



UNIVERSITY OF THE PUNJAB

Part-I A/2017
Examination:- M.A./M.Sc.

Roll No.

Subject: Chemistry (New Course)
PAPER: I (Physical Chemistry)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

Note: Attempt any Five questions. All questions carry equal marks.

- Q1. a. What is rate of reaction. Develop a kinetic expression for a third order reaction when three of the reactants have different initial concentrations. Derive its units. 1, 17, 2
- Q2. a. What is entropy? Discuss the significance of entropy. 10
b. What is Nerst heat theorem. Give its applications 10
- Q3. a. How barometric formula could be used to calculate the effect of altitude on distribution. 15
b. Discuss the effect of normalized wave function. 05
- Q4. a. Determine the activity coefficient of a salt by EMF method. 10
b. Discuss the construction working and advantages of alkaline fuel cells. 10
- Q5. a. Discuss the physical significance of Partition function. 05
b. Derive a relationship between Internal energy and partition function. 15
- Q6. a. What are rigid rotors? Calculate the energy levels of the rigid rotors and bond length of simple molecules. 15
b. What are Eigen functions and Eigen values. Explain with the help of examples. 05
- Q7. a. What do you understand from the concept of degeneracy? 08
b. Give an account of the experimental methods that are used to study the kinetics of fast reactions. 12
- Q8. a. What is a concentration cell. Determine the EMF of electrode concentration cell without transference. 15
b. Discuss the concept of spontaneous and non spontaneous reactions with respect to second law of thermodynamics. 05
- Q9. Write note on any two of the following: (10+10)
(i) Adiabatic Demagnetization
(ii) Statistical treatment of entropy
(iii) Tunnel effect



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Subject: Chemistry (New Course)
PAPER: II (Inorganic Chemistry)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

Q. No.1	a) What is Crystal Field Theory? Discuss various factors which affect the magnitude of crystal field splitting?	15
	b) Discuss the chemistry of Lanthanides in Tripositive oxidation state	10
Q. No.2	a) Explain the geometries of AB_4E_2 and AB_3E_2 type molecules on the basis of VSEPR theory by giving two examples in each case.	15
	b) Give different methods for the preparation of transition metal complexes by giving suitable examples.	10
Q. No.3	a) Discuss in detail the chemistry of $Fe_2(CO)_9$.	10
	b) Define Resonance and Resonance Energy. Discuss Various Rules of Resonance and draw the resonance contributing structures of following species: i) CO_3^{2-} ii) NH_3 iii) NO_3^- iv) SO_4^{2-} v) N_3^-	15
Q. No.4	a) Explain the Chemistry of Sodium Nitroprusside.	10
	b) Discuss various applications of Coordination compounds.	10
	c) What is Band Model?	05
Q. No.5	a) Explain the Bridge bond by giving suitable examples.	12
	b) π -acceptor Ligands stabilize metals in a low positive oxidation state. Justify the statement with reference to bonding in metal carbonyls.	13
Q. No.6	a) What is meant by Lanthanide Contraction? Discuss its reasons and Consequences.	15
	b) Describe N(E) curves for metals, semi metals and non-metals.	10
Q. No.7	Write note on any TWO of the followings: a) Trans Effect b) Optical Isomerism in Metal complexes c) Metal Nitrosyls	2x12.5=25



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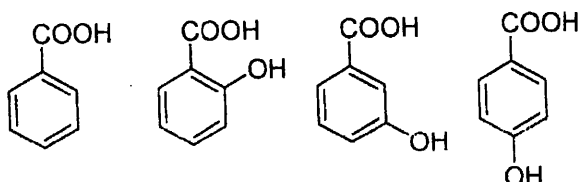
Subject: Chemistry (Old & New Course)
PAPER: III (Organic Chemistry)

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

Q. No. 1.

- A) Arrange the following compounds in the increasing order of their acidity. Give reasons for your order. [8]



