



Reg. No. : .....

Name : .....

First Semester M.Sc. Degree Examination, January 2017

Branch : CHEMISTRY

CH/CL/CA/CM 211 – Inorganic Chemistry – I

(2016 Admission)

Time : 3 Hours

Max. Marks : 75

## SECTION – A

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

1. a) Why is a solution of copper(II) sulphate blue ?  
b) Explain why complexes that contain acetate ions as ligands are much less stable than those of the same metal ion when acetylacetonate ions as the ligands.  
c) Explain why there are no low-spin tetrahedral complexes.
2. a) Precise measurement need not be accurate. Why ?  
b) EDTA titrations need buffer solutions. Why ?  
c) What are redox indicators ?
3. a) In the solid state, phosphorus(V) chloride exists as an ionic solid composed of  $\text{PCl}_4^+$  cation and  $\text{PCl}_6^-$  anions but the vapour is molecular. To what point groups do the ionic species in the solid belong ?  
b) Molecules belonging to the point groups  $D_{2h}$ ,  $C_{3h}$ ,  $T_h$  and  $T_d$  cannot be chiral. Which elements of these rule out chirality ?  
c) The group  $C_{3v}$  consists of the symmetry operations  $E$ ,  $C_3$ ,  $C_3^2$ ,  $\sigma_v(1)$ ,  $\sigma_v(2)$  and  $\sigma_v(3)$ . Construct the group multiplication table for this group.
4. a) Compared to molybdenum(VI) and tungsten(VI), chromium(VI) does not have an extensive polyanion chemistry. Suggest an explanation.  
b) Explain the structure of  $\text{XeF}_2$ .  
c) What are zeolites ?
5. a) Ozone layer depletion is maximum at the polar regions. Why ?  
b) Describe the chemistry of soil.  
c) In general COD is higher than BOD. Why ?

(2×10=20 Marks)

P.T.O.



## SECTION - B

Answer either among (a) or (b) from each question, carries 5 marks.

6. a) Explain isomerism in metal complexes with examples.  
b) Explain Jahn-Teller theorem.
7. a) What are the different types of errors ? How errors can be minimized ?  
b) Explain various types of titrations.
8. a) Using similarity transformation show that the six elements of the  $C_{3v}$  point group can be divided into three classes.  
b) Explain 'The Great Orthogonality Theorem'. What are the rules derived from GOT ?
9. a) Explain the preparation and properties of (i)  $KrCl_4$  (ii)  $KrF_2$  (iii)  $KrBr_6$  (iv)  $KrCrO_4$  (v)  $KrO_2$ .  
b) Write a note on preparation and uses of inter-halogen compounds.
10. a) What is ozone umbrella ? Describe the path for the depletion of it due to nitrogen oxides and  $Cl_2$ .  
b) Explain Pourbaix diagram.

(5×5=25 Marks)

## SECTION - C

Answer any three questions. Each question carries 10 marks.

11. Explain the molecular orbital theory of the bonding in the complex  $[Co(NH_3)_6]^{3+}$ .
12. Explain the principles and instrumentation of TG. What are factors that affect TG curves ? What are its applications in the study of metal complexes ?
13. Construct the character table for  $C_{2h}$  point group and explain.
14. Write a note on preparation, properties and structure of isopoly acids of Mo and V.
15. List out the major air pollutants. Outline how they affect human health. (10×3=30 Marks)



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Reg. No. : .....

Name : .....

**First Semester M.Sc. Degree Examination, January 2017**  
**Branch : Chemistry**  
**CH/CL/CA/CM 211 : INORGANIC CHEMISTRY – I**  
**(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) Iodine is almost insoluble in water, but it dissolves readily in aqueous solution of KI. Why ? Explain.  
b) What are silicones ? What are the causes for the strength of silicones ?  
c) Distinguish between isopoly and heteropoly acids of Molybdenum with suitable examples.
2. a) Account for the fact that mode of splitting of 'd' orbitals in an octahedral field is just reverse of that in a tetrahedral field.  
b) Explain why stepwise equilibrium constant values decrease as the number of ligands attached to the metal increase.  
c)  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$  is slightly distorted tetragonal. Why ?
3. a) What do you mean by confidence intervals ? Explain.  
b) An ore analysis gave the following results for its Fe content : 12.3, 13.1, 12.8, 12.7, 11.6, 11.2 and 11.8 mg/g. Calculate the mean and standard deviation.  
c) What is meant by 'Aging' of precipitates ?
4. a) What are Zero dimensional nanoparticles ? Give examples.  
b) Give the principle of X-ray diffraction and explain how it can be used for the size determination of nano particles ?  
c) Explain how optical properties of quantum dots are related to quantum confinement effect ?



