   d. CsI

_a_19. Which does not affect the rate at which a solid solute dissolve?
    a. the vapor pressure of the solvent
    b. the temperature of the solvent
    c. the surface area of the solid
    d. the speed at which the solution is stirred

_b_20. How much methanol, CH_3OH (molar mass = 32.05 g/mol), is needed to
make a 0.90 m solution in 250 g of water?
    a. 0.14 g CH_3OH c. 100 g CH_3OH
    b. 7.2 g CH_3OH d. 220 g CH_3OH

_b_21. Molecules whose water solutions can carry electric current
    a. are nonpolar.   c. do not dissolve in water
    b. ionize in water.   d. decompose in water.

_c___ 22. Which of the following <u>does not</u> increase the rate at which a solid dissolve in
       water?
       a. raising the temperature of the water
       b. stirring the solution
       c. using large pieces of the solid
       d. crushing the solid

__c_ 23. A solution that contains a large concentration of solute but can hold even more
       solute is
       a. unsaturated and dilute.   c. unsaturated and concentrated.
       b. saturated and dilute.   d. saturated and concentrated.

___a_ 24. 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.

__d_ 25. The rate at which a solid dissolve is
       a. directly related to solubility.
       b. inversely related to solubility.
       c. related to the square of the solubility.
       d. not related to solubility.

__c_ 26. To prepare 3.50 L of a 1.25M solution, how many grams of cobalt (II) acetate,
$Co(C_2H_3O_2)_2$ would you need?
       a. 221 g.   c. 774 g.
       b. 619 g.   d. 906 g.

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Q2) Matching

  a. dissolved molecule

  b. enthalpy of solution

  c. are more soluble at lower temperature

  d. definition of molarity

  e. ion in solution

  f. dilute solution

  g. generally, increases solubility

  h. hydrogen bond

__e__ 27. $K^+(aq)$

__a__ 28. $C_6H_{12}O_6(aq)$

__h__ 29. O - H . . O - H

__f__ 30. $10^{-10}M$ NaCl

__g__ 31. temperature

__b__ 32. heat term in $A(s) \longrightarrow A(aq) + heat$

__d__ 33. moles solute per liter solution

__c__ 34. gases in water solutions

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Q3) Completion

35. A solution that contains all of a solute that can dissolve in the solvent at a given temperature is a(n) --------a-   A. saturated   B. unsaturated   C. supersaturated

36. The symbol M in 2.0M stands for -----------
          A. molality   B. molarity

37. A solution that holds less of a solute than it is capable of holding is a(n) b
          A. saturated   B. unsaturated   C. supersaturated

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38. A(n)   ------------- is an unstable system that contains more solute than would normally dissolve in the solvent at a given temperature. c
          A. saturated   B. unsaturated   C. supersaturated

39.. ----------- bonding occurs when hydrogen atoms on one molecule are attracted to atoms of high electronegativity on another molecule.
          A. polar   B. hydrogen   C. ionic

40. The heat gained or lost when a solute is dissolved in a solute is called the enthalpy of ----- _.
          A. solute   B. solvent   C. solution

41. As temperature -------------, the solubility of gases in liquids generally   a .
          A. increases   B. decreases   C. does not affect

42. When a ------------ dissolves and recrystallizes at the same rate, the solution is at equilibrium a
          A. solute   B. solvent   C. solution

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43. A substance that does not dissolve in a polar solvent is probably b
          A. polar   B. non polar

44. To carry an electric current, a solution must contain -----   .
          A. molecules   B. ions   C. crystals

45. A solution that contains more dissolved solute than a saturated solution contains under the same conditions is called a(n) c
          A. saturated   B. unsaturated   C. supersaturated

46. A homogeneous mixture that contains particles in a dispersed phase that do not settle out is a(n)

                    A. solute   B. solvent   C. solution   c

47. Dissolution processes with negative enthalpies of solution are ------------ processes b

                    A. endothermic   B. exothermic

48. A solute molecule that is surrounded by water molecules is called ----------- a

                    A. hydration   B. dehydration

49. The solubility of $CuCl_2(s)$ would   -----------   with increasing solvent temperature. a

                    A. increase .   B. decrease

Q4) Short Answer

**B 50. The liquid compound 1-butanol $CH_3CH_2CH_2CH_2OH$) is ----------
-- bsoluble in water.**   .

A. highly   B. moderately   C. weakly

**D 51. What mass of ammonium selenite, $(NH_4)_2SeO_3$, must be
dissolved to make 1240 mL of a 0.300M solution? d**

A. 45.6 g   B.50.6 g   C. 55.6 g   D. 60.6 g

**A 52. What is the molarity of a solution that contains 17.2 g
of lithium perchlorate, $LiClO_4$, in 2250 mL of solution? a**

A. 0.0719M   B. 0.0619M   C. 0.0519M   D. 0.0419M

**C 53. Calculate the molarity of a solution that contains 258 g of
acetic acid, CH_3CO_2H, in 945 mL of solution. c**

A. 4.05M   B. 4.25M   C. 4.55M   D. 4.75M

A 54. Explain the meaning of the phrase "like dissolves like" in terms of polar and nonpolar substances. a

A. Polar dissolves polar and nonpolar dissolves nonpolar.

B. Nonpolar dissolves polar and polar dissolves nonpolar.

B 55. What do molarity and molality measure and how do the two terms differ? b

A. Molality is the number of moles of solute per liter of solution. Molarity is the number of moles of solute per kilogram of solvent.

B. Molarity is the number of moles of solute per liter of solution. Molality is the number of moles of solute per kilogram of solvent.

A 56. Ethanol dissolves in water, but carbon tetrachloride does not. What can you conclude about ethanol and carbon tetrachloride? a

A. Ethanol must be polar and carbon tetrachloride must be nonpolar

B. Ethanol must be nonpolar and carbon tetrachloride must be polar

B 57. What mass of iodine, I_2 (molar mass = 253.80 g/mol), must be used to prepare a 0.960 m solution if 100.0 g of ethanol, C_2H_5OH, is used? b

    A. 20.4 g I_2 B. 24.4 g I_2 C.28.4 g I_2 D. 32.4 g I_2

D 58. What is the molarity of a solution composed of 8.210 g of potassium chromate, K_2CrO_4 (molar mass = 194.20 g/mol), dissolved in enough water to make 0.500 L of solution? d

    A. 0.0546 M   B.0.0646 M   C. 0.0746 M   D. 0.0846 M

A 59. What is the molal concentration of a solution made by dissolving 34.2 g of sucrose, $C_{12}H_{22}O_{11}$ (molar mass = 342.34 g/mol), in 125 g of water. a

    A. 0.799 m   B. 0.699 m   C. 0.599 m   D. 0.499 m

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