

WJEC Chemistry GCSE

10: Carbon Compounds

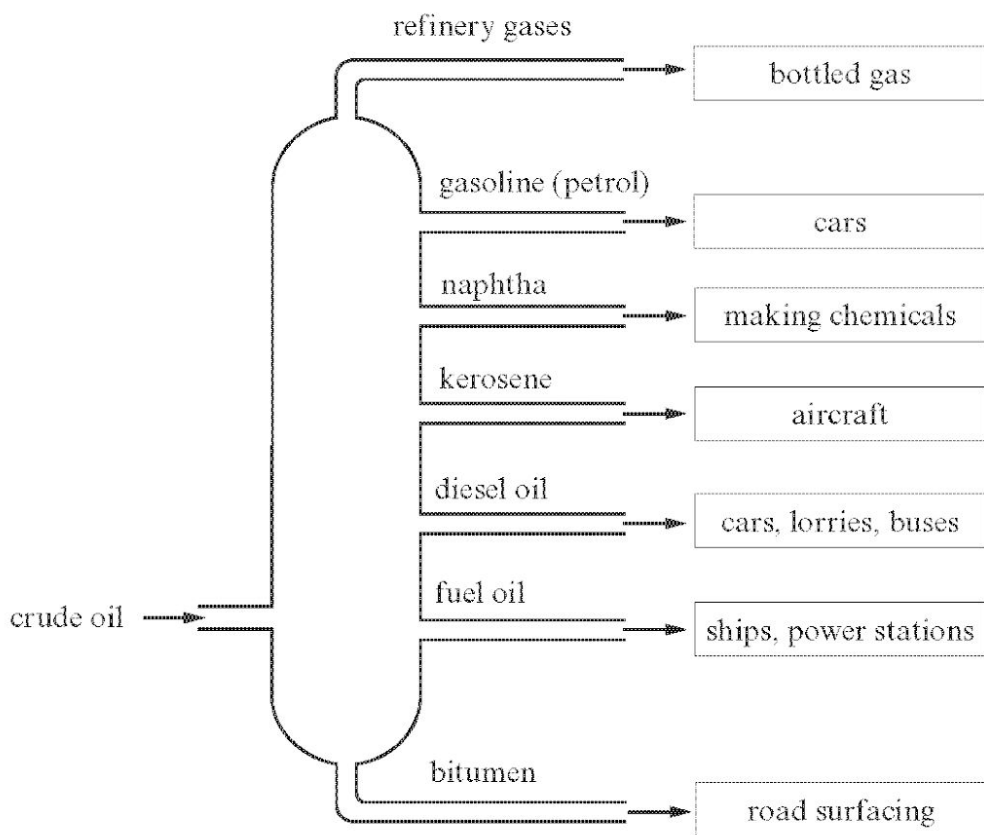
Practice Questions

England Specification

1. Crude oil is a mixture of hydrocarbons that is formed from the remains of simple marine organisms.

(a) State what is meant by a *hydrocarbon*. [1]

(b) Crude oil is separated into fractions in a process called fractional distillation.



State why the fractions obtained are not single compounds. [1]

- (c) Most fractions are used as fuels. However, others are converted into small reactive molecules that can be used to form plastics.

Name the process used to

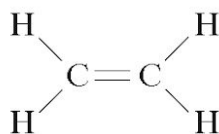
- (i) produce the small reactive molecules,

..... [1]

- (ii) make plastics from these small reactive molecules.

..... [1]

- (d) Ethene is an example of a monomer. It is used to produce polythene. The structure of ethene is shown below.



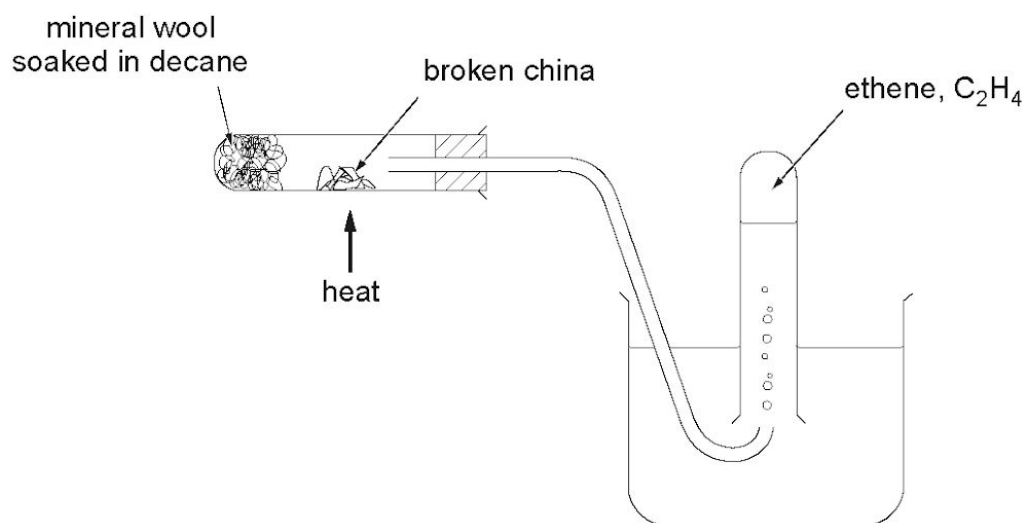
Describe what happens to ethene molecules in the production of polythene. [2]

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- (e) Give **one** disadvantage of the use of plastics such as polythene. [1]

.....

