Exam I Name:

CHM 1046

Spring 2011 Lab Day:

MC: Pick the best answer (2 pt each, 54pts total)

1. Which of the following is an example of ionic bonding?
   1. NH3 b. NaCl c. N2 d. Ar
2. Which of the following does not have a dipole moment?
   1. CH2Cl­2 b. CCl4 c. NH3 d. H2O
3. Which of the following would have the least % ionic character?
   1. HI b. HBr c. HCl d. HF
4. Which of the following is a true statement?
   1. A molecule that contains polar bonds is always polar
   2. A molecule that does not contain polar bonds is always polar
   3. A molecule that contains polar bonds is never polar
   4. A molecule must contain at least 1 polar bond to be polar
5. Which of the following has a dipole-dipole intermolecular force?
   1. N2 b. CO2 c. CH4 d. H2O
6. Which of the following does not have a dispersion intermolecular force?
   1. Ar b. H2 c. He2+ d. Cl2
7. Which of the following has the hydrogen bonding intermolecular force?
   1. CH4 b. H+ c. NH3 d. CO2
8. What is the name for the following phase change?

I2(s) 🡪 I2(g)

* 1. Melting
  2. Sublimation
  3. Deposition
  4. Condensation

1. Which of the following phase changes has a -ΔS?
   1. Solid 🡪 liquid
   2. Liquid 🡪 Gas
   3. Gas 🡪 solid
   4. Solid 🡪 liquid
2. Which of the following phase changes has a +ΔH?
   1. Gas 🡪 liquid
   2. Gas 🡪 solid
   3. Liquid 🡪 solid
   4. Gas 🡪 liquid
3. Given the following table of compounds with boiling points, which has the lowest vapor pressure?

|  |  |
| --- | --- |
| Compound | Boiling Point (°C) |
| H2O | 100 |
| CH3OH | 64.96 |
| CH3CH2OCH2CH3 | 34.5 |
| CH3CH2OH | 78.5 |

* 1. H2O
  2. CH3OH
  3. CH3CH2OCH2CH3
  4. CH3CH2OH

1. If I have a sample of H2O at 25°C and I heat it to 85°C, which will have the highest vapor pressure?
   1. The H2O at 25°C b. The H2O at 85°C
2. For the following phase diagram, what is the name for point X on the diagram?

X

Pressure

Temperature

* 1. Boiling point
  2. Melting point
  3. Triple point
  4. Critical point

1. Which of the following is a description of a unsaturated solution?
   1. Contains less solute than a solvent has the capacity to dissolve
   2. Contains more solute than a solvent has the capacity to dissolve
   3. Contains exactly the amount of solute that the solvent has the capacity to dissolve
2. For the following phase diagram, a change from point A to point B corresponds to?

B

A

Pressure

Temperature

* 1. Sublimation
  2. Condensation
  3. Vaporization
  4. Melting

1. If I add 15 g of NaCl to 2 L of water, which is the solvent?
   1. NaCl b. H2O
2. Which of the following sets of conditions favors maximum solubility of solute in solvent?
   1. The intermolecular forces between solute and solvent molecules are much stronger than the intermolecular forces between solute molecules, but much weaker than the intermolecular forces between solvent molecules.
   2. The intermolecular forces between solute and solvent molecules are much stronger than the intermolecular forces between solute molecules and the intermolecular forces between solvent molecules.
   3. The intermolecular forces between solute and solvent molecules are much stronger than the intermolecular forces between solvent molecules, but much weaker than the intermolecular forces between solute molecules.
   4. The intermolecular forces between solute and solvent molecules are much weaker than the intermolecular forces between solute molecules or the intermolecular forces between solvent molecules.
3. Which of the following would you expect to be the least soluble in water?
   1. NH3 b. H2O c. H2 d. NaCl
4. Which of the following would you expect to have the larger (more negative) hydration energy?
   1. Na+ b. Mg2+ c. Li+ d. Ba2+
5. What is the molarity of a solution prepared by diluting 0.289 g of NaCl to 500 mL with water?
   1. 9.89 x10-3 M b. .578 M c. 9.89 x10-6 M d. 5.78 M
6. What is the molality of a solution prepared by dissolving 6.29 g NaOH in 750 g of water?
   1. 4.77 m b. 2.10 x10-4 m c. .210 m d. 8.39 m
7. How does the solubility of a gas in a solvent depend on temperature?
   1. Increasing the temperature increases the solubility of the gas.
   2. Increasing the temperature decreases the solubility of the gas.
   3. Increasing the temperature does not affect the solubility of the gas.
8. For the following reaction, express the rate of the formation of C with respect to concentration and time

