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VCE Chemistry ½

Isomerism in Organic Chemistry [2.6]

Homework Solutions

Admin Info & Homework Outline:

Student Name	
Questions You Need Help For	
Compulsory Questions	Pg 2 - Pg 16
Supplementary Questions	Pg 17 - Pg 30

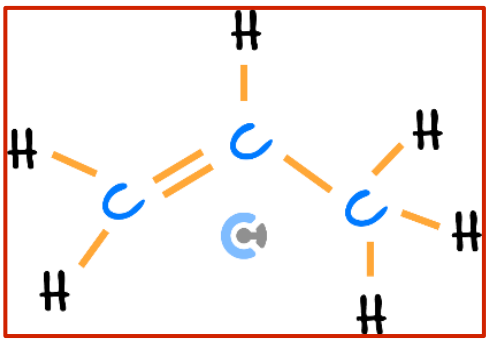
Section A: Compulsory Questions (64 Marks)

Sub-Section [2.6.1]: Apply IUPAC Conventions to Identify, Draw & Write IUPAC Names of Straight-Chained & Branched Alkenes

Question 1 (6 marks)

Consider the homologous series of alkenes.

a. Draw and name the alkene that has a carbon chain length of 3 carbons. (1 mark)



Propene

b. State the general molecular formula of alkenes. (1 mark)

C_nH_{2n}

For the following molecules, draw their structural formula and give their semi-structural formula.

c. Ethene

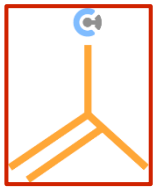
i. Skeletal diagram. (1 mark)

ii. Semi-structural formula. (1 mark)

CH_2CH_2

d. 2-methylpropene

i. Skeletal diagram. (1 mark)



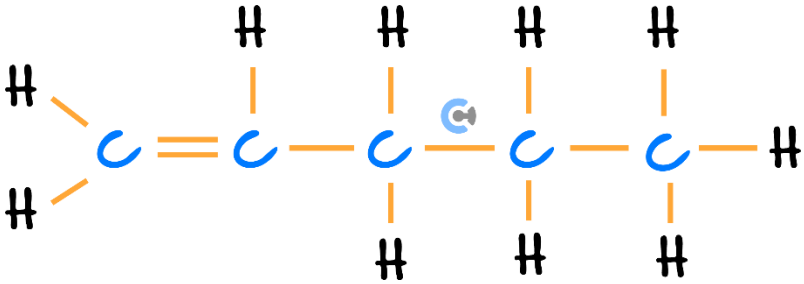
ii. Semi-structural formula. (1 mark)

$CH_2C(CH_3)CH_3$

Question 2 (9 marks)

For each of the following, name the molecule and draw the semi-structural formula & skeletal diagram.

a.

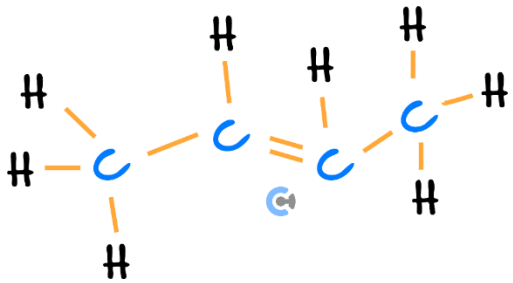


i. Name and write the semi-structural formula. (2 marks)

Pent-1-ene; $CH_2CHCH_2CH_2CH_3$

ii. Draw the skeletal diagram. (1 mark)

b.

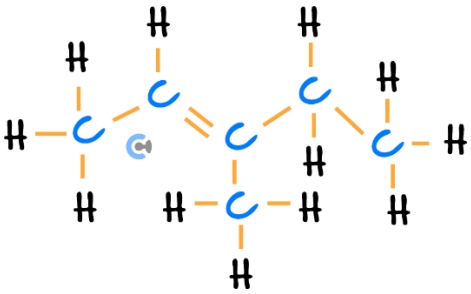


i. Name and write the semi-structural formula. (2 marks)

But-2-ene: $CH_3CHCHCH_3$

ii. Draw the skeletal diagram. (1 mark)

c.



i. Name and write the semi-structural formula. (2 marks)

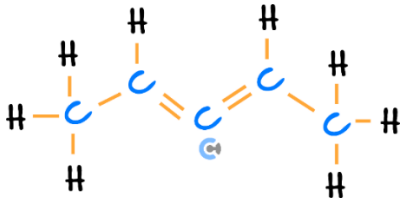
3-methylpent-2-ene; $CH_3CHC(CH_3)CH_2CH_3$

ii. Draw the skeletal diagram. (1 mark)

Question 3 (9 marks)

Name each of the following and give their semi-structural and skeletal diagram.

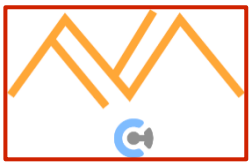
a.



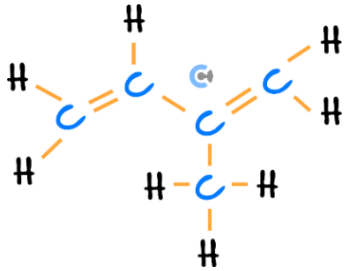
i. Name and semi-structural formula. (2 marks)

Pent-2, 3-adiene; $CH_3CHCCHCH_2$

ii. Skeletal diagram. (1 mark)



b.

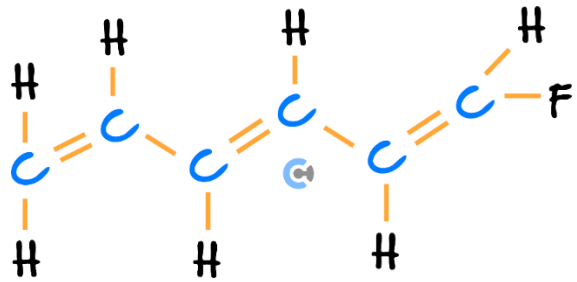


i. Name and semi-structural formula. (2 marks)

2-methylbut-1, 3-adiene; $CH_2CHC(CH_3)CH_2$

ii. Skeletal diagram. (1 mark)

c.



i. Name and semi-structural formula. (2 marks)

1-fluorohex-1, 3, 5-triene; $CH_2CHCHCHCHCHF$

ii. Skeletal diagram. (1 mark)

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Sub-Section [2.6.2]: Identify & Explain What Structural Isomers Are

Question 4 (2 marks)

Mary is investigating structural isomers.

a. Define the term "structural formula." (1 mark)

A formula which shows the arrangement of atoms in the molecule of a compound.

