OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



EXAM QUESTION PACK

C6.2 ORGANIC CHEMISTRY

SCORE	PERCENTAGE
/194	%

STEMUP

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Gateway Chemistry A (9-1)

Organic chemistry

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

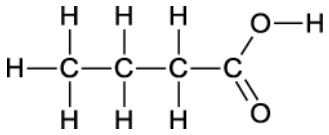
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **194**.
- The total number of marks may take into account some 'either/or' question choices.

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1 Look at the displayed formula of an organic compound.



What is the name of this compound?

A butanoic acid
B butanol
C propanoic acid
D propanol

Your answer ☐

[1]

2 A student bubbles ethene gas into bromine water.

What is observed?

A colour change from blue to colourless
B colour change from colourless to orange
C orange precipitate is made
D colour change from orange to colourless

Your answer ☐

[1]

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3 DNA is a condensation polymer made from monomers called nucleotides.

How many different nucleotides are used to make DNA molecules?

A 2
B 3
C 4
D 5

Your answer ☐

[1]

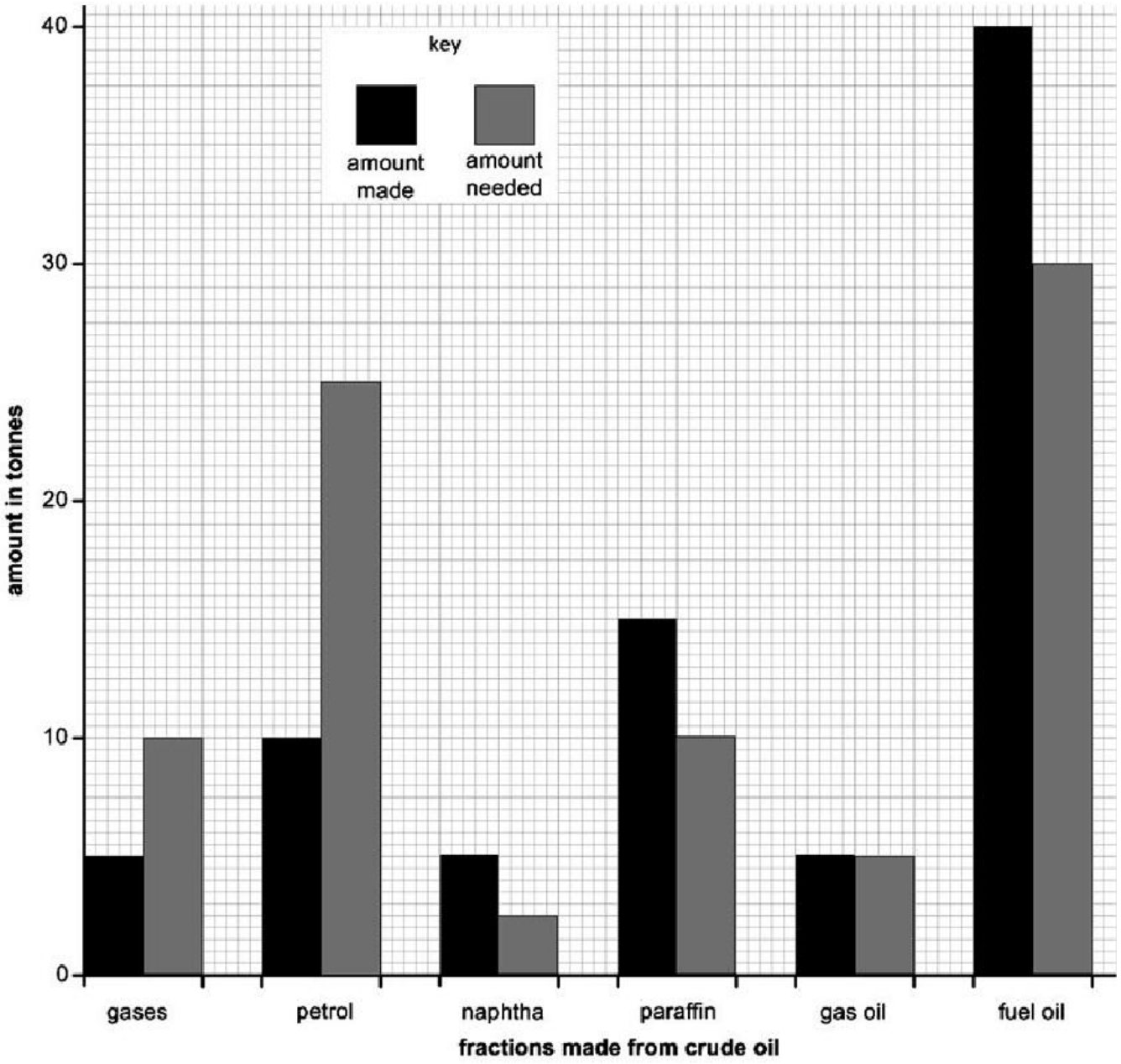
4 The bar chart shows the amount of some of the fractions made from 100 tonnes of crude oil by fractional distillation.

It also shows the amount of each fraction needed for everyday uses.

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Cracking converts large molecules into smaller more useful molecules to make the supply match the demand.
Which fractions are most likely to be cracked to make the supply match the demand?

A gas oil and fuel oil
B gas oil and petrol
C naphtha, paraffin and fuel oil
D petrol and gases

Your answer ☐

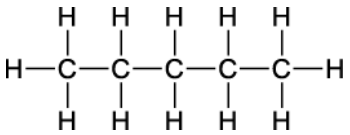
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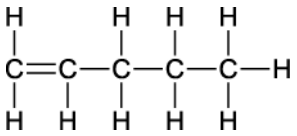
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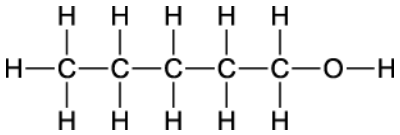
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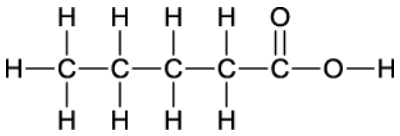
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5 Which displayed formula includes the functional group of an alcohol?

A 

B 

C 

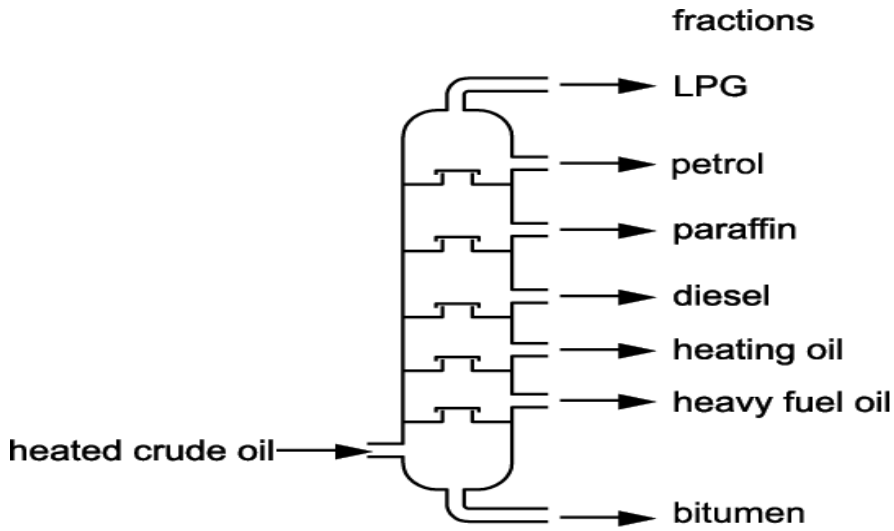
D 

Your answer ☐

[1]

6(a) Crude oil is used as a source of fuels. It is separated into many fractions by fractional distillation.

The diagram below shows a fractionating column.



Crude oil contains a mixture of hydrocarbons that boil at different temperatures.

Describe **how** crude oil can be separated using a fractionating column.

---

[4]

(b) The alkane, $C_{15}H_{32}$, is cracked to make an alkene, C_6H_{12} and an alkane, C_3H_8.

Construct the **balanced symbol** equation for this reaction.