2. The following diagram shows an experiment that could be carried out in the laboratory to obtain ethene from decane, $C_{10}H_{22}$.



- (i) Complete the following **symbol** equation for the reaction taking place. [1]

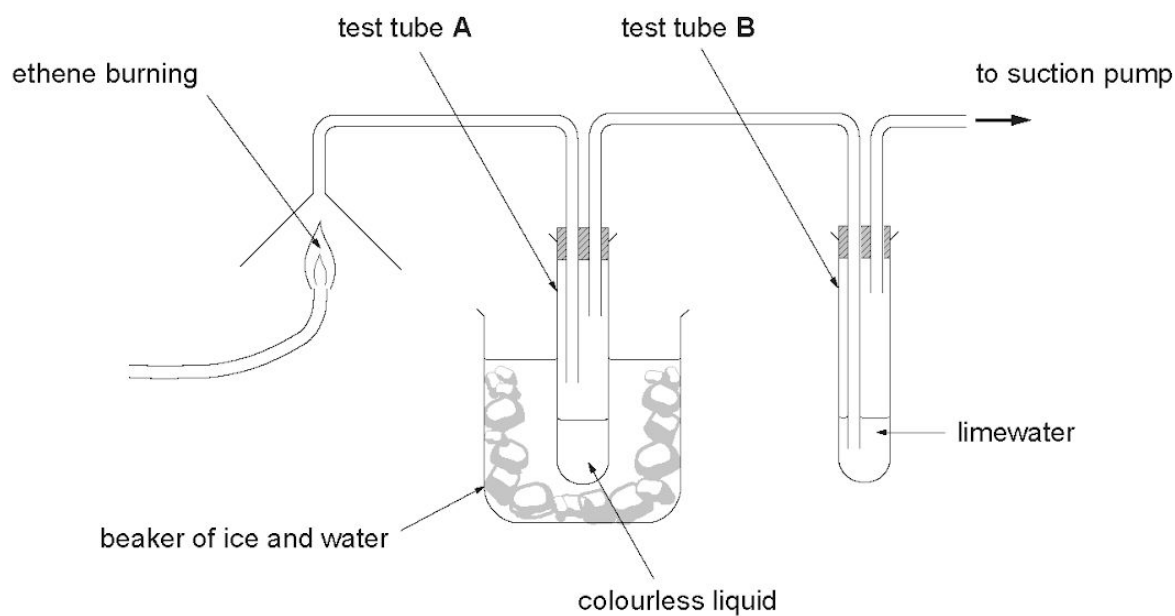


- (ii) Name the process which has taken place. [1]

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(b) Ethene is a hydrocarbon.

The following diagram shows apparatus that can be used to investigate the products formed when ethene is burned.



- (i) State what you would expect to happen to the limewater in test tube **B** and give the reason for your answer. [1]

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- (ii) The experiment was repeated with hydrogen being burned instead of ethene.

- I. State what would be seen in test tube **A**. Give a reason for your answer. [2]

.....

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- II. State and explain what would be seen in test tube **B**. [2]

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3. (a) An unknown alkane, X, was found to contain 9.0g of carbon and 2.0g of hydrogen. Calculate the simplest formula for this alkane. [3]

$$A_r(\text{H}) = 1$$

$$A_r(\text{C}) = 12$$

Simplest formula

- (b) Calculate the percentage by mass of carbon in butane, an alkane containing four carbon atoms. [2]

