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— **TUITION** —

Phone: +442081445350

www.chemistryonlinetuition.com

Email: asherrana@chemistryonlinetuition.com

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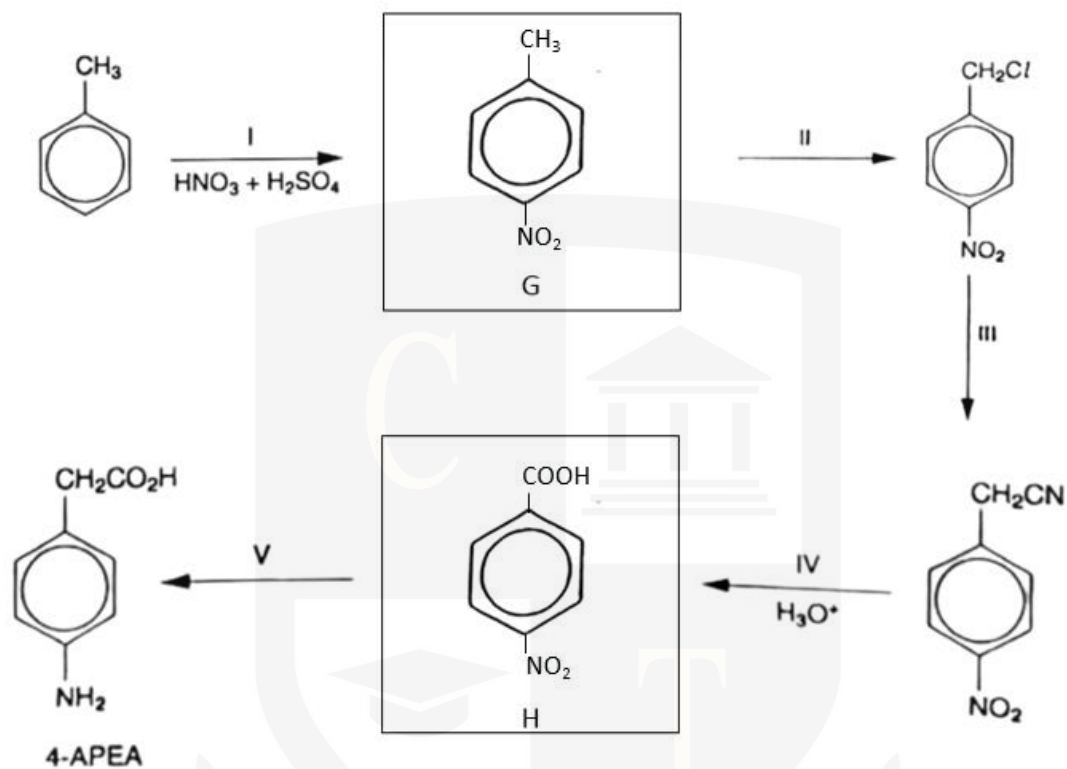
Level & Board	CIE (A-LEVEL)
TOPIC:	HYDROCARBONS
PAPER TYPE:	SOLUTION - 2
TOTAL QUESTIONS	11
TOTAL MARKS	90

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Hydrocarbons - 2

1)

(a)



(b)

- step II: $\text{Cl}_2 + \text{light}$.
- Step III: KCN (in ethanol) + heat. Temperature $\approx 75^\circ\text{C}$.
- Step V: Sn + HCl + heat [NaOH is used to separate Amine].

2)

(a) (i) reaction I: reaction: PCl_5

condition: dry ether.

reaction II: reagent: NH_3

condition: concentrated ammonia under pressure.

(ii) Nucleophilic substitution

(iii) Delocalisation of lone pair on chlorine over benzene ring produces a stronger $C - Cl$ bonds.

(b) (i) reaction III: reagent: Conc, HNO_3 and conc. H_2SO_4

condition: at $55 - 60^\circ C$.

reaction IV: reagents: Sn and conc. HCl

condition: heat under reflux.

