



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry

Paper: I-A Physical Chemistry (Special)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q.1. What are tracers? Discuss their principle and applications. (25)
- Q.2. What is radioactivity? Discuss the kinetics of disintegration of a radioactive substance. Prove that half -life period of radioactive substance is independent of initial number of atoms. (25)
- Q.3. Discuss the Eley-Rideal mechanism of catalytic reaction of two gases on solid surface. (25)
- Q.4. Explain osmosis and osmotic pressure. How would you determine the molecular weight of macromolecules by Osmometry. (25)
- Q.5. What are emulsions? Give classification of emulsions. How can you identify W/O and O/W emulsions? (25)
- Q.6. What is SOL? Give classification of SOL. Discuss electrical properties of SOL in detail. (25)
- Q.7. Write short notes on any **TWO** of the following: (25)
- (i) Kinetics of enzyme catalysis
 - (ii) Electro-osmosis
 - (iii) Emulsifiers



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: I-B Inorganic Chemistry (Special)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q. No.1** a) Explain the use of d-orbitals in pi bonding. 12
b) What are the specific characteristics of organic reagents to be used in gravimetric analysis? 13
- Q. No.2** a) Explain the correlation diagram for explaining the structure of triatomic molecules. 10
b) What are Cage compounds? Discuss the cage compounds of Phosphorus. 15
- Q. No.3** a) Discuss the chemistry of Dimethylglyoxime. 08
b) What are the Periodic anomalies of the non metals and post transition metals. 10
c) What are the applications of Plasma spectroscopy in various fields of life? 07
- Q. No.4** a) What are the types of stability? Explain any one of them with mathematical interpretation? 10

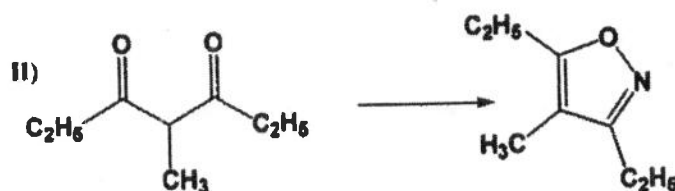
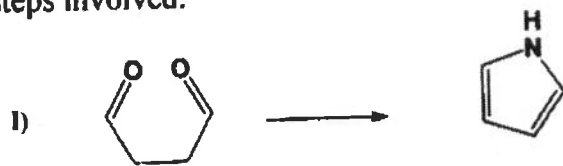
- b) How organic reagents can be classified on various basis? Explain with examples. 10
- c) Write a short note on Ultramarines. 05
- Q. No.5
- a) What are Silicates? How are they classified? Give their formulae and structures. 10
- b) What is the principle of Atomic Absorption Spectrophotometer? Discuss the instrumentation of AAS. 15
- Q. No.6
- a) How the Entropies of solids and vapours can be estimated? 10
- b) Briefly describe different types of burners used in Atomic Spectroscopy. 15
- Q. No.7 Write note on any TWO of the followings: 2x12.5 =25
- i. Use of organic reagents in spectrophotometric analysis
 - ii. Principle and instrumentation of ICP
 - iii. Lattice Energy calculations for sodium chloride lattice by Born Haber Cycle



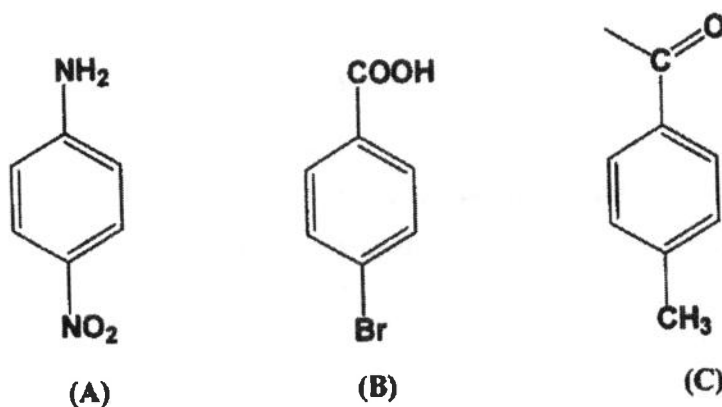
NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q.1. A) At which position does the substitution occur for the following reaction? Explain your answer and give one example for each case. [10]
- Electrophilic substitution reaction of Pyrrole.
 - Electrophilic substitution reaction of Pyridine.