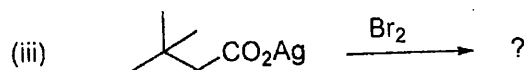
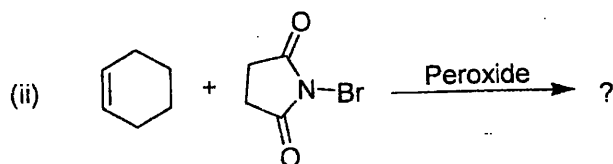
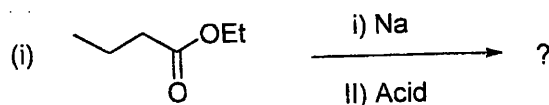
- B) Arrange the following compounds in the increasing order of their basicity. Give reasons for your order. [8]



- C) Explain how the nature of hybridization has an influence on the strength of bases? Give suitable examples. [4]

Q. NO. 2

- A) Describe two different methods for the detection of free radicals. [8]
B) Explain Captodative effect for stability of free radicals with examples. [3]
C) Predict the major products of following reaction via free radical mechanism. Draw complete mechanism for all steps. [9]



Q. NO. 3

- A) Describe two methods for converting alkenes into *trans*-1, 2-diols. Draw complete mechanism. [5+5]
B) How will you manage to bring about following transformation? Draw complete mechanisms. [5+5]
I. Primary alcohol \longrightarrow Aldehyde
II. Primary alcohol \longrightarrow Carboxylic acid

Q. NO.4

Write a note on the following reactions (reaction, mechanisms and synthetic applications).

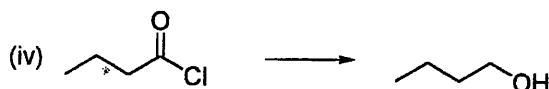
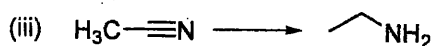
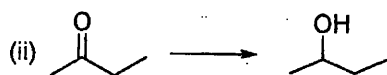
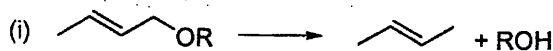
[10 + 10]

- Mannich reaction
- Darzen's glycosidic ester synthesis

Q. NO. 5

How would you bring about the following conversions? Write complete mechanisms for all steps involved.

[20]

**Q. NO. 6**

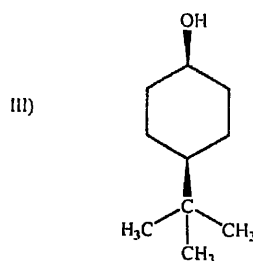
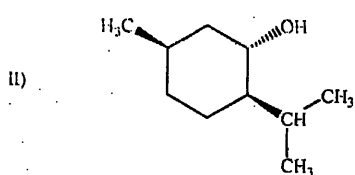
A) Give two examples of organic compounds which show optical isomerism without a chiral carbon atom. Explain why these compounds are optically active. [5]

B) Draw both the geometrical isomers for the following compounds and assign Z or E designation to each of them. [6]

- 3-Methyl-2-pentene
- 2-Iodo-2-butene
- 1-Bromo-1, 2- dichloroethylene

C) Draw all possible chair conformations of each of the following molecules and indicate which is more stable. [9]

I) cis-1-Ethyl-3-propylcyclohexane

**Q. NO. 7**

A) Describe the different methods used for the resolution of racemic mixture. Give examples for each method. [8]

B) Draw the perspective formulas of the enantiomers of following compounds and label each enantiomer as R or S. [4]

- 2-Bromobutane
- 1-bromo-3-pentanol

C) Define the following terms with examples. [8]

