

Reg. No. :

Name :

Fifth Semester B.Sc. Degree Examination, January 2020

First Degree Programme under CBCSS

Chemistry

Core Course VI

CH 1542 : INORGANIC CHEMISTRY — III

(2014 - 2016 Admission)

Time : 3 Hours

Max. Marks : 80

Answer **all** each carries **1** mark :

1. What is the magnetic behaviour of Cu^+ ion?
2. Acidic character of transition metal oxides _____ with increase in oxidation number.
3. Nickel is purified by _____ process.
4. The number of bridging co present in $\text{Fe}_2(\text{CO})_9$ is _____.
5. What is Zeise's salt?
6. What is the unit of magnetic moment.
7. Give an example for bidentate ligand.
8. What is Zeigler = Natta catalyst?
9. The hybridisation of Xe in XeF_6 is _____.
10. The shape of XeF_4 is _____.

(10 × 1 = 10 Marks)

P.T.O.

Answer any eight :

11. Zn, Cd and Hg are not considered as transition metals. Why?
12. What is lanthanoid contraction? Explain its causes.
13. Among Fe^{2+} and Fe^{+3} which is more paramagnetic and why?
14. State and explain 18 electron rule.
15. Write any two major iron proteins in a normal adult.
16. $2\text{C}_2\text{H}_6 + 2\text{N}(\text{Et})_2\text{H} + \text{FeCl}_2 \rightarrow \xrightarrow{?} + 2[\text{N}(\text{Et})_2\text{H}_2]^+ \text{Cl}^-$.
17. Define the term ligand. Give two examples.
18. Why do tetrahedral complex not show geometrical isomerism.
19. Give an evidence that $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$ are ionisation isomers.
20. Give any two methods for the preparation of B_2H_6 .
21. List the various oxyacids of phosphorous.
22. SiCl_4 is readily hydrolysed but not CCl_4 why?

(8 × 2 = 16 Marks)

Answer any six :

23. Write any four applications of co-ordination compounds.
24. Explain why transition elements exhibit variable oxidation state.
25. Chromium is a typical metal while mercury is a liquid why?
26. Write a note on haemocyanin.
27. What is Ziegler-Natta catalyst? What is it used for?
28. $[\text{CN}(\text{NH}_3)_6]^{3+}$ is paramagnetic while $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic explain why?

29. What are silicones? Give their preparation and uses.
30. Explain lanthanoid contraction.
31. What are interhalogen compounds? Give examples.

(6 × 4 = 24 Marks)

Answer **any two**

32. Explain the extraction of lanthanides from monozite.
33. (a) Briefly discuss the biochemistry of calcium and magnesium.
(b) Discuss the functions of haemoglobin and myoglobin.
34. For the complex $[\text{Fe}(\text{en})_2\text{Cl}_2]\text{Cl}$ identify
- (a) the oxidation number of iron
(b) the hybrid orbitals and shape of the complex
(c) the magnetic behaviour of the complex
(d) name of the complex.
35. (a) What are the different types of glasses? List their uses.
(b) Give an account of zeolites and their uses.

(2 × 15 = 30 Marks)

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First Degree Programme under CBCSS

Chemistry

Core Course

CH 1542 : INORGANIC CHEMISTRY – III

(2017 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Answer in a word/sentence. Each question carries 1 mark.

1. Zn(II), Cd(II) and Hg(II) ions are colourless. Why?
2. What is the most common oxidation state of lanthanides?
3. Sketch the d orbital splitting in square planar complex
4. What is liquation?
5. What is calcination in metallurgy?
6. Why are transition metals mostly used in construction materials?
7. Explain the structure of Zeise's salt?
8. What are cytochromes?

9. Which is the most common ore of iron?

10. What is lanthanide contraction?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions, each question carries **2** marks. (short answer questions)

11. Briefly explain the metallurgy of sodium.

12. Explain the laws of spectrophotometry.

13. The electronic spectra of the lanthanide complexes are sharper in comparison with that of the transition metal complexes. Why?

