19MCHEH101 Reg No : .....

# CHOICE BASED FIRST SEMESTER M.Sc. Chemistry DEGREE EXAMINATION MARCH 2021

## Inorganic Chemistry Theory - I

**Duration:3 Hours** **Max Marks:70**

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## PART - A

**1. Answer any TEN of the following :** **(10×2= 20 Marks)**

a). Explain the term Electronegativity. How is it related to electron affinity and ionisation energy?

b). What is meant by hcp and ccp?

c). Electron affinity of an atom increases in the 3rd period as we move from Na to Cl. Mg and P are however exceptions: Explain

d). Out of the following, select Lux Flood acid/acids and justify your answer
$CO_2$, $SO_2$, $BF_3$, $H^-$

e). Give redox reaction in liq. $SO_2$.

f). Mention any two limitations of Arrhenius theory.

g). What are Organic precipitants? Give any two examples.

h). What is Peptisation?

i). Account for the rejection of a result based on Q test.

j). List out the Applications of Nanotechnology in electronics.

k). The curves in the Ellingham diagram slope upwards: Justify.

l). What are Latimer diagrams?

## PART - B

**Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)**

### UNIT - I

2. a)How do atomic and ionic radii change within a group and period in the periodic table
b)Arrange the following in the increasing order of ionisation potential? Justify your answer.
i)Li, B, C, O, N, Be, Cl
ii)Na, K, Li, Cs, Rb (6+4)

3. a)Represent the combination of atomic orbitals to form molecular orbitals.
b) Compare the shapes of the following pairs of molecules and explain the reasons for the differences in each pair
$NH_3$ and $PH_3$ (6+4)

## UNIT - II

4. a. Arrange the following in the order of increasing acid strength

i) $BBr_3$, $BI_3$ $BF_3$ ii) $SnCl_2$, $SnCl_4$ iii) $BF_3$, $B_2H_6$ ,$BPh_3$

b. What are Lewis bases? Arrange the following in the order of increasing acid strength

i)$NH_3$, $PH_3$ $AsH_3$

ii) $NH_3$, $(CH_3)_2NH$, $CH_3NH_2$, $(CH_3)_3N$. (6+4)

5. a. Explain neutralisation reactions in liq $NH_3$ & anhydrous $H_2SO_4$.

b. Discuss solvolysis reactions in lq. $SO_2$. (6+4)

## UNIT - III

6. a) Explain with examples,
i) Titration of Strong acid against a strong base,
ii) Titration of a weak acid against a strong base. Plot the respective titration curves.
b) Explain Primary standards with examples and comment on the properties of primary standards. (6+4)

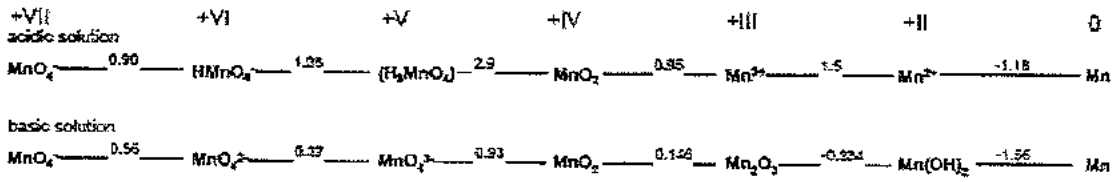
7. a) Distinguish between Absolute Formation constant and Conditional formation constant.
b) Explain the basic requirements of a titration reaction.
c) Write a note on types of EDTA titrations. (4+3+3)

## UNIT - IV

8. a. Discuss briefly the various methods used for the reduction of roasted ores to the metallic state.

b. Explain Froth Flotation process. (6+4)

9. Construct Frost Diagram for the following Latimer Diagram




Name the type of the reaction mentioned below & Justify the feasibility of the reaction.

$$BrO_3^- \xrightarrow{+1.4} HOBr \xrightarrow{+1.5} Br_2$$ (6+4)

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19MCHEH102 Reg No : .....

