

2020

CHEMISTRY (Honours)**Paper Code : X - A & B****[New Syllabus]**

Full Marks : 65

Time : Three Hours

**Important Instructions
for Multiple Choice Question (MCQ)**

- Write Subject Name and Code, Registration number, Session and Roll number in the space provided on the Answer Script.

Example : Such as for Paper III-A (MCQ) and III-B (Descriptive).

Subject Code :

III	A	&	B
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Subject Name :

- Candidates are required to attempt all questions (MCQ). Below each question, four alternatives are given [i.e. (A), (B), (C), (D)]. Only one of these alternatives is 'CORRECT' answer. The candidate has to write the Correct Alternative [i.e. (A)/(B)/(C)/(D)] against each Question No. in the Answer Script.

Example – If alternative A of 1 is correct, then write :

1. – A

- There is no negative marking for wrong answer.

মাল্টিপল চয়েস প্রশ্নের (MCQ) জন্য জরুরী নির্দেশাবলী

- উত্তরপত্রে নির্দেশিত স্থানে বিষয়ের (Subject) নাম এবং কোড, রেজিস্ট্রেশন নম্বর, সেশন এবং রোল নম্বর লিখতে হবে।

উদাহরণ — যেমন Paper III-A (MCQ) এবং III-B (Descriptive)।

Subject Code :

III	A	&	B
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Subject Name :

- পরীক্ষার্থীদের সবগুলি প্রশ্নের (MCQ) উত্তর দিতে হবে। প্রতিটি প্রশ্নে চারটি করে সম্ভাব্য উত্তর, যথাক্রমে (A), (B), (C) এবং (D) করে দেওয়া আছে। পরীক্ষার্থীকে তার উত্তরের স্বপক্ষে (A) / (B) / (C) / (D) সঠিক বিকল্পটিকে প্রশ্ন নম্বর উল্লেখসহ উত্তরপত্রে লিখতে হবে।

উদাহরণ — যদি 1 নম্বর প্রশ্নের সঠিক উত্তর A হয় তবে লিখতে হবে :

1. — A

- ভুল উত্তরের জন্য কোন নেগেটিভ মার্কিং নেই।

Paper Code : X-A

Full Marks : 15

Time : Thirty Minutes

Choose the correct answer.

Each question carries 1 mark.

- Jahn-Teller effect is not observed in high spin complexes of
(a) d^7 (b) d^5 (c) d^4 (d) d^9
- A coordination complex compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution. On reacting this solution with excess of AgNO_3 solution, we get two moles of AgCl precipitate. The ionic formula for this complex would be
(a) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$
(b) $[\text{Co}(\text{NH}_3)_5\text{Cl}][\text{Cl}(\text{NO}_2)]$
(c) $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)\text{Cl}](\text{NH}_3)\text{Cl}$
(d) $(\text{Co}(\text{NH}_3)_5)[(\text{NO}_2)_2\text{Cl}_2]$
- $\text{Fe}_2(\text{CO})_9$ is diamagnetic. Which of the following reasons is correct??
 - Presence of one CO as bridge group
 - Presence of monodentate ligand
 - Strong antiferromagnetic coupling among two Fe center
 - Resonance hybridization of CO
- Which one of the following is expected to exhibit optical isomerism?

(en = ethylenediamine)
 - cis- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
 - trans- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
 - cis- $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
 - trans- $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- What is ground state term symbol for a free d^3 ion?
a) ^4F b) ^4D c) ^2F d) ^2D
- The IUPAC name of the coordination compound $\text{K}_3[\text{Fe}(\text{CN})_6]$ is
 - Potassium hexacyanidoferrate (II)
 - Potassium hexacyanidoferrate (III)
 - Potassium hexacyanidoiron (II)
 - tripotassium hexacyanidoiron (II)

Turn Over

7. The volume (in mL) of 0.1 M AgNO_3 required for complex precipitation of chloride ions present in 30 mL of 0.01 M solution of $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$, as silver chloride is close to
- 3
 - 4
 - 5
 - 6
8. The attractive forces between metal ions and delocalised electrons can be weakened or overcome by
- Low Temperature
 - High Temperature
 - Water
 - None of the above
9. π bonding is not involved in
- Ferrocene
 - Dibenzene Chromium
 - Zeise's Salt
 - Grignard Reagent
10. Blood protein is ?
- albumin
 - haemoglobin
 - both (a) and (b)
 - none of these
11. The conduction of electricity in metallic bonding is due to presence of
- | | |
|--------------------------|------------|
| a) Protons | b) Lattice |
| c) Delocalised Electrons | d) Nucleus |
12. EDTA act as
- | | |
|---------------------|-----------------------|
| a) Chelating agent | b) Sequestering agent |
| c) Both (a) and (b) | d) None of the above |
13. In reference to biological role, Ca^{2+} ions are important in
- triggering the contraction of muscles
 - generating the right electrode potential across cell membrane
 - hydrolysis of ATP
 - defence mechanism

