UNIVERSITY OF THE PUNJAB

Part-I A/2018
Examination:- M.A./M.Sc.

Roll No. ....

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

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

Q.1. (a) What is opposing reaction? Give examples. Develop a kinetic expression for 1st order opposed by 2nd order reaction. (10)

(b) Discuss the kinetics of thermal decomposition of ozone. (10)

Q.2. (a) What is partition function? Give its significance. Develop a relationship between entropy and partition function. (15)

(b) Derive expression for average and most probable velocity from Maxwell's equation for distribution of velocities. (05)

Q.3. (a) What are inter ionic effects of electrolytes. Explain (10)

(b) Explain fuel cells. (10)

Q.4 (a) Explain the formation of H_2 molecule on the bases of VBT. (10)

(b) Explain Harmonic Oscillator. (10)

Q.5 (a) Discuss Adiabatic demagnetization in detail (10)

(b) Derive and expression for clauses inequality. (10)

Q.6 (a) Explain the transition state theory with the help of examples. (10)

(b) Give mathematical quantum description of diatomic rigid rotator. (10)

Q.7 Explain concentration cell with transference. Derive expression for Emf of concentration cell with transference. (20)

Q.8 (a) What is Nernst heat theorem? Give its application (10)

(b) Explain the physical significance of partition function. (10)

Q.9 Write note on any two of the followings:-

(i) Debye-Huckl theory for weak electrolytes. (10)

(ii) Parallel reactions. (10)

(iii) 2nd law of thermodynamics (10)

UNIVERSITY OF THE PUNJAB

Part-I   A/2018
Examination:- M.A./M.Sc.

Subject: Chemistry (Old & 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) Explain CFT. What are the factors which affect crystal field splitting?   13

b) What is meant by Lanthanide Contraction? Explain its occurrence and consequences.   12

Q. No.2   a) Explain geometries the molecules of AB_3E_2 and AB_4E type on the bases of VSEPR theory giving Two examples for each.   15

b) How Transition Metal complexes are prepared by Redox reactions. Give suitable examples.   10

Q. No.3   a) Discuss the chemistry of $Fe(CO)_5$.   10

b) Explain the structure of following molecules on the basis of VBT?   15

i) $[Mo(CN)_8]^{-4}$ ii) I_3^- iii) $XeOF_4$ iv) $[PF_6]^-$ v) NOCl

Q. No.4   a) Explain the chemistry of $Fe(CO)_2(NO)_2$.   10

b) Describe Optical isomerism in metal complexes.   10

c) How CFT explains the colors of metal complexes?   05

Q. No.5   a) Explain the Bent bond by giving suitable examples.   12

b) The low oxidation state of transition metals is stabilized by π-acceptor ligands. Justify this statement with reference to bonding in metal carbonyls.   13