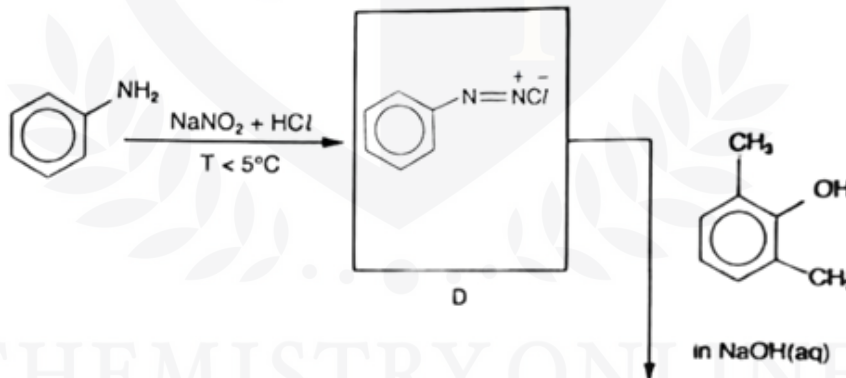
(ii) reaction III: Electrophilic substitution

Reaction IV: Reduction

(c) reagent and conditions: Bromine water, room temperature.

Observation with phenylamine: color of bromine(aq) turns brown to colorless and colorless and white precipitate is produced.

(d)



E

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3)

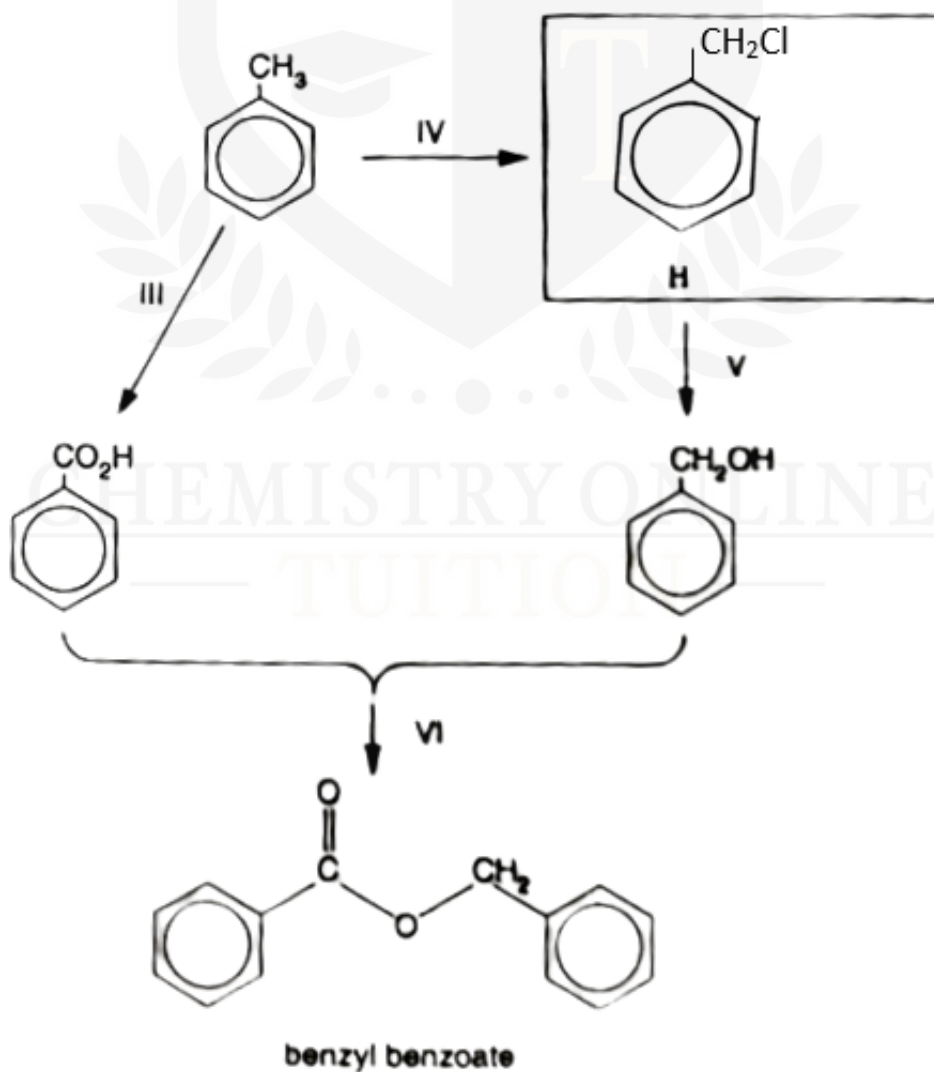
(a)