$$A_r(\text{H}) = 1$$

$$A_r(\text{C}) = 12$$

Percentage by mass of carbon = %

5

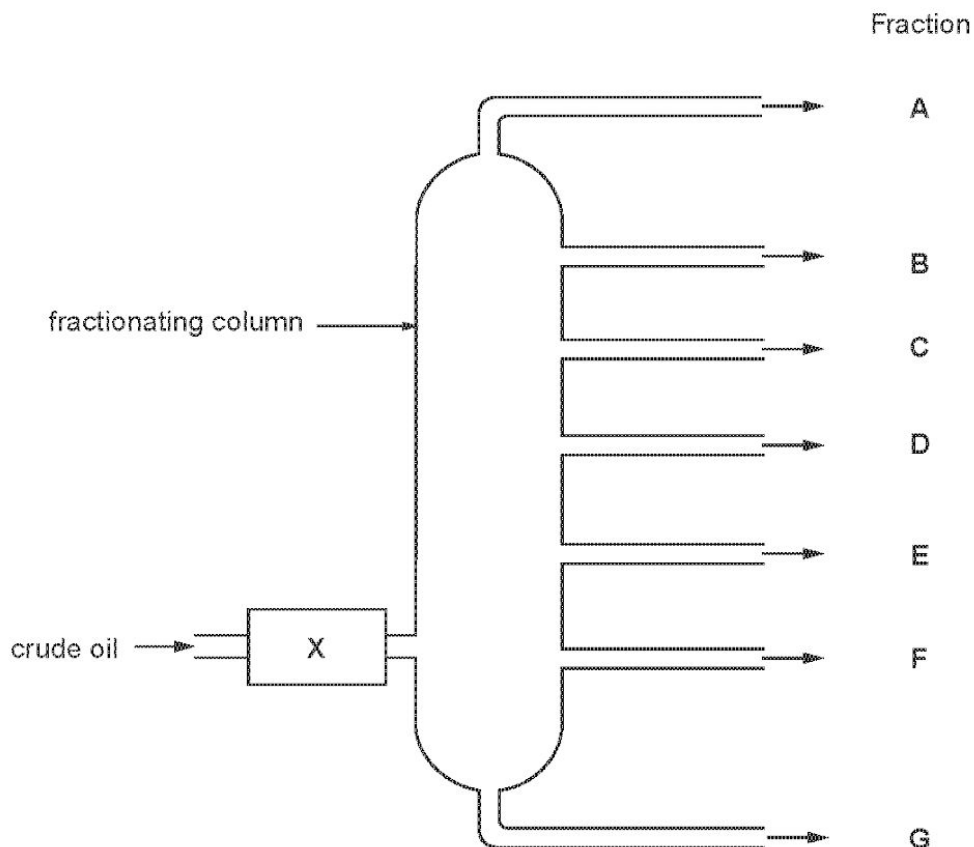
4. (a) Crude oil is a source of some very important fuels. State how crude oil was formed. [2]

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- (b) Crude oil is a mixture of compounds called hydrocarbons. They are separated into different fractions in a fractionating column.



- (i) State what happens to the crude oil in X before it is allowed to enter the fractionating column. [1]

.....

- (ii) State the property of hydrocarbons which allows them to be separated using this method. [1]

.....

(c) A similar process can also be used to separate gases from air.

The table below shows the boiling points of three gases that can be obtained from air.

Gas	Boiling point (°C)
argon	-186
nitrogen	-196
oxygen	-182

To separate the gases, air is compressed and cooled to become liquid air. The liquid air is then allowed to warm up slowly.

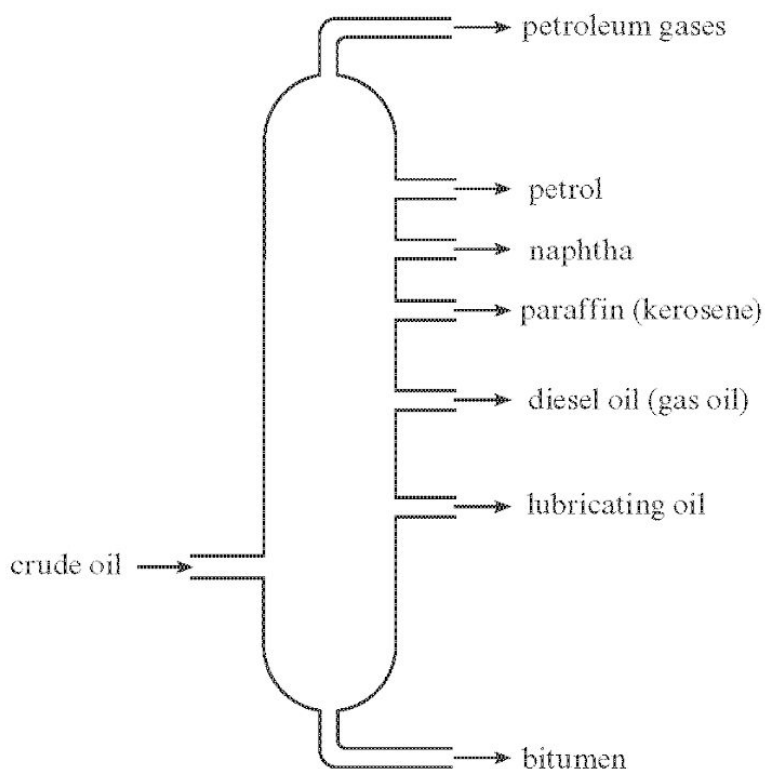
State which of the three gases boils first when liquid air warms up and give the reason for your answer. [2]

.....

.....

5.

The diagram below represents the separation of crude oil into useful fractions in industry.



Write an account of this industrial process.

[6 QWC]

Include in your answer

- the name of the separation method,
- what crude oil is,
- a description of how crude oil is separated.

