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1.

If heat is added to ice and liquid water in a closed container and, after the addition of the heat, ice and liquid water remain,

1. the temperature will increase somewhat.
2. the vapor pressure of the water will decrease.
3. the vapor pressure of the water will rise.
4. the vapor pressure of the water will remain constant.
5. the temperature will decrease somewhat.

2.

When one mole of a nonvolatile nonelectrolyte is dissolved in three moles of a solvent, the vapor pressure of the solution compared with that of the pure solvent is

1. 1/4.
2. 3/4.
3. 1/3.
4. 4/5.
5. 1/5.

3.

What is the mole fraction of water in a solution that contains 6.5 mol of ethanol (C_2H_5OH) and 2.6 mol of water?

1. 0.71
2. 0.16
3. 0.25
4. 0.29
5. 0.40

4.

An ideal solution is formed from a mixture of the nonvolatile solute urea, $CO(NH_2)_2$, and methanol, CH_3OH. The vapor pressure of pure methanol at 20°C is 89 mmHg. Calculate the mole fraction of urea that is obtained from mixing 6.6 g of urea with 32.4 g of methanol.

1. 0.90

2. 0.17
3. 0.28
4. 0.098
5. 0.83

5.

What is the molality of a solution that contains 73.3 g of 1,4-dichlorobenzene, $C_6H_4Cl_2$, in 493 mL of carbon tetrachloride? (The density of CCl_4 is 1.60 g/mL.)

1. 0.149 m
2. 0.093 m
3. 0.156 m
4. 1.62 m
5. 0.633 m

6.

Calculate the molecular weight of a small protein if a 0.40-g sample dissolved in 101 mL of water has an osmotic pressure of 9.3 mmHg at 28°C.

1. 7.4 10^3 g/mol
2. 8.0 10^3 g/mol
3. 1.0 10^4 g/mol
4. 1.0 10^4 g/mol
5. none of these

7.

What is the mole fraction of urea, CH_4N_2O, in an aqueous solution that is 36% urea by mass?

1. 0.55
2. 0.86
3. 0.36
4. 0.14
5. 0.65

8.

Determine the freezing point of a 0.16 m solution of glucose in water. (K_f for water is 1.86°C/m.)

1. −0.60°C
2. −0.15°C

| 3. –0.30°C |
| 4. 0.15°C |
| 5. 0.30°C |

9.

A 2.5-g sample of a small protein having a molecular weight of 52,000 g/mol is dissolved in 57.6 mL of water. Calculate the osmotic pressure of the solution in millimeters of mercury at a temperature of 24°C.

| 1. 1.2 mmHg |
| 2. 37000 mmHg |
| 3. 15 mmHg |
| 4. 0.020 mmHg |
| 5. 800 mmHg |

10.

When solid $Ca(CH_3COO)_2$ is dissolved in a nearly saturated solution of $Ca(CH_3COO)_2$, the solution becomes warmer. This information indicates that if the temperature of a solution is decreased,

| 1. the solubility of $Ca(CH_3COO)_2$ will increase. |
| 2. H will become negative. |
| 3. H will become zero. |
| 4. the solubility of $Ca(CH_3COO)_2$ will decrease. |
| 5. the solubility of $Ca(CH_3COO)_2$ will not change. |

11.

The boiling points of the hydrogen halides are listed below.
HF   19°C
HCl   –85°C
HBr   –67°C
HI   –35°C
Which of the following accounts for the relatively high boiling point of HF?
1. HF has the strongest H—X bond.
2. HF molecules form hydrogen bonds.
3. HF molecules have the strongest van der Waals forces.

| A. 1 only |
| B. 3 only |
| C. 2 and 3 only |
| D. 1 and 2 only |
| E. 2 only |

12.

Neon atoms do not combine to form Ne_2 molecules, yet neon atoms can be liquified through the following intermolecular forces:

1. dipole–dipole
2. London forces
3. hydrogen bonding
4. nonmetal–nonmetal
5. dipole–induced dipole

13.

Which of the following are colligative properties?
1. Vapor-pressure elevation
2. Boiling-point elevation
3. Vapor-pressure lowering

A. 1 only
B. 1 and 2 only
C. 2 and 3 only
D. 2 only
E. 3 only

14.

What is the expected boiling point of a solution prepared by dissolving 5.28 g of sugar $(C_{12}H_{22}O_{11})$ in 52.0 g of water (H_2O)? For water, $T_b = 100.00°C$ and $K_b = 0.512°C\ m^{-1}$.

1. 99.85°C
2. 0.15°C
3. 97.30°C
4. 100.15°C
5. 102.70°C

15.

A 12.0% sucrose solution has a density of 1.05 g/cm^3. The number that gives the best value for the mass of sugar in 55 mL of this solution is

1. 6.9 g.
2. 58 g.
3. 6.60 g.
4. 6.93 g.
5. 6.6 g.

16.

The solubility of a gas in a liquid can *always* be increased by

1. decreasing the pressure of the gas above the solvent.
2. decreasing the temperature of the gas above the solvent.
3. increasing the pressure of the gas above the solvent.
4. increasing the temperature of the solvent.
5. decreasing the polarity of the solvent.

17.

When 0.156 mol of urea, a nonelectrolyte whose MM = 60.1 and whose density = 1.48 g/cm^3, is dissolved in 131 g of water (K_f = 1.86°C/molal), the molality of the solution is

1. 1.762 *m*.
2. 0.0214 *m*.
3. 2.21 *m*.
4. 0.0716 *m*.
5. 1.191 *m*.

18.

Which of the following molecules exhibits hydrogen bonding?

1. HBr
2. CaH_2
3. H_2S
4. B_2H_6
5. HNF_2

19.

The *strongest* intermolecular forces between molecules of PH_3 are

1. ion–dipole attractions.
2. dipole-dipole interactions.
3. hydrogen bonds.
4. London forces.
5. covalent bonds.

20.

Which of the following solutions would have the highest osmotic pressure?

1. 0.3 M $C_6H_{12}O_6$, glucose
2. 0.2 M NaCl, sodium chloride

3. 0.2 M $MgBr_2$, calcium chloride
4. 0.3 M $C_{12}H_{22}O_{11}$, sucrose
5. 0.3 M CH_3COOH, acetic acid