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Jars Education

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Time : 1 Hour 15 Minute

STD 11 Science Chemistry
Chapter Based Test

Total Marks : 40

SECTION A

* **Choose The Right Answer From The Given Options.[1 Marks Each]** **[6]**

1. $H-C\equiv C-H \xrightarrow[\text{(ii) } CH_3CH_2Br]{\text{(i) } NaNH_2/\text{liq } NH_3} X \xrightarrow[\text{(ii) } CH_3CH_2Br]{\text{(i) } NaNH_2/\text{liq } NH_3} Y$

(A) X is 2-butyne Y is 2 hexyne.
(B) X is 1-butyne, Y is 2-hexyne.
(C) X is 1-butyne Y is 3-hexyne.
(D) X is 2-butyne, Y is 3-hexyne.

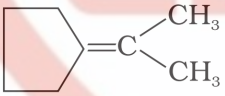
2. Which of the following is Aromatic Hydrocarbon?

(A) C_2H_2 (B) C_3H_8 (C) C_5H_{12} (D) C_6H_6

3. Which of the following alkenes on ozonolysis give a mixture of ketones only?

(a) $CH_3—CH=CH—CH_3$

(b) $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}—CH=CH_2$

(c) 

(d) $(CH_3)_2C=C\begin{matrix}CH_3\\CH_3\end{matrix}$

4. Propene is allowed to react with B_2D_6 and the product is treated with acetic acid. The final product obtained is:

(A) 1-deuteriopropane
(B) 2-deuteriopropane
(C) 1-deuteriopropene
(D) 2-deuteriopropene

5. In the reaction, $CH_3-\underset{\displaystyle Br}{\overset{\displaystyle |}{CH_2}} \xrightarrow[\Delta]{\text{alc. KOH}} A,$ A is:

(A) $CH_2=CH_2$
(B) CH_3CH_3
(C) $CH\equiv CH$
(D) Both (a) and (b)

6. Phenyl magnesium bromide reacts with methanol to give:

(A) Benzene.
(B) Toluene.
(C) Phenol.
(D) Arisole.

* **Answer The Following Questions In One Sentence.[1 Marks Each]** **[5]**

7. Write IUPAC names of the following compound:

8. How can we obtain isobutane from n-butane?
9. Which alkene, on heating with $KMnO_4$/ KOH gives Hexane 1, 6-dioic acid?
10. Which alkyne would you start with to Prepare $CH_3 - CH_2 - CH_2 - CO - CH_3$?
11. Which of the two trans-but-2-ene or trans-pent-2-ene is non-polar?

SECTION B

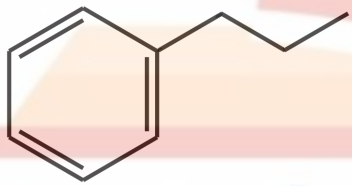
*** Given Section consists of questions of 2 marks each.** **[6]**

1. How would you convert the following compound into benzene?
   Ethene.
2. An alkyl bromide (X) react with sodium metal dissolved in anhydrous ether to form 4, 5-diethyl octane. Identify 'X'.
3. Rotation around carbon-carbon single bond of ethane is not completely free. Justify the statement.

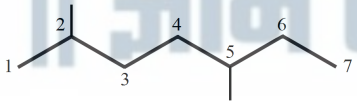
SECTION C

*** Given Section consists of questions of 3 marks each.** **[9]**

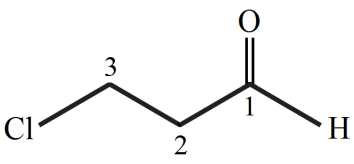
1. 2 Arrange the following set of compounds in order of their decreasing relative reactivity with an electrophile, E^+.
   Toluene, p-H_3C-C_6H_4-NO_2 , p-O_2N-C_6H_4-NO_2.
2. Convert:
   i. Ethylene to Nitrobenzene.
   ii. Write short note on Markovnikov's Rule.
3. Write IUPAC names of the following:
   a.



   b.



   c.



