4 SEM TDC CHMH (CBCS) C 8

2022

(June/July)

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) The increasing order of the strength of the ligands I^-, CO, Cl^- and H_2O in the spectrochemical series is

(i) $I^- < H_2O < Cl^- < CO$

(ii) $Cl^- < I^- < H_2O < CO$

(iii) $I^- < Cl^- < H_2O < CO$

(iv) $I^- < Cl^- < CO < H_2O$

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

(i) SF_6

(ii) $[PF_5]^-$

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

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

(c) In the complex $[Ti(H_2O)_6]^{3+}$, the metal ion has

(i) d^1-configuration

(ii) d^2-configuration

(iii) d^3-configuration

(iv) d^5-configuration

(d) The common oxidation state shown by transition elements is

(i) +2

(ii) +3

(iii) +4

(iv) +5

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

(i) 0

(ii) 1

(iii) 2

(iv) 5

(f) Non-heme iron protein is

(i) myoglobin

(ii) haemoglobin

(iii) cytochrome P450

(iv) hemerythrin

UNIT—I

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

(a) What are labile and inert complexes? Give examples. 1+1=2

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

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

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

(c) Write the formula of the following compounds : 1+1=2

(i) Dichlorobis(triphenylphosphine) palladium (II)

(ii) Potassium pentachloronitrido-osmate (VI)

(d) Write the name and formula of each of the following types of ligand : 1+1=2

(i) A bidentate ligand with one acidic and one neutral donor

(ii) A tridentate ligand with three neutral donors

3. Answer any *two* questions : 3×2=6

(a) What do you mean by crystal field stabilization energy (CFSE)? Calculate CFSE for each of the following octahedral systems in Dq units : 1+1+1=3

(i) d^5-high spin

(ii) d^6-low spin

(b) $[Ni(CO)_4]$ is tetrahedral while $[Ni(CN)_4]^{2-}$ ion is square planar. Explain in the light of valence bond theory. 1½+1½=3

(c) Define stereoisomerism. Discuss the stereoisomerism exhibited by the complex ion $[Co(en)_2Cl_2]^+$. 1+2=3

4. Answer any *two* questions : 4×2=8

(a) What is the basis of crystal field theory? Draw the splitting patterns for octahedral, tetrahedral and square planar complexes in a crystal field. 1+3=4

(b) On the basis of CFT, calculate the spin only magnetic moment value (μ_s) for $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ ions. 2+2=4

(c) 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 and low spin states. 2+2=4

UNIT—II

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

(a) Give reasons—

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

(ii) *d*-block elements show variable oxidation states. 1½+1½=3

(b) The decrease in the radius of elements Na(Z = 11) to Cl(Z = 17) is 0·55 Å, while the decrease for Sc(Z = 21) to Zn(Z = 30) is only 0·13 Å.

Explain the above data. 3

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

(d) Write all possible oxidation states exhibited by the elements of the first row transition series. 3

6. Find out the numbers of unpaired electrons and calculate the spin only magnetic moment value for the following ions : 2+2=4

   (a) Fe^{2+}

   (b) Mn^{2+}

UNIT—III

7. Answer any *two* questions : 2×2=4

   (a) What are the consequences of lanthanide contraction?

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

   (c) What are the problems in the separation of lanthanides from one another?

UNIT—IV

8. Answer any *two* questions : 4×2=8

   (a) What is the essential element present in haemoglobin? How does it help in oxygen transport and storage? 1+3=4

(Continued)

(b) Explain the role of sodium and potassium ions in biological system. 2+2=4

(c) How does lead harm the human body? How can lead poisoning be prevented? 2+2=4

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