compound	All carbon atoms can be coplanar	not all carbon atoms can be coplanar
A	✓	
B		✓
C	✓	
D	✓	
E	✓	

(b) reaction I: reagent: Cl_2 & AlCl_3 . condition: warm under reflux.

reaction II: reagent Cl_2 .

condition: heat or light.



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(ii) reaction III: reagent: $\text{KMnO}_4/\text{OH}^-$. condition: heat

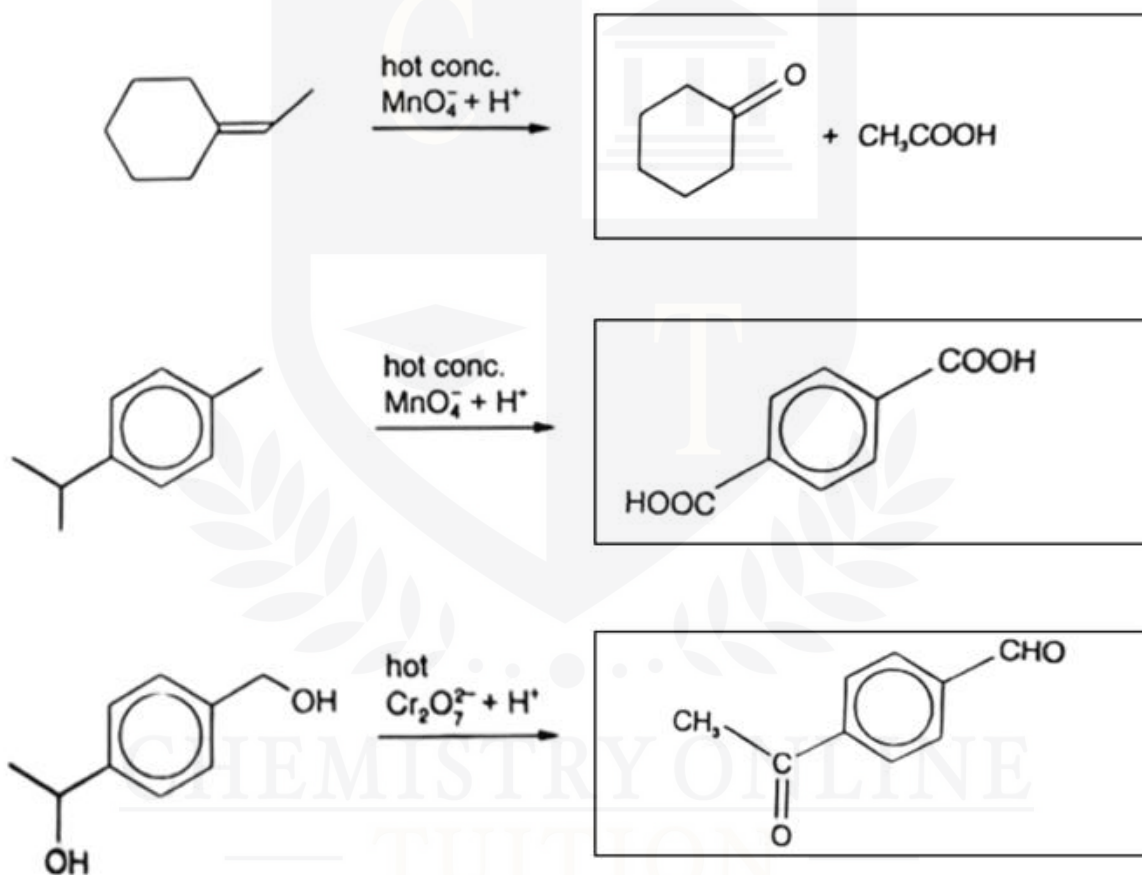
reaction V: reagent: NaOH aqueous. condition: heat

