Organic Chemistry

Q1. (2018)

2 Damp litmus paper is used to test for chlorine gas.

Which statement describes the correct result of the test for chlorine gas?

A Damp blue litmus paper turns red then white.

B Damp blue litmus paper turns white then red.

C Damp red litmus paper turns blue then white.

D Damp red litmus paper turns white then blue.

Your answer ☐ **[1]**

Q2. (2018)

5 The list shows part of the reactivity series of metals including carbon.

Sodium
Lithium
Calcium
Magnesium
Aluminium
Carbon
Zinc
Iron
Tin
Lead

Which row of the table correctly describes how the metals are extracted from their ores?

	Metals extracted by electrolysis	Metals extracted by heating with carbon
A	Sodium, Magnesium, Zinc	Aluminium, Iron, Tin
B	Aluminium, Zinc, Iron	Lead, Tin
C	Calcium, Magnesium, Aluminium	Sodium, Iron, Tin
D	Sodium, Calcium, Magnesium	Lead, Tin, Zinc

Your answer ☐ **[1]**

Q3. (2018)

9 Which statement is true for a reversible reaction when it is at dynamic equilibrium?

A The concentration of the products is increasing.

B The rate of the backward reaction is greater than the rate of the forward reaction.

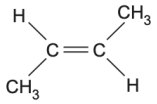
C The rate of the forward reaction is equal to the rate of the backward reaction.

D The rate of the forward reaction is greater than the rate of the backward reaction.

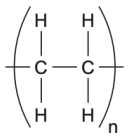
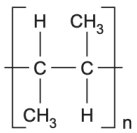
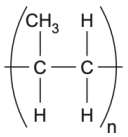
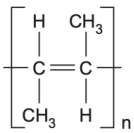
Your answer ☐ **[1]**

Q4. (2018)

11 Look at the displayed formula of the monomer butene.



What is the formula of the **polymer** formed from butene?

			
A	**B**	**C**	**D**

Your answer ☐ **[1]**

Q5. (2018)

12 DNA molecules are polymers.

What are the monomers that make up DNA called?

A Carbohydrates

B Nucleotides

C Phosphates

D Proteins

Your answer ☐ **[1]**

Q6. (2018) – 24b, 24c

Context:

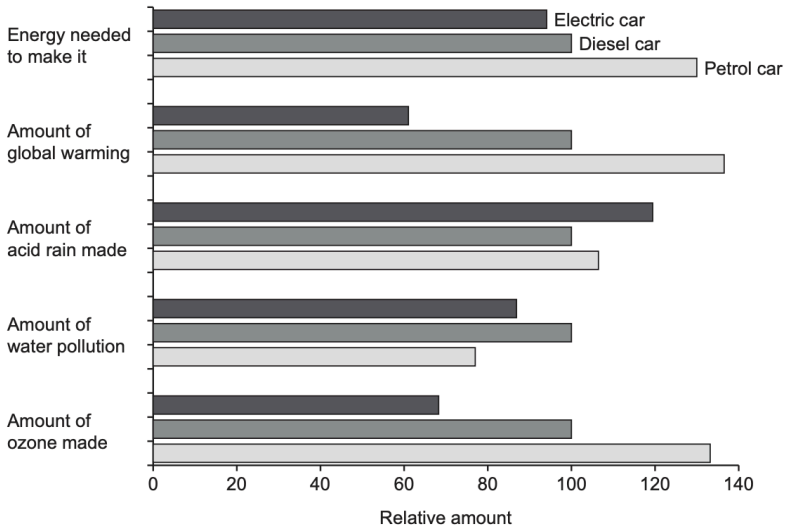
24 This question is about life-cycle assessment.

(a) A car company is developing three new cars:

- A petrol car
- A diesel car
- An electric car.

They do a life-cycle assessment of each car.

Look at the information about the life-cycle assessment of each car.



The company decides to manufacture and sell the electric car.

