

1. In which combination of states do the components produce a suspension?

- A) liquid in liquid (L/L)                      C) liquid in solid (L/S)  
B) liquid in gas (L/G)                         D) solid in solid (S/S)

Ans: B

2. In which combination of states are the components always miscible?

- A) gas in gas (G/G)                            C) gas in liquid (G/L)  
B) liquid in solid (L/S)                        D) solid in solid (S/S)

Ans: A

3. In a solution, the substance present in the smaller amount is called the \_\_\_\_\_.

Ans: solute

4. In a solution, the substance present in the larger amount is called the \_\_\_\_\_.

Ans: solvent

5. Which substance is not a homogeneous mixture?

- A) sugar in water    B) sand in water    C) soft drink    D) gasoline

Ans: B

6. In an aqueous solution of sodium chloride, \_\_\_\_\_ is the solute and \_\_\_\_\_ is the solvent.

- A) Cl; Na    B) Na; Cl    C) NaCl; H<sub>2</sub>O    D) H<sub>2</sub>O; NaCl

Ans: C

7. The designation KCl(aq) means KCl is:

- A) the solute in a homogeneous mixture  
B) the solute in a heterogeneous mixture  
C) the solvent in a homogeneous mixture  
D) the solvent in a heterogeneous mixture

Ans: A

8. The interaction between any solute and any solvent is called \_\_\_\_\_.

Ans: solvation

9. The interaction between water and dissolved substances in a solution is called \_\_\_\_\_.

Ans: hydration

10. Which substance is most likely to be insoluble in water?

- A) sodium sulfate   B) barium nitrate   C) sodium acetate   D) barium sulfate

Ans: D

11. Which compound is most likely to be soluble in water?

- A) calcium phosphate                      C) magnesium carbonate  
B) sodium hydroxide                        D) aluminum sulfide

Ans: B

12. Which statement about the solubility of substances is correct?

- A) All ammonium salts are insoluble.  
B) All nitrate salts are insoluble.  
C) All phosphate salts, except Group I salts and ammonium phosphate, are insoluble.  
D) The sulfide salts of sodium, magnesium, and potassium are insoluble.

Ans: C

13. A solution contains 50.0 g of water and 1.20 g of solute. Calculate the % w/w concentration.

Ans: 2.34%

14. A solution is made by dissolving 0.75 g of salt in 100.00 mL of water. Calculate the % w/w and % w/v for the solution assuming that 1.00 mL of water weighs 1.00 g, and the final solution volume is 100.00 mL.

Ans: % w/w: 0.74%; % w/v: 0.75%

15. A solution is prepared by mixing 80.0 mL of alcohol with enough water to give 200.0 mL solution. Calculate the % v/v concentration of alcohol in the solution.

Ans: 40.0%

16. The blood volume of an adult is 5.0 L. Blood alcohol levels of 0.50% v/v can cause a coma. What volume of pure ethyl alcohol, in liters, would produce this critical blood alcohol level, assuming the ethyl alcohol is all absorbed into the blood?

Ans:            0.025 L

17. Calculate the concentration, in % w/w, of a solution composed of 15.0 g of sugar and 100.0 mL of water, assuming that water has a density of 1.00 g/mL.

Ans:            13.0%

18. Calculate the concentration, in % w/w, of a solution composed of 135 g of solid dissolved in 105 mL of water.

Ans:            56.3%

19. How would you prepare 100.0 g of a 4.60% w/w aqueous solution of KCl?

Ans: Add 4.60 g of KCl to 95.4 mL of water.

20. How many grams of salt are present in 250.0 mL of a 7.40% w/w aqueous salt solution?

Ans: 18.5 g

21. How many grams of a 6.28% w/w glucose solution are needed to provide 5.00 g of glucose?

Ans: 79.6 g

22. How many grams of a 5.00% w/w lactate solution are needed to provide 8.25 g of lactate?

Ans: 165 g

23. Explain how to prepare 500.0 mL of an 8.00% v/v methyl alcohol solution.

Ans: Dissolve 40.0 mL methyl alcohol in a small amount of water, and then add enough water to produce exactly 500 mL of solution.

24. Explain how to prepare 100.0 mL of a 12.0% v/v ethanol solution.

Ans: Dissolve 12.0 mL of ethanol in a small amount of water, and then add enough water to produce exactly 100 mL of solution.

25. A 250.0-mL sample of saltwater is evaporated to dryness, leaving a residue of salt weighing 27.9 g. Calculate the % w/v of the original saltwater.

Ans: 11.2% w/v

26. Explain how to prepare 250.0 mL of a 0.9000% w/v NaCl solution.

Ans: Dissolve 2.250 g of NaCl in a small amount of water. Then add enough water to produce 250.0 mL of solution.

