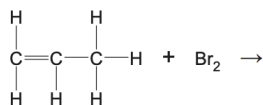


Organic Chemistry

Q1. (2018)

- 4 What is the formula of the product in this equation?



- A $\text{C}_2\text{H}_3\text{Br}$
B $\text{C}_3\text{H}_5\text{Br}_2$
C $\text{C}_2\text{H}_3\text{Br}$
D $\text{C}_3\text{H}_6\text{Br}_2$

Your answer

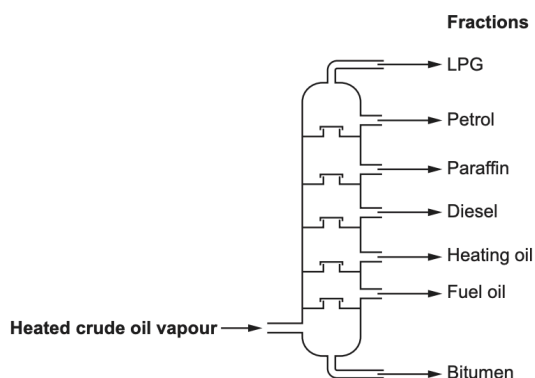
[1]

Q2. (2018) – 16b

- (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]

Q3. (2018) – 16c

- (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]

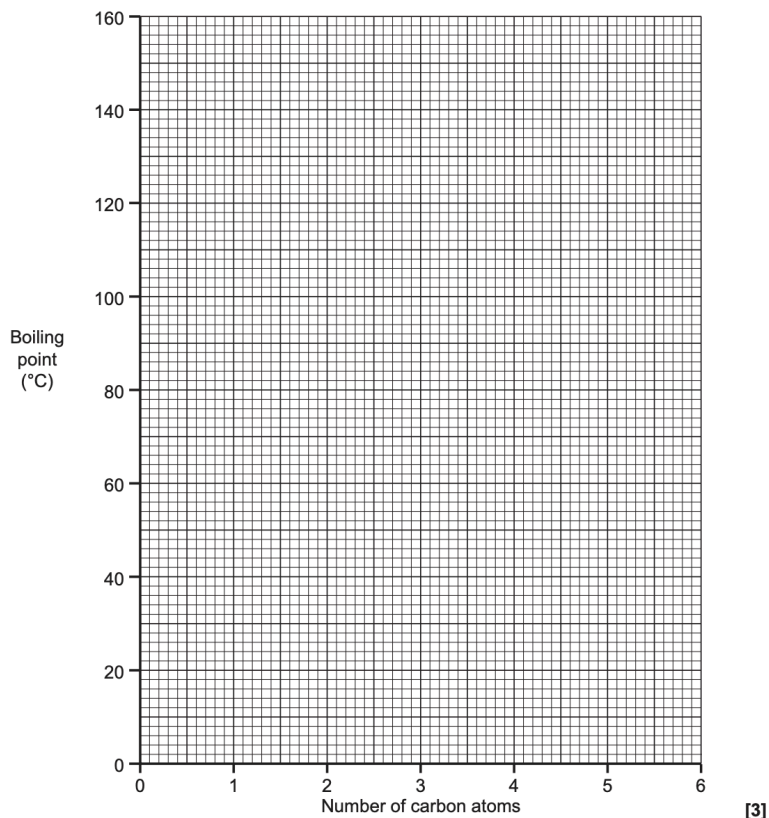
Q4. (2018)

17 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.



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)

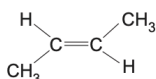
- (d) Ethanol, C_2H_5OH , can be oxidised to **ethanoic acid** using potassium manganate(VII).

What is the formula of ethanoic acid?

..... [1]

Q5. (2018)

- 22 Look at the displayed formula of the monomer butene.



A)

- (a) What feature of butene molecules allows them to act as monomers?

..... [1]

B)

- (b) Butene is an alkene.

What is the **general formula** for an alkene?

..... [1]

C)

- (c) Butene undergoes **addition polymerisation** to form poly(butene).

Write the **displayed formulae**, for poly(butene).

[2]

D)

- (d) DNA molecules are polymers made from four different monomers.

What are the monomers in DNA called?

..... [1]

E)

- (e) Polyesters are polymers made by **condensation polymerisation**.

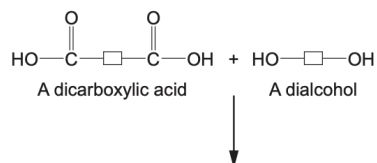
- (i) What is the minimum number of **functional groups** that a monomer must have to form a condensation polymer?

