2 0 1 6

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

Full Marks : 55

Time : 2½ hours
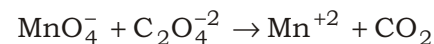
(PART : B—DESCRIPTIVE)

(*Marks* : 35)

The figures in the margin indicate full marks for the questions

1. (a) What is meant by the 'dual' nature of electron? Derive the equation $\lambda = h / p$, where λ = wavelength, h = Planck's constant and p = momentum of the particle. 1+3=4

(b) State Hund's rule of maximum multiplicity. Calculate the wavelength (λ) of a particle of mass 1 mg moving with a velocity of $12 \cdot 5 \text{ m s}^{-1}$ provided $h = 6 \cdot 625 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$. 1+2=3

(*Turn Over*)

OR

2. (a) Write Schrödinger wave equation for a three-dimensional box, explaining the symbols. 1

(b) State Heisenberg uncertainty principle. 2

(c) Calculate σ (screening effect) and Z_{eff} (effective nuclear charge) for 4s electron in Mn ($Z = 25$). 4

3. (a) Discuss the position of hydrogen in the periodic table. 1

(b) Explain why the atomic radii of representative elements increase from top to bottom in the periodic table. 3

(c) Balance the following redox reaction in acidic medium : 3

$$\text{MnO}_4^- + \text{C}_2\text{O}_4^{-2} \rightarrow \text{Mn}^{+2} + \text{CO}_2$$

OR

4. (a) How are electron affinity and ionization potential related to electronegativity? 1

(b) Calculate the equivalent weight of KMnO_4 in acidic solution. 3

Given :

Atomic weight of K = 39·1
Atomic weight of Mn = 95·9
Atomic weight of O = 16·0

(*Continued*)

www.gzrsc.edu.in

(3)

(c) Explain why Group IA metals (Li, Na, K, Rb, Cs) have very low first ionization energies.   3

5. (a) Explain why ice has lesser density than water.   2

(b) Explain why F_2 is non-polar, HF is polar and LiF is ionic in character. $1+1\frac{1}{2}+1\frac{1}{2}=4$

(c) Define bond moment.   1

OR

6. (a) What is dipole moment?   1

(b) Discuss the salient features of valence bond theory of covalent compound.   4

(c) Which one (H_2O or HCl) will have higher boiling point and why?   2

7. (a) Write the IUPAC name for $[Co(N_3)(NH_3)_5]SO_4$ compound.   1

(b) Discuss two salient features of geometrical isomerism. $1+1=2$

(c) Explain with examples inner sphere complexes and outer sphere complexes.   4

OR

8. (a) What is complex ion?   1

(b) What is optical isomerism? Explain with suitable example. $1+1=2$

(4)

(c) Discuss with suitable examples the stereochemistry of complexes with coordination number six.   4

9. (a) What is artificial radioactivity?   1

(b) Write short notes on (any *two*) : $2+2=4$

  (i) Nuclear binding energy

  (ii) Mass defect

  (iii) Packing fraction

(c) What is half-life period of a radioactive element? Write the formula.   2

OR

10. (a) Define radioactive equilibrium.   1

(b) Discuss the effect of the value of neutron multiplication factor K, on a fission chain reaction.   3

(c) How many α and β particles need to be emitted by $^{226}_{88}$Ra to produce eventually $^{206}_{82}$Pb ?   3

★★★

Subject Code : CHEM/II/02

Booklet No. A

Date Stamp ....

....

2 0 1 6

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

(PART : A—OBJECTIVE)

(*Marks* : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided : 1×5=5

1. Which of the following sets of quantum numbers is possible?

(a) n 4, l 2, m 2, s 2   (   )

(b) n 4, l 2, m 2, s $\frac{1}{2}$ (   )

(c) n 4, l 2, m 2, s 1   (   )

(d) n 4, l 0, m 0, s 0   (   )

/228

2. Which of the following is not consistent in regards to atomic radii?

    (a)   Li > Be > B > C   (   )

    (b) Cl^- > Cl   (   )

    (c)   K > K^+ (   )

    (d) Al^{3+} > Mg^{2+} (   )

3. Which of the following has T-shaped structure?

    (a) ClF_3 (   )

    (b) SO_3 (   )

    (c) BF_3 (   )

    (d) TiO_2 (   )

4. All strong-field ligand complexes with coordination number four force

    (a)   tetrahedal stereochemistry   (   )

    (b)   square planar stereochemistry   (   )

    (c)   bi-pyrimidal stereochemistry   (   )

    (d)   octahedral stereochemistry   (   )

5. The SI unit of radioactivity is

    (a)   curie, Ci   (   )

    (b)   rutherford, Ru   (   )

    (c)   becquerel, Bq   (   )

    (d) neutrino, Nu   (   )
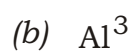
(4)

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Explain why an electron orbital can accommodate maximum two electrons only.

2. State Fajans' rule. Explain which of the following cations will have greater polarising power :

(a) Mg^2

(b) Al^3

3. Is iodometry a redox reaction? Explain.

4. What kind of isomerism is exhibited by $[Co(en)_3]^3$ (en = ethylenediamine)? Draw the relevant structures.

5. State the group displacement law for radioactive elements.

★ ★ ★