Chem paper

Chemistry (SRM Institute of Science and Technology)

029

SRM

DEPARTMENT OF CHEMISTRY
College of Engineering and Technology
SRM Institute of Science and Technology
Kattankulathur – 603203

Set-1

INTERNAL ASSESSMENT – I (FJ1)

Program: B.Tech
Course Code & Title: 21CYB101J & Chemistry
Year & Sem: I Year & II Sem

Date: 19-02-2025
Duration: 8.00-8.50am
Max. Marks: 25 marks

Course Articulation Matrix

At the end of this course, learners will be able to:	POs				
Course Outcomes (CO)	1	2	3	4	5
CO1 Rationalize bulk properties using periodic properties of elements, evaluate water quality parameters like hardness and alkalinity	3		3	2	
CO2 Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions, determine acidic strength and redox potentials of aqueous solution	3	3	3		
CO3 Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries, determine acidic strength and conductance of aqueous solution		3	3	2	
CO4 Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer	3		3	3	
CO5 Analyze the importance of advanced processing techniques towards engineering applications and measure the acidic strength of aqueous solution	3		3		3

Part – A (5 x 1 = 5 Marks)

Answer ALL The Questions

1 When the valence d orbitals of the central metal ion in octahedral complex are split in energy levels in CFT, which orbitals are raised to higher energy?

(a) d_{xy} and $d_{x^2-y^2}$ (b) d_{xy}, d_{xz} and d_{yz} (c) d_{xz} and d_{yz} (d) $d_{x^2-y^2}$ and d_{z^2}

2 The crystal field splitting energy (Δo) is inversely proportional to

(a) geometry (b) number of d-electrons (c) coordination number (d) oxidation state

3 Which of the following complex is most stable?

(a) $[AlBr_6]^{3-}$ (b) $[AlI_6]^{3-}$ (c) $[AlF_6]^{3-}$ (d) $[AlCl_6]^{3-}$

4 How many geometrical isomers are possible for $[Co(NH_3)_3(NO_2)_3]$ complex?

(a) 2 (b) 3 (c) 4 (d) 0

5 The number of unidentate ligands in the complex ion is called _____

(a) EAN (b) Coordination number (c) Primary valency (d) Oxidation number

Part – B (2 x 10 = 20 Marks)

6. a. *i.* Calculate the CFSE of d^4 and d^7 in high spin tetrahedral complexes in terms of Δo (6 Marks)

ii. Write short note on linkage and hydrate isomerism in coordination compounds. (4 Marks)

(OR)

b. *i.* Calculate the energy of the $[Ti(H_2O)_6]^{3+}$ complex with a wave number of 20,000 cm^{-1}. (5 Marks)

ii. Which among the following complexes have large crystal field splitting in each pair with appropriate justification? (5 Marks)

(1) $[Co(H_2O)_6]^{2+}$ and $[Co(H_2O)_6]^{3+}$ (2) $[Co(CN)_6]^{3+}$ and $[Co(NH_3)_6]^{3+}$

a. Give the steps for Slater's rule and using it, calculate Z_{eff} for an electron residing in 2p level of F^- ion (Z for Fluorine atom is 9). (10 Marks)

(OR)

b. *i.* What are the characteristics of hard acids? Give few examples. (5 Marks)

ii. Calculate the magnetic moment of high spin complexes of Fe^{2+} and Co^{3+} [Z for Fe and Co are 26 & 27 respectively]. (5 Marks)

Q.No	BL	CO	PO
1	2	1	4
2	1		1
3	3		3
4	3		3
5	1		1

Q.No	BL	CO	PO
6 a.	3	1	4
	1		1
6b.	3		4
	4		3
7a.	3		3
7b.	2		1
	3		3

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Set-2

INTERNAL ASSESSMENT – I (FJ1)

Program: B.Tech	Date: 19-02-2025
Course Code & Title:21CYB101J & Chemistry	Duration: 8.00-8.50am
Year &Sem: I Year &II Sem	Max. Marks: 25 marks

Course Articulation Matrix

At the end of this course, learners will be able to:	POs				
Course Outcomes (CO)	1	2	3	4	5
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CO4 Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer	3		3	3	
CO5 Analyze the importance of advanced processing techniques towards engineering applications and measure the acidic strength of aqueous solution	3		3		3

Part – A (5 x 1 = 5 Marks)

Answer ALL The Questions

1 Among the following base, which one is soft?
(a) NH_3 (b) I^- (c) H_2O (d) OH^-

2 An aqueous solution of Ni^{2+} contains $[Ni(H_2O)_6]^{2+}$ and its magnetic moment is 2.83 BM. When ammonia is added in it the magnetic moment of solution_____

(a) will remain the same (b) will increase from 2.83 BM
(c) will decrease from 2.83 BM (d) cannot be predicted theoretically.