..... [1]

F)

(ii) Polyesters are made from a carboxylic acid and an alcohol.

Complete the block diagram to show the formation of a polyester.



[2]

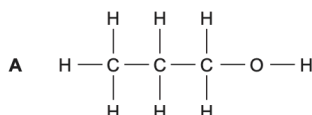
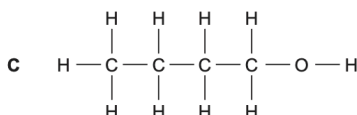
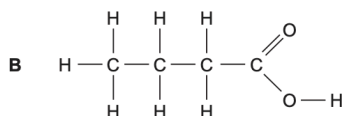
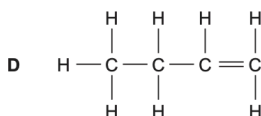
G)

(iii) What is the **formula** of the molecule that is eliminated in the reaction to form a polyester?

..... [1]

Q6. (2019)

5 Which displayed formula shows butanol?



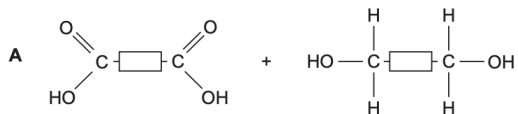
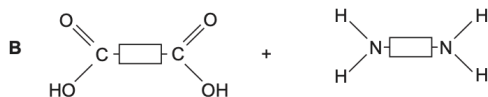
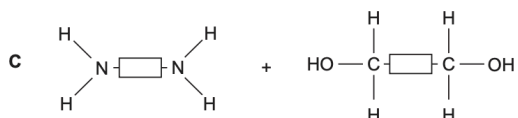
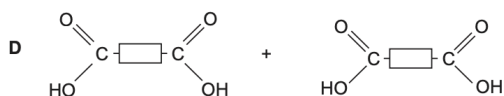
Your answer

☐

[1]

Q7. (2019)

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



Your answer

☐

[1]

Q8. (2019)

13 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]

Q9. (2019) – 21b

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

Monomer	Structure
Ethene	$\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array}$
Ethane-1,2-diol	$\begin{array}{c} \text{H} & \text{H} \\ & \\ \text{H}-\text{O}-\text{C}-\text{C}-\text{O}-\text{H} \\ & \\ \text{H} & \text{H} \end{array}$
Ethanedioic acid	$\begin{array}{c} & \text{O} \\ & \\ \text{HO}-\text{C} & -\text{C}-\text{OH} \\ & \\ \text{O} & \end{array}$

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]

Q10. (2019) – 21c

A)

(c) DNA and proteins are biological polymers.

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

..... [1]

B)

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

..... [1]

Q11. (2019) – 21d

(d) An alcohol, **X**, has the formula $\text{C}_3\text{H}_7\text{OH}$.

Alcohol **X** can be oxidised to a compound, **Y**, with the molecular formula $\text{C}_3\text{H}_6\text{O}_2$.

A)

(i) Compound **Y** is **not** an alcohol but is a member of another homologous series.

Write down the name of this homologous series.

..... [1]

B)

- (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**

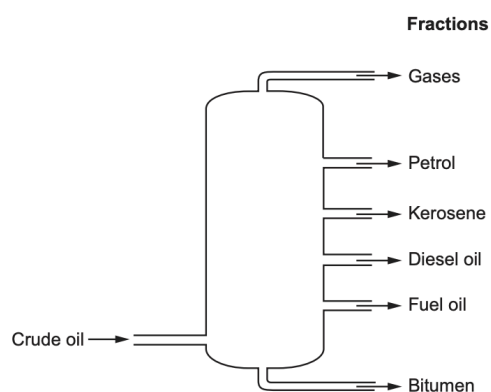
Compound **Y**

[2]

Q12. (2020)

- 3 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]

Q13. (2020)

4 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 $C_{2n+2}H_2$

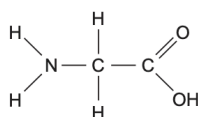
Your answer

☐

[1]

Q14. (2020)

7 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]

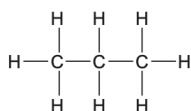
Q15. (2020)

10 A student reacts a hydrocarbon with bromine water.

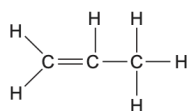
The formula of the product is $C_3H_6Br_2$.

Which is the displayed formula of the hydrocarbon?