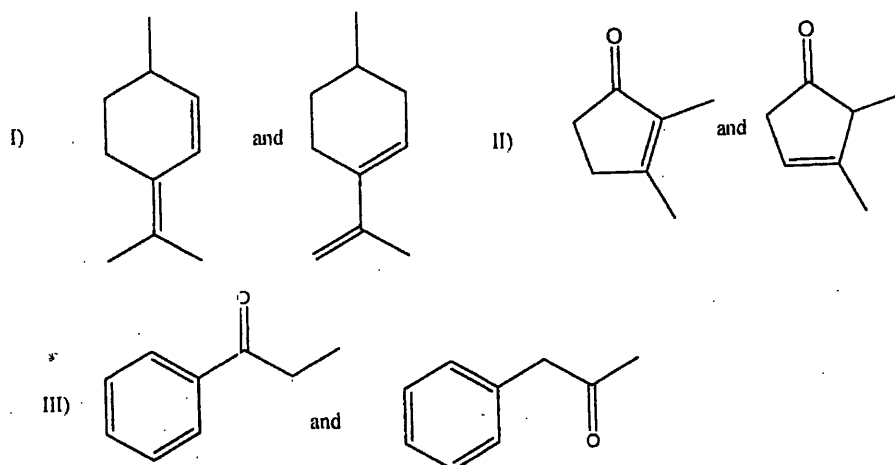
- Epimers
- Meso compounds
- Enantiomeric excess
- Alternating axis of symmetry

Q. NO. 8

- A) Determine the total number of possible vibrational modes for water. [2]
- B) How will you distinguish between the following pairs of compounds with the help of IR spectroscopy? [15]
- I. n-hexane and cyclohexane
 - II. 1-butyne and 2-butyne
 - III. CH_3CHO and CH_3COCH_3
 - IV. PhCONH_2 and PhCH_2NH_2
 - V. 2-hexanol and 2-hexanone
- C) Why conjugation of $\text{C}=\text{O}$ with $\text{C}=\text{C}$ lowers its stretching frequency? [3]

Q. NO. 9.

- A) Briefly answer the following questions [8]
- I. What is the Beer-Lambert law?
 - II. How can we use UV / VIS spectroscopy to measure the rate of a reaction?
 - III. What are chromophore and auxochrome?
 - IV. What are bathochromic effect and hypsochromic effect?
- B) Explain why a polar solvent usually shifts the $\pi \rightarrow \pi^*$ transition to a longer wavelength and $n \rightarrow \pi^*$ transition to shorter wavelength? [3]
- C) How could you use UV / visible spectroscopy to distinguish between the compounds in each of the following pairs? [9]





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Subject: Chemistry (New Course)
PAPER: IV (i) [Biochemistry]

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

- Q.1 i. Derive Michealis-Menten equation for single substrate enzyme catalyzed Reactions. Briefly explain why Michealis-Menten equation can't be applied to Irreversible enzyme inhibition? (15)
- ii. Differentiate between the following (10)
- (a) Specific activity and Molecular activity of Enzymes
(b) Kinases and Phosphorylases (c) Racemases and Epimerases
(d) Allosteric and Non-Allosteric Enzymes (e) Enzymes and Non-Biological catalysts
- Q.2 i. Discuss the various basis of classification of amino acids? Give examples of each class. (14)
- ii. Draw the structures of all aromatic amino acids and also write their one and three letter codes. (6)
- iii. Glycine has a PI value of 5.98. Its pK₁ value is 2.34, calculate pK₂. (5)
- Q.3 i. Briefly describe the structural features of A and B DNA. (12)
- ii. A DNA is one million base pairs long. Considering the B DNA structure and linear form, Calculate the number of helical turns and length of the DNA molecule. (7)
- iii. Discuss the structure of mRNA. (6)
- Q.4 i. What are omega 6 and omega 3 fatty acids? Give examples and discuss their biological significance. (12)
- ii. Explain the following terms and their significance (10)
- (a) Saponification and saponification value
(b) Peroxidation and peroxide value
- iii. A lipid contains fatty acids that are 89% unsaturated; would this lipid be solid at room temperature or liquid? What if the fatty acids are 13% saturated? (03)
- Q.5 i. Discuss in detail the isomerism in monosaccharides. (10)
- ii. Differentiate between the following (10)
- (a) Reducing and Non-reducing sugars (b) Starch and Glycogen
(c) Dextran and Dextrin (d) Amylose and amylopectin
(e) Cellulose and Cellobiose
- iii. Write briefly about physiologically important sugar derivatives. (05)
- Q.6 i. Discuss in detail how allosteric modifiers, covalent modifications and compartmentalization of enzymes regulate their activities? (15)
- ii. Write briefly about the composition and structure of cellular membranes. (10)
- Q.7 Write short notes on any two of the following (25)
- i. Direct and Indirect Colorimetry
ii. Role of Vitamin B as Co-enzymes
iii. Ribosomes
iv. Specific Dynamic Action (SDA) of food