Q. No.6   a) Discuss the applications of lanthanides in daily life.   15

b) Describe the Metallic bonding on the basis of Electron Sea Theory.   10

Q. No.7   Write note on any **TWO** of the followings: 2x12.5 =25

i) Spectrochemical Series

ii) N(E) Curves

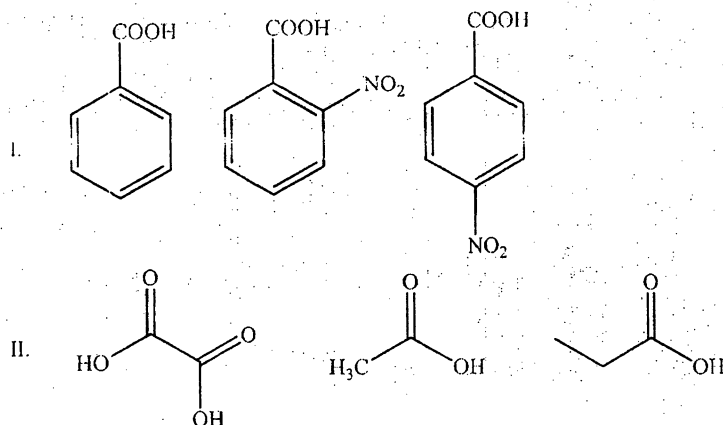iii) Semi-Conductors

UNIVERSITY OF THE PUNJAB

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 compounds of each of the following groups in order of increasing acidity, giving explanation for your order.   [5 x 2 = 10]
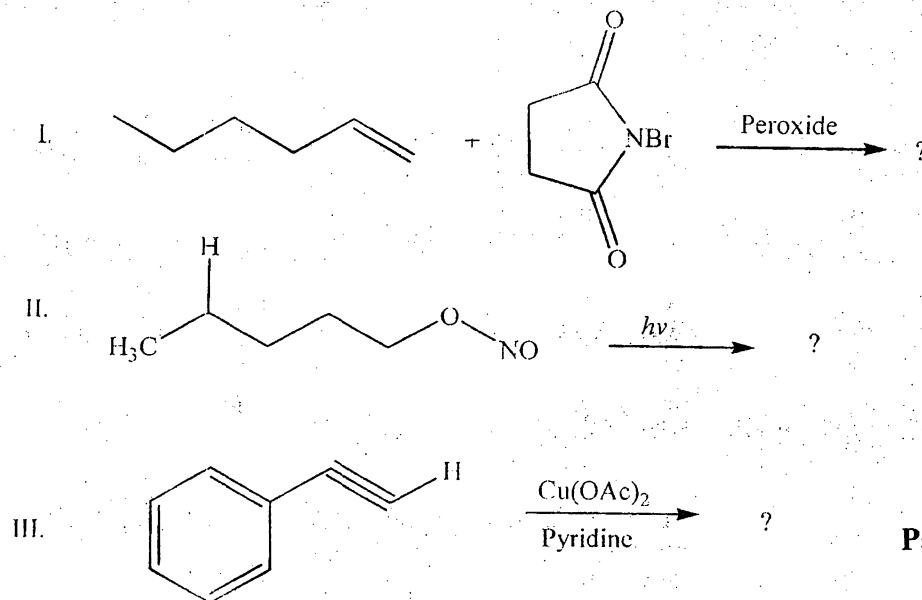

I.

II.

B) Compare the basicity of compounds of following groups. Justify your answer.

[2.5 x 4 = 10]

    I.   Aniline and cyclohexylamine

    II.   *o*-Nitroaniline and *p*-nitroaniline

    III.   Ammonia and methyl amine

    IV.   Benzonitrile and cyclohexylamine

Q. NO. 2.

A) Predict the major products of following reaction via free radical mechanism. Draw complete mechanism for all steps.   [5 x 3 = 15]

I.

II.

III.

B)   Explain Captodative effect for stability of free radicals with examples.   [5]

Q. NO. 3.

How would you bring about the following conversions? Write complete mechanisms for all steps involved.   [4 X 5 = 20]

I. C_2H_5—NH—C_2H_5 $\longrightarrow$ C_2H_5—N(OH)—C_2H_5

II.

III.

IV.

