# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY DEPARTMENT OF APPLIED CHEMISTRY 

END OF SECOND SEMESTER EXAMINATIONS - APRIL/MAY 1999
GENERAL CHEMISTRY FOR BIOLOGY - SCH 1217
TIME: THREE HOURS

## 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 $0,5 \mathrm{M} \mathrm{NaOH}$. (5 marks)
2. Calculate the concentration of all the species present in the dissociation of $0,5 \mathrm{M} \mathrm{H}_{2} \mathrm{C}_{2} \mathrm{O}_{4}$.
$\mathrm{K}_{1}=5,6 \times 10^{-2}$
$\mathrm{K}_{2}=5,4 \times 10^{-5}$
(10 marks)
3. Which substances are acids or bases in aqueous solution according to the Bronsted and Lowry Theory.
$\mathrm{HClO}_{4} ; \mathrm{NH}_{3} ; \mathrm{CO}_{3}{ }^{2-} ; \mathrm{HCO}_{3}{ }^{-} \mathrm{S}^{2-} ; \mathrm{HS}^{-}$
(6 marks)
4. Calculate the concentration of $\mathrm{H}^{+}$and $\mathrm{OH}^{-}$ions in a solution containing $25 \mathrm{ml} 0,2 \mathrm{M}$ $\mathrm{CH}_{3} \mathrm{COOH}$ and $15 \mathrm{ml} 0,1 \mathrm{M} \mathrm{CH} 3 \mathrm{COONa}^{2}$
( 9 marks)
5. In the analysis of a lead ore the following results were obtained (\%) 14,$50 ; 14,43,14,54$; 14,$45 ; 14,44 ; 14,52 ; 14,58 ; 14,40 ; 14,2514,19$.

Given that $\mathrm{Q}_{2}=0,42$ for $\mathrm{n}=10$ 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

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 $0,4 \mathrm{~atm}$ pressure. The initial pressure is 10 atm and the final pressure is $0,4 \mathrm{~atm}$. The temperature is kept constant at $0^{\circ} \mathrm{C}$.
(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 $\boldsymbol{x}$ is the amount transformed into products after time $\boldsymbol{t}$ the $\boldsymbol{x}=\boldsymbol{k t}$.
3. (a) Draw a titration curve, when $100.00 \mathrm{ml} 0,10 \mathrm{M} \mathrm{Na}_{2} \mathrm{CO}_{3}$ is titrated with $0,10 \mathrm{MHCl}$, Calculate the pH when the following volumes of acid have been added:
(i) 50.00 ml
(ii) 91.00 ml
(iii) 98.00 ml
(iv) 109.00 ml
(v) 150.00 ml
(vi) 191.00 ml
(vii) 199.00 ml
(b) A base of mass $0,534.1 \mathrm{~g}$ containing $92 \% \mathrm{NaOH}$ and $8 \%$ impurities was dissolved in a volumetric flask of volume $100,00 \mathrm{ml}$. Calculate the molar concentration of the solution HCl if $15,00 \mathrm{ml}$ of the solution was titrated with $19,50 \mathrm{ml}$ acid HCl .
4. (i) Why is the complexmetric titration of $\mathrm{CO}^{2+} ; \mathrm{Zn}^{2+} ; \mathrm{Ni}^{2+}$ and $\mathrm{Cd}^{2+}$ 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) $1,703 \mathrm{~g}$ of $\mathrm{Al}\left(\mathrm{NO}_{3}\right)_{3} \cdot \mathrm{nH}_{2} \mathrm{O}$ was dissolved in $200,0 \mathrm{ml}$ to a $20,0 \mathrm{ml}$ aliquot was added $\mathrm{Na}_{2} \mathrm{Mg}$ EDTA. In the titration of $\mathrm{Mg}^{2+} 17,45 \mathrm{ml} 0,02507 \mathrm{M}$ EDTA was used. Calculate the percentage (\%) concentration of $\mathrm{Al}\left(\mathrm{NO}_{3}\right)_{3}$ in the sample.

## END OF QUESTION PAPER!!!!

