mfs

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ATk

2007

CHEMISTRY (Optional)

001131

रसायनशास्त्र (वैकल्पिक)

Time : 3 hours

Maximum Marks : 200

Note :
- (i) In all attempt *five* questions.

- (ii) *Question No. 1 is* compulsory.

- (iii) Of the remaining Questions. Attempt **any four** by selecting **one question** from each section.

- (iv) Number of optional questions upto the prescribed number in the order in which questions have been solved, will only be assessed and excess answers of the question/s will not be assessed.

- (v) Candidate should not write roll number, any names (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he will be penalised.

1. Answer *any four* of the following :

   (a) (i) Explain how does Bohr's theory account for spectrum of hydrogen ?   7

   (ii) State Heisenberg's principle and give its mathematical statement.   3

   (b) (i) What are colligative properties ? Give four examples.   5

   (ii) Explain the use of colligative property for the determination of molecular weight of a non-volatile compound. (Select any one property)   5

   (c) (i) What are different types of hybridization ?   3

   (ii) "The geometry of molecule depends upon the type of hybridization". Explain this statement giving suitable examples.   7

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(d) (i) What are reactive intermediates ? Name the common reactive intermediates formed during organic reactions.   4

    (ii) Complete the following reactions. Name the reaction intermediate formed during reaction :   6

$$H_2C{=}CH{-}CH_3 + HBr \longrightarrow \ldots\ldots$$

$$\text{(phenol ring with OH)} + CHCl_3 \xrightarrow{OH^{\ominus}} \ldots\ldots$$
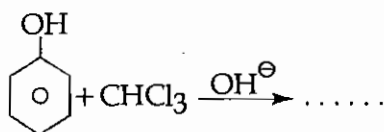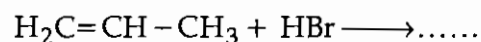
(e) (i) What is lattice energy ? Explain the importance of Born-Haber cycle.   6

    (ii) What is co-ordination number ? Explain it by using example of NaCl.   4

Section - A

2. (a) (i) What are polymers ? How are they classified on the basis of physical properties ?   6

      (ii) Explain tacticity in polymers.   4

   (b) (i) Discuss Lewis concept of acids and bases. Give suitable examples.   10

      (ii) What is selection rule ? What are the limitations of rotational spectra ?   5

      (iii) Calculate the band length of carbon monoxide molecule, if it's first rotational spectrum line appears at $3.84 \times 10^2 m^{-1}$.   5

$$[h = 6.626 \times 10^{-34} Js,\ C = 3 \times 10^8 ms^{-1},\ C = 12,\ O = 16,\ 1\ amu = 1.66 \times 10^{-27} kg]$$

   (c) (i) What are the sources of emission of SO_2 leading to air pollution ? What are the methods to control pollution by SO_2 ?   6

      (ii) Give the method for industrial preparation of calcium super phosphate.   4

3. (a) Give the preparation and applications of following polymers.   10

    (i)   Leflon   (ii)   Polyvinyl Chloride

    (iii) Silicones   (iv)   Phenol-formaldehyde resin

    (b) (i)   'Water is considered as universal solvent'. Explain this statement in detail.   10

    (ii)   Give the applications of IR spectra.   5

    (iii) The force constant of H - F band is $9.7 \times 10^2 N\ m^{-1}$. Calculate the vibrational
           frequency of the molecule $C = 3 \times 10^8 ms^{-1}$, H = 1, F = 19.   5

    (c) (i)   What is green house effect ? What are it's consequences ? What are methods
           to control it ?   6

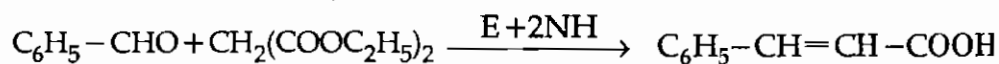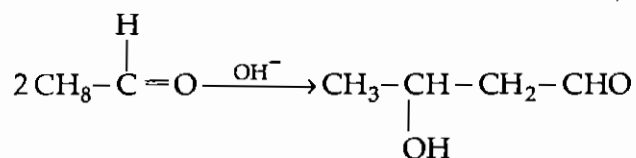   (ii)   Mention the advantages and disadvantages of urea as fertilizer.   4

Section - B

4. (a) (i)   What are the causes of deviation of gases from ideal behaviour ?   6

    (ii)   The equilibrium constant for the reaction.

    $$Zn + 2H^+ \longrightarrow Zn^{+2} + H_2$$

    is 6.0×10^{25} at 298K. Set up the cell in which this reaction takes place and
    calculate the standard potential of zinc electrode.   4

    (b) (i)   What are the limitations of first law of thermodynamics ? State the second
           law of thermodynamics in at least four terms.   8

    (ii)   State Hess's law of constant heat summation. Give one example which
           illustrates this law.   6

    (iii) The heat of combustion of carbon monoxide is -280 kJ mol^{-1} at 298K.
           Calculate the heat of combustion at 578K. The molar heat capacity changes
           by -11.5 JK^{-1} mol^{-1} during the reaction.   6

    (c) (i)   What are zero order reactions ? Give suitable examples.   4

    (ii)   What is adsorption ? What are the factors which affect the adsorption ?   4

    (iii) State BET equation and give the meaning of each term involved in the
           equation.   2
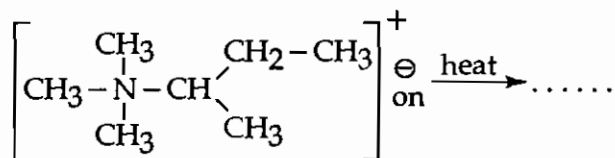
9. (a) (i) Give possible mechanism of following reaction :   6