14. Discuss the structure of dibenzene chromium

15. Briefly explain Scanning Electron Microscopy (SEM).

16. What is the reason for the high spin nature of the tetrahedral complexes?

17. Write a note on the geometrical isomerism in coordination complexes.

18. State and explain 18 electron rule.

19. What are the factors affecting the stability of metal complexes?

20. What are ambidentate ligands? Explain with examples.

21. Calculate the CFSE of the complex $[\text{Co}(\text{NH}_3)_6]^{2+}$.

22. What is the function of cytochrome P450 in human body?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Each question carries **4** marks. (short essay type)

23. Give a short note on Jahn Teller distortion and its consequence.
24. Write a note on the preparation, properties and uses of $K_2Cr_2O_7$.
25. Explain the magnetic properties and complexation behaviour of lanthanides.
26. Discuss the mechanism of oxygen transport in blood.
27. Differentiate between Atomic absorption spectroscopy and Flame emission spectroscopy.
28. Discuss the working of a sodium - potassium pump in biological system.
29. Explain the bonding in complexes using valence bond theory.
30. Briefly explain the biochemistry of magnesium and calcium.
31. Explain the purification of metals by zone refining.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Each question carries **15** marks. (essay type)

32. (a) Explain the application of coordination complexes in qualitative and quantitative analysis. **8**
- (b) Explain the factors affecting crystal field splitting. **7**
33. (a) Write a note on AFM and TEM. **5**
- (b) Mention the applications of organometallic compounds. **5**
- (c) Explain the principle of TG with example. **5**

34. (a) Write a note on the magnetic properties and colour of metal complexes. 5
- (b) Differentiate between haemoglobin and myoglobin in terms of their structure and function. 5
- (c) Explain the structure of iron carbonyls. 5
35. (a) Give a note on the ligand substitution reactions in metal complexes. 5
- (b) What are iron sulphur proteins? 5
- (c) Discuss the classification of organometallic compounds. 5
- (2 × 15 = 30 Marks)**
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First Degree Programme under CBCSS

Core Course

Chemistry

CH 1542 : INORGANIC CHEMISTRY III

(2013, 2015-2016 Admission)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **one** mark.

1. Which is coloured, solution of $TiCl_3$ or $TiCl_4$? Justify your answer.
2. Which is stabler Cu^+ or Cu^{2+} ? why?
3. What is the hybridization and geometry of the complex $[Pt (NH_3)_4]^{2+}$?
4. What are carboranes? Give one examples.
5. How is silicon rubber prepared?
6. Give any one application of coordination compounds in qualitative analysis.
7. What are the important raw materials used for the preparation of glasses.
8. Give two examples of phosphorous based polymers.

P.T.O.

9. What is Bohr effect?
10. What are LNCC? Give one example.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Each question carries **2** marks

11. Why do Zr and Hf display similar properties?
12. Tetrahedral complexes are high spin. Justify?
13. Find out the hybridisation, geometry and predict the magnetic property of the complex $[\text{Co F}_6]^{3+}$.
14. Explain why $[\text{Fe (H}_2\text{O)}_6]^{3+}$ ion is more paramagnetic than $[\text{Fe (CN)}_6]^{3-}$.
15. What are labile and inert complexes?
16. Give the geometry and the structure of the compound ClF_3 .
17. Draw the structures of XeF_2 and XeF_4 .
18. Give one method of preparation of Ni(CO)_4 .
19. What are pseudo halide ions? Give one example.
20. Calculate EAN of the central atom in the following.
 - (a) $\text{K}_4[\text{Fe(CN)}_6]$
 - (b) $[\text{Pt(NH}_3)_6]^{4+}$
21. Boron nitride resembles graphite. Comment on this statement.
22. Explain the function of Na-K pump in biological process.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. Each question carries **4** marks.

23. Explain the behavior of the oxidizing agent KMnO_4 in acidic, basic and neutral solution.
24. Briefly discuss the characteristics of d block elements.
25. What are high spin and low spin complexes? Explain with examples.
26. Illustrate stereo isomerism in coordination compounds using example.
27. Explain the diamagnetic property of ferrocene on the basis of valence bond theory.
28. Explain the role of hemoglobin and myoglobin in biological system.
29. Describe the bonding in metal-alkene complexes.
30. Write a short note on zeolites.
31. Discuss about silicon based polymers.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. Each question carries **15** marks.

32. Compare lanthanides and actinides based on
 - (a) Electronic Configuration
 - (b) Oxidation states
 - (c) Magnetic Properties
 - (d) Spectral properties

33. (a) Explain sigma bonding of octahedral complexes using Molecular Orbital Theory.
- (b) Draw Molecular orbital diagram for $[\text{Co}(\text{NH}_3)_6]^{3+}$ and predict its magnetic property.
34. Define organometallic compounds. Discuss its classification in detail with example for each class.
35. Discuss preparation, properties and bonding in Diborane.