27. What volume of a 10.0% w/v solution of  $\text{HNO}_3$  contains 63.1 g of  $\text{HNO}_3$ ?

A) 100 mL   B) 300 mL   C) 567 mL   D) 631 mL

Ans: D

28. What volume of a 25.0% w/v solution of NaOH contains 1.20 mol of NaOH?

A) 4.80 mL   B) 192 mL   C) 214 mL   D) 293 mL

Ans: B

29. One liter of 2 M NaOH can be prepared with:

- A) 20 g of NaOH B) 40 g of NaOH C) 60 g of NaOH D) 80 g of NaOH

Ans: D

30. How many grams of hydrochloric acid are in 500.0 mL of a 5.000 M solution?

- A) 36.50 g B) 54.75 g C) 73.01 g D) 91.15 g

Ans: D

31. Calculate the molarity of a  $\text{KNO}_3$  solution if evaporation of a 10.0-mL sample to dryness leaves 0.51 g of solid  $\text{KNO}_3$ .

Ans: 0.50 M

32. Calculate the molarity of a solution prepared by dissolving 10.0 g of solid  $\text{CuCl}_2$  in enough water to make 1.0-L solution.

Ans: 0.074 M

33. Calculate the number of moles of solute contained in 200.0 mL of a 0.354 M solution of that substance.

Ans: 0.0708 mol

34. Calculate the volume of a 0.245 M solution that contains 0.15 mol of solute.

Ans: 0.61 L

35. Calculate the mass of solid remaining when 25.0 mL of 0.750 M KCl solution is evaporated to dryness.

Ans: 1.40 g

36. Explain how to prepare 0.250 L of a 0.500 M  $\text{CuSO}_4$  solution.

Ans: Dissolve 20.0 g of  $\text{CuSO}_4$  solid in a small amount of water, and add sufficient water to achieve a volume of 0.250 L.

37. The molarity of chloride ion,  $\text{Cl}^-$  (aq), in 100.0 mL of a 0.500 M barium chloride,  $\text{BaCl}_2$ , solution is:

- A) 0.100 M B) 0.250 M C) 0.500 M D) 1.00 M

Ans: D

38. How many liters of water must be added to 4 L of a 6 M  $\text{HNO}_3$  solution to produce a 2 M  $\text{HNO}_3$  solution?

- A) 4 L B) 6 L C) 8 L D) 12 L

Ans: C

39. How many moles of sulfate ions are there in 0.2 L of a 2 M sodium sulfate solution?

- A) 0.2 mol B) 0.4 mol C) 0.6 mol D) 0.8 mol

Ans: B

40. What is the molarity of a solution if 0.110 L of the solution contains 8.7 g of  $\text{CaCl}_2$ ?

- A) 0.050 M B) 0.71 M C) 1.1 M D) 79 M

Ans: B

41. What amount of water must be evaporated from 0.5 L of a 1 M NaOH solution to increase the NaOH concentration to 5 M?

- A) 0.1 L B) 0.2 L C) 0.3 L D) 0.4 L

Ans: D

42. Calculate the number of grams of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) needed to prepare 0.500 L of a 1.00 M sucrose solution.

- A) 85.5 B) 171 C) 342 D) 684

Ans: B

43. What is the molarity of a solution prepared by mixing 0.100 L of 1.50 M NaCl with 0.500 L of 1.06 M NaCl?

- A) 0.855 M B) 1.13 M C) 1.28 M D) 2.56 M

Ans: B

44. What is the molarity of a solution made by dissolving 32.0 g of KCl in enough water to make 425 mL of solution?

- A) 0.00101 M B) 0.425 M C) 1.01 M D) 2.30 M

Ans: C

45. Which solution is the most concentrated?

- A) 1 mol of solute dissolved in 1 L of solution
- B) 2 mol of solute dissolved in 3 L of solution
- C) 6 mol of solute dissolved in 4 L of solution
- D) 4 mol of solute dissolved in 8 L of solution

Ans: C

46. What is the concentration of a solution containing 10.0 mol of copper(II) nitrate in 5.0 L of solution?

- A) 0.50 M
- B) 2.0 M
- C) 5.0 M
- D) 10 M

Ans: B

47. What volume of 2.00 M NaCl solution is needed to prepare 0.250 L of 0.100 M NaCl?

Ans: 12.5 mL

48. What volume of 4.0 M NaOH solution is needed to prepare 0.50 L of 0.25 M NaOH?

Ans: 31 mL

49. To what final volume should 0.100 L of 8.00 M  $\text{H}_2\text{SO}_4$  be diluted to produce a 1.00 M  $\text{H}_2\text{SO}_4$  solution?