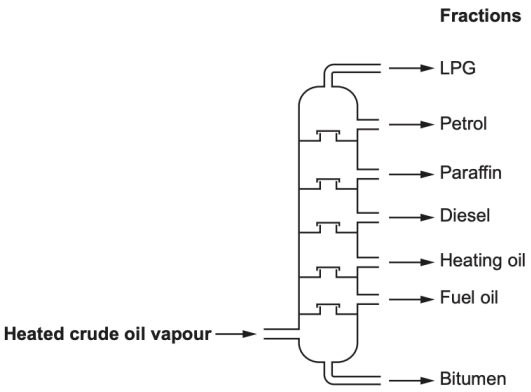
Question:

A)

(b) The fuels for the petrol and diesel cars are made from crude oil.

Crude oil is separated into different parts by **fractional distillation**.

The diagram shows a fractionating column.



Explain why crude oil **vapour** can be separated by fractional distillation.

.....

.....

.....

.....

..... **[3]**

B)

(c) The table shows the boiling points of molecules present in different crude oil fractions.

Molecule	Boiling point (°C)
A	−2
B	125
C	216
D	502

Which molecule, **A**, **B**, **C** or **D**, is in the **LPG fraction**?

Explain your decision.

.....

..... **[2]**

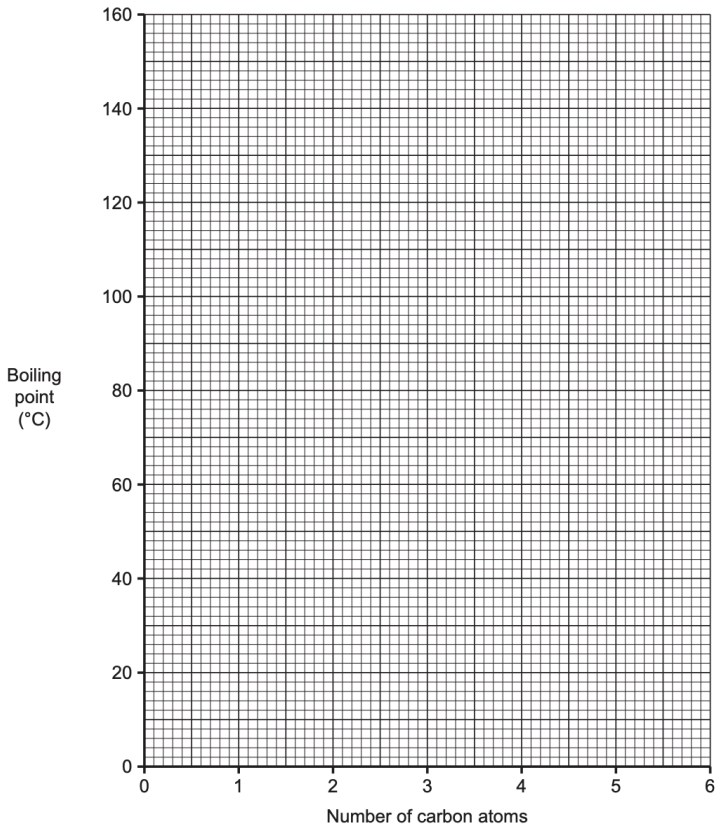
Q7. (2018)

25 A student is using the internet to find out about alcohols. The student finds the following information.

Name	Number of carbon atoms	Boiling point (°C)
Methanol	1	65
Ethanol	2	79
Propanol	3	97
Pentanol	5	138
Hexanol	6	156

A)

(a) Plot a graph of the boiling points of the alcohols on the grid. Draw a line of best fit.



[3]

B)

(b) **(i)** The student could not find a value for the boiling point of butanol, C_4H_9OH.

Use the graph to estimate the boiling point of butanol.

Answer = ... °C **[1]**

C)

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

[1]

D)

(c) The alcohols all react in a similar way because they all contain the same **functional group**.

What is the functional group in an **alcohol** molecule?

..... **[1]**

E)

(d) Ethanol, C_2H_5OH, can be oxidised to **ethanoic acid** using potassium manganate(VII).

What is the formula of ethanoic acid?