(2 × 15 = 30 Marks)

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Fifth Semester B.Sc. Degree Examination, February 2021.

First Degree Programme under CBCSS

Chemistry

Open Course

CH 1551.2 : FUNDAMENTALS OF CHEMISTRY AND ITS APPLICATIONS
TO EVERYDAY LIFE

(2013, 2015-16 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries 1 mark.

1. What is the shape of water molecule?
2. Write the electronic configuration for carbon atom.
3. Give an example for a nitrogenous fertilizer.
4. Name a common adulterant found in ghee.
5. What is the major constituent of moth balls?
6. Who is the Father of modern chemistry?
7. Which metal exist as a liquid at 0°C?

8. What kind of chemical bonding is present in NaCl?
9. Name an artificial sweetener used in soft drinks.
10. Who proposed the plum pudding model of the atom?

(10 × 1 = 10 Marks)

SECTION - B

Answer **any eight** questions. Each question carries **2** marks.

11. What is a detergent?
12. Define ionization potential.
13. What are soft drinks?
14. What are isotopes?
15. Define valency.
16. What are taste makers?
17. What are food adulterants?
18. Draw the Bohr model for nitrogen atom.
19. Define electronegativity.
20. Elements in the same group show similarities in their properties. Why?
21. What is the major ingredient of household bleach?
22. Among nitrogen and oxygen which has higher ionization potential value? Why?

(8 × 2 = 16 Marks)

SECTION - C

Answer **any six** questions. Each question carries **4** marks.

23. Differentiate between compound and mixture.
24. Explain the formation of ionic bond using a suitable example.
25. What are the major ingredients of firecrackers? Explain the role of each ingredient.

26. Discuss about Rutherford model of atom and its limitations.
27. Write a short note on food preservatives.
28. What are fertilizers? Explain the hazardous due to the use of fertilizers.
29. Discuss about the properties halogen group elements.
30. What is diagonal relationship? Explain.
31. Discuss about the properties of subatomic particles.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **15** marks.

32. Discuss about the salient features of modern periodic table.
33. Give an account on the chemical ingredients and method of action of
 - (a) Match box
 - (b) Shampoo
 - (c) Detergent
34. Discuss about the Bohr theory of atom. What are its merits and demerits?
35. Explain
 - (a) Ionic bond and covalent bond
 - (b) Electrical conductivity of graphite and diamond.

(2 × 15 = 30 Marks)

(Pages : 4)

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Reg. No. :

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Fifth Semester B.Sc. Degree Examination, February 2021

First Degree Programme Under CBCSS

Chemistry

Core Course - VII

CH 1543 — ORGANIC CHEMISTRY - II

(2017 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION - A

(Very short answer type questions)

Answer **all**. Each question carries 1 mark.

1. How does the basicity of primary, secondary and tertiary alkylamines vary?
2. Name the test that is used to identify primary amines.
3. How does methanal react with ammonia?
4. Compare the acidity of methanol, propan-2-ol and phenol
5. Give the method of preparation of coumarin.
6. What is the effect of shielding on delta value of an NMR signal?
7. Which stretching is responsible for the broad band at 3400 cm^{-1} in IR spectrum of aniline?

P.T.O.

8. Name two green solvents.
9. Illustrate Williamson's synthesis with a suitable example.
10. What is an auxochrome?

(10 × 1 = 10 Marks)

SECTION - B

(Short answer questions)

Answer **any eight** questions. **Each** carries **2** marks.

11. Explain with equation how methyl magnesium bromide can be converted into tertiary butylalcohol.
12. How is primary, secondary and tertiary alcohols distinguished?
13. Explain the term λ_{\max} in terms of UV-visible spectroscopy.
14. What is meant by finger print region in an IR spectrum of an organic molecule?
15. How can phenol be converted to parabromophenol?
16. Give one example for an ultrasonicated reaction that can be carried out in acid medium.
17. Illustrate Schotten Baumann reaction with a suitable example.
18. What is Kolbe Schmidt reaction?
19. What is meant by haloform test?
20. What is meant by base peak in mass spectroscopy?
21. What is meant by green synthesis?
22. What are the conditions for a molecule to be IR active?

(8 × 2 = 16 Marks)

SECTION – C

(Short essay questions)

Answer **any six** questions. **Each** question carries **4** marks.

