

1. Assume 12,500 J of energy is added to 2.0 moles (36 grams) of H₂O as an ice sample at 0°C. The molar heat of fusion is 6.02 kJ/mol. The specific heat of liquid water is 4.18 J/g °C. The molar heat of vaporization is 40.6 kJ/mol. The resulting sample contains which of the following?
- A. water and water vapor
 - B. ice and water
 - C. only water
 - D. only water vapor
 - E. only ice
2. In a certain mountain range, water boils at 94°C. What is the atmospheric pressure under these conditions? The enthalpy of vaporization of water at 100°C is 40.7 kJ/mol. The normal boiling of water is 100 °C.
- A. 1750 mmHg
 - B. 324 mmHg
 - C. 613 mmHg
 - D. 941 mmHg
 - E. 329 mmHg
3. Which is the best reason for why water in a glass capillary has a concave meniscus, while mercury in a glass capillary has a convex meniscus?
- A. Mercury has a greater dispersion force than water.
 - B. The water is attracted more strongly to the glass than the mercury is attracted to the glass.
 - C. The mercury is attracted more strongly to the glass than the water is attracted to the glass.
 - D. Water is a molecular compound while mercury is a metallic element.
 - E. Water has a greater dispersion force than mercury.
4. Which compound has the lowest standard enthalpy of vaporization at 25°C?
- A. C₆H₁₄
 - B. C₈H₁₆
 - C. C₅H₁₂
 - D. C₈H₁₈
 - E. C₇H₁₆

$$\frac{C_1}{C_2} = \frac{P_1}{P_2}$$

$$C_2 = \frac{C_1 P_2}{P_1}$$

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$$P_2 = \frac{C_2 P_1}{C_1}$$

5. Which of the following concerning intermolecular forces is/are correct?

- Intermolecular forces depend in part on the shape of a molecule.
- London forces contribute to the net forces of attraction found in all molecular solids and liquids.
- Hydrogen bonding is a special category of dipole-dipole attractions.

A. i only B. ii only C. iii only D. i and ii E. i, ii, and iii

6. If the solubility of O_2 at 0.160 bar and $25^\circ C$ is 6.65 g/100 g H_2O , what is the solubility of O_2 at a pressure of 1.84 bar and $25^\circ C$?

- 77 g/100 g H_2O
- 22.5 g/100 g H_2O
- 1.7 g/100 g H_2O
- 0.0 g/100 g H_2O
- 0.6 g/100 g H_2O

$$3.92 = \frac{g}{L}$$

$$3.92 = \frac{\text{mole}}{L}$$

$$3.92 = \frac{\text{mole}}{1330}$$

$$3000 = \frac{g}{L}$$

7. What is the mass percent of an aqueous sodium hydroxide solution in which the molarity of $NaOH$ is 9.98 M ? The density of the solution is 1.33 g/mL. Molar mass of $NaOH = 40.0$ g/mol)

- 0.1%
- 30.0%
- 13.2%
- 1.7%
- 68.9%

8. Substance A has a greater molar mass than substance B. If 50 g of substance A are dissolved in 250 g of water in one beaker, and 50 g of substance B are dissolved in 250 g of water in another beaker, then

- the vapor pressure of solution A will be lower than the vapor pressure of solution B.
- the solution of A will freeze at a lower temperature than the solution of B.
- the two solutions will have the same vapor pressure.
- the boiling point of solution A will be lower than the boiling point of solution B.
- the solution of A will have a higher osmotic pressure than the solution of B.

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9. When a 33.8-g sample of an unknown compound is dissolved in 500. g of benzene, the freezing point of the resulting solution is 3.77°C . The freezing point of pure benzene is 5.48°C , and K_f for benzene is $5.12^\circ\text{C}/m$. Calculate the molar mass of the unknown compound.

- A. 173 g/mol
 B. 202. g/mol
 C. 101.2 g/mol
 D. 405 g/mol
 E. 19.8 g/mol

10. At 36°C , what is the osmotic pressure of a 0.82% NaCl by weight aqueous solution? Assume the density of the solution is 1.0 g/mL . molar mass of NaCl = 58.0 g/mol .

- A. 0.35 atm
 B. 3.5 atm
 C. $4.1 \times 10^2\text{ atm}$
 D. 7.1 atm
 E. 0.82 atm

11. For the hypothetical reaction $\text{A} + 2\text{B} \rightarrow 2\text{C} + \text{D}$, the initial rate of disappearance of A is $2.0 \times 10^{-2}\text{ mol}/(\text{L} \cdot \text{s})$. What is the initial rate of disappearance of B?

- A. $8.0 \times 10^{-2}\text{ mol}/(\text{L} \cdot \text{s})$
 B. $4 \times 10^{-2}\text{ mol}/(\text{L} \cdot \text{s})$
 C. $1.4 \times 10^{-1}\text{ mol}/(\text{L} \cdot \text{s})$
 D. $4.0 \times 10^{-4}\text{ mol}/(\text{L} \cdot \text{s})$
 E. $1.4 \times 10^{-2}\text{ mol}/(\text{L} \cdot \text{s})$

$$M_u = \frac{\Delta \text{solut} \times K_f}{\Delta \text{solut} \times 10^{-3} \times \Delta T_f} \quad 1 = \frac{\Delta}{m_1} \quad m_1 = 100$$

$$1.71 \quad m = \frac{2}{L}$$

$$d = \frac{100}{mL} \quad m_1 = 100$$

$$\Delta V = nRT$$

$$\frac{\sin^2 \theta - \cos^2 \theta}{\sin \theta}$$

12. If the rate law for a reaction is
 $\text{Rate} = k[\text{ClO}_3^-][\text{I}^-][\text{H}^+]^2$
 what are the units of k ?

- A. $(\text{L} \cdot \text{s})/\text{mol}$
 B. $\text{mol}^2/(\text{L}^2 \cdot \text{s})$
 C. $\text{mol}/(\text{L} \cdot \text{s})$
 D. $\text{L}^2/(\text{mol}^2 \cdot \text{s})$
 E. $\text{L}^3/(\text{mol}^3 \cdot \text{s})$

$$t_{1/2} = \frac{\ln 2}{k[A]^n}$$

13. A first-order reaction is 45% complete at the end of 35 minutes. What is the length of the first half-life of this reaction?

- A. 41 min
 B. 39 min
 C. 30. min
 D. 27 min
 E. none of these

14. For a reaction: $aA \rightarrow \text{Products}$, $[A]_0 = 6.0 \text{ M}$, and the first two half-lives are 56 and 28 minutes, respectively.

Calculate k (without units)

- A. 1.2×10^{-2}
 B. 3.0×10^{-3}
 C. 5.4×10^{-2}
 D. 1.0×10^{-2}
 E. none of these

15. The following data were obtained for the hypothetical reaction $2A + B \rightarrow \text{products}$.

¹ $[A]_0 (M)$	² $[B]_0 (M)$	Initial Rate (M/s)
0.2	0.1	5
0.2	0.2	20
0.6	0.1	15

What is the overall order of this reaction?

- A. 4
 B. $\frac{1}{2}$
 C. 0
 D. 3
 E. 1