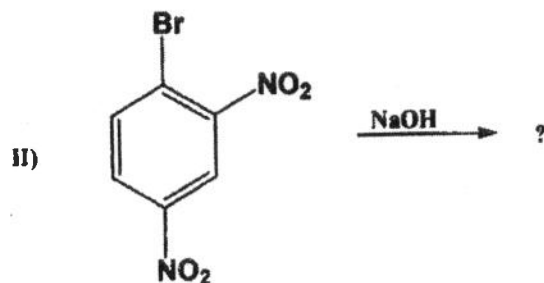
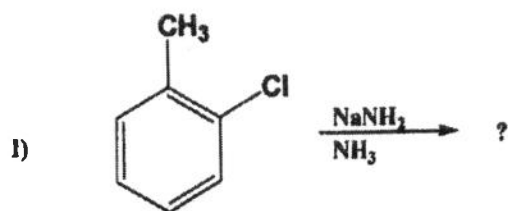
- B) How can you bring about following conversions? Write complete mechanism for all the steps involved. [10]



- Q.2. A) Outline all steps with mechanisms involved in the synthesis of following compounds from benzene. [12]

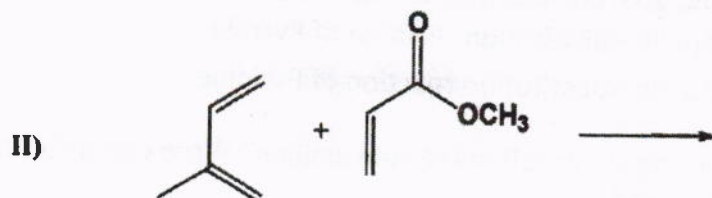
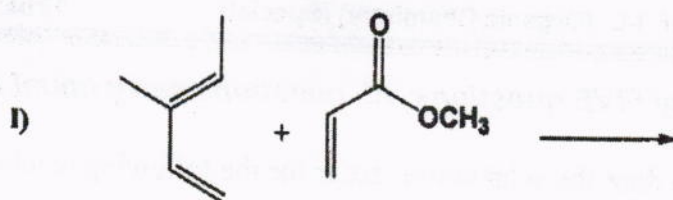


- B) Complete the following reactions and draw mechanisms for all steps involved. [8]

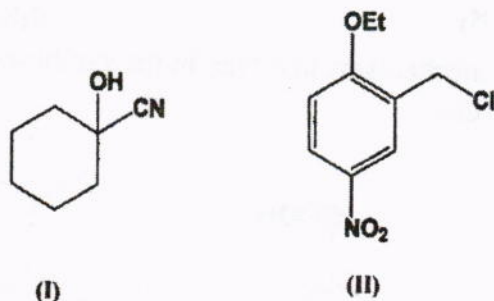


- Q.3. A) By using energy level correlation diagram how can you explain that thermal electrocyclic reactions involving $4n+2$ electrons proceed in a disrotatory fashion while photochemical electrocyclic reactions involving $4n+2$ electrons proceed in a conrotatory fashion? [10]
- B) By using frontier molecular orbital approach (FMO), explain the thermal and photochemical [1, 5] alkyl shift. [6]

- C) Draw the all possible products of following cycloaddition reactions and indicate the major product? [4]

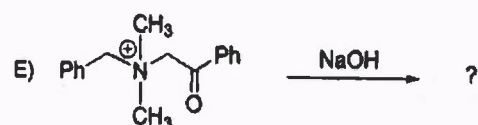
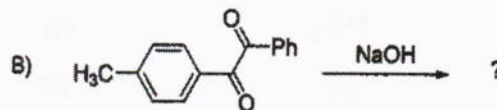
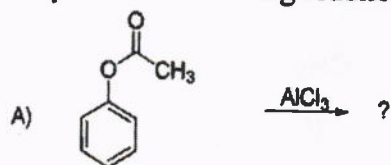


