[Time: Three Hours]   **[Marks:100]**

Please check whether you have got the right question paper.

N.B: 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 long table/non-programmable calculator is allowed.

Q.1 A   Select the correct option and complete the following statements.   12

   i.   At 298 K, pOH of NaOH of solution is 2.5, its pH is _____.
        a)   14
        b)   2.5
        c)   11.5
   ii. The dissociation constants for some monobasic acids are: K_a (Acid)$_1$ = 5.4 X 10^{-10}, K_a(Acid)$_2$ =1.8 X 10^{-5}
        and K_a (Acid)$_3$ = 6.3 X 10^{-5}. _____ is the weakest acid among them.
        a)   (Acid)$_1$
        b)   (Acid)$_2$
        c)   (Acid)$_3$
   iii. The SI unit of frequency of radiation is _____.
        a)   cm
        b)   m
        c)   Hertz
   iv. The maximum number of centre of symmetry possesses by any crystal is_____.
        a)   2
        b)   4
        c)   1
   v.   The bond angle X – P – X in PX$_3$ gets reduced _____.
        a)   with increase in electronegativity of halogen atom
        b)   with decrease in electronegativity of halogen atom
        c)   without any effect of electronegativety of halogen atom
   vi. The steric number gives _____.
        a)   only number of bonded atoms
        b)   number of bonded atoms and lone pair of electrons
        c)   only number of lone pairs
   vii. Strong reducing agents have _____.
        a)   greater positive value of standard reduction potential
        b)   greater negative value of standard reduction potential
        c)   lesser positive value of standard reduction potential
   viii. The indicator employed in the titrations involving the use of iodine solution is _____
        a)   starch
        b)   methyl orange
        c)   phenolphthalein
   ix. Flagpole hydrogen in cyclohexane experiences _____ strain.
        a)   Pitzer
        b)   Angle
        c)   Transannular

1

x. Out of the following, _____ is anti –aromatic?

a)

b)

d)
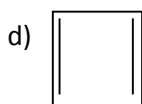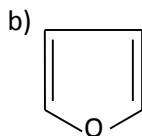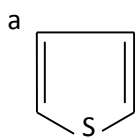
xi. In chlorobenzene, Cl exhibits _____ effect:
   a) Only +R effect
   b) Only – I effect
   c) Both +R effect & -I effect

xii. _____ is meta directing group in aromatic electrophilic substitution.
   a) –CN
   b) –Cl
   c) –NH₂

B State whether the following statements are True or False: 3
   i. Radio waves have more energy than IR radiations.
   ii. Density of water is less than that of ice.
   iii. Anti-aromatic compounds are more stable than aromatic compounds.

C Match the following columns: 5

Column A		Column B	
i.	Mixture of acetic acid & sodium acetate	1)	$109^0 28'$
ii.	Plank's theory	2)	Basic buffer
iii.	Oxidation state of Mn in KMnO₄	3)	Acid buffer
iv.	Covalency of N	4)	Quantisation of energy
v.	Tetrahedral angle	5)	3
		6)	107^0
		7)	+5
		8)	+7

Q.2 A i. The degree of ionization of 0.1 M acetic acid solution is 0.0134 at 298 K. What will be the degree of ionization of 0.05 M acetic acid solution at 298 K.   5

ii. Explain any three factors that affect degree of ionization.   3

OR

A i. Explain the mechanism of the buffer action of acid buffer.   5

ii. Calculate Hydroxyl ion concentration [OH⁻] of a solution having pH 4.70 at 298 K   3

B i. Calculate and compare the energies of two radiation, one with wavelength 400 nm and the other with 800 nm.   5
(h = 6.625 X 10⁻³⁴ J.s, c = 3 X 10⁸ m/s)

ii. State and explain law of constancy of interfacial angles   3

OR

2

B	i.	Find Miller indices of the planes whose intercepts on crystallographic axes are (3a,b,c) and	5
		$(3a, 3b, \infty c)$	3
	ii.	Write a note on electronic transition	
C	i.	Define : a) pH b) Common ion effect	2
	ii.	Define : a) electromagnetic spectrum b) Wave number of radiation	2

