[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)   _____ is a weak electrolyte.
   a)   Nitric Acid
   b)   Sodium Hydroxide
   c)   Acetic Acid

ii)   At 298 K, pH + pOH = _____
   a)   7
   b)   14
   c)   12

iii)   _____ are the highest energy and lowest wavelength radiations.
   a)   Ɣ rays
   b)   UV radiations
   c)   IR radiations

iv)   The geometrical form consisting of a regular arrangement of a constituent particles of a crystalline
          solid in three dimensional space is called _____
   a)   Unit cell
   b)   Space Lattice
   c)   Lattice planes

v)   A polar covalent bond is formed when the bonding pair of electrons in a molecule is _____.
   a)   Shared equally by both the atoms
   b)   Not shared equally by both the atoms
   c)   Transferred from one atom to the other atom

vi)   Polarisabililty of an anion _____.
   a)   Increases with decrease in size
   b)   Increases with increase in size
   c)   Decreases with increase in charge

vii)   Strongest oxidizing agent in the electrochemical series is _____.
   a) F_2
   b)   Li
   c) H_2

viii)   The titration in which free iodine solution is used is called _____ titration.
   a)   Iodometric
   b)   Iodimetric
   c)   Coulometric

ix)   During flipping:
   a)   Axial bonds are not changed to equatorial.
   b)   Axial bonds are changed to equatorial.
   c)   Equatorial bonds are not changed to axial.

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x) Oleum is _____.
   a) SO_3 & H_2SO_4
   b) SO_3 in pyridine
   c) $ClSO_3H$ in CCl_4

xi) Which of the following compounds is anti- aromatic?
   a) Cyclopropenyl anion
   b) Cyclopropenyl cation
   c) Tropylium cation

xii) _____ is stong electon withdrawing group.
   a) $-CH_3$
   b) $-NO_2$
   c) $-NH_2$

B State whether the following statements are True or False: 3
   i) A crystal can have more than one centre of symmetry.
   ii) At room temperature, $BaSO_4$ is freely soluble in water.
   iii) During halogenations of aromatic hydrocarbons, $FeCl_3$ is the halogen carrier

C Match the following columns: 5

Column A	Column B
i) Fluorescence	i) delayed emission of low energy radiation
ii) Rubber	ii) instantaneous emission of low energy radiation
iii) H-O-H bond angle in H_2O	iii) 90^0
iv) H-N-H bond angle in NH_3	iv) Amorphous solid
v) Chair form	v) 104.5^0
	vi) 107.2^0
	vii) Most stable conformation
	viii) Least stable conformation

Q.2 A   i) Explain the factors that affect the degree of ionization of any weak electrolyte   5
    ii) Calculate the pH of 0.05 M Acetic acid if it is 2.5% ionized.   3

OR

A   i) At 298 K, calculate the pH of   5
    a) 0.0005 M NaOH
    b) 0.05 M H_2SO_4.   3
    ii) Explain with suitable examples "Common Ion Effect".

B   i) Calculate the wavelength, wave number and energy associated with radiation of frequency 5.71×10^{14} Hz.   5
(h = 6.626×10^{-34} J s, c = 3×10^8 m/s)
    ii) State and explain the law of constancy of interfacial angles.   3

OR

B   i) Find Miller indices of the planes whose intercepts on crystallographic axes are   5

(a/2, b/2, 2c) and (a, b,∞ c).

    ii) Write a note on electronic transition.   3

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C i) Define: a) Buffer capacity   b) Buffer action   02
   ii) Define : a) Spectroscopy   b) Wavelength radiation   02

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

C i) Define : a) Degree of ionization   b) Polyprotic acid   02
   ii) Define : a) Plane of symmetry   b) Lattice planes   02

Q.3   A   i)   Explain ionic bond and coordinate bond with suitable examples.   04
        ii)   Write a comprehensive note on Fajan's rules.   04