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6. (a) Crude oil is a mixture of hydrocarbons.

State how it was formed.

[2]

(b) The table below shows properties of some fractions that can be obtained from crude oil.

Fraction	Size of molecule (number of carbon atoms)	Boiling point range (°C)	Colour of fraction	Viscosity at room temperature	How it burns
fuel gas	C ₁ -C ₄	-160 to 20	colourless		very easily with a clean yellow flame
petrol	C ₅ -C ₁₀	20 to 70	pale yellow	runny	easily with a clean yellow flame
naphtha	C ₈ -C ₁₂	70 to 120	yellow	fairly runny	quite easily with a yellow flame and some soot
kerosene	C ₁₀ -C ₁₆	120 to 240	dark yellow	quite viscous	harder to burn with quite a smoky flame
diesel oil and lubricating oil	C ₁₅ -C ₃₀	240 to 350	brown	viscous	hard to burn and a smoky flame

Use the information in the table opposite to answer parts (i) and (ii).

(i) Describe how any two properties of crude oil fractions depend on the size of the molecule. [2]

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(ii) Two fuels used in caravans are propane, C₃H₈, and butane, C₄H₁₀. Both fuels are used in the summer but propane is preferred during the winter.

Explain why.

[2]

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7. (a) Crude oil is a mixture of hydrocarbons.

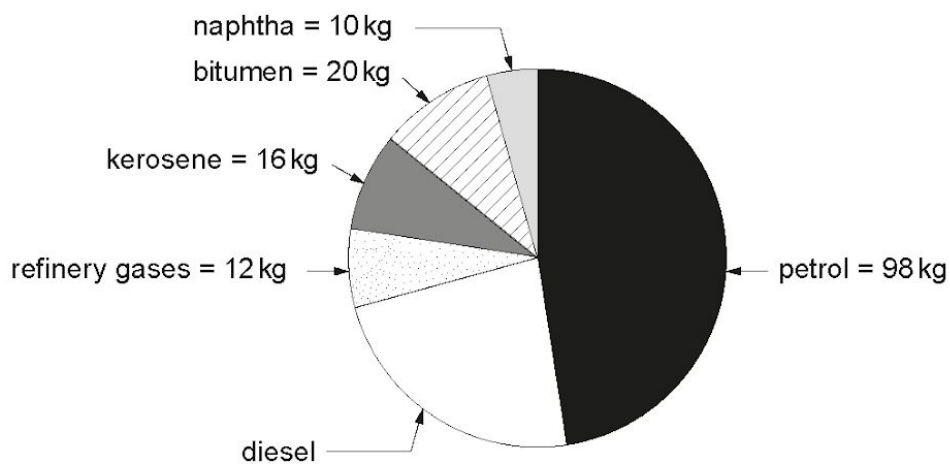
(i) State what is meant by a *hydrocarbon*. [1]

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.....

(ii) Describe how crude oil was formed. [2]

.....
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(b) The following pie chart shows the mass in kg of each fraction present in 200 kg of crude oil.



(i) Name the two fractions that are not used as fuels. [1]

..... and

(ii) Calculate the percentage of diesel present in this crude oil. [2]

Percentage of diesel = %

(iii) The names of some processes are given in the box below.

cracking	polymerisation	distillation	electrolysis
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Name the process by which

I. large hydrocarbon molecules can be made into smaller molecules, [1]

.....

II. small reactive molecules can be joined together to produce long chains. [1]

.....

8

8.

The percentage of carbon dioxide in air is 0.04%.

State, giving a reason in each case, how you would expect the percentage of carbon dioxide to change

(a) in a crowded classroom, [2]

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(b) in a greenhouse full of plants on a sunny day, [2]

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(c) in the furnace of a coal-fired power station. [2]

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- [illegible]

10.

The following table shows the main products formed during the burning of coal and hydrogen.

Fuel	Main product(s) of burning
coal	carbon dioxide sulfur dioxide water
hydrogen	water

- (a) (i) Name the **three** elements that must be present in coal to give the products shown in the table. [1]

.....

- (ii) Coal is a finite (non-renewable) resource.

State what is meant by a *finite resource*. [1]

.....

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- (b) (i) Balance the symbol equation for the burning of hydrogen in air. [1]



- (ii) State the chemical test for hydrogen gas and give the expected result. [1]

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- (iii) Give **two** disadvantages of using hydrogen as a fuel. [2]

1.

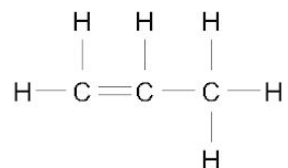
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2.

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11.

