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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, January 2016
Branch : CHEMISTRY
CH/CL/CA 231 : Inorganic Chemistry – III
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer **two** among **a)**, **b)** and **c)** from **each** question and **each** question carries 2 marks.

1. a) Draw the structure of $Mn_2(CO)_{10}$ and $Fe_2(CO)_{12}$.

   b) Give one method for the synthesis of Ferrocene.

   c) What is Wilkinson catalyst ? Mention its application.

2. a) The reaction $[Cr(H_2O)_6]^{2+} + [Co(H_2O)_5Cl]^{2+} \rightarrow [Cr(H_2O)_5Cl]^{2+} + [Co(H_2O)_6]^{2+}$ is thought to proceed via an inner sphere mechanism. Write down the elementary steps involved in this reaction mechanism.

   b) $[Co(NH_3)_5X]^{2+}$ undergoes acid hydrolysis as well as base hydrolysis. What are the products obtained by the above two hydrolysis ?

   c) The aquation of $[Co(NH_3)_4Cl_2]^{+}$ is 10^3 times faster than that of $[Co(NH_3)_5Cl_2]^{2+}$. Why ?

3. a) Discuss the role of Magnesium in photosynthesis.

   b) Explain the action of a copper containing metalloenzyme.

   c) Discuss the role of P clusters in the Fe-Mo protein of nitrogenase.

4. a) What is photoconductivity ? Give examples for photoconducting materials.

   b) Write down the applications of ferroelectricity .

   c) Explain the term 'super exchange'.

P.T.O.

P.T.O.

5. a) Give a note on liquid drop model of nucleus.

   b) Distinguish between half life and average life. How are they related ?

   c) Explain the source of energy of 'Sun'. **(2×10=20 Marks)**

SECTION – B

Answer either **a)** or **b)** of **each** question and **each** question carries **5** marks.

6. a) Explain the structure and bonding in butadiene complexes.

   b) Write down one method of preparation each for allyl, Cyclopentadiene, cycloheptatriene and cyclooctatetraene complexes.

7. a) What is trans effect ? Propose a two step synthesis for 'cis' and trans $[PtCl_2(NO_2)NH_3)^-$.

   b) Give an account of solvolytic reactions in octahedral complexes.

8. a) Explain the mechanism of Iron storage and transport in biological system.

   b) Discuss the structural features and mechanism of Cu-Zn SOD.

9. a) Give short notes on :

   i) Superconductivity and

   ii) Photovoltaic effect.

   b) Discuss the effect of temperature on magnetism.

10. a) Give a brief note on nuclear shell model.

    b) What is meant by radioactive equilibrium ? The ratio between atoms of two radioactive elements A and B at equilibrium was found to be $3.1 \times 10^9 : 1$. If the half life period of A is 2×10^{10} years, what is the half life period of B ?

(5×5=25 Marks)

SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. i) With suitable examples discuss the applications of infrared spectroscopy for the elucidation of bonding in metal carbonyls.

    ii) Explain the mechanism of Hydroformylation reaction.

12. i) List out the factors affecting the rate of substitution in octahedral complexes and discuss about any two of them.

    ii) Arrange the following in the order of rate of substitution by H_2O and explain the reason for your answer.
    $[Co(NH_3)_6]^{3+}$, $[Rh(NH_3)_6]^{3+}$, $[Ir(NH_3)_6]^{3+}$.

13. i) Discuss the function and significance of $Na^+ - K^+$ pump.

    ii) Outline the structural features and mechanism of action of Carboxy peptidase A.

14. Give an account of different types of magnetism.

15. What is radiation dose ? Define the different units of radiation dose. Explain one method for the measurement of dose.

(10×3=30 Marks)

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c) State and explain Curie and Curie-Weiss laws.

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B – 4317

Third Semester M.Sc. Degree Examination, January 2017
Branch : CHEMISTRY
CL/CA/CH 231 : Inorganic Chemistry – III
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer **two** among **a)**, **b)** and **c)** from **each** question and **each** question carries **2** marks.

1. a) The IR stretching frequency of CO in metal carbonyls is lower than that for free CO molecule. Why ?

   b) What is meant by hapticity ? Explain with suitable examples.

   c) How does fluxionality differ from tautomerism ?