---

[1]

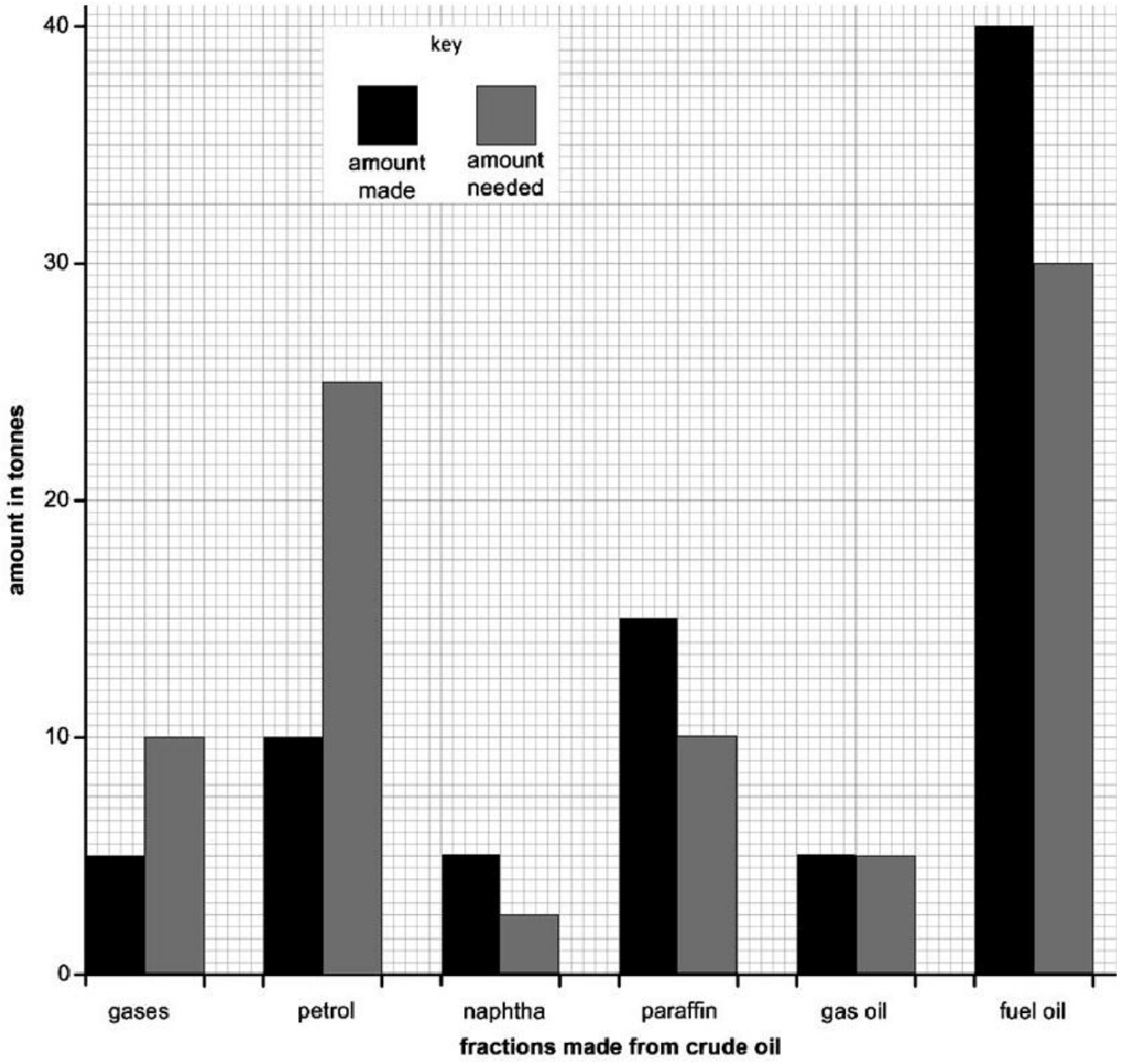
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7 The bar chart shows the amount of some of the fractions made from 100 tonnes of crude oil by fractional distillation.

It also shows the amount of each fraction needed for everyday uses.



Cracking converts large molecules into smaller more useful molecules to make the supply match the demand.

Which fractions are most likely to be cracked to make the supply match the demand?

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A gas oil and fuel oil

B gas oil and petrol

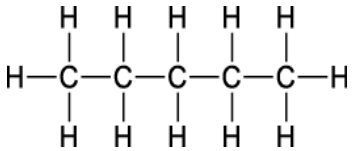
C naphtha, paraffin and fuel oil

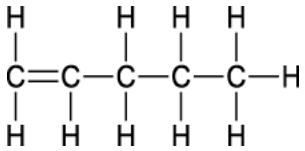
D petrol and gases

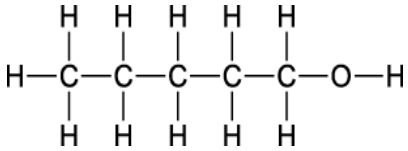
Your answer ☐

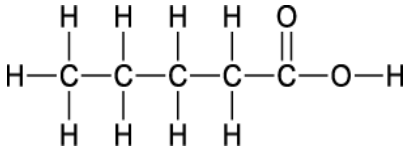
[1]

8 Which displayed formula includes the functional group of an alcohol?

A 

B 

C 

D 

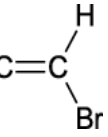
Your answer ☐

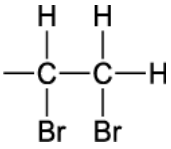
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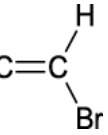
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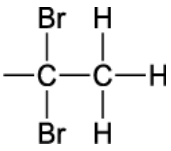
9 A student bubbles ethene gas into bromine water.

Which displayed formula shows the product of this reaction?

A 

B 

C 

D 

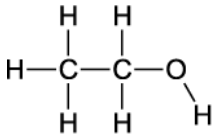
Your answer ☐

[1]

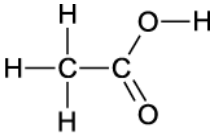
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10 A student heats compound **X** with acidified potassium manganate(VII) solution.

The product of the reaction is compound **Y**.



X



Y

What is the colour change seen during this reaction?

A colourless to orange
B colourless to purple
C orange to colourless
D purple to colourless

Your answer ☐

[1]

11 A condensation polymer is made from two monomers.

One of the monomers has two –OH groups in its molecules.

The other monomer has two –COOH groups in its molecule.

Which one of the following is the polymer?

A polyamide
B poly(chloroethene)
C polyester
D DNA

Your answer ☐

[1]

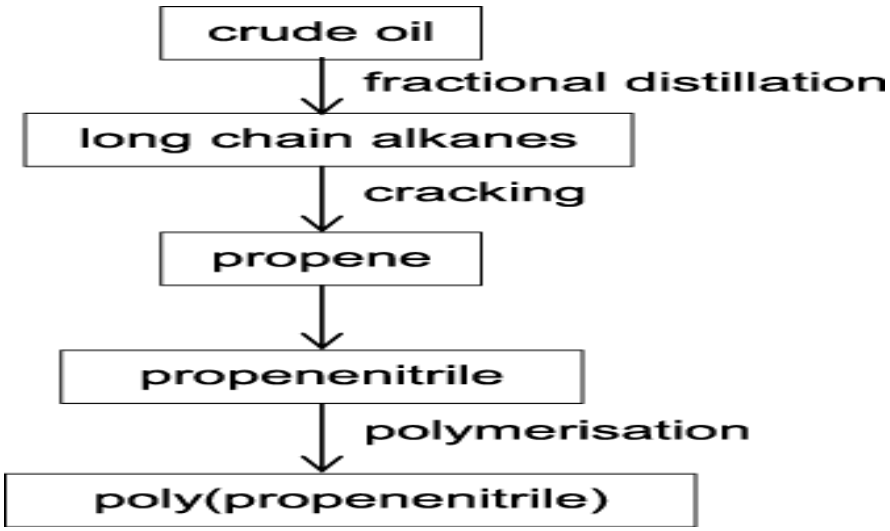
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12(a) Poly(propenenitrile) is an addition polymer.

Look at the flow chart. It shows how poly(propenenitrile) is made from crude oil.



Crude oil is a complex mixture of hydrocarbons.

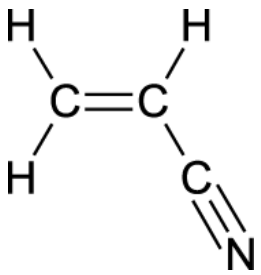
Fractional distillation separates this mixture.

Explain, in terms of intermolecular forces, fractional distillation.

---

[2]

(b) Look at the displayed formula for propenenitrile.



Propenenitrile is an unsaturated compound.

How you can tell from the displayed formula?

---

[1]

13 This question is about foods.

Mayonnaise is made by mixing oil, water and egg yolk.

Egg yolk acts as an emulsifier and stops the oil and water from separating.

Look at the diagram.

It shows a molecule of an emulsifier.



Explain how the emulsifier stops oil and water from separating.

---

[2]

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14 Perfumes, flavourings and nail varnish remover all contain an ester.

Esters are flammable.

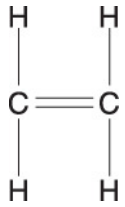
Describe how to do a simple experiment to make an ester including an explanation of the safety precautions you should take.

The quality of written communication will be assessed in your answer to this question.

---

[6]

15(a) Look at the displayed formula of ethene.



Why is ethene described as **unsaturated?**

---

[1]

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(b) Bromine water is used to test for an alkene.

Ethene decolourises bromine water.

(i) What type of reaction is this?

---

[1]

(ii) What type of compound is formed in this reaction?

---

[1]

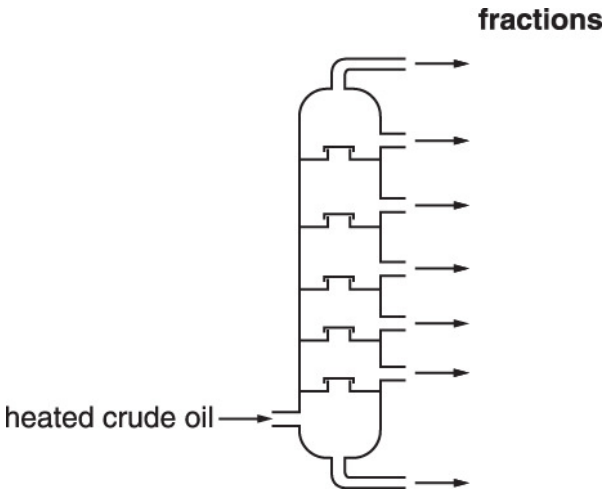
(c) Poly(ethene) is used to make plastic bags.