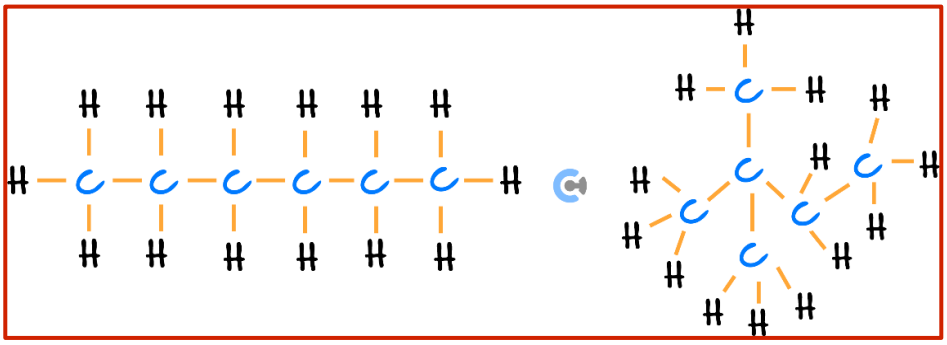
b. List **three** different types of structural formulas. (1 mark)

Positional, functional, chain isomers.

Question 5 (6 marks)

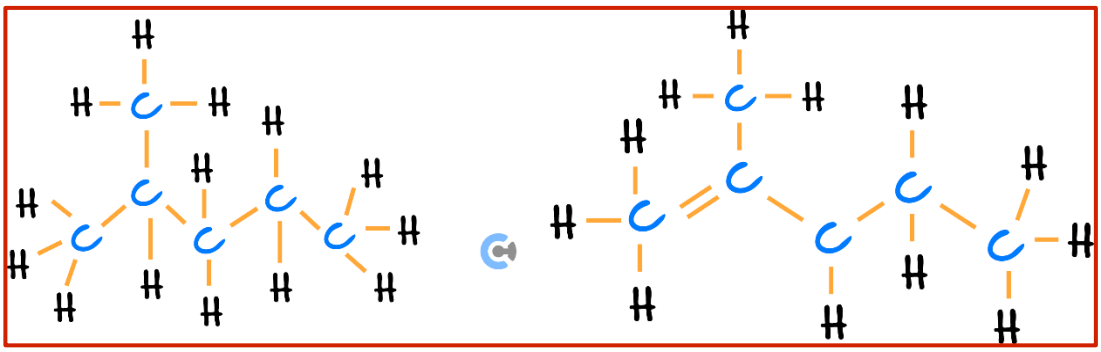
For the following molecules, determine if they are chain isomers and draw their structures.

a. Hexane and 2, 2-dimethylbutane. (3 marks)



Yes

b. 2-methylpentane and 2-methylpent-1-ene. (3 marks)

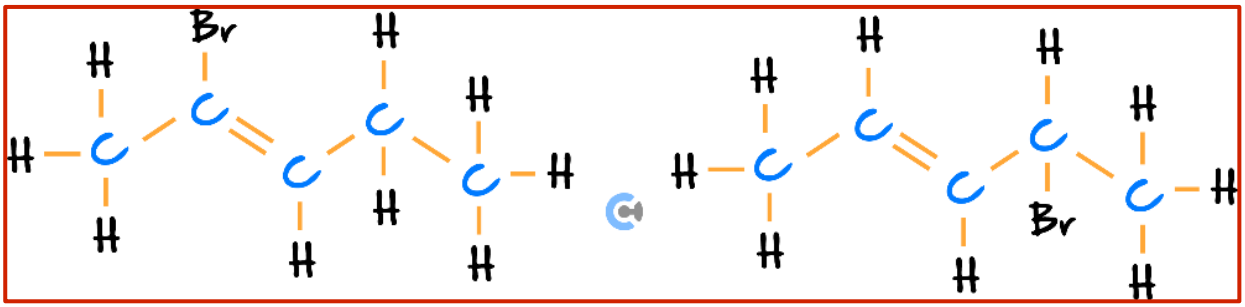


No

Question 6 (4 marks)

Consider the following two molecules: 2-bromopent-2-ene and 4-bromopent-2-ene.

a. Draw their structural formulae. (2 marks)



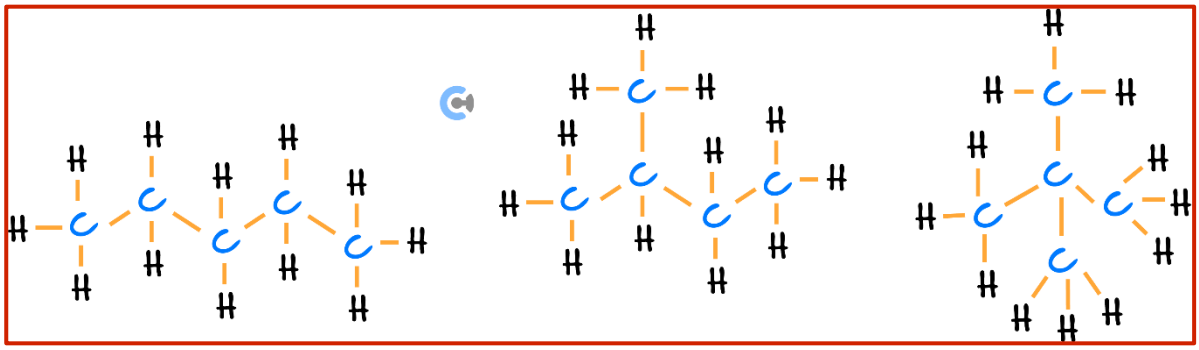
b. Are these two molecules positional isomers? Explain your answer. (2 marks)

Yes, because the length of the longest carbon chain is preserved and the naming is only changed because the bromine shifted from the 2nd to 4th carbon, making it positional isomer.