2. a) Distinguish between thermodynamic stability and kinetic stability of complexes.

   b) Presence of large ligands in the reacting complex favours dissociative mechanism of substitution in octahedral complexes. Justify.

   c) Illustrate photoaquation reactions of metal complexes.

3. a) Differentiate between essential and trace elements in biological systems.

   b) Give a note on the significance of $Na^+ – K^+$ pump in biological system.

   c) Mention the role of 'Zn' in carboxypeptidase A.

4. a) What is superconductivity ? Give examples for superconducting materials.

   b) What are Lasers ? Give their important applications.

   c) State Curie and Curie – Weiss laws.

P.T.O.

5. a) Write down the semiemperical mass equation and explain the asymmetry term.

   b) A neutron initiated fission reaction of $_{92}U^{235}$ yields $_{42}Mo^{97}$, two neutrons and an isotope of an element. Which is the element ?

   c) Nuclear reactors are usually built close to rivers or lakes. Why ? **(2×10=20 Marks)**

SECTION – B

Answer either **a)** or **b)** of **each** question and **each** question carries **5** marks.

6. a) Discuss the structure and bonding in Ferrocene.

   b) Discuss the mechanism of hydroformylation reaction.

7. a) What is trans effect ? How are 'cis' and trans $[PtCl_2(NH_3)NO_2]$ synthesized from $[PtCl_4]^{2-}$?

   b) Derive the rate law expression for substitution in octahedral complexes which takes place via dissociative mechanism.

8. a) Discuss the mechanism of oxygen binding in haemoglobin.

   b) What are Cytochromes ? Write down the important reactions catalysed by cytochrome P 450.

9. a) Give a brief note on dielectric properties of materials.

   b) Discuss the applications of piezo and pyroelectricity.

10. a) Derive the equation for radioactive decay and growth.

    b) What is meant by half life period ? Half life of radium is 1580 years and molar mass is 226 g mol^{-1}. Show that 1 g of radium gives 3.7×10^{10} disintegrations per second. **(5×5=25 Marks)**

SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. i) With suitable examples discuss the applications of Infrared spectroscopy for the elucidation of bonding in metal carbonyls.

    ii) Explain the mechanism of Hydrogenation.

12. i) Explain the mechanism of ligand substitution reactions in square planar complexes.

    ii) Give a comparison of Outer sphere Vs. Inner sphere mechanisms.

13. Discuss the structure and biological functions of

    i) Ferritin

    ii) Transferrin

    iii) Catalase

    iv) Vitamin B_{12}.

14. Give an account of different types of magnetism.

15. With the help of a diagram explain the principle and working of a nuclear reactor. **(10×3=30 Marks)**

D – 3830

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Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, January 2018

Branch : CHEMISTRY

CH/CL/CA/CM 231 : Inorganic Chemistry – III

(2016 Admission)

Time : 3 Hours Max. Marks : 75

SECTION – A

Answer **any two** among **(a)**, **(b)** and **(c)** of **each** question. **Each** sub-question carries 2 marks.

1. a) What are the different binding modes of NO ? Illustrate with examples.

   b) Free alkenes are reactive towards electrophiles, where as coordinated alkenes are more susceptible to nucleophilic attack. Why ?

   c) What is Wilkinson's catalyst ? What is its use ?

2. a) $[Ni(CN)_4]^{2-}$ is thermodynamically stable, but kinetically labile. What is meant by this ?

   b) What is acid hydrolysis ? Give its rate law and name the mechanism.

   c) What is photo-isomerisation reaction ? Illustrate with an example.

3. a) What are ionophores ? What are their functions ?

   b) What are siderophores ? What are their functions ?

   c) What are nitrogenases ? Which metal ions are present at their active sites ? What are their functions ?

4. a) How do C– N, C – O and N – O stretching frequencies in cyano-, carbonyl- and nitrosyl complexes change ? Why ?

   b) What are the resonance conditions for an ESR experiment ?

   c) Why are solid samples used for recording Mossbauer spectra ?

P.T.O.

