

系所組別： 生物醫學工程學系丁組

考試科目： 普通化學

考試日期：0219，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

- (10%) Name the following compounds.
(a) HF, (b) HClO₃, (c) Na₃PO₄, (d) (NH₄)₂SO₄, (e) K₃[Fe(CN)₆].
- (20%) Give the formulas for the following compounds.
(a) 1,2,3-propanetriol, (b) ferrous hydroxide, (c) ethyl acetate, (d) poly(lactic acid), (e) cobalt(II) permanganate, (f) silver oxalate, (g) N,N-dimethylmethanamide, (h) poly(dimethylsiloxane), (i) sodium chloride, (j) oxolane.
- (10%) A metal forms two different chlorides. Analysis shows one to be 54.1% chlorine and the other to be 64.4% chlorine by weight. What are the possible values of the atomic weight of the metal? (atomic weight of chlorine is 35.5 g/mol)
- (10%) The du Pont company has developed a nitrometer, an apparatus for the rapid routine analysis of nitrates, which measures the volume of NO liberated by the reaction of concentrated H₂SO₄ with nitrates in the presence of metallic mercury, by the reaction
$$2\text{KNO}_3 + 4\text{H}_2\text{SO}_4 + 3\text{Hg} \rightarrow \text{K}_2\text{SO}_4 + 3\text{HgSO}_4 + 4\text{H}_2\text{O} + 2\text{NO}$$
In a simple form of this apparatus, the NO is collected over water in a graduated tube and its volume, temperature, and pressure are measured. A 1.000 g sample containing a mixture of KNO₃ and K₂SO₄ is treated in this manner, and 37.50 ml of NO is collected over water at a temperature of 23°C and a pressure of 732.0 torr. Calculate the percentage of KNO₃ in the original sample.
- (10%) Consider the unbalanced reaction:
$$\text{MnO}_4^- + \text{C}_2\text{O}_4^{2-} + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$$
(a) Balance the reaction.
(b) What is the molarity of a K₂C₂O₄ solution if 35.00 ml of it is needed for the titration of 47.65 ml of 0.06320 M KMnO₄ solution?
- (10%) Two reactants for a given reaction are M and N.
(a) If, for a given initial concentration of M, a five-fold increase in the concentration of N causes a 25-fold increase in the initial rate of reaction, what can be said about the order with respect to N?
(b) If M is not only a reactant but also the solvent, what is the probable order with respect to M in the experimentally determined rate expression?
- (10%) The Edison cell (essentially a nickel-iron battery) is a rugged storage battery that may receive hard treatment and yet give good service for years. It may even be left uncharged indefinitely and still

(背面仍有題目,請繼續作答)

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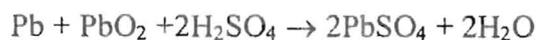
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be recharged. It gives 1.3 volts. Its electrolyte is a 21.0% KOH solution to which a small amount of LiOH is added. The chemical reaction that occurs on discharge is



Write the half-cell reactions for the electrodes. Which reaction takes place in the negative pole?

8. (10%) During the discharge of a lead storage battery, the density of the sulfuric acid falls from 1.294 g/ml to 1.139 g/ml. Calculate the number of ampere-hours the battery must have been used. The overall reaction in the battery is



Note that the denser sulfuric acid is 39.0% H_2SO_4 by weight; the less dense one is 20.0% H_2SO_4 by weight. The battery holds 3.50 liters of acid. Assume that the volume remains unchanged during discharge.

9. (5%) A particular linear hydrocarbon molecule has six carbons and ten hydrogens. Is it saturated or unsaturated? Draw the possible line drawings.
10. (5%) Chloromethane has a much higher boiling point than methane. Please give two reasons for this.