<div align="center">OR</div>

C	i.	Define : a) Diprotic acid b) Buffer capacity	2
	ii.	Define : a) Axis of symmetry b) Unit cell	2
Q.3 A	i.	Explain (a) covalent bond (b) ionic bond with suitable examples.	4
	ii.	Define polarizability of an anion. Explain any two factors which favour the covalent character of an ionic bond.	4

<div align="center">OR</div>

A	i.	Draw the Lewis dot structure for the following molecules	4
		i) NH_4^+	
		ii) ClO_4^-	
	ii.	What is VSEPR theory? Describe the basic ideas of VSEPR theory given by Gillespie and Nyholm.	4
B	i.	Balance the following equation with stepwise explanation in acidic medium:	4
		$Cr_2O_7^{2-} + C_2O_4^{2-} + H^+ \rightarrow Cr^{3+} + CO_2 + H_2O$	
	ii.	The standard electrode potential values of TI for the following redox reactions are given below:	4

Redox reaction	E^0 values
$TI^+_{(aq)} + e^- \rightarrow TI_{(S)}$	-0.34V
$TI^{3+}_{(aq)} + 2e^- \rightarrow TI^+_{(S)}$	1.25V
$TI^{3+}_{(aq)} + 3e^- \rightarrow TI_{(S)}$	$E^0 = ?$

Construct the Latimer diagram and find out the E^0 and ΔG^0 values for the reaction:
$TI^{3+}_{(aq)} + 3e^- \rightarrow TI_{(S)}$
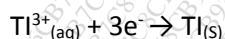
<div align="center">OR</div>

| B | i. | Explain the role of $KMnO_4$ as an oxidizing agent with suitable example. | 4 |
| | ii. | Calculate the E_{system} for the titration of 10 cm^3 of 0.1M Fe(II) versus 0.02M $KMnO_4$ on addition of (a) 5.0 cm^3 (b) 10.0 cm^3 and (c) 11.0 cm^3 of 0.02M $KMnO_4$ in a solution of pH = 1 [$E^0_{Pt/Fe(III),Fe(II)}$ = 0.77 V; $E^0_{Pt/MnO4-,Mn2+}$ =1.51 V] | 4 |

| C | Explain the application of VSEPR theory for predicting and F - I – F bond angles in IF$_7$ [Atomic number of I=53] | 4 |

<div align="center">OR</div>

C	Explain the application of VSEPR theory for predicting shape and F – Xe – F bond angles in XeF$_2$ [Atomic number of Xe = 54]	4
Q.4 A	i.	Draw the chair and boat conformations of cyclohexane and explain their relative stabilities.	5
	ii.	Explain aromaticity of naphthalene. Draw its resonating structures.	3

<div align="center">OR</div>

A	i.	Explain stability of cyclobutane and cyclopropane on the basis of Angle Strain Theory.	5
	ii.	Explain aromaticity of anthracene. Draw its resonating structures.	3
B	i.	Explain the effect of presence of nitro group on benzene for further electrophilic substitution with respect to orientation and reactivity.	5
	ii.	Explain Huckel's rule with examples.	3

<div align="center">3</div>

OR

B   i.   How will you prepare cumene from benzene? Name the reaction and write its mechanism.   5

     ii.   Write a note on ortho, para- directing groups in electophilic aromatic substitution. With examples.   3

C   i.   Which of the following are aromatic: Tropylium cation and cyclopentadiene? Justify your answer.   2

     ii.   Why is cyclobutadiene antiaromatic in nature?   2

OR

C   i.   What is meant by flipping? Explain flipping in cyclohexane.   4

Q.5   Attempt any four of the following.

A   Derive Henderson equation for the pH of basic buffer.   5

B   Distinguish between amorphous solids and crystalline solids.   5

C   On the basis of Lewis concept of covalent bonding explain single and double bonding in covalent molecules   5

D   Find the oxidation number of sulphur in $Na_2S_2O_3$, H_2SO_4, SO_2, SF_6 and H_2S.   5

E   What are the conditions which must be satisfied for a compound to exhibit aromatricity?   5

F   What is Friedel Craft's acylation? Give an example with mechanism of the reaction.   5