- Q.4. A) What is phase transfer catalysis? How the quaternary ammonium salts work as phase transfer catalysts? [5]
 B) What are cheletropic reactions? Give two examples. [5]
 C) How can we synthesize peptides by using solid phase synthesis? Give one example. [10]
- Q.5. A) What are protecting groups? Describe the addition and removal of three different protecting groups for amines. [10]
 B) Suggest a retrosynthetic analysis and synthesis for each of the following target molecules. [6]

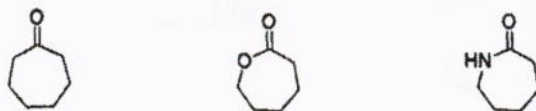


- C) What is aza Wittig reaction? Draw complete mechanism. [4]

- Q.6. Complete the following reactions and draw their mechanisms. [5 x 4 = 20]



- Q.7. A) Explain why aryl groups have far greater migratory aptitude than alkyl groups and hydrogen in Wagner-Meerwein rearrangement? [3]
 B) How will you synthesize the following compounds from cyclohexanone? Write complete mechanism for each step involved. [12]



- C) What is Favorskii rearrangement? Give mechanism and one example. [5]
- Q.8. A) Explain the structure of singlet carbene and triplet nitrene. [5]
 B) What are different methods to generate carbene? [5]
 C) Describe the Hantzsch synthesis of Pyridine. [10]
- Q.9. A) What is Arndt-Eistert Synthesis? Draw complete mechanism of all steps. [10]
 B) What is hydroboration? Explain with mechanism. [5]
 C) Give mechanism and example of [2, 3] wittig rearrangement. [5]



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: I-D: Bio-Chemistry (Special)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FIVE questions. All questions carry equal marks.

1. a) Discuss briefly oxidative phosphorylation and regulation of ATP production. (12)
b) Give an account of biosynthesis of Palmitic acid. (8)
2. a) Describe glycolysis in detail and give an account of energy yield in each step of this process. (12)
b) Describe the digestion and absorption of carbohydrates. (8)
3. Explain the biosynthetic steps along with their enzymes involved in the formation of Inosine monophosphate (IMP) and how it converted into AMP and GMP. (12+8)
4. a) Describe the essential amino acids with examples? Briefly explain the biosynthesis and degradation of amino acids. (3+12)
b) Describe the digestion and absorption of proteins (5)
5. Explain the chemistry, synthesis and biological function of hormone which related with diabetes mellitus and produced in pancreas. (20)
6. a) Describe the step wise synthesis of pyrimidine nucleotide. (10)
b) Explain the role of electron transport chain in ATP synthesis in a living organism. (10)
7. a) Describe briefly the β -oxidation of Fatty acids. (10)
b) Explain the Biosynthesis and degradation of purine nucleotides (10)
8. a) Which kind of hormones secreted by posterior lobe of Pituitary gland? Describe the chemistry and functions of Oxytocin (12)
b) Explain the Gluconeogenesis process and its regulation (8)
9. Write note on any two of the following: (10+10)
 - a) Male sex hormone
 - b) Glycogenesis
 - c) Urea cycle



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: I-E: Analytical Chemistry (Special)

Roll No.
Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q No.1 (a) Discuss in detail Reference Electrodes used in Potentiometer. (10)
(b) Give the working of a potentiometer and its applications. (10)
(c) Note on gas-sensing Electrode. (5)

- Q No.2 (a) Give reason why HPLC is better Technique than G.C. (10)
(b) Discuss theory of Gas Solid Chromatography. (10)
(c) What are the factors which effect the separations in HPLC/ GC. (5)

- Q No.3 (a) Discuss following current: (10)
1. Migration Current
2. Diffusion Current
3. Residual Current
(b) Discuss Ilkovic equation for the quantitative estimation in polarography. (10)
(c) Discuss the principal of voltammetry? (5)