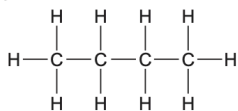
A



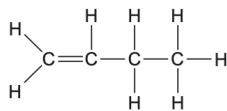
B



C



D



Your answer

☐

[1]

Q16. (2020)

11 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]

Q17. (2020)

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

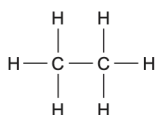
- A $-\text{CH}_3$
- B $-\text{COOH}$
- C $-\text{CO}_2$
- D $-\text{OH}$

Your answer

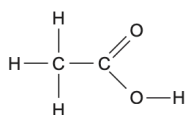
[1]

Q18. (2020)

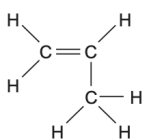
20 Look at the displayed formulae of some compounds.



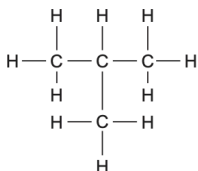
Compound A



Compound B



Compound C



Compound D

A)

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

..... and

B)

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

1

2

[3]

C)

- (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]

D)

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

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

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

Q19. (2021)

- 1 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]

Q20. (2021)

- 8 What is the formula of the functional group in **carboxylic acids**?

- A -C=C-
B -COOH
C -CO_2
D -OH

Your answer ☐

[1]

Q21. (2021)

12 Which of these functional groups can react together to form a **condensation** polymer?

- A —C=C— and —COOH
- B —C=C— and —NH_2
- C —COOH and —NH_2
- D —OH and —NH_2

Your answer ☐

[1]

Q22. (2021)

20 The fractional distillation of crude oil makes many useful fractions.

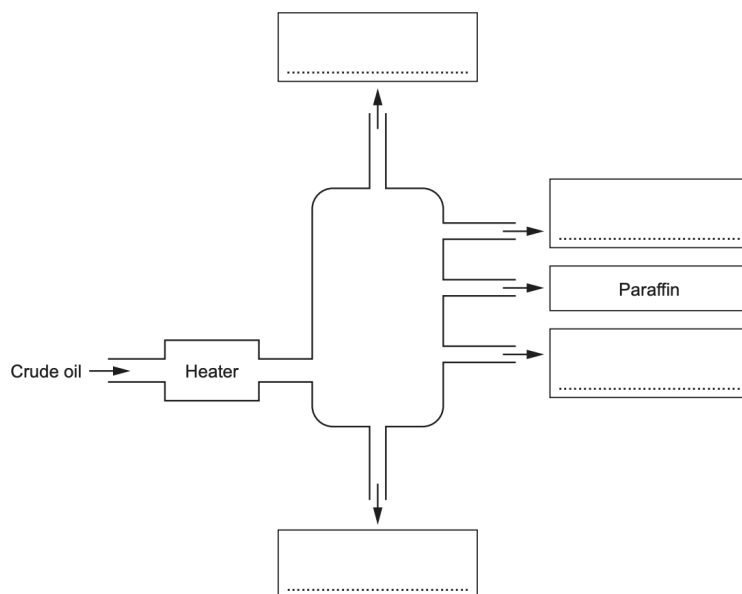
Table 20.1 shows the boiling temperatures of some fractions.

Fraction	Boiling temperature (°C)
Bitumen	above 400
Diesel	300–350
LPG	below 40
Paraffin	175–250
Petrol	4–175

Table 20.1

A)

(a) Look at the diagram of a fractionating column.



Complete the diagram by writing the names of the missing fractions in the boxes.

Choose from the fractions in Table 20.1.

Use the boiling temperatures in the table to help you.

[2]

B)

(b) After crude oil is separated into fractions, some fractions are then **cracked**.

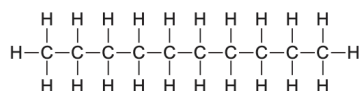
(i) Explain why some fractions are cracked.

.....

 [3]

C)

- (ii) Look at the displayed formula of decane.



The cracking of decane involves the breaking of covalent bonds.

Explain why the cracking of decane makes a mixture of products.

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

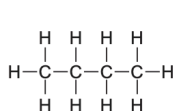
D)

- (iii) Complete the **balanced symbol** equation for the cracking of a molecule of $C_{30}H_{62}$.

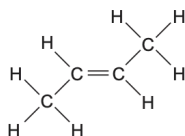


E)

- (c) Look at the displayed formulae of compounds **A** and **B**.



Compound **A**



Compound **B**

A few drops of bromine water are added to 1 cm^3 of each of compounds **A** and **B**.

