(18) 09/5/17

S. No. of Ques. Paper : 1189

Your Roll No.....

Unique Paper Code : 217281

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Name of Paper : Chemistry Paper III (CHCT-101)

Name of Course : B.Sc. (Hons.) Mathematics Concurrent Course-III/ B.Sc. Mathematical Science

Semester : II

Duration : 3 hrs

Maximum Marks : 75

(*Write your Roll No. on the top immediately on receipt of the question paper*)

Attempt ***three*** *questions from Section A and* ***three*** *questions from Section B. Use separate answer sheets for Sections A and B. Questions should be numbered in accordance to the number in the question paper. Calculators may be used.*

SECTION A

Attempt three questions from this section.

1.(a) On the basis of MO theory, N_2 molecule is diamagnetic, while O_2 molecule is paramagnetic. Explain.

(b) What are Fajan's rules? Explain, giving suitable example.

(c) $BaSO_4$ is insoluble in water, whereas Na_2SO_4 is soluble in water. Explain.

(d) Represent the splitting of *d*-orbitals in a square planar field.

4,3,3,2½

2. Calculate the lattice energy of CsCl using the following data:

$$Cs(s) \xrightarrow{S} Cs(g) \qquad \Delta H = 79.9 \text{ kJ/mol}$$

$$Cs(g) \xrightarrow{I} Cs^+(g) \qquad \Delta H = 374.05 \text{ kJ/mol}$$

$$Cl_2(g) \xrightarrow{D} 2Cl\cdot(g) \qquad \Delta H = 241.84 \text{ kJ/mol}$$

$$Cl\cdot(g) \xrightarrow{EA} Cl^-(g) \qquad \Delta H = -397.90 \text{ kJ/mol}$$

$$Cs(g) + \tfrac{1}{2} Cl_2(g) \xrightarrow{\Delta H_f} CsCl \qquad \Delta H = -623.00 \text{ kJ/mol}$$

(b) Account for the following: BeF_2 is linear, while SF_2 is angular in shape.

(c) NaCl is ionic, but NaI is predominantly covalent. Explain.

(d) Write the main postulates of VSEPR theory.

4,3,3,2½

3.(a) Predict the final products formed in the following reactions on the basis of *trans* effect (with explanation):

(i) $[PtCl_4(NH_3)]^- + NO_2^- \rightarrow$?

(ii) $[PtCl_4(NO_2)]^{2-} + NH_3 \rightarrow$?

(b) Draw the resonance structures of CO_3^{2-} ion.

(c) What is the Jahn-Teller effect?

(d) On the basis of hybridization, predict the shapes of the following molecules:

XeF_6, $ClOF_3$, IO_4^-

4,2½,3,3

4. (a) Comment on Schottky and Frenkel effects (with suitable examples).

(b) What is the concept of multiplicity rule? Explain.

(c) The electron transfer from $[Co(NH_3)_6]^{2+}$ to $[Co(NH_3)_6]^{3+}$ is slower than from $[Fe(CN)_6]^{4-}$ to $[Fe(CN)_6]^{3-}$. Explain.

(d) How will you account for the smaller bond order of NO compared to NO^+ on the basis of MO theory?

4,2½,3,3

SECTION B

Attempt three questions from this section.

5. Explain why:

(a) Aliphatic amines are stronger bases than the aromatic amines.

(b) Vinyl carbocation is less stable than the corresponding alkyl carbocation.

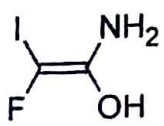
(c) *p*-Nitrophenol is more acidic than *o*-nitrophenol.

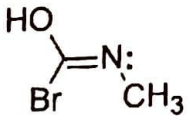
(d) Chair conformation of cyclohexane is more stable than boat conformation.

(e) Diethyl ether has lower boiling point and lower water solubility as compared to that of 1-butanol.

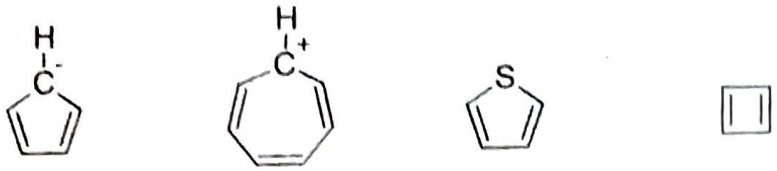
$5 \times 2½ = 12½$

6. (a) Assign *E/Z* configuration to the following compounds:





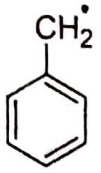
(b) Which of the following compounds are aromatic and why?



(c) Draw all the possible stereoisomers of tartaric acid [COOH-CHOH-CHOH-COOH]. Explain their relationships with each other. Which of these are optically active and which are optically inactive?

4,4,4½

7. (a) Draw resonance structures of benzyl radical



(b) *o*-Bromoanisole and *m*-bromoanisole, on treatment with iodamide in liquid ammonia, give the same product. Name the product and explain its formation.

(c) Differentiate between natural and synthetic rubber. Explain, giving their synthesis.

(d) Assign *R/S* configuration to the following compounds:

2 ½,4,3,3

8. Complete the following reactions and also indicate the name of the reaction:

(b) $C_6H_5COCH_3 + HCHO + C_2H_5NHC_2H_5 \rightarrow$?

(c) $CH_3CH{=}CH_2 + HBr \xrightarrow{\text{Peroxide}}$?

(d) $2\ HCHO \xrightarrow[\Delta]{NaOH(aq)}$?

(e) $CH_3COOC_2H_5 \xrightarrow{C_2H_5ONa}$?

$5 \times 2\frac{1}{2}$