- Q No.4 (a) How Quantitative & Qualitative Analysis is perform by TGA. (10)
(b) Compare the DTA with DSC (8)
(c) Give the application of DTA (7)

- Q No.5 (a) Discuss the theory of Conductometry. (7)
(b) Discuss the factors which effect the conductance. (8)
(c) Discuss the Instrumentation & applications of Conductometer. (10)

- Q No. 6 (a) Discuss Anodic Stripping voltametry. (10)
(b) Discuss the instrumentation & applications of Polarography. (10)
(c) Discuss Potentiometric titrations. (5)

Q No.7 Write a note on any two of the following. (12) (13)

1. Thermometric titrations
2. Dropping mercury electrode
3. Instrumentation of G.C
4. Voltammetry



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: I-F: Applied Chemistry (Special)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

Q. 01	a. Discuss the different raw materials which can be used for paper manufacturing. Discuss the importance of these raw materials with reference to the specific end product which is obtained from each of these sources.	15
	b. Compare and discuss the sulphate and sulphite processes for preparation of pulp for paper manufacturing.	10
Q. 02	a. Explain how acetylene, ethylene and propylene are prepared and discuss the industrial importance of each.	13
	b. Describe the industrial importance of toluene and naphthalene.	12
Q. 03	a. Describe the manufacturing and uses of potash fertilizers.	13
	b. Use a flow sheet diagram to comprehensively explain the synthesis of urea.	12
Q. 04	a. Explain desalting of crude oil. Give its significance in petroleum refining.	13
	b. Explain process of alkylation and polymerization of petroleum.	12

Q. 05	a. What is chrome tanning? Discuss all steps involved in the process of chrome tanning	13
	b. Discuss different methods of waste disposal in the tanning industry. Explain its environmental impact.	12
Q. 06	a. Write down complete process of conversion of vegetable oil into vegetable ghee. Support your answer with diagram and chemical reactions, where required.	15
	b. Explain the processes of extrusion and injection molding.	10
Q. 07	Write short note on the following.	
	a. Living polymers	05
	b. Lignin	05
	c. Fractional distillation	05
	d. Reforming of petroleum	05
e. Lubricants and paints	05	



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: II-A / I-2-N Physical Chemistry (Additional)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q.1 (a) Explain classification of polymers on the basis of application and crystallinity. (05)
(b) Write down different methods of preparation of polymers. (05)
(c) Discuss the kinetics of the free radical polymerization. (15)
- Q2. (a) Describe theoretical basis of Raoult's Equation. (13)
(b) Discuss Osmosis and osmotic pressure method for molar mass determination. (12)
- Q3. (a) What is laser? Write down its principle and describe its production by pumping, spontaneous and stimulated emission. (13)
(b) Discuss basic laws of photochemistry and their limitations (12)
- Q4. (a) Discuss different types of vibrational modes in polyatomic molecules. (10)
(b) Write sampling technique and advantages of FT-IR spectroscopy. (5)
(c) What is nature of light radiations? Classify different types of spectroscopy on the basis of spectral region. (10)
- Q5. (a) Differentiate between fluorescence and phosphorescence phenomena related to emission of light. (15)
(b) Describe photosensitized reactions in detail. (10)
- Q6. (a) What is Raman spectroscopy? Describe pure Raman spectra of linear molecules. (10)
(b) Discuss the instrumentation and applications of visible spectroscopy. (15)
- Q7. Write notes on **TWO** of the followings. (12.5+12.5)
(a) Separation of solid solutions
(b) Condensation polymerization
(c) Chemiluminescence



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part - II Annual Examination - 2020

Subject: Chemistry Paper: II-B [Inorganic Chemistry (Additional)]

