



HCG-1318

Seat No. _____

M. Sc. (Sem. II) Examination

April / May - 2015

CHN-503 : Physical Chemistry

Time : 3 Hours]

[Total Marks : 70

- Instructions :**
- (1) Each question carries 14 marks.
 - (2) Figures to the right indicate marks of the question.
 - (3) Write answers of all the question in the same answer book.

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

- (i) Describe the flow method to study fast reactions.
- (ii) Explain : Lindemann theory of unimolecular reactions.
- (iii) Discuss about the collision theory of reaction rate.

(b) Answer any one of the following : 4

- (i) For reaction probability factor is 22138 and its collision number (Z^0) is 3.146×10^{10} ml/cm and energy of activation of a reaction is 22388 Cal. Find the rate constant of reaction. (T=22°C)

- (ii) The following values for the first order rate constant were obtained for a reaction

Temp °C	K
25°	$3.46 \times 10^{-5} \text{ S}^{-1}$
35°	$13.50 \times 10^{-5} \text{ S}^{-1}$

Calculate the Arrhenius Frequency factors.

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

- (i) Derive Gibb's adsorption isotherm equation.
- (ii) Explain : any one method for determining the molecular weight of polymer.
- (iii) What is CMC ? What are the factors affecting the CMC of surfactants ?

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

- (i) A polymer sample contains equal mass of particle with molecular weight 2×10^4 and 4×10^4 respectively. Calculate \overline{M}_n and \overline{M}_w .
- (ii) If the adsorbed nitrogen required to form a mono layer on one gram of $\text{Fe-Al}_2\text{O}_3$ catalyst at -190°C , occupies 2.86 cm^3 at 0°C and 1 atm, what is the surface area of the catalyst. One molecule of N_2 covers 16.2 \AA^{-2} at -190°C . [$N = 6.02 \times 10^{23}$, $1 \text{ meter}^2 = 10^{20} \text{ \AA}^{-2}$]

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

- (i) Write a note on Gouy–Chapmann model for electrical double layer.
- (ii) Discuss Lippmann equation for surface excess process at electrified interface.
- (iii) Explain the nature and importance of Tafel plot.

(b) Answer any one of the following : 4

- (i) In an alkali chloride cell, a saturated solution of 6N NaCl is electrolysed at 25°C, using a steel cathode [Hydrogen over voltage, $\eta = 0.2\text{V}$], which of the two ions, H^+ or Na^+ will be discharged first? pH of the solution is 7, $E_{\text{H}/\text{H}^+}^\circ = 0.00\text{V}$.

$$E_{\text{Na}/\text{Na}^+}^\circ = 2.71\text{V}$$

activity = concentration

- (ii) Explain : Electrocapillary curves.

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

- (i) Describe the quantum aspects of charge transfer at electrode-solution interface.
- (ii) Short note on electrocardiography.
- (iii) Explain the theory and apparatus used in polarographic analysis.

(b) Answer any one of the following :

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- (i) Metalion M^{++} is being reduced at the dropping mercury electrode. In the limiting current region, the values of m and t are 1.46 mg/s and 4.29 respectively. A standard calibration curve for M^{++} was prepared and its slope was $4.92 \mu\text{a}/\text{mm}$. Calculate the diffusion coefficient of M^{++} .
- (ii) Explain "Donnan membrane equilibrium".

5 Answer any seven of the following :

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- (i) Why reactions of higher orders are rare ?
- (ii) Define the terms – adsorption and adsorbent.
- (iii) What is the shape of the graph drawn
- (a) $K \rightarrow T$
- (b) $\log K \rightarrow 1/T$
- (iv) What is the principle of polarography ?
- (v) What is 'overpotential' ?
- (vi) Define polymerisation in your words.
- (vii) What is electro catalysis ?
- (viii) What is oscillatory reaction ? Give an example.
- (ix) Definition over voltage and give factors affecting over voltage.
- (x) What is Zeta potential ?
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