

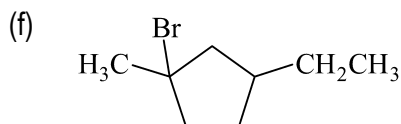
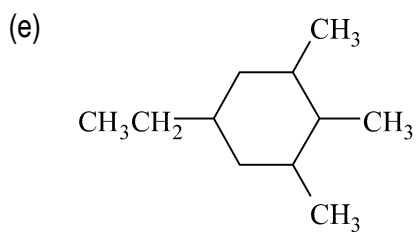
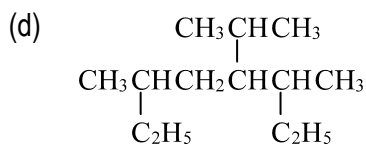
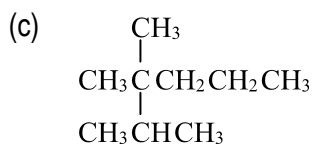
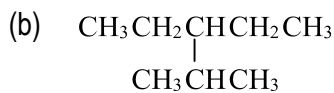
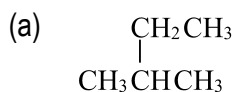
TOPIC	SUBTOPIC	LEARNING OUTCOMES	MAPPING COGNITIVE DOMAINS			
			C1	C2	C3	C4
Hydrocarbon	5.1 Alkanes	a) Define and classify hydrocarbons into: i. Aliphatic and aromatic ii. Saturated and unsaturated	√	√		
		b) Draw structure and name alkane compounds according to IUPAC rules for: i. Straight chain and branched alkanes (parent chain $\leq C_{10}$) ii. Cyclic alkanes ($C_3 - C_6$) iii. Alkyl groups		√		
		c) Explain the following physical properties: i. Boiling points of - Alkanes based on molecular weight - Isomeric alkanes - Alkanes and cycloalkanes ii. Solubility in water and organic solvents			√	√
		d) Write equation for the combustion of alkanes in: i. Excess oxygen ii. Limited oxygen		√		
		e) Explain the halogenation reaction of alkanes		√		
		f) Explain the monosubstitution of alkanes containing equivalent and non-equivalent type of hydrogen atoms			√	
		g) Illustrate the free radical monosubstitution mechanism of alkanes				√
	5.2 Alkenes	a) Draw structures and name alkenes according to the IUPAC nomenclature for: i. Straight chain and branched alkenes - (parent chain $\leq C_{10}$) - Cyclic alkenes ($C_3 - C_6$) - Simple dienes ($C_4 - C_6$)		√		
		b) Explain boiling point of isomeric alkenes				√
		c) Describe the preparation of alkenes through: i. Dehydration of alcohol ii. Dehydrohalogenation of haloalkanes				√
		d) Outline the mechanisms for c(i)				√
		e) Justify major product formed using Saytzeff's Rule				√
		f) Predict the major product of the elimination reaction				√
		g) Explain the addition reaction of alkenes with: i. Hydrogen in the presence of catalyst ii. Halogen (Cl_2 or Br_2) in inert solvent (CH_2Cl_2) iii. Halogen (Cl_2 or Br_2) in water iv. Hydrogen halides (HCl or HBr) v. Acidified water		√		
		h) Predict the products forms according to the Markovnikov's rule				√
		i) Illustrate the mechanism of electrophilic addition of (g) iv and (g) v				√
		j) Predict the product of the reaction between alkene and hydrogen bromide in the presence of hydrogen peroxide/acid peroxide according to anti Markovnikov's rule				√
		k) Explain/ Predict the reaction of alkenes with: i. O_3 followed by Zn, H_2O or O_3 followed by $(CH_3)_2S$ (ozonolysis) ii. Hot, acidified $KMnO_4$				√
		l) Identify the position of double bond through:				√

		i. Ozonolysis				
		ii. Reaction with hot, acidified KMnO_4				
		m) Explain the unsaturation test for alkenes:				
		i. Baeyer's test using dilute KMnO_4 solution				✓
		ii. Bromine in CH_2Cl_2				
		iii. Bromine water				

5.1: HYDROCARBON (ALKANES)

1. Name the following compounds according to the IUPAC nomenclature:

[LO:5.1(c)]