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q. No.1 a) What are Metallocenes? Describe the chemistry of Ferrocene. (12)
b) Discuss the redox reactions with Inner Sphere Mechanism giving suitable examples. (13)
- Q. No.2 a) Discuss the biochemistry of iron in detail (10)
b) Describe different methods of detection and measurement of radioactivity. (15)
- Q. No.3 a) Compare different type of chemical reactions carried out in liquid Ammonia and Water. (13)
b) Derive the mathematical relationship between disintegration constant and half life time of a radioactive substance. Also co-relate it with initial amount of radioactive material. (12)
- Q. No.4 a) Describe chemistry of spinels. (13)
b) Classify the metal complexes into inert and labile type in terms of electronic configuration and size to charge ratio of metal ion involved? (12)
- Q. No.5 a) Discuss the chemistry of 2 e donor system with reference to organometallic compounds. (13)
b) What is cis-platin? Discuss its mechanism of action in chemotherapy. (12)
- Q. No.6 a) Discuss the chemistry of molten salts. (13)
b) What is metalloporphyrin? Discuss the structure and function of Haemoglobin. (12)
- Q. No.7 Write note on any TWO of the followings: (2X12.5=25)
i) Applications of radioactive isotopes
ii) Nitrogen fixation
iii) Fluxional behavior in organometallic compounds



UNIVERSITY OF THE PUNJAB
M.A./M.Sc. Part – II Annual Examination – 2020

Subject: Chemistry Paper: II-C (Organic Chemistry) (Additional)

Roll No.

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FIVE questions. All questions carry equal marks.

Q. No. 1.

(4 x 5 = 20)

- a) Why only a small quantity of the sample (in the vapour state) is used for analysis in the mass spectrometer?
- b) Explain why the deuterium-coupled ^1H -spectrum of cyclohexane- d_{11} contains only a sharp singlet at room temperature but two singlet at 170 K.
- c) In benzaldehyde, two of the ring protons have resonance at 7.87 ppm, and the other three have resonance in the range from 7.5 to 7.6 ppm. Explain.
- d) Arrange the following protons in the decreasing order of their δ values in ^1H -NMR and account for your order: Methyl, ethylenic, acetylenic, aryl and aldehydic.
- e) How will you distinguish between CH_3Cl , CH_3Br , and CH_3I by mass spectrometry?

Q. No. 2.

- a) How can deuterium labelling experiments be used to determine the reaction mechanism? Illustrate with examples. **(10)**
- b) Differentiate between E_1 & E_2 elimination reaction with the help of examples. **(10)**

Q. No. 3. Differentiate between the following with suitable examples. **(10 + 10)**

- (a) SN_1' & SN_2' reactions
- (b) Saytsev & Hoffman rules and the factors favoring each of them.

Q. No. 4.

- a) How would you explain the stereochemistry of SN_1 & SN_2 reactions? **(10)**
- b) How would to determine the mechanism of base catalysis? **(10)**

Q. No.5.

- a) What are different chemical and physical properties of alkaloids. **(10)**
- b) What is isoprene rule? Explain how the biosynthesis of squalene take place from isoprene. **(10)**

Q. No.6.

(6 + 4 + 10)

- a) Draw all the possible stereoisomers of 1,5-dichloro-2,4-dimethyl-3-pentanol and give the number of signals shown by each of them in their CMR spectra.
- b) Predict the appearance of the ^1D -NMR spectrum of propyl bromide.
- c) Deduce the structure of each of the following compounds on the basis of their molecular formula and PMR data.
 - i. $\text{C}_{10}\text{H}_{14}$: δ 1.3 (9H, singlet) and 7.0-7.5 (5H, multiplet)
 - ii. C_6H_{14} : δ 0.9 (12H, doublet) and 1.4 (2H, heptet)
 - iii. $\text{C}_4\text{H}_6\text{Cl}_4$ δ 3.9 (4H, doublet) and 4.6 (2H, triplet)
 - iv. $\text{C}_3\text{H}_7\text{OCl}$: δ 2.0 (2H, quintet), 2.8 (1H, singlet), 3.7 (2H, triplet) and 3.8 (2H, triplet).

