

Total number of printed pages-8

53(CY 201) ENCH

2015

ENGINEERING CHEMISTRY

Paper : CY 201

Full Marks : 100

Time : Three hours

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

Answer Question 1 and **any four** from the rest.

1. (a) Fill in the blanks : 5

(i) The stability of 3° amine is _____ than 2° amine.

(ii) The monomer units of Nylon-6, 6 are adipic acid and _____ .

(iii) The other name of Buna-S-rubber is _____ .

(iv) Walden inversion of configuration is observed in _____ .

(v) Bakelite is known as _____ resins.

Contd.

- (b) Define Auxochrome with example. 2
- (c) Radius of A^+ and B^- are 50pm and 154pm respectively. If they form an ionic compound what will be the coordination number of A^+ . Explain. 2
- (d) What is reference electrode? Describe the construction and working of Ag/AgCl electrode. $1+1=2$
- (e) Write the mathematical formula of Vant's Hoff equation. Why osmotic pressure is used for molecular weight determination? $1+1=2$
- (f) Distinguish between addition and condensation polymerisation 2
- (g) In a first order reaction has an activation energy of 104500 joule/mol and pre-exponential factor of Arrhenius equation has a value $5 \times 10^{12} \text{ sec}^{-1}$. At what temperature reaction would have half-life of 3 minutes? 4
- (h) What is ionic bonding? 1

2. (a) Prove that $t_{1/2} = \frac{2^{n-1} - 1}{(n-1)a^{n-1}k}$ 3

where, n is the order of n th-order reaction.

- (b) It is found that for the reaction,



$A = 4.0 \times 10^4 \text{ L mol}^{-1} \text{ s}^{-1}$ at 298K. Use

$\sigma(\text{NO}) = 0.42 \text{ nm}^2$ and $\sigma(\text{Cl}_2) = 0.93 \text{ nm}^2$

to estimate the ρ -factor for the reaction. 5

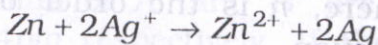
- (c) Distinguish between thermoplastic and thermo-setting plastic. Give example.

$$2\frac{1}{2} + 2\frac{1}{2} = 5$$

- (d) What is the value of the rate constant, predicted by the Arrhenius equation if $T \rightarrow \infty$? Is the value physically reasonable? 2+1=3

- (e) Write polymerisation reaction of Terylene. Give the IUPAC names of the reactants and products. 4

3. (a) What is meant by EMF of a cell? Calculate the standard EMF of a cell which involves the following cell reaction :



2+3=5

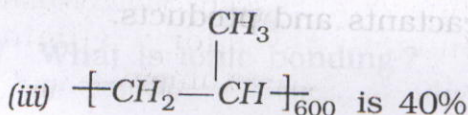
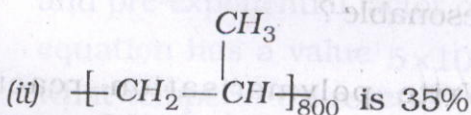
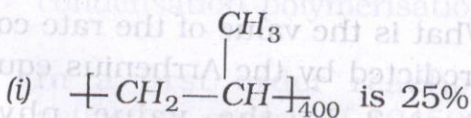
given that, $E_{\text{Zn}/\text{Zn}^{2+}}^{\circ} = 0.76\text{volt}$ and

$E_{\text{Ag}/\text{Ag}^+}^{\circ} = -0.80\text{volt}$

- (b) Discuss the origin of nuclear magnetic resonance spectroscopy. Indicate diagrammatically the splitting of signals in proton NMR ($^1\text{H NMR}$) spectra
(i) CH_3OH and (ii) $\text{CH}_3\text{CH}_2\text{OH}$.

2+4=6

- (c) Calculate the \bar{M}_n and \bar{M}_w of polypropylene with following composition.

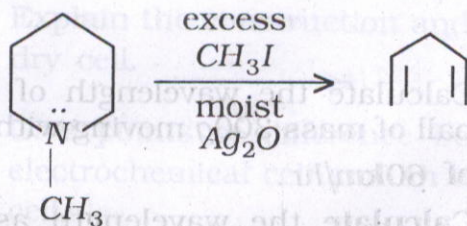


(d) Describe the various molecular vibrations involved in infra-red spectroscopy with schematic diagrams taking H_2O as an example. 4

4. (a) "Acetolysis of both 4-methoxy-1-pentyl brosylate and 5-methoxy-2-pentyl brosylate gave the same mixture of products." Explain the reason behind it with the appropriate chemical reactions. 5

(b) What are the two types of nucleophilic reactions? Give an example of SN^1 reaction with appropriate chemical reaction. Draw the energy profile diagram of SN^1 -reaction. 2+3+2=7

(c) For the following reaction give the appropriate mechanism : 3



(d) Distinguish between Saytzeff rule and Hofmann-rule for elimination reactions? Give example. 5

5. (a) What is Calorific value? Distinguish between Net and Gross-calorific value. $2+3=5$

(b) Give short notes on : $2 \times 5 = 10$

(i) Chromophore

(ii) Octane number

(iii) Water gas

(iv) Producer gas

(v) Cctane number.

(c) Concentration of a reactant A changed from $0.044M$ to $0.32M$ in 25 minutes. What are the average rate of the reaction during this interval? 2

(d) A solution contains equal number of particles with molar masses $10,000 \text{ g mol}^{-1}$ and $20,000 \text{ kg mol}^{-1}$, respectively. Calculate \bar{M}_n and \bar{M}_m . 3

6. (a) Calculate the wavelength of a tennis ball of mass $300g$ moving with a speed of $60km/hr$.

Calculate the wavelength associated with an electron moving with a speed of $60km/hr$.

Compare and comment on the result of two cases. $2+2+1=5$

(b) Describe the Born Haber's cycle for the calculation of lattice energy of LiF . Why fused $NaCl$ conduct electricity but not solid $NaCl$? $4+2=6$

(c) State phase rule. Explain the one component phase diagram of CO_2 . $1+4=5$

(d) If Ge -crystal lattice is doped with small amount of Al , then what type of semiconductor will be produced? 2

(e) Write the complete electronic configuration of K . Write the value of all quantum numbers associated with valence electron. $\frac{1}{2}+1\frac{1}{2}=2$

7. (a) Explain the construction and uses of a dry cell. $1\frac{1}{2}+1\frac{1}{2}=3$

(b) Give points of difference between an electrochemical cell and an electrolytic cell. 4

(c) Explain triple point and metastable state with the help of phase diagram of water. $1+1+3=5$

(d) From Collision theory, prove that

$$k_2 = N_A \sigma \bar{C}_{rel} \exp^{-E_a/RT} \times \rho$$

where ;

k_2 is the rate constant for unimolecular reaction $A \longrightarrow P$. 5

(e) Give Arrhenius equation. With the help of Arrhenius equation prove that ;

$$\log k = \frac{E_a}{2 \cdot 303R} \left[\frac{T_2 - T_1}{T_1 T_2} \right]$$

with ; $E_a \rightarrow$ activation energy. 3