

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 8383

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Roll No.....

Unique Paper Code : 217153 / 217181

Name of the Paper : CHCT-101 : CHEMISTRY

Name of the Course : B.Sc. (H) Physics /B.Sc. (H) Mathematics, Part I
(Concurrent Course)

Semester : I

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. Attempt 3 questions from Section A and 3 questions from Section B.
3. Please indicate the section you are attempting by putting a heading and do not intermix the sections.
4. The questions should be numbered in accordance to the number in the question paper.
5. Calculators and log tables may be used.

SECTION A

Attempt **three** questions in all.

1. (a) Explain the following :
 - (i) The bond angle of $\text{OF}_2 < \text{H}_2\text{O}$ whereas $\text{Cl}_2\text{O} > \text{H}_2\text{O}$.
 - (ii) Zinc blende (ZnS) flouts the radius ratio rule.
 - (iii) O_2 is paramagnetic whereas, O_2^{2-} is diamagnetic.
 - (iv) m- And p- nitrophenols have higher boiling points than o-isomer.
 - (v) NH_3 stabilises Co^{3+} ion rather than Co^{2+} ion forming $[\text{Co}(\text{NH}_3)_6]^{3+}$
- (b) Give the hybridization of the central atom in :
 TeF_5^- , IO_3^- , PCl_4^+ .
- (c) What is the order of boiling point of CH_4 , NH_3 , H_2O and HF ? Explain giving reasons. (7½,3,2)

P.T.O.

2. (a) Write Kaputinskii equation for lattice energy of an ionic compound and explain the terms involved. What is its advantage over Born Lande's equation ?

OR

Draw molecular orbital diagram of $[\text{Co}(\text{NH}_3)_6]^{3+}$ complex and explain the magnetic properties.

- (b) Arrange the following in increasing bond angles X-P-X order and justify :
 PF_3 , PCl_3 , PBr_3 .
- (c) Identify the example, which best suits the property mentioned. Giving reasons for your choice :
- (i) Higher ionization enthalpy : O_2 or N_2 .
- (ii) Distorted octahedral complex : $[\text{Fe}(\text{CN})_6]^{4-}$ or $[\text{Fe}(\text{CN})_6]^{3-}$
- (d) Distinguish between labile and inert complexes. (4,2½,5,1)
3. (a) Can hypothetical sodium dichloride (NaCl_2) exist ? Justify your answer.
- (b) Calculate the limiting radius ratio of cation to that of anion when co-ordination number is six.
 Given $r_{\text{Be}^{2+}} = 59 \text{ pm}$ and $r_{\text{S}^{2-}} = 170 \text{ pm}$, predict the geometry of BeS .
- (c) Draw the molecular orbital energy level diagram for CO. Calculate bond order.
- (d) How will you classify the oxides – $\text{Fe}^{\text{II}}\text{TiO}_3$ and $\text{Ca}^{\text{II}}\text{TiO}_3$? What are the structural differences in the two oxides ?

OR

What is trans-effect ? How tran- effect used to distinguish cis- and trans-
 $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ in Kurnakov's test ? (3,3,2½,4)

4. (a) How the π -bonding effects on the value of Δ_o ?
- (b) The reduction of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ is about 10^{10} times faster than the reduction of $[\text{Co}(\text{NH}_3)_6]^{3+}$. Discuss the mechanism behind this.
- (c) Which compound in each of the following pairs would have higher lattice energy and why ?
- (i) MgO and MgS
- (ii) NaCl and MgCl_2

- (d) What is the relationship between tetrahedral Δ_t , octahedral, Δ_o and square planar, Δ_{sp} ?
- (e) Ni^{2+} forms square planar complex, $[\text{Ni}(\text{CN})_4]^{2-}$ with CN^- whereas it forms octahedral complex, $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$, with water. Explain.