# CHOICE BASED FIRST SEMESTER M.Sc. Chemistry DEGREE EXAMINATION MARCH 2021

## Organic Chemistry Theory - I

**Duration:3 Hours** **Max Marks:70**

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## PART - A

**1. Answer any TEN of the following :** **(10×2= 20 Marks)**

a). What is hyper conjugation? How does it explain the stability of alkenes ?

b). Explain delocalization in 1,3-butadiene and benzene

c). Chloroacetic acid is stronger than acetic acid why?

d). Give examples of trapping reagents for carbenes and benzynes.

e). Justify, benzyl, allyl free radicals are more stable than tertiary free radical, while vinyl is least stable.

f). Give any two methods of generation of carbenes.

g). What is Prelog's rule? Give an example.

h). Write the structure of cis-decalin in Newmann projection.

i). Give reason: Chair form of cyclohexane is stable than boat form.

j). Explain mutarotation of D-glucose.

k). Give the reaction for the formation of fructosazone.

l). What are reducing sugars? Give an example.

## PART - B

**Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)**

### UNIT - I

2. a) Write a note on C8, C10 and C14 annulenes.
   b) Explain the aromaticity of non-benzenoid compounds with examples. (6+4)

3. a) Discuss the effect of resonance on dipole moment and base strength of amines.
   b) Compute the resonance energy of benzene from heat of hydrogenation. (6+4)

### UNIT - II

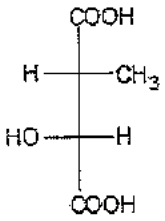
4. a) Write a note on identification of products for the determination of reaction mechanism
   b) Discuss the structure and reactions of nitrenes (4+6)

5. a) Explain the factors affecting the stability of carbanions.
   b) Write a note on
   (i) Reactions of benzyne
   (ii) Isotopic labelling (4+6)

## UNIT - III

6. a) Write a brief note on methods of determining configuration of geometrical isomers.
   b) Explain syn and anti isomers using suitable examples. (5+5)

7. a) Interconvert following Fischer projection formula to Sawhorse and Newman projection formulae




   b) Explain the terms (i) Chirality (ii) Stereogenic centre
   (iii) Enantiomerism (iv) Optical activity
   c) Write the Sawhorse and Newman projection formulae of 3(R)-bromo-2(S)-butanol. (3+4+3)

## UNIT - IV

8. a) Write a note on alkaline degradation techniques.
   b) What is Smith degradation? Explain why the polysaccharides with 1,3-linkage does not undergo Smith degradation.
   c) Elucidate the structure of cellulose. (3+3+4)

9. a) Write a note on esters of carbohydrates and amino sugars.
   b) What are terminal deoxy sugars? Explain the synthesis of fucose. (5+5)

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19MCHEH103 Reg No : .....

# CHOICE BASED FIRST SEMESTER M.Sc. Chemistry DEGREE EXAMINATION MARCH 2021

## Physical Chemistry Theory - I

**Duration:3 Hours** **Max Marks:70**

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## PART - A

**1. Answer any TEN of the following :** **(10×2= 20 Marks)**

a). State Liouville's theorem.

b). Calculate the free energy change accompanying the compression of 1 mole of a gas at 57°C from 25 to 200 atm. The fugacities of the gas at 57°C may be taken as 23 and 91 atm, respectively, at pressure of 25 and 200 atm.

c). Justify: A pressure of about 200 atm is maintained in the Haber's process for the manufacture of ammonia.

d). Write the expression for pressure in terms of partition function and explain the terms.

e). Electronic partition function is generally equal to the degeneracy of ground electronic state. Why?

f). Define the terms "forces" and "fluxes".

g). Explain Arrhenius energy and Arrhenius pre-exponential factor

h). Give the advantages and limitations of continuous flow method of study of fast reactions

i). For a given first order reaction, the reactant reduces to $1/4^{th}$ of its inital value in 10 mins. Calculate the rate constant of the reaction.

j). Give the Schrodinger's wave equation for the energy of the particle confined to a 3-D box..

k). Write the expression for wave function of a particle confined to a 1-D box.

l). How Planks idea of quantisation is used to explain Black body radiation?