reaction VI: reagent: conc. H_2SO_4 condition: heat

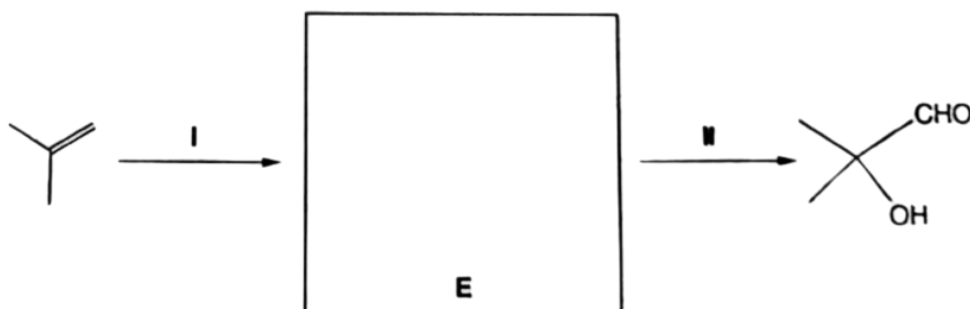
(iii) reaction III: oxidation

reaction V: Nucleophilic substitution

4)



(e) (i)



(ii) reaction I: cold, dilute KMnO_4 , mild condition.

reaction II: acidified $\text{K}_2\text{Cr}_2\text{O}_2$, distill the vapours.

5)

(a) (i) hydrocarbon: A compound which is made up only of carbon and hydrogen is known as hydrocarbon.

(ii) *fractional distillation*: It is a separation technique in which separation of compounds is according to difference in their boiling points.

(b) (i) process 1: high temperature and high pressure.

Process 2: high temperature in the presence of catalyst (Al_2O_3).

(ii) $\text{C}_{12}\text{H}_{24} \rightarrow \text{C}_5\text{H}_{12} + \text{C}_6\text{H}_{12}$

(c) (i)

$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	$\text{CH}_3\text{CH}_2\underset{\text{CH}_3}{\text{C}}\text{HCH}_3$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Isomer B	Isomer C	Isomer D

(ii) isomer: B

Explanation: Straight chain or unbranched molecule has greater area of contact hence greater strength of intermolecular forces of attractions and high boiling points.

(b) Heat evolved = $mc\Delta T$

$$= 200 \times 4.18 \times 27.5$$

$$= 22990 \text{ J or } 23.0 \text{ KJ}$$

(ii) 23.0 KJ produced from 0.47 g of E

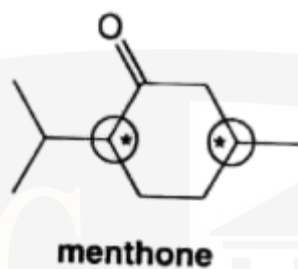
$$2059 \text{ KJ produced from } = \frac{0.47 \times 2059}{23.0} = 42.08 \text{ g of E}$$

(f) Mr of $\text{C}_3\text{H}_6 = 42$

Hence E is C_3H_6 .

6)