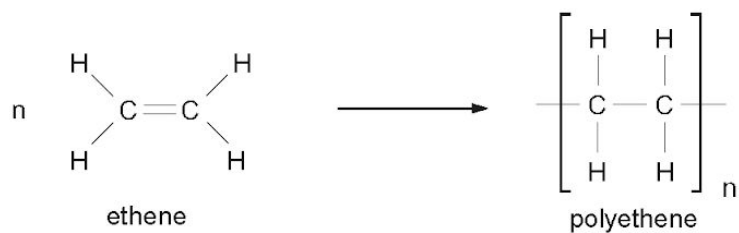
- (a) The following diagram shows the structural formula of propene.



Give the molecular formula of propene. [1]

- (b) An alkane contains three carbon atoms and eight hydrogen atoms. Draw its structural formula. [1]

- (c) The equation below shows the formation of polyethene from ethene.



Describe what happens to ethene molecules during the formation of polyethene. [3]

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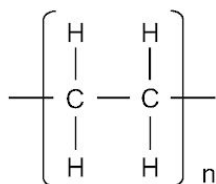
12.

The following table shows information about some organic compounds.

Name	Molecular formula	Structural formula
ethene	C_2H_4	$ \begin{array}{c} H & & H \\ & \diagdown & / \\ & C = C \\ & / & \diagdown \\ H & & H \end{array} $
propane	C_3H_8	
hexane		$ \begin{array}{cccccc} H & H & H & H & H & H \\ & & & & & \\ H-C & -C & -C & -C & -C & -C-H \\ & & & & & \\ H & H & H & H & H & H \end{array} $
	CH_4	$ \begin{array}{c} H \\ \\ H-C-H \\ \\ H \end{array} $

(a) Complete the table by filling all **three** empty boxes. [3]

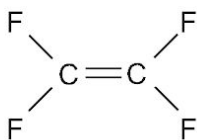
(b) (i) Name the compound from the table above that can be used to form the polymer represented by the following structure. [1]



Compound

(ii) Small reactive molecules, such as alkenes, that join together to form polymers are known as [1]

(c) Another polymer can be formed from the following compound.



(i) Choose from the box below the name of the polymer produced from this compound. [1]

polyethene	polypropene	polyvinylchloride
polytetrafluoroethene	polystyrene	

Polymer

(ii) Draw the repeating unit for this polymer. [1]

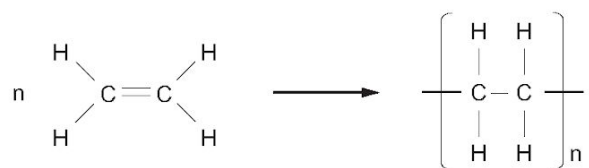
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13.

The following table shows some information about four organic compounds.

Name	Molecular formula	Structural formula	Family of hydrocarbons
methane		$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array} $	
butane	C_4H_{10}		alkane
ethene	C_2H_4	$ \begin{array}{ccc} \text{H} & & \text{H} \\ & \diagdown \quad \diagup & \\ & \text{C}=\text{C} & \\ & \diagup \quad \diagdown & \\ \text{H} & & \text{H} \end{array} $	
	C_3H_6	$ \begin{array}{ccccc} & \text{H} & & \text{H} & & \text{H} \\ & & & & & \\ \text{H} & -\text{C} & - & \text{C} & = & \text{C} \\ & & & & & \\ & \text{H} & & & & \text{H} \end{array} $	alkene

- (a) Complete the table. [4]
- (b) Ethene undergoes polymerisation to form polythene. The following equation shows the reaction taking place.



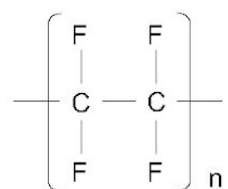
Describe what happens during this process. [2]

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(c) Another polymer is PTFE. Its repeating unit is shown below.



Draw the structure of the monomer used to produce PTFE.

[1]

14.

- (a) The table below shows the names, molecular formulae and the structural formulae of the first two members of the alkene series. Complete the table by giving the structural formula of butene, C_4H_8 . [1]

Name	Molecular formula	Structural formula
ethene	C_2H_4	$ \begin{array}{cc} H & H \\ & \\ C & = C \\ & \\ H & H \end{array} $
propene	C_3H_6	$ \begin{array}{ccccc} & H & & & H \\ & & & & \\ H & - C & - & C & = C \\ & & & & \\ & H & & H & H \end{array} $
butene	C_4H_8	

- (b) Explain how polypropene is formed from propene.

[4]

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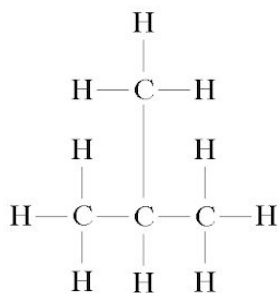
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15.

- (a) Give the **molecular** formula of the substance with the structural formula shown below.



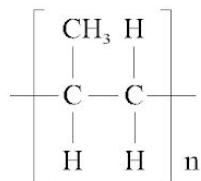
Molecular formula [1]

- (b) Give the name and the **structural** formula of the hydrocarbon with the molecular formula C_3H_8 . [2]

Name

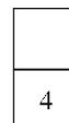
Structural formula

- (c) Polypropene is represented as shown below.



