

**2022/TDC(CBCS)/EVEN/SEM/
CHMHCC-401T/339**

TDC (CBCS) Even Semester Exam., 2022

CHEMISTRY

(Honours)

(4th Semester)

Course No. : CHMHCC-401T

(Coordination Chemistry and its Application)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

Answer any *ten* questions :

2×10=20

1. Find the primary and secondary valency of Ni
in $[\text{Ni}(\text{CO})_4]$. 1+1=2
2. What do you mean by high-spin and low-spin
complexes?
3. Draw a crystal-field splitting diagram for a
square-planar complex.

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(Turn Over)



4. What are the ambidentate ligands? Give one suitable example of ambidentate ligand. 1+1=2
5. Draw the structure and indicate the types of isomer formed by the complex $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$.
6. Give the IUPAC (2005) names of the following : 1×2=2
- (a) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$
- (b) $[\text{Co}(\text{en})_2(\text{ONO})\text{Cl}]\text{Cl}$
7. Calculate the number of unpaired electrons in Cr^{3+} and Mn^{2+} ions. 1+1=2
8. Why is Mn (II) not stable in aqueous solution?
9. $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless. Give reasons.
10. Why is $\text{La}(\text{OH})_3$ more basic than $\text{Lu}(\text{OH})_3$?
11. Why does Eu exhibit stable +2 oxidation state instead of +3 oxidation state?
12. Why are La^{3+} and Ce^{4+} diamagnetic in nature?

13. What are essential trace elements? Cite one example. 1+1=2
14. Define porphyrin. Give one example of metalloporphyrin. 1+1=2
15. What is chelation therapy?

SECTION—B

Answer any *five* questions : 6×5=30

16. (a) Using VBT, explain the feasibility of formation of $[\text{CoF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ ions. Predict their magnetic properties and indicate them as low-spin and high-spin. 3
- (b) What do you understand by crystal-field stabilization energy (CFSE)? Calculate the CFSE for d^3 metal ion in tetrahedral fields. 1+2=3
17. (a) Predict and explain the magnetic moment values of $[\text{Mn}(\text{CN})_6]^{3-}$ and $[\text{Cu}(\text{NH}_3)_4]^{2+}$. 3
- (b) Explain the consequence of Jahn-Teller effect on the structure of $[\text{CuCl}_6]^{4-}$. 3

18. (a) What is meant by isomerism? Name and explain various types of geometrical isomerism exhibited by coordination compounds. 3
- (b) Briefly describe the three factors that influence formation of complexes. 3
19. (a) Give the possible stereochemistries for coordination number 4 with an example each. 1+2=3
- (b) How does colour change principle help in detection of complex formation? 3
20. (a) What are *d*-block elements? Give their electronic configurations. 2+1=3
- (b) How would you account for +2, +3 and +4 oxidation states of titanium? Which of these states is most stable and why? 1+2=3
21. (a) How do the transition elements act as catalysts? Name two catalysts that are used in the industry. 2+1=3
- (b) Name the important oxidation states of chromium. Draw a structure of the complex formed by Cr^{2+} ion. 1+2=3
22. (a) What are lanthanide contractions? What are the consequences of lanthanide contraction? 1+2=3

- (b) Give an account for the colour exhibited by compounds of lanthanum series. 3
23. (a) Name the lanthanide elements. Give their electronic configurations and the number of unpaired electrons in the ground state of the following species : 3
 Ce^{4+} , Gd^{3+}
- (b) Describe the ion-exchange method to separate compounds of lanthanides. 3
24. (a) Illustrate the structure of haemoglobin. How does the structure change upon O_2 binding in haemoglobin? 2+2=4
- (b) Can a metal be toxic as well as essential for a living being? Explain with example. 2
25. (a) What are heavy metals? Explain the toxic effects of mercury on human health. Suggest one antidote for mercury poisoning. 1+2+1=4
- (b) Give one example each of a coordination compound as anti-cancer and anti-heavy-metal drugs. 1+1=2

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