OR

Suggest a mechanism for direct electron transfer from $[\text{Fe}(\text{CN})_6]^{4-}$ to $[\text{Fe}(\text{CN})_6]^{3-}$. (3,3,3,1,2½)

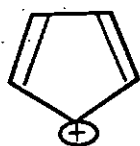
SECTION B

Attempt three questions in all.

5. Explain why ?

- (i) Cyclohexylamine is more basic than aniline.
- (ii) Allyl free radical is more stable than propyl free radical.
- (iii) Propyne is more acidic than propane.
- (iv) Chair conformation of cyclohexane is more stable than boat conformation.
- (v) The rate of nitration of toluene is greater than that of benzene. (12½)

6. (a) Which of the following compounds are aromatic and why ?



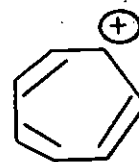
(i)



(ii)

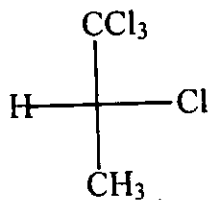


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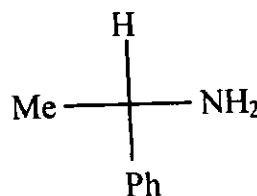


(iv)

(b) Assign R or S configuration.



(i)



(ii)

- (c) Why the chlorination of nitrobenzene gives m-chloro nitrobenzene while of bromobenzene gives o- and p-chloro bromobenzene ?
- (d) (i) Differentiate between configuration and conformation.
- (ii) Give the mechanism of Claisen condensation. (3,3,2½,4)

P.T.O.

7. (a) Draw the most stable chair conformation of trans-1,2-dimethyl cyclohexane and explain why?

(b) Give the final product and the mechanism by which it is obtained –



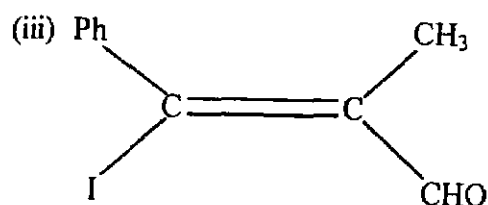
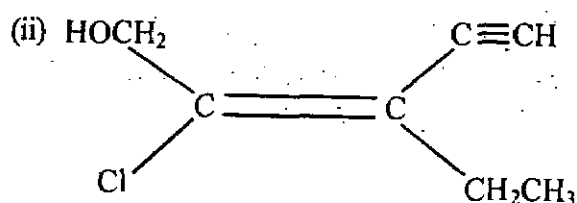
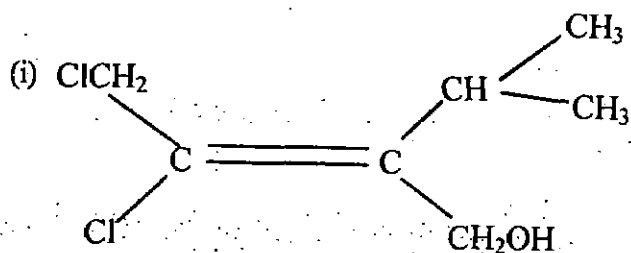
(c) Write short notes on :

- (i) Addition and condensation polymerization
(ii) Benzyne intermediate

(d) Give and explain the order of basicity :

- (i) $\text{C}_6\text{H}_5\text{NH}_2$ (ii) $p\text{-NO}_2\text{C}_6\text{H}_4\text{NH}_2$ (iii) $p\text{-CH}_3\text{OC}_6\text{H}_4\text{NH}_2$
(3,3,4,2½)

8. (a) Assign the E/Z to the following geometrical isomers :



(b) Which is the most favourable conformation of 1,2-ethanediol—Gauche or Anti?

(c) o-Hydroxybenzoic acid is more acidic than benzoic acid while p-hydroxybenzoic acid is less. Why?

(d) Write all the possible stereoisomers of 2,3-dichlorobutane and give their relationship amongst each other.

(e) Give the complete reaction and product so obtained when methyl magnesium bromide reacts with CO_2 .
(3,2,2,4,1½)

(3000)****