Give the **molecular** formula of the monomer used to make polypropene. [1]

Molecular formula



16.

Organic substances are arranged in families of compounds with similar properties.

- (a) The table below shows the first four members of two families of organic compounds, alkanes and alcohols.

Alkanes	Alcohols
methane CH_4	methanol CH_3OH
ethane C_2H_6	ethanol $\text{C}_2\text{H}_5\text{OH}$
propane C_3H_8	propanol $\text{C}_3\text{H}_7\text{OH}$
butane C_4H_{10}	butanol $\text{C}_4\text{H}_9\text{OH}$

The general formula for members of the alkane family is $\text{C}_n\text{H}_{2n+2}$.

Give the general formula for members of the alcohol family. [1]

-
- (b) Isomers are compounds which have the same molecular formula but different structural formulae.

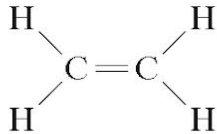
Propanol has two isomers. Draw the two positional isomers of propanol. [2]

Isomer 1	Isomer 2
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(c) Another family of organic compounds is the alkene family.

Complete the table below.

[2]

Name	Molecular formula	Structural formula
ethene	C_2H_4	
	C_3H_6	

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17.

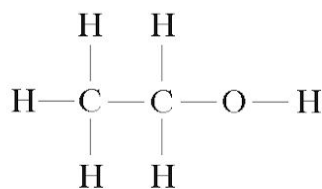
- (a) The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table.

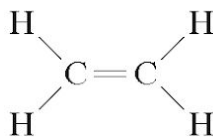
[3]

Name	Molecular formula	Structural formula
	CH_4	$ \begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array} $
ethane	C_2H_6	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $
propane		$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $
butane	C_4H_{10}	

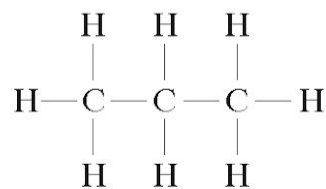
(b) The structural formulae of five carbon compounds are shown below.



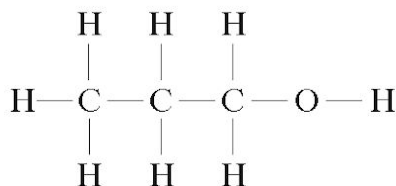
A



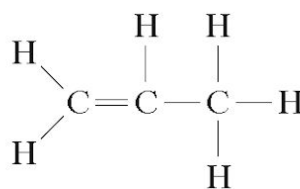
B



C



D



E

Give the letter **A-E** of the structure which shows

(i) ethanol, $\text{C}_2\text{H}_5\text{OH}$,

[1]

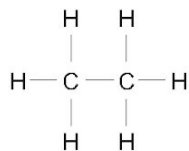
(ii) propene, C_3H_6 ,

[1]

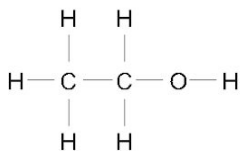
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18.

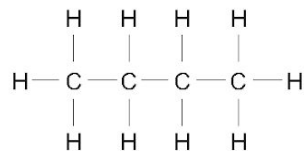
(a) The structural formulae of some organic compounds are shown below.



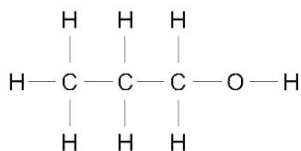
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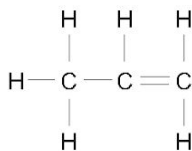
B



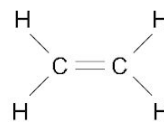
C



D



E



F

(i) Give the letters, **A-F**, of **two** alkanes and **two** alcohols.

[2]

Alkanes and

Alcohols and

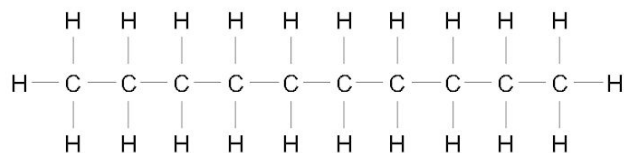
(ii) State which compound, **A-F**, has the molecular formula C_3H_6 .

[1]

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(b) Give the molecular formula of decane.

[1]



.....

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19.

- (a) (i) The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table.

[2]

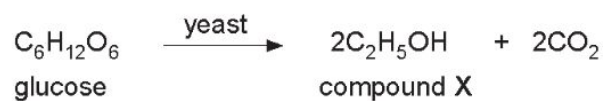
Name	Molecular formula	Structural formula
methane	CH_4	
ethane	<pre> H H H — C — C — H H H </pre>
propane	C_3H_8	<pre> H H H H — C — C — C — H H H H </pre>
butane	C_4H_{10}	<pre> H H H H H — C — C — C — C — H H H H H </pre>

- (ii) Octane contains 8 carbon atoms. Give the molecular formula for octane.