Draw the displayed formula of poly(ethene).

[2]

16(a) Crude oil is separated into many fractions by fractional distillation.

The diagram shows a fractionating column.



Look at the table. It shows the boiling point range for some of the fractions.

Fraction	Boiling point range in °C
bitumen	above 350
heating oil	240 to 350
paraffin	120 to 240
petrol	20 to 70
LPG	−160 to 20

Write down the name of the fraction which 'exits' from the **bottom** of the fractionating column.

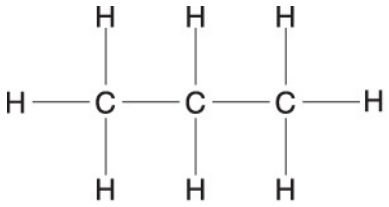
[1]

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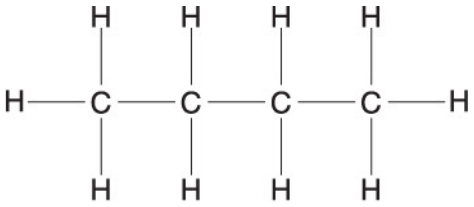
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(b) LPG contains propane and butane.



propane



butane

(i) Write down the **molecular formula of butane**.

answer _____

[1]

(ii) Look at the displayed formulas of propane and butane.

Propane and butane are **hydrocarbons**.

They are also **alkanes**.

Explain why they are both hydrocarbons and alkanes.

_____

_____

_____

_____ **[3]**

17 The picture shows two feeding bottles for a baby.



These bottles have been painted with a special paint.

This paint contains a thermochromic pigment.

Explain why this paint has been used.

---

[2]

18 Ethene is used to make a **polymer**.

Write down the name of this polymer.

---

[1]

19 Many car engines burn petrol.

Petrol contains octane.

Octane reacts with oxygen.

Carbon dioxide and water are made.

Write down the **word equation** for this reaction.

---

[1]

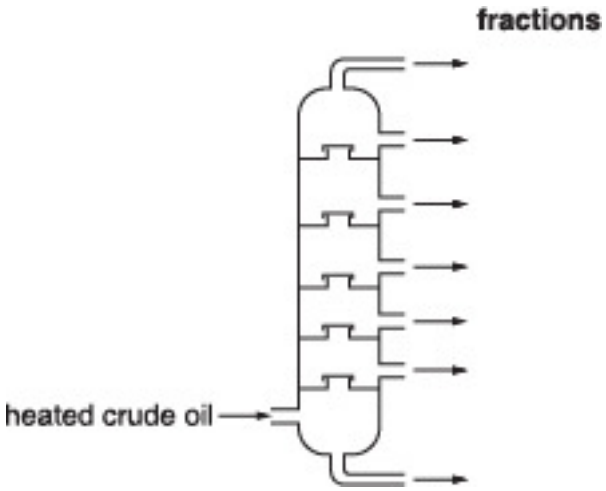
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20(a) Crude oil is separated into many fractions by fractional distillation.

The diagram shows a fractionating column.



Look at the table. It shows the boiling point range for some of the fractions.

Fraction	Boiling point range in °C
bitumen	above 350
heating oil	240 to 350
paraffin	120 to 240
petrol	20 to 70
LPG	?160 to 20

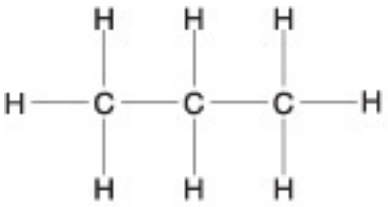
Write down the name of the fraction which 'exits' from the **bottom** of the fractionating column.

Explain your answer.

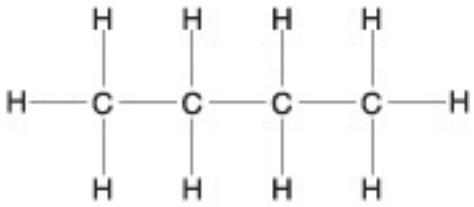
---

[2]

(b) LPG contains propane and butane.



propane



butane

(i) Write down the **number of atoms** in a molecule of **butane**.

answer _____

[1]

(ii) Look at the displayed formulas of propane and butane.

Propane and butane are **hydrocarbons**.

They are also **alkanes**.

Explain why they are both hydrocarbons and alkanes.

_____

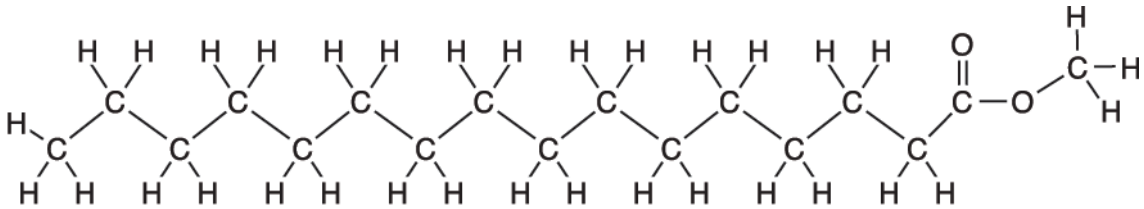
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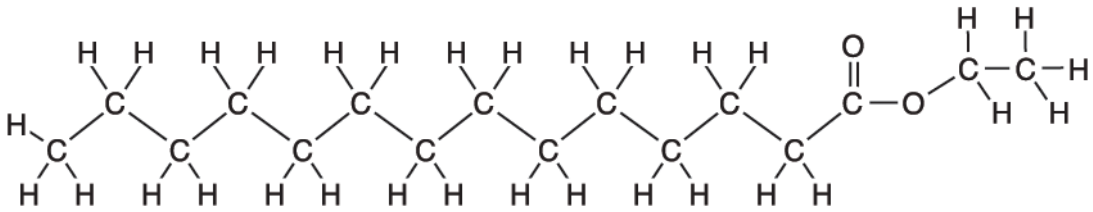
_____ **[3]**

21(a) Look at the diagrams. They show the displayed formulas of some fats and oils.

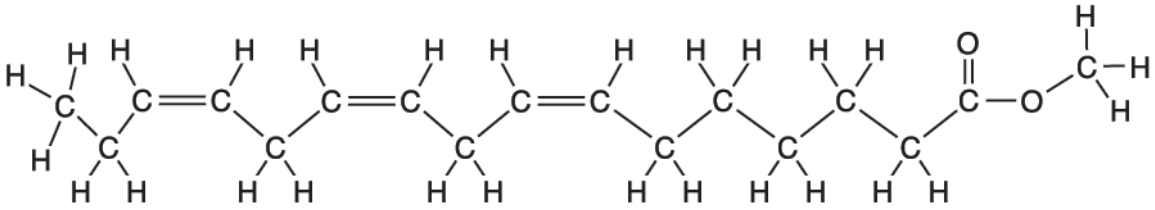
Formula **A**



Formula **B**



Formula **C**



Which formula is **unsaturated**?

Explain your answer.

---

[2]

(b) Oils can be used to make an **emulsion**.

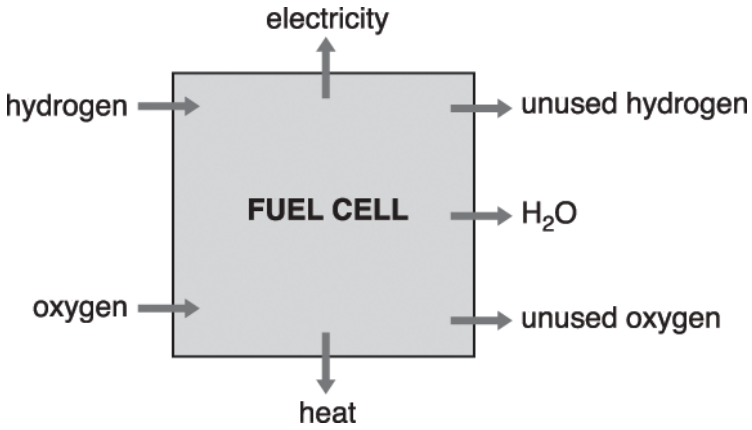
What is meant by an emulsion?

---

[2]

22(a) Fuel cells are used to make electricity.

Look at the diagram. It shows what happens in a fuel cell.



What is the name of the fuel used in this fuel cell?

---

[1]

(b) In this fuel cell, hydrogen, H_2, reacts with oxygen, O_2. Water, H_2O, is made.

Write a **balanced symbol** equation for this reaction.

---

[2]

(c) The burning of fossil fuels makes waste products that cause pollution.

This fuel cell does **not** make waste products that cause pollution.

Explain why.

---

[1]

(d) Fuel cells are used to provide electrical energy in spacecraft.

Write down one **other advantage** of using fuel cells in spacecraft.

