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

$$CH_4 + 2\ldots\ldots\ldots \rightarrow CO_2 + \ldots H_2O$$

[2]

(b). 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]

