AS LEVEL CHEMISTRY

2.1.2 BASIC CONCEPTS IN ORGANIC CHEMISTRY

2.1.2 ALKANES

2.1.3 ALKENES

TEST

Answer all questions

Max 48 marks

Name ……..
Mark ……../48 ……....% Grade ……

1. (a) Many organic molecules show structural isomerism. State what is meant by the term *structural isomerism*.

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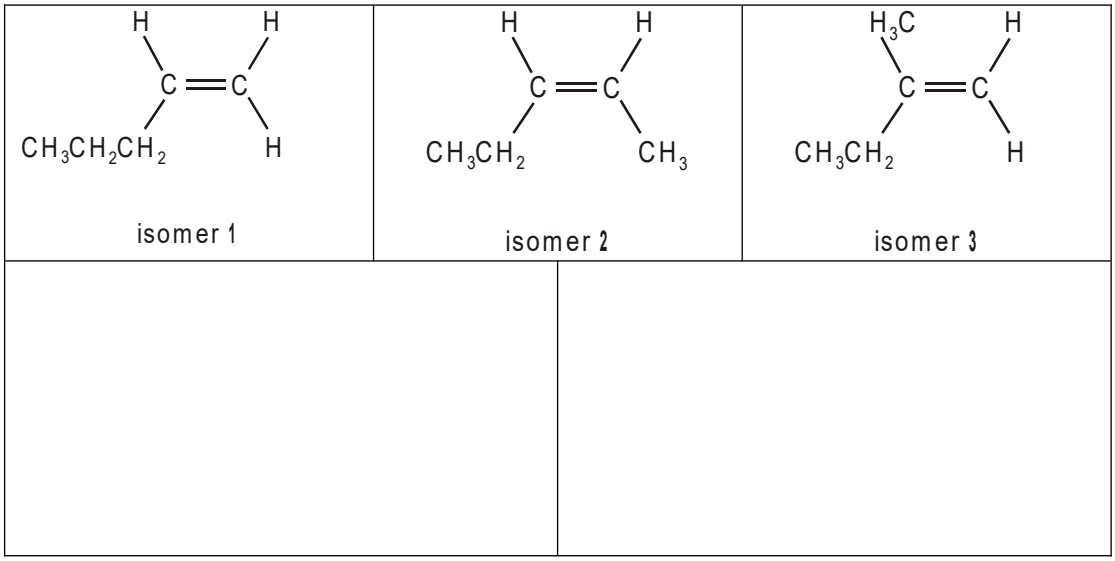
[2]

(b) Isomers **1**, **2** and **3**, shown below, are unsaturated structural isomers of C_5H_{10}.



(i) Complete the boxes by drawing two other unsaturated structural isomers of C_5H_{10}.

[2]

(ii) Name isomer **3**.

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[1]

(iii) Draw the skeletal formula of isomer **2**.

[1]

[Total 6 marks]

2. Cyclohexane, C_6H_{12}, reacts with chlorine to produce chlorocyclohexane, $C_6H_{11}Cl$.

$$C_6H_{12} + Cl_2 \rightarrow C_6H_{11}Cl + HCl$$

The mechanism for this reaction is a free radical substitution.

(i) Write an equation to show the initiation step.

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[1]

(ii) State the conditions necessary for the initiation step.

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[1]

(iii) The reaction continues by **two** propagation steps resulting in the formation of chlorocyclohexane, $C_6H_{11}Cl$.

Write equations for these **two** propagation steps.

step 1 .....

step 2 .....

[2]

(iv) State what happens to the free radicals in the termination steps.

