EASTERN UNIVERSITY, SRI LANKA
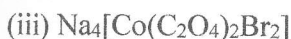
COND EXAMINATION FIRST SEMESTER IN SCIENCE-2021/2022 (Mar 2024)

CH2012 Inorganic Chemistry-I

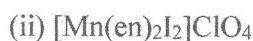Answer **all** questions   Time allowed: **Two hours**

1 (a) *Write* down the coordination number and the oxidation number of the metal in each of the following.

(i) $[MnO_4]^-$

(ii) $K[CuCl_2]$

(iii) $Na_4[Co(C_2O_4)_2Br_2]$

(iv) $[Cr(EDTA)]^-$

(20 Marks)

(b) *Give* the correct IUPAC name for each of the following coordination compounds.

(i) $Na_2[Ni(CN)_4]$ (ii) $[Mn(en)_2I_2]ClO_4$

(20 Marks)

(c) *Draw* all the structures possible for the following complexes. Indicate the stereoisomers wherever possible.

(i) $[Ni(NH_3)_2Cl_2]$ (ii) $[Fe(en)_2Br_2]^+$

(30 Marks)

(d) *Calculate* the crystal field stabilization energies (CFSE) of Co (II) complexes having octahedral coordination with (i) Cl⁻ (ii) CN⁻. *Justify* these complexes in the order of increasing stability?

(30 Marks)

Contd..

2 (a) *Write* down the d^n electronic configuration of each of the transition metal ion in the following complexes and draw the energy level splitting diagrams to show the occupancy of the electrons in the d-orbitals.
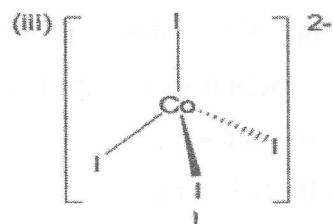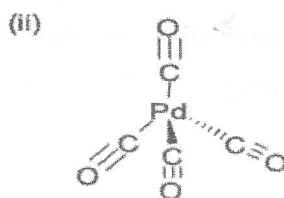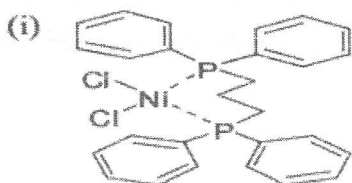
(30 Marks)

(b) (i) *Explain* the type of hybridization in $[Co(NH_3)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$.

(ii) *Calculate the* spin only magnetic moment of the two complexes mentioned in (i)

(20 Marks)

(c) *Explain* the following type of isomerism by using an example for each of them.

(i) linkage isomerism   (ii) polymerisation isomerism   (iii) geometrical isomerism

(30 Marks)

(d) Using crystal field theory, *draw* the crystal field d-orbital energy level diagram for each of the following complexes by assigning electrons to 3d orbitals of the metal ions.

(i) $[Co(en)_2]^{2+}$ (ii) $[FeF_6]^{3-}$
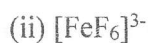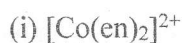
(20 Marks)

3 (a) *Explain* the following:

(i) Spectrochemical series   (ii) Charge transfer spectra

(20 Marks)

(b) *Explain* the difference between the thermodynamic and the kinetic stability of coordination compounds by using a suitable example.

(20 Marks)

(c) Hydrogen can be placed with alkali metals or with halogens. *Give* four reasons for each of them and *explain* why it is placed in period I.

(30 marks)

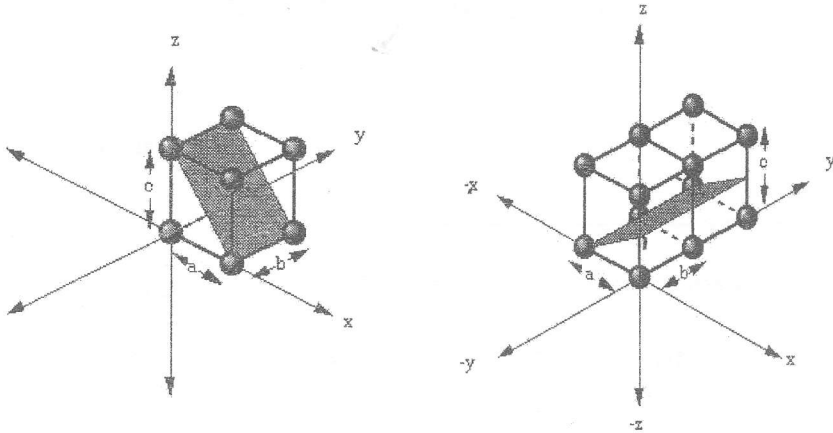(d) List out four similarities and dissimilarities between elements of subgroup I^A and II^A.

(30 marks)

4) (a) *Calculate* the Miller indices of the planes for the intercepts given below and *draw* the Miller planes in a cubic unit cell.

(i) ¼ a, ¼ b, α (ii) a,b,c   (iii) ¼ a, α, ¼ c   (iv) 2a, b, c

(20 Marks)

(b) *Determine* the Miller indices of the planes of the cubic systems shown below.

(20 Marks)

(c) *Derive* the Bragg's equation for the determination of inter-planer spacing of a cubic crystal system.

(20 Marks)

(d) A powder diffraction photograph of an element X showed diffraction lines at the following distances (in *mm*) from the central spot.

12.1, 17.1, 21.0, 24.3, 27.2, 29.9, 34.7, 36.9, 38.9, 40.9, 42.8

(I) *Calculate* the $h^2+k^2+l^2$ values for each line.

(II) *Determine* the common divisor constant.

(III) *Identify* the unit cell and *determine* its dimension when 71 pm X-ray is used. (Assume that the radius of camera is 5.75 cm)

(40 marks)

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