

1. Write a structural formula for each of the following compounds. (20%)

- (1) Ethylene glycol, (2) Acetylene, (3) Glycerin, (4) Nitrite, (5) Acetonitrile,
 (6) Chloroform, (7) Ammonium phosphate, (8) Magnesium bicarbonate,
 (9) Ferric hydroxide, (10) *para*-Aminobenzoic acid.

2. Name the following compounds with **English** and Indicate whether each of these compounds is an electrolyte or a non-electrolyte when placed in water

(10%)

- (1) NaClO_4 , (2) $(\text{CH}_3)_2\text{CHOH}$ (3) $(\text{CH}_3)_2\text{O}$ (4) KCrO_4 , (5) HBr

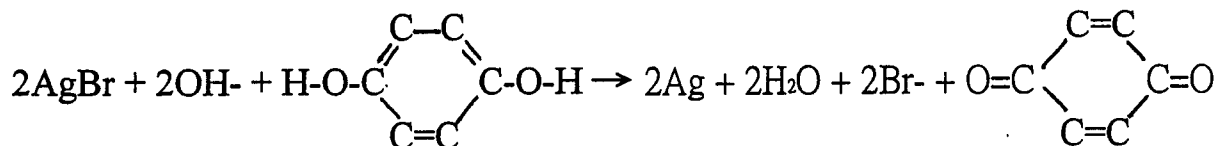
3. A compound is known to contain carbon and hydrogen. It might also contain oxygen. A 0.250 g sample of the compound is burned to produce 0.293 g H_2O and 0.478 g CO_2 .

(10%)

- (1) What is the formula for this compound?
 (2) What is the percent by mass for each element in this compound?
 (3) Write the balanced combustion reaction (reaction with O_2) for this compound.

4. The hydroquinone molecule can be converted to the quinone molecule as shown below:

(10%)



You may want to use a combination of shortcut rules and dot diagrams to assign oxidation numbers before answering the following questions:

- (a) which atom(s) are oxidized and reduced, respectively?
 (b) What is the oxidizing agent and what is the reducing agent?

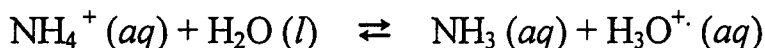
5. Describe the alternative definitions of acids and bases on the basis of Arrhenius, Bronsted-Lowry and Lewis concepts, respectively.

(10%)

(背面仍有題目,請繼續作答)

6. Please define what is (1) buffer solution and buffer capacity, (2) acid-base indicator, respectively. (10%)

7. Consider the following equilibrium: (10%)



The K_{eq} for the reaction is 5.6×10^{-10} .

(1) Is a solution of ammonium ion weakly acidic or strongly acidic?

(2) Is water acting as an acid or base according to the Bronsted-Lowry definition? Explain.

(3) Should we call the K_{eq} an acidic constant, K_{a} , or a basicity constant, K_{b} ? Explain your answer.

8. Chlorine exists as two isotopes in nature, $^{35}_{17}\text{Cl}$ (atomic weight 34.969, %

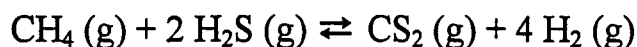
natural abundance = 75.77%), and $^{37}_{17}\text{Cl}$ (atomic weight 36.966). (10%)

(1) What is the % natural abundance for $^{37}_{17}\text{Cl}$ isotope?

(2) What is the atomic weight of naturally occurring Chlorine?

(3) How many times heavier is $^{37}_{17}\text{Cl}$ than $^{35}_{17}\text{Cl}$?

9. Consider the reaction: (10%)



For this reaction at 900°C , the equilibrium concentrations (K_{eq}) is 3.59. The concentrations of the gases in the vessel at 900°C are; $\text{CS}_2 = 1.51 \text{ M}$; $\text{H}_2 = 1.08 \text{ M}$; $\text{CH}_4 = 1.15 \text{ M}$; $\text{H}_2\text{S} = 1.20 \text{ M}$, respectively. Please calculate it and show that this reaction is at equilibrium or not.