V.
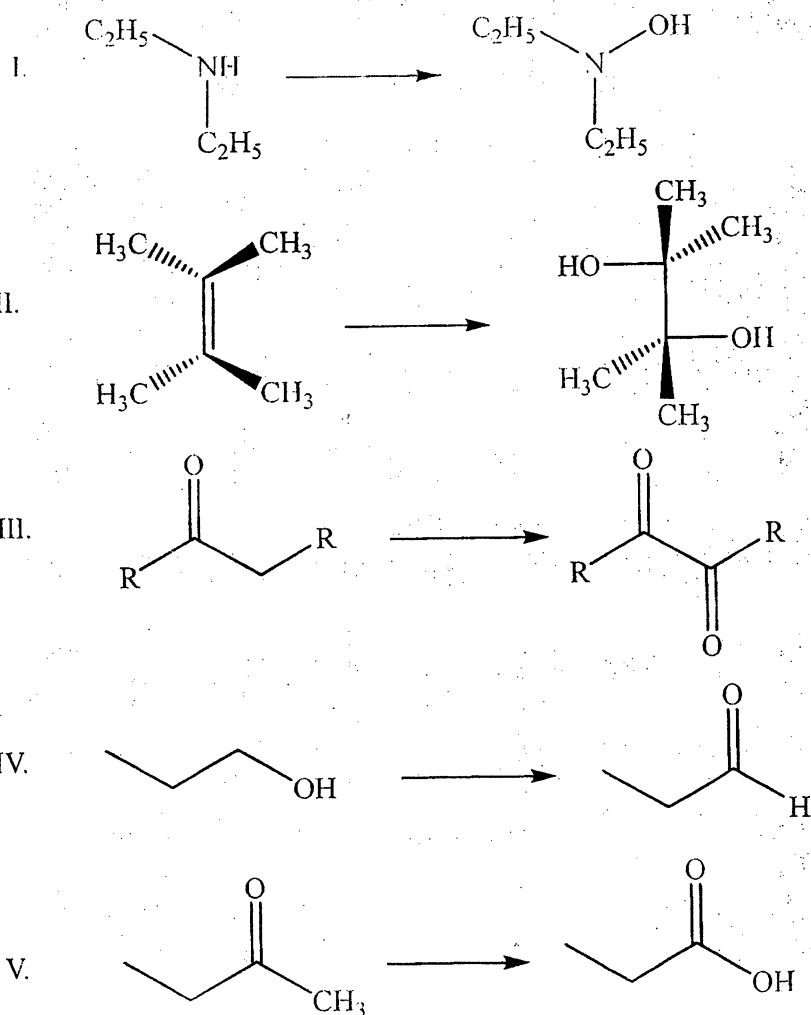
Q. NO. 4.

A) How can you convert alkyne into *cis*-alkene and *trans* alkene? Give complete mechanisms.   [5]

B) What is Wolff-Kishner reduction? Give example with complete mechanism.   [5]

C) Explain why $NaBH_4$ reduces aldehydes and ketones but not the carboxylic acid? Give complete mechanism of reduction of ketone with $NaBH_4$.   [5]

D) Why does Birch reduction on benzene derivatives with an electron donating group happen at ortho and meta positions? Explain with mechanism.   [5]
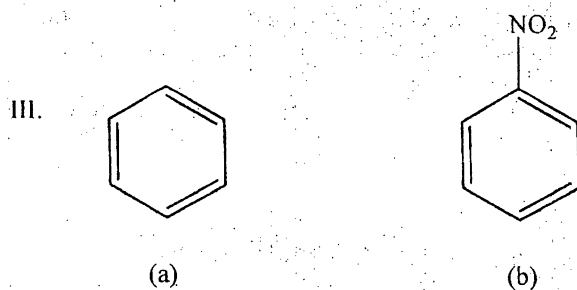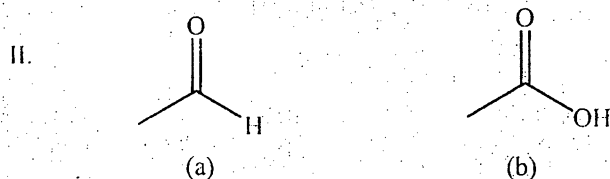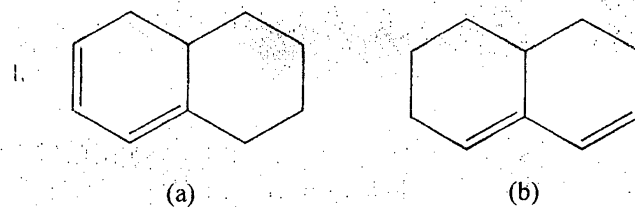
Q. NO. 5.

Write a note on the following reactions (reaction, mechanisms and synthetic applications).   [10 x 2 = 20]

I.   Stobbe condensation

II.   Mannich reaction

Q. NO. 8.

A) How could you use UV / visible spectroscopy to distinguish between the compounds in each of the following pairs? [4 x 3 = 12]

I.

(a)   (b)

II.

(a)   (b)

III.

(a)   (b)

B) Briefly answer the following questions [2 x 4 = 8]

I. What is vacuum UV region?

II. What is difference between λ_{max} and ε_{max}?

III. What is solvent cut-off wavelength? Give example.

IV. How can we use UV / VIS spectroscopy for the determination of concentration of a single absorbing substance in a solution?

Q. NO. 9.

A) Briefly answer the following questions [2 x 5 = 10]

I. What is difference between combination band and difference band?

II. Determine the total number of possible vibrational modes for carbon dioxide.

III. How can you readily distinguish aldehydes from ketones by using infrared spectroscopy?

IV. What is fingerprint region in infrared spectrum?

V. Compare the stretching frequency of O ——D and O ——H bonds.

B) How will you distinguish between the following pairs of compounds with the help of IR spectroscopy? [2.5 x 4 = 10]

I. Acetone and ethyl alcohol

II. Acetic acid and ethyl acetate

III. Propyne and acetonitrile

IV. Cyclohexanol and phenol

Q. NO. 6.

A) Draw the Fisher projections for all the stereoisomers of 2, 3, 4- trihydroxypentanoic acid and label each chiral carbon atom as R or S. [4]

B) Describe the different methods used for the resolution of racemic mixture. Give examples for each method. [4]

C) Differentiate the following terms with examples. [2 x 4 = 8]

     I. Configurational isomerism and conformational isomerism

     II. Racemic mixture and Meso compound

     III. Torsional strain and Angle strain

     IV. Erythro isomer and threo isomer

D) Draw the perspective formulas of the enantiomers of following compounds and label each enantiomer as R or S. [2 x 2 = 4]

