

- (a) Motion of a charged particle is in a direction  $\perp$  ar to magnetic field. What will charge ; it speed, direction of motion, K.E. of momentum.
- (b) Coils in a resistance box are made of double up insulated wire. Why?
- (c) Power factor can often be improved by the use of capacitor of appropriate capacitance in the circuit. Explain.
- (d) What is the nature of current versus potential difference graph for Ohmic and non Ohmic resistor ?
- (e) Write down the transformation equations of electric field  $\vec{E}$ .
- (f) What is Bohr magneton ? Calculate its value.
- (g) What is the value of  $\vec{\nabla} \cdot \vec{B}$  and  $\vec{\nabla} \times \vec{B}$  for points inside the current loop ?

## CHEMISTRY Paper-V

### (Inorganic Chemistry-B)

**Time Allowed : 3 Hours**

**Max. Marks : 22**

**Note:** Attempt five questions in all, including question No. 9 (Unit - V) which is compulsory and selecting one question each from Units I-IV.

#### Unit-I

1. (a) Draw neat diagram for NaCl and CsCl structure. What is the basic difference between the two structures ?
- (b) What are stoichiometric compounds ? Discuss the Frenkel defects. 2,2
2. (a) What are semiconductors ? Discuss mechanism of intrinsic and extrinsic semiconductors.
- (b) (i) What are the limitations of radius ratio rule ?
- (ii) A solid is made up of two elements X and Y. Atomic Y are in CCP arrangement while atoms X occur all the tetrahedral sites. What is the formula of the compound ? 2,2

#### Unit-II

3. (a) What is hydrogen bond ? Discuss two types of hydrogen bonds. Give two examples of each type.
- (b) Calculate the lattice energy of KCl crystal from the following data
- Sublimation energy of K (S) = 102.5 kJ/mol
- Dissociation energy of  $\text{Cl}_2$  (D) = 230.5 kJ/mol

Ionization energy of K (g) (I) = 450.6 kJ/mol

Electron affinity of Cl(g) (E) = -350.2 kJ/mol

Heat of formation of KCl (4H<sub>l</sub>) = -420.4 kJ/mol.

4. (a) Why solubilities of halides of silver in water are low while that of alkali metal halides are very high? 2,2
- (b) Explain different types of van der Waals forces. 2,2

### Unit - III

5. (a) (i) Boron forms no compounds in unipositive state but lithium in unipositive state is quite stable.
- (ii) What happens when boric acid is heated to redness? Write the reaction.
- (b) Discuss the structure of borazine. Why is it called inorganic benzene. 2,2
6. (a) Explain the following:
- (i) [AlF<sub>6</sub>]<sup>3-</sup> exists whereas [BF<sub>6</sub>]<sup>3-</sup> does not.
- (ii) How do the carbides CaC<sub>2</sub> and Al<sub>4</sub>C<sub>3</sub> differ?
- (b) (i) Define diagonal relationship. Give resemblance between boron and silicon.
- (ii) What are fluorocarbons? Name one fluorocarbon which is used as a refrigerant. 2,2

### Unit - IV

7. (a) Discuss the structure of OF<sub>2</sub>. Why is the bond angle of OF<sub>2</sub> molecule smaller than that of Cl<sub>2</sub>O?
- (b) (i) Write two reactions of H<sub>2</sub>SO<sub>4</sub> acts as an oxidising agent.
- (ii) Why SF<sub>6</sub> has zero dipole moment while SF<sub>4</sub> has non-zero dipole moment? 2,2
8. (a) (i) Write formulae of oxoacids of chlorine. Explain the trend of their acid strength giving reason.
- (ii) Complete the reaction:
- $$S_4N_4 + Cl_2 \rightarrow \dots\dots\dots \text{ and } S_4N_4 + SnCl_2 \rightarrow \dots\dots\dots$$
- (b) (i) What are interhalogen compounds? Give suitable example.
- (ii) I<sub>3</sub><sup>-</sup> is known whereas F<sub>3</sub><sup>-</sup> is not known. Why? 2,2

### Unit - V

9. (a) The radii of Mg<sup>++</sup> and O<sup>-</sup> are 0.66 Å and 1.40 Å. Predict the probable type of the site occupied by Mg<sup>++</sup> ions.
- (b) Cu<sup>+</sup> and Na<sup>+</sup> are of the same size but CuCl is insoluble while NaCl is soluble in water. Explain.