2. Draw the structural formula for each of the following compounds: **[LO:5.1(c)]**
 - (a) 1,1-dichloro-3-methylcyclohexane
 - (b) 1-bromo-5-chloro-3-ethyl-3-methylpentane
 - (c) 5-sec-butyl-2,4-dimethylnonane

3. Each of the following IUPAC names is incorrect. Explain why it is incorrect and give the correct IUPAC name. **[LO:5.1(c)]**
 - (a) 2-methyl-2-isopropylheptane
 - (b) 1,5-dimethylcyclohexane
 - (c) 3-butyl-2,2-dimethylhexane

4. Arrange the following alkanes in order of increasing boiling points. Explain your answer. **[LO:5.1(d)i]**
 - (a) nonane, pentane, decane, heptane
 - (b) pentane, 2-methylbutane, 2,2-dimethylpropane
 - (c) $(\text{CH}_3)_2\text{CHCH}_3$, $(\text{CH}_3)_4\text{C}$, $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$, $\text{CH}_3(\text{CH}_2)_3\text{CH}_3$

5. Explain why butane is soluble in benzene but insoluble in water. **[LO:5.1(d)ii]**

6. Write a balanced chemical equation for the combustion of propane in **[LO:5.1(e)]**
 - (a) excess oxygen
 - (b) limited oxygen

7. A mixture of propane and bromine is exposed to sunlight. The reaction equation is given below. **[LO:5.1(h)]**

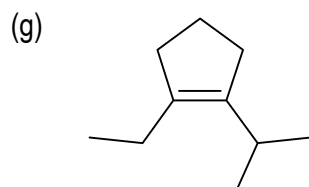
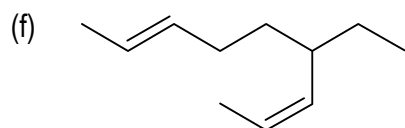
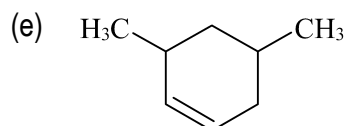
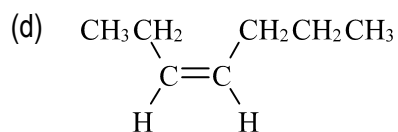
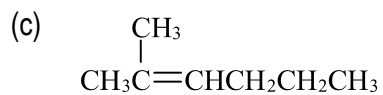
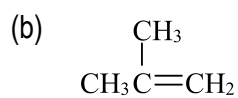
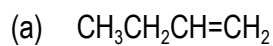
$$\text{CH}_3\text{CH}_2\text{CH}_3 + \text{Br}_2 \xrightarrow{\text{uv}} \text{A} + \text{B}$$
 - (a) State the type of the reaction.
 - (b) What is the function of sunlight in the reaction?
 - (c) Draw the structure of the monosubstituted products, A and B. Identify the major product.
 - (d) Write the mechanism for the formation of the major product.
 - (e) Give the observation of the reaction.
 - (f) What would happen if the mixture is kept in the dark at room temperature?

8. Show the mechanism for the bromination of methylcyclopentane under sunlight. **[LO:5.1(h)]**

5.2: HYDROCARBON (ALKENES)

1. Give the IUPAC names for the following alkenes:

[LO:5.2(b)]



2. Draw the structural formula for each of the following alkenes: [LO:5.2(b)]

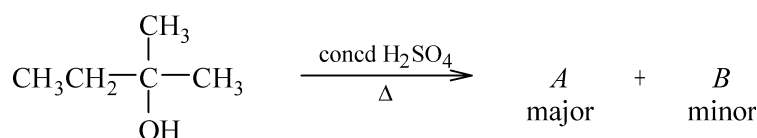
- | | |
|-----------------------------|---------------------------|
| (a) 2,3-dimethyl-2-butene | (b) 4,5-dibromo-1-pentene |
| (c) <i>trans</i> -2-hexene | (d) <i>cis</i> -4-octene |
| (e) 1,2-dichlorocyclobutene | |

3. The following names are incorrect. Suggest the correct names and give your reason(s). [LO:5.2(b)]

- | | |
|--------------------------------|--------------------------|
| (a) <i>trans</i> -3-pentene | (b) 2-methylcyclohexene |
| (c) 1-sec-butyl-2-cyclopentene | (d) 1-isopropyl-1-butene |

4. (a) Define Saytzeff's rule. [LO:5.2(f)]

(b) Draw the structural formulae and name the major and minor products for the following reaction: [LO:5.2(d)i]



Write the reaction mechanism for the formation of the major product.