     I. 3-Chloro-1-pentanol

     II. 2-hydroxypropanoic acid

Q. NO. 7.

A) Draw all possible conformations of each of the following molecules and explain which is more stable. [3 x 3 = 9]

     I. *cis*-1-Ethyl-3-phenylcyclohexane

     II. 1, 3, 5-Triethylcyclohexane (all *cis*)

     III. Propane

B) Draw both the geometrical isomers for the following compounds and assign Z or E designation to each of them. [2 x 3 = 6]

     I. 2-Bromo-3-methyl-2-pentene

     II. 1-Bromo-1-chloro-2-iodoethylene

     III. 3-Methyl-3-hexene

C) Classify the following compounds as optically active or optically inactive. Justify your answer. [1 x 5 = 5]
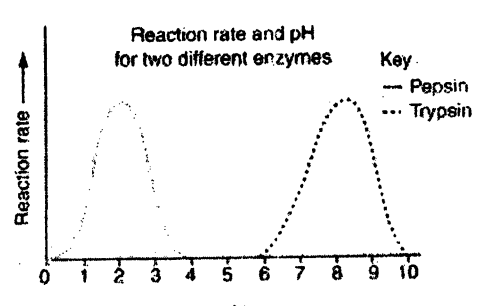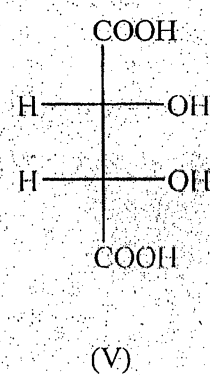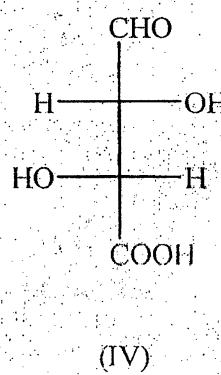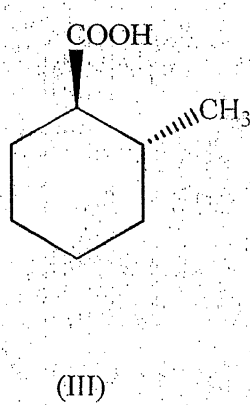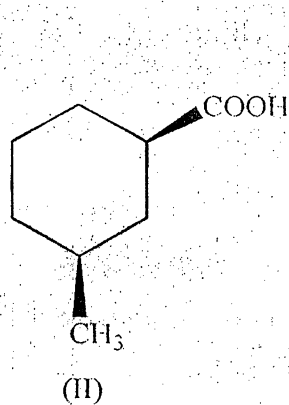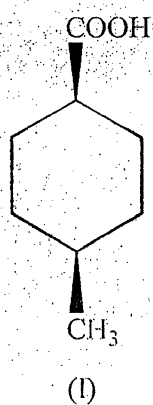

  (I)   (II)   (III)   (IV)   (V)

UNIVERSITY OF THE PUNJAB

Part-I   A/2018
Examination:- M.A./M.Sc.

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

TIME ALLOWED: 3 hrs.
MAX. MARKS: 100

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

Q1. i	Write a note on the energy value of foods.	10
ii	Enzymes are specific in action. Keeping in view the concept of active site, discuss the idea of enzyme specificity.	10
iii	With respect to function and properties, differentiate between glycoproteins and proteoglycans.	05
Q2. i	The graph shows a typical effect of pH on the reaction rate for two different enzymes. Describe and explain how pH affects enzyme activity.	05
ii	What do you understand by the following terms? Outline their importance in the study of enzymes. (i) K_m (ii) V_{max} (iii) K_{cat} (vi) Binding energy	08
iii	What are the six classes of enzymes? Briefly describe the type of reaction catalyzed by each class and give an example.	12
Q3. i	The pK1 and pK2 values of isoleucine are 2.36 and 9.68 respectively. Calculate the pI of isoleucine and also show its structure at these three pH values.	10
ii	Define the primary, secondary, tertiary and quaternary structure of proteins.	04
iii	Haemoglobin plays an important role in the transport of oxygen in the body. Write a brief note on the structure of haemoglobin.	06
iv	Write the equation for the formation of a peptide bond between a glycine and valine residue. Label the amino and carboxyl terminals.	05
Q4. i	With reference to their role in living organisms, explain the differences in the structure of DNA and mRNA.	10
ii	Differentiate between a nucleotide and nucleoside.	02
iii	Diagrammatically show the hydrolysis of RNA under alkaline conditions.	05
iv	Discuss the distinguishing features of A, B and Z DNA.	08
Q5. i	Discuss the biological roles of lipids with examples.	15
ii	Write a note on the classification of fatty acids.	10
Q6. i	Glycosaminoglycans are important constituents of the skin and help in preventing dryness. With the help of examples, define glycosaminoglycans.	05
ii	With the help of structures differentiate between the following: (a) aldohexose and ketohexose (b) hexose and pentose (c) D and L sugars (d) alpha and beta glucose (e) reducing and non-reducing sugars (f) starch and glycogen	12
iii	Write a note on structural polysaccharides.	08
Q7. I	Define buffers. Explain the phenomenon of buffering with the help of Handerson-Hasselbach equation and elucidate the importance of buffers in biological systems.	10
ii	Write short notes on any three of the following: (a) role of vitamins (b) saponification and calculation of saponification value (c) energy requirements under different living and physiological conditions (d) reversible enzyme inhibition (e) biological significance of glucose	05x3