23. Mention the differences between phenols and alcohols.
24. How is benzene sulphonic acid converted to p- nitro phenol?
25. How can aniline be converted to p-bromoaniline?
26. Sketch the ^1H NMR spectrum of ethanol.
27. Illustrate the following reactions with mechanism
 - (a) Reimer-Tiemann reaction
 - (b) Claisen condensation.
28. Discuss the method of separation of three kinds of amines.
29. How is aniline converted into Phenyl carbylamine? Give the mechanism.
30. Give the name and mechanism of the reaction that you would adopt for the conversion of normal butyl amine to 1-butene.
31. Illustrate, with an example each, two different nucleophilic addition reactions undergone by aldehydes and ketones.

(6 × 4 = 24 Marks)

SECTION – D

(Long essay questions)

Answer **any Two**. **Each** question carries **15** marks.

32. Discuss the principles of green chemistry. **(15)**
33. Discuss the mechanism of the following reactions.
 - (a) Cannizzaro reaction
 - (b) Fries rearrangement
 - (c) Benzidine rearrangement

(3 × 5 = 15 marks)

34. Discuss :

(a) Zeisel's method of estimation of methoxy group.

(b) Crown ethers. How are they named? Mention their applications.

(c) The synthetic applications of benzenediazonium chloride.

(3 × 5 = 15 marks)

35. (a) Illustrate two microwave assisted reactions, one each in organic solvent and in water.

(b) Define atom economy of a synthetic reaction. Explain its significance with a suitable example.

(c) Explain the splitting of a signal into multiplets due to spin-spin coupling taking the example of NMR spectrum of ethyl chloride.

(3 × 5 = 15 marks)

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Fifth Semester B.Sc. Degree Examination, February 2021

First Degree Programme Under CBCSS

Chemistry

Core Course VII

CH 1543 : PHYSICAL CHEMISTRY II

(2013, 2015-16 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. (Each question carries 1 mark)

1. State Third law of thermodynamics.
2. Define ensemble.
3. What is meant by critical micelle concentration?
4. What is photoelectric effect?
5. What is the energy expression of a particle in a 1D box?
6. How is the energy of radiation related to its wavelength?
7. In which region are the vibrational spectra of molecules obtained?
8. Write the equation. relating magnetic susceptibility and magnetic field strength.

P.T.O.

9. How many signals do the protons of TMS exhibit in its NMR spectrum?
10. Define dipole moment.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type (Answer **any eight** questions, Each question carries **2** marks)

11. CO is an exception to III law of thermodynamics. Explain.
12. Write the expression for internal energy in terms of partition function.
13. Explain Hardy-Schulz rule.
14. Distinguish between a true solution and colloid.
15. Write Schrodinger equation and explain the terms.
16. Write the expression for energy and wave function of a particle in a 3D box.
17. What is the energy of radiation with wavelength 800 nm.
18. Calculate the reduced mass of HCl, [H = 1.008; Cl = 35.45]
19. Explain the term Stoke's and antistoke's lines in Raman spectroscopy.
20. Define molar extinction coefficient.
21. Distinguish between diamagnetic substance and paramagnetic substance.
22. Para dichlorobenzene molecule have zero dipole moment. Why?

(8 × 2 = 16 Marks)

SECTION - C

Short essay type (Answer **any six** questions, Each question carries **4** marks)

23. Derive the expression for internal energy in term of partition function.
24. Define ensembles and explain the different types of ensembles.
25. Diagrammatically represent different vibrational modes of CO₂. Classify them as IR active and IR inactive modes.
26. Write down the Schrodinger Wave equation for hydrogen atom in Cartesian and spherical polar co-ordinates and explain the terms.
27. Given that the force constant for the H - Cl bond is 482.08 N m⁻¹. Calculate the fundamental vibrational frequency in s⁻¹.
28. Explain the term spin -spin coupling in NMR spectroscopy.
29. What is spin only magnetic moments? Calculate the spin only magnetic moment of Chromium atom.
30. Explain the application of colloids.
31. Write the Clausius -Mosotti equation and explain the terms.

(6 × 4 = 24 Marks)

SECTION - D

Essay type (Answer **any two** questions. Each Question carries **15** marks)

32. (a) Evaluate absolute entropy of a gas using third law of Thermodynamics.
(b) Explain the kinetic and optical properties of colloids.