14. What is oxidation number of Fe in Rubredoxin, Fe-S protein ?

- a) +2
- b) +3
- c) +6
- d) +2 & +3

15. In chlorophyll which metal ion is present?

- | | |
|-------|-------|
| a) Na | b) Ca |
| c) Mg | d) Cu |
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2020

CHEMISTRY (Honours)**Paper Code : X-B****[New Syllabus]**

Full Marks : 50

Time : Two Hours Thirty Minutes

*The figures in the margin indicate full marks.*Answer any *five* questions taking at least *two* questions from each group.**Group - A**

1.

a) Arrange CO, Ethylene diamine and NO^+ in terms of their relative location in spectrochemical series. Justify your answer.

b) What do you understand by "Jahn-Teller" effect in d-orbital complexes? Explain with suitable examples.

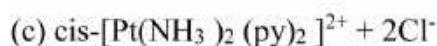
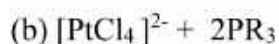
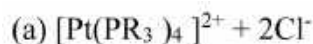
c) Mercuric Chloride is colorless where as Mercuric Iodide has an intense color. Explain this observation. (4+4+2 = 10)

2.

a) Use the trans effect series to suggest synthetic routes to cis- and trans- $[\text{PtCl}_2(\text{NH}_3)_2]$ from $[\text{Pt}(\text{NH}_3)_4]^{2+}$ and $[\text{PtCl}_4]^{2-}$

b) A Pt(II) complex of tetramethyldiethylenetriamine is attacked by Cl^- , 10^5 times less rapidly than the diethylenetriamine analogue. Explain this observation in terms of an associative rate-determining step.

c) Predict the products in following reactions:



$$[(2+2) + 3 + (1+1+1)] = 10$$

Turn Over

3.

- a) What are conductors, insulators, impurity and intrinsic semiconductors? 4
- b) What do you mean by π donor ligands and π acceptor ligands? Cite examples in each type of ligand. 2+2=4
- c) What is superconductivity? What types of materials are superconductors? 2

4.

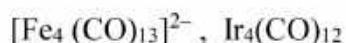
- a) What is "Curie Temperature"? How does it play a vital role in metallic bonding and conductivity?
- b) Distinguish between industrial alloys and substitutional alloys.
- c) Explain Type I and Type II superconductors with help of diagram and graphical representations.
- d) Why flat-panel TV sets and laptop/desktops are better in viewing experience compared to old conventional TFT monitors and TV sets?
- e) Give an example of a nanocrystalline material which can be used as artificial heart-valve.

$$(1+1)+2+3+2+1 = 10$$

Group B

5.

- a) Sketch an η^2 interaction of 1,4-butadiene with a metal atom and (b) do the same for an η^4 interaction.
- b) Give the equation for a workable reaction that will convert $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2$ into (a) $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\eta^5\text{-C}_5\text{H}_4\text{COCH}_3)$ and (b) $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\eta^5\text{-C}_5\text{H}_4\text{CO}_2\text{H})$.
- c) Apply 18 electron rule to find out number of metal metal bonds in following compounds:



$$(2+2)+(2+2)+2 = 10$$

Turn Over

6.

a) The vanadium–carbon distance in $V(CO)_6$ is 200 pm but only 193 pm in $[V(CO)_6]^-$. Explain. 2

b) Account for the following trend in IR frequencies: 3

$[Cr(CN)_5(NO)]^{4-}$ $\nu(NO) = 1515\text{ cm}^{-1}$

$[Mn(CN)_5(NO)]^{3-}$ $\nu(NO) = 1725\text{ cm}^{-1}$

$[Fe(CN)_5(NO)]^{2-}$ $\nu(NO) = 1939\text{ cm}^{-1}$

c) What do you understand by the term “masking” in complexometry? 2

d) Cite two experimental evidences for DCD model in Zeise’s salt. 3

7.

a) Compare and contrast the acid–base catalytic activities of Zn(II) and Fe(III) (2x2 =4)

b) Explain the mechanistic pathway of oxygen transport by Myoglobin and explain the difference of such pathway with that of hemoglobin. (4)

c) What is apoenzyme? 2

8.

a) Give an example of homogeneous organometallic catalyst and explain its action.

b) Explain why pure nitrosyl complexes are not very common.

c) Distinguish between metallocene and sandwich complex.

d) Give example of oxidative addition reaction and reductive elimination reactions in organometallic compounds, with proper explanations. $[2+2+2+(2+2)] = 10$