

14. (a) Explain the neutron diffraction experiment. (6)

Or

- (b) Explain the VB theory of metallic bonding. (6)

15. (a) Explain free electron theory of metallic bonding. Mention its failures. (10)

Or

- (b) Describe the crystal structure of rutile and rock salt. (10)

1729/MC1/PCHE01

NOVEMBER 2016

INORGANIC CHEMISTRY – I

Time : Three hours

Maximum : 100 marks

Answer ALL the questions.

UNIT I

1. (a) State the Pauling – Slater refinements. (2)
- (b) Define bond order. Give an example. (2)
2. (a) Write the properties of ionic compounds. (6)

Or

- (b) Write note on Bonding in simple tri atomic molecules. (6)
3. (a) State the VSEPR theory. Explain the shapes of molecules by using VSEPR theory. (10)

Or

- (b) What is lattice energy? How is it calculated by Born-Landé equation? (10)

UNIT II

4. (a) Why do Mn^{2+} high spin octahedral complexes obey spin only formula very closely? (2)
- (b) Which one has higher magnetic moment? $\text{Fe}(\text{CN})_6^{3-}$ or FeF_6^{3-} . Justify your answer. (2)
5. (a) Write a note on orbital quenching. (6)

Or

- (b) Write about the spin-orbit coupling on magnetic moments. (6)
6. (a) Explain the effects of lanthanide contraction. (10)

Or

- (b) Discuss the position of lanthanides and actinides in the periodic chart of elements. (10)

UNIT III

7. (a) Give equations for auto ionisation of N_2O_4 . (2)
- (b) Whether HF is a protic or aprotic solvent? (2)
8. (a) Give an account of solutions of alkali metals in liquid ammonia. (6)

Or

- (b) Write a short notes on symbiosis. (6)

9. (a) Write any three reactions of liquid NH_3 . (10)

Or

- (b) State and explain HSAB principle with examples. (10)

UNIT IV

10. (a) Predict the magnetic moment of ^{15}N . (2)
- (b) D^2 is stable but dineutrons or diprotons do not exist. (2)
11. (a) Calculate radius, volume, molar volume and density of $^{31}_{15}\text{P}$. (6)

Or

- (b) Discuss the power projects in India. (6)
12. (a) Give the salient features applications and limitations of liquid drop model. (10)

Or

- (b) Discuss the applications of radio active in industry and agriculture fields. (10)

UNIT V

13. (a) What is point group? (2)
- (b) What do you mean by space lattice? (2)

- (b) Write any two examples and explain the E and Z-notation. What is the advantage of this system over cis and trans system of notation? (6)

12. (a) Define the term asymmetric synthesis and state and illustrate Cram's rule of asymmetric induction. (10)

Or

- (b) Give an account of generation and detection of free radicals. (10)

UNIT V

13. (a) Give a method of preparation for oxazole and thiazole. (2)

- (b) Illustrate pechmann synthesis of coumarins. (2)

14. (a) Illustrate the methods of synthesis of flavones. (6)

Or

- (b) Discuss the chemistry of apigenin. (6)

15. (a) Discuss the structural elucidation of uric acid. (10)

Or

- (b) What are the chemical evidences which go to prove the structure of caffeine? Give a method of synthesis. (10)

1730/MC2/PCHE02

NOVEMBER 2016

ORGANIC CHEMISTRY — I

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) What do you understand by term "negative hyper conjugation"? (2)

- (b) Aniline is less basic than methylamine. Explain. (2)

2. (a) Discuss how Craig's rule can be applied to determine aromaticity. (6)

Or

- (b) Explain with suitable examples how steric effects influences the acidity and basicity of organic compounds. (6)

3. (a) Discuss the various factors that affect the acidity of organic compounds with suitable examples. (10)

Or

- (b) Write a note on the aromaticity of the following compounds.

- (i) Azulene
- (ii) Annulenes
- (iii) Cyclopenta-dienyl anion. (10)

UNIT II

4. (a) Explain why carboxylic acids cannot be esterified in basic media. (2)
- (b) What is isoinversion? Explain. (2)
5. (a) How would you distinguish between S_N^1 and S_N^2 mechanisms on basis of stereochemical studies?

