



ACA-3872

Seat No. \_\_\_\_\_

**M. Sc. (Sem. II) Examination**

March/April – 2019

**CHN-503 : Physical Chemistry : Paper - IX**

Time : 3 Hours]

[Total Marks : 70

**Instructions :**

- (1) Each question carries 14 marks.
- (2) Figures to the right indicate marks of the question.

1 (a) Answer the following : (any two) 10

- (i) Explain "Collision theory" of reaction rates and its failures.
- (ii) Write a short note on : Belousov-Zhabatinskii (BZ) reactions.
- (iii) Name various methods used to study the kinetics of fast reactions and discuss nuclear magnetic resonance method in detail.

(b) Answer the following : (any one) 4

- (i) The rate constant of a reaction is  $1.5 \times 10^7 \text{ sec}^{-1}$  at  $50^\circ\text{C}$  and  $4.5 \times 10^7 \text{ sec}^{-1}$  at  $100^\circ\text{C}$ . Evaluate the Arrhenius parameters 'A' and 'Ea'.

- (ii) The rate constant for the first order decomposition of a certain reaction is given by the equation,

$$\ln K (\text{sec}^{-1}) = 14.34 - \frac{1.25 \times 10^4}{T};$$

Calculate energy of activation and the rate constant at 500 K.

2 (a) Answer the following : (any two) 10

- (i) What is CMC ? What are the factors affecting the CMC of surfactants ?
- (ii) Write a short note on Kelvin equation for vapour pressure of droplets.
- (iii) What are macromolecules ? How is the molecular weight of a macromolecule determined with the help of osmotic pressure method ?

(b) Answer the following : (any one) 4

- (i) A protein sample consists of an equimolar mixture of haemoglobin ( $M = 15.5 \text{ kg mol}^{-1}$ ), ribonuclease ( $M = 13.7 \text{ kg mol}^{-1}$ ) and myoglobin ( $M = 17.2 \text{ kg mol}^{-1}$ ). Calculate the  $\overline{M}_n$  and  $\overline{M}_w$ . Which is greater ?

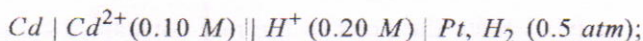
- (ii) In a polymer sample 30% molecules have a molecular mass 20,000, 40% have molecular mass 30,000 and the rest have 60,000. Calculate Mass average and number average molecular weight in a sample.

3 (a) Answer the following : (any two) 10

- (i) Derive Lippmann equation.  
(ii) Write a note on over-potential. How is it measured ?  
(iii) Explain Debye-Huckel-Onsager equation.

(b) Answer the following : (any one) 4

- (i) Calculate the potential (EMF) of the cell



(Given  $E^0$  for  $Cd^{2+} / Cd = -0.403 V$ ,

$$R = 8.14 JK^{-1} mol^{-1}, F = 96,500 C mol^{-1}).$$

- (ii) For 20 minutes, a current of 5 A is applied to between platinum electrodes to electrolyze a solution of  $Ni(NO_3)_2$ . Find the amount of Ni deposited at the cathode ?

4 (a) Answer the following : (any two) 10

- (i) Write a note on tunneling.  
(ii) Explain the theory of semi-conductor interfaces.  
(iii) Discuss electrocatalysis theory.

(b) Answer the following : (any one)

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- (i) Explain the principle of electrocardiography.
- (ii) Discuss the principle of polarography.

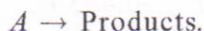
5 Answer in one to four lines : (any seven)

14

- (i) What is relaxation time ?
- (ii) Write the effect of catalyst on reaction velocity.
- (iii) Name some important natural polymers.
- (iv) Define Graft copolymer.
- (v)  $Cu^+(aq)$  is unstable in solution and undergoes simultaneous oxidation and reduction, as per the reaction;  $2Cu^+(aq) \rightleftharpoons Cu^{2+}(aq) + Cu(s)$ .

Calculate  $E^\circ$ .

- (vi) State the units of the rate constant for a zero order reaction of the type :



- (vii) Define enzyme catalysis.
- (viii) What is membrane potential ?
- (ix) What do you understand by  $n-p$  junction ?
- (x) Define "Residual" current.