5. a) Write down the chemistry of photochemical smog.  
b) Give the photochemical reaction for the formation of ozone in the stratosphere.  
c) How can you determine the cation exchange capacity of soil ? (10×2= 20 Marks)

SECTION - B

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

6. a) Give an account of stability and properties of Astatine.  
b) What are Nitrides ? Quoting suitable examples give their classification and structure.
7. a) Brief any one method for the determination of stability constant.  
b) How does the concept of CFSE useful in explaining the variation of hydration enthalpy of  $M^{2+}$  ions of first row transition metals.
8. a) Give a brief note on 'Scatter diagram' and its significance.  
b) Distinguish between coprecipitation and postprecipitation with suitable examples.
9. a) Describe the synthesis, properties and applications of fullerenes.  
b) Brief the lithographic process in the fabrication of nano materials.
10. a) List out the major air pollutants. Outline how they affect human health ?  
b) Describe how can you quantify soil acidity ? (5×5= 25 Marks)



SECTION - C

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

11. i) Describe the preparation, structure and bonding of Noble gas compounds.  
ii) Explain the classification and structure of silicates.
12. i) Distinguish stepwise and overall formation constants. The octahedral amine complex can be prepared by using a solution of ammonia which has been supersaturated with ammonia gas such that  $\log \beta_4 = 7$ ,  $\log k_5 = 0.85$  and  $\log k_6 = 0.42$ . Calculate the overall  $\beta_6$  for  $[\text{Ni}(\text{NH}_3)_6]^{2+}$   
ii) Explain the splitting of 'd' orbitals in tetragonal, bipyramidal and square pyramidal fields.
13. i) What is meant by 'Error' ? What are the methods to minimize it ?  
ii) What are chelometric titrations ? Discuss about their applications in quantitative analysis.
14. Outline the idea of characterization of nanomaterials using SEM, TEM and STM techniques.
15. Describe the chemistry of processes in hydrosphere.

(10×3 = 30 Marks)



Reg. No. : .....

Name : .....

**First Semester M.Sc. Degree Examination, March 2018**  
**Branch : CHEMISTRY**  
**CH/CL/CM/CA 211 : Inorganic Chemistry – I**  
**(2016 Admission Onwards)**

Time : 3 Hours

Max. Marks : 75

## SECTION – A

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

1. a) Nickel and Platinum are in the same family of Periodic Table but  $[\text{NiCl}_4]^{2-}$  and  $[\text{PtCl}_4]^{2-}$  differ considerably in their geometries. Why ?  
b) Give two examples each for high spin and low spin complexes of  $\text{Fe}^{2+}$ .  
c) What is meant by CFSE ?
2. a) What is 'F' test ? Give its significance.  
b) Give the name and structure of two organic precipitants used in gravimetry.  
c) What are precipitation titrations ? Mention one example.
3. a) What are the symmetry elements and symmetry operations of  $D_{3h}$  point group ?  
b) Draw the geometry, symmetry elements and assign the point group of  $\text{CHCl}_3$ .  
c) What are Abelian and cyclic groups ? Give one example for each.
4. a) Explain how  $\text{XeF}_6$  reacts with water.  
b) Why are the O-F bonds in  $\text{O}_2\text{F}_2$  longer than  $\text{OF}_2$  whereas the O-O bond in  $\text{O}_2\text{F}_2$  is short compared with that in  $\text{H}_2\text{O}_2$  ?  
c) Draw the structure of  $\text{IF}_5$  and  $\text{IF}_7$ .
5. a) Explain the formation of smog in the environment.  
b) How does  $\text{NO}_x$  causes ozone depletion ? Write down the related chemical reactions.  
c) Distinguish between BOD and COD.

(2×10=20 Marks)

P.T.O.



## SECTION - B

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

6. a) Discuss about the various factors affecting the magnitude of splitting parameter ( $\Delta$ ) in complexes.  
b) Discuss the merits of MOT over CFT.
7. a) Give a brief note on the rules for computation of results.  
b) What are the various factors affecting TG and DTA curves ? Explain.
8. a) State and explain Great Orthogonality Theorem.  
b) Find out the matrix representation of symmetry group  $D_{3h}$ .
9. a) Name the important compounds of Krypton. Give an account of their preparation.  
b) What are Zeolites ? How are they prepared ? Discuss their application as water softening agents.
10. a) Explain the hazards of common air pollutants on human health.  
b) With suitable example, explain the use of pE-pH diagrams for redox sensitive elements. (5×5=25 Marks)

## SECTION - C

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

11. Outline the molecular orbital theory and draw the M.O diagram of  $[\text{Co}(\text{NH}_3)_6]^{3+}$ .
  12. Give an account of the classification of various errors and describe the methods to minimize errors.
  13. Explain and prove the five important rules concerning irreducible representations and their characters.
  14. Give an account of preparation, properties and structure of Heteropoly acids of Molybdenum and Tungsten.
  15. Discuss the chemistry of processes in Hydrosphere. (10×3=30 Marks)
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F – 4684

Reg. No. : .....

Name : .....