UNIVERSITY OF THE PUNJAB

Subject: Chemistry (Old & New Course)   **TIME ALLOWED: 3 hrs.**
PAPER: IV (ii) [Analytical Chemistry]   **MAX. MARKS: 100**

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

Q1.

    a. Discuss various types of errors. How can you minimize/measure them?   10, 15

    b. The following masses were recorded for 12 different masses (all given in grams):
       5.683 5.549 5.548 5.552 5.620 5.536 5.539 5.684 5.551 5.552 5.554 5.632
       Report the mean, median, range, standard deviation, and variance for these data.

Q2.

    a. Explain the extraction of metals by solvent extraction. How does pH affect the
       efficiency of extraction?   13, 6, 6

    b. Why is solid phase extraction preferred over solvent phase extraction?

    c. Write the applications of solvent extraction in analytical Chemistry

Q 3

    a. Write note on Van Deemter equation.   10, 8, 7

    b. Compare the advantages and disadvantages of paper and thin layer chromatography.

    c. How can you detect colorless spots in paper and thin layer chromatography?

Q 4

    a. Define interference. Describe it with respect to atomic absorption spectroscopy. What
       steps can be taken to minimize it?   9, 8, 8

    b. How flame is used as an atomizer? Briefly explain its events.

    c. How is atomic absorption spectroscopy better than flame emission spectroscopy?

Q5

    a. How do UV/Vis radiations interact with organic molecules? Explain the effect of
       conjugation on UV/Vis spectra.   12, 9, 4

    b. Discuss the Beer Lambert law with respect to chemical and instrumental deviations.

    c. Differentiate single beam and double beam spectrophotometer.

Q 6

    a. Write a note on cation and anion exchange resins.   10, 10, 5

    b. Write a note on water softening by ion exchange chromatography.

    c. How ion exchange resins can be regenerated?

Q 7

    a. Draw the optical layout of flame photometer. Briefly discuss its components.   6, 13, 6

    b. What is electrophoresis? Describe capillary zone electrophoresis. Also, illustrate the
       advantages of capillary zone electrophoresis over traditional electrophoresis methods.

    c. How electrophoresis is different from other separation techniques?

UNIVERSITY OF THE PUNJAB

Part-I   A/2018
Examination:- M.A./M.Sc.

Subject: Chemistry (Old & 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) Explain the 'boiling point curve' and how it is useful in determining composition of the vapors in distillation process.   8

(b) Describe the basic components of a factional distillation column and its working with the help of a diagram.   8

(c) Describes the different procedures by which halogens are introduced in the organic compounds and also describes the different derivatives of chlorines.   9

Q. No.2

(a) Write down the manufacturing and industrial applications of phthalic anhydride.   13

(b) Explain the Solvay process for soda ash manufacturing.   12

Q. No.3

(a) Discuss the classification of detergents along with suitable examples and their applications.   15

(b) Describe the continuous method of soap manufacturing with the help of flow sheet diagram.   10

Q. No.4

(a) Write down modified soda lime process for water softening.   12

(b) What do you mean by demineralization? Which types of resins are used for this purpose?   13

Q. No. 5

(a) Explain the annealing process in glass manufacturing also explain its significance.   12

(b) Describe the types of safety glasses and also discuss their manufacturing.   13

Q. No. 6

(a) Describe different chemical reactions taking place in rotary kiln during cement manufacturing.   13

(b) What do you understand about setting of cement and how it is tested?   12

Q. No.7 Write short notes on any three of the following: 25

(a) Colored glass

(b) Cleansing action of soap

(c) Nitration

(d) Caustic Soda

(e) Ion exchange resins