---

[1]

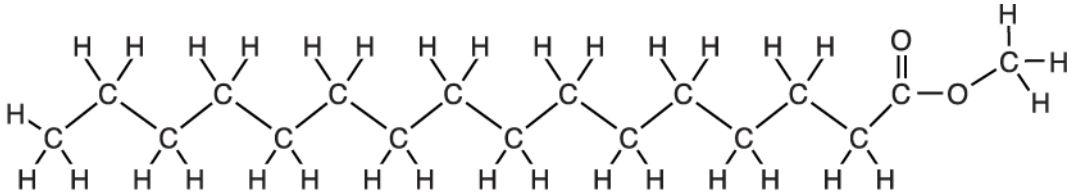
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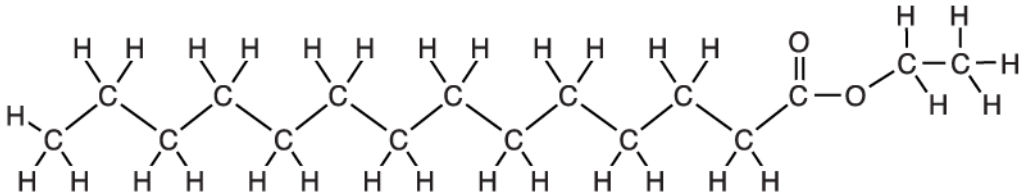
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23(a) Look at the diagrams. They show the displayed formulas of some fats and oils.

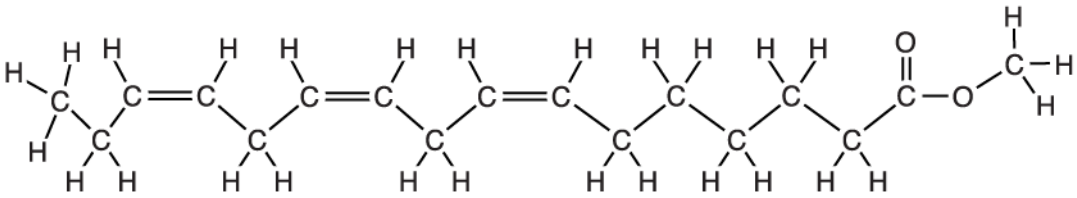
Formula **A**



Formula **B**



Formula **C**



Which formula is **unsaturated**?

Explain your answer.

---

[2]

(b) Fats and oils can be split up by **saponification**.

Explain what happens during saponification.

---

[2]

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(c) Look at the diagram of a detergent molecule.



Explain, using its structure, how a detergent molecule removes fat and oil stains from clothes.

---

[2]

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24 Look at the diagram of a detergent molecule.



Explain how detergents remove fat and oil stains from clothes.

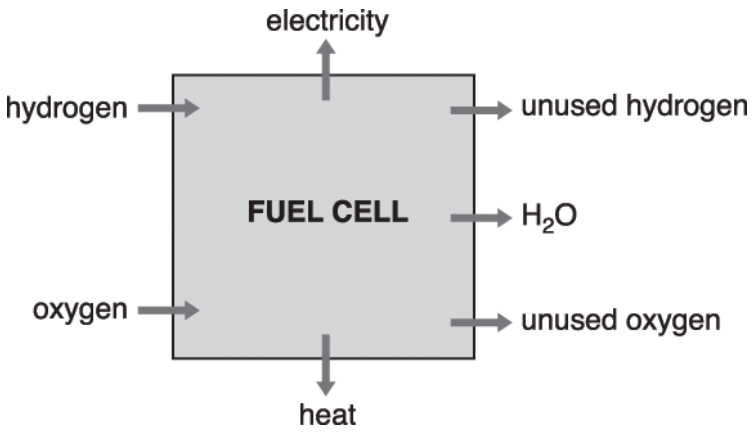
You may wish to draw a **labelled** diagram.

---

[3]

25 Fuel cells are used to make electricity.

Look at the diagram. It shows what happens in a fuel cell.



Hydrogen-oxygen fuel cells produce water.

Water is not a pollutant.

Fuel cells still cause pollution.

Write down two ways that fuel cells can cause pollution.

1

2

---

[2]

26 Some fats are **unsaturated.**

Describe a chemical test to show that a fat is unsaturated.

test _____

result _____

---

[2]

27(a) Glucose reacts to make carbon dioxide and ethanol.

Look at the formulas.

Substance	Formula
glucose	$C_6H_{12}O_6$
carbon dioxide	CO_2
ethanol	C_2H_5OH

Write down the **balanced symbol** equation for this reaction.

[2]

(b) The general formula for an alcohol is

$$C_nH_{2n+1}OH$$

Propanol contains three carbon atoms.

(i) Write the formula for propanol.

[1]

(ii) Draw the **displayed formula** of propanol.

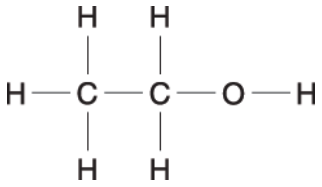
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28 Ethanol, propanol and butanol are alcohols.

Look at the displayed formula of ethanol.



Alcohols have the general formula $C_nH_{2n+1}OH$.

(i) A molecule of propanol has **3** carbon atoms.

Write the formula of propanol.

---

[1]

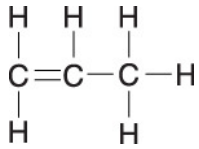
(ii) Draw the **displayed** formula of butanol, C_4H_9OH.

[1]

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29(a) Poly(propene) is a polymer made from propene.

Look at the displayed formula for propene.

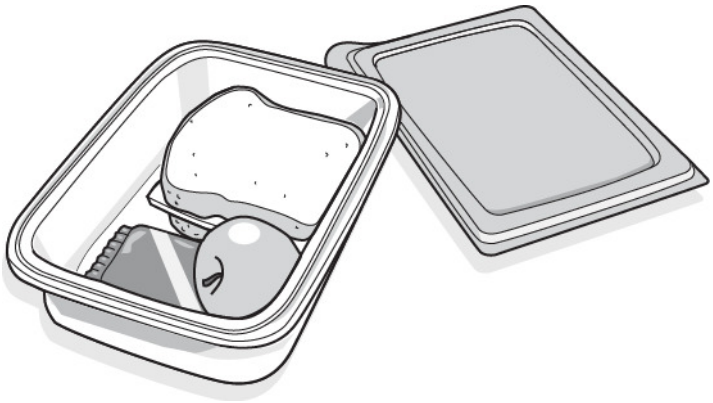


Draw the displayed formula for poly(propene).

[2]

(b) Poly(propene) is used to make sandwich boxes.

Look at Anna's sandwich box. It contains the sandwiches for her lunch.



One of the properties of poly(propene) is that it is flexible.

Explain **why** poly(propene) is flexible and suggest, with reasons, two **other** properties needed by poly(propene)

to be suitable for making a sandwich box.

The quality of written communication will be assessed in your answer to this question.

[6]

30 A power station burns methane, CH_4.

Construct a **balanced symbol** equation for the complete combustion of methane.

[2]

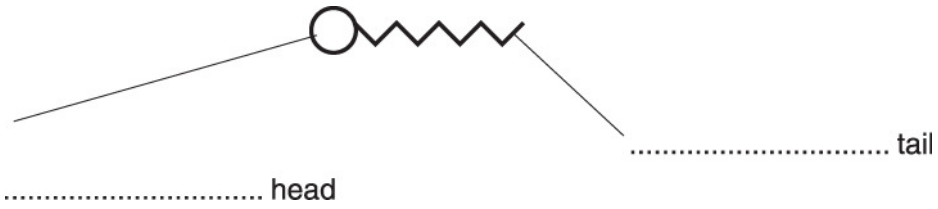
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31 This question is about emulsifiers and cooking.

Mayonnaise is a mixture of an emulsifier, an oil and water.

The emulsifier helps to stop the oil and water from separating.

Look at the structure of an emulsifier molecule.



(i) Label the two parts of the emulsifier molecule.

[1]

(ii) Explain how an emulsifier helps to stop oil and water from separating.

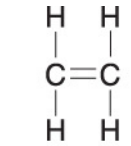
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[2]

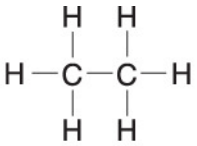
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32(a) This question is about compounds containing carbon.

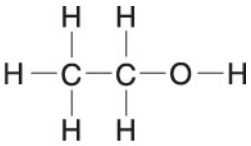
Look at the displayed formulas of some compounds.



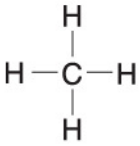
compound **A**



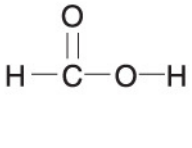
compound **B**



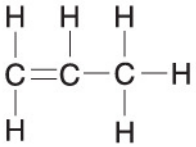
compound **C**



compound **D**



compound **E**



compound **F**

What is the **molecular formula** for compound **B**?

_____

[1]

(b) Explain why compound **B** is a hydrocarbon but compound **C** is not a hydrocarbon.

_____

_____

_____

_____ **[3]**

(c) Two compounds are **unsaturated**.

Which two?