Sub-Section [2.6.3]: Find Possible Structural Isomers (Chain, Positional, Functional) of Alkanes, Alkenes & Haloalkanes from a Given Molecular Formula

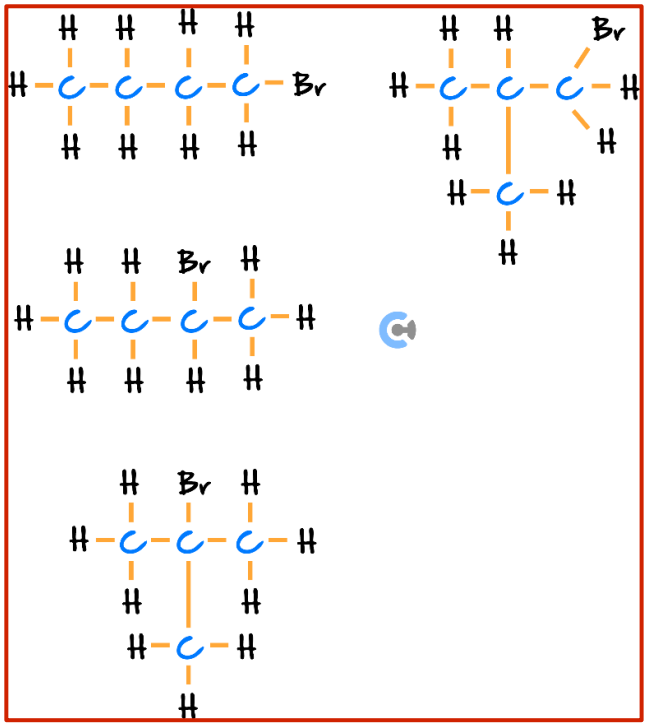
Question 7 (3 marks)

Draw all the possible isomers of C_5H_{12} that can be found.



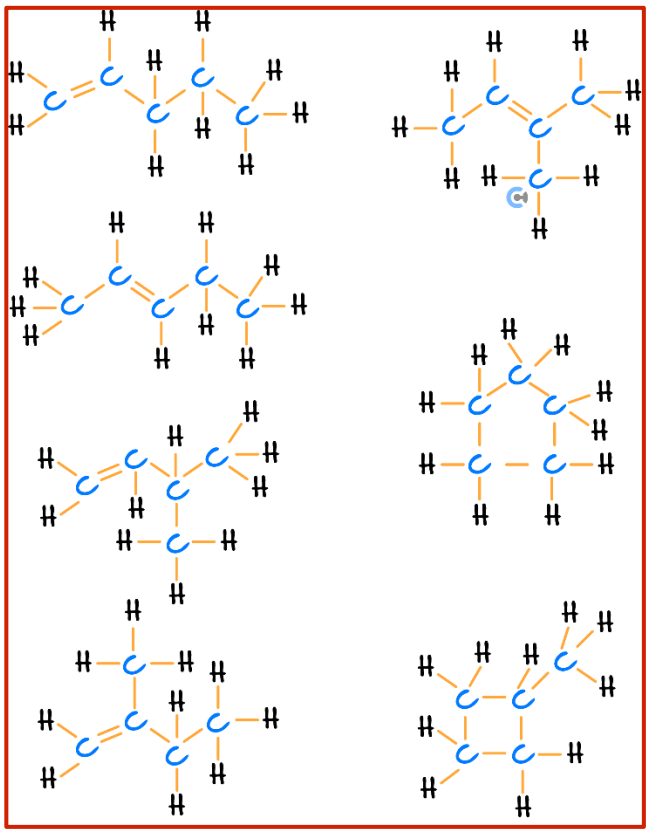
Question 8 (3 marks)

Draw all the possible isomers of C_4H_9Br that can be found.



Question 9 (5 marks)

Draw the skeletal diagrams of all the possible isomers of C_5H_{10} that can be found.



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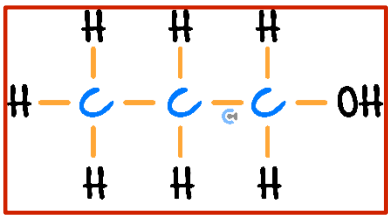
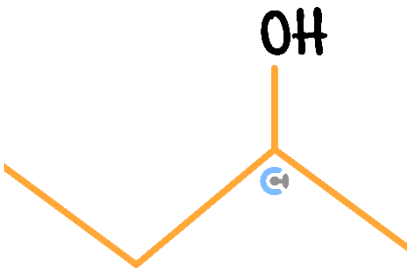
Sub-Section [2.6.4]: Apply IUPAC Conventions to Identify, Draw & Write IUPAC Names of Straight-Chained & Branched Alcohols

Question 10 (3 marks)

a. Draw the structural formula of propan-1-ol. (1 mark)

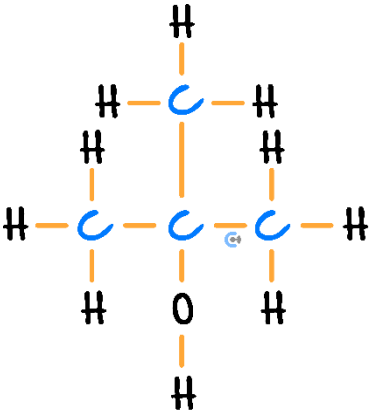


b. The skeletal formula of a molecule is provided below. Provide its IUPAC name. (1 mark)



butan-2-ol

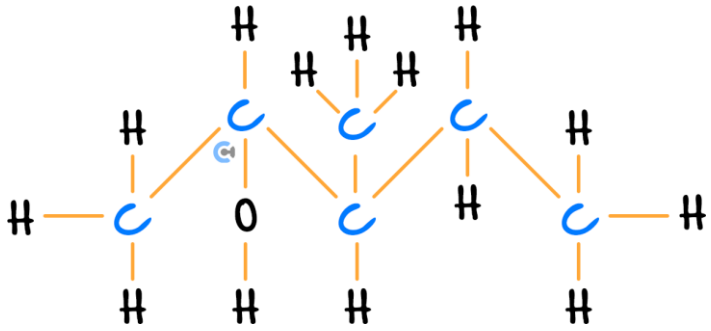
c. The structural formula of a molecule is provided below. Provide its IUPAC name. (1 mark)



2-methylpropan-2-ol or methylpropan-2-ol

Question 11 (3 marks)

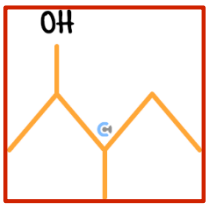
The following molecule is to be investigated.



