Total number of printed pages:06 **Programme(UG/)/2nd Semester/UCH201**

2023

ENGINEERING CHEMISTRY

Full Marks: 100

Time: Three hours

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

*Question 1 is mandatory and Answer any **FOUR** questions.*

1 Answer all the questions 1x20=20

(A) Find the correct inductive effect series

a. -CN > -SO_3H> -CHO> -CO

b. - SO_3H > - CN > -CHO> -CO

c. -CN > -SO_3H> -CO> -CHO

d. -CN > - CO > -CHO> - SO_3H

(B) The example of Lewis acid is

a. NH_3

b. $AlCl_3$

c. $^-OCH_3$

d. HCl

(C) An alkene compound propene-1 could be converted to 1-bromopropane in the presence of HBr through free radical reaction mechanism, the name of the reaction is

a. Markovnikoff rule

b. Anti-Markovnikoff rule

c. E2 reaction

d. Saytzeff rul

(D) In S_N^2 and E2 reaction, there is no rate determining step. It is due to

a. Slow reaction

b. Fast reaction

c. Formation of carbocation

d. Formation of carbanion

(E) In Chichibabin reaction, the mechanism is

a. an addition-elimination

b. elimination

c. S_N^2

d. addition

(F) Which of the following is a weak electrolyte?

a NaOH

b. HCl

c. CH_3COONa

d. CH_3COOH

(G) The cell: Zn / H_2SO_4|| H_2SO_4 / Cu is an example of

a. Primary standard electrochemical cell

b. Secondary standard electrochemical cell

c. Reversible electrochemical cell

d. Irreversible electrochemical cell

(H) Stronger the oxidizing agent greater the

a. Reduction potential

b. Oxidation potential

c. Ionic behavior

d. Both (a) and (b)

(I) For adiabatic process

a. $\Delta U = 0$

b. $\Delta H = 0$

c. $\Delta Q = 0$

d. $\Delta S = 0$

(J) When a system undergoes change at constant pressure, it is known as:

a. Isothermal process

b. Isobaric process

c. Isochoric process

d. Adiabatic process

(K) Which one of the following is correct?

a. Uracil is a heterocyclic base present in DNA

b. Uracil is a heterocyclic base present in RNA

c. Uracil is a heterocyclic base present in both RNA and DNA

d. None of these

(L) The monomers of Bakelite are

a. Urea and formaldehyde

b. Phenol and formaldehyde

c. Formaldehyde and styrene

d. None

(M) The molecularity of the following reactions respectively are

$H_2 + I_2 \rightarrow 2HI$ and $PCl_5 \rightarrow PCl_3 + Cl_2$

a. Two and One

b. One and two

c. Two and two

d. None

(N) Nylon 6,6 is an example of

a. Addition polymer

b. Condensation polymer

c. Natural Rubber

d. None

(O) Vitamin A is useful for the treatment of

a. Hair loss

b. Night blindness

c. Skin problem

d. None

(P) According to spectrochemical series Cl^-, Br^- etc are examples of _____ ligands.

a. Strong

b. Weak

c. Moderate

d. None of the above

(Q) Stretching and bending vibrational modes are observed in

a. UV-Visible spectroscopy

b. Mass spectroscopy

c. NMR spectroscopy

d. Infra-red spectroscopy

(R) Beer-Lambert's law is related to

a. Vibrational spectroscopy
b. Electronic Absorption spectroscopy
c. Mass spectroscopy
d. NMR spectroscopy

(S) Cetane number is associated with

a. Diesal
b. Petrol
c. Kerosene
d. Ethanol

(T) Which of the following is the highest rank of coal?

a. Lignite
b. Anthracite
c. Graphite
d. Bituminous coal

2 (A) Define the following: (a) Electrode potential (b) Oxidation potential (c) Reduction potential — 6

(B) What are the differences between (a) electrolytic cell and electrochemical cell. (b) EMF and Potential difference — 3 +3=6