SECTION D

* **Case study based questions** **[4]**

1. Read the passage given below and answer the following questions from 1 to 5.

$$CH_4 + Cl_2 \xrightarrow{h\nu} \underset{\text{Chloromethane}}{CH_3Cl} + HCl \quad (13.10)$$

$$CH_3Cl + Cl_2 \xrightarrow{h\nu} \underset{\text{Dichloromethane}}{CH_2Cl_2} + HCl \quad (13.11)$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{h\nu} \underset{\text{Trichloromethane}}{CHCl_3} + HCl \quad (13.12)$$

$$CHCl_3 + Cl_2 \xrightarrow{h\nu} \underset{\text{Tetrachloromethane}}{CCl_4} + HCl \quad (13.13)$$

Alkanes are generally inert towards acids, bases, oxidising and reducing agents. However, they undergo the following reactions under certain conditions.

1) Substitution reactions One or more hydrogen atoms of alkanes can be replaced by halogens, nitro group and sulphonic acid group. Halogenation takes place either at higher temperature (573-773K) or in the presence of diffused sunlight or ultraviolet light. Lower alkanes do not undergo nitration and sulphonation reactions. These reactions in which hydrogen atoms of alkanes are substituted are known as substitution reactions. As an example, chlorination of methane is given below: Halogenation

$$CH_3 - CH_3 + CL_2 \xrightarrow{hv} \underset{\text{Chloroethane}}{CH_3 - CH_2Cl} + HCl$$

It is found that the rate of reaction of alkanes with halogens is $F_2 > C_{l2} > Br_2 > I_2$. Rate of replacement of hydrogens of alkanes is: $3^\circ > 2^\circ > 1^\circ$. Fluorination is too violent to be controlled. Iodination is very slow and a reversible reaction. It can be carried out in the presence of oxidizing agents like HIO_3 or HNO_3.

$$CH_4 + I_2 \rightleftharpoons CH_3I + HI$$

$$HIO_3 + 5HI \rightarrow 3I_2 + 3H_2O$$

Halogenation is supposed to proceed via free radical chain mechanism involving three steps namely initiation, propagation and termination.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l); \quad \Delta_c H^\ominus = -890\ kJ\ mol^{-1}$$

$$C_4H_{10}(g) + 13/2\ O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l); \quad \Delta_c H^\ominus = -2875.84\ kJ\ mol^{-1}$$

The General combustion equation for any alkane is:

$$C_nH_{2n+2} + \left(\frac{3n+1}{2}\right) O_2 \rightarrow nCO_2 + (n+1)H_2O$$

Combustion

Alkanes on heating in the presence of air or dioxygen are completely oxidized to carbon dioxide and water with the evolution of large amount of heat.

Due to the evolution of large amount of heat during combustion, alkanes are used as fuels. During incomplete combustion of alkanes with insufficient amount of air or dioxygen, carbon black is formed which is used in the manufacture of ink, printer ink, black pigments and as filters.

(i) $2CH_4 + O_2 \xrightarrow{Cu/523K/100atm} 2CH_3OH$
Methanol

(ii) $CH_4 + O_2 \xrightarrow[\Delta]{Mo_2O_3} HCHO + H_2O$
Methanal

(iii) $2CH_3CH_3 + 3O_2 \xrightarrow[\Delta]{(CH_3COO)_2Mn} 2CH_3COOH + 2H_2O$
Ethanoic acid

(iv) Ordinarily alkanes resist oxidation but alkanes having tertiary H atom can be oxidized to corresponding alcohols by potassium permanganate.

$(CH_3)_3CH \xrightarrow[\text{Oxidation}]{KMnO_4} (CH_3)_3COH$
2-Methylpropane — 2-Methylpropan-2-ol

Controlled oxidation Alkanes on heating with a regulated supply of dioxygen or air at high pressure and in the presence of suitable catalysts give a variety of oxidation products.

