Total number of printed pages–8

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

1. *(A)* Fill in the blanks :   1×5=5

    (i)   The monomer unit of PP is
            _____ .

    (ii) The unit of rate constant of 2nd
            order reaction is _____ .

    (iii) The monomer units of Terylene are
            _____ and _____ .

    (iv) Positive catalyst _____ the rate
            of a chemical reaction.

                                    Contd.

(B) Mention whether the following statements are true **or** false : 1×5=5

(i) OH group is an example of chromophore.

(ii) Symmetric bonds, for example, H_2 or Cl_2 are IR active.

(iii) Mass spectroscopy provides information about molecular mass.

(iv) Methanol has two different sets of protons (methyl and hydroxyl) and thus it is expected to give two signals in ^1H NMR investigation.

(v) Bathochromic shift is a change of spectral band position in the absorption, reflectance, transmittance or emission spectrum of a molecule to a longer wavelength (lower frequency).

(C) Indicate true **or** false : 1×5=5

(i) Strength of carboxylic acid : Trichloroacetic acid > Dichloroacetic acid > Monochloroacetic acid > Acetic acid.
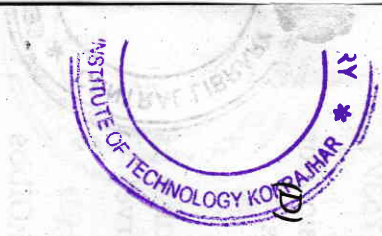
(ii) Inductive effect is an electronic effect due to polarization of pi-bonds within a molecule or ion.

(iii) Relative inductive effects is in the following order :

$-NO_2 > -CHO > -F > -OH > -NH_2 > -C_6H_5$

(iv) Mesomeric effect is in the category of permanent effect.

(v) Bond length : greater the $-I$ effect, small will be the bond length.

(D) Answer the following short questions :

(i) Differentiate between isothermal process and adiabatic process. 1

(ii) In which case the entropy of a substance is zero at 0°C or 0K? Justify your answer. 1

(iii) Give the differences between electrolytic cell and electrochemical cell. 2

(iv) State the relationship between enthalpy and internal energy. 1

2. (A) Describe the working principle of standard hydrogen electrode. 4

(B) Write *two* applications of Nernst equation. 3

(C) For the following cell, write down the cell reaction and calculate the emf. 5

$$Zn|Zn^{+2}(a=0.1) \| Ag^+(a=0.1)|Ag \left[E°_{Ag|Ag^+} = -0.799V; \quad E°_{Zn|Zn^+} = +0.763V \right]$$

(D) Deduce the mathematical expression for the first law of thermodynamics. 4

(E) Prove that the adiabatic P-V curve is steeper than isothermal P-V curve. 3

(F) What is the relationship between Gibbs free energy and entropy? 1

3. (A) Define hyperchromic and hypochromic shifts. 2

(B) Describe the instrumentation of IR spectrometer giving a suitable diagram. 5
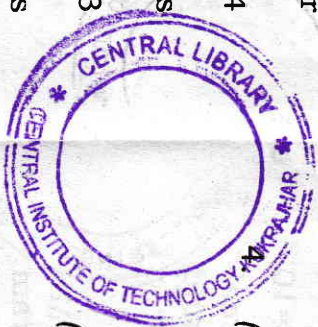
(C) What are the numbers of components, phases and degrees of freedom in the following system? 3

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

(D) Write short notes on : 3+3+4=10

(i) Effects of electronegativity difference on polarity of covalent bonds

(ii) Hydrogen bonding

(iii) Properties of an ideal fuel.

(A) How do you explain fission of carbon bonds? What are the homolytic and heterolytic fission? Explain with equations and examples. 2+4=6

(B) Write down the reaction with mechanism for electrophilic and nucleophilic addition reactions. 3+3=6

(C) What is Saytzeff's rule? Give example with reaction. 1+2=3

(D) What is Markovnikov and anti-Markovnikov's rule? Give example with reaction. 2+2=4

(E) Give examples of Lewis acid and Lewis bases.   1

5. (A) Distinguish between order and molecularity of a reaction.   2

(B) What is natural rubber? Give the reaction of its synthesis.   1+2=3

(C) 50% of 1st order reaction is completed in 23 mins. Calculate the time required to complete 90% of the reaction.   5

(D) Write short notes on :   2×5=10
Buna-S rubber, Polythene, Urea-formaldehyde Resin, Nylon-66 and Thermosetting plastic.

6. (A) Give a brief introduction to NMR spectroscopy with a suitable diagram of NMR spectrophotometer.   5

(B) Calculate the frequency of C–H stretch, given that $k = 5 \times 10^5\, gm\, sec^{-2}$,
$m_C = 20 \times 10^{-24}\, gm$ and
$m_H = 1.6 \times 10^{-24}\, gm$.   5

(C) $100\, gms$ of argon expands from a pressure of $10\, atm$ $0.1\, atm$ at $100°C$. Calculate the heat absorbed, assuming ideal behaviour. [At. wt. of $Ar = 40$; $R = 8.314\, J\, mol^{-1} K^{-1}$].   5

(D) Write short notes on : (any two)   2½×2=5
(i) Aviation gasoline
(ii) Octane number
(iii) Biodiesel
(iv) Water gas.

7. (A) What is Favorskii reaction? Give reaction with mechanism.   1+4=5

(B) What is dipole moment? Give the differences among o, p, m-dichlorobenzene in terms of dipole moment.   1+3=4

(C) Write one difference between electrophiles and nucleophiles.   1

(D) What do you mean by rate of a reaction ? A 1st order reaction has rate constant of $5000s^{-1}$ at $25°C$ and an activation energy of $6 \times 10^4 J\,mol^{-1}$. At what temperature would rate constant be $10,000s^{-1}$?   5

(E) Write short notes on the following : $2\frac{1}{2}\times2=5$

   (i) Flash point

   (ii) LPG.

———