2021

CHEMISTRY (Honours)

Paper Code : X - A & B

[New Syllabus]

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 |

  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 |

  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.

1. Which of the following ligands can give a five-membered ring when bind to the metal as a chelating ligand?
   (A) 1, 2-ethanediamine
   (B) carbonato
   (C) malonato
   (D) 1, 3-propanediamine

2. CFSE of $[Ti(H_2O)_6]^{+3}$ is —
   (A) 4 Dq
   (B) 8Dq
   (C) – 12Dq
   (D) 16Dq

3. Which of the following shows facial isomer?
   (A) $[Co(EDTA)]^-$
   (B) $[Co(NH_3)_4(CN)Cl]^+$
   (C) $[Cr(NH_3)_3Cl_3]$
   (D) $[Cr(NH_3)_4Cl_2]$

4. Applying 18 electron rule M-M bond present in $Fe_3(CO)_{12}$ is —
   (A) 1
   (B) 2
   (C) 3
   (D) 4

5. Which of the following complex is diamagnetic?

(A) $[Ni(CN)_4]^{2-}$

(B) $[Ni(Cl)_4]^{2-}$

(C) $[Ni(NH_3)_6]^{2+}$

(D) $[Ni(H_2O)_6]^{2+}$

6. Which of the following is the strongest π-acceptor ligand?

(A) NO

(B) PF_3

(C) PCl_3

(D) CO

7. Which of the following is not involved in electron transfer?

(A) Carbonic anhydrase

(B) Cytochrome b

(C) Rubredoxin

(D) Nitrogenase

8. The $[Ti(H_2O)]^{3+}$ shows purple colour due to —

(A) MLCT band

(B) IVCT

(C) LMCT

(D) d-d transition

9. The ground state symbol of a d^2 ion is —

(A) $^3F_2$

(B) $^3F_4$

(C) $^3D_2$

(D) $^3P_2$

10. The magnetic moment of $[CoI_4]^{2-}$ is more than 3.5 BM. Pick the correct statement(s).

(A) It is a tetrahedral complex

(B) It is square planar

(C) It is low spin

(D) None of these

11. Primary and Secondary valencies of *Cr* in $[Cr(H_2O)_4Cl_2]Cl.2H_2O$ respectively are —

(A) 1, 6

(B) 2, 6

(C) 3, 4

(D) 3, 6

12. Metal-Metal quadrupole bonds are well known for metal —

(A) *Ni*

(B) *Co*

(C) *Fe*

(D) *Re*

13. The standardization of EDTA solution is made by titrating with the standard solution of —

(A) $ZnCl_2$

(B) $CaCl_2$

(C) $Mg(OAc)_2$

(D) $Zn(OAc)_2$

14. The C-atom in C_5H_5 ring of ferrocene is —

(A) sp

(B) sp^2

(C) sp^3

(D) sp^3d^2 hybridised

15. Cis-platin is used to cure —

(A) anaemia

(B) headache

(C) cancer

(D) none of these

2021

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) Describe the geometry of $[Fe(SCN)_4]^-$ and $[Fe(NH_3)_6]^{+2}$ and compare their magnetic moments.

   (b) What is meant by back-bonding? Give an example in support of your answer.

   (c) Explain on the basis of CFSE that water stabilises Co(II) while NH_3 stabilises Co(III). 4+3+3

2. (a) What are outer orbital octahedral complexes? Give an example.

   (b) What is Irving William's order of stability of complexes with a given ligand?

   (c) What are magnetically dilute and magnetically concentrated substances? What do the symbols S, L and J signify? 3+3+4

3. (a) $[Ni(H_2O)_6]^{2+}$ shows transition at 9000, 14000, 25000 cm^{-1}; Assign the bands with required energy level from the concept of Orgel diagram.

   (b) What is Jahn-Teller distortion? What are the experimental evidences of J-T distortions?

   (c) Define the term (i) Super exchange (ii) Curie temperature. 3+4+3

4. (a) Distinguish between interstitial alloys and substitutional alloys.

   (b) Identify *cis* and *trans*-platin through chemical method.

(c) What is meant by kinetically and thermodynamically stability constant of a complex ion? Elucidate the term "chelate effect" and "opposing of chelate effect" 3+3+4

Group - B

5. (a) Describe the preparation and properties of Ziegler Natta catalyst.

(b) Give three methods to prepare ferrocene. How does ferrocene undergo (i) Friedel Craft reaction, (ii) Mannich condensation and (iii) Acylation?

(c) Applying 18 electron rule find out the number of metal-metal bonds in

(i) $Fe_3(CO)_{12}$ (ii) $Ir_4(CO)_{12}$ 3+3+4

6. (a) How does a vibrational spectrum help to understand bonding in carbonyls?

(b) Pure nitrosyl complexes are relatively rare — explain.

(c) The isocyanides usually stabilise the higher oxidation states of metals. Explain.

(d) What are metal-metal bonded compounds? Explain with at least two examples. 3+2+2+3

7. (a) Describe the role of Na^+ K^+ in biological system.

(b) What are toxic metal ions? Describe their effects.

(c) What are PS-I and PS-II? Explain their role in photosynthesis. 3+3+4

8. (a) Explain the principle of EDTA titrations along with the theory of metal ion indicators, masking and demasking agents.

(b) What is the role of metal chelates in living system?

(c) Discuss the role of haemoglobin in living systems. 5+2+3