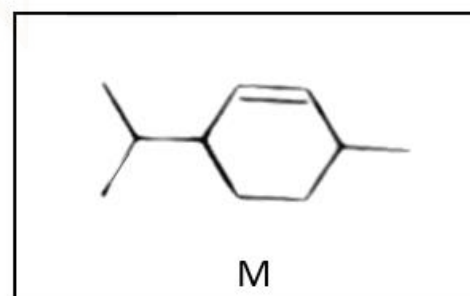
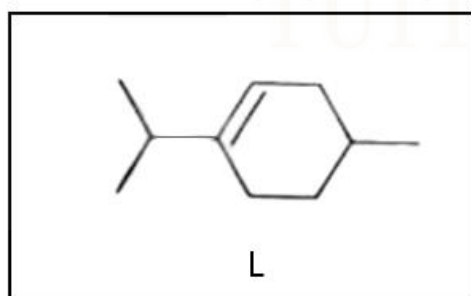
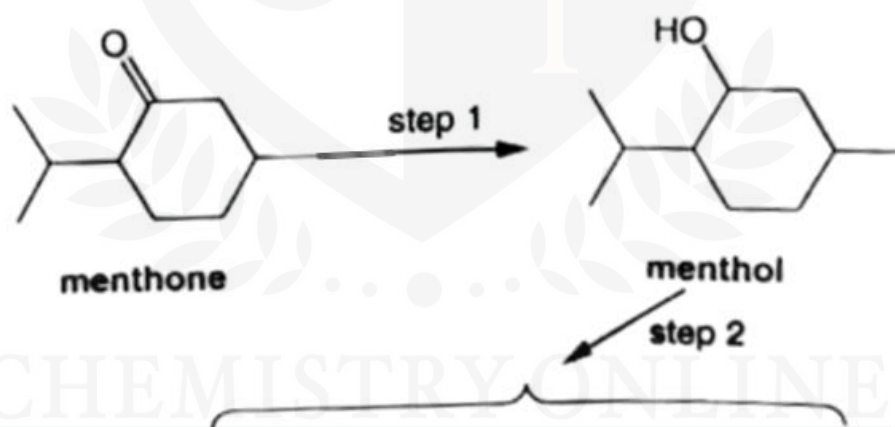
(e)



(b) (i) Step 1: LiAlH_4 dissolved in ethanol.

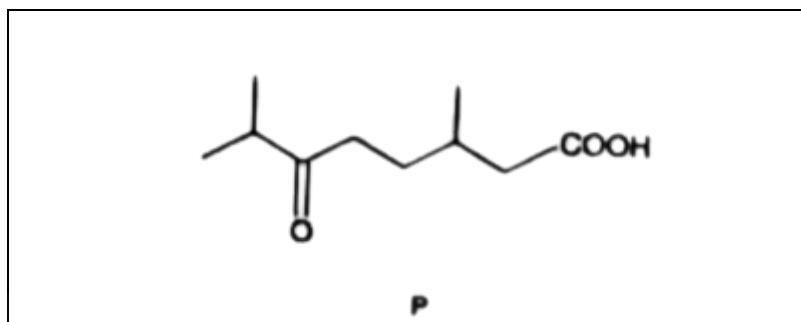
Step 2: Conc, H_2SO_4 at 130°C or hot Al_2O_3 at 350°C .

(ii)



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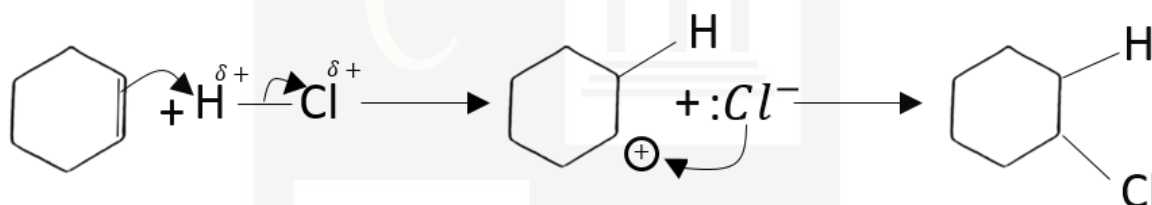
(c) (i) M