a. Name and semi-structural formula. (2 marks)

3-methylpentan-2-ol ; $CH_3CH(OH)CH(CH_3)CH_2CH_3$

b. Skeletal diagram. (1 mark)



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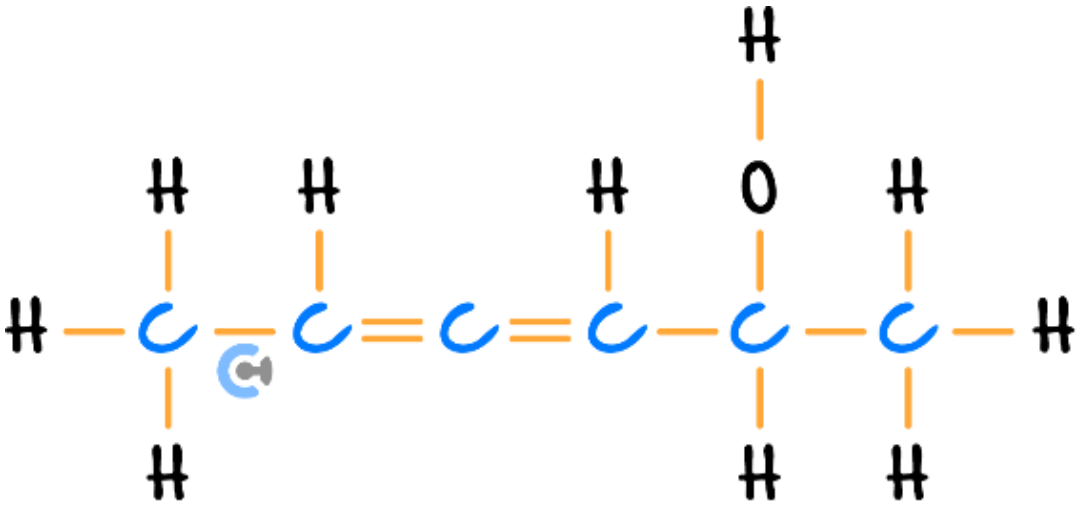
Question 12 (6 marks)

Name each of the following and give their semi-structural and skeletal diagram.

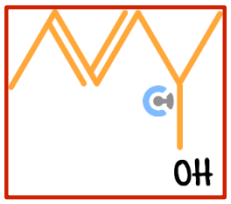
a.



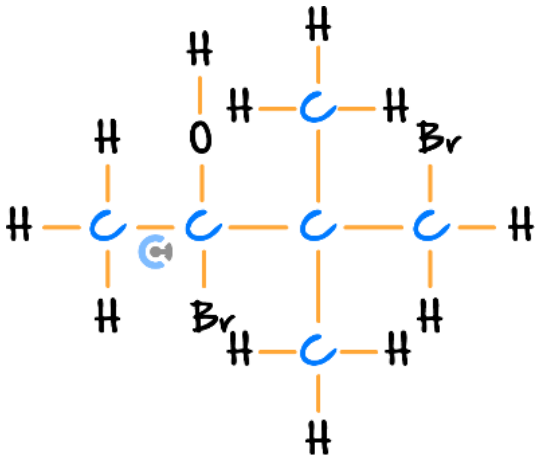
i. Name and semi-structural formula. (2 marks)

$CH_3CHCCHCHOHCH_3$
Hex-3, 4-dien-2-ol

ii. Skeletal diagram. (1 mark)



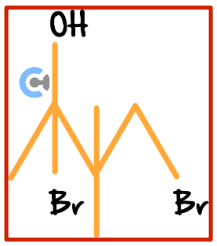
b.



i. Name and semi-structural formula. (2 marks)

$CH_3CBrOHC(CH_3)_2CH_2Br$
2, 4-dibromo-3, 3-dimethyl-butan-2-ol

ii. Skeletal diagram. (1 mark)



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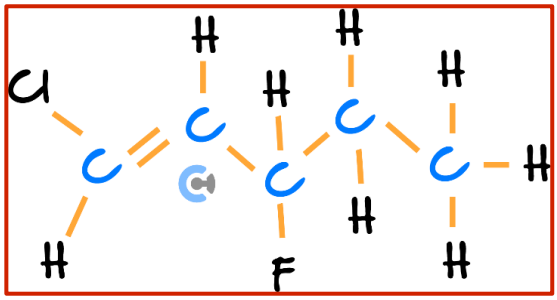
Sub-Section: The 'Final Boss'

Question 13 (5 marks)

A molecule which is being investigated is molecule A, which is 1-chloro-3-fluoropent-1-ene.

a. For molecule A, 1-chloro-3-fluoropent-1-ene, draw its:

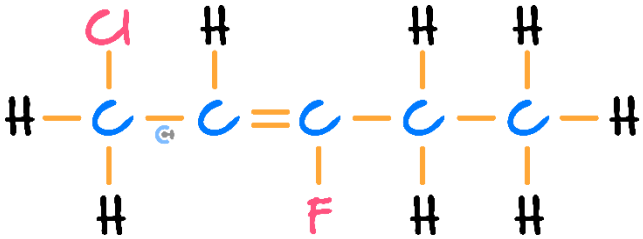
i. Structural formula. (1 mark)



ii. Semi-structural formula. (1 mark)

$CHClCHCHFCH_2CH_3$

b. This molecule A is then compared to molecule B which is shown below.



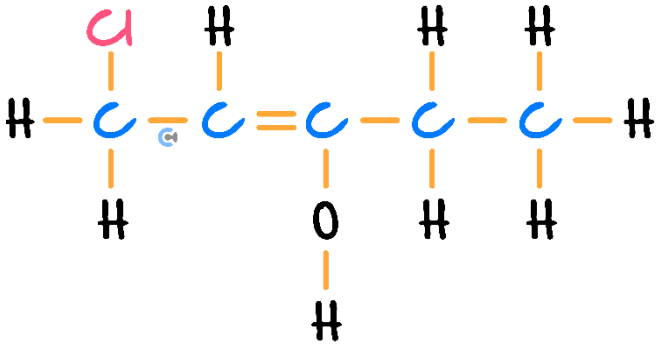
i. Name molecule B above. (1 mark)

1-chloro-3-fluoropent-2-ene

ii. What type of isomers, if any, are molecule A and molecule B? Justify your answer. (1 mark)

Positional isomers – double bond is in a different position.