(C) Calculate the pH of the following half cell: Pt, H_2/H_2SO_4. The oxidation potential is 0.3 volt. — 4

(D) The standard reduction potential of the Ag^+/Ag electrode at 298K is 0.799V. Given that for AgI, $k_{sp} = 8.7 \times 10^{-17}$, evaluate the potential of Ag^+/Ag electrode in a standard solution of AgI. — 4

3 (A) Explain more acid strength of trichloroacetic acid than acetic acid. — 2

(B) Give E1 mechanism for conversion of ethanol to alkene. — 4

(C) Write down the reaction for — 2 x 3=6

(a) When ketene is decomposed in the presence of sunlight
(b) Alkene to haloalkane
(c) Nucleophilic addition reaction

(D) When two carbonyl compounds (A) are treated with base it gives product B and further dehydration of B gives product C. Give the reaction with mechanism and identify the products A, B and C. 4

OR

When a reactant A is treated with base it gives product (cyclopentanoic acid). Identify the reactant A and name of the reaction, give reaction mechanism.

(E) Give synthesis method for acetaminophen (paracetamol). 4

4 (A) For a 1^{st} order reaction A→ P, 4

Prove that Rate constant (k) = $0.693/t_{1/2}$

Where $t_{1/2}$ is the half-life period.

(B) If a 1^{st} order reaction has an activation energy of 104500 $Jmol^{-1}$ and the Arrhenius constant A has the value $5X\ 10^{13}\ S^{-1}$. At what temperature will the reaction have a half- life of 1 minute? 4

(C) Define isoelectric point. What is isoelectric point for Aspartic acid 4

If Pka_1 = 1.88 and Pka_2 = 3.65 ?

(D) Write short notes on: PE and PP. 4

(E) Define monosaccharides, oligosaccharides and polysaccharides. Give example of each. 4

5 (A) What is crystal field stabilization energy? Show that the paramagnetic behavior of $[CoF_6]^{3-}$ is higher than $[Co(NH_3)_6]^{3+}$. 1+4=5

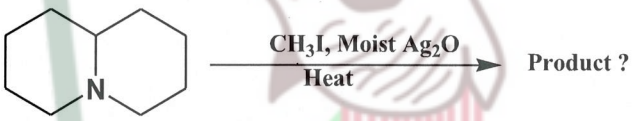
(B) Draw a schematic diagram of NMR instrument mentioning its important components. Explain the splitting pattern of ^1H NMR signal of ethanol. 2+3=5

(C) Describe briefly about n-type and p-type of semiconductors. 4

(D) State the Beer's law associated with UV-Visible spectroscopy. 2

(E) Write short notes on (any two) – 2+2=4

(i) Water gas, (ii) Octane Number and (iii) LPG.

6	(A)	What is meant by valence band and conduction band?	2
	(B)	Write three important properties of an ideal fuel.	3
	(C)	Distinguish between DNA and RNA.	2
	(D)	Write about the dependence of rate constant on rate of a reaction. Give the Arrhenius equation.	3
	(E)	Deduce the mathematical expression for 1st law of thermodynamics. What will be the amount of heat change for a system which undergoes changes (a) under isothermal condition (b) under condition, where volume remains constant.	3+2=5
	(F)	Give conversion with mechanism for 2-Bromobutane to butene-1 and butene-2.	3
	(G)	Give free radical mechanism for Markovnikoff rule.	2
7	(A)	Complete the following reaction and give mechanism 	5
	(B)	A heat engine operating between 227°C and 27°C absorbs 1k.cal of heat from 227°C reservoir per cycle. Calculate (i) The amount of heat discharged into the low temperature reservoir per cycle. (ii) The amount of work done per cycle (iii) The efficiency of the engine.	5
	(C)	Define monosaccharides, oligosaccharides and polysaccharides. Give example of each.	5
	(D)	Give an example of nuclear fuel. Write briefly about proximate and ultimate analyses of coal.	5

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