Or

- (b) Write a note on S_E^1 mechanism. (6)
6. (a) Write note on the following.
- (i) Ambident nucleophiles.
 - (ii) S_N^i mechanism.
 - (iii) S_N^{Ar} mechanism. (10)

Or

- (b) Discuss the various mechanisms encountered during the hydrolysis of esters under acid/base catalytic conditions. (10)

UNIT III

7. (a) With a suitable example write the steps involved in E_1 mechanism. (2)
- (b) List out the characteristic features of pyrolytic eliminations. (2)
8. (a) Discuss briefly on various mechanisms of β -elimination. (6)

Or

- (b) With appropriate examples write a note on Bredt's rule. (6)
9. (a) Discuss on the preparation and synthetic applications of Grignard reagents and lithium dimethyl cuprate. (10)

Or

- (b) Illustrate the mechanism and applications of Wittig reaction and its modification. (10)

UNIT IV

10. (a) State and illustrate the relationship between substrate symmetry and chirality. (2)
- (b) How will you distinguish asymmetric and dissymmetric molecules? (2)
11. (a) Illustrate the optical isomerism exhibited by biphenyl, allenes and spiranes. (6)

Or

UNIT V

13. (a) Write the need of approximation methods. (2)
(b) What is meant by SCFAO? (2)
14. (a) State and prove variation theorem. (6)

Or

- (b) Discuss the perturbation treatment of helium atom. (6)
15. (a) Derive the eigen values of $\hat{L}^2$. (10)

Or

- (b) Solve the Schrodinger equation for hydrogen like atoms. (10)

1731/MC3/PCHE03

NOVEMBER 2016

PHYSICAL CHEMISTRY — I

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) Explain the significance of the free energy functions A and G. (2)
(b) Show that an ideal gas has zero internal pressure. (2)
2. (a) Derive the Gibbs-Duhem equation. (6)

Or

- (b) Discuss the third law of thermodynamics. (6)
3. (a) Derive the four Maxwell's relations. (10)

Or

- (b) Give an account of partial molar properties. (10)

UNIT II

4. (a) Define Debye-Huckel constants A and B. (2)
(b) State Debye-Huckel limiting law and explain. (2)

5. (a) What are asymmetry and electrophoretic effects? Explain. (6)

Or

- (b) How are electrodes classified? Give examples. (6)

6. (a) Derive Butler-Volmer equation for an electrode process involving one electron transfer and deduce Tatal equation. (10)

Or

- (b) Discuss the theory of corrosion. How is corrosion prevented? (10)

UNIT III

7. (a) What is steady state approximation? How does it simplify the reactions scheme? (2)

- (b) What you mean by the primary and secondary salt effects? Illustrate with examples. (2)

8. (a) Explain the origin of lower and upper explosion limits in the H_2O_2 reaction. (6)

Or

- (b) Compare the ARRT and collision theory of reaction rates. (6)

9. (a) Explaining the general principle involved in the flow techniques, describe a suitable experimental method of determining the rate constant for the reaction. (10)

Or

- (b) Discuss briefly principles, salient features, experimental details and important applications of crossed molecular beam technique. (10)

UNIT IV

10. (a) What do you mean by a black body? (2)

- (b) What is normalisation? (2)

11. (a) Using plank's law devine the Wein's law. (6)

Or

- (b) Write note on photoelectric effect. (6)

12. (a) Discuss the postulates of quantum mechanics. (10)

Or

- (b) Write down the Schrodinger wave equation for a rigid rotor and solve it. (10)

UNIT V

13. (a) How is Beer's law deviated? (2)
(b) What are the factors affecting fluorescence? (2)
14. (a) How is vanadium determined in lubricating oil? (6)

Or

- (b) How is trace lead determined in a ferrous alloy? (6)
15. (a) Discuss the applications of DTA. (10)

Or

- (b) Discuss the theory and applications of emission spectroscopy. (10)

1732/MC4/PCHE04

NOVEMBER 2016

ANALYTICAL CHEMISTRY

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) Define chemical shift. (2)
(b) Mention the selection rule for IR spectroscopy. (2)
2. (a) Discuss the principles of UV spectroscopy. (6)

