3 SEM TDC CHM M 1 (N/O)

2018

(November)

CHEMISTRY

(Major)

Course : 301

(Inorganic Chemistry—I)

(New Course)

Full Marks : 48
Pass Marks : 14

Time : 2 hours

The figures in the margin indicate full marks for the questions

1. Select the correct answer : 1×5=5

(a) The complex ion which does not obey EAN rule is

(i) $[Pt(NH_3)_6]^{4+}$

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

(iii) $[Co(NH_3)_6]^{3+}$

(iv) $[Cu(CN)_4]^{3-}$

(b) 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

(c) The free ion ground term for Ni^{2+} ion is

(i) ^4F

(ii) ^2D

(iii) ^3F

(iv) ^3D

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

(i) SF_6

(ii) $[PF_6]^-$

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

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

(Continued

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

(i) 0

(ii) 1

(iii) 2

(iv) 5

2. Answer the following questions : 2×8=16

(a) What is spectrochemical series? Write one application of the spectrochemical series. 1+1=2

(b) Find out the values of *L* and *S* for ^3P, ^1D, ^3F and ^2G. ½+½+½+½=2

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

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

(ii) A tridentate ligand with three neutral donors

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

(i) $Na_3[Co(CN)_5NO]$

(ii) $[(NH_3)_5Co-NH_2-Co(NH_3)_5]Cl_3$

(Turn Over)

(e) Write the formulas of the following complexes : 1+1=2

(i) Dichloro-*bis*-(triphenyl phosphine) palladium (II)

(ii) Pentaamine (dinitrogen) ruthenium (II) chloride

(f) $[Fe(H_2O)_6]^{2+}$ is labile but $[Fe(CN)_6]^{4-}$ is inert. Explain. 2

(g) Explain inert and labile complexes with examples. 2

(h) What are the problems in the separation of lanthanides from one another? 2

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

(a) What do you mean by crystal field stabilization energy (CFSE)? Calculate CFSE for each of the following octahedral systems :

(i) d^5-high spin

(ii) d^6-low spin 1+2=3

(Continued)

(b) Discuss the geometrical isomerism of $[Ma_2X_2]^{n\pm}$ and $[MA_4X_2]^{n\pm}$ type complexes. 1½+1½=3

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

(d) Draw and explain the Orgel diagram for a d^1-system. 3

(e) What are inner complexes? Give the characteristics of inner complexes. 1+2=3

4. (a) Write a note on acid hydrolysis of cobalt (III) compounds with suitable example. 3

(b) Explain the mechanisms of reactions in the following : 2+2=4

(i) $[L_5MX] \xrightarrow{\text{slow}} X + [L_5M]$

$\downarrow +Y$ fast

$[L_5MY]$

(ii) $[L_5MX] \xrightarrow{\text{slow}} \left[L_5M\begin{matrix}X\\Y\end{matrix}\right]$

$\downarrow$ fast

$[L_5MY] + X$

(Turn Over)

5. *(a)* State and explain the following with suitable examples : 2+2=4

(i) Laporte selection rule

(ii) Spin selection rule

(b) The complex ion $[Co(NH_3)_6]^{3+}$ is octahedral and diamagnetic and $[CoF_6]^{3-}$ is also octahedral but paramagnetic. How does valence bond theory account for this observation? 2+2=4

6. Answer either *(a)* or *(b)* : 3

(a) What do you understand by lanthanide contraction? Discuss its causes. 1+2=3

(b) Give reasons of the following :

(i) Ti^{4+} ion is more stable than Ti^{3+} ion. 1½

(ii) *d*-block elements show variable oxidation state. 1½

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