Reg. No. : .....

Name : .....

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C – 5099

Second Semester M.Sc. Degree Examination, August 2017

Branch : Chemistry

CH/CA/CL/CM 221 – INORGANIC CHEMISTRY II

(2016 Admission)

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 tetrasulfur tetranitride.
   b) What is phospham ? Describe the synthesis of $P_3N_3Cl_6$.
   c) How N-substituted and B-substituted borazines are synthesized ?
2. a) Derive the term symbols for d^2, d^3 and d^5 ions in the ground state.
   b) What do you mean by spin only value of magnetic moment ? Calculate the spin-only magnetic moment of a manganese(II) complex in a weak field.
   c) An aqueous solution of $[Mn(H_2O)_6]^{2+}$ is pale pink in color. Why ?
3. a) What are seven crystals systems ?
   b) Calculate the Miller indices of a crystal plane which cut through the crystal axes at (2a, –3b, –3c).
   c) What do you mean by color centres in alkali halide crystals ?
4. a) Comment on the oxidation states exhibited by lanthanides.
   b) Explain the electronic spectral properties of lanthanides.
   c) Magnetic moments of Sm^{3+} and Eu^{3+} are found to be different from those calculated from Landé expression. Why ?

P.T.O.

5. a) Explain the effect of temperature on the electrical conductance of (i) metals and (ii) semiconductors. Give reasons.

   b) What do you mean by Brillouin zone ?

   c) What are ferroelectric materials ? Explain their uses. **(2×10=20 Marks)**

SECTION – B

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

6. a) What are carboranes ? Discuss the synthesis of the three isomers of dicarbadodecaborane (12). How carboranes form metallacarboranes ?

   b) Explain the structure of $P_3N_3Cl_6$. Is it aromatic ? Compare Craig-Paddock and Dewar models of the bonding in phosphazenes ?

7. a) What are charge transfer transitions ? How Orgel diagrams are useful for the study of electronic spectra of transition metal complexes ?

   b) Explain Gouy's method for the determination of magnetic moments of metal complexes.

8. a) Discuss the principle and procedure of powder X-ray diffraction studies. What are the merits and demerits of this method ?

   b) Discuss the structures of zinc blende, wurtzite, fluorite and nickel arsenide.

9. a) Why the separation of lanthanides are difficult ? Explain one method to separate the lanthanides.

   b) Write an account of transuranium elements and their stabilities.

10. a) What is superconductivity ? Explain BCS theory of superconductivity.

    b) Discuss various methods of synthesis and purification of semiconducting materials.

(5×5=25 Marks)

SECTION – C

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

11. Describe closo, nido and arachno boranes bringing about clearly their topology and their relationships.

12. Explain the use of magnetic susceptibility measurements in the determination of structures of transition metal complexes.

13. What are perfect and imperfect crystals ? Explain point, line and plane defects in crystals. Discuss the thermodynamics of Schottky and Frenkel defects.

14. Describe the various components present in monazite, ilmenite, zircon and siliminite present in the beach sands of Kerala.

15. On the basis of band theory, explain the classification of solids into insulators, conductors and semiconductors.

(10×3=30 Marks)

Reg. No. : .....

Name : .....

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E – 5120

Second Semester M.Sc. Degree Examination, October 2018

Branch : Chemistry

CH/CL/CA/CM 221 : INORGANIC CHEMISTRY – II

(2016 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) Describe the structures of P_4S_7 and P_4S_{10}.

   b) Drive the possible 'styx' numbers for B_4H_{10}.

   c) On the basis of Wade's rule, predict the structure of $C_2B_9H_{13}$.

2. a) Ti^{3+} and Cu^{2+} have same terms and same number of bands but have different magnetic moments.

   b) Explain the increase and decrease in Δ_0 values for $[Fe(H_2O)_6]^{2+} = 10400\ cm^{-1}$; $[Fe(H_2O)_6]^{3+} = 13700\ cm^{-1}$; and $[Co(H_2O)_6]^{2+} = 9300\ cm^{-1}$; $[Co(H_2O)_6]^{3+} = 18200\ cm^{-1}$.

   c) The magnetic moment of $[Mn(CN)_6]^{3-}$ is 2.8 B.M. while the magnetic moment of $[MnBr_4]^{2-}$ is 5.9 B.M. What are the geometries of the complex ions ?

3. a) Why X-rays are used as diffraction gratings for crystal structure determination ?

   b) Calculate the Miller indices of a crystal plane which cut through the crystal axes at (2a, 3b, 2c).

   c) What is the difference between spinel and inverse spinel structures ?

P.T.O.

4. a) Zr and Hf cannot be separated easily. Why ?
   b) Comment on the various oxidation states exhibited by lanthanides.
   c) How f orbitals split in a cubic crystal field ?

