# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY <u>DEPARTMENT OF APPLIED CHEMISTRY</u> <u>END OF SECOND SEMESTER EXAMINATIONS – APRIL/MAY 1999</u> <u>GENERAL CHEMISTRY FOR BIOLOGY - SCH 1217</u> <u>TIME: THREE HOURS</u>

#### **INSTRUCTIONS TO CANDIDATES**

Answer All questions from Section A and Any Three questions from Section B. Total marks = 100.

#### SECTION A

- 1. Calculate the ionic strength of a solution of equal volumes of IMHCl and 0,5M NaOH. (5 marks)
- 2. Calculate the concentration of all the species present in the dissociation of 0,5M H<sub>2</sub>C<sub>2</sub>O<sub>4</sub>.

 $K_1 = 5.6 \times 10^{-2}$   $K_2 = 5.4 \times 10^{-5}$  (10 marks)

3. Which substances are acids or bases in aqueous solution according to the Bronsted and Lowry Theory.

HClO<sub>4</sub>; NH<sub>3</sub>;  $CO_3^{2-}$ ; HCO<sub>3</sub> S<sup>2-</sup>; HS<sup>-</sup> (6 marks)

4. Calculate the concentration of H<sup>+</sup> and OH<sup>-</sup> ions in a solution containing 25ml 0,2M CH<sub>3</sub>COOH and 15ml 0,1M CH<sub>3</sub>COONa (9 marks)

5. In the analysis of a lead ore the following results were obtained (%) 14,50; 14,43, 14,54; 14,45; 14,44; 14,52; 14,58; 14,40; 14,25 14,19.

Given that  $Q_2 = 0,42$  for n=10 at 95% confidence level, show that 14,25 and 14,58 must be either rejected or retained. Calculate the Meln and the Standard deviation.

(10 marks)

### SECTION B

4.

Answer any three questions from Section B. Each question in Section B carries 20 marks.

- 1. One mole of an ideal gas is allowed to expand against piston that supports 0,4atm pressure. The initial pressure is 10atm and the final pressure is 0,4atm. The temperature is kept constant at 0°C.
  - (a) How much energy is transferred to the surroundings (mechanical) from the gas during the expansion?
  - (b) What is the change in the internal energy and enthalpy of the gas?
  - (c) How much heat energy is absorbed from the thermal surroundings?
- 2. (a) State six (6) factors that influence the rate of chemical reactions.
  - (b) What is the difference between the order and molecularity of a reaction?
    - (c) For a zero order reaction, show that if x is the amount transformed into products after time t the x = kt.
- 3. (a) Draw a titration curve, when 100.00ml 0,10M Na<sub>2</sub>CO<sub>3</sub> is titrated with 0,10MHCl, Calculate the pH when the following volumes of acid have been added:
  - (i) 50.00ml
  - (ii) 91.00ml
  - (iii) 98.00ml
  - (iv) 109.00ml
  - (v) 150.00ml
  - (vi) 191.00ml
  - (vii) 199.00ml
  - (b) A base of mass 0,534.1g containing 92% NaOH and 8% impurities was dissolved in a volumetric flask of volume 100,00ml. Calculate the molar concentration of the solution HCl if 15,00ml of the solution was titrated with 19,50ml acid HCl.
  - (i) Why is the complexmetric titration of  $CO^{2+}$ ;  $Zn^{2+}$ ;  $Ni^{2+}$  and  $Cd^{2+}$  done in an ammonium buffer solution.
    - (ii) Why is the determination of cations with a charge of +3 and +4 with EDTA carried out in acidic media.
    - (iii)  $1,703g \text{ of } Al(NO_3)_{3.nH_2O}$  was dissolved in 200,0ml to a 20,0ml aliquot was added Na<sub>2</sub>Mg EDTA. In the titration of Mg<sup>2+</sup> 17,45ml 0,02507M EDTA was used. Calculate the percentage (%) concentration of Al(NO<sub>3</sub>)<sub>3</sub> in the sample.

## END OF QUESTION PAPER!!!!

