

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 log table/non-programmable calculator is allowed.

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

12

- i. A plane whose intercepts in crystallographic axes are $\frac{1}{2}a : \infty b : \frac{1}{3}c$, its Miller indices are
 - a) 2:0:3
 - b) $\frac{1}{2}:0:3$
 - c) 3:0:2
- ii. Sodium chloride crystal possesses elements of symmetry.
 - a) 23
 - b) 24
 - c) 22
- iii. is the pOH of 0.1M NaOH.
 - a) 13
 - b) 1
 - c) 14
- iv. The energy of X-rays is that of ultraviolet radiations.
 - a) less than
 - b) greater than
 - c) equal to
- v. The molecular shape of PCl_5 is
 - a) triangular planar
 - b) pentagonal
 - c) trigonal bipyramidal
- vi. molecule / species is isoelectronic with CS_2 .
 - a) NO_2
 - b) NO_2^+
 - c) NO_2^-
- vii. Oxidation state of Chromium in CrO_4^{2-} is
 - a) +6
 - b) +2
 - c) +4
- viii. In the reaction : $\text{Zn} + \text{Cl}_2 \rightarrow \text{ZnCl}_2$,
 - a) Zn is reduced
 - b) Zn is oxidized
 - c) Chlorine is oxidized

- ix. conformer has maximum torsional strain.
- Eclipsed
 - Staggered
 - Skew
- x. When a molecule experiences strain, its internal energy
- decreases
 - increases
 - equalizes
- xi. Cyclooctane has strain than cyclohexane due to torsional strain.
- lesser
 - greater
 - equal or lesser
- xii. Cyclohexane has the highest of all the alicyclic ring systems.
- stability
 - unstability
 - energy

B State whether the following statements are True or False :

03

- Fluorescence involves the absorption of high energy radiation by a sample followed by the instantaneous emission of low energy radiation.
- Greater the difference in electronegativity of the combining atoms, more polar is the bond formed.
- C—C—C bond angle in cyclopropane is 120° .

C Match the following columns.

05

- Column A
- Henderson's equation for acid buffer
 - $1A^0$
 - Self oxidation and reduction
 - Graphical representation of stability of different oxidation states
 - $-\text{SO}_3\text{H}$

- Column B
- 0.1nm
 - Frost diagram
 - ortho, para directing
 - disproportionation
 - deionization
 - meta directing and deactivating group
 - $\text{pH} = \text{pka} + \log \frac{[\text{salt}]}{[\text{acid}]}$
 - $\text{pH} = \text{pka} - \log \frac{[\text{salt}]}{[\text{acid}]}$

Q.2 A i. Derive an expression for the acid dissociation constant of a weak monobasic acid, HA and for the base dissociation constant of a weak monoacidic base, BOH.

05

- Explain :
- Buffer action
- Buffer capacity.

03

OR

A i. Define the term crystallography and state its three laws. 05

ii. What is emission spectroscopy ? 03

B i. A buffer solution of pH equal to 6.6 is to be prepared with 500 cm³ of 0.08M solution of a weak acid HA ($K_a = 6 \times 10^{-6}$). Calculate the amount of the salt to be added to the buffer solution. The molar mass of the salt is 142. 05ii. Calculate the frequency, wave number and energy associated with a quantum of visible light of 5250 Å. ($h = 6.626 \times 10^{-34}$ Js, $c = 3 \times 10^8$ m/s) 03

OR

B i. The dissociation constant of a weak monobasic acid is 2.6×10^{-5} . Calculate its degree of dissociation and concentration of H⁺ ions in 0.06M solution of acid. 05ii. What is the pH of a 0.25M solution of a weak monoacidic base, strychnine at 298 K? ($K_b = 1.82 \times 10^{-6}$). 03