_____ and _____

[1]

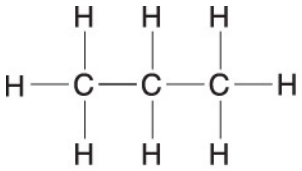
33 The LPG fraction of crude oil contains propane gas, C_3H_8.

Write a **balanced symbol** equation for the **incomplete** combustion of propane in oxygen, O_2.

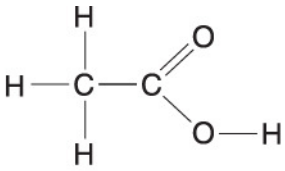
Only carbon monoxide, CO, and water are made.

[2]

34(a) Look at the displayed formulas of some compounds.



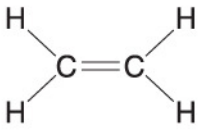
compound **A**



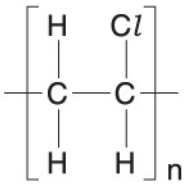
compound **B**



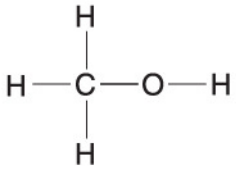
compound **C**



compound **D**



compound **E**



compound **F**

Compound **F** is **not** a hydrocarbon.

Explain how you can tell from the displayed formula.

[1]

(b) Which compound is an **unsaturated** hydrocarbon?

Choose from **A**, **B**, **C**, **D**, **E** or **F**.

[1]

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(c) Which compound is a **polymer**?

Choose from **A**, **B**, **C**, **D**, **E** or **F**.

_____

[1]

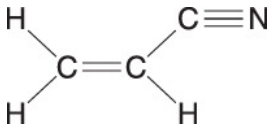
(d) Compound **D** makes an addition polymer.

Draw the **displayed formula** of this addition polymer.

[1]

35 Stowmarket Synthetics is a chemical company that makes polymers.

They make a polymer from a monomer called propenenitrile.



What is the name of the polymer made from propenenitrile?

[1]

36 Fractional distillation separates crude oil into useful fractions.

Look at the table.

It shows some information about fractions obtained from crude oil.

Fraction	Boiling temperature in °C
bitumen	above 350
LPG	less than 40
fuel oil	300 – 350
heating oil	250 – 300
petrol	40 – 200
paraffin	200 – 250

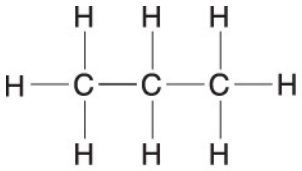
Write about how fractional distillation separates crude oil into fractions and list the fractions in the position, from top to bottom, that they 'exit' the fractionating column.

The quality of written communication will be assessed in your answer to this question.

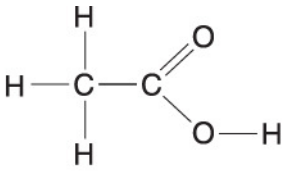
[6]

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37(a) Look at the displayed formulas of some compounds.



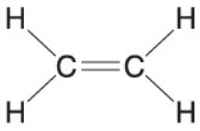
compound **A**



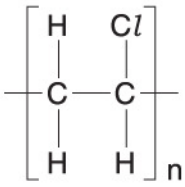
compound **B**



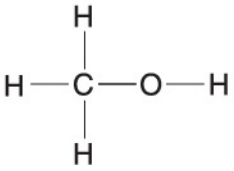
compound **C**



compound **D**



compound **E**



compound **F**

Write down a compound that is a **hydrocarbon**.

Choose from **A**, **B**, **C**, **D**, **E** or **F**.

_____

[1]

(b) Look at the displayed formula for compound **B**.

How many **different elements** are in compound **B**?

_____

[1]

(c) Compound **E** is a polymer called poly(chloroethene).

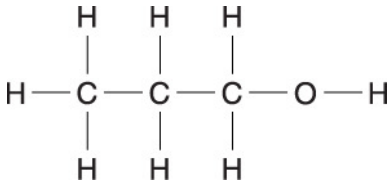
Write down the name of the **monomer** that poly(chloroethene) is made from.

_____

[1]

38(a) Propanol and ethanol are alcohols.

Look at the displayed formula of propanol.



Propanol is **not** a hydrocarbon. Explain why.

---

[2]

(b) Ethanol can be made from ethene.

Look at the word equation.

ethene + water → ethanol

Write down the name of this type of reaction.

Choose from the list.

displacement

electrolysis

hydration

galvanising

answer _____ [1]

39 Hexane burns in a limited supply of oxygen.

Incomplete combustion happens.

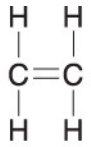
Write a **word equation** for the **incomplete** combustion of hexane.

---

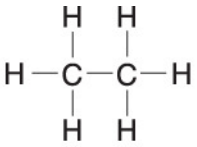
[1]

40(a) This question is about compounds containing carbon.

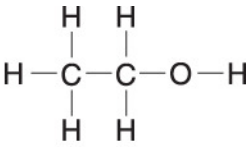
Look at the displayed formulas of some compounds.



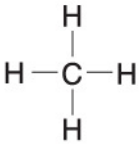
compound **A**



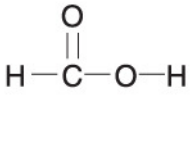
compound **B**



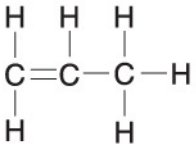
compound **C**



compound **D**



compound **E**



compound **F**

Two compounds have molecules that contain only **five** atoms.

Which two?

_____ and _____

[1]

(b) Two compounds decolourise bromine water.

Which two?

_____ and _____

[1]

(c) Explain why compound **B** is a hydrocarbon but compound **C** is not a hydrocarbon.

---

[3]

41 Crude oil is a mixture of hydrocarbons.

Crude oil is separated into useful fractions.

Which of these mixtures of substances could be in a fraction from crude oil?

A C_2H_4, C_4H_{10}, $C_4H_{10}O$

B C_2H_4, C_2H_3Br, C_4H_{10}

C C_2H_6, C_3H_8, C_4H_{10}

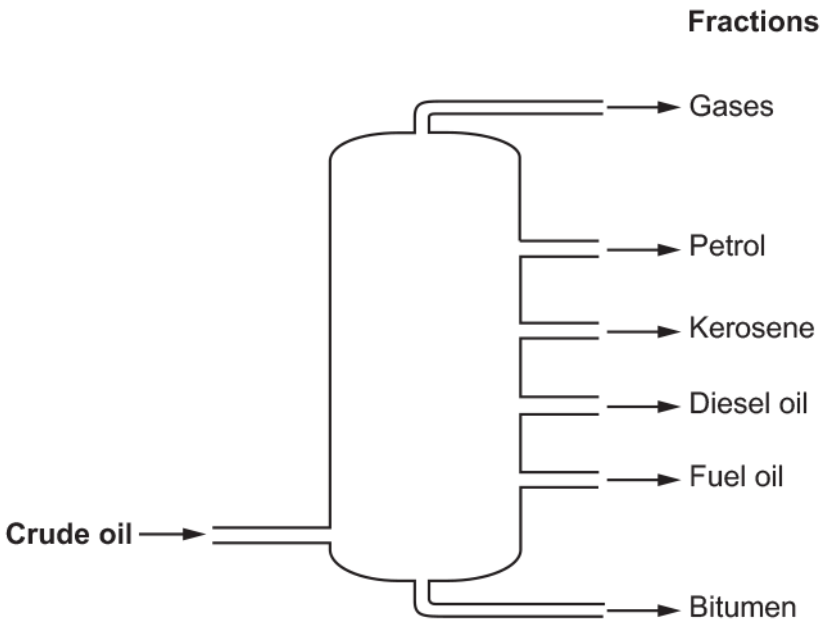
D C_2H_6, C_2H_3Br, $C_4H_{10}O$

Your answer ☐ [1]

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42 Crude oil is separated into useful fractions by fractional distillation.

The diagram shows the useful fractions made in fractional distillation.



Which of these fractions has the **weakest** intermolecular forces?

A Bitumen
B Diesel oil
C Gases
D Petrol

Your answer ☐ [1]

43 What type of reaction takes place between an alkene and hydrogen?

A Addition
B Dehydration
C Neutralisation
D Thermal decomposition

Your answer ☐ [1]

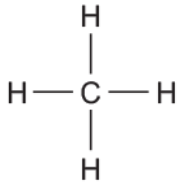
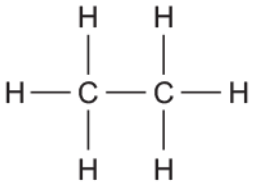
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44(a) This question is about hydrocarbons.

The table shows some information about alkanes.

Name of alkane	Molecular formula	Structure
Methane	CH_4	
Ethane	.....	
.....	C_4H_{10}	.....

Complete the table. [3]

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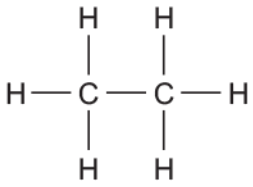
(b) Ethane is a **saturated hydrocarbon**.

Explain why ethane is called both a hydrocarbon **and** saturated.

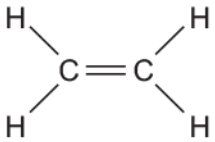
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[2]

(c) A student has two test tubes. One contains **ethane** and one contains **ethene**.



