

Unit 5 - Week 3

Course outline

How does an NPTEL online course work?

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Week 3

Lecture 10 : Crystal Field Theory: Octahedral vs. Tetrahedral Complex

Lecture 11 : Application of CFSE: Spinel and J-T Distortion

Lecture 12 : Introduction to Molecular Magnetism

Lecture 13 : Problem Solving Approach

Lecture 14 : Magnetism

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Week 3 : Assignment 3

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2020-02-19, 23:59 IST.

1) Given the molecular formula of the hexa-coordinated complexes

1 point

(i) $\text{CoCl}_3(\text{NH}_3)_6$

(ii) $\text{CoCl}_3(\text{NH}_3)_5$

(iii) $\text{CoCl}_3(\text{NH}_3)_4$

If the number of coordinated NH_3 molecules in (i), (ii) and (iii) respectively are 6, 5 and 4 then the oxidation state of Co in (i), (ii) and (iii) are respectively

- +6, +5, +4
- +3, +2, +1
- 0, +1, +2
- +3, +3, +3

No, the answer is incorrect. Score: 0

Accepted Answers: +3, +3, +3

2) Using crystal field theory, identify from the following complex ions that shows same spin only magnetic moment values

1 point

(A) $[\text{CoF}_6]^{3-}$ (B) $[\text{IrCl}_6]^{3-}$ (C) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

- A and B
- B and C
- A and C
- A, B and C

No, the answer is incorrect. Score: 0

Accepted Answers: A and C

3) The magnetic moment of an octahedral $\text{Co}(\text{II})$ complex is 4.0 BM. The electronic configuration of the complex is

1 point

- $t_{2g}^5 e_g^2$
- $t_{2g}^6 e_g^1$
- $t_{2g}^3 e_g^4$
- $t_{2g}^4 e_g^3$

No, the answer is incorrect. Score: 0

Accepted Answers: $t_{2g}^5 e_g^2$

4) The crystal field stabilization energy (CFSE), in units of Δ_0 for $[\text{CoF}_3(\text{H}_2\text{O})_3]$ is

1 point

- 0
- 0.4
- 0.8
- 1.8

No, the answer is incorrect. Score: 0

Accepted Answers: 0.4

5) Which one of the following complexes is Jahn-Teller distorted

1 point

- $[\text{Co}(\text{NH}_3)_6]^{+3}$
- $[\text{Cr}(\text{H}_2\text{O})_6]^{+3}$
- $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$
- $[\text{Fe}(\text{CN})_6]^{-4}$

No, the answer is incorrect. Score: 0

Accepted Answers: $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$

6) Consider the two complexes (A) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ and (B) $[\text{Ni}(\text{NH}_3)_6]^{2+}$, the right statement is

1 point

- Complex (A) is diamagnetic and complex (B) is paramagnetic
- Complex (B) is diamagnetic and complex (A) is paramagnetic
- Both are paramagnetic
- Both are diamagnetic

No, the answer is incorrect. Score: 0

Accepted Answers: Both are paramagnetic

7) The correct spinel structure of Co_3O_4 is

1 point

- $[\text{Co}^{2+}]_t [2\text{Co}^{3+}]_o \text{O}_4$
- $[\text{Co}^{2+}]_t [2\text{Co}^{3+} \text{Co}^{3+}]_o \text{O}_4$
- $[\text{Co}^{2+} \text{Co}^{3+}]_t [\text{Co}^{3+}]_o \text{O}_4$
- $[2\text{Co}^{3+}]_t [\text{Co}^{2+}]_o \text{O}_4$

No, the answer is incorrect. Score: 0

Accepted Answers: $[\text{Co}^{2+}]_t [2\text{Co}^{3+}]_o \text{O}_4$

8) The correct set of electronic configurations for metal ions in octahedral coordination geometry for strong Jahn-Teller distortion is

1 point

- $t_{2g}^6 e_g^1, t_{2g}^3 e_g^1, t_{2g}^6 e_g^3$
- $t_{2g}^1, t_{2g}^3 e_g^2, t_{2g}^6 e_g^1$
- $t_{2g}^3, t_{2g}^3 e_g^1, t_{2g}^3 e_g^2$
- $t_{2g}^3 e_g^2, t_{2g}^6 e_g^2, t_{2g}^6 e_g^3$

No, the answer is incorrect. Score: 0

Accepted Answers: $t_{2g}^6 e_g^1, t_{2g}^3 e_g^1, t_{2g}^6 e_g^3$

9) The spin-only magnetic moment of $[\text{MnF}_6]^{3-}$ is

1 point

- 3.2 BM
- 4.0 BM
- 4.9 BM
- 5.5 BM

No, the answer is incorrect. Score: 0

Accepted Answers: 4.9 BM

10) The complex that shows orbital contribution to the magnetic moment is

1 point

- $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
- $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
- $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$

No, the answer is incorrect. Score: 0

Accepted Answers: $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$