## PART - B

**Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)**

### UNIT - I

2. a) Derive any three Maxwell's relations.
b) The values of molar heat capacity of a gaseous system are different at constant pressure and constant volume. Justify. (5+5)

3. a) Show that change in density with time is equal to zero based on Liouville's theorem.
b) Explain microcanonical, canonical and grand canonical ensemble with suitable diagrams. (4+6)

## UNIT - II

4. a) Derive an expression for entropy production due to heat flow.
   b) Explain the criteria for non-equilibrium states. (5+5)

5. a) Derive the expression for internal energy and heat capacity in terms of partition function.
   b) Deduce the relation between molar and molecular partition function. (5+5)

## UNIT - III

6. a) Explain Double sphere model for reactions in solutions
   b) State and explain Hammett equation (5+5)

7. a) Using Maxwell Distribution curve of Molecular energy describe how reaction rates are affected by change in temperature
   b) Distinguish between first and pseudo-first order reactions (5+5)

## UNIT - IV

8. a) What are operators? Explain any 3 operators and describe the rules for writing operators corresponding to any property.
   b) Which of the following pair of operators commute?
   i) x and d/dx ii) d/dx and $[(d^2/dx^2)+ 2 (d/dx)]$ (6+4)

9. a) Discuss the application of Huckel Molecular orbital theory to ethylene molecule.
   b) Discuss the application of Schrodinger's wave equation for a rigid rotar and deduce the expression for its energy. (5+5)

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19MCHES104 Reg No : .....

# CHOICE BASED FIRST SEMESTER M.Sc. Chemistry DEGREE EXAMINATION MARCH 2021

## Analytical Chemistry & Molecular Spectroscopy

**Duration:3 Hours** **Max Marks:70**

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## PART - A

**1. Answer any TEN of the following :** **(10×2= 20 Marks)**

a). Why is guard column used in HPLC?

b). State the stationary and mobile phase for TLC.

c). Mention the stationary phase and the mobile phase used in GC.

d). Differentiate between colorimeter and spectrophotometer

e). Explain the possible types of emission spectra

f). Give the advantages of ICP-AES

g). What are the information we get from SEM?

h). Mention the factors affecting DSC.

i). Justify that an exothermic peak is obtained in DTA curve of Calcium oxalate in oxygen atmosphere but not in nitrogen atmosphere

j). Distinguish between Elastic scattering and In-elastic scattering.

k). The normal modes of vibration of $CO_2$ molecule are $\gamma_1 = 1330\ cm^{-1}$, $\gamma_2 = 667\ cm^{-1}$, $\gamma_3 = 2349\ cm^{-1}$. Calculate the zero point energy.

l). Cooking in microwave oven is faster than the conventional method. Give reason

## PART - B

**Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)**

### UNIT - I

2. a) Explain counter-current extraction method of solvent extraction
b) A solution of 6.0 g of substance A in 50ml of aqueous solution is in equilibrium at 20°C with a solution of A in ether containing 108g of A in 100ml. Calculate the amount of A extracted by shaking 100ml of an aqueous solution containing 10g of A with i) 100ml of ether ii) 50 ml of ether twice (5+5)

3. a) Describe the role of ion-exchangers in demineralisation of water.
b) Write the applications of Column Chromatography (5+5)

## UNIT - II

4. a) Explain the various types of Interferences found in AAS and suggest ways to eliminate them.
   b) Describe in detail the construction and working of Hollow cathode lamp (5+5)

5. a) State and explain the factors affecting measurement in turbidimetry.
   b) Explain the principle and procedure used to determine sulphate by turbidimetry (5+5)

## UNIT - III

6. a) Explain the factors affecting TGA curves
   b) A 0.6025g of sample containing $Ca^{2+}$ and $Ba^{2+}$ ions was precipitated as $BaC_2O_4.H_2O$ and $CaC_2O_4.H_2O$. The precipitate was heated to 320°C to 400°C to give a constant weight 0.5713g and 620°C to give a constant weight of 0.4673g. Calculate the percentage of calcium and barium in the sample (6+4)

7. a) Describe the operating principle and instrumentation of TEM
   b) Write a note on sample preparation method in TEM (6+4)

## UNIT - IV

8. a) Write a note on Rotational Raman spectroscopy for linear diatomic molecules.
   b) Explain Mutual exclusion principle with example and explain why $CO_2$ is Raman active but IR inactive
   c) Explain some of the uses of Raman Effect. (4+3+3)

9. a) How are molecules classified based on principle moments of inertia? Explain with examples.
   b) Describe the diatomic molecule as a rigid rotar and derive the expression for moment of inertia. (5+5)

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