- (c) How many pentagonal and hexagonal faces are present in  $C_{70}$  and  $C_{76}$  fullerenes ?
- (d) Which out of  $CCl_4$  and  $SiCl_4$  can be easily hydrolysed and why ?
- (e) Why bleaching action of  $SO_2$  is temporary process ?
- (f) Why concentrated nitric acid becomes yellow on exposure to sunlight ?

6 × 1 = 6

## CHEMISTRY Paper-VI

### (Organic Chemistry-B)

**Time Allowed : 3 Hours**

**Max. Marks : 22**

**Note:** Attempt any five questions in all including Question No. 9 which is compulsory question and selecting one question from each Unit I-IV.

#### Unit - I

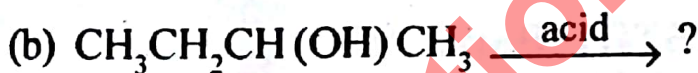
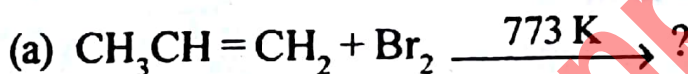
1. With suitable examples, explain the followings :

(a) Hofmann elimination

(b) Ozonolysis

2,2

2. Write the products of following reactions :



4

#### Unit - II

3. Write appropriate examples, explain the following in relevance to alkynes:

(a) Metal - ammonia reduction

(b) Polymerization

2,2

4. (a) Illustrate the Diels - Alder reaction with example.

(b) With appropriate example, discuss the mechanism of electrophilic addition reaction of alkynes.

1,3

#### Unit - III

5. (a) Elaborate the mechanism of nitration of benzene.

(b) List the factors which effect the *ortho to para ratio* of the products

2.2

6. (a) With resonance contributing forms, discuss the reactivity of halobenzenes towards the aromatic electrophilic substitution.  
 (b) Write the product/s of following reaction :



#### Unit - IV

7. (a) Discuss the stereochemistry of  $\text{S}_\text{N}^2$  reaction.  
 (b) Describe the addition - elimination mechanism of nucleophilic aromatic substitution reaction. 2, 2
8. (a) What happens when ethyl bromide is treated with :  
 (i) KCN (ii) NaSH (iii) Na/Dry ether (iv) AgCN  
 (b) Why allyl halides are more reactive than alkyl halides towards nucleophilic substitution reaction. 2, 2

#### Compulsory Question

9. (a) Give industrial application of propene.  
 (b) What do you understand by acidity of alkynes ?  
 (c) Define Huckel rule with example.  
 (d) How will you prepare chloroform ? 4 × 1.5 = 6

### CHEMISTRY Paper-VII

#### (Physical Chemistry-B)

Time Allowed : 3 Hours

Max. Marks : 22

Note: Attempt five questions in all with one question each from Units I, II, III and IV and Question IX is compulsory.

#### Unit - I

1. (a) What is Joule-Thomson effect ? Prove that it is an isoenthalpic process. Define Joule-Thomson coefficient and inversion



## Unit - II

3. (a) Using Kirchoff's equation for the variation of  $\Delta H$  of a reaction with temperature at constant pressure, calculate  $\Delta H$  at  $227^\circ\text{C}$  of the reaction :



where  $\Delta H(27^\circ\text{C}) = -20 \text{ kJ mol}^{-1}$ ,

Molar heat capacity ( $\text{J K}^{-1} \text{ mol}^{-1}$ )

$$C_p(\text{A}) = 5.2 ; C_p(\text{B}) = 9.2 ; C_p(\text{C}) = 15.0 ; C_p(\text{D}) = 12.0$$

Assume that the heat capacity of each substance does not change in the temperature range  $27^\circ$  to  $227^\circ\text{C}$ .

