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53 (CY 201) ENCH

2017

ENGINEERING CHEMISTRY

Paper : CY 201

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer Q. No. 1 and **any four** from the rest.

1. (a) Fill in the blanks : $1 \times 5 = 5$

(i) Unit of rate-constant of 3rd order reaction is _____.

(ii) The value of Mark-Houwink exponent lies between _____ and _____.

(iii) The monomer units of terylene are ethylene glycol and _____.

(iv) If rate law of a chemical reaction is $K = [C_{12}H_{22}O_{11}][H_2O]$ then the order of the reaction is _____.

Contd.

(b) Match the following: $1 \times 5 = 5$

Group A

Group B

- | | |
|--|-------------------------------|
| (i) The electrode potential of hydrogen electrode has been assigned value | (i) 0.1V |
| (ii) A cell that converts electrical energy into chemical energy is called | (ii) 0.0V |
| (iii) A cell that converts chemical energy of H_2 gas into electrical energy is called | (iii) electrolytic cell |
| (iv) H_2 , O_2 , N_2 etc. are | (iv) Fuel cell |
| (v) UV-visible region of the electromagnetic spectrum can induce | (v) Infrared-active |
| | (vi) Infrared-inactive |
| | (vii) bond breaking |
| | (viii) Electronic transitions |
| | (ix) 1V |

(c) — Give the answers of following questions :

- (i) What is degree of polymerisation ?
What are the names of monomers of Bakelite ? $1+1=2$

(ii) What is activation energy? Draw the energy profile diagram for catalysed and un-catalysed chemical reactions. 1+2=3

(iii) Give an account of the factors influencing corrosion. 5

2. (a) What is P.D.I. of a polymer? Equal masses of polymer molecules with $M_1 = 1 \times 10^4$ and $M_2 = 1 \times 10^5$ are mixed. Calculate P.D.I. of the polymer. 1+3=4

(b) Define the terms electrode and electrolytes. What are strong and weak electrolytes? Give examples. 1+1+4=6

(c) "Acetolysis of both 4-methoxy-1-pentyl brosylate and 5-methoxy-2-pentyl brosylate give the same mixture of products due to neighbouring group participation." Give proper reaction-mechanism for above reactions. 2+2=4

- (d) What is a pseudo-unimolecular reaction? Give example. 2+1=3
- (e) Mention the differences between EMF and Potential difference. 3
3. (a) Write short notes on: Urea-formaldehyde resin, bakelite and Neoprene. 2×3=6
- (b) Define pH. K_w for H_2O at 313K is 2.92×10^{-14} . What are $[H_3O^{\oplus}]$, $[OH^{\ominus}]$ and pH of pure water at this temperature? 1+3=4
- (c) Write down Nernst's equation and mention *two* of its applications. 5
- (d) Describe the instrumentation of NMR spectrometer with a suitable diagram. 5
4. (a) What is the molecular weight of Teflon; when DP is 1×10^6 ? What is the ratio of its molecular weight to that of polyethylene with the same DP? 2+3=5

(b) Write short notes on : Carbonisation of coal, Octane number and cetane number. 1+2+2=5

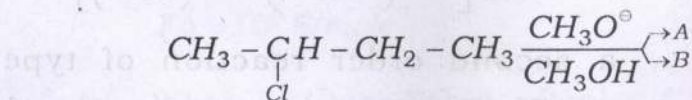
(c) Mention the properties of ionic and covalent compounds. 6

(d) What are secondary cells ? Mention the application of lead acid storage battery. 4

5. (a) Distinguish between thermoplastic and thermosetting plastics. Give examples. 3+1=4

(b) Why osmotic pressure is used for determination of number-average molar mass (\overline{M}_N) of a polymer ? 1

(c) What is Saytzeff rule ? Write down the reaction products A and B for the following : 1+2+2=5



Give proper mechanistic pathway.

(d) Give points of differences between dry and wet corrosion. 4

(e) Write short notes on ionic crystal and crystal defects. 3+3=6

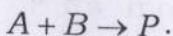
6. (a) Distinguish between unimolecular nucleophilic and bimolecular nucleophilic substitution reactions with proper energy-profile diagram. 2

(b) Prove that, for a n^{th} -order reaction $t_{1/2} \propto \frac{1}{a^{n-1}}$ where, $t_{1/2}$ is half-life period of n^{th} -order reaction and a is initial concentration of reactant. 4

(c) From the thermodynamic aspects of transition state theory, prove that,

$$K_2 = \frac{RT}{Nh} \left[\exp\left(\frac{-AH^\ddagger}{RT}\right) \cdot \exp\left(\frac{AS^\ddagger}{R}\right) \right] \text{ for}$$

a second order reaction of type



(d) Give a schematic diagram representing the instrumentation of a IR spectrophotometer. 4

(e) Describe the types of hybridisation associated with CH_4 , C_2H_4 and C_2H_2 . 6

7. (a) Find the order of a reaction, if the time of half-completion for a certain reaction is found to change from 50secs to 25 secs., when the initial concentration is changed from 0.5 to 1M. 3

(b) Give Arrhenius equation to explain dependance of rate-constant on temperature. Calculate temperature for reaction at which its half-life is 2 minutes. Given $A = 5 \times 10^{13} S^{-1}$ and $E_a = 10^5 S/mole$. 1+3=4

(c) What is Chichibabin reaction? Give example with proper reaction mechanism. 1+1=2

(d) What is a hydrogen bond? Define various types of hydrogen bonds with suitable examples. $2+4=6$

(e) Calculate the frequency of C-H stretch, given that $K = 5 \times 10^5 \text{ gm sec}^{-2}$,

$$M_C = 20 \times 10^{-24} \text{ gm} \text{ and } M_H = 1.6 \times 10^{-24} \text{ gm}.$$

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