Exam 1 Practice Problems

1. What is the strongest type of intermolecular force present in H2?

A) ion-dipole

B) dipole-dipole

C) dispersion

D) hydrogen bonding

E) None of the above

1. Choose the pair of substances that are most likely to form a homogeneous solution.

A) NaCl and CH4

B) CH4 and NH4+

C) LiF and CH4

D) CH4 and H2O

E) NH4+ and H2O

1. Give the term for amount of solute in mole per mass of solvent in kg.

A) Molality

B) Molarity

C) Mole fraction

D) Mole percent

E) Mass percent

1. Identify the colligative property.

A) Vapor pressure lowering.

B) Freezing point depression.

C) Boiling point elevation.

D) Osmotic pressure.

E) All of the above.

1. Given the following rate law, how does the rate of reaction change if the concentration of Y is doubled?

 Rate = k [X][Y]2

A) The rate of reaction will increase by a factor of 2.

B) The rate of reaction will increase by a factor of 4.

C) The rate of reaction will increase by a factor of 5.

D) The rate of reaction will decrease by a factor of 2.

E) The rate of reaction will remain unchanged.

1. What data should be plotted to show that experimental concentration data fits a second-order reaction?

A) ln[reactant] vs. time

B) [reactant] vs. time

C) ln(k) vs. 1/T

D) 1/[reactant] vs. time

E) ln(k) vs. Ea

1. Write a balanced reaction for which the following rate relationships are true.

 Rate =  =  = 

A) 2 N2O5 → 4 NO2 + O2

B) 4 NO2 + O2 → 2 N2O5

C) 2 N2O5 → NO2 + 4 O2

D)  NO2 + O2 →  N2O5

E)  N2O5 →  NO2 + O2

1. Determine the solubility of CO2 in soda water at 25°C if the pressure of CO2 is 5.2 atm. The Henry's law constant for carbon dioxide in water at this temperature is 3.4 × 10-2 M/atm.
2. Calculate the molality of a solution formed by dissolving 27.8 g of LiI in 500.0 mL of water
3. A solution is prepared by dissolving 27.0 g of NaCl in 225g of water. Calculate the mass % of KCl in the solution.
4. Determine the molality of an aqueous solution prepared by dissolving 0.112 moles of LiCl in 13.7 moles of H2O.

1. Determine the vapor pressure of a solution at 55°C that contains 34.2 g NaCl in 375 mL of water. The vapor pressure of pure water at 55°C is 118.1 torr.
2. Determine the freezing point of a solution that contains 78.8 g of naphthalene (C10H8, molar mass = 128.16 g/mol) dissolved in 722 mL of benzene (d = 0.877 g/mL). Pure benzene has a melting point of 5.50°C and a freezing point depression constant of 4.90°C/*m*.
3. Given the following balanced equation, determine the rate of reaction with respect to [NOCl].

 2 NO(g) + Cl2(g) → 2 NOCl(g)

1. Given the following balanced equation, determine the rate of reaction with respect to [O2]. If the rate of formation of O2 is 6.94 x 10-1 M/s, what is the rate of the loss of O3?

 2 O3(g) → 3 O2(g)

1. Determine the rate law and the value of k for the following reaction using the data provided.

 2 NO(g) + O2(g) → 2 NO2(g)

|  |  |  |
| --- | --- | --- |
| [NO]i (M) | [O2]i (M) | Initial Rate (M-1s-1) |
| 0.030 | 0.0055 | 8.55 x 10-3 |
| 0.030 | 0.0110 | 1.71 x 10-2 |
| 0.060 | 0.0055 | 3.42 x 10-2 |

1. The rate constant for the first-order decomposition of N2O is 3.40 s-1. What is the half-life of the decomposition?

1. The first-order decomposition of cyclopropane has a rate constant of 6.7 x 10-4 s-1. If the initial concentration of cyclopropane is 1.33 M, what is the concentration of cyclopropane after 644 s?
2. The second-order decomposition of HI has a rate constant of 1.80 x 10-3 M-1s-1. How much HI remains after 27.3 s if the initial concentration of HI is 4.78 M?
3. If the activation energy for a given compound is found to be 42.0 kJ/mol, with a frequency factor of 8.0 × 1010 s-1, what is the rate constant for this reaction at 298 K?
4. A reaction is found to have an activation energy of 108 kJ/mol. If the rate constant for this reaction is 4.60 × 10-6 s-1 at 275 K, what is the rate constant at 366 K?
5. Given the following proposed mechanism, predict the rate law for the overall reaction.

 2NO2 + Cl2 → 2NO2Cl (overall reaction)

 Mechanism

 NO2 + Cl2 → NO2Cl + Cl slow

 NO2 + Cl → NO2Cl fast

Answers

1. C
2. E
3. A
4. E
5. B
6. D
7. A
8. 0.18 M
9. 0.415 molality
10. 10.7%
11. 0.454 molal
12. 115 torr
13. 0.74oC
14. Rate =

1. 0.463 M/s
2. Rate = 1.7 × 103 M-2s-1[NO]2[O2]
3. 0.204 s
4. 0.86 M
5. 3.87 M
6. 3.5 × 103 s-1
7. 0.58 s-1
8. Rate = k[NO2][Cl2]