Or

- (b) Discuss the characteristics of functional group vibrations. (6)
3. (a) Write note on the following: (i) off resonance decoupling (ii) Shift reagents. (5+5)

Or

- (b) Compare the H-I and C-13 NMR spectroscopy. (10)

UNIT II

4. (a) What is mass spectrum? Give an example. (2)
(b) State the axial haloketone rule. (2)
5. (a) State and explain octant rule. (6)

Or

- (b) Write note on the adsorption chromatography. (6)
6. (a) Discuss the theory and applications of TLC. (10)

Or

- (b) Describe the theory and applications of paper chromatography. (10)

UNIT III

7. (a) Define over voltage. (2)
(b) What are amperometric titrations? (2)
8. (a) Write note on the potentiometric titration. (6)

Or

- (b) With a neat sketch of a polarogram, bring out the important features of polarograms. (6)

9. (a) Describe the construction and working of glass electrode. (10)

Or

- (b) Write briefly about: (10)
(i) Tadel's equation
(ii) Butler – volmer equation.

UNIT IV

10. (a) Mention any four comparison operators. (2)
(b) Mention any two methods of selecting a cell. (2)
11. (a) How is Excel solver used to optimize a polynomial equation? (6)

Or

- (b) How can a spread sheet be developed for a potentiometric titrations? (6)
12. (a) Discuss the various formatting and charts in Excel. (10)

Or

- (b) Describe the statistical functions and referencing cells in Excel. (10)

UNIT V

13. (a) State the electrovalence rule. (2)
(b) Give the structure of $B_{10}C_{12}H_{12}$. (2)
14. (a) What are Keggin – type and Anderson – type heteropoly anions? Explain. (6)

Or

- (b) What are carboranes? How are they prepared? (6)
15. (a) Explain the structures of the following :
(i) Talc
(ii) Pyrophyllite. (5 + 5)

Or

- (b) (i) What are clathrates? Explain.
(ii) Write a note on Metal – only clusters. (5 + 5)

1733/MC5/PCHE05

NOVEMBER 2016

INORGANIC CHEMISTRY – II

Time : Three hours

Maximum : 100 marks

Answer ALL the questions.

UNIT I

1. (a) What are Laport and spin-forbidden transitions in electronic spectroscopy? (2)
(b) Write a brief note on stabilization of unusual oxidation states of metal ions by complexation. (2)
2. (a) Give an example of linkage isomerism. How will you distinguish between the isomers. (6)

Or

- (b) Explain the terms Nephelauxetic effect and nephelauxetic ratio. What is the significance of nephelauxetic effect? (6)
3. (a) List out the evidences of M – L covalency. (10)

Or

- (b) Explain the formation of $[CoF_6]^{3-}$ and $[Fe(CN)_6]^{4-}$ using MOT and CFT. (10)

UNIT II

4. (a) Write a note on kinetic stability and thermodynamic stability. (2)
(b) $[\text{Cu}(\text{en})_3]^{2+}$ – The formation of this complex is not observed in solution. Explain. (2)
5. (a) Account for the stability of a chelate complex. (6)

Or

- (b) Rationalize the fact that stability increases in the order $[\text{Co}(\text{NH}_3)_6]^{3+} < [\text{Co}(\text{en})_3]^{3+} < [\text{Co}(\text{dien})_2]^{3+}$. (6)
6. (a) Discuss the Job's method of determining stability constant of a complex. (10)

Or

- (b) Describe the mechanisms of $\text{S}_{\text{N}}1$, $\text{S}_{\text{N}}2$ and $\text{S}_{\text{N}}1\text{CB}$. (10)

UNIT III

7. (a) Why are Nickelocene, Cobaltcene are unstable? (2)
(b) Give the structure of trimethyl platinum? (2)
8. (a) Discuss the various types of acetylene complex. (6)

Or

- (b) Write notes on complexes involving extended pi-system. (6)

9. (a) What is fluxional behaviour of molecules? How will you find it? Explain it with examples. (10)

Or

- (b) Discuss the use of IR spectra in metal carbonyls. (10)

UNIT IV

10. (a) eT bands are more intense than d-d transitions. Why? (2)