[1]

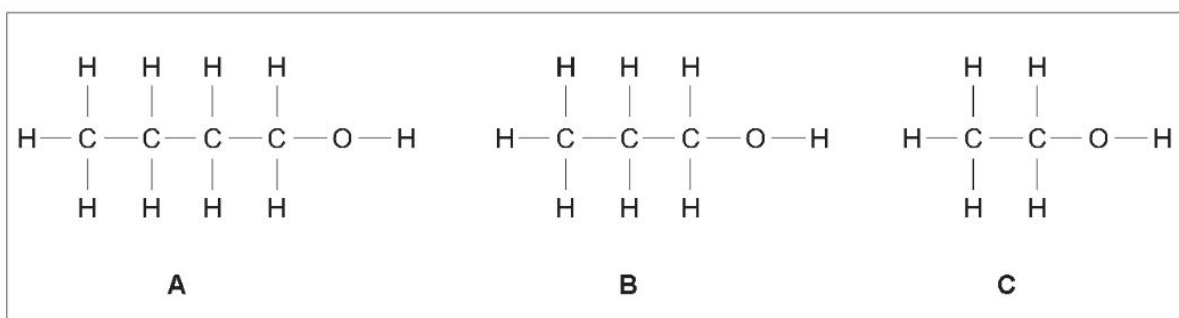
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- (b) (i) Compound X is made by a process called fermentation. The equation below shows the reaction that occurs.



Give the name of compound X. [1]

- (ii) Choose from the box below the structural formula, **A**, **B** or **C**, of compound X. [1]



Letter

- (iii) Give one everyday use of compound X. [1]

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20.

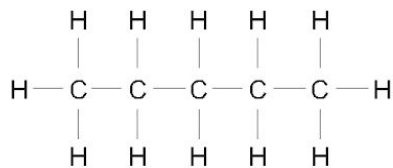
(a) The table below shows the first five members of the alkane family.

Alkane	Molecular formula
methane	CH_4
ethane	C_2H_6
propane	C_3H_8
butane	C_4H_{10}
pentane	C_5H_{12}

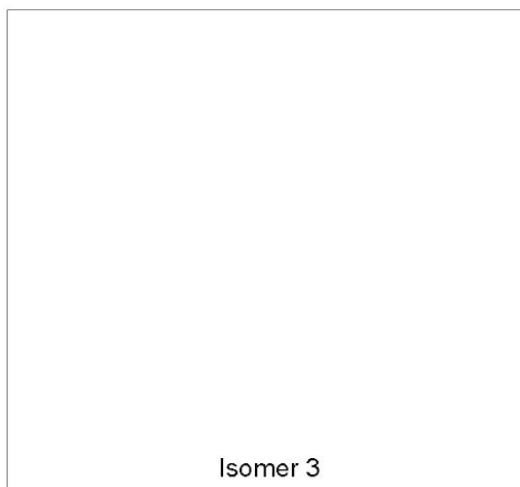
(i) Give the molecular formula for the alkane which contains 18 hydrogen atoms. [1]

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(ii) C_5H_{12} has three isomers. The diagram below shows one of these isomers. Draw the other two isomers. [2]



Isomer 1

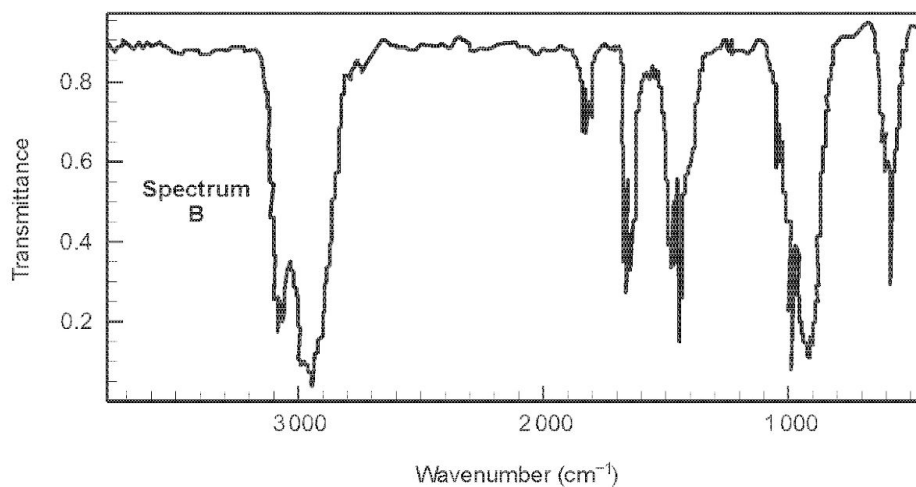
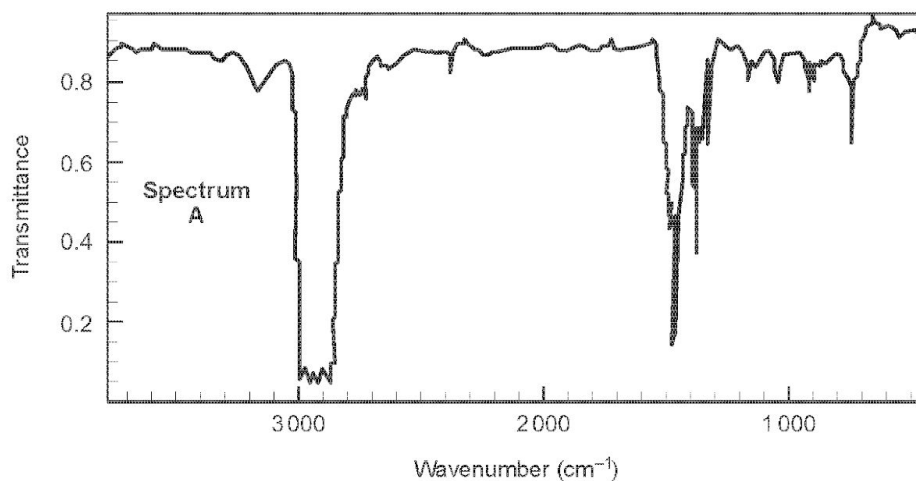