3 How many geometrical isomers are possible in $[Al(C_2O_4)_3]^{3-}$?
(a) 0 (b) 2 (c) 3 (d) 4

4 $[Fe(H_2O)_6]^{2+}$ and $[Fe(CN)_6]^{4-}$ differ in:
(a) Geometry and magnetic moment (b) Geometry and hybridization

5. Based on HSAB theory to predict solubility, what happens when AgF and LiI are placed together into solution?

(A) Only LiF precipitates

(B) No precipitate is formed

(C) Both LiF and AgI precipitates

(D) Only AgI precipitates initially, but dissolves back into solution when Ag^+ forms a complex ion with F^- ions and H_2O.

Part – B (2 x 10 = 20 Marks)

6. a. Discuss how CFT explains the splitting of d-orbitals in an octahedral crystal field; calculate CFSE and magnetic moment for high-spin as well as low-spin complexes of metal ion with d^5 configuration. (10 Marks)

(OR)

b. i. What is the difference between high-spin and low-spin complexes in terms of color? Use d-d transitions and crystal field theory to explain. (5 Marks)

ii. Provide an example of a coordination compound that exhibits optical isomerism. Explain how the isomers are different and how their optical activity can be observed. (5 Marks)

7 a. i Give HSAB principle. Explain how it categorizes acids and bases and provide an example of a reaction that illustrates the principle. (6 Marks)

ii What is the effective nuclear charge experienced by a valence d-electron in copper [Z for Cu = 29]? Show all steps in your calculation. (4 Marks)

(OR)

b. Define atomic size, explain the factors affecting and discuss the periodic trends in atomic size across a period and down a group in the periodic table. (10 Marks)

Q.No	BL	CO	PO
1	4	1	1
2	2		1
3	3		3
4	2		4
5	2		4

Q.No	BL	CO	PO
6a.	1	1	1
6b. i.	3		3
ii.	2		3
7a. i.	1		1
ii.	2		4
7b.	1		1

(c) Magnetic moment and color (d) Hybridization and number of d electrons

5 The electronic configuration of metal atom/ionic octahedral complex with d^4 configuration, if $\Delta_o <$ pairing energy is:

(a) $t_{2g}^4 e_g^0$ (b) $e_g^4 t_{2g}^0$ (c) $t_{2g}^3 e_g^1$ (d) $e_g^2 t_{2g}^2$

Part – B (2 x 10 = 20 Marks)

6. a. i. What are different types of isomerism in coordination compounds? Describe geometrical and optical isomerism with suitable examples. (10 Marks)

(OR)

b. i. Explain, why the transition metal coordination compounds with strong field ligands are yellow, orange or red in color, whereas with weak field ligands they are often blue-green, blue or indigo in color. (5 Marks)

ii. Draw structures for linkage isomers of $[Co(NH_3)_5NO_2]Cl_2$ and optical isomers of $[CoCl_2(en)_2]^+$ (5 Marks)

7 a. What are the features of crystal field splitting theory? Calculate CFSE values in terms of Δ_o for high spin and low spin octahedral complexes having d^5 and d^7 configuration. (10 Marks)

(OR)

b. i. Explain the factors affecting crystal field splitting with suitable examples. (6 Marks)

ii. With examples, define hard base and soft base. (4 Marks)

Q.No	BL	CO	PO
1	1	1	1
2	3		3
3	2		4
4	3		3
5	2		4

Q.No	BL	CO	PO
6 a.	1	1	1
6b.	3		3
	2		4
7a.	3		3
	2		4
7b	1		1

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Set- 1

INTERNAL ASSESSMENT – I [FJ1]

Program: B. Tech.
Course Code & Title: 21CYB101J & Chemistry
Year & Sem: I Year & II Sem

Date: 19-02-2025
Duration: 12.30 – 1.20 PM
Max. Marks: 25 marks

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Part – A (5 x 1 = 5 Marks)
Answer ALL the Questions

1. Which of the following ions would have a spin-only magnetic moment of approximately 4.9 BM?
   (A) Co^{3+} (B) Ni^{2+} (C) Mn^{2+} (D) Fe^{3+}
2. According to the spectrochemical series, which of the following ligands would cause a low- spin configuration in a transition metal complex?
   (A) F^- (B) Cl^- (C) CN^- (D) I^-
3. How many geometrical isomers are possible in a complex of type $[MA_2(L)_2]$, where A is unidentate and L is bidentate?
   (A) 0 (B) 2 (C) 3 (D) 4
4. F is more electronegative than Cl because:
   (A) F has higher electron affinity than Cl
   (B) F has a greater tendency to attract the shared pair of electrons in a covalent bond.
   (C) F has higher electron gain enthalpy than Cl.
   (D) F lies above Cl in the same group within the periodic table.