5. a) What do you mean by Brillouin zone ?
   b) Explain the effect of temperature on the electrical conductance of (i) metals and (ii) semiconductors. Give reasons.
   c) What are pyroelectrics ? Mention their applications. **(2×10=20 Marks)**

SECTION – B

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

6. a) How stock synthesized borazine ? Describe the synthesis of N-and B-substituted borazines. How borazine reacts with bromine ?
   b) How polythiazyl is synthesized ? Explain its structure. Why it is considered as a one dimensional conductor ?

7. a) How do Tanabe – Sugano diagrams differ from Orgel diagrams ? Draw Tanabe – Sugano diagaram for $[V(H_2O)_6]^{3+}$ and explain the electronic transitions.
   b) Discuss Gouy method for determination of magnetic moment of complexes.

8. a) Discuss with examples point, line and plane defects found in crystals.
   b) Discuss the salient features of covalent, metallic and hydrogen bonded crystals.

9. a) Why the separation of lanthanides is difficult ? Outline the different methods of separation of lanthanides.
   b) Discuss the oxidations states, spectral and magnetic properties of actinides.

10. a) Discuss free electron theory of solids.
    b) Discuss various methods of synthesis and purification of semiconducting materials.

(5×5=25 Marks)

SECTION – C

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

11. What are carboranes ? How carboranes can be converted to metallacarboranes ? Describe the synthesis of metallacarboranes.

12. Explain the applications of magnetic susceptibility measurements for the study of structures of metal complexes.

13. Describe the structures of zinc blende, rutile, nickel arsenide and perosvskite.

14. Write an account of trans-uranium elements and their stabilities.

15. Discuss the band theory of solids and its application in the classification of materials into conductors, semiconductors and insulators ? **(10×3=30 Marks)**

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G – 4476

Reg. No. : .....

Name : .....

Second Semester M.Sc. Degree Examination, July 2019

Branch : Chemistry/Polymer Chemistry

CH/CL/CM/CA/PC 221 : INORGANIC CHEMISTRY – II

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

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) What is Polythiazyl? Give its preparation and structure.

   (b) What is inorganic graphite? Discuss its preparation and uses.

   (c) How is diborane prepared? Give its structure.

2. (a) What are term symbols? Derive the term symbols for d^4 and d^8 ions.

   (b) Why is $[Mn(H_2O_6]^{2+}$ faintly coloured?

   (c) The magnetic moments of $[Ni(CN)_4]^{2-}$ and $[Ni(C1)_4]^{2-}$ are zero and 4.2BM, respectively. Why?

3. (a) Define (i) unit cell and (ii) space lattice.

   (b) When does a crystal said to possess a rotation-inversion axis?

   (c) Define imperfections in crystals. What is atomic imperfection?

P.T.O.

4. (a) Correlate the occurrence of +2 and +4 oxidation states of lanthanides with their electronic configurations.

(b) Lighter actinide ions exhibit broadening of absorption peaks somewhat like the broadening found in transition metal ions. Why?

(c) What is sillimanite? What are its composition and use?

5. (a) What are k space and Brillouin zones?

(b) Explain doping with an example.

(c) What is photovaltic effect? Mention its applications.

(10 × 2 = 20 Marks)

SECTION – B

Answer either **(a) or (b)** of **each** question, and each question carriers **5** marks.

6. (a) Give one method each for the preparation of P_4S_3 and P_4S_{10}. Discuss their structures and uses.

(b) State Wade's rules and discuss with examples.

7. (a) What are charge-transfer transitions? Discuss their types and characteristics.

(b) What do you mean by orbital contribution and quenching of orbital angular moments? In which cases do you expect quenching? Explain with examples.

8. (a) Using suitable examples, explain different close packed structures such as, BCC, FCC and HCP.

(b) How are colour centers formed? Discuss their characteristics.

9. (a) What is lanthanide contraction? Discuss its consequences.

(b) What are trans-uranium elements? Comment on their stabilities. What are their uses?

10. (a) What is Missner effect? How are superconductors classified as Type I and Type II? Give examples.

(b) What is ferroelectric effect? How is it produced? Mention the uses of ferroelectric.

(5 × 5 = 25 Marks)

SECTION – C

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

11. What are cyclophosphazines? Briefly discuss the synthesis, structures and uses of cyclophosphazines with 6-and 8 membered rings.

12. What are Orgel diagrams? How are they constructed? Using specific examples, explain their advantages in interpreting electronic spectra of coordination compounds.

13. Discuss the powder method of X-ray diffraction for crystals structure studies. Show, how 'd' values can be derived from the data.

14. Write notes on:

(a) Use of lanthanide complexes as shift reagents.

(b) Extraction of thorium.

15. What are the postulates of band theory of solids? Discuss the refinements made on simple band theory. What are its merits over free electron theory?

(3 × 10 = 30 Marks)