..... **[1]**

Q8. (2019)

6 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}

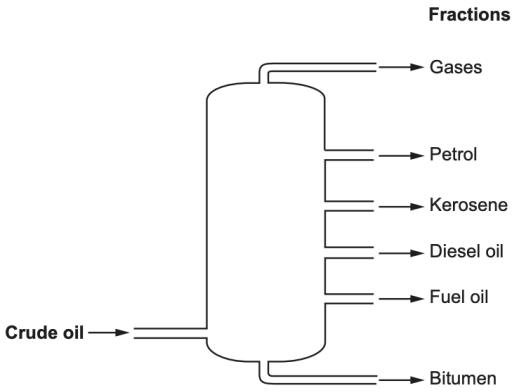
D C_2H_6, C_2H_3Br, $C_4H_{10}O$

Your answer ☐ **[1]**

Q9. (2019)

7 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]**

Q10. (2019)

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

A Addition

B Dehydration

C Neutralisation

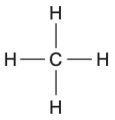
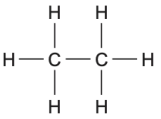
D Thermal decomposition

Your answer ☐ **[1]**

Q11. (2019)

17 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}	.....

A)

(a) Complete the table. **[3]**

B)

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

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

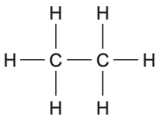
.....

.....

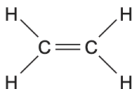
..... **[2]**

C)

(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 .....

Ethene .....

[2]

D)

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

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

..... **[1]**

E)

(e) Pentane, C_5H_{12}, is an alkane found in petrol.

Pentane undergoes **complete combustion** in excess oxygen, O_2.

Carbon dioxide and water are made.

Write the **balanced symbol** equation for the complete combustion of pentane.

..... **[2]**

Q12. (2019)

20 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

A)

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

Tick (✓) **one** box.

X ☐

Y ☐

Z ☐

[1]

B)

(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]**

D)

(c) Fractions from crude oil contain alkanes.

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

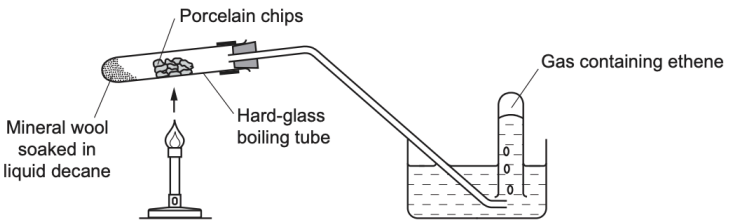
Write the **formula** of hexadecane, the alkane with 16 carbon atoms.

..... **[1]**

E)

(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]**

F)

(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**.

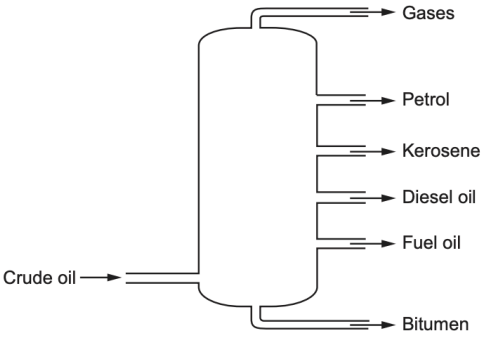
..... **[1]**

Q13. (2020)

7 Crude oil is separated into fractions by fractional distillation.

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

Fractions



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

A Bitumen

B Diesel oil

C Gases

D Petrol

Your answer ☐ **[1]**

Q14. (2020)

8 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]**

Q15. (2020)

10 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]**

Q16. (2020)

12 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]**

Q17. (2020)

19 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

A)

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

Tick (✓) **one** box.

- Gases ☐
- Petrol ☐
- Naphtha ☐
- Paraffin ☐
- Fuel oil ☐
- Waxes and tar ☐

[1]

B)

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

Tick (✓) **one** box.

- Gases ☐
- Petrol ☐
- Naphtha ☐
- Paraffin ☐
- Fuel oil ☐
- Waxes and tar ☐

[1]

C)

(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]**

D)

(ii) Cracking is a very useful reaction.

Explain why.

Use information from the table in your answer.

.....

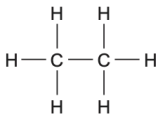
.....

..... **[2]**

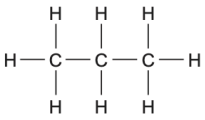
Q18. (2020)

22 This question is about compounds of carbon.

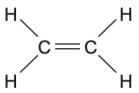
Look at the displayed formulae of ethane, propane and ethene.



