銘傳大學九十二學年度管理研究所碩士班招生考試

(甲組) 第一節

普通化學 試題

A. CHOICE QUESTIONS (30%) (可使用計算機)

1. At a temperature of 500^0C the equilibrium constant, K_c, for the following nitrogen fixation reaction is 6.0×10^{-2}. If 0.250 mol/L of H_2 and 0.050 mol/L of NH_3 are present at equilibrium, what is the concertration of N_2?

   $3H_2(g) + N_2(g) \rightarrow 2NH_2(g)$

   a. 0.075M
   b. 0.7M
   c. 0.250M
   d. 0.025M
   e. 1.85M

2. Which of the following is true about chemical equilibrium?
   a. At equilibrium the total concentration of products equals the total concentration of reactants.
   b. Equilibrium is the result of cessation of all chemical change.
   c. There is only one set of equilibrium concentrations that equals the K_e value.
   d. The rate constant of the forward reaction is equal to the rate constant for the reverse reaction.
   e. At equilibrium the rate of the forward process is the same as the rate of the reverse process.

3. Which of the following compounds is a strong electrolyte?
   a. H_2O
   b. O_2
   c. H_2SO_4
   d. $C_6H_{12}O_6$ (glucose)
   e. CH_3COOH (acetic acid)

4. According to the solubility rules, which one of the following compounds is insoluble in water?
   a. NaCl
   b. $MgBr_2$
   c. $FeCl_2$

d. AgBr
e. $ZnCl_2$

5. Which reaction below is NOT an oxidation-reduction reaction?
   a. $CaCl_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2NaCl(aq)$
   b. $2Na(s) + 2H_20(1) \rightarrow 2NaOH(aq) + H_2(g)$
   c. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$
   d. $Zn(s) + Cu(NO_3)_2(aq) \rightarrow Zn(NO_3)_2(aq) + Cu(s)$
6. A spontaneous endothermic reaction always:
   a. causes the surroundings to get colder.
   b. Bursts into flame.
   c. Requires a spark to initiate it.
   d. Releases heat to the surroundings.
7. In the reaction: $HSO_4^-(aq) + OH^-(aq) \rightarrow SO_4^{2-}(aq) + H_2O(1)$ the conjugate acid-base pairs are:

	Pair 1		Pair2
a.	HSO_4^- and SO_4^{2-}	;	H_2O and OH^-
b.	HSO_4^- and H_3O^+	;	SO_4^{2-} and OH^-
c.	HSO_4^- and OH^-	;	SO_4^{2-} and H_2O
d.	HSO_4^- and OH^-	;	OH^- and SO_4^{2-}
e.	HSO_4^- and OH^-	;	SO_4^{2-} and H_3O^+

8. When 0.7521g of benzoic acid was burned in a calorimeter containing 1000 g of water, a temperature rise of 3.60^0C was observed. What is the heat capacity of the bomb calorimeter, excluding water? The heat of combustion of benzoic is -26.42kJ/g. (The Specific Heat of water is 4.184 J/g^0C)
   a. 15.78 kJ/^{o}C
   b. 4.18 kJ/^{o}C
   c. 5.52 kJ/^{o}C
   d. 1.34 kJ/^{o}C
   e. 752.1 kJ/^{o}C
9. Atoms emit visible and ultraviolet light: (complete)
   a. as electrons jump from lower energy levels to higher levels.
   b. As the atoms condense from a gas to a liquid.
   c. As electrons jump from higher energy levels to lower levels.
   d. As they are heated and the solid melts to form a liquid.
   e. As the electrons move about the atom within an orbit.
10. The number of orbitals in a d subshell is:
    a. 1
    b. 2

