Mid Term Exam Chem. 202 2nd Term 2009 Time allowed : 60 minutes	Student name: Student number: Section:

Question One (10 Marks)

Choose the right answer from the followings:

1. Which of the following liquids would make a good solvent for iodine, I_2?

   A. HCl   B. H_2O C. CH_3OH D. CS_2

2. Calculate the molality of a solution containing 14.3 g of NaCl in 42.2 g of water.

   A. 2.45×10^{-4} m   B. 5.80×10^{-4} m   C. 5.80 m   D. 103 m

3. The solubility of nitrogen gas at 25°C and a nitrogen pressure of 522 mmHg is 4.7×10^{-4} mol/L. What is the value of the Henry's Law constant in mol/L·atm?

   A. 9.0×10^{-7} mol/L·atm   B. 4.7×10^{-4} mol/L·atm
   C. 3.2×10^{-4} mol/L·atm   D. 1.5×10^{3} mol/L·atm

4. Dissolving a solute such as KOH in a solvent such as water results in

   A. an increase in the melting point of the liquid.
   B. a decrease in the boiling point of the liquid.
   C. a decrease in the vapor pressure of the liquid.
   D. no change in the boiling point of the liquid.

5. How much heat is required to raise the temperature of 1,500 g of water from 25°C to 52°C? The specific heat of water is 4.184 J/g·°C.

   A. 1,500 kJ   B. 169 kJ   C. 6.27 kJ   D. 40.5 J

6. Which of these processes is *endothermic*?

   A. $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$ B. $H_2O(g) \rightarrow H_2O(l)$
   C. $3O_2(g) + 2CH_3OH(g) \rightarrow 2CO_2(g) + 2H_2O(g)$ D. $H_2O(s) \rightarrow H_2O(l)$

7. Which of these species has the highest entropy (S°) at 25°C?

   A. CO(g)   B.$CH_3OH(l)$ C. $MgCO_3(s)$ D. $H_2O(l)$

8. A negative sign for ΔG indicates that, at constant T and P,

A. the reaction is exothermic.   B. the reaction is endothermic.
C. the reaction is fast.   D. the reaction is spontaneous.

9. During osmosis

    A.   pure solvent diffuses through a membrane but solutes do not.
    B.   pure solutes diffuse through a membrane but solvent does not.
    C.   pure solvent and a solution both diffuse at the same time through a membrane.
    D.   gases diffuse through a membrane into a solution and build up pressure.

10. The combustion of pentane produces heat according to the equation
$$C_5H_{12}(l) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(l) \qquad \Delta H^o_{rxn} = -3{,}510 \text{ kJ/mol}.$$

How many grams of CO_2 are produced per 2.50×10^3 kJ of heat released?

A. 0.0809 g   B. 157 g   C. 31.3 g   D. 3.56 g

Question Two   (5 Marks)

Solve the following problems:

1. Hydrogen peroxide (H_2O_2) decomposes according to the equation   (2 marks)
$$H_2O_2(l) \rightarrow H_2O(l) + (1/2)O_2(g).$$

Calculate K_p for this reaction at 25°C. ($\Delta H^\circ = -98.2$ kJ/mol, $\Delta S^\circ = 70.1$ J/K·mol)

2. When 12.1 g of the sugar sucrose (a nonelectrolyte) are dissolved in exactly 800 g of water, the solution has a freezing point of -0.082°C. What is the molar mass of sucrose? K_f of water is 1.86°C/m. (2 marks)

3. The osmotic pressure of a 0.010 M $MgSO_4$ solution at 25°C is 0.318 atm. Calculate i, the van't Hoff factor, for this $MgSO_4$ solution. (1 mark)

<u>Constants:</u>

$R = 8.314 \, J \, K^{-1}.mol^{-1}$, $R = 0.082$ atm. L .$K^{-1} mol^{-1}$
($C = 12 \, g \, mol^{-1}$, $O = 16 \, g.mol^{-1}$, $Na = 23 \, g.mol^{-1}$, $Cl = 35.5 \, g \, mol^{-1}$)

With my best wishes