**53 (CY 201) ENCH**

**2019**

# ENGINEERING CHEMISTRY



Paper : CY 201

*Full Marks : 100*

Time : Three hours

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

*Answer **any five** questions.*

1. *(A)* Fill in the blanks : 1×5=5

   *(i)* The quantity of electricity needed to liberate one *g* equivalent of an element is _____ coulombs.

   *(ii)* Prevention of corrosion of iron by metal coating is called _____.

   *(iii)* Octane number of isooctane is considered to be _____.

*Contd.*

(iv) The process in which heat is allowed to enter and leave the system but the temperature remains constant is known as _____.

(v) Consider the cell $Zn/Zn^{2+}(aq)\|Cu^{2+}(aq)/Cu$, $E^{\circ}\left(Cu^{2+}/Cu\right)=+0.35V$ and $E^{\circ}\left(Zn^{2+}/Zn\right)=-0.763V$. The standard e.m.f of the cell is _____.

(B) Answer the following questions : 1×5=5

(i) Smaller will be the band length
- (a) Due to greater of + *I* effect
- (b) Due to greater of – *M* effect
- (c) Due to greater of + *M* effect
- (d) Due to greater of – *I* effect.

(ii) Which of the following reaction pathway followed for Saytzeff rule ?
- (a) $E_2$
- (b) *E*1
- (c) *SN*1
- (d) *SN*2





(iii) α – hydrogen requires
- (a) Cannizzaro reacti
- (b) Aldol reaction
- (c) Friedel-Craft react
- (d) Hoffmann elimina reaction.

(iv) Singlet carbene is
- (a) *Sp*-hybridised
- (b) $Sp^2$-hybridised
- (c) $Sp^3$-hybridised
- (d) $Sp^2$ *d*-hybridised.

(v) The below mentioned o strength of carboxylic a

$CCl_3COOH > CHCl_2COOH > CH_2ClCOOH >$
- (a) True
- (b) depends upon so
- (c) False
- (d) depends upon te

(C) Find out ***true/false*** from th

(i) The unit of rate const order reaction is *mol*

(ii) In homopolymers the building block monomers are of different types.

(iii) Every 10°C rise temperature, the rate of a chemical reaction increases by 1.5.

(iv) Hexamethyldiammine is the monomer of Nylon–6, 6.

(v) Saponification of ester is an example of 2nd-order reaction of type $A + B \rightarrow P$.

(D) Answer the following questions :

(i) What is bio-catalyst ? 1

(ii) Define what are base peaks observed in mass spectroscopy. 1

(iii) Distinguish between homogeneous and heterogenous catalyst. Give example. 1+1=2

(iv) How parent peaks are different from base peaks in mass spectroscopy ? 1





2. (A) What is energy of activation or activation energy ? Draw the energy profile diagram explaining the conditions for endothermic and exothermic reaction. Give the Arrhenius equation of rate constant for a chemical reaction. 1+2+2=5

(B) Explain the terms of Chromophore and Auxochrome citing proper example. 4

(C) Write the features of *E*1 and *E*2 reactions. What types of kinetics *E*1 and *E*2 followed ? Draw the potential energy diagram of each. 3+1+2=6

(D) What is carbonization of coal ? Distinguish between high temperature carbonization (HTC) and low temperature carbonization (LTC). 5

3. (A) Describe instrumentation of NMR spectrometer. 5

(B) What are stretching and bending modes of molecular vibrations associated with vibrational spectroscopy ? 6

(C) What are *n*-type and *p*-type semi conductors ? Explain with examples. 2+2=4

(D) Mention the properties of an ideal fuel. 5

4. *(A)* Write the cell reaction and e.m.f equation for the following cell : 4

$Fe / Fe^{2+} // Sn^{2+} / Sn$ .

*(B)* Calculate the pH of the half cell : $Pt, H_2 / H_2SO_4$ . The oxidation potential is $+0.2V$ . 3

*(C)* Deduce the expression of work done for isothermal reversible process for one mole of an ideal gas. 4

*(D)* One mole of an monoatomic gas undergoes an isothermal reversible change at $25°C$ to twice its original volume. Calculate the heat absorbed by the system and work done by the system. 5

*(E)* Explain difference between electrode potential and standard electrode potential. 2

*(F)* Write down the application of Nernst equation. 2

5. *(A)* Calculate the temperature for a reaction at which its half-life is 2 minutes. 4

Given $A = 50.00 \times 10^{-10} s^{-1}$ and $E_a = 10^5 Jmol^{-1}$





*(B)* Distinguish between addition and condensation polymer. 2

*(C)* Define pseudounimolecular reaction. Give *two* examples of pseudounimolecular reaction. 1+2=3

*(D)* Write short notes on : 2×4=8

*(a)* Nylon – 6, 6

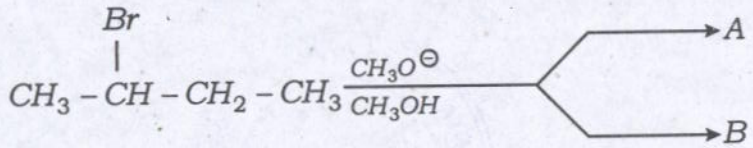
*(b)* Buna-S-rubber

*(c)* Natural rubber

*(d)* Teflon.

*(E)* Give the concentration versus time plot of 2nd order reaction of type $A + B \rightarrow P$. What is the slope of the plot ? 2+1=3

6. *(A)* Write the reaction product of the following with proper reaction mechanism pathway. 2+3=5




*(B)* Explain inductive and mesomeric effects mentioning their applications. 3+3=6

*(C)* Write short notes on : 2+2=4

*(i)* Octane number

*(ii)* Cracking of hydrocarbons.

(D) Give the mechanism of acid or base catalysed aldol reaction. 5

7. (A) In the reduction of nitric oxide 50% of the reaction was completed in $K_{10}$ seconds when the initial pressure was 258 *mm Hg* and in 224 seconds when partial pressure was 202 *mm Hg*. Find the order of the reaction. 5

(B) Describe the mechanism of electrochemical corrosion when a metal comes in contact with acid. 5

(C) Write types of hybridisations, shapes of singlet and triplet carbene with examples. 5

(D) What is a coordinate or dative band? Explain the formation of ammonium ion. 2+3=5