Ethane



Propane



Ethene

A)

(a) 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)

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

This reaction is called **polymerisation**.

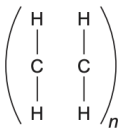
(i) Why do ethene molecules undergo polymerisation but ethane molecules do not?

.....

..... **[1]**

C)

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



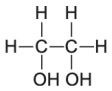
[2]

Q19. (2021)

5 What is the correctly displayed formula of **ethanoic acid**?

A

B



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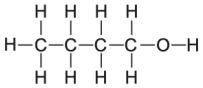
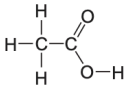


D

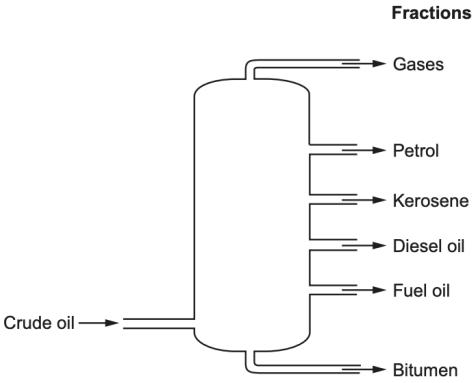


Your answer ☐ **[1]**

Q20. (2021)

7 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 **smallest** molecules?

A Bitumen

B Diesel oil

C Gases

D Petrol

Your answer ☐ **[1]**

Q21. (2021)

8 Transition metals have properties that are different from other metals in the Periodic Table.

Copper is a transition metal.

Which of the following describes copper?

A A metal which forms blue compounds.

B A metal which reacts violently with water.

C A metal with a low density that floats on water.

D A metal with a low melting point.

Your answer ☐ **[1]**

Q22. (2021)

11 Propene gas is bubbled into bromine water.

What happens to the colour of the bromine water?

A Changes from colourless to orange

B Changes from orange to colourless

C Stays colourless

D Stays orange

Your answer ☐ **[1]**

Q23. (2021)

14 Butene, pentene and hexene are alkenes. They are all members of the same homologous series.

Why are they members of the same homologous series?

A Their molecules differ by $-CH_3$.

B They have the same general formula.

C They have the same molecular formula.

D They have the same physical properties.

Your answer ☐ **[1]**

Q24. (2021)

15 Butane is a hydrocarbon molecule with a low boiling point.

Which statement about butane is correct?

A Butane is a large molecule and has strong intermolecular forces.

B Butane is a large molecule and has weak intermolecular forces.

C Butane is a small molecule and has strong intermolecular forces.

D Butane is a small molecule and has weak intermolecular forces.

Your answer ☐ **[1]**

Q25. (2021)

17 This question is about some of the hydrocarbons found in crude oil.

Table 17.1 shows information about four hydrocarbons found in crude oil.

Hydrocarbon	Molecular formula	Boiling point (°C)
Ethane	C_2H_6	–89
Hexane	C_6H_{14}	68
Nonane	C_9H_{20}	
Pentadecane	$C_{15}H_{32}$	271

Table 17.1

A)

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

What is meant by a hydrocarbon?

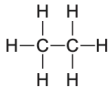
.....

.....

..... **[2]**

B)

(b) Look at the displayed formula for ethane.



Ethane is a **saturated** compound.

What is meant by a saturated compound?

.....

..... **[1]**

C)

(c) Use the information in **Table 17.1** to predict the boiling point of nonane.

..... **[1]**

D)

(d) Explain why a mixture of hexane, nonane and pentadecane can be separated by fractional distillation.

In your answer use information from **Table 17.1** and ideas about intermolecular forces.

.....

.....

.....

.....

.....

..... **[3]**

E)

(e) Nonane is one of the hydrocarbons found in aircraft fuel.

Nonane burns completely in a plentiful supply of oxygen.

Complete the **balanced symbol** equation by putting numbers on the dotted lines.

$$C_9H_{20} + \ldots\ldots O_2 \rightarrow \ldots\ldots CO_2 + \ldots\ldots H_2O$$

[2]

Q26. (2021) – 21c

(c) Ethanol, C_2H_5OH, burns in a plentiful supply of oxygen to form carbon dioxide and water.

