

編號： 240 系所：醫學工程研究所丁組

科目：普通化學

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

1. (10%) Name the following compounds with **English** and **Chinese**.  
(1)  $\text{Ca}(\text{OH})_2$ , (2)  $\text{SnO}_2$ , (3)  $\text{K}_4[\text{Fe}(\text{CN})_6]$ , (4)  $\text{KMnO}_4$ , (5)  $\text{NaHCO}_3$
2. (10%) What current is needed to deposit 0.500 g of chromium from a solution containing  $\text{Cr}^{3+}$  over a one hour period (MW for  $\text{Cr}=52$ )? (Farady's law :  $Q$  (charge) =  $nF$ ) Here,  $n$  = number of moles of electrons,  $F$  = constant of 96500 Coulomb/mole)
3. (10%) 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).  
(1) What is the % natural abundance for  $^{37}_{17}\text{Cl}$  isotope and what is it different from  $^{35}_{17}\text{Cl}$ ?  
(2) What is the atomic weight of naturally occurring Chlorine?  
(3) How many times heavier is  $^{37}_{17}\text{Cl}$  than  $^{35}_{17}\text{Cl}$ ?
4. (10%) A compound is known to contain carbon and hydrogen. It might also contain oxygen. A 0.500 g sample of the compound is burned to produce 0.409 g  $\text{H}_2\text{O}$  and 0.999 g  $\text{CO}_2$ .  
(a) What is the empirical formula for this compound?  
(b) What is the percent by mass for each element in this compound?  
(c) The molar mass of this compound is 132.159 g/mole. What is the molecular formula for this compound?  
(d) Write the balanced combustion reaction (reaction with  $\text{O}_2$ ) for this compound.
5. (10%) Using a diagram, show you would construct a zinc-aluminum battery. Label the cathode, the anode, the + electrode, and the - electrode. Also, be sure to indicate the direction of electron flow and identify the beaker in which oxidation occurs and the beaker in which reduction take place.
6. (10%) Consider the reaction:  $\text{CH}_4(\text{g}) + 2\text{H}_2\text{S}(\text{g}) \rightleftharpoons \text{CS}_2(\text{g}) + 4\text{H}_2(\text{g})$   
The equilibrium concentrations of the reactions and products are:  $\text{CS}_2 = 6.10 \times 10^{-3} \text{ M}$ ;  $\text{H}_2 = 1.17 \times 10^{-3} \text{ M}$ ;  $\text{CH}_4 = 2.35 \times 10^{-3} \text{ M}$ ;  $\text{H}_2\text{S} = 2.93 \times 10^{-3} \text{ M}$ . Please calculate the value of equilibrium constant ( $K_{\text{eq}}$ ) for this reaction.

(背面仍有題目,請繼續作答)

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7. (10%) When acid is added to a buffer, the pH changes a little bit. Why does the pH change at all and why doesn't the buffer hold the pH completely constant?
8. (5%) Draw a dot diagram for the molecule; (1) O<sub>3</sub>, ozone, and (2) CO, carbon monoxide.
9. (5%) Chloromethane has a much higher boiling point than methane. Please give two reasons for this.
10. (5%) A tank of acetylene gas (C<sub>2</sub>H<sub>2</sub>) contains 48.5 lb of the gas and is at a pressure of 600.2 lb/in.<sup>2</sup> (760 mmHg = 14.696 lb/in.<sup>2</sup>, 453.6 g = 1 lb). Express the pressure of the gas in atmospheres and the amount of gas in moles.
11. (5%) How many milliliters of a 0.250 M solution of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) are required to obtain 100.0 g of glucose?
12. (5%) For a particular reaction, the reactants are at 30 kJ/mole, the products are at 60 kJ/mole, and the transition state is at 100 kJ/mole. Sketch a reaction energy profile showing both  $\Delta E_{\text{rxn}}$  and  $E_a$ . Also, calculate the magnitude of  $\Delta E_{\text{rxn}}$  and state whether this reaction is endothermic or exothermic.
13. (5%) How do we go about determining the orders in a rate law?