The fluorine atom is then swapped out for a −OH group, as shown below in molecule C.



c. What type of isomers, if any, are molecule B and molecule C? Justify your answer. (1 mark)

Not isomers – they have different amounts of each atom, so they are different molecules altogether.

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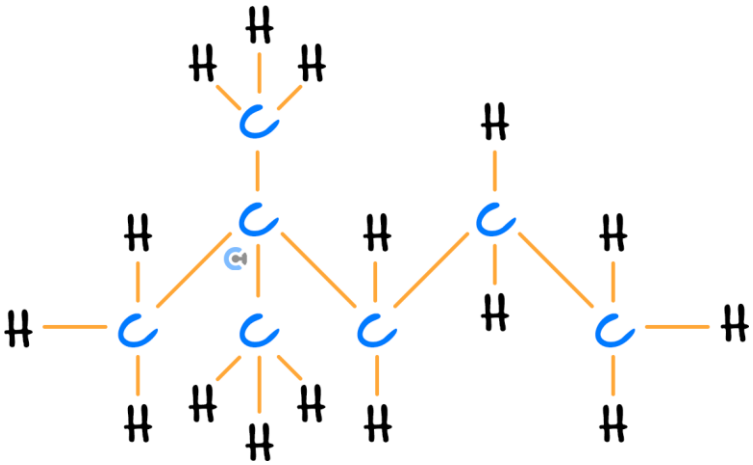
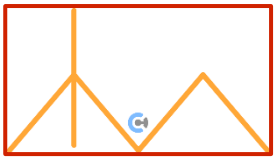
Section B: Supplementary Questions (58 Marks)

Sub-Section [2.6.1]: Apply IUPAC Conventions to Identify, Draw & Write IUPAC Names of Straight-Chained & Branched Alkenes

Question 14 (3 marks)



Name	Semi-Structural Formula	Skeletal Diagram
2, 2-dimethylpentane	$CH_3CHClCCl(CH_3)CH_2CH_2CH_3$	

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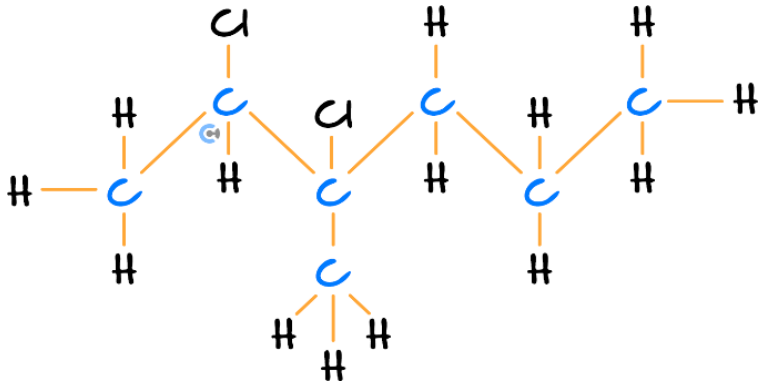
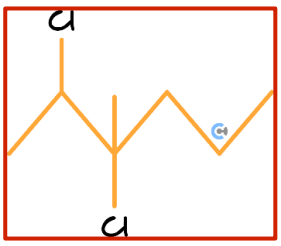
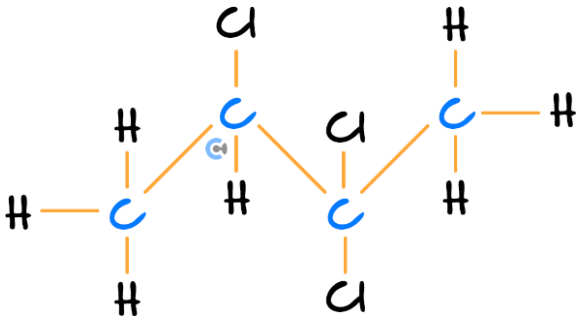
Question 15 (6 marks)

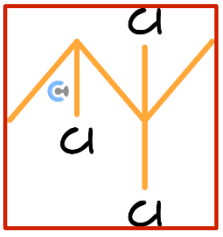
a. (3 marks)



Name	Semi-Structural Formula	Skeletal Diagram
2, 3-dichloro-3-methylhexane	$CH_3CHClCCl(CH_3)CH_2CH_3$	

b. (3 marks)



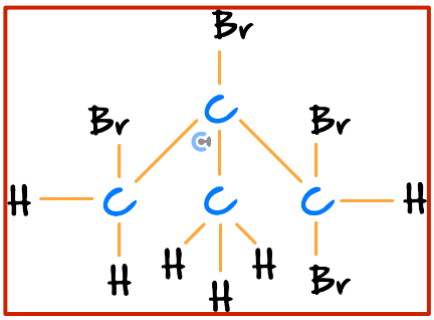
Name	Semi-Structural Formula	Skeletal Diagram
2, 3, 3-trichlorobutane	$CH_3CHClCCl_2CH_3$	

Question 16 (9 marks)

Name each of the following and give their semi-structural and skeletal diagram.

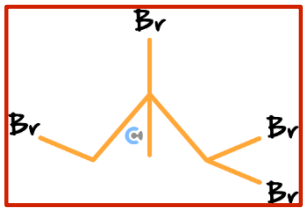
a. 1, 1, 2, 3-tetrabromomethylpropane.

i. Name and semi-structural formula. (2 marks)



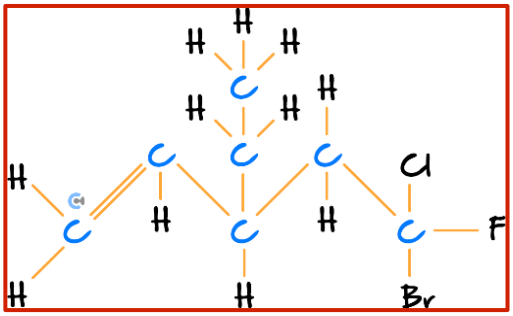
$CH_2BrCBr(CH_3)CHBr_2$

ii. Skeletal diagram. (1 mark)



b. 5-bromo-5-chloro-5-fluoro-3-ethylpent-1-ene.

i. Name and semi-structural formula. (2 marks)