Ordinarily alkanes resist oxidation but alkanes having tertiary H atom can be oxidized to corresponding alcohols by potassium permanganate .

Pyrolysis Higher alkanes on heating to higher temperature decompose into lower alkanes, alkenes etc. Such a decomposition reaction into smaller fragments by the application of heat is called pyrolysis or cracking.

$$C_6H_{14} \xrightarrow{773K} \begin{cases} C_6H_{12} + H_2 \\ C_4H_8 + C_2H_6 \\ C_3H_6 + C_2H_4 + CH_4 \end{cases}$$

Pyrolysis of alkanes is believed to be a free radical reaction. Preparation of oil gas or petrol gas from kerosene oil or petrol involves the principle of pyrolysis. For example, dodecane, a constituent of kerosene oil on heating to 973K in the presence of platinum, palladium or nickel gives a mixture of heptane and pentene.

$C_{12}H_{26} \xrightarrow[973K]{Pt/Pd/Ni} C_7H_{16} + C_5H_{10} +$ other products
Dodecane — Heptane — Pentene

Conformations- Alkanes contain carbon-carbon sigma (σ)bonds. Electron distribution of the sigma molecular orbital is symmetrical around the internuclear axis of the C–C bond which is not disturbed due to rotation about its axis. This permits free rotation

about C–C single bond. This rotation results into different spatial arrangements of atoms in space which can change into one another. Such spatial arrangements of atoms which can be converted into one another by rotation around a C-C single bond are called conformations or conformers or rotamers. Alkanes can thus have infinite number of conformations by rotation around C-C single bonds. However, it may be remembered that rotation around a C-C single bond is not completely free. It is hindered by a small energy barrier of 1^{-20} kJ mol–1 due to weak repulsive interaction between the adjacent bonds. Such a type of repulsive interaction is called torsional strain. Conformations of ethane : Ethane molecule (C_2H_6) contains a carbon – carbon single bond with each carbon atom attached to three hydrogen atoms. Considering the ball and stick model of ethane, keep one carbon atom stationary and rotate the other carbon atom around the C-C axis. This rotation results into infinite number of spatial arrangements of hydrogen atoms attached to one carbon atom with respect to the hydrogen atoms attached to the other carbon atom. These are called conformational isomers (conformers). Thus there are infinite number of conformations of ethane. However, there are two extreme cases. One such conformation in which hydrogen atoms attached to two carbons are as closed together as possible is called eclipsed conformation and the other in which hydrogens are as far apart as possible is known as the staggered conformation. Any other intermediate conformation is called a skew conformation. It may be remembered that in all the conformations, the bond angles and the bond lengths remain the same. Eclipsed and the staggered conformations can be represented by Sawhorse and Newman projections.

i. Alkanes contain carbon-carbon … bonds.
   a. sigma σ
   b. pi bondπ
   c. deltaδ
   d. eta η

ii. C-C single bond is hindered by a small energy barrier of…. kJ mol^{-1}
   a. 10 - 200
   b. 1 - 20
   c. 100 - 427
   d. 342 - 786

iii. A decomposition reaction into smaller fragments by the application of heat is called as ….
   a. pyrolysis
   b. cracking
   c. both (a) & (b)
   d. combustion

iv. Which of the following steps are involving in free radical chain mechanism
   a. initiation
   b. propagation
   c. termination
   d. All the above

v. The … reaction in which alkanes on heating in the presence of air or dioxygen are completely oxidized to carbon dioxide and water with the evolution of large amount of heat.
   a. pyrolysis
   b. cracking
   c. both (a) & (b)
   d. combustion

SECTION E

*** Given Section consists of questions of 5 marks each.** **[10]**

1. Write chemical equations for combustion reaction of the following hydrocarbons:
   i. Butane.
   ii. Pentene.
   iii. Hexyne.
   iv. Toluene.
2. How do you account for the formation of ethane during chlorination of methane?

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