Q. No.7.

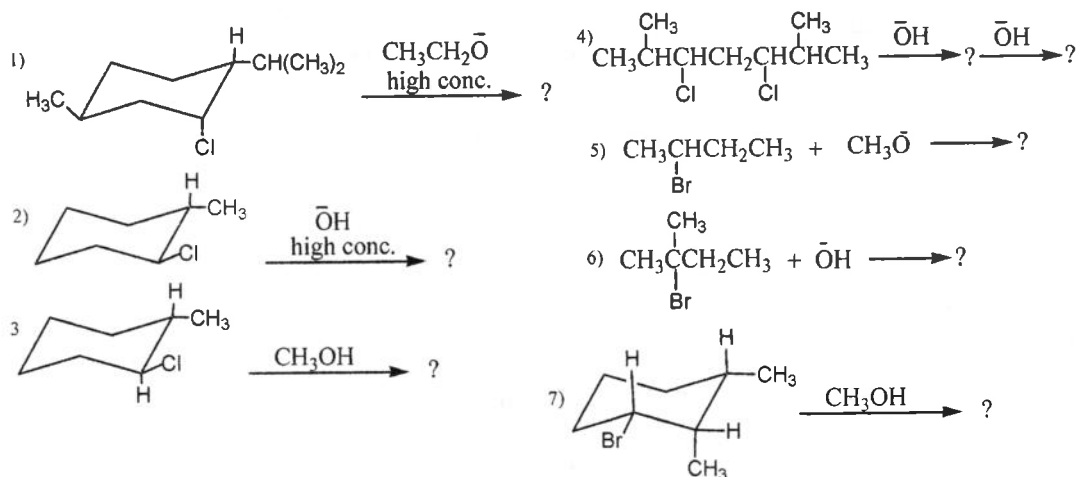
- a) What fragments are expected as a result of McLafferty rearrangement in the following compounds? **(10)**
 - i) 5-Methyl hexanal,
 - ii) 4-Methyl-2-pentanone,
 - iii) 2-Butylcyclohexanone,
 - iv) Butyl 2,2-dimethylpropanoate,
 - v) 2-Ethylhexanoic acid.
- b) Define ionization. Briefly explain at different modes of ionization in mass spectrometry. **(10)**

Q. No.8.

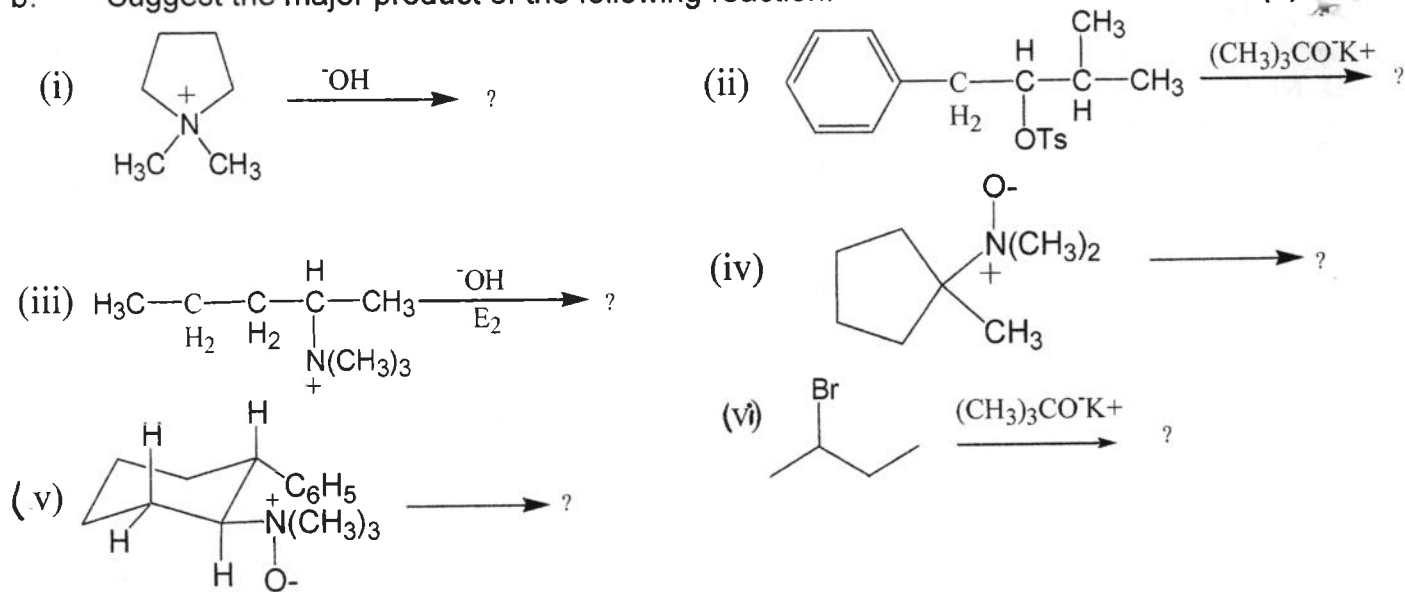
- a) Briefly explain the chemical and physical properties of alkaloids. (10)
 b) Write a short note on any two of the following. (5+5)
 i) Terpenes ii) steroids iii) Cocaine
 iv) Nicotene v) Morphine