- A) 0.100 L
- B) 0.300 L
- C) 0.400 L
- D) 0.800 L

Ans: D

50. When 20.0 mL of a 0.500 M salt solution is diluted to 1.00 L, the concentration of the diluted solution is:

- A) 0.00100 M
- B) 0.0100 M
- C) 1.00 M
- D) 10.0 M

Ans: B

51. Which expression is equal to one part per million?

- A) 1 ng/L
- B) 1  $\mu\text{g}/\text{L}$
- C) 1 mg/L
- D) 1 g/L

Ans: C

52. Which expression is equal to one part per billion?

- A) 1 ng/L
- B) 1  $\mu\text{g}/\text{L}$
- C) 1 mg/L
- D) 1 g/L

Ans: B

53. Which process will likely increase the solubility of KCl in water?

- A) stirring the mixture
- B) increasing the surface area of KCl
- C) raising the temperature of the mixture
- D) increasing the pressure on the surface of the water

Ans: C

54. A solution exhibiting equilibrium between the dissolved and the undissolved solute must be:

- A) dilute
- B) concentrated
- C) saturated
- D) unsaturated

Ans: C

55. The condition known as gout results directly from:

- A) excess accumulation of urine in the body
- B) the insolubility of uric acid and its sodium salt in body fluids
- C) a disorder of nucleotide biosynthesis
- D) decreased levels of nucleotide metabolism

Ans: B

56. Which precipitate appears when a sodium chloride solution is added to a saturated aqueous solution of silver nitrate?

- A) sodium chloride
- B) silver nitrate
- C) sodium nitrate
- D) silver chloride

Ans: D

57. A soluble sodium salt solution is mixed with  $\text{BaCl}_2$  and a precipitate forms. Which anion could be present in the soluble salt solution?

- A)  $\text{CH}_3\text{COO}^-$
- B)  $\text{NO}_3^-$
- C)  $\text{Br}^-$
- D)  $\text{SO}_4^{2-}$

Ans: D

58. Which cation forms soluble salts with  $\text{Br}^-$ ,  $\text{Cl}^-$ ,  $\text{I}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ , and  $\text{S}^{2-}$ ?

- A)  $\text{Fe}^{2+}$
- B)  $\text{K}^+$
- C)  $\text{Ca}^{2+}$
- D)  $\text{Pb}^{2+}$

Ans: B

59. Write the complete ionic equation and the net ionic equation for the reaction of sodium sulfide,  $\text{Na}_2\text{S}$ , with silver nitrate,  $\text{AgNO}_3$ .

Ans: Complete:  $2\text{Ag}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{Na}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s}) + 2\text{Na}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq})$

Net:  $2\text{Ag}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) \rightarrow \text{Ag}_2\text{S}(\text{s})$

60. Write the complete ionic equation and the net ionic equation for the reaction of calcium chloride,  $\text{CaCl}_2$ , with sodium phosphate,  $\text{Na}_3\text{PO}_4$ .

Ans: Complete:  $3\text{Ca}^{2+}(\text{aq}) + 6\text{Cl}^-(\text{aq}) + 6\text{Na}^+(\text{aq}) + 2\text{PO}_4^{3-}(\text{aq}) \rightarrow \text{Ca}_3(\text{PO}_4)_2(\text{s}) + 6\text{Cl}^-(\text{aq}) + 6\text{Na}^+(\text{aq})$

Net:  $3\text{Ca}^{2+}(\text{aq}) + 2\text{PO}_4^{3-}(\text{aq}) \rightarrow \text{Ca}_3(\text{PO}_4)_2(\text{s})$

61. Define osmosis.

Ans: Osmosis is the flow of water through a semipermeable membrane, similar to diffusion. When there is a concentration difference in two solutions separated by a membrane, water flows from the side with the lower concentration of solute into the more concentrated solution, in effort to equalize the concentrations.

62. Explain the difference between osmotic pressure and hydrostatic pressure.

Ans: Both types of pressure cause the flow of water. Osmotic pressure is caused by a solute concentration difference across a semipermeable membrane, whereas hydrostatic pressure is caused by mechanical means, such as the pumping of the heart.

63. Explain how water can be purified using the reverse of osmosis.

Ans: Osmosis can be reversed by applying hydrostatic pressure to a "salty" solution separated from pure water by a membrane impermeable to the solute.

64. What is the osmolarity of a solution in which 1 mol of  $\text{MgCl}_2$  is dissolved in 1 L of water?

Ans: 3 osmol/L

65. Calculate the osmolarity of a solution containing 45.0 g of KOH per liter.

Ans: 1.60

66. Calculate the osmolarity of a 0.25 M solution of  $\text{CaCl}_2$ .

Ans: 0.75

67. Under \_\_\_\_\_ conditions, the solute concentrations inside and outside the cell are equal.  
Ans: isotonic

68. Hemolysis occurs under which osmotic condition?  
A) hydrostatic B) hypotonic C) hypertonic D) isotonic  
Ans: B

69. To prevent harm, fluids added to blood must be:  
A) hydrostatic B) hypotonic C) hypertonic D) isotonic  
Ans: D

70. With respect to an aqueous solution, organize the terms suspension, colloid, and solution in order of increasing relative particle size.  
A) solution < suspension < colloid C) solution < colloid < suspension  
B) colloid < solution < suspension D) colloid < suspension < solution  
Ans: C

71. An isotonic solution is one whose osmolarity is 0.30. Which statement is true?  
A) Both 0.30 M glucose and 0.15 M NaCl are isotonic.  
B) Both 0.15 M glucose and 0.15 M NaCl are isotonic.  
C) Both 0.15 M glucose and 0.30 M NaCl are isotonic.  
D) Both 0.30 M glucose and 0.30 M NaCl are isotonic.  
Ans: A

**END OF SECTION**