- (b) State and explain Hess's law of constant heat summation. What is the significance of this law ? 2,2
4. (a) Define enthalpy of neutralization. How can the heat of dissociation of acetic acid be determined ?
- (b) Calculate the bond energy of  $\text{C} = \text{C}$  from the following reaction:  
 $\text{H}_2\text{C} = \text{CH}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CH}_3 - \text{CH}_3(\text{g}) ; \Delta H = -125.25 \text{ kJ}$   
 The bond energies of  $\text{C} - \text{C}$ ,  $\text{C} - \text{H}$  and  $\text{H} - \text{H}$  are 347.3, 414.2 and 435.1 kJ, respectively. 2,2

## Unit - III

5. (a) What are multimolecular, macromolecular and associated colloids ? Give one example of each type.
- (b) Write a short note on Hofmeister series. 2,2
6. (a) Explain the terms 'dialysis' and 'electrodialysis'. Briefly explain one application of dialysis.
- (b) What is peptization ? Explain taking an example. 2,2

## Unit - IV

7. (a) 0.44 g of a substance dissolved in 22.2 g of benzene lowered the freezing point of benzene by  $0.567^\circ\text{C}$ . Calculate the molecular mass of the substance.  $K_f$  for benzene is  $5.12^\circ\text{C mol}^{-1}$ .
- (b) Define molal elevation constant. Derive an expression relating the boiling point of a solution with the molality of the dissolved solute. 2,2
8. (a) What is Van't Hoff factor ? How is it used to calculate the degree of dissociation and degree of association of a solute ?
- (b) A solution containing 13.5 g urea per 500 ml of solution in water has

## (Compulsory Question)

9. (a) Distinguish between reversible and irreversible thermodynamic processes with examples.
- (b) How bond energies can be useful in calculating the enthalpy change of a reaction ?
- (c) Define the terms 'gold number' and 'congo rubin numbers.'
- (d) What are emulsions ? Write various types of emulsion with examples.
- (e) What is meant by reverse osmosis ? Give an application of reverse osmosis.
- (f) How do you explain that relative lowering of vapour pressure is a colligative property? 6 × 1 = 6

**BOTANY Paper-A****(Plant Diversity-II)****Time Allowed : 3 Hours****Max. Marks : 36**

- Note:**
1. Attempt five questions in all.
  2. Question No. 1 is compulsory.
  3. Attempt four more questions, selecting one from each unit.
  4. Draw well labelled diagrams wherever necessary.

## 1. (a) Multiple Choice Questions :

- (i) Prominent vallecular canals are characteristic feature of which part of *Equisetum* aerial stem ?
- |                |               |
|----------------|---------------|
| (a) Pith       | (b) Cortex    |
| (c) Endodermis | (d) Pericycle |
- (ii) Heterosporous condition is seen in :
- |                        |                      |
|------------------------|----------------------|
| (a) <i>Rhynia</i>      | (b) <i>Equisetum</i> |
| (c) <i>Selaginella</i> | (d) <i>Pteris</i>    |
- (iii) Branched, multicellular and obliquely, septate rhizoids occur in :
- |                    |                       |
|--------------------|-----------------------|
| (a) <i>Funaria</i> | (b) <i>Anthoceros</i> |
| (c) <i>Riccia</i>  | (d) <i>Marchantia</i> |
- (iv) In *Selaginella* stem trabeculae represents modified
- |                     |         |
|---------------------|---------|
| (a) Epidermal cells | (b) ... |
|---------------------|---------|