Q. No.9.

- a) Draw the product of following elimination reactions along with mechanisms. (14)



- b) Suggest the major product of the following reaction. (6)





UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Roll No.

Subject: Chemistry Paper: II-D [Biochemistry (Additional)]

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q. 1. a. Write down the composition of Blood and explain the importance of formed elements of blood. (10)
b. What is the composition normal of urine? Why it is changed during various abnormal conditions and diseases? (10)
- Q.2. a. Describe the structure and function of kidney. Write down the role of kidney in detoxification of drugs. (10)
b. Explain the structure and detoxification mechanism of liver. (10)
- Q. 3. What is the importance of immune system in the management of COVID-19? Write down the details of cell mediated and Humoral response of immune system. (20)
- Q.4. Discuss antibiotic, anti-viral, anti-malarial and anti-fungal drugs with suitable example. What is meant by drug resistance? (20)
- Q.5. Write notes on the followings. (20)
i. Muscle contraction
ii. Hemoglobin degradation
iii. CSF
iv. Radioisotopes
- Q.6. Describe the regulation of gene expression in prokaryotes and eukaryotes. What steps are involved in protein synthesis? Also describe briefly the applications of recombinant technology. (20)
- Q.7. What is fermentation biotechnology? Discuss role of prokaryotes and fungi in the industry. How lactic acid is produced through fermentation? (20)
- Q.8. Differentiate between the followings. (20)
i. HPLC and GC
ii. ELISA and RIA
iii. Myeloma and Hybridoma
iv. Buffer and solution
- Q.9. Write down the importance of vitamins in the biological system. Give the biochemical functions, deficiency symptoms and requirements of the vitamin B complex. (20)



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Exam – 2020

Roll No.

Subject: Chemistry Paper: II-E (Analytical Chemistry) (Additional)

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q.1 a) How Stokes and Anti-stokes Lines are produced and enhanced by the use of Lasers? (07)
b) Discuss the atomic energy levels and molecular energy levels. (08)
c) Describe different types of Wavelength selectors and Detectors used in UV/Vis spectrophotometers. (10)
- Q.2 a) Describe the selection rule for vibrational spectroscopy? Give the detail for different vibrational modes. (10)
b) What do you know about the origin of infrared spectra? (05)
c) Explain the role of Infra-Red Spectroscopy for qualitative and quantitative chemical analysis. (10)
- Q.3 a) How can you explain the Atomic Fluorescence Spectroscopy? (07)
b) Explain the multi-element analysis with plasma devices. (10)
c) Describe the functions and advantages of inductively coupled plasma sources with reference to the atomic fluorescence. (08)
- Q.4 a) Discuss the production and importance of dye lasers. (12)
b) Describe different kinds of laser system in detail. (13)
- Q.5 a) Describe the identification and determination of structural features of compounds with the help of nuclear magnetic resonance spectroscopy. (12)
b) Explain the working of Fourier Transform NMR spectrometer. (07)
c) Discuss the use of NMR imaging in medicines. (06)
- Q.6 a) Explain the single focusing and double focusing mass analyzers used in mass spectrometry. (07)
b) How does ESI ionization source work in mass spectrometry? (09)
c) How the interpretation of mass spectra is being used for identification of unknown compounds? (09)
- Q.7 Write comprehensive notes on any three of the following: (9, 8, 8)
a) Soft and hard ionization sources
b) Multi-Level Laser Systems
c) Role of Detectors in UV/Vis spectroscopy
d) Properties and spectrum of Electromagnetic Radiations



