2021

Time : 3 hours

Full Marks : 50

Pass Marks : 23

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

*Answer any **five** questions, selecting at least **one** from each Group. Q. No. 1 is compulsory.*

1. Select the correct answer of the following : 1×10 = 10

(a) Wavelength for IR region lies between :

(i) 10 nm – 100 pm

(ii) 10 m – 1 cm

(iii) 1 cm – 100 μm

(iv) None of these

(b) The ground state term symbol for d^2 configuration is :

(i) $^3F_1$

(ii) $^3F_3$

(iii) $^1F_2$

(iv) $^3F_2$

(c) Heisenberg uncertainty principle rules out the exact simultaneous measurement of :

(i) Probability and intensity

(ii) Energy and velocity

(iii) Charge density and radius

(iv) Position and velocity

(d) Which molecule has linear structure ?

(i) H_2O

(ii) BF_3

(iii) XeF_2

(iv) NH_3

(e) In I_3^- ion, the hybridization is :

(i) sp^3d

(ii) sp^3

(iii) sp^3d^2

(iv) dsp^2

(f) Which of the following ions has highest value of magnetic moment ?

(i) Mn^{2+}

(ii) Cr^{3+}

(iii) Co^{2+}

(iv) Ni^{2+}

(g) Which of the following complex ions does not possess tetrahedral structure ?

(i) $[BeF_4]^{2-}$

(ii) $[NiCl_4]^{2-}$

(iii) $[ZnCl_4]^{2-}$

(iv) $[Ni(CN)_4]^{2-}$

(h) The hybridization of Xenon atom in XeF_4 is :

(i) sp^2

(ii) sp^3d

(iii) dsp^2

(iv) sp^3d^2

(i) Which of the following is a pseudohalogen ?

(i) IF_7

(ii) $(CN)_2$

(iii) ICl_2

(iv) I_3^-

(j) Dimethylglyoxime is the specific reagent for the test of :

(i) V

(ii) Na

(iii) Al

(iv) Ni

Group – A

2. (a) State and explain de Broglie equation for wave particles duality of electrons.

(b) Discuss the verification of de Broglie relation. 5+5 = 10

3. Predict the geometry of the following with the help of Hybridization and VSEPR theory : 2×5 = 10

(a) BF_3

(b) SF_6

(c) IF_7

(d) I_3^-

(e) SO_4^{--}

4. (a) Explain the following : 3+3 = 6

(i) Chelate and chelate complexes

(ii) Effective atomic number

(b) Give IUPAC names of the following : 1×4 = 4

(i) $K_3[Cr(C_2O_4)_3]$

(ii) $K_4[Fe(CN)_6]$

(iii) $[Co(NH_3)_6]Cl_3$

(iv) $Ni(CO)_4$

Group – B

5. (a) Explain the following : $2\frac{1}{2} \times 2 = 5$

   (i) All inert gases are monoatomic

   (ii) The radius of noble gas is the highest in a series

   (b) What are pseudohalogens ? Explain with examples. 5

6. Discuss the chemistry of Titanium with respect to the following : $2\frac{1}{2} \times 4 = 10$

   (a) Position in P. T.

   (b) Oxidation states

   (c) Complex formation

   (d) Acid – Base nature of its compounds

7. Give reasons for the following : $2\frac{1}{2} \times 4 = 10$

   (a) Graphite is good conductor of electricity whereas Diamond is bad conductor of electricity.

   (b) $SiCl_4$ is hydrolysed but CCl_4 is not.

(c) CO_2 exists in gaseous state while SiO_2 exists in solid state

(d) H_2O is liquid but H_2S is gas at room temperature.

Group – C

8. (a) What is the spectral range of IR Spectroscopy ? 4

(b) Write any three applications of IR Spectroscopy. 6

9. Discuss the application of any two of the following reagents in Inorganic analysis : 5+5 = 10

(a) EDTA

(b) α-Nitroso – β-Naphthol

(c) Cupferron

10. Discuss the chemistry involved in the manufacture of cement or glass. 10