

14 • Solutions

PRACTICE TEST

- What is the molality of 7.80% by weight glucose ($C_6H_{12}O_6$ molar mass = 180.16 g/mol) solution?
a) 0.470 m d) 0.0454 m
b) 0.845 m e) 0.0844 m
c) 0.0432 m
- The mol fraction of NH_4Cl in a solution is 0.0311. What is its molality?
(The molar mass of water is 18.016 g/mol.)
a) 1.78 *m* d) 0.562 *m*
b) 1.66 *m* e) 0.0983 *m*
c) 0.969 *m*
- What is the mol fraction Na_2SO_4 in a solution which is 11.5% by weight Na_2SO_4 (molar mass $Na_2SO_4 = 142.06$ g/mol and $H_2O = 18.016$ g/mol)?
a) 0.0810 d) 0.0173
b) 0.0914 e) 0.0162
c) 0.0745
- What is the mol fraction $NaNO_3$ in a solution which is 2.15 *m*?
a) 0.0180 d) 0.09387
b) 0.0268 e) 0.0785
c) 0.0373
- A 1.34 *M* $NiCl_2$ (molar mass = 129.6 g/mol) solution has a density of 1.12 g/cm³. What is the weight percent $NiCl_2$ of the solution?
a) 1.73% d) 25.4%
b) 8.64% e) 29.8%
c) 15.5%
- A 1.25 *M* $Cu(NO_3)_2$ (molar mass = 187.56 g/mol) solution has a density of 1.19 g/cm³. What is the weight percent $Cu(NO_3)_2$ of the solution?
a) 1.88% d) 14.3%
b) 2.36% e) 19.9%
c) 10.5%
- Hydrobromic acid (molar mass = 80.9 g/mol) is commercially available in a 34.0 mass percent solution which has a density of 1.31 g/cm³. What is the molarity of the commercially available hydrobromic acid?
a) 2.75 *M* d) 9.35 *M*
b) 4.45 *M* e) 10.2 *M*
c) 5.50 *M*
- The maximum contamination level of arsenic ion in a water system is 0.050 parts per million. If the arsenic is present as $AsCl_3$, how many grams of arsenic chloride could be present in a system that contains 8.2×10^5 Liters?
a) 0.55 g d) 62 g
b) 7.3 g e) 98 g
c) 41 g
- A student prepared a solution containing 0.30 mol solute and 1.00 mole solvent. The mole fraction of *solvent* is
a) 1.30 d) 0.30
b) 1.00 e) 0.23
c) 0.77

10. Which measure of concentration is most appropriate for the calculation of the vapor pressure of a solution?
- a) mol fraction d) weight %
b) molarity e) ppm
c) molality
11. A chemist knows the empirical formula of a new compound but not the molecular formula. What must be determined experimentally so that the molecular formula can be determined?
- a) density d) melting point
b) viscosity e) molar mass
c) % composition
12. A volumetric flask is necessary for the preparation of which one of the following concentration measurements?
- a) molality d) molarity
b) X e) ppm
c) mass %
13. If the pressure of a gas over a liquid increases, the amount of gas dissolved in the liquid will
- a) increase
b) decrease
c) remain the same
d) have a higher vapor pressure
e) depends on the polarity of the gas
14. Which of the following solutions would have the lowest vapor pressure?
- a) 1 m glucose ($C_6H_{12}O_6$)
b) 1 m $MgCl_2$ d) 1 m $NaBr$
c) 1 m $NaNO_3$ e) pure H_2O
15. What is the primary energetic factor in the lack of miscibility between $CCl_4(l)$ and water?
- a) the strength of intermolecular forces between CCl_4 molecules
b) the strength of intermolecular forces between H_2O molecules
c) the charge on the C atom in CCl_4
d) the difference between the molecular weights of the molecules
e) the electronegativity difference between carbon and chlorine
16. Which of the following would have a boiling point closest to that of 1 m $NaCl$?
- a) 1 m sucrose ($C_{12}H_{22}O_{11}$)
b) pure H_2O d) 0.5 m CH_3OH
c) 1 m $MgCl_2$ e) 1 m NH_4NO_3
17. Which of the following would have the highest freezing point?
- a) 1 m glucose ($C_6H_{12}O_6$)
b) 1 m $MgCl_2$ d) 1 m $(NH_4)_2SO_4$
c) 1 m $NaNO_3$ e) pure H_2O
18. You need a solution that is 0.15 m in ions. How many grams of $MgCl_2$ (molar mass = 95.2 g/mol) must you dissolve in 400. g of water? (Assume total dissociation of the ionic salt.)
- a) 0.060 g d) 7.6 g
b) 1.9 g e) 17 g
c) 5.7 g

19. A solution is prepared by dissolving 0.500 g of non-dissociating solute in 12.0 g of cyclohexane. The freezing point depression of the solution is 8.94°C . The K_{fp} for cyclohexane is $-20.0^{\circ}\text{C}/m$. Calculate the molar mass of the solute.
- a) 93.2 g/mol d) 182 g/mol
 b) 112 g/mol e) 205 g/mol
 c) 128 g/mol
20. What is the freezing point of a solution containing 4.134 grams naphthalene (molar mass = 128.2) dissolved in 30.0 grams paradichlorobenzene? The freezing point of pure paradichlorobenzene is 53.0°C and the freezing point depressing constant K_{fp} is $-7.10^{\circ}\text{C}/m$.
- a) 52.0°C d) 17.6°C
 b) 48.7°C e) 7.63°C
 c) 45.4°C
21. What is the molar mass of a compound if 4.28 grams is dissolved in 25.0 grams of chloroform solvent to form a solution which has a boiling point elevation of 2.30°C . The boiling point constant of chloroform K_{bp} is $+3.63^{\circ}\text{C}/m$.
- a) 34.5 g/mol d) 168 g/mol
 b) 67.5 g/mol e) 270 g/mol
 c) 135 g/mol
22. Concentrated salt solutions have boiling points lower than those calculated using the equation, $T_b = K_b \cdot m \cdot i$. Which of the following is a reasonable explanation of this observation?
- a) Positive ions repel each other more at high concentration.
 b) Ions of opposite charge will tend to stay paired instead of breaking up.
 c) The water molecules will have a greater attraction for each other.
 d) Concentrated solutions really have small particles of non-dissolved salt, thus lowering the molality.
 e) The difference between the crystal lattice energy and the heat of hydration must be taken into consideration.

Answers:

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| 1. | A | 11. | E |
| 2. | A | 12. | D |
| 3. | E | 13. | A |
| 4. | C | 14. | B |
| 5. | C | 15. | B |
| 6. | E | 16. | E |
| 7. | C | 17. | E |
| 8. | E | 18. | B |
| 9. | C | 19. | A |
| 10. | A | 20. | C |
| | | 21. | E |
| | | 22. | B |