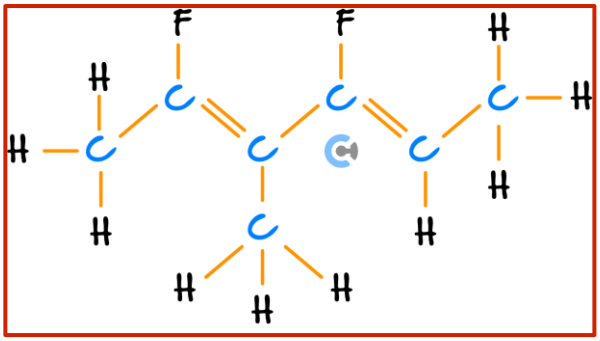


$CH_2CHCH(CH_2CH_3)CH_2CFClBr$

ii. Skeletal diagram. (1 mark)

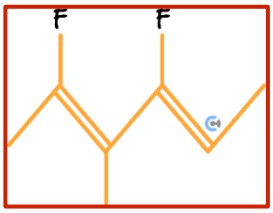
c. 2, 4-difluoro-3-methylhex-2, 4-adiene.

i. Name and semi-structural formula. (2 marks)



$CH_3CFC(CH_3)CFCHCH_3$

ii. Skeletal diagram. (1 mark)

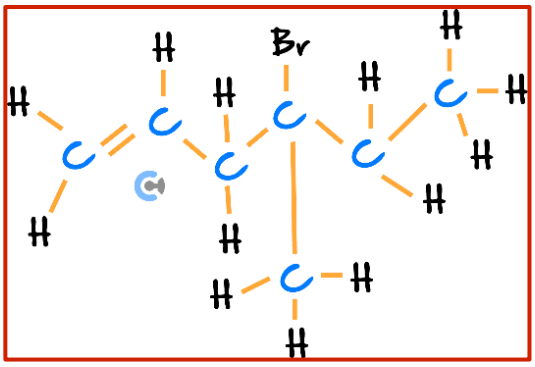


Question 17 (4 marks)

For each of the following molecules, fill out the following information.

a. 4-bromo-4-methylhex-1-ene.

i. Structural formula. (1 mark)

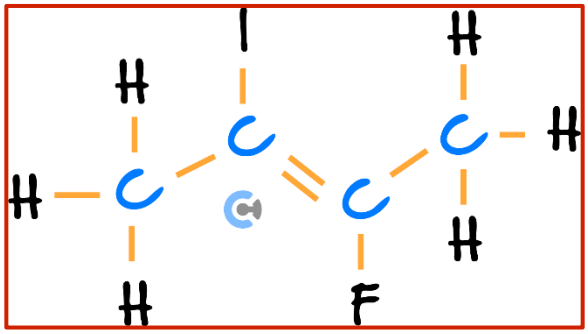


ii. Semi-structural formula. (1 mark)

$CH_2CHCH_2CBr(CH_3)CH_2CH_3$

b. 2-iodo-3-fluorobut-2-ene.

i. Structural formula. (1 mark)



ii. Semi-structural formula. (1 mark)

$CH_3CICFCH_3$

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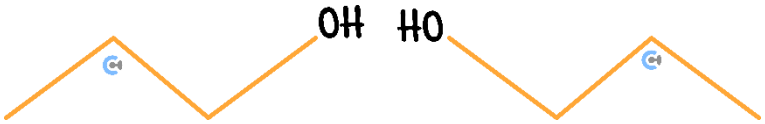
Sub-Section [2.6.2]: Identify & Explain What Structural Isomers Are

Question 18 (1 mark)

The following two molecules are to be investigated.

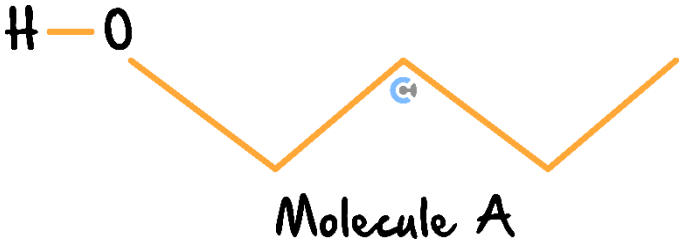


State what type of isomers, if any, these are.

The are the same molecule – propan-1-ol and are not isomers.

Question 19 (4 marks)

The following molecule A is to be investigated.

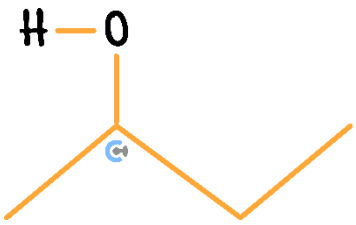


Molecule A

a. State the IUPAC name of molecule A. (1 mark)

Butan-1-ol

It is then compared to molecules B and C, shown below.



Molecule B

Molecule C

b. State the type of isomer (chain, positional or functional), if any, between each of the following molecules.

i. Between molecules A and B. (1 mark)

positional isomers

ii. Between molecules A and C. (1 mark)

chain isomers

iii. Between molecules B and C. (1 mark)

chain and positional isomers

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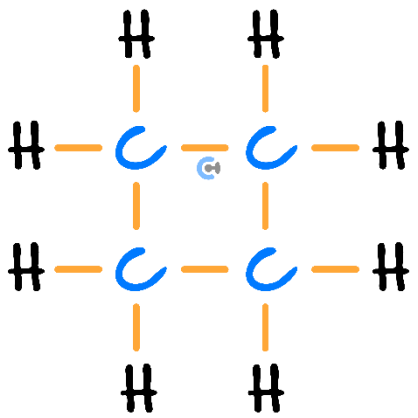
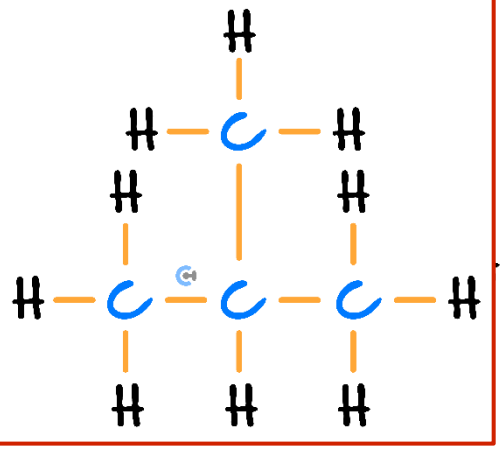
Question 20 (5 marks)

The following molecules are to be compared.