A + 6 B 🡪 2C + 3D

* 1. Δ[C]/Δt b. Δ[C]/2Δt c. -Δ[C]/Δt d. -Δ[C]/2Δt

1. Which of the following will affect the rate of a reaction?
   1. Concentration of reactants
   2. Temperature
   3. Catalyst
   4. All of the above
2. Which of the following statements is incorrect?
   1. In a series of stepwise reactions, the rate-determining step is the slowest one.
   2. The rate constant for a reaction can be changed by changing the temperature.
   3. The rates of most chemical reactions change with time.
   4. The rate constant is dependent on the reactant concentrations.
3. For the following second order reaction, how long will it take for a 80% solution of A to decompose to a 20% solution if the rate constant is 0.248 L/mol\*s at 25°C?

3A 🡪 2D

* 1. -15 seconds b. .93 seconds c. 15 seconds d. -.93 seconds

1. For the following first order reaction, what is the half life if the rate constant is 2.49 s-1 and the original concentration of A is 2.56 M?
   1. 0.278 seconds b. 3.59 seconds c. 2.07 seconds

LA 1: 10 pts

For a certain reaction the rate constant doubles when the temperature is increased from 25°C to 65°C. Calculate the activation energy

LA 2: 10 pts

The density at 20°C of a 0.395 m solution of acetic acid in water is 0.9951 g/mL. What is the concentration of this solution in molarity? The molar mass of acetic acid, CH3CO2H is 60.05 g/mol

LA 3: 10 pts

The vapor pressure of unknown C at 27.5°C is 156 mm Hg. The heat of vaporization of unknown C is 121.6 kJ/mol. What is the vapor pressure of unknown C (in mm Hg) at 84°C?

Does your calculated vapor pressure seem reasonable? Why or why not?

LA 4: 16 pts

For the following reaction 3 experiments have been run and the data collected is in the following table

3 L + 5 N 🡪 2 Q + 9 V

|  |  |  |  |
| --- | --- | --- | --- |
| Experiment # | [L] | [N] | Rate (mol/L\*s) |
| 1 | 0.12 | 0.63 | 8.86 x10-4 |
| 2 | 0.19 | 0.63 | 2.22x10-3 |
| 3 | 0.22 | 0.82 | 1.95 x10-3 |

1. Find the order of the reaction with respect to L
2. Find the order of the reaction with respect to N
3. What is the overall order of the reaction?
4. Write the rate law
5. Calculate the rate constant, K

1. What is the rate when [R] = 1.2 M and [Q] = 3.45 M

Equations:

M = mol/L Psoln = Psolv \* Xsolv

m = mol/kg Ptot = (P°A \* XA) + (P°B \* XB)

ln P2 = ln P1 + [(ΔHvap/R) \* (1/T1 – 1/T2)]

ln (K2/K1) = Ea/R [1/T1 – 1/T2]

|  |  |  |
| --- | --- | --- |
| Order | Conc-Time  Relation | Half-life |
| 0 | [A]0 – [A] = kt | [A]0  2k |
| 1 | ln [A]0 = kt  [A] | 0.693  k |
| 2 | 1 – 1 = kt  [A] [A]0 | 1  k[A]0 |