C i. Deduce the expression for ionic product of water at 298 K. 02

ii. Define a buffer solution. Give examples of buffer solutions. 02

OR

C i. Explain pH scale in detail. 02

ii. Define the term : 02

a) Wave length of radiation

b) Frequency of radiation

Q.3 A i. Define the covalent bond. Explain its three characteristics. 04

ii. Illustrate with suitable examples, how the covalent character is favoured by charge on the ion and pseudo inert gas configuration. 04

OR

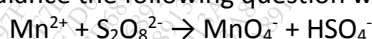
A i. On the basis of Sidgwick Powell's theory, predict and explain the shapes of the following types of molecules : 04

a) AB₆b) AB₇

ii. State and justify whether the following pairs of molecules are isoelectronic or not 04

a) PF₃, NH₃b) N₃⁻, CO₂

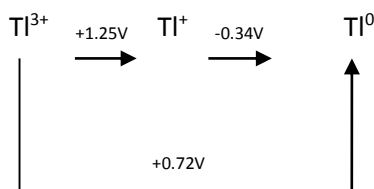
B i. Balance the following question with stepwise explanation in acidic medium 04



ii. Construct a Frost diagram from the following Latimer diagram (in aqueous acidic) 04

solution) and explain which is

- the most stable oxidation state
- the oxidation state having highest reduction potential.



OR

- B i. Explain the role of iodine as a redox agent with suitable examples. 04
- ii. Calculate the E_{system} for the titration of 50.0 cm^3 of 0.1M Fe(II) with 0.02M KMnO_4 on addition of (a) 25.0 cm^3 (b) 50.0 cm^3 and (c) 55.0 cm^3 solution of 0.02M KMnO_4 at $\text{pH} = 1$. $[E^0_{\text{Pt/Fe(III),Fe(II)}} = 0.77 \text{ V} ; E^0_{\text{Pt/MnO}_4^-, \text{Mn}^{2+}} = 1.51 \text{ V}]$. 04

- C Explain the application of VSEPR theory for predicting shape and $\text{F}-\text{Xe}-\text{F}$ bond angles in XeF_5 [Atomic number of Xe = 54]. 04

OR

- C Explain the application of VSEPR theory for predicting the shape and $\text{F}-\text{I}-\text{F}$ bond angles in IF_7 [Atomic number of I = 53]. 04

- Q.4 A i. Explain aromatic electrophilic substitution with mechanism. 05
- ii. Write Hammond's postulate about transition states. 03

OR

- A i. Explain directing influence of $-\text{NH}_2$ group on electrophilic aromatic substitution. 05
- ii. State the influence of the following groups on orientation of the incoming electrophile in monosubstituted benzene- 03
- $-\text{C}_2\text{H}_5$
 - $-\text{CN}$
 - $-\text{I}$

- B i. Explain how does $-\text{NO}_2$ group influence orientation and reactivity for electrophilic substitution in nitrobenzene? 05
- ii. What is antiaromaticity? Illustrate with two examples. 03

OR

- B i. What is Friedel Crafts acylation? Explain the mechanism of the reaction and give one 05

example.

- ii. What is Huckel's rule? Explain how benzene and phenanthrene obey this rule.

C Explain the aromaticity of the following :-

- Furan
- Cyclopentadienyl anion

OR

C With suitable examples explain Baeyers strain and transnular strain in cycloalkanes.

Q.5 Attempt any FOUR of the following :

A Explain in detail "Common Ion Effect".

B Find the Miller indices of the planes whose intercepts on crystallographic axes are $(1/3) a : 4b : 2c$ and $(1/2) a : 1b : \infty c$.

C On the basis of Lewis concept of covalent bonding, explain double and triple bonding in Covalent molecules.

D Find the oxidation number of Manganese in KMnO_4 , MnO_2 , MnCl_2 and Chlorine in KClO_3 , ClF_3 .

E Draw various conformers of cyclohexane and explain their relative stabilities. Explain flipping in cyclohexane.

F Explain with mechanism :- "sulphonation of benzene".