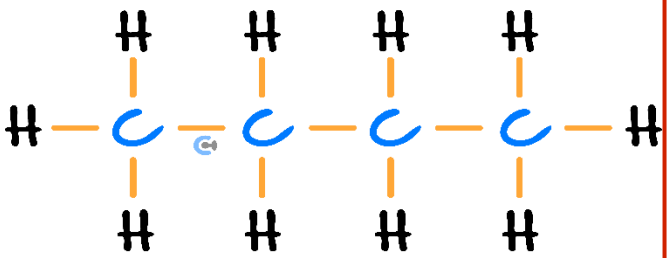
Name: Cyclobutane



Name: 2-methylpropane



Name: Butane



a. Write the IUPAC name for each in the relevant spaces provided above. (3 marks)

b. State which of the above molecules are isomers of each other. Justify your answer. (2 marks)

Butane and 2-methylpropane as they both have molecular formula of C_4H_{10}.
Cyclobutane has a molecular formula of C_4H_8 instead.

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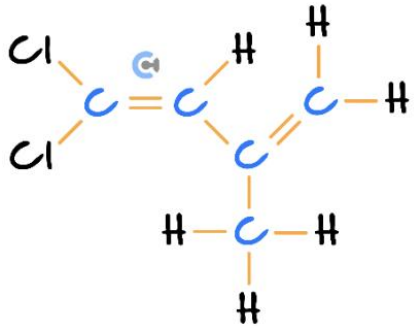
Question 21 (6 marks)

Consider the following molecule.



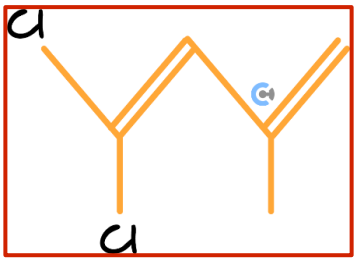
a. What is the functional group with the highest priority? (1 mark)

C = C double bond (alkene)

b. State the name of this molecule. (1 mark)

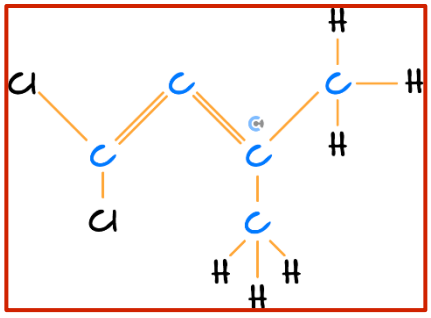
1, 1-dichloro-3-methylbut-1, 3-adiene

c. Draw the skeletal diagram of this molecule. (1 mark)



d. If there was instead a molecule of 1, 1-dichloro-3-methyl-but-1, 2-adiene, what type of isomer would this molecule be classified as and draw its structural formula. (3 marks)

Would be classified as a positional isomer as the functional group of the double bond has shifted position, but the base carbon chain length remains same.



Sub-Section [2.6.3]: Find Possible Structural Isomers (Chain, Positional, Functional) of Alkanes, Alkenes & Haloalkanes from a Given Molecular Formula

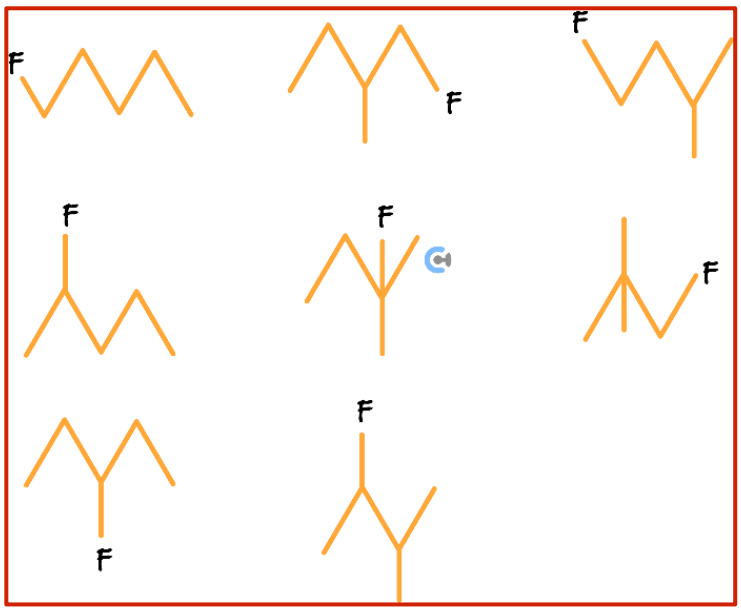
Question 22 (2 marks)

Identify the number of possible isomers that can be found of C_3H_6.

2 isomers – propene, cyclopropane

Question 23 (3 marks)

Draw the skeletal diagram of all the possible isomers of $C_5H_{11}F$ that can be found.



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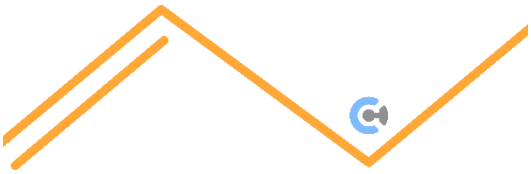
Question 24 (4 marks)

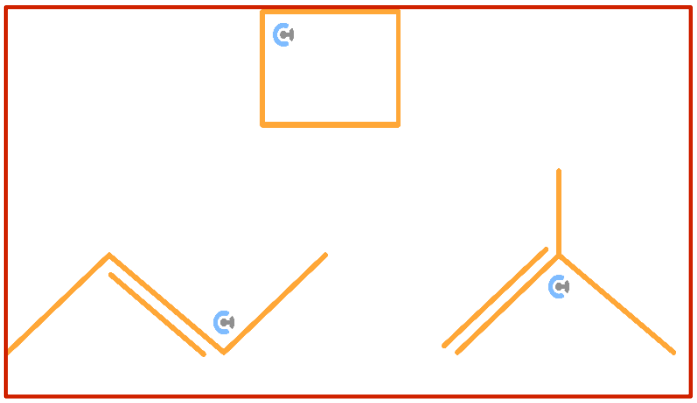
The following molecule is being investigated.



a. Write its IUPAC name. (1 mark)

But-1-ene

b. Draw the skeletal formula of all other structural isomers of the molecule. (3 marks)



Question 25 (3 marks)

Draw the semi-structural formula for all potential isomers of C_4H_9OH, given that all isomers are alcohols.