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

   A   i)   Draw the Lewis dot structure for the following molecules: 04
           (i) NF_3 (ii) H_2O
        ii)   Explain isoelectronic principle with suitable examples.   04
   B   i)   Balance the following equation with stepwise explanation: 04
         $Zn + HNO_3 \rightarrow N_2O + Zn(NO_3)_2 + H_2O$

        ii)   The standard electrode potential values of copper for the following redox reactions are   04
           given below:

Redox reactions	E^0 values
$Cu^{2}_{(aq)} + e^- \rightarrow Cu^+_{(aq)}$	+0.159V
$Cu^+_{(aq)} + e^- \rightarrow Cu_{(s)}$	+0.520V
$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$	$E^0 = ?$

Construct Latimer diagram and find out the E^0 and ΔG^0 values for the reaction :
$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$
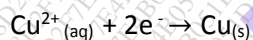
<div align="center">OR</div>

   B   i)   Explain how copper is extracted from its ore by auto reduction process.   04
        ii)   Calculate the E_{system} for the titration between 0.1M Ce(IV) and 5cm^3 of 0.1M Fe(II) after   04
           addition of (i) 2.0 cm^3 ii) 5.0 cm^3 and (iii) 6.0 cm^3 of 0.1M Ce(IV).
           [$E^0_{Pt/Fe(III), Fe(II)}$ =0.77 ; $E^0_{Pt/Ce(IV), Ce(III)}$ =1.44V]

   C   Explain the application of VSEPR theory for predicting shape and F-S-F bond angles in SF_4 [Atomic   04
      number of S=16]

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

   C   Explain the application of VSEPR theory for predicting shape and F-Br-F bond angles in BrF_5 [Atomic   04
      number of Br =35]

Q.4   A   i) Explain the following strains in cycloalkanes – van der Waals strain, Torsional strain.   05
   ii) State and explain Hückel's rule with examples.   03

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

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

A   i) Draw the various conformers of cyclohexane and their potential energy diagram.   05
    ii) Explain aromaticity of pyrrole.   03

B   i) What are activated aromatic rings for electrophilic substitution reaction? Give examples with   04
resonance structures.
    ii) Explain with a suitable example the concept antiaromaticity.   04
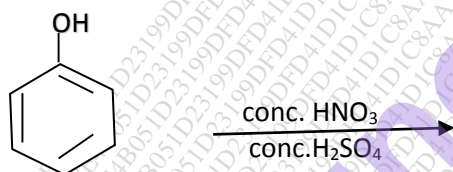
<center>OR</center>

B   i) Draw and explain the energy profile diagram for aromatic electrophilic subsituation reaction.   04
    ii) Explain Hammond's Postulate.   04

C   i) Write an equation for the nitration of nitrobenzene.   02
    ii) Write an equation for acylation of benzene. Name the electrophile formed in the reaction.   02

<center>OR</center>

C   Complete the reactions. Name the products.   02
    i)
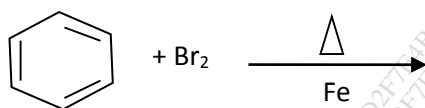
    ii)   02

Q.5   Attempt **any four** of the following:
  A   Derive Henderson's equation for the pH of an acid buffer.   05
  B   Explain the following phenomenon that occurs when electromagnetic radiation interacts with matter: 05
    i) Absorption ii) Emission
  C   Explain Lone pair - Lone pair repulsion is maximum than the repulsion of lone pair- bond pair and bond
    pair – bond pair of electrons.   05
  D   Find the oxidation number of Phosphorus in PH_3, P_2O_5, H_3PO_4, $POCl_3$ and PCl_5.   05
  E   What is aromaticity? Which of the following molecules or ionic species are aromatic? Cyclopentadiene   05
    and cyclopentadienyl anion. Justify your answer.
  F   Give the mechanism of sulphonation of benzene.   05

<center>4</center>