- (b) Why Auger spectrum is not possible for H and He? (2)

11. (a) Write note on charge transfer spectra. (6)

Or

- (b) Explain UPS of O_2 and N_2 molecule. (6)

12. (a) Discuss the applications of MB spectrum. (10)

Or

- (b) Calculate the 10Dq and β for Co (II) and Ni (II) octahedral complexes. (10)

12. (a) Discuss the mechanism of oxidation of glycols by any two suitable reagents in organic chemistry. (10)

Or

- (b) Compare the mechanistic aspects of prevost and Woodward hydroxylation. (10)

UNIT V

13. (a) What happens when α -terpene is treated with alcoholic sulphuric acid? (2)
(b) Write down the structure of maltose and indicate the reducing and non-reducing parts. (2)
14. (a) Outline the various stages involved in the formation of meralonic acid from acetyl coenzyme A. (6)

Or

- (b) Write note on the amino sugars. (6)
15. (a) Elucidate the structure of Camphor. (10)

Or

- (b) Give a precise account of polysaccharides. (10)

1734/MC6/PCHE06

NOVEMBER 2016

ORGANIC CHEMISTRY – II

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) What is cis elimination? Give an example. (2)
(b) Explain the E_2 elimination. (2)
2. (a) Discuss the mechanism of Wagner-Meerwein rearrangement. (6)

Or

- (b) Describe the mechanism of Fries rearrangement.
3. (a) Discuss the mechanism of the following :
(i) Hofmann rearrangement
(ii) Curtius rearrangement. (5+5)

Or

- (b) Discuss the conformation and reactivity of cyclohexane derivatives. (10)

UNIT II

4. (a) What is photostationary state? Illustrate with an example. (2)
- (b) Define conrotatory and disrotatory motions. (2)
5. (a) Distinguish between the thermal and photochemical reactions. (6)

Or

- (b) Write the help of Woodward Hoffmann rules, discuss the stereochemical course of cyclisation of 1,3,5-hexatriene. (6)
6. (a) What are the properties of an excited state? Explain the various unimolecular and bimolecular photophysical processes.

Or

- (b) Discuss the common reactions of excited ketone. (10)

UNIT III

7. (a) Write any two problems for the synthesising any organic compound. (2)
- (b) What is activating group? Explain. (2)

8. (a) Discuss the Umpolung synthesis. (6)

Or

- (b) Give an account of Robinson annelation. (6)

9. (a) Describe the uses of activating and blocking groups in synthesis. (10)

Or

- (b) Discuss the stereoselective problems of geometrical and optical isomerism. (10)

UNIT IV

10. (a) What happens to KMnO_4 when it is added to benzene in the presence and the absence of 18-crown-6? (2)

- (b) How will you get cyclopropane from 1, 1-dibromocyclopropane. (2)

11. (a) Epoxidation with peroxy acids are highly stereoselective — Explain with a suitable example. (6)

Or

- (b) Discuss the mechanism of Clemmenson reduction. (6)

13. (a) Write a note on tacticity of polymers. (2)
(b) What are industrial polymers? (2)
14. (a) Distinguish between chain and step polymerisation. (6)

Or

- (b) Explain the basics for the manufacture of LDPE and HDPE. (6)
15. (a) Discuss the mechanism and the kinetics of vinyl radical polymerisation. (10)

Or

- (b) Describe the viscometry method of determining molecular weight of a polymer. (10)

1735/MC7/PCHE07

NOVEMBER 2016

PHYSICAL CHEMISTRY — II

Time : Three hours

Maximum : 100 marks

Answer ALL the questions.