- (i) Explain why compound **B** decolourises bromine water but compound **A** does not.

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

F)

- (ii) Write the **balanced symbol** equation for the reaction of compound **B** with bromine, Br_2 .

..... [1]

Q23. (2021)

A)

21 This question is about polymers.

- (a) Many biological substances are polymers.

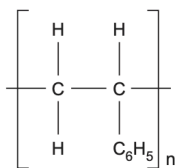
Complete the table to state the type of monomer which forms each of the biological polymers.

Polymer	Type of monomer
DNA	
Protein	
Starch	

[3]

B)

(b) Look at the structure of the polymer called poly(styrene).



This polymer is made from a **monomer**.

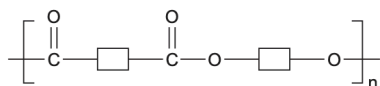
Draw the structure of the monomer.

[2]

C)

(c) Polyesters are also polymers.

Look at the structure of a polyester.



This polymer is made from **two different monomers**.

Draw a molecule of each different monomer.

[2]

Q24. (2022)

- 1 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?

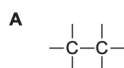
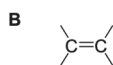
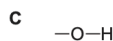
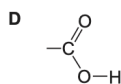
- A C_3H_6
B C_6H_{12}
C C_6H_{14}
D C_8H_{16}

Your answer

[1]

Q25. (2022)

3 Which functional group does a monomer need to contain to form addition polymers?



Your answer ☐

[1]

Q26. (2022)

10 Which statement about polymerisation is correct?

- A Amino acid monomers make polymers called proteins by addition polymerisation.
- B DNA is a polymer made from four identical monomers called nucleotides.
- C Polyesters are condensation polymers made from monomers containing carboxylic acid and alcohol functional groups.
- D Poly(ethene) is a polymer made from ethene monomers by condensation polymerisation.

Your answer ☐

[1]

Q27. (2022)

18 The table shows information about some compounds of carbon.

Compound	Formula
A	C_2H_4
B	$\text{C}_2\text{H}_5\text{OH}$
C	$\text{C}_3\text{H}_7\text{COOH}$
D	C_4H_{10}
E	C_6H_{14}

A)

(a) Compounds **D** and **E** belong to the homologous series called the **alkanes**.

What is the **general formula** of the alkanes?

..... [1]

B)

(b) Which homologous series does compound **C** belong to?

Tick (✓) the correct answer.

Alcohols ☐

Alkenes ☐

Carboxylic acids ☐

Esters ☐

[1]

C)

- (c) Compound **A**, C_2H_4 , burns in oxygen.

Write the **balanced symbol** equation for the **incomplete** combustion of compound **A**.

..... [2]

D)

- (d) Compound **D** and compound **E** are obtained from crude oil by fractional distillation.

Explain how fractional distillation separates compound **D** and compound **E**.
Use ideas about intermolecular forces.

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

Q28. (2023)

- 10 Which of these homologous series can form addition polymers?

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

Your answer ☐

[1]

Q29. (2023)

- 12 Ethane is a very small hydrocarbon molecule.

Which row about ethane is correct?

	Easy to ignite?	Boiling point
A	✓	high
B	✗	high
C	✓	low
D	✗	low

Your answer ☐

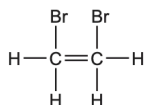
[1]

Q30. (2023)

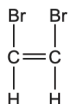
- 14 Ethene, C_2H_4 , reacts with bromine in an addition reaction.

What is the structural formula of the product?

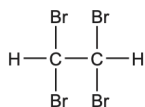
A



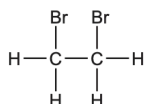
B



C



D



Your answer

[1]

Q31. (2023) – 17b, 17c

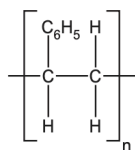
- 17 The table shows information about three different polymers, **A**, **B** and **C**.

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]

Q32. (2023)

- 20 Butane, C_4H_{10} , is an alkane.

Butane undergoes complete combustion in oxygen.

A)

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

..... [2]

B)

- (b) Table 20.1 lists the energy given out when 1 g of different alkanes burn.

Table 20.1

Alkane	Energy given out (kJ)
butane	49.2
ethane	52.6
methane	55.6
propane	50.4

State the relationship between the number of carbon atoms in the alkane and the energy given out.

.....

..... [1]

C)

- (c) Butane is found in the LPG fraction when crude oil is separated into different fractions by fractional distillation.

Table 20.2 shows some information about four other molecules that are found in four different fractions.