**First Semester M.Sc. Degree Examination, February 2019**  
**Branch : Chemistry/Polymer Chemistry**  
**CH/CL/CM/CA/PC 211 : INORGANIC CHEMISTRY – I**  
**(Common for Chemistry (2016 Admission Onwards) and Polymer**  
**Chemistry (2018 Admission))**

Time : 3 Hours

Max. Marks : 75

SECTION – A

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

- a) Calculate the CFSE of a  $d^4$  system in strong octahedral field.

b) State Jahn-Teller Theorem.

c) Tetragonal distortion is exhibited by

i)  $d^0$                       ii)  $d^5$                       iii)  $d^9$                       iv)  $d^3$  system
- a) Explain the terms i) Standard deviation ii) Average deviation.

b) What is redox reaction ? Give examples.

c) Evaluate the following expressions rounding off the answer to the appropriate number of significant figures i)  $42.71 \text{ g} + 9.643 \text{ g} + 8.0 \text{ g}$   
ii)  $0.165 \text{ m}^3 \text{ kg} + 10.487 \text{ m}^{-3} \text{ kg}$ .
- a) What is meant by character table ?

b) What is the basis for irreducible representations ?

c) Assign the point group to the following molecules

i) Ferrocene (staggered)

ii) Naphthalene.



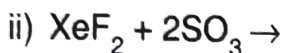
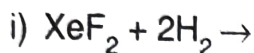
P.T.O.





4. a) Discuss the position of Noble gases in periodic table.

b) Complete the following reactions



c) Explain the term of shape selectivity.

5. a) What is a smog ?

b) What are green house gases ?

c) What is the effect of ozone depletion ?

(2×10=20 Marks)

#### SECTION – B

Answer **either** among (a) or (b) from **each** question carries 5 marks.

6. a) Explain Crystal Field Stabilization Energy (CSFE). How it vary with ligand field strength ?

b) What are the type of pi bonding ? Discuss the pi bonding in complexes.

7. a) Explain the difference between

i) Accuracy-Precision

ii) Determinate-Indeterminate errors.

b) What is a complexometric titrations ? Name some important polydentate complexometric titrations.

8. a) Explain Great Orthogonally Theorem.

b) Construct the character table for  $C_{2v}$  point group.

9. a) Write short notes on silicones.

b) Discuss the preparation and properties of Xenon fluorides.

10. a) Give the composition of air.

b) Give the significance of BOD and COD.

(5×5=25 Marks)

## SECTION - C

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

11. Construct the M.O. diagram of an octahedral complex using sigma bonding. Calculate its bond order.

12. Explain the different types of errors and how it will be minimized.

13. Discuss the construction of character table  $C_3V$  point group.

14. Briefly explain the preparation, properties and applications of isopoly and heteropoly acids of Mo and W.

15. Explain the chemistry of soil.

(3×10=30 Marks)



**First Semester M.Sc. Degree Examination – Model question paper**  
**Branch III – Chemistry/ Branch IV – Analytical Chemistry**  
**CH/CL 211: INORGANIC CHEMISTRY – I**  
(2020 Admission Onwards)

Time: 3 Hrs

Max. Marks: 75

**SECTION A**

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

1. (a) Sketch the splitting of d orbitals in a trigonal bipyramidal complex.  
(b) Which among  $\text{CN}^-$  and  $\text{NH}_3$  have a higher nephelauxetic effect? Why?  
(c) Calculate the CFSE for a  $d^4$  ion.
  
2. (a) Differentiate accuracy from precision.  
  
(b) What are metallochromic indicators? Give an example.  
(c) What is a Student t test used for?
  
3. (a) CdS is a yellow pigment while CdSe is red. Give reason.  
(b) What is NASICON?  
(c) What are anti-stokes phosphors?
  
4. (a) What are zeolites? Explain their use as water softeners?  
(b) Determine the probable structure of perxenate ion using VSEPR theory.  
(c) What are polysiloxanes? Give its structure.
  
5. (a) List two conditions that favour the formation of photochemical smog.  
(b) Discuss briefly a method to quantify soil acidity.  
(c) How do chlorine free radicals tamper the ozone layer?

[2 × 10 = 20]

**SECTION B**

Answer either (a) or (b) from each question. Each sub question carries 5 marks

6. (a) State and illustrate Jahn-Teller distortion.  
(b) Discuss the factors affecting the magnitude of  $\Delta_o$ .
  
7. (a) What is a scatter diagram? What is its significance?  
(b) Discuss briefly the principle behind EDTA titrations.
  
8. (a) What are SOFCs?  
(b) Briefly discuss the structure of fullerides.
  
9. (a) Zeolites find applications as microporous materials and molecular sieves. Substantiate this statement.  
(b) What are isopoly acids?
  
10. (a) List out five unique properties of water.  
(b) Discuss on the various air pollutants and their effect on human health.

[5 × 5 = 25]

### SECTION C

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

11. Describe the Molecular orbital energy level diagrams for octahedral metal complexes with and without  $\pi$ -bonds.
  12. Explain the utility of TG, DTA and DSC in the study of metal complexes.
  13. Detail the types of solid electrolytes giving due importance to structural aspects.
  14. Elaborate the properties of the heteropoly acids of Mo and W.
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15. What are pourbaix diagrams? Outline its role in explaining the chemistry of processes in lithosphere.

[10 × 3 = 30]