Ethane



Ethene

The student added **bromine water** to each test tube.

Describe what she observes.

Ethane ---

Ethane ---

[2]

(d) Ethane belongs to the **homologous series** called the alkanes.

What is the name of the homologous series that **ethene** belongs to?

[1]

45(a) Crude oil is separated into useful fractions using fractional distillation.

The table shows the percentages of crude oil fractions from different oil wells.

Fraction	Percentage of fraction in crude oil		
	Oil well X	Oil well Y	Oil well Z
LPG	2	7	10
Petrol	3	10	25
Paraffin	6	15	20
Diesel	7	11	15
Fuel oil	26	29	28
Bitumen	56	28	2

Which oil well contains the highest percentage of low boiling point fractions?

Tick (✓) **one** box.

X ☐

Y ☐

Z ☐

[1]

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(b) A barrel of crude oil from oil well **Y** has a mass of 139 kg.

Calculate the mass of **fuel oil** in this barrel.

Mass = ... kg **[2]**

(c) Fractions from crude oil contain alkanes.

Alkanes have the general formula C_nH_{2n+2}.

Write the **formula** of hexadecane, the alkane with 16 carbon atoms.

[1]

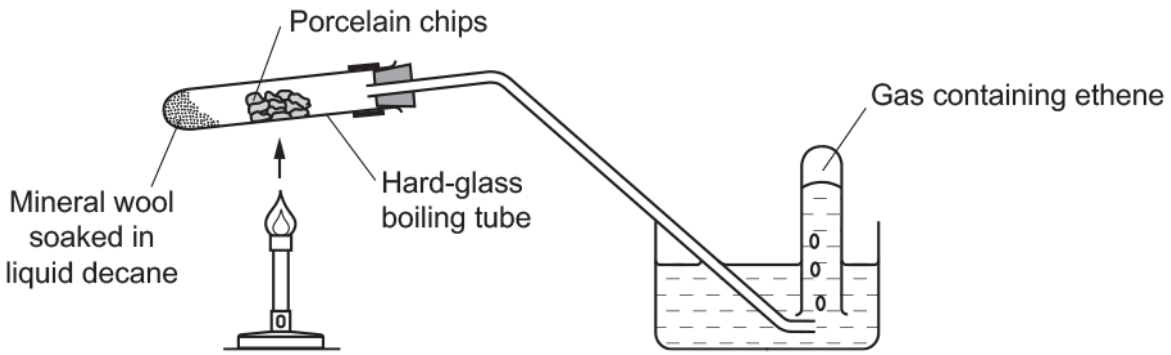
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(d) A sample of decane was cracked.

Look at the diagram of the apparatus used.



(i) Describe how this apparatus is used to produce ethene from decane.

---

[2]

(ii) One molecule of decane, $C_{10}H_{22}$, produced two molecules of ethene, C_2H_4, and one molecule of product **Z**.

$C_{10}H_{22} \rightarrow 2C_2H_4$ + product **Z**

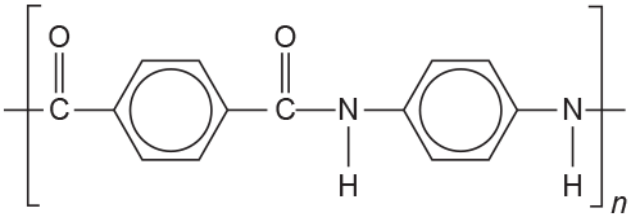
Write the **formula** for product **Z**.

---

[1]

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46 Look at the structure of Kevlar®.

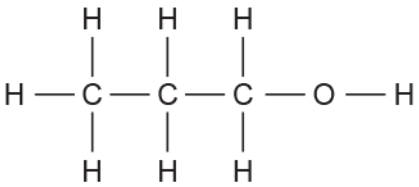


What type of molecule is Kevlar®?

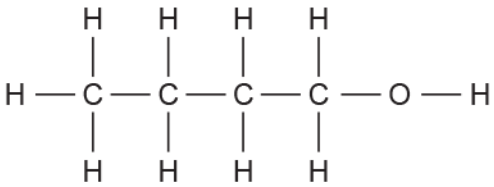
[1]

47 Which displayed formula shows butanol?

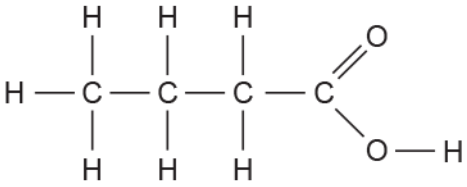
A



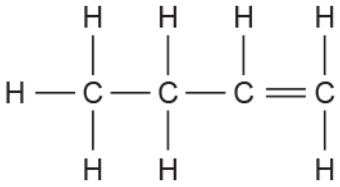
C



B



D



Your answer

[1]

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48 A hydrogen-oxygen fuel cell produces electricity.

Hydrogen reacts with oxygen to produce water.

What is the equation for the reaction that happens at the **anode**?

A $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

B $4H^+(aq) + 4e^- \rightarrow 2H_2(g)$

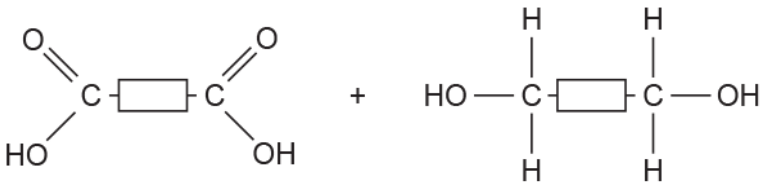
C $2H_2(g) \rightarrow 4H^+(aq) + 4e^-$

D $4H^+(aq) + O_2(g) + 4e^- \rightarrow 2H_2O(g)$

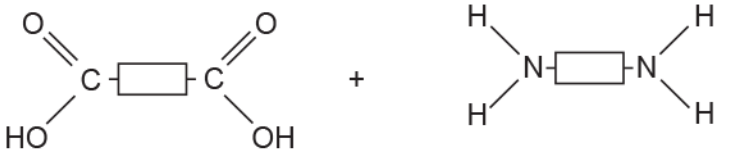
Your answer ☐ [1]

49 Which pairs of molecules would react to form a **polyester**?

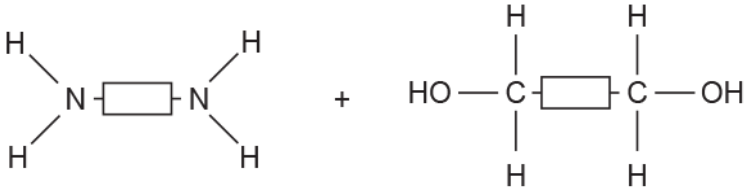
A



B



C



D



Your answer ☐ [1]

50 Which statement explains why **polyamides** are condensation polymers?

A A molecule of water forms each time a hydroxyl link forms.

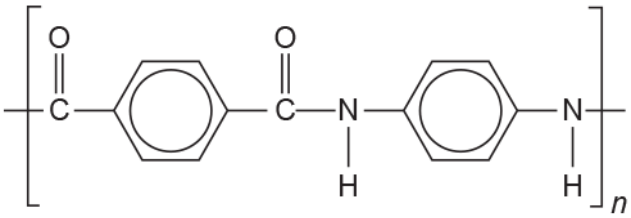
B A molecule of water forms each time an ester link forms.

C A molecule of water forms each time an amine group reacts with a carboxylic acid group.

D A molecule of water forms each time an alcohol group reacts with a carboxylic acid group.

Your answer [ ] **[1]**

51 Look at the structure of Kevlar®.

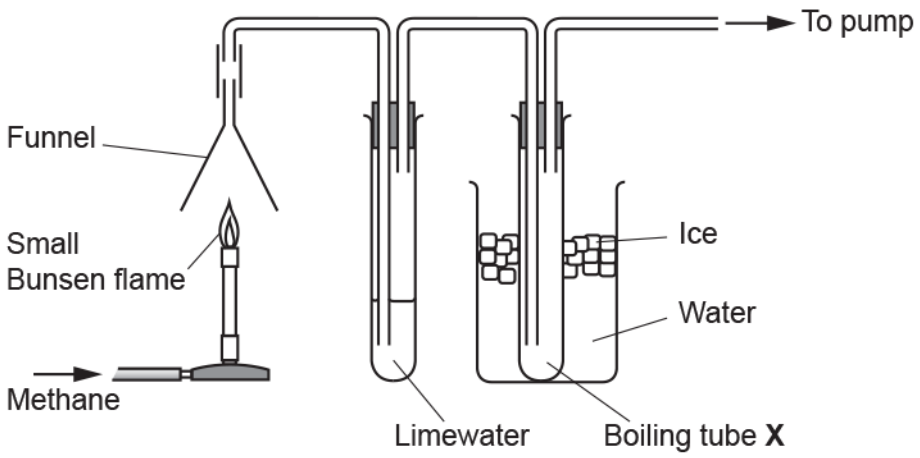


What type of molecule is Kevlar®?

[1]

52(a) A student did an experiment to prove that methane gas, CH_4, produces carbon dioxide and water when it burns.

Look at the diagram of her experiment.



The limewater turned milky showing that carbon dioxide had been formed.