Table 20.2

Molecule	Formula	Boiling point (°C)
heptadecane	$C_{17}H_{36}$	302
eicosane	$C_{20}H_{42}$	342
tetracosane	$C_{24}H_{50}$	
octacosane	$C_{28}H_{58}$	436

- (i) Predict the boiling point of tetracosane.

Boiling point of tetracosane = °C [1]

D)

- (ii) Octacosane is separated lower down the fractionating column than the other three molecules in **Table 20.2**.

Explain why using ideas about intermolecular forces.

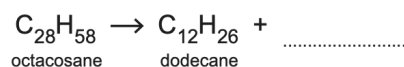
.....
.....
.....
..... [3]

E)

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

The equation shows the cracking of octacosane to make dodecane and **one** other product.

Complete and balance the equation.



[2]

F)

- (e) **Table 20.3** shows the percentage supply and demand for some of the different fractions obtained from crude oil.

Table 20.3

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

More petrol can be obtained by cracking another fraction.

Suggest and explain which fraction is cracked to obtain petrol.

Fraction

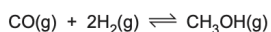
Reason

..... [2]

Q33. (2023) – 21d, 21e, 21f

- 21 Methanol, CH₃OH, is made in industry by reacting carbon monoxide with hydrogen.

This is the equation for the reaction.



The forward reaction is exothermic.

A)

- (d) (i) Draw the structural formula of methanol, CH₃OH.

[2]

B)

- (ii) State the **functional group** in methanol.

..... [1]

C)

- (e) Methanol can be oxidised to methanoic acid.

State the **oxidising agent** used in this reaction.

..... [1]

D)

- (f) Methanoic acid is a carboxylic acid.

Carboxylic acids react with alcohols to form an ester and one other product.

- (i) What type of reaction is this?

Tick (✓) **one** box.

Addition ☐

Condensation ☐

Decomposition ☐

Neutralisation ☐

[1]

E)

- (ii) State the name of the other product in this type of reaction.

..... [1]

Q34. (2024)

- 1 Which substance is an **unsaturated** hydrocarbon?

- A CH_4
B C_2H_6
C C_3H_6
D C_3H_8

Your answer ☐

[1]

Q35. (2024)

- 2 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]

Q36. (2024)

- 4 Which of these is one of the four nucleotides in the polymer DNA?

- A Cytosine
B Deoxyribose
C Fructose
D Phosphate

Your answer ☐

[1]

Q37. (2024)

- 5 Polyesters are condensation polymers.

Which monomers are polyesters made from?

- A A carboxylic acid and an ester
- B An alcohol and a carboxylic acid
- C An alcohol and an amine
- D An amine and a carboxylic acid

Your answer ☐

[1]

Q38. (2024)

- 11 The polymer nylon can be made from hexanedioyl dichloride, $\text{ClOC}(\text{CH}_2)_4\text{COCl}$, and hexane-1,6-diamine, $\text{NH}_2(\text{CH}_2)_6\text{NH}_2$.

Which small molecule is made as well as nylon?

- A HCl
- B H_2
- C H_2O
- D NH_3

Your answer ☐

[1]

Q39. (2024)

A)

- 19 The first member of the alkane homologous series is methane, CH_4 .

(a) State the formula of the alkane with 10 carbon atoms.

..... [1]

B)

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

..... [2]

C)

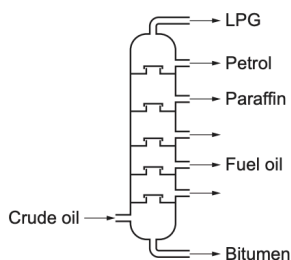
(c) Methane can also undergo **incomplete** combustion.

Carbon monoxide and water are made in incomplete combustion.

State **one** other possible product of the incomplete combustion of methane.

..... [1]

(d) Alkanes are obtained from the fractional distillation of crude oil.



Explain why the LPG fraction leaves at the **top** of the fractionating column. Use ideas about intermolecular forces.

[4]

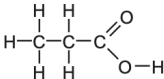
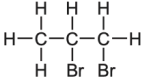
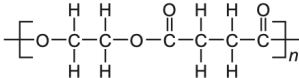
[4]

(e) Which industry is crude oil a feedstock for?

..... [1]

[1]

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

Description	Structural Formula
Made by an addition reaction between an alkene and hydrogen, H_2	
Made when propanol is oxidised	
Made when propene reacts with bromine water	
Made in a condensation polymerisation reaction	

[4]