5. a) What are magic numbers ? Explain.

   b) The half-life of a radioactive isotope is 4.8 minutes how much of the isotope will remain in a sample of 1 mg after 10 minutes ?

   c) What is transmutation ? Illustrate with an example.

(2×10=20 Marks)

SECTION – B

(Answer either **(a)** or **(b)** of each question. **Each** question carries **5** marks.)

6. a) Give one example each for polynuclear carbonyls with and without bridging. Give their methods of preparation, structures and bonding.

   b) Discuss the structure and bonding of dibenzene chromium complex.

7. a) What are stepwise-and overall formation constants ? How are they related ?

   b) Explain the mechanism of inner-sphere electron transfer reaction with an example.

8. a) Which are essential and trace elements found in biological systems ? How are they classified ?

   b) What is superoxide dismutase ? Discuss its structure and function.

9. a) Using examples, explain the use of IR spectroscopy to findout :
      i) Whether the water molecule in a complex is lattice held or coordinated.
      ii) Whether CO in a metal carbonyl is terminal or bridging.

   b) Using suitable example, illustrate the use of Mossbauer spectroscopy in identifying the oxidation state of iron in a complex.

10. a) Discuss briefly liquid drop model of nucleus. How does it explain nuclear fission.

    b) What is meant by radioactive equilibrium ? Differentiate transient and secular equilibria.

(5×5=25 Marks)

SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. What is hydroformylation reaction ? Explain it based on the catalytic cycle using cobalt carbonyl catalyst.

12. Discuss the salient features of kinetics and mechanism of ligand substitution reactions of square planar complexes with special reference to trans-effect. What are the theoretical basis of trans-effect ?

13. Give a comparative account of the structures and functions of myoglobin and hemoglobin.

14. Write the principle of NMR spectroscopy. Using suitable examples, illustrate its use in the structural studies of ionorganic compounds and biomolecules.

15. Discuss the principle, working and uses of :

    a) Breeder reactor and

    b) G.M. Counter.

(3×10=30 Marks)

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H – 4109

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, January 2020

Chemistry/Polymer Chemistry

CH/CL/CM/CA/PC 231 — INORGANIC CHEMISTRY III

COMMON FOR CHEMISTRY

(Common for Chemistry (2016 Admission onwards) and Polymer Chemistry (2018 Admission))

Time : 3 Hours

Max. Marks : 75

PART – A

Answer **any two** among (a), (b) and (c) from each question. Each sub-question carries **2** marks :

1. (a) Give the structure of a complex where the nitrosyl groups bond to metal in linear and bent forms. How many electrons are donated by each type of ntrosyl group to the metals.

   (b) Represent the structures of $Fe(CO)_5$, $Fe_2(CO)_9$ and $Fe_3(CO)_{12}$.

   (c) What do you mean by hapto nomenclature?

2. (a) $Cr(H_2O)_6^{2+}$ is labile and $Cr(CN)_6^{2-}$ is inert. Why?

   (b) How is and *trans* isomers of $[Pt\,Cl_2(NH_3)NO_2]^-$ are prepared from $[PtCl_4]^{2-}$?

   (c) Write down the Marcus equations.

P.T.O.

3. (a) What are essential and trace elements in biological systems?

(b) Explain the role of calcium in biological systems.

(c) Write one toxic effect of each metal Cd, Hg and Cr.

4. (a) How many signals do you expect for $[Cu(H_2O)_4]^{2+}$ in EPR spectroscopy?

(b) How IR spectroscopy can be used to study the nature of carbonyls in metal complexes?

(c) What do you mean by chemical shift in NMR spectroscopy?

5. (a) What is the connection between nuclear stability and binding energy of atomic nucleus?

(b) What are half-life and average life of a radioactive species.

(c) Explain the liquid drop model of the nucles.

(10 × 2 = 20 Marks)

PART – B

Answer either (a) and (b) of each questions. Each question carries **5** marks.

6. (a) Draw the structures of $CO_2(CO)_8$, $Ru_3(CO)_8$, $Ru_3(CO)_{12}$ and $RH_4(CO)_{12}$. Show that 18-electron rule is satisfied in each case.

(b) Explain the synthesis of dibenzene chromium. Describe its structure.

7. (a) Describe the A and D mechanisms of substitution reactions involving coordination complexes. How can you distinguish between them?