A small amount of a colourless liquid condensed in boiling tube **X**. The student said that this proved that burning methane produced water.

The teacher said that the experiment had been set up incorrectly.

The teacher said that the student's conclusion about water was not valid.

Describe and explain how the student could change how the experiment is set up to prove that water is produced by burning methane.

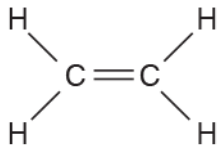
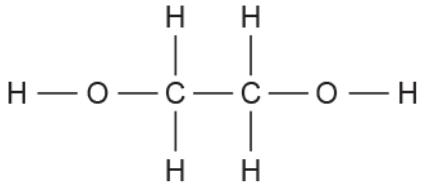
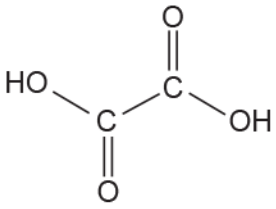
[2]

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(b) Look at the monomers shown in the table.

Monomer	Structure
Ethene	
Ethane-1,2-diol	
Ethanedioic acid	

Two of the monomers from the table react to form a polymer which is a **polyester**.

Explain, using the appropriate monomers from the table, how the polyester is formed.

Include the **type of polymerisation** and an **equation for the reaction** in your answer.

[4]

(c) An alcohol, **X**, has the formula C_3H_7OH.

Alcohol **X** can be oxidised to a compound, **Y**, with the molecular formula $C_3H_6O_2$.

(i) Compound **Y** is **not** an alcohol but is a member of another homologous series.
Write down the name of this homologous series.

[1]

(ii) Draw the **displayed formula** of a molecule of alcohol **X** and of a molecule of compound **Y**.

Show all the covalent bonds.

Alcohol **X**

Compound **Y**

[2]

(d) DNA and proteins are biological polymers.

(i) How many **different** monomers are found in a DNA polymer?

[1]

(ii) What are the monomers in **proteins** called?

[1]

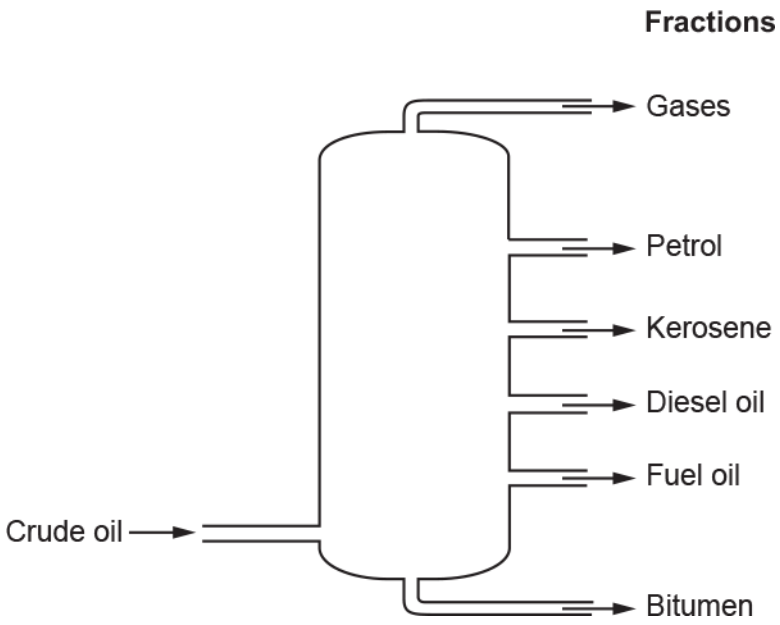
53 What happens to the potential difference of a chemical cell once the reactants are used up?

A It decreases
B It increases
C It starts and finishes at 0 V
D It stays the same

Your answer ☐ [1]

54 Crude oil is separated into fractions by fractional distillation.

Look at the diagram of the fractions made in fractional distillation.



Which of these fractions has the **lowest** boiling point?

A Bitumen
B Diesel oil
C Gases
D Petrol

Your answer ☐ [1]

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55 DNA molecules are polymers.

What is the name of the **monomers** that make up DNA molecules?

A Amino acids
B Carbohydrates
C Nucleotides
D Proteins

Your answer ☐ [1]

56 Which of the following are the first four members of the homologous series of **alcohols**?

A CH_4, C_2H_6, C_3H_8, C_4H_{10}
B CH_3OH, C_2H_5OH, C_3H_7OH, C_4H_9OH
C $HCOOH$, CH_3COOH, C_2H_5COOH, C_3H_7COOH
D C_2H_4, C_3H_6, C_4H_8, C_5H_{10}

Your answer ☐ [1]

57 Ethene, C_2H_4, reacts with bromine, Br_2, in an addition reaction.

Which is the balanced symbol equation for this reaction?

A $C_2H_4 + Br_2 \rightarrow C_2H_3Br + HBr$
B $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$
C $C_2H_4 + 2Br_2 \rightarrow C_2Br_4 + 2H_2$
D $C_2H_4 + 2Br_2 \rightarrow C_2H_4Br_4$

Your answer ☐ [1]

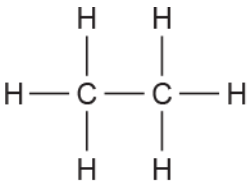
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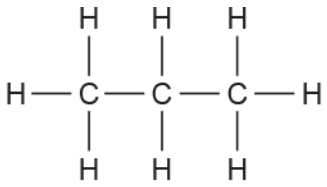
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58(a) This question is about compounds of carbon.

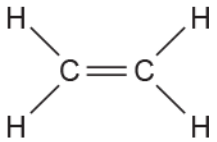
Look at the displayed formulae of ethane, propane and ethene.



Ethane



Propane



Ethene

Ethane and propane are both members of the **homologous series** called the alkanes.

Write down **two** reasons why ethane and propane are members of the same homologous series.

1 _____

2 _____

[2]

(b) Many ethene molecules react together to form the polymer poly(ethene).

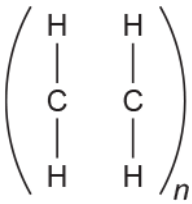
This reaction is called **polymerisation**.

(i) Why do ethene molecules undergo polymerisation but ethane molecules do not?

_____

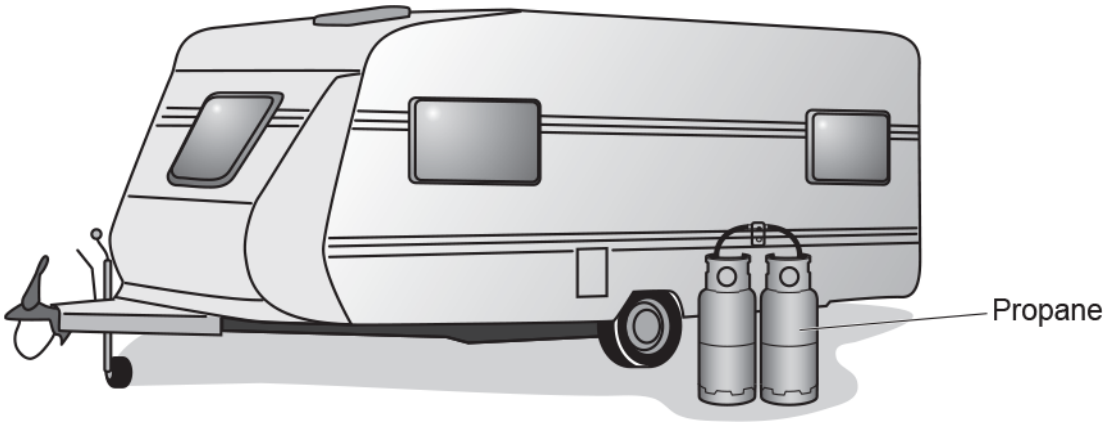
_____ **[1]**

(ii) Complete the diagram to show the displayed formula of poly(ethene).



[2]

(c) * Propane gas is used as a fuel for cooking and heating in caravans.



Incomplete combustion of propane can occur if the campers do not take sensible precautions.

Describe how incomplete combustion of hydrocarbons such as propane happens and the problems it can cause for campers.

Include a **balanced symbol** equation in your answer.

[6]

59(a) Fractional distillation separates crude oil into useful fractions.

Look at the table.

It shows the percentage of each fraction made from crude oil. It also shows the percentage of each fraction needed for everyday uses.

Fraction	Percentage made by fractional distillation	Percentage needed for everyday uses
Gases	4	11
Petrol	11	22
Naphtha	10	18
Paraffin	12	20
Fuel oil	22	10
Waxes and tar	23	4

(i) Which fraction is **made** in the **greatest** percentage?

Tick (✓) **one** box.

Gases ☐

Petrol ☐

Naphtha ☐

Paraffin ☐

Fuel oil ☐

Waxes and tar ☐

[1]

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(ii) Which fraction is **needed** in the **smallest** percentage?

Tick (✓) **one** box.

Gases ☐

Petrol ☐

Naphtha ☐

Paraffin ☐

Fuel oil ☐

Waxes and tar ☐

[1]

(b) Cracking changes large hydrocarbon molecules into smaller hydrocarbon molecules.

(i) One of the conditions needed for cracking is a high pressure.

