

[Time: Three Hours]

[Marks: 100]

Please check whether you have got the right question paper

- NB:** 1. All questions are compulsory.
 2. Answers to the same questions must be written together.
 3. Figures to the right indicate full marks.
 4. The use of log table/ non programmable calculator is allowed.

- Q.1 (A)** Select the correct option and complete the following statements (**Any twelve**) **(12)**
- i) The pH of Milk is _____.
 a) 5.6 b) 6.5 c) 7.5
 - ii) _____ is an example of basic buffer.
 a) $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$ b) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$
 c) $\text{NH}_4\text{OH} + \text{NaCl}$
 - iii) The pH of 0.001 M HCl is _____.
 a) 0.001 b) 3 c) 0.1
 - iv) _____ among these has the shortest wavelength.
 a) Radio waves b) Infrared waves c) Ultraviolet waves
 - v) Repeatable entity of a crystal structure is known as _____.
 a) crystal b) lattice c) unit cell
 - vi) Amorphous solids are _____.
 a) super cooled liquids
 b) substances with definite melting points
 c) possess anisotropy
 - vii) The number of bond pairs in silicon tetrachloride molecule is _____.
 a) 4 b) 0 c) 2
 - viii) Number of electrons in valence shell of carbon in methane is _____.
 a) 4 b) 8 c) 6
 - ix) The Steric number for CO_2 molecule is _____.
 a) 4 b) 2 c) 8
 - x) The bond angle in HgCl_2 is _____.
 a) 120° b) 90° c) 180°
 - xi) A graphical plot of potential vs pH of an electrochemical system is _____.
 a) Frost b) Latimer c) Pourbaix
 - xii) Indicator used in the titration involving the use of Iodine solution is _____.
 a) KMnO_4 b) starch c) methyl orange
 - xiii) The bond angle in planar cyclohexane is _____.
 a) 60° b) 120° c) 109°

- xiv) _____ is used as a catalyst in halogenation of benzene.
 a) FeCl_3 b) FeCl_2 c) LiAlH_4
- xv) Cl has _____ inductive effect.
 a) electron attracting b) electron repelling c) none
- xvi) Anthracene has _____ pi electrons
 a) 6 b) 10 c) 14
- xvii) Phenanthrene is _____.
 a) aromatic b) antiaromatic c) non aromatic
- xviii) Electron withdrawing groups have _____ effect on aromatic ring in electrophilic substitution.
 a) activating b) deactivating c) none

(B) State whether the following statements are True or False **(3)**
(Any Three)

- i) In an infinitely dilute solution, a weak electrolyte is completely dissociated.
- ii) The energy of visible light is lesser than the infrared rays.
- iii) ClF_3 is T-shaped molecule.
- iv) The number of lone pairs in BeCl_2 molecule is one.
- v) Cyclopentadiene is Antiaromatic.
- vi) The energy of transition state is higher than that of intermediate.

(C) Match the following columns **(Any Five)** **(5)**

Column A		Column B	
(i)	pH of gastric juice	(a)	32
(ii)	Elements of symmetry of cubic crystal	(b)	reduction
(iii)	Decrease in oxidation number	(c)	m-directing group
(iv)	self indicator	(d)	2.0
(v)	$-\text{NO}_2$	(e)	axial bonds become equatorial
(vi)	Flipping of cyclohexane	(f)	23
		(g)	KMnO_4
		(h)	phenolphthalein