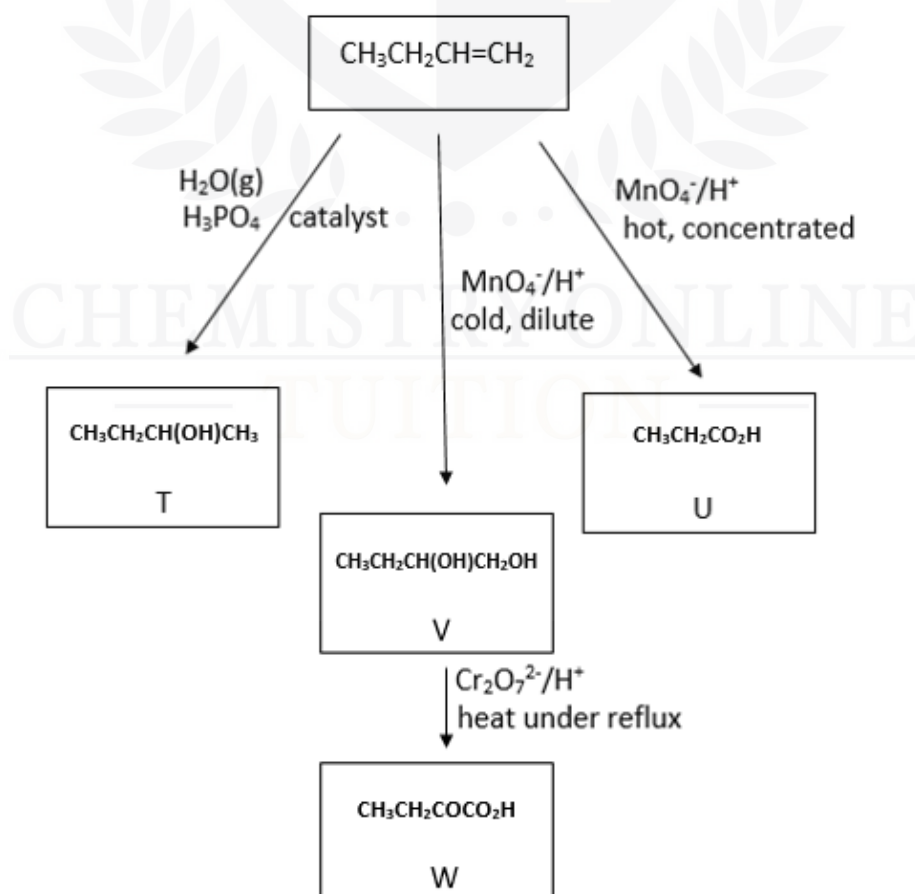
(iii) reagent(s): 2, 4-Dinitrophenyl hydrazine.

observation: Orange precipitates are formed.

(d)

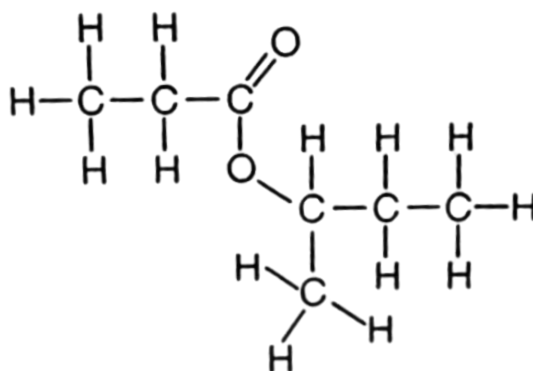


7)



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(b)

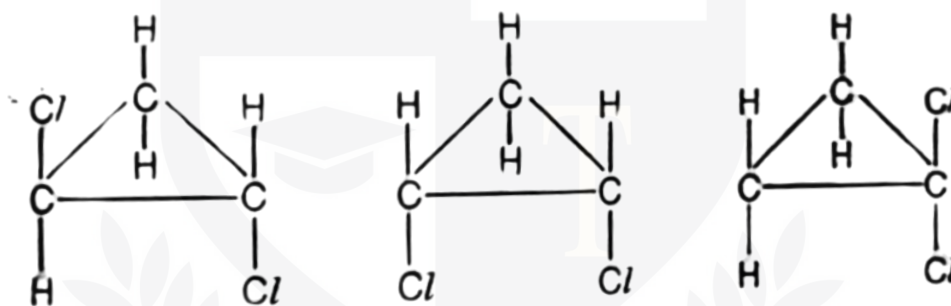


8)

(a) 118°

(b) (i) Electrophilic addition.