Write down **one** other condition needed.

[1]

(ii) Cracking is a very useful reaction.

Explain why.

Use information from the table in your answer.

[2]

(c) In 2008 the USA produced 4 900 000 barrels of crude oil per day. In 2019 this had increased to 11 000 000 barrels of crude oil per day.

Calculate the percentage increase in the number of barrels of crude oil produced per day from 2008 to 2019.

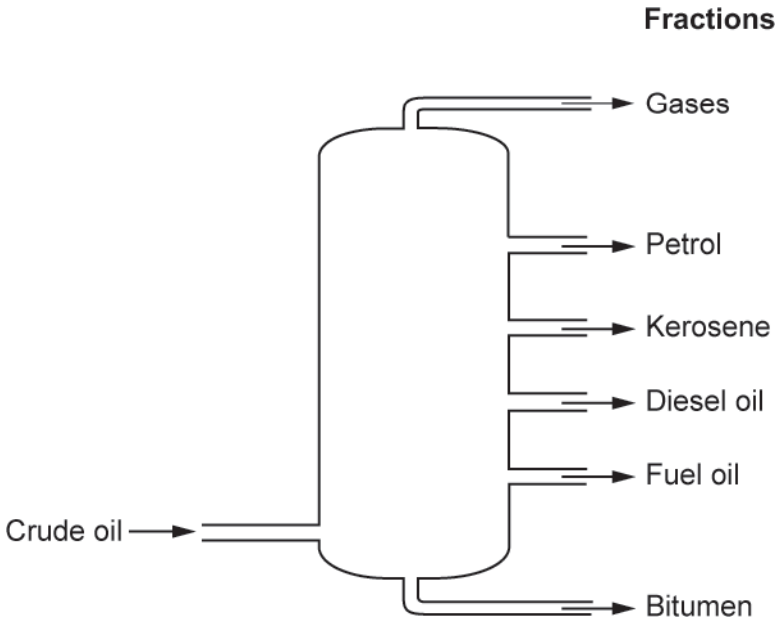
Use the formula: percentage increase $= \frac{\text{increase}}{\text{original}} \times 100$

Give your answer to **2** decimal places.

Percentage increase = ... % **[3]**

60 Crude oil is separated into fractions by fractional distillation.

Look at the diagram of the fractions made in fractional distillation.



Which of these fractions has the **strongest** intermolecular forces?

A Bitumen
B Diesel oil
C Gases
D Kerosene

Your answer ☐ [1]

61 What is the **general formula** of the fractions produced by the fractional distillation of crude oil?

A C_nH_{2n}
B C_nH_{2n+2}
C $C_2H_{2n+1}OH$
D $C_{2n+2}H_2$

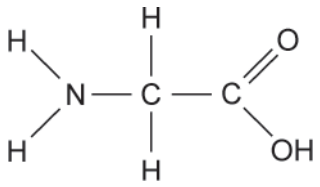
Your answer ☐ [1]

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62 Look at the structure of glycine.



Glycine is a monomer that reacts to form proteins.

Glycine contains **two** different functional groups that allow it to undergo polymerisation.

What are the two functional groups?

A $-NH_2$ and $-C=O$

B $-NH_2$ and $-CH_2-$

C $-NH_2$ and $-OH$

D $-NH_2$ and $-COOH$

Your answer [ ] **[1]**

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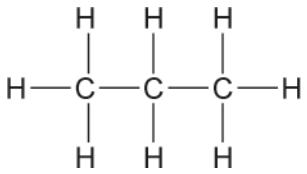
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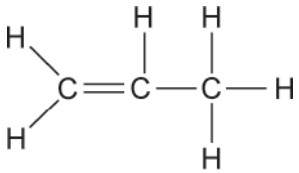
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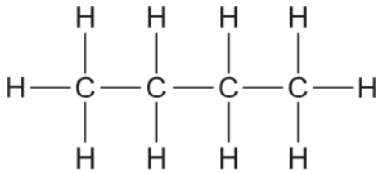
63 A student reacts a hydrocarbon with bromine water.

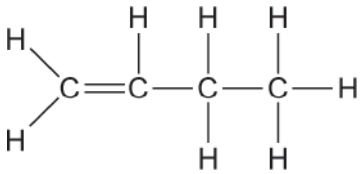
The formula of the product is $C_3H_6Br_2$.

Which is the displayed formula of the hydrocarbon?

A 

B 

C 

D 

Your answer [ ] [1]

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64 Which of these homologous series can react together to form addition polymers?

A Alcohols and carboxylic acids
B Alkenes only
C Alkenes and alkanes
D Carboxylic acids only

Your answer ☐ **[1]**

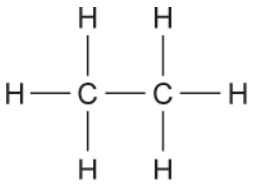
65 What is the formula of the functional group in **alcohols**?

A $-CH_3$
B –COOH
C $-CO_2$
D –OH

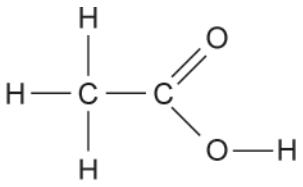
Your answer ☐ **[1]**

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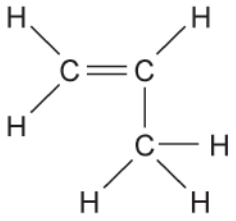
66(a) Look at the displayed formulae of some compounds.



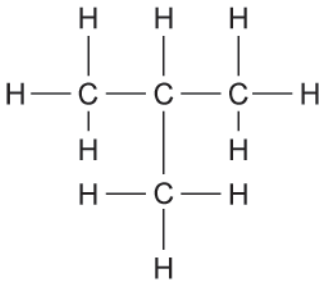
Compound **A**



Compound **B**



Compound **C**



Compound **D**

(i) Which **two** compounds are members of the same **homologous series**?

..... and .....

(ii) Write down **two** reasons for your answer in **(i)**.

1 _____

2 _____

[3]

(b) Many molecules of compound **C** react together to form a polymer.

This reaction is called **addition polymerisation**.

(i) Draw the **displayed formula** of the polymer formed by compound **C**.

[2]

(ii) Another type of polymerisation is **condensation polymerisation**.

Describe one **difference** between addition polymerisation and condensation polymerisation.

---

[1]

(c) * A student has unlabelled samples of three liquids.

The student knows that the three liquids are:

- pentane, C_5H_{12}
- pentene, C_5H_{10}
- ethanoic acid, CH_3COOH.

Describe tests that the student should do to identify each of the three liquids.

Include **balanced symbol** equations for the reactions described.

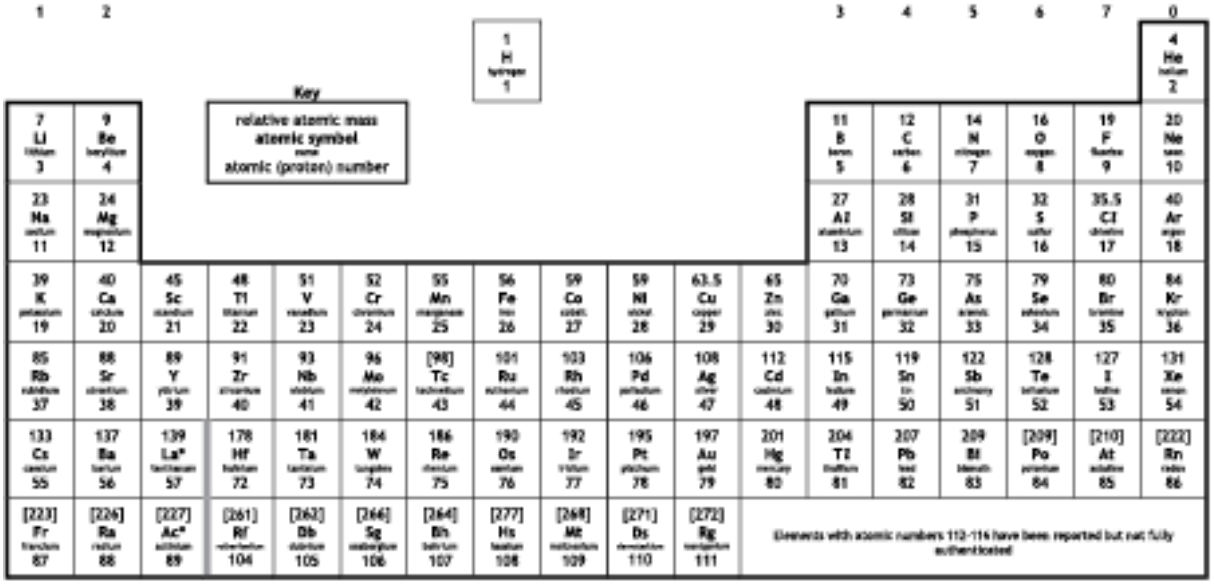
[6]

END OF QUESTION PAPER

Resource assets

Resource asset for Q39

The Periodic Table of the Elements



1	2											3	4	5	6	7	0
						1 H hydrogen 1											4 He helium 2
7 Li lithium 3	9 Be beryllium 4	Key: relative atomic mass; atomic symbol; name; atomic (proton) number										11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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