Q.2

Attempt any Four of the following

- (A) Explain the use of Henderson equation for the measurement of pH of a basic buffer solution? (5)
- (B) A buffer solution of pH 4.5 is to be prepared by using acetic acid and sodium acetate. Calculate the ratio of [salt] : [acid] that must be used. [Given: $K_a = 1.8 \times 10^{-5}$] (5)
- (C) Define the term Degree of ionization. What are the factors which affect the degree of ionization? (5)
- (D) The lowest frequency of electromagnetic radiation used for communication purposes is at 76 Hz. Calculate the
 a) wavelength
 b) frequency in m^{-1} and
 c) energy of the electromagnetic radiation. (5)
 [Given: $c = 3 \times 10^8 \text{ m/s}$; $h = 6.626 \times 10^{-34} \text{ Js}$]
- (E) Define crystallography and interfacial angle. Explain the law of constancy of interfacial angles. (5)
- (F) What are the seven crystal systems? Give the unit parameters (length and angles) of any three-crystal system. (5)

Q.3

Attempt any Four of the following

- (A) Define the following terms:- (5)
 a) polarizability b) ionic bond
 c) metallic bond d) covalent bond
- (B) Draw Lewis dot structures for the following molecule/ions. (5)
 a) BF_3 b) NH_4^+
- (C) Explain isoelectronic principle. Give any two of its applications. (5)
- (D) Give a brief account of Sidwick-Powell theory. On the basis of this theory predict the shape of the following molecules. (5)
 a) BeH_2 b) BCl_3
- (E) Balance the following redox reaction with stepwise explanation: (5)

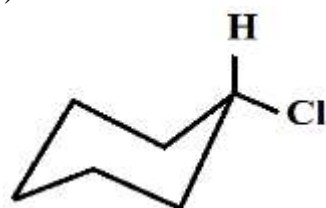
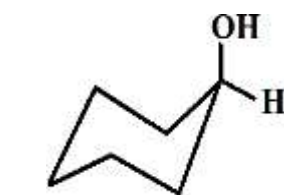
$$\text{Fe}^{2+} + \text{MnO}_4^- + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{Fe}^{3+} + \text{H}_2\text{O}$$
 (in acidic medium)
- (F) i) Calculate the E system for titration of 10.0 cm^3 of 0.1 M Fe^{2+} with a standard solution of Ce^{4+} in presence of 0.1 M Sulphuric acid, on addition of (5)
 a) 5.0 cm^3 and b) 11.0 cm^3 of 0.1 M Ce^{4+} solution at 298 K
 $E^0(\text{Pt}/\text{Fe}^{3+}, \text{Fe}^{2+}) = 0.771 \text{ V}$, $E^0(\text{Pt}/\text{Ce}^{4+}, \text{Ce}^{3+}) = 1.44 \text{ V}$

Q.4

- (A) i) Explain Nitration of Benzene with mechanism? (3)
 ii) Explain Baeyer's strain theory? (2)
- (B) Explain Huckel's Rule of aromaticity? Discuss aromaticity of (5)

naphthalene and anthracene.

- (C) i) Which of the following has substituent on axial bonds? (3)
- a) b)



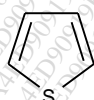
- ii) Explain antiaromaticity with suitable examples? (2)
- (D) State Hammond's Postulate. Explain how it is possible to identify the structure of Transition States. (5)
- (E) Explain Steric strain and Pitzer strain? (5)
- (F) What are activated aromatic rings and deactivated aromatic rings? (5)

Q.5

Attempt any Four of the following

- (A) Derive the expression for ionic product of water. (5)
- (B) Define wavelength and frequency. Give three characteristics of electromagnetic radiation. (5)
- (C) i) Find out the oxidation number of S in $\text{Na}_2\text{S}_2\text{O}_3$ and H_2SO_4 . (2)
- ii) What are disproportionation reactions? Explain the disproportionation reaction of Cu^+ to Cu^{2+} and Cu^0 . (3)
- (D) Explain Frost diagram for manganese ion in various oxidation states. (5)
- (E) Draw the chair conformation and boat conformation of cyclohexane. Explain the structures of chair conformations and boat conformation? (5)
- (F) Which of the following are aromatic, antiaromatic or non aromatic. Justify (5)

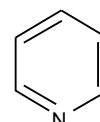
a)



b)



c)



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