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Roll No.

Time: 3 Hrs. Marks: 100

Subject: Chemistry Paper: II-F (Applied Chemistry) (Additional)

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q.1 (a) How coal chemicals are recovered from gaseous mixture coming out from the foul main of the coke ovens? (13)
- (b) What is COAL TAR? Which cuts are obtained by distillation of coal tar? (12)
- Q.2 (a) Explain the manufacturing of steel by heat treatment. (9)
- (b) Give general classification Steel with suitable examples. (8)
- (c) How corrosion of steel can be controlled? (8)
- Q.3 (a) How cane sugar is manufactures? Give flow sheet of the process. (18)
- (b) Explain the process for sugar manufacturing for Beet. (7)
- Q.4 (a) Discuss the manufacturing and application of Nylon 6,6. (12)
- (b) Describe the manufacturing of Viscose Rayon. Give flow sheet (13)
- Q.5 (a) Give general classification of textile dyes. (8)
- (b) How an azo dye can be manufactured? (9)
- (c) Differentiate Between Acid dyes and Disperse dyes. (8)
- Q.6 (a) Give the principle and basic instrumentation for AAS. Describe applications of the technique (15)
- (b) Explain the significance of On-line analysis. (10)
- Q.7 Write a short note on any **TWO** of the following (12,13)
- (i) Theories of corrosion
- (ii) Gas Chromatography
- (iii) Manufacturing of Cast Iron



UNIVERSITY OF THE PUNJAB

M.A./M.Sc. Part – II Annual Examination – 2020

Roll No.

Subject: Chemistry

Paper: IV (Environmental Chemistry)

Time: 3 Hrs. Marks: 100

NOTE: Attempt any FOUR questions. All questions carry equal marks.

- Q. 1** (a) How the concept of GREEN CHEMISTRY helps to protect our environment? (15)
(b) Discuss ENVIRONMENTAL EDUCATION and environment degradation in detail. (10)
- Q. 2** (a) Explain RECLAMATION OF SOIL in detail. (10)
(c) How RADON, CO and VOC's affect indoor air quality? (15)
- Q.3** (a) What is EUTROPHICATION? How it relates with use of fertilizers? (7)
(b) Discuss the ACTIVATED SLUDGE PROCESS for sewage treatment. (10)
(c) Give the NEQS for Drinking water. (8)
- Q.4** (a) Discuss METHANE and NITROUS OXIDE as Green House Gases. (8)
(b) Briefly describe LEAD and ARSENIC poisoning. (10)
(c) What is BIOACCUMULATION & BIOAMPLIFICATION? (7)
- Q.5** (a) How pH of soil relates to NUTRIENT AVAILABILTY? (5)
(b) How MINING activities contributes soil pollution? (8)
(c) What is SOIL EROSION? Give its causes and environmental impacts. (12)
- Q.6** (a) Why ENVIRONMENTAL MONITORING is important? (5)
(b) Briefly explain the term CHEMICAL SPECIATION? (10)
(c) Give the role of CHROMATOGRAPHIC techniques in pollutant analysis. (10)
- Q.7** Write a note on any **THREE** of the followings; (8,8,9)
(i) Reducing Smog
(ii) Global Warming impact
(iii) Aflatoxins as pollutants
(iv) Trickling Filters
(v) Indoor air pollution