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Subject: Chemistry (New Course)
PAPER: IV (ii) [Analytical Chemistry]

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

Attempt any FOUR questions. Each question carries equal marks.

1. a. Consider the following three data sets $A = \{9, 10, 11, 7, 13\}$, $B = \{10, 10, 10, 10\}$ and $C = \{1, 1, 10, 19, 19\}$. (15)
 - a. Calculate the mean of each data set
 - b. Calculate the standard deviation of each data set
 - c. Which set has the largest standard deviation
 - b. Explain correlation and regression? (10)
2. a. Describe the principal and applications of solvent extraction of metals? What factors affect the efficiency of solvent extraction? (15)
b. Write a detailed note on solid phase extraction. (10)
3. a. What is flame emission? Write a note on use of atomic spectra for the analysis of samples. (15)
b. What are the limitations of flame emission spectrometry? (10)
4. a. Write down the differences between molecular and atomic spectroscopy. (10)
b. Give the detail about the instrumentation of UV-Visible spectrometer. (08)
c. How UV-Visible spectroscopy is helpful in analysis of organic compounds. (07)
5. a. Explain theory and principle of Lambert Beer's Law? (13)
b. What is the extinction coefficient? (12)
6. a. What is capillary electrophoresis? (5)
b. Write principle, instrumentation and applications of capillary electrophoresis. (10)
c. What is the principle and theory of gel chromatography. (10)
7. a. What are the applications of column adsorption chromatography? (10)
b. How can we separate the metals on ion exchange columns? (10)
c. How is ion exchange phenomena helpful in purification and softening of water. (5)



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Roll No.

Subject: Chemistry (New Course)
PAPER: IV (iii) [Applied Chemistry]

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

- Q. No.1 (a) Differentiate between 'evaporation' and 'vaporization'. Briefly describe the different types of evaporators used in the industry. 15
- (b) Write down mechanism of sulfonation of benzene with sulfuric acid. Give a brief note on the industrial applications of sulfonation. 10
- Q. No.2 (a) What are common raw materials used in glass manufacturing, also mention their approximate proportions. 13
- (b) Describe the manufacturing of colored and coated glasses. 12
- Q. No.3 (a) Describe different types of Portland cements along with their main applications. 10
- (b) Highlight the major differences between the wet and dry process for cement manufacturing, also describe the reasons on which a particular cement manufacturing process is preferred. 15
- Q. No.4 (a) What is boiler scaling, highlight its disadvantages on boiler operation, briefly describe boiler scale treatment? 15
- (b) Write down modified soda lime process for water softening. 10
- Q. No. 5 (a) Write down different types of additives/builders used during soap manufacturing. 15
- (b) Compare the cleansing action of a detergent and soap, also mention why detergents are better. 10
- Q. No. 6 (a) Describe the manufacturing of oxalic acid and its applications. 12
- (b) Give important properties of sulfuric acid. How it is manufactured in Industry by contact process. 13
- Q. No.7 Write short notes on any three of the following 25
- (a) Distillation
- (b) Oxidation
- (c) Caustic soda
- (d) Setting of cement
- (e) Reverse osmosis