2 0 1 4

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

Full Marks : 55

Time : 2 hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

*The figures in the margin indicate full marks
for the questions*

1. (a) What is meant by dual nature of electron? Write de Broglie equation and explain the terms involved. 1+2=3

   (b) A cricket ball weighing 100 g is to be located within $0·1 Å$. What is the uncertainty in its velocity?
   (Given, $h = 6·63 \times 10^{-34}$ J-s) 2

   (c) State and explain Pauli exclusion principle. 2

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OR

2. (a) Draw radial probability distribution curves for 1s and 2p orbitals and give their characteristics.   3

   (b) What is Aufbau principle? Write electronic configurations of the elements of atomic numbers 24 and 35.   2

   (c) Calculate the effective nuclear charge fell by a 2p electron of a nitrogen atom.   2

3. (a) What is meant by electronegativity of an element? How is it related to electron affinity and ionisation potential?   2

   (b) Calculate the equivalent weight of $Na_2S_2O_3 \cdot 5H_2O$ (M. wt. = 248) and $KBrO_3$ (M. wt. = 167) in the following reactions :   3

$$(i) \quad S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$$

$$(ii) \quad BrO_3^- + H^+ \rightarrow Br^-$$

   (c) What is meant by ionisation energy? On what factors does it depend?   2

OR

4. (a) What is formal potential? Discuss the influence of precipitation reaction on formal potential.   1+3=4

   (b) Define electron affinity. Explain why the electron affinity value of Be, Mg and noble gases are zero.   3

5. *(a)* Predict the geometry of the following molecules on the basis of VSEPR theory : 3

    (i) ClF_3

    (ii) $SnCl_2$

    (iii) SF_4
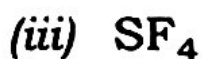
(b) H_2O and HF have abnormally high boiling points. Explain why. 2

(c) Calculate the percentage ionic character of HCl, if the electronegativities of H and Cl are $2 \cdot 1$ and $3 \cdot 0$ respectively. 2

OR

6. *(a)* Define dipole moment. What is its unit? Dipole moment of CO_2 and SO_2 molecules are zero and $1 \cdot 60$ D respectively. Give reason. 2+2=4

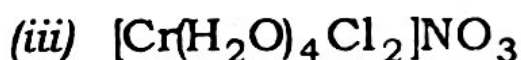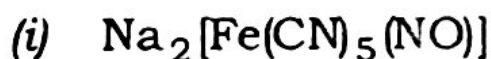*(b)* Give a brief account of hydrogen bonding in inorganic compounds. 3

7. *(a)* What are the postulates of Werner's theory? 4

(b) State effective atomic number (EAN) rule. Calculate the EAN of the central metal atom in the following compounds :   1+2=3

    (i) $[Cr(CO)_6]$

    (ii) $K_3[Fe(CN)_6]$
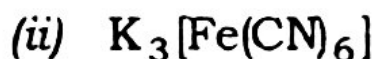
OR

8. (a) Write the IUPAC names of the compounds given below :   3

    (i) $Na_2[Fe(CN)_5(NO)]$

    (ii) $K[PtCl_3(NH_3)]$

    (iii) $[Cr(H_2O)_4Cl_2]NO_3$

(b) What is meant by coordination isomerism? Give one example.   2

(c) Draw all the possible isomers of $[Pt(NH_3)_4Cl_2]^{2+}$.   2

9. (a) What do you understand by n/p ratio? How does it effect the stability of the nucleus.   3
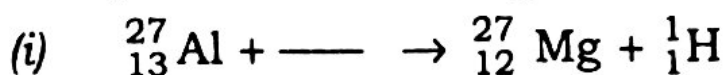
(b) State and explain group displacement law in radioactivity.   2

(c) Describe briefly the theory of radioactive disintegration.   2

OR

10. *(a)* What is artificial transmutation? Complete the following reactions :   1+2=3

    (i) $^{27}_{13}Al + \text{------} \rightarrow \, ^{27}_{12}Mg + \, ^{1}_{1}H$

    (ii) $^{9}_{4}Be + \text{------} \rightarrow \, ^{12}_{6}C + \, ^{1}_{0}n$

(b) Give a brief account of—

    (i)   packing fraction;

    (ii)   nuclear fusion reaction.   2

(c) Explain what is meant by average life and half-life period of a radioactive element.   2

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2 0 1 4

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Inorganic Chemistry—I)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions
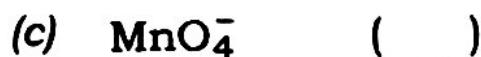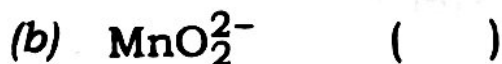
SECTION—A

(Marks : 5)

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

1. Radial wave function of an orbital decides

    (a) size of the orbital   (   )

    (b) orientation of the orbital   (   )

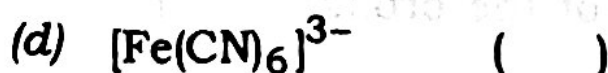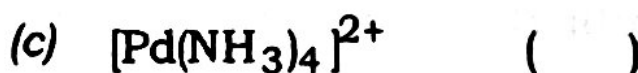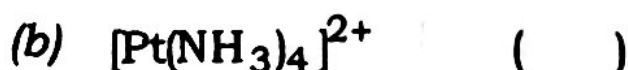   (c) size and orientation of the orbital   (   )
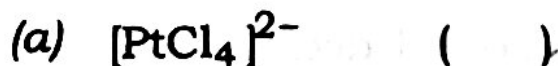
    (d) None of the above   (   )

2. Which one of the following does Mn exhibit its highest oxidation state?

(a) MnO_2 (   )

(b) MnO_2^{2-} (   )

(c) MnO_4^- (   )

(d) MnO   (   )

3. Which one of the following combinations give the most ionic compound?

(a) Na and H   (   )

(b) Mg and O   (   )

(c) Br and F   (   )

(d) Cs and F   (   )

4. The complex that is not square planar is

(a) $[PtCl_4]^{2-}$ (   )

(b) $[Pt(NH_3)_4]^{2+}$ (   )

(c) $[Pd(NH_3)_4]^{2+}$ (   )

(d) $[Fe(CN)_6]^{3-}$ (   )

5. During an alpha decay the mass number changes by

    (a)   2 units   (   )

    (b)   3 units   (   )

    (c)   4 units   (   )

    (d)   0 unit   (   )

(**4**)

(*Marks* : 15)

Answer the following questions :   3×5=15

1. What are quantum numbers? Explain the significance of each quantum number.

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2. The size of Cl^- ion is greater than that of Cl atom, while that of Na^+ ion is smaller than that of Na atom. Explain why.

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3. State Fajans' rules. Explain giving reasons, which of the following cations will have greater polarising power :

(a) Na^+ or Mg^{2+}

(b) Cu^{2+} or Ca^{2+}

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4. Define chelating ligands and chelates. Give examples.

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8. Describe briefly the following :

(a) Mass defect

(b) Nuclear fission

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