(major product)
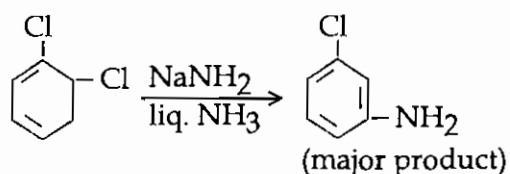
(ii) Electrophilic substitution in pyridine is difficult than in benzene. Justify.   4

(iii) Explain the mechanism of following reactions.   10

$$2\,CH_8-\overset{\overset{\displaystyle H}{|}}{C}=O \xrightarrow{\;OH^-\;} CH_3-\underset{\underset{\displaystyle OH}{|}}{CH}-CH_2-CHO$$

$$C_6H_5-CHO+CH_2(COOC_2H_5)_2 \xrightarrow{\;E+2NH\;} C_6H_5-CH=CH-COOH$$

(b) (i) Complete the reaction and assign the type of elimination.   5

$$\left[CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{N}}-CH\overset{CH_2-CH_3}{\underset{CH_3}{\diagup\!\!\!\diagdown}} \right]^{+}\overset{\ominus}{\underset{on}{}} \xrightarrow{\;heat\;} \cdots\cdots$$

(ii) Complete the reaction and mention the reactive intermediate formed during
the reaction   5

$$CH_3-CH_2-C\equiv N+C_2H_5MgI \longrightarrow \cdots\cdots$$
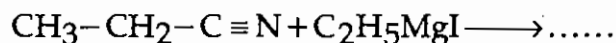
(c) (i) How will you convert glyceryl trioleafe to glyceryl tristearate ? Give reaction
only.   4

(ii) Mention the main steps in the manufacture of soap by Kettle process.   6

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5. (a) (i) Explain critical phenomenon with reference to gases. 6

 (ii) The emf of a cell is 1.420 volt at 298K and 1.390 volt at 318K. The cell reaction is 4

 $$Zn + Hg_2SO_4 \longrightarrow ZnSO_4 + 2Hg.$$

 Calculate ΔH and ΔS of the reaction at 298K.

 (b) (i) Explain Joule Thomson effect. 6

 (ii) Define 'heat capacity' of a gas. How heat capacity at constant pressure and heat capacity at constant volume are interrelated ? 7

 (iii) 14 gm of nitrogen is allowed to expand from a volume of 5 dm^3 to a volume of 20 dm^3 at 300K. Calculate q, w, ΔE and ΔH of the process. 7

 (c) (i) What are pseudounimolecular reactions ? Explain with suitable examples. 4

 (ii) How are catalysed reactions classified ? 3

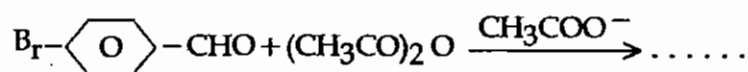 (iii) Mention main characteristics of enzyme catalysis. 3

Section - C

6. (a) (i) Give an account of variable oxidation states of first series of transitional elements. 4

 (ii) 'Most of the lanthanones are coloured and paramagnetic'. Explain. 6

 (b) (i) What is crystal field splitting ? Discuss the splitting of d orbitals in octahedral complexes. 8

 (ii) What are trace elements ? 4

 (iii) What are criteria for essential elements ? 4

 (iv) Why myoglobin has greater affinity for oxygen than haemoglobin. 4

 (c) (i) What is corrosion ? What are the different types of corrosion ? 6

 (ii) What are the economic losses due to corrosion ? 4

7. (a) (i) On the basis of electronic configuration, discuss the magnetic properties of first transitional series. 5

    (ii) Mention the important ores of uranium. Give any four properties of uranium. 5

  (b) (i) What are the assumptions of valence bond theory ? What are it's merits and demerits ? 8

    (ii) What are ion pumps ? Discuss the role of sodium pump in biological system. 5

    (iii) Discuss the structure of vitamin B_{12} (structural formula is not expected). 3

    (iv) Give various functions of B_{12}. 4

  (c) (i) Give the electrochemical theory of corrosion. 4

    (ii) Explain methods adopted for preventing metals from corrosion. 6

Section - D

8. (a) (i) Nitration of chlorobenzene gives p-chloronitrobenzene while chlorination of nitrobenzene gives m-chloronitrobenzene. Give reason. 6

    (ii) Give one example of each : SN_1 reaction and SN_i reaction. 4

    (iii) Give the name of reaction and write the product : 10

$$2 \ (CH_3)_2 \ CH-CH_2-CHO \xrightarrow{\ 60\% \ KOH \ } \ \ldots\ldots$$

$$2 \underset{}{\left\langle \underset{\text{O}}{\overset{\overset{\displaystyle CH_3}{|}}{}} \right\rangle} \xrightarrow[\text{aqueous alcohol}]{\ KCN \ } \cdots\cdots$$

$$B_r - \left\langle \text{O} \right\rangle - CHO + (CH_3CO)_2 \ O \xrightarrow{\ CH_3COO^- \ } \ldots\ldots$$

  (b) (i) Give the intermolecular mechanism of Fries Rearrangement. 6

    (ii) Dehydration of 2-butanol gives 2-butane as a major product. Explain. 4

  (c) (i) Mention important distinguishing points between fats and oils. 6

    (ii) How will you prepare sodium lauryl sulphate from lauryl alcohol ? Give reaction only. 4

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