- (b) (i) The first two members of the alkene family are ethene, C_2H_4 , and propene, C_3H_6 . Give the general formula for the alkene family. [1]

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- (ii) Draw the structural formula for propene. [1]

- (c) Study the infrared spectra of propane and propene below. Using the information in the table opposite, identify the spectrum of propene and give a reason for your answer. [1]



Bond	Wavenumber/cm ⁻¹
C=C	1 620 to 1 670
C=O	1 650 to 1 750
C—H	2 800 to 3 100
O—H	2 500 to 3 550

Spectrum

Reason

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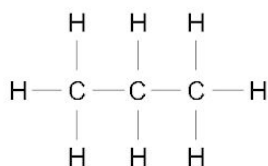
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21.

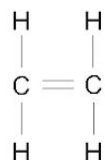
(a) Draw a line to link each type of substance to the property that best describes it. [1]

Type of substance	Property
shape memory polymer	does not change when heated
thermoplastic	regains original shape when heated
thermoset	softens when heated

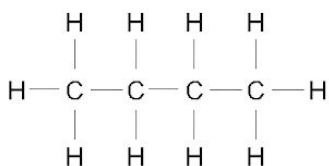
(b) The structural formulae of four organic compounds are shown below.



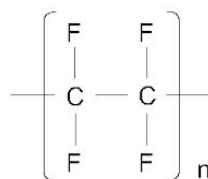
A



B



C



D

(i) Give the chemical name of compound **B**. [1]

(ii) Give the letter of the compound that is **not** a hydrocarbon and give a reason for your answer. [2]

.....
.....

(iii) Give the letter of the compound that can undergo polymerisation and give a reason for your answer. [2]

.....
.....

(c) The molecular formula of propene is C_3H_6 .

Draw the structural formula of propene. [1]

22.

Crude oil can be separated into fractions using fractional distillation.

(a) Explain why it is possible to separate crude oil using this process. [2]

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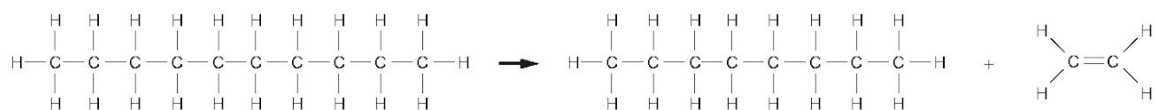
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(b) Naphtha is one fraction not usually used as a fuel. It contains decane, $C_{10}H_{22}$, which can be further processed by cracking as shown below.

decane \longrightarrow octane + ethene

$C_{10}H_{22}$ \longrightarrow C_8H_{18} + C_2H_4



State how the process is carried out and explain why it is important. [4]

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23.

Describe and explain the process of addition polymerisation. Include examples to support your answer. [6 QWC]

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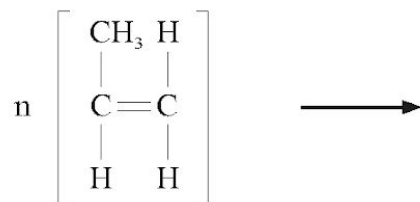
24.

- (a) (i) Give the chemical name of the polymer represented by the diagram below. [1]



- (ii) Propene undergoes polymerisation to give the polymer polypropene.

- I Complete the equation for the production of polypropene. [1]



- II Name this type of polymerisation. [1]

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- (b) There are two types of plastic: thermoplastics and thermosets.

Give **one** similarity and **one** difference in their structures. [2]

Similarity

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Difference

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