[This question paper contains 4 printed pages.]

Sr. No. of Question Paper: 5828 D Your Roll No......

Unique Paper Code : 217281

Name of the Course : Credit Course for B.Sc. (Hons.) Mathematics /

**B.Sc.** Mathematical Science

Name of the Paper : Chemistry

Semester : II

Duration: 3 Hours Maximum Marks: 75

# **Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Use of nonprogrammable scientific calculators allowed.

SECTION A (Max. Marks: 38) (Inorganic Chemistry)

(Attempt any Four questions.)

1. (a) Explain the term lattice energy and Hydration energy. How does solubility of an ionic compound depends on them?

## OR

Write Kapustinskii equation for the lattice energy of an ionic compound and explain the terms involved. What are its advantages over Born-Lande's equation. (4)

(b) Using the following data, explain using Born – Haber Cycle, Why NaCl<sub>2</sub> does not exist?

Lattice energy for  $NaCl_2(U_2) = -2180 \text{ KJ mol}^{-1}$ 

Sublimation energy of Na(s) =  $108 \text{ KJ mol}^{-1}$ 

Dissociation energy of  $Cl_2(\Delta) = 242 \text{ KJ mol}^{-1}$ 

Ionization energy of Na(g) (IE<sub>1</sub>) = 496 KJ mol<sup>-1</sup>

 $Na^{+}(g)(IE_{2}) = 4562 \text{ KJ mol}^{-1}$ 

Electron affinity for Cl (g) (EA<sub>1</sub>) =  $-349 \text{ KJ mol}^{-1}$  (4)

(c) State Bent's Rule. (1½)

P.T.O.

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- 2. (a) Show diagrammatically splitting of d orbitals in tetrahedral field. (3)
  - (b) Draw M.O. diagram me of NO molecule or HCl molecule. (2½)
  - (c) How is intramolecular bonding different from intermolecular hydrogen bonding? (2)
  - (d) Why low spin tetrahedral complexes are not known to exist? (2)
- 3. (a) State John Teller Theorem. What are the conditions for: No distortion, slight distortion and strong distortion in octahedral complexes? (4)
  - (b) What is trans effect? On the basis of trans effect complete the following reaction

$$\begin{bmatrix} Cl \\ Cl - Pt^{2} - Cl \\ Py \end{bmatrix} + Br \longrightarrow \begin{bmatrix} ? \end{bmatrix} + NH_3 \longrightarrow \begin{bmatrix} ? \end{bmatrix}$$
(3)

(c) How does  $\pi$  – bonding affect  $\Delta_0$  in coordination complexes?

#### OR

Explain briefly the electrostatic polarization theory and  $\pi$  – bonding theory of Trans effect. (2½)

4. (a) Give the hybridization of the central atom and predict the shape of any **two** of the following:

(i) 
$$NO_3^-$$
 ion (ii)  $XeF_4$  (iii)  $ClF_3$  (2×2=4)

(b) Which complex in each pair will have higher  $\Delta_0$  value and why?

(i) 
$$[Cr(.CN)_6]^{3-}$$
 or  $[Cr(.H_2O)_6]^{3+}$ 

(ii) 
$$[Cr(.CN)_6]^{3+}$$
 or  $[Cr(.H_2O)_6]^{2+}$  (4)

- (c) Calculate CFSE of d<sup>8</sup> ion in weak octahedral field. (1½)
- 5. (a) Explain any four of the following:  $(4 \times 2 = 8)$ 
  - (i) Why is N<sub>2</sub> molecule diamagnetic and O<sub>2</sub>, paramagnetic?
  - (ii) Sugar is covalent in nature but is soluble in water while BaSO<sub>4</sub> although ionic is insoluble in water. Explain.

- (iii) Although hydrogen bonding in HF is stronger than present in water; why does water have much higher boiling point?
- (iv) Although F<sub>2</sub> and are gases; why is bromine liquid and iodine exist as solid at room temperature?
- (v) Pure HCl does not conduct electricity but its aqueous solution does?
- (b) How is thermodynamic stability different from kinetic stability of a substance?

### OR

How are instantaneous dipole – induced interactions different from dipole – dipole interactions? (1½)

# SECTION B (Max. Marks: 37) (Organic Chemistry)

(Attempt Three questions including Ouestion No. 1 which is compulsory.)

1. (a) Answer any six of the following:

 $(6 \times 2 = 12)$ 

- (i) Draw Newmann conformations of n butane. Which of these is the most and the least stable? Explain.
- (ii) Why 2,4,6 trinitrophenol is strongly acidic in nature? Explain.
- (iii) Draw one each meso and enatiomeric forms of tartaric acid.
- (iv) Explain the directive influence of the following groups when present in benzene nucleus:
  - (i) -CHO (ii) -OH
- (v) In what respect natural rubber differ from synthetic rubber? Draw their respective structures.
- (vi) Explain the terms Enatiomers and Distereoisomers with examples.
- (vii) Give one example each of reactions involving carbene and aryne as an intermediate.
- (viii) Why is benzyl cation more stable isopropyl carbocation?

(b) What is chirality?

(1)

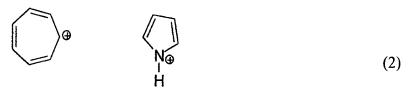
- 2. (a) What happens when methyl magnesium bromide reacts with the following:
  - (i) carbon dioxide (ii) methanal (iii) propanone (iv) ethyl acetate (4)
  - (b) Assign R / S or E / Z configuration (as the case may be) to any two of the following:

(c) Complete the following giving the name of the reaction

(i) 
$$CH_3CH = CH_2 + HBr \xrightarrow{peroxide}$$
?

(ii)  $CH_3COCH_2CH_3 + I_2 \xrightarrow{aq. NaOH}$ ? (2×2=4)

- 3. (a) Why is it necessary to carryout diazotiasation at 0-5°C? Write equation for azo dye test for aromatic primary amines. (4)
  - (b) What happens when phenol is heated with chloroform and alkali? Name the product formed after acidification. Name the reaction involved. (4)
  - (c) Using Huckel's Rule, explain which of the following are aromatic?



- (d) What are the differences between E1 and E2 elimination reactions? Explain giving example of each type. (2)
- 4. (a) Give the structures of any two nucleophiles. (2)
  - (b) Discuss the mechanism of Cannizaro reaction with suitable example. (4)
  - (c) Write short notes on any two of the following name reactions:
    - (i) Mannich reaction
    - (ii) Dieckmann Reaction
    - (iii) Claisen condensation
    - (iv) Darzen Reaction (4)

(1000)