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[1]

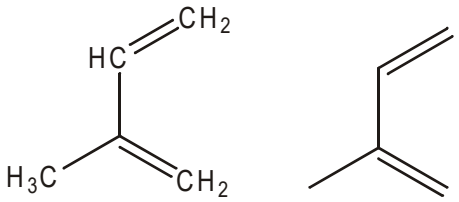
[Total 5 marks]

3. Isoprene is an alkene that can be tapped from some trees. It is the monomer in natural rubber.

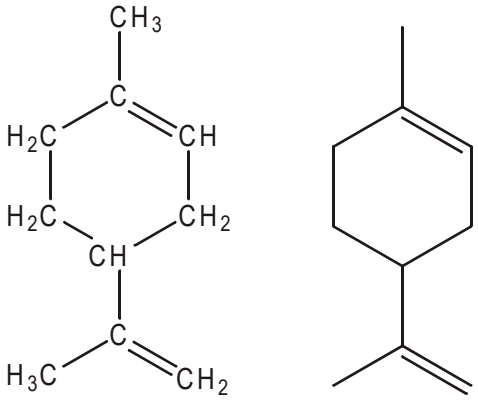
Limonene is a natural oil found in the rind of oranges and lemons.

Both isoprene and limonene contain two double bonds.

Their structural and skeletal formulae are shown below.



isoprene



limonene

(a) (i) What is the molecular formula of **isoprene**? .....

[1]

(ii) What is the empirical formula of **limonene**? .....

[1]

(b) In the presence of a suitable catalyst, isoprene and limonene both react with hydrogen.

(i) State a suitable catalyst for this reaction. .....

[1]

(ii) Write an equation for the reaction when **isoprene** reacts **completely** with hydrogen.

[2]

(iii) Draw the skeletal formula of a product formed when **limonene** reacts **partially** with hydrogen.

[1]

[Total 6 marks]

4. Alkenes undergo electrophilic addition reactions to form saturated compounds.

(i) Define the term *electrophile*.

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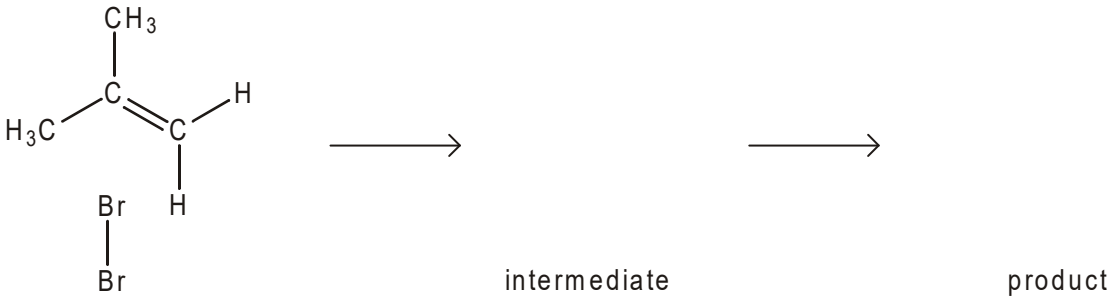
[1]

(ii) The reaction between bromine and methylpropene is an electrophilic addition. Describe, with the aid of curly arrows, the mechanism for this reaction. Show the intermediate and the product along with any relevant dipoles and lone pairs of electrons.



[4]

[Total 5 marks]

5. But-1-ene is just one isomer with the molecular formula C_4H_8.

Using C_4H_8 as your example, describe and explain what is meant by structural isomerism and *cis-trans* isomerism.

Include diagrams in your answer.

In your answer you should make clear how each type of isomerism is related to structural features.

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[Total 7 marks]

6. In this question, one mark is available for the quality of spelling, punctuation and grammar.

The fractions from crude oil can be processed by cracking, reforming and isomerisation.

- Outline these processes with the aid of suitable equations.
- State clearly the industrial importance of the products formed in each process.

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[8]

Quality of Written Communication [1]

[Total 9 marks]

7. But-1-ene is just one isomer with the molecular formula C_4H_8.

The chemical properties of but-1-ene are similar to those of ethene.

- Using this information, predict the organic products in, and the equations for, the reactions of but-1-ene with bromine, hydrogen bromide and steam.
- Draw a section of the polymer formed from but-1-ene by showing two repeat units.
- Discuss **two** ways in which chemists are trying to minimise the damage to the environment caused by the disposal of polymers.

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[Total 10 marks]