5. Draw the structural formulae of alkenes that would be formed when 2-bromo-3-methylbutane is subjected to dehydrohalogenation with potassium hydroxide in ethanol. Predict the major product. [LO: 5.2(d)ii]

6. Write the equation for the preparation of propene from compounds below. Write mechanism in 5(b)

- | | |
|---------------------|----------------------|
| (a) 2-chloropropane | [LO: 5.2(d)ii] |
| (b) propanol | [LO: 5.2 (d)I & (e)] |

7. (a) Define Markovnikov's rule. [LO: 5.2(i)]

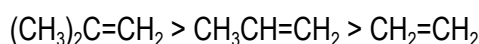
(b) Write an equation of the reaction between 2-methylpropene and hydrogen bromide to form the product. [LO:5.2(h)iv]

(c) State the type of reaction involved. [LO:5.4(e)]

(d) Write the mechanism that accounts for the formation of the product. [LO:5.2(j)]

8. Explain the order of reactivity when the following alkenes are subjected to acid-catalysed hydration.

[LO: 5.2(h)iv & (j)]



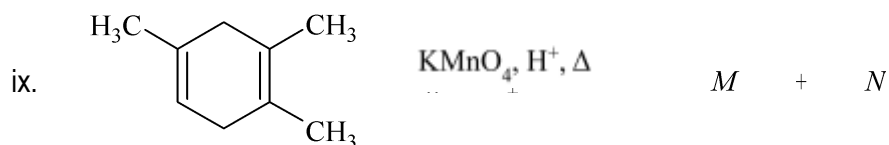
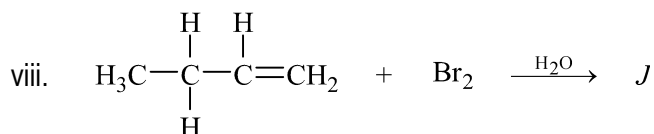
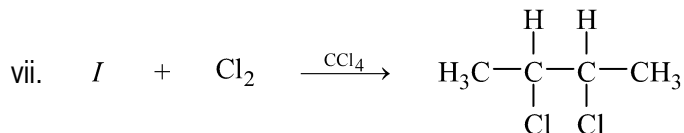
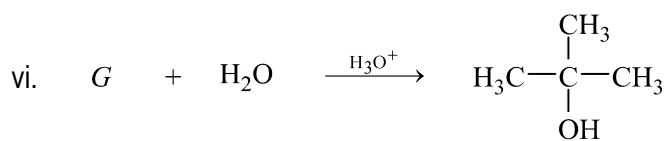
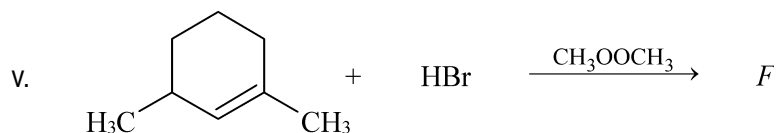
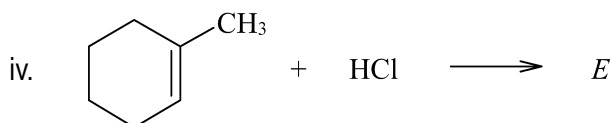
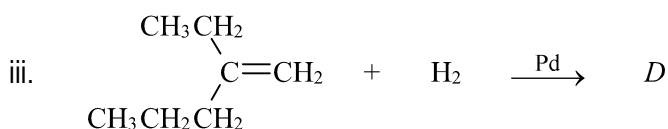
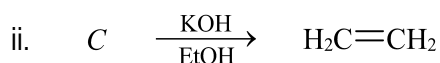
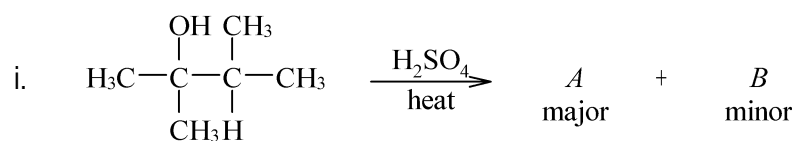
9. For each of the following reaction:

(a) Draw the structural formulae of compounds A to P

(b) State the type of reaction involved

(c) Specify name of reaction involved

[LO:5.2(b)]





- 12.



- 14.