c. 3
d. 5
e. 7

11. Which of the following is **not** an intermolecular force that affects the structure of a protein?
    a. hydrongen bonds
    b. dispersion forces
    c. activation energy
    d. ionic forces
    e. dipole-dipole forces
12. For the following reaction at equilibrium, which choice gives a change that will shift the position of equilibrium to favor more products?
    $2NOBr(g) \rightarrow 2NO(g) + Br_2(g) \qquad \Delta H^o_{rxn} = 30$ kj
    a. increase the total pressure by decreasing the volume.
    b. Add more NO
    c. Remove Br_2
    d. Lower the temperature
    e. Selectively remove NOBr
13. Complete the sentence. The PCl5 molecule has:
    a. nonpolar bonds, and is a nonpolar molecule.
    b. Polar bonds, but is a polar molecule.
    c. Polar bonds, and is a polar molecule.
    d. Polar bonds, but is a nonpolar molecue.
14. which of the following molecules have the same geometries?
    a. SF_4 and CH_4
    b. CO_2 and H_2O
    c. CO_2 and BeH_2
    d. N_2O and NO_2
15. The two molecules represented below are examples of
    $CH_3-CH_2-O-CH_2CH_3 \qquad CH_3CH_2\,CH_2\,CH_2-OH$
    a. isotopes
    b. structural isomers
    c. carboxylic acids
    d. unsaturated hydrocarbonds.

B. SHORT ANSWER QUESTIONS (70%)

1. Phosgene, a World War I gas , consists of 12.41% C, 16.17% O, and 71.69% Cl. 1.0 L of this gas at STP has a mass of 4.42g. What is the molecular

formula of phosgene? (C:12.01, O:16.00, Cl:35.45) (5%)

2. Given the following $\triangle H$ values (5%)

   $H_2(g) + 1/2O_2 \rightarrow H_2O(1)$ $\quad \triangle H^0_f = -285.8kJ$

   $H_2O_2(1) \rightarrow H_2(g) + O_2(g)$ $\quad \triangle H_{rxn} = 187.6\ kJ$

   Calculate $\triangle H_{rxn}$ for the following reaction $H_2O_2(1) \rightarrow H_2(1) + 1/2O_2(g)$

3. Some commercial drain cleaners contain sodium hydroxide and aluminum powder. What volume of H_2 is formed at STP when 6.0 g of Al is treated with excess NaOH? (Al :26.98) (5%)

4. If we have 75 g of water at 25^0C to boil to dryness: (12%)
   a. How much heat is added to the water to raise the temperature to 100^0C?
   b. How much heat is added to evaporate the water?
   c. What is the total amount of heat used? (Heat of fusion of water = 335J/g , Specific heat = 4.189J/g · ^{0}C , Heat of vaporization = 2262 J/g)

5. Hydrogen iodide decomposes according to the equation: 2HI(g) → H2(g) $K_c = 0.0156$ at 400^0C A 0.66 mol sample of HI was injuected into a 2.0L reaction vessel held at 400^0C. calculate the concentrations of H_2 and HI at equilibrium. (9%)

6. The combustion of one mole of benzene, C6H6, in oxygen liberates 3268 kJ of heat. The products of the reaction are carbon dioxide and water.
   a. Write the thermochemical equation for the combustion of benzene.
   b. Is the reaction exothermic or endothermic?
   c. How much heat is given off when 8 moles of benzene are burned?
   d. How much heat is given off when 183 gms of oxygen are reacted? (O: 16.00) (12%)

7. Refer to the following equilibrium equation:
   $C(s) + H2O(g) + 2296J/mole \rightarrow CO(g) + H_2(g)$
   a. What will happen to the concentration of carbon monoxide if the temperature of this system is raised?
   b. If additional gaseous water is added to this reaction mixture, what will happen to the temperature of the mixture.
   c. What will happen to the mass of carbon, if wee add water to the system?
   d. Which way will the reaction shift if the pressure on the system is increased.

8. Calculate the pH of a solution containing 0.20 g of NaOH in 2,000 mL of solution. (5%)

9. How many moles of KclO3 are needed to form 2.8 L of O2, measured at STP, according to the following equation?

$2HCl_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

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