33. Describe briefly the principle of vibrational spectroscopy. What are its applications?
34. (a) Derive the expression for energy and wave function of a particle in a one dimensional box.
(b) Calculate the energy of an electron confined in a box of 10 nm length.
35. Write notes on (a) Parachor (b) Chemical shift (c) Dipole moment and molecular structure.

(2 × 15 = 30 Marks)

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Fifth Semester B.Sc. Degree Examination, February 2021

First Degree Programme Under CBCSS

Chemistry

Core Course

CH 1541 : PHYSICAL CHEMISTRY – I

(2018 Admission – Regular)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer all questions. One word type. Each question carries 1 mark.

1. What will happen to the most probable velocity of a gas when the temperature is increased?
2. Which gas has the lowest critical temperature?
3. What is the SI unit of vander Waal's?
4. How many numbers of crystal systems exist in nature?
5. How many numbers of atoms in the unit cell of face centred cubic lattice?
6. What is the SI unit of coefficient of viscosity?
7. Liquids with high intermolecular forces have high viscosity. Explain.

P.T.O.

8. What will happen to vapour pressure of solution when a non-volatile solute is dissolved in a solvent?
9. When 5KJ of work is done on the system and 1KJ is given out by the system what will be ΔU ?
10. What is the point group of boat form of cyclohexane?

(10 × 1 = 10 Marks)

SECTION – B

Answer **any eight** questions. Short answer type. Each question carries **2** marks.

11. Define root mean square velocity of a gas.
12. What is meant by the Boyle Temperature of a gas?
13. At what temperature will the RMS velocity of O_2 gas be equal to that of H_2 molecule at $27^\circ C$
14. Under what conditions does a real gas approach ideal behaviour?
15. What is the Joule-Thomson coefficient for an ideal gas?
16. What do you mean by smectic liquid crystal?
17. What do you mean by abnormal molecular mass?
18. Explain why the addition of a non-volatile solute increases the boiling point of a liquid?
19. Show that $C_p - C_v = R$ for one mole of an ideal gas.
20. Define efficiency of heat engine.
21. How is entropy of fusion of a substance related to enthalpy of fusion?
22. List out the symmetry elements of the C_{2v} point group.
23. Write down the expression for interplanar spacing (d_{hkl}) of a cubic unit cell.

24. What is molal elevation constant?
25. Define entropy.
26. What are colligative properties?

(8 × 2 = 16 Marks)

SECTION – C

Answer **any six** questions. Short essay type. Each question carries **4** marks.

27. Explain the structure of NaCl.
28. Derive Bragg's equation.
29. Acetic acid associates to form double molecules. 1.65 g of acetic acid when dissolved in 100g of benzene raised the boiling point by 0.36°C. Calculate Van't Hoff's factor and degree of association of acetic acid in benzene.
30. Explain the molecular mass determination by Beckmann's method.
31. Explain the entropy criteria for reversible and irreversible process.
32. Derive the relation : $dG = VdP - SdT$.
33. Derive the Gibbs - Duhem equation.
34. Explain fugacity and its determination by graphical method.
35. Define the term Gibb's free energy? What is its physical significance?
36. Explain the Swam theory of liquid crystal.
37. Explain the non-stoichiometric defects in crystals.
38. What are critical constants of a gas? How would you determine them?

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. Long essay type, Each question carries **15** marks.

39. Derive the expression connecting the Joule-Thomson coefficient and inversion temperature with van der Waals constants.
40. (a) State and illustrate the Hess's law of constant heat summation.
(b) Explain two applications of Hess's law.
(c) The standard enthalpy of reaction for the hydrogenation of ethylene (C_2H_4) to ethane (C_2H_6) is -136.8 KJ/moles. The standard enthalpy of formation of ethane is -84.4 kJ/moles. Calculate the standard enthalpy of formation of ethylene?
41. (a) Explain the different types of point defects in crystals.
(b) Explain the powder method for crystal structure determination?
42. (a) Discuss the different classes of liquid crystals with suitable examples.
(b) Explain the different characterization techniques of liquid crystals.
43. (a) Derive the Gibbs Helmholtz relation and its significance.
(b) Construct the group multiplication table for C_{2v} point group.
44. (a) Explain the different types of colligative properties exhibited by dilute solutions.
(b) Discuss the method of determination of molecular mass by Rast's method.

(2 × 15 = 30 Marks)