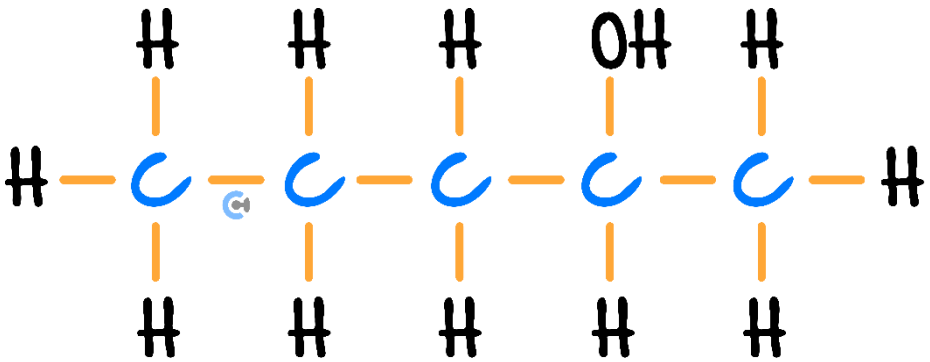
1. $CH_3CH_2CH_2CH_2OH$
2. $CH_3CH_2CH(OH)CH_3$
3. $CH_3C(OH)(CH_3)_2$ or $CH_3C(OH)(CH_3)CH_3$
4. $CH_3(CHCH_3)CH_2OH$

Sub-Section [2.6.4]: Apply IUPAC Conventions to Identify, Draw & Write IUPAC Names of Straight-Chained & Branched Alcohols

Question 26 (2 marks)

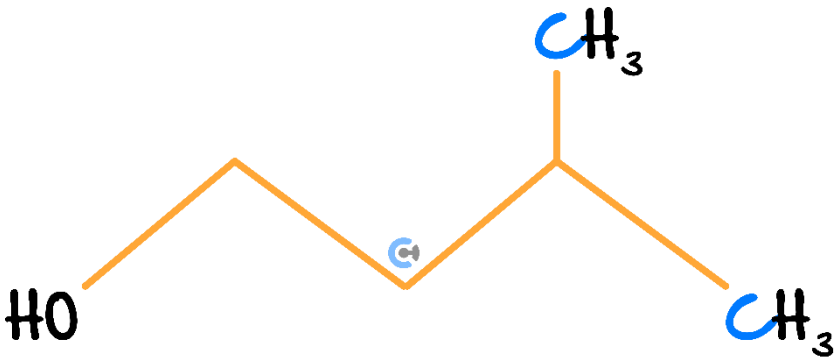
Name the following molecules.

a. (1 mark)



Pentan-2-ol

b. (1 mark)



4-methylpentan-1-ol

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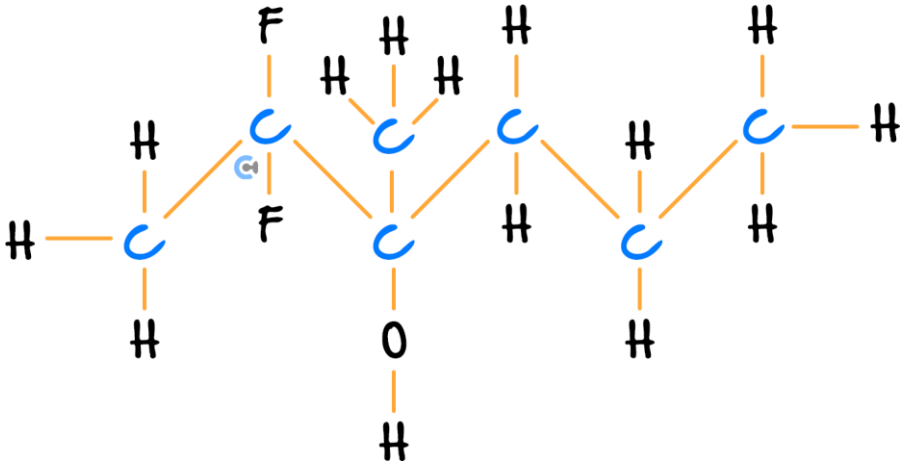
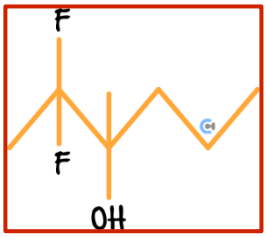
Question 27 (3 marks)



a. Name and semi-structural formula. (2 marks)

2, 2-difluoro-3-methylhexan-3-ol;
$CH_3CF_2(CH_3)C(OH)CH_2CH_2CH_3$

b. Skeletal diagram. (1 mark)



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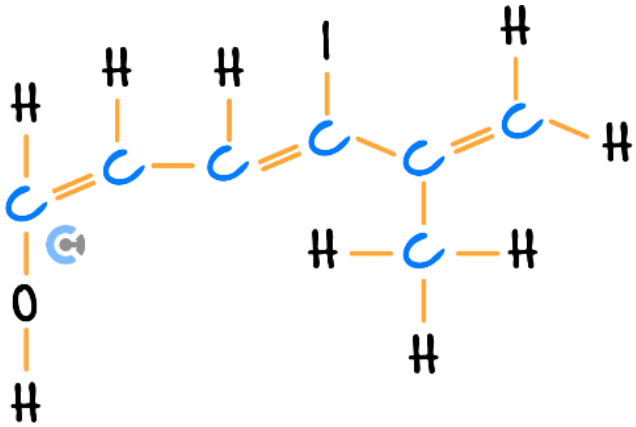
Question 28 (3 marks)

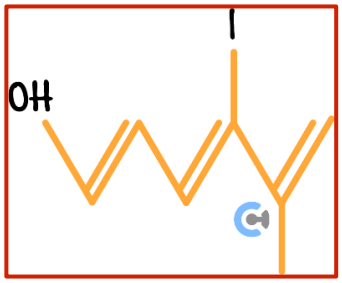
The following molecule is to be investigated.



a. Name and semi-structural formula. (2 marks)

$CHOHCHCHCIC(CH_3)CH_2$
4-iodo-5-methylhex-1, 3, 5-atrien-1-ol

b. Skeletal diagram. (1 mark)



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