4 SEM TDC CHMH (CBCS) C 8

2024

(May/June)

CHEMISTRY

(Core)

Paper : C–8

(Inorganic Chemistry)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Select the correct answer : 1×6=6

(a) Which of the following has the highest lability?

(i) SF_6

(ii) $[PF_6]^-$

(iii) $[SiF_6]^{2-}$

(iv) $[AlF_6]^{3-}$

(b) The CFSE for the d^3-ion in strong crystal field is

(i) 4 Dq

(ii) 8 Dq

(iii) 12 Dq

(iv) 16 Dq

(c) The metal present in carbonic anhydrase is

(i) Mg

(ii) Fe

(iii) Zn

(iv) Co

(d) If ingested, cadmium accumulates in

(i) liver

(ii) kidney

(iii) bone

(iv) muscles

(e) In the complex $[Cu(H_2O)_6]^{2+}$, the metal ion has configuration

(i) d^1

(ii) d^2

(iii) d^9

(iv) d^4

(f) The number of $4f$-electrons in lanthanum is

(i) 0

(ii) 1

(iii) 2

(iv) 5

UNIT—I

2. Answer the following questions : 2×4=8

(a) What are labile and inert complexes? Give examples. 2

(b) Define crystal field stabilization energy. Find CFSE for strong field d^5 complex. 1+1=2

(c) Arrange the ligands I^-, CO, Cl^-, CN^- and H_2O in the increasing order of the strength as given in spectro-chemical series. Which of the following complexes has larger Δ_0 value?

$[Fe(H_2O)_6]^{3+}$ or $[Fe(H_2O)_6]^{2+}$ 1+1=2

(d) Write IUPAC names of the following compounds : 1+1=2

(i) $[Co(NH_3)_5SCN]Cl_2$

(ii) $K_3[Co(CN)_5NO]$

3. Answer any *two* questions : 3×2=6

(a) What are ionization isomerism, linkage isomerism and coordination isomerism in coordination complexes? Explain with examples. 1×3=3

(b) Define stereoisomerism in complexes. Discuss the stereoisomerism exhibited by the complex ion, $[Co(en)_2(NH_3)_2]^{3+}$. 1+2=3

(c) Write three basic postulates of valence bond theory (VBT) in complexes. 3

4. Answer any *two* questions : 4×2=8

(a) Discuss the crystal field splitting in the complex $[Fe(CN)_6]^{4-}$. Calculate its spin only magnetic moment and crystal field stabilization energy. 2+2=4

(b) For the $[Cr(H_2O)_6]^{2+}$ ion, the mean pairing energy (P) is found to be 23500 cm^{-1}. The magnitude of Δ_0 is 13900 cm^{-1}. Calculate the CFSE for the complex in both high-spin state and low-spin state. 2+2=4

(c) Why is there no case of high-spin and low-spin for a d^8 system (Ni^{2+})? Explain in the light of VBT citing examples. 4

UNIT—II

5. Answer any *three* questions : 3×3=9

(a) Give reasons—

(i) why Zn, Cd, Hg are not regarded as true transition elements;

(ii) why $[Ti(H_2O)_6]^{3+}$ ion is violet. 1½+1½=3

(b) Explain the Latimer and Ebsworth diagram to account the stability of various oxidation states and e.m.f. 3

(c) Write any three differences between first- and second-transition series elements. 3

(d) Give reasons for the following : 1½+1½=3

(i) Ti^{4+} ion is more stable than Ti^{3+} ion.

(ii) $[CoF_6]^{3-}$ is paramagnetic.

6. Find the number of unpaired electrons and calculate the spin-only magnetic moment in the following complexes : 2+2=4

(i) $[Fe(H_2O)_6]^{2+}$

(ii) $[Co(CN)_6]^{3-}$

UNIT—III

7. Answer any *two* questions : 2×2=4

(a) What are the consequences of lanthanide contraction?

(b) "Cerium is the only lanthanide which is stable in (+4) oxidation state." Justify the statement.

(c) Sm^{2+} is a good reducing agent and Ce^{4+} is a good oxidizing agent. Explain.

UNIT—IV

8. Answer any *two* questions : 4×2=8

(a) Discuss the structure and function of carboxypeptidase. 2+2=4

(b) Draw the structure of haemoglobin. How does it help in oxygen transport? 2+2=4

(c) Discuss the poisoning effect of Hg in human body. How can it be treated? 3+1=4

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