UNIT I

1. (a) What is meant by order of a group? Indicate the relationship between sub groups and main group with examples. (2)
- (b) State any two theorems related to direct products. (2)
2. (a) State and explain the great orthogonality theorem. (6)

Or

- (b) Construct the character table for C_{3v} point group. (6)
3. (a) Explain the following :
- (i) Determination of point group of a molecule.
- (ii) Direct product. (5 + 5)

Or

- (b) Discuss the group theoretical analysis of IR and Raman active vibrations of molecule. (10)

UNIT II

4. (a) Distinguish between parallel and perpendicular vibrations. (2)
(b) What are the characteristics of Raman lines? (2)
5. (a) State and explain the Born-Oppenheimer approximation. (6)

Or

- (b) Discuss the EPR spectra of C_u and M_n complexes. (6)
6. (a) Discuss the theory of rotational spectroscopy. (10)

Or

- (b) Discuss the principles and theory of NMR spectroscopy. (10)

UNIT III

7. (a) Derive the Gibbs equation. (2)
(b) Distinguish between micelle and reverse micelle. (2)
8. (a) Explain the BET isotherms. (6)

Or

- (b) Define the following :
(i) Surfactants
(ii) Kelvin equation
(iii) Micro emulsions. (2 + 2 + 2)

9. (a) Discuss the mechanisms of the following :

- (i) Langmuir-Hinshelwood
(ii) Langmuir-Rideal. (5 + 5)

Or

- (b) Distinguish between the physical and chemical adsorption. (10)

UNIT IV

10. (a) What are canonical ensembles? (2)
(b) The quantum yield for some reaction is less than 1 and for some reaction it is very much larger than 1 - why? (2)
11. (a) Discuss in detail the different types of delayed fluorescence. (6)

Or

- (b) Explain the reactions of hydrated electron. (6)

12. (a) Derive Stern-Volmer equation. Write its also applications. (10)

Or

- (b) Compare the Fermi-Dirac, and Bose-Einstein statistics. (10)

12. (a) Describe the structure of carboxypeptidase A. What is its function? Critically analyze its selectivity and the underlying reaction mechanism. (10)

Or

- (b) What do you mean by non-heme proteins? Indicate some of the non-heme proteins and their functions. (10)

UNIT V

13. (a) What is anabolism and catabolism? (2)
(b) Explain the term "limit cycle behaviour". (2)

14. (a) Explain the terms COSY and NOESY in NMR spectra. (6)

Or

- (b) What is oxidative phosphorylation? Explain. (6)

15. (a) Discuss the concepts that form the basis for host-guest chemistry. (10)

Or

- (b) Give an account of supramolecular photochemistry. (10)

1736/MC8/PCHE08

NOVEMBER 2016

CHEMISTRY OF BIOMOLECULES

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) Amino acids are amphoteric in nature. How? (2)

- (b) Differentiate between nucleoside and nucleotide. (2)

2. (a) How is a peptide synthesized using C and N protecting groups? (6)

Or

- (b) Explain the Koshland's induced fit model. (6)

3. (a) Give a detail account of genetic code. (10)

Or

- (b) Discuss the various structures of proteins. (10)

UNIT II

4. (a) What is the effect of the deficiency of the following vitamins : (2)
- (i) A_1
 - (ii) B_1
 - (iii) B_2
 - (iv) C.
- (b) What happens when adrenaline is fused with KOH? (2)
5. (a) Give the synthesis of Vitamin A_1 . (6)

Or

- (b) Elucidate the structure of the pyrimidine fragment of vitamin B_1 . (6)
6. (a) Discuss the structure of Vitamin B_2 . (10)

Or

- (b) Give suitable chemical evidences to establish the followings :
- (i) Vitamin A, has β -ionine ring system
 - (ii) Ascorbic acid contains η -lactose ring and not δ -lactose
 - (iii) Vitamin E_1 is a chroman derivative and not Coumaran derivative. (10)

UNIT III

7. (a) State the functional nature of oxygen in alkaloids. (2)
- (b) How are antibodies classified? (2)
8. (a) How will you bring out the following conventions : (6)
- (i) Diosgenin $\rightarrow$ progesterone
 - (ii) Estrone $\rightarrow$ Estriol.
- Or
- (b) Give the synthesis of quinine. (6)
9. (a) Establish the structure of norcotine. (10)

Or

- (b) Adduce chemical evidence for the size of Ring A of cholesterol. (10)

UNIT IV

10. (a) Why are electron transport rates faster in iron-sulphur protein? (2)
- (b) What is metallothionein? Give one example. (2)
11. (a) Discuss the important biological activities of alkyl cobalamins. (6)
- Or
- (b) Specify the role of manganese in photosynthesis. (6)