(b) Explain the mechanism of outer sphere redox reactions.

8. (a) Explain mechanistic aspects of Na^+/K^+ ion-pump.

(b) What is carboxypeptidase A? Explain its structure and functions.

9. (a) Explain briefly the principle of ^{1}H NMR spectroscopy.

(b) The EPR spectrum of bis (salicylaldimine) copper (II) shows four groups of lines which result from the coupling of an electron with $^{63}Cu\,(I = 3/2)$ nucleus; the hyperfine structure in each of the four groups consists of eleven peaks with intensity ratio of 1: 2: 3: 4: 5: 6: 5: 4: 3: 2: 1. Explain the two types of splitting observed.

10. (a) State and explain the semiempirical mass equation.

(b) What is radioactive equilibrium? Explain the difference between transient and secular equilibria.

(5 × 5 = 25 Marks)

PART – C

Answer **any three** questions, and each question carries 10 marks.

11. How ferrocene is synthesized? Describe its structure and bonding.

12. Explain the mechanism of ligand substitution in octahedral complexes.

13. Why nitrogen fixation is an important process? Taking two examples of *in-vitro* complexes and explain their importance on understanding nitrogen fixation process and mechanism.

14. Describe the use of Mössbauer spectra for the study of high and low spin complexes of iron (II) and iron (III).

15. Explain the 'nuclear fission, how it can be used as a source of energy?

(3 × 10 = 30 Marks)

(Pages : 3)

K – 4909

Reg. No. : .....

Name : .....

Third Semester M.Sc. Degree Examination, February 2021

Chemistry / Polymer Chemistry

CH/CL/CA/CM/PC 231 – INORGANIC CHEMISTRY III

Common for Chemistry (2016 Admission onwards) and

Polymer Chemistry (2018 Admission onwards)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer any **two** among (a).(b)and (c) from each question. **Each** sub question carries **2** marks.

1. (a) Explain the structure of bis (benzene) chromium.

   (b) Explain the hapto nomenclature of organometallics with a suitable example.

   (c) Give the mechanism of Zeigler-Natta polymerization of alkenes.

2. (a) What is macrocyclic effect?

   (b) Explain photoaquation reactions in metal complexes with example.

   (c) Explain the terms stability and lability of complexes?

3. (a) Explain the electron systems used in photosynthesis.

   (b) What are metalloenzymes? Give examples.

   (c) Explain the role of ferritin in biological systems.

P.T.O.

4. (a) What happens to CO stretching frequency in IR pectrum of acetylacetone on metal ion cordination?

(b) Explain the EPR spectra of $[Cu(acac)_2]$.

(c) What is the principle behind ^{19}F NMR?

5. (a) What is Mass defect? How is it related to binding energy?

(b) Write a note on magic numbers?

(c) What is meant by secular equilibria?

(10 × 2 = 20 Marks)

SECTION – B

Answer either (a) or (b) of each question. **Each** question carries **5** marks.

6. (a) Discuss the structure and bonding in Zeise's salt.

(b) Write a note on fluxional molecules.

7. (a) Discuss the Marcus theory of outer sphere electron transfer reactions.

(b) Explain spectrophotometric method to determine stability of complexes.

8. (a) Give a brief explanation on toxicity of metal ions.

(b) Manganese plays an important role in production of oxygen in photosynthesis. Justify.

9. (a) Explain chemical shift and spin-spin coupling in NMR spectroscopy.

(b) Write a note on CD spectra of metal complexes.

10. (a) Write a note on breeder reactor.

(b) Write a note on nuclear shell model.

(5 × 5 = 25 Marks)

SECTION – C

Answer any **three** questions. **Each** question carries **10** marks.

11. Discuss briefly the application of organometallic compounds in organic synthesis and catalysis.

12. Give a brief account on the photochemical reactions of ruthenium complexes.

13. Discuss oxygen transport by heme proteins with special reference to pH dependence such as haemoglobin and myoglobin.

14. Discuss the theory behind Mossbauer spectroscopy. Explain the use of Mossbauer spectroscopy in studying iron complexes.

15. Write a note on GM counters and scintillation counters.

(3 × 10 = 30 Marks)