(ii)



9)

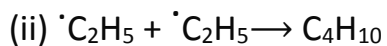
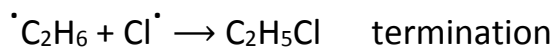
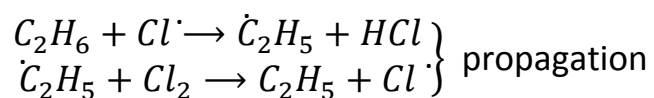
(a) physical process: Fractional distillation

Chemical process: Cracking

(b) (i) Alkanes have strong $C - H$ and $C - C$ bonds. Furthermore, the similar electronegativities of carbon and hydrogen give non-polar molecules.(ii) ethane: 109.5

ethane: Trigonal planar

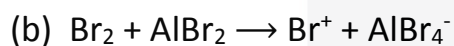
(iv) Ethane contains 4 σ bonds on the carbon atoms.Ethene contains 3 σ and 1 π bonds on the carbon atoms



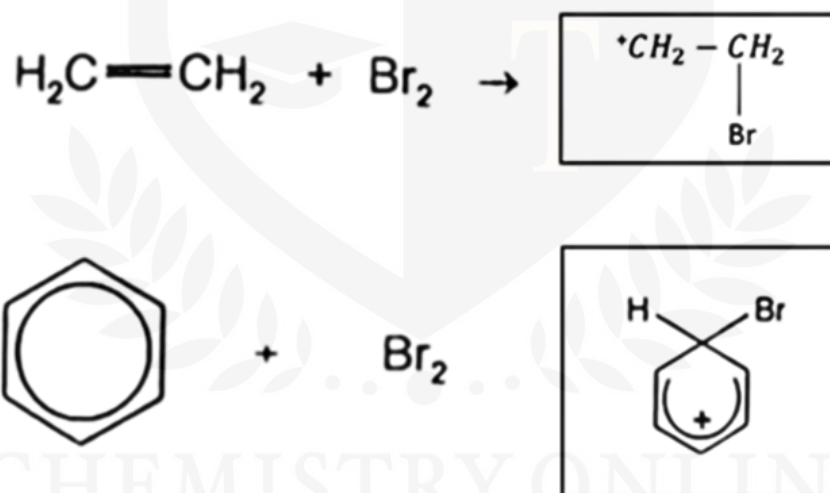
10)

(a) (i) ethene: Addition

(ii) benzene: Substitution



(c) (i)



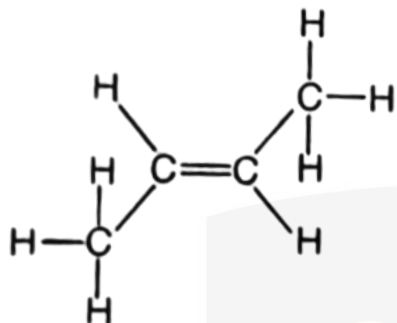
(ii) The ring of pi electrons in bromobenzene does not change after the reaction.

Thus bromobenzene is still unsaturated.

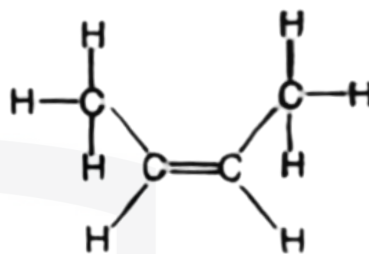
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11)

(b) (i) Stereoisomers are different molecules which have the same molecular and structural formula, but have a different arrangement of atoms in space.



name: Trans-but-2-ene



name: Cis-but-2-ene

(c) reagent: NaBH_4

product: Propan-2-ol

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DR. ASHAR RANA



**CHEMISTRY ONLINE
— TUITION —**

Phone: +442081445350
www.chemistryonlinetuition.com
Email: asherrana@chemistryonlinetuition.com

- Founder & CEO of Chemistry Online Tuition Ltd.
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CONTACT INFORMATION FOR CHEMISTRY ONLINE TUITION

- UK Contact: 02081445350
- International Phone/WhatsApp: 00442081445350
- Website: www.chemistryonlinetuition.com
- Email: asherrana@chemistryonlinetuition.com
- Address: 210-Old Brompton Road, London SW5 OBS, UK