This is an example of complete combustion.

(i) Write the **balanced symbol** equation for this reaction.

..... **[2]**

Q27. (2022)

4 Bromine water is used to test between ethane and ethene.

	Ethane	Ethene
A	bromine water is decolourised	no colour change
B	bromine water goes cloudy	bromine water is decolourised
C	bromine water goes clear	no colour change
D	no colour change	bromine water is decolourised

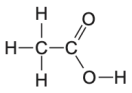
Which row in the table gives the correct test results?

Your answer ☐ **[1]**

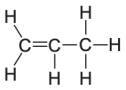
Q28. (2022)

5 What is the displayed formula of **propanoic acid**?

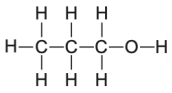
A



B



C



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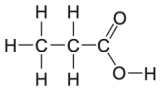


Your answer ☐ **[1]**

Q29. (2022)

6 DNA molecules are polymers made from monomers.

What are the monomers called?

A Alkenes

B Amino acids

C Carbohydrates

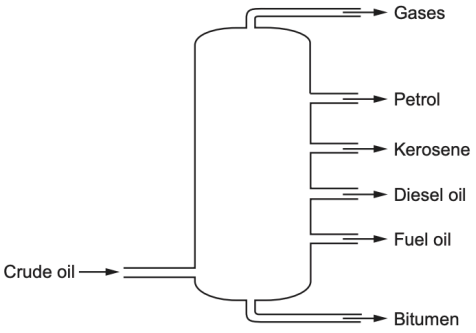
D Nucleotides

Your answer ☐ **[1]**

Q30. (2022)

7 Crude oil is separated into useful chemicals by fractional distillation.

The diagram shows the useful chemicals made in fractional distillation.



Which of these chemicals has the **largest** molecules?

A Bitumen

B Diesel oil

C Gases

D Petrol

Your answer ☐ **[1]**

Q31. (2022)

14 Large molecules produced by fractional distillation are cracked to make smaller molecules.

Octane, C_8H_{18}, is cracked to form ethene, C_2H_4, and one other product.

What is the formula of the other product?

A C_3H_6

B C_6H_{12}

C C_6H_{14}

D C_8H_{16}

Your answer ☐ **[1]**

Q32. (2022)

16 The table shows information about some compounds of carbon.

Compound	Formula
A	CH_4
B	C_2H_4
C	C_2H_6
D	C_3H_6
E	C_3H_8

A)

(a) Some of the compounds belong to the homologous series called the **alkanes**.

Which hydrocarbons are alkanes?

Tick (✓) **three** boxes.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐ **[3]**

B)

(b) Which homologous series do the compounds which are **not** alkanes belong to?

Tick (✓) **one** box.

Alcohols ☐

Alkenes ☐

Carboxylic acids ☐

Esters ☐

[1]

C)

(c) Compound **B**, C_2H_4, burns completely in oxygen.

State the names of the **two products** of this reaction.

..... and ..... **[2]**

D)

(d) Compound **A** is obtained from crude oil by fractional distillation.

Complete the sentences about fractional distillation. Use words from the list.

cracked	**colder**	**condense**	**evaporate**
fractions	**heated**	**hotter**	**polymers**

Crude oil is ..... as it enters a fractionating column. The vapours get ..... as they rise. The vapours ..... to a liquid at different points. The separated parts of crude oil are called ..... .

[4]

Q33. (2022) – 19e

19 The table shows information about three metals.

Metal	Corrosion in moist air	Density (g/cm³)	Electrical conductivity	Melting point (°C)
aluminium	no obvious corrosion	2.7	good	660
copper	corrodes slowly	9.0	excellent	1084
iron	corrodes quickly	7.9	good	1538

(e) Poly(chloroethene) is a polymer made from the monomer chloroethene.

This is the structure of chloroethene.

A)

(i) Explain why chloroethene is **not** a hydrocarbon.

.....

..... **[1]**

B)

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

H Cl

C C

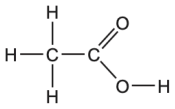
H H

[2]

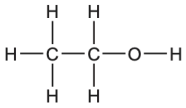
Q34. (2023)

5 What is the displayed formula of **ethanol**?

A



B



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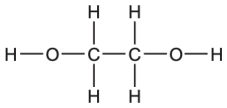

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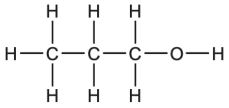


Your answer ☐ **[1]**

Q35. (2023)

7 Methane is a hydrocarbon.

Which substance **cannot** be produced when methane burns in air?

A Carbon

B Carbon dioxide

C Hydrogen

D Water

Your answer ☐ **[1]**

Q36. (2023)

18 Propane, C_3H_8, is an alkane.

Propane undergoes complete combustion in oxygen. Carbon dioxide and water are made.

A)

(a) Write the **balanced symbol** equation for the complete combustion of propane.

..... **[2]**

B)

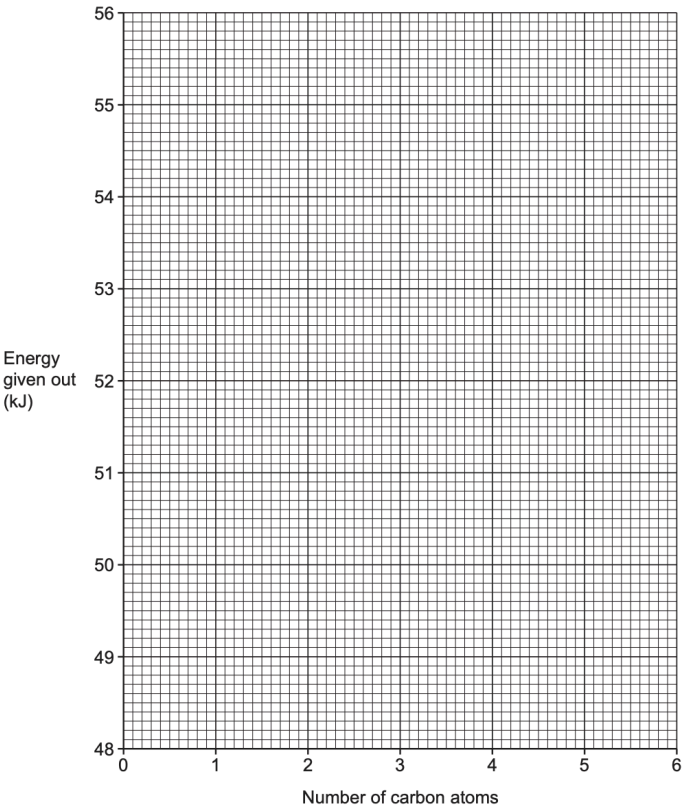
(b) The table shows the energy given out when 1 g of different alkanes burn.

Alkane	Number of carbon atoms	Energy given out (kJ)
methane	1	55.6
ethane	2	52.6
propane	3	50.4
butane	4	
pentane	5	48.7
hexane	6	48.4

(i) Plot a graph of the data from the table. **[2]**

C)

(ii) Draw a curve of best fit on your graph. **[1]**



D)

(iii) The energy given out when 1 g of butane burns is missing from the table.

Use the graph to estimate the energy given out by butane.

Energy given out by butane = ... kJ **[1]**

E)

(c) Complete the **displayed formula** of propane, C_3H_8.

H
|
C

[1]

Q37. (2023)

20 Crude oil is separated into different fractions by fractional distillation.

Table 20.1 shows information about three of the molecules that are found in three different fractions.

Table 20.1

Molecule	Formula	Boiling point (°C)
nonane	C_9H_{20}	151
heptadecane	$C_{17}H_{36}$	302
octacosane	$C_{28}H_{58}$	436

A)

(a) Which of these three molecules would be separated **highest** up the fractionating column?

Explain your answer using ideas about molecular size and boiling point.

Molecule .....

Reason .....

.....

..... **[3]**

B)

(b) Cracking breaks down large molecules produced in fractional distillation into more useful molecules.

The equation shows the cracking of octacosane.

$$C_{28}H_{58} \longrightarrow C_{12}H_{26} + 8C_2H_4$$

octacosane dodecane molecule **X**

(i) State the name of molecule **X**, C_2H_4.

..... **[1]**

C)

(ii) Molecule **X** has the general formula C_nH_{2n}.

Octacosane and dodecane are both alkanes and have a different general formula.

State the general formula of the alkanes.

..... **[1]**

D)

(c) **Table 20.2** shows the percentage supply and percentage demand for some of the different fractions obtained from crude oil.

Table 20.2

Fraction	Percentage supply (%)	Percentage demand (%)
LPG	2	4
petrol	5	23
naphtha	8	
kerosene	12	7
diesel oil	17	23
fuel oil	56	38

(i) Calculate the percentage demand for naphtha.

Percentage demand for naphtha = ... % **[1]**

E)

(ii) Suggest why fuel oil, rather than diesel oil, is cracked to obtain petrol.

.....

..... **[1]**

Q38. (2023) – 23b, 23c

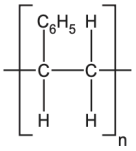
23 The table shows information about three different polymers, **A**, **B** and **C**.

Tensile strength is the amount of load a material can take before it breaks.

	Melting point (°C)	Softening temperature (°C)	Stiffness (MPa)	Tensile strength (MPa)
A	130	72	980	15
B	240	95	3200	65
C	250	75	2400	50

A)

(b) This is the repeating unit in polymer **B**.



Draw the structure of the **monomer** from which polymer **B** is made.

[2]

B)

(c) Some substances are naturally occurring polymers.

Draw lines to connect each **monomer** with its naturally occurring **polymer**.

Monomer	Polymer
amino acids	DNA
nucleotides	proteins
sugars	starch

[2]

Q39. (2024)

5 How many different monomers (nucleotides) is DNA made from?

A 2

B 3

C 4

D 5

Your answer ☐ **[1]**

Q40. (2024)

6 What is the functional group in an alcohol molecule?

A –C–H

B –C=C–

C –COOH

D –O–H

Your answer ☐ **[1]**

Q41. (2024)

14 Which substance is an **unsaturated** hydrocarbon?

A CH_4

B C_2H_6

C C_3H_6

D C_3H_8

Your answer ☐ **[1]**

Q42. (2024)

15 What happens when liquid bromine, Br_2, boils?

A Covalent bonds break

B Electrostatic forces break

C Intermolecular forces break

D Ionic bonds break

Your answer ☐ **[1]**

Q43. (2024)

A)

16 This question is about compounds of carbon.

(a) The first member of the alkane homologous series is methane, CH_4.

State the name of the next alkane in the homologous series, C_2H_6.

..... **[1]**

B)

(b) Complete the **balanced symbol** equation for the **complete** combustion of methane.

$$CH_4 + 2 \text{ .....} \longrightarrow CO_2 + \text{ ... } H_2O$$ **[2]**

C)

(d) Methane is obtained from the fractional distillation of crude oil.

Complete the sentences to explain why crude oil is separated by fractional distillation.

Crude oil is separated by fractional distillation because the molecules have

different ....

Larger molecules have ..... intermolecular forces.

These intermolecular forces require more ..... to break.

[3]

D)

(e) Fractional distillation produces a large amount of long chain molecules.

There is a high demand for short chain molecules.

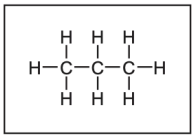
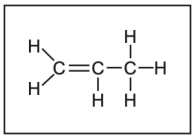
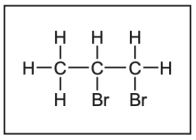
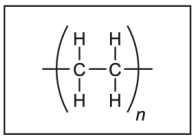
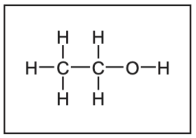
Put a (ring) round the name of the process used to produce more short chain molecules.

combustion **cracking** **oxidation** **polymerisation**

[1]

E)

(f) Draw lines to connect each **description** with its correct **structural formula**.

Description	Structural Formula
Can be oxidised to a carboxylic acid	
Has the general formula C_nH_{2n+2}	
Decolourises bromine water	
Made in a polymerisation reaction	
	

[4]