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**Question Bank of Coordination compounds**

**Third stage Chemistry 20a23-2024**

**Assistant Lecturer**

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Q1 /Compare the electron configuration of d6 according CFT diagram for both field states then calculate CFSE for weak field state.

 Q2 /Calculate CFSE for [Fe(NH3)6]Cl3 according Dq parameter. (At.No. Fe=26)

Q3 /Calculate CFSE for t2g5 eg2 according Dq parameter, is it weak field or strong field?

Q4 /Compare the electron configuration of d5 according CFT diagram for both field states then calculate CFSE for strong field

Q5 /Select the complex that has the largest value for Δo from each pair, and give a brief reason for your answer in each case.

(a) [Fe(CN)6]3- and [Fe(CN)6]4-

 (b) [Co(NH3 )6]3+ and [Ru(NH3 )6]3+ (c) [Co(CN)6]4- and [Co(H2O)6]2+

Q6/Why tetrahedral complexes are always high-spin and paramagnetic in depended on the ligand field and why ∆t = 4/9 ∆o?

Q7/∆t =4/9 ∆0

Q8 /Between [Mn(CN)6]3- and [Mn(CN)6]4- ,[Co(CN)6]3- and [CoF6]3- , [NiCl4]2- and [PdCl4]2- , [Cu(NH3)6]2+ and [Cr(NH3)6]2+ Which is more likely to be high spin? Why? At.No. Mn=25, Co=27, Ni=28, Pd=47, Cu=29, Cr=24.

Q9 /For the [Cr(H2O)6]2+ ion the main pairing energy P is found to be 23500 cm-1 . The magnitude of Δo 13900 cm-1. Calculate the CFSE for the complex in configurations corresponding to high spin or low spin states, which is more stable? 24Cr

Q10 /a) using CFT, depict the electronic of the Rhodium (II)ion in an O.h field for which the CFS Δo is less than the pairing energy P. b) calculate the CFSE for the configuration in terms of Δo and P . 45Rh

Q11/ Determine the configuration (in the form t2gm egn or egm t2gn , as appropriate), the number of unpaired electrons, and the ligand field stabilization energy as a multiple of Δo or Δt for each of the following complexes using the spectrochemical series to decide, where relevant, which are likely to be strong‐field and which weak‐field. (a) [Co(NH3)6]3+ ;

(b) [Fe(OH2)6]2+ ; (c) [Fe(CN)6]3– ; (d) [Cr(NH3)6]3+ ; (e) [W(CO)6];

(f) [FeCl4]2– and (g) [Ni(CO)4].

Q12 /Calculate the CFSE for [Co(NH3)6]3+ , the pairing energy = 19150 cm-1 , and the Δ magnitude =23000 cm-1 , Co = 27.

Q13 /Calculate CFSE [Cr(en)3]3+ Δ= 21900 cm-1.

Q14 /Calculate the CFSE for [FeBr4]2- , Δo = 22500 cm-1 and P=26000 cm-1, At.no. Fe=26

Q15/Calculate the CFSE for electronic configuration e4 t23.

Q16/Draw the crystal field splitting for the following complexes:[Cr(H2O)6] 3+ and [Cr(NH3 )6]3+ .

Q17/ For which member of the following pairs of complexes would Δo be the larger and why? [CrF6]3- and [Cr(NH3)6]3+ ; [Fe(CN)6]4- and [Fe(CN)6]3-

Q18 /What color expected for complex that absorbs light at 600 nm?

Q19/What color expected for an octahedral complex appears if energy Δo= 3.75 x 10-19 J, Plank const.= 6.626 x 10-34 J.s, speed light = 3 x 108 m/s. Q20/Would you expect a violet solution to be high spin or low spin? What about a red solution?

Q21/There are two solutions , one which is yellow and another is violet. The solutions are [Cr(H2O)6]3+ and [Cr(CN)6]3- what are the colors of each solution?

 Q22 /Calculate the octahedral crystal field splitting energy in KJ/mol for [Fe(CN)6]4- , if the wavelength of the most intensely absorbed light is 305 nm.

Q23/Using MOT show why oxygen is paramagnetic molecule(O2)? O=8

Q24/Explain why NO+ more stable than NO and CN- more stable than CN show by M.O. diagram.

Q25/Show Jahn-Teller effect for Cu2+, then draw the elongation type diagram for it is octahedral geometrical structure.

Q26/Draw M.O. diagram for $π$ donor ligand.

Q 27/ There are two solutions, one which is yellow and another is violet. The solutions are [Cr(H2O)6]3+ and [Cr(CN)6]3- what are the colors of each solution?

Q 28/ Draw M.O. diagram for [COF6]3-.

Q 29/Draw M.O. diagram for ligand $π$ acceptor (back donation).

Q 30/Draw M.O diagram for [CO(NH3)6]+3.

Q31/ Between [Mn(CN)6]3- and [Mn(CN)6]4- , [Co(CN)6]3- and [CoF6]3-, [NiCl4]2- and [PdCl4]2-,[Cu(NH3)6]2+ and [Cr(NH3)6]2+ Which is more likely to be high spin? Why?

At.No. Mn=25, Co=27, Ni=28, Pd=47, Cu=29, Cr=24.

Q32/For the [Cr(H2O)6]2+ ion the main pairing energy P is found to be 23500 cm-1. The magnitude of Δo 13900 cm-1. Calculate the CFSE for the complex in configurations corresponding to high spin or low spin states, which is more stable? 24Cr

Q33/a) Using CFT, depict the electronic of the Rhodium (II)ion in an O.h field for which the CFS Δo is less than the pairing energy P.

b) Calculate the CFSE for the configuration in terms of Δo and P. 45Rh

Q34/Determine the CFSE of d6 complex having Δo = 25000 cm-1 and P=15000 cm-1

Q35/ Determine the configuration (in the form *t2gmegn* or *egmt2gn*, as appropriate), thenumber of unpaired electrons, and the ligand field stabilization energy as a multiple ofΔo or Δt for each of the following complexes using the spectrochemical series to decide,where relevant, which are likely to be strong‐field and which weak‐field.

(a)[Co(NH3)6]3+; (b) [Fe(OH2)6]2+; (c) [Fe(CN)6]3–; (d) [Cr(NH3)6]3+;

(e) [W(CO)6]; (f) [FeCl4]2– and (g) [Ni(CO)4].

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Q38/Calculate the CFSE for [FeBr4]2- At.no. Fe=26.

Q39/Calculate the CFSE for electronic configuration e4 t23.

Q40/ Draw the crystal field splitting for the following complexes:

 [Cr(H2O)6]3+ and [Cr(NH3)6]3+.

Q41/ What color expected for complex that absorbs light at 600 nm?

 Q42/ What color expected for an octahedral complex appears if energy Δo= 3.75 x 10-19 J, Plank const.= 6.626 x 10-34 J.s, speed light = 3 x 108 m/s.

 Q43/ Would you expect a violet solution to be high spin or low spin? What about a red solution?

Q44/ There are two solutions, one which is yellow and another is violet. The solutions are [Cr(H2O)6]3+ and [Cr(CN)6]3- what are the colors of each solution?

 Q45/ For which member of the following pairs of complexes would Δo be the larger and why?

[CrF6]3- and [Cr(NH3)6]3+

[Fe(CN)6]4- and [Fe(CN)6]3-

Q46/ A**-**Between [NiCl6]4- and [NiCl4]2- Which one is more likely to be high spin and weakly field? Why? Then calculate CFSE for it if you know Δ**o 13900 cm-1** and **P=18000 cm-1** and the color of it from dark or light? Explain. At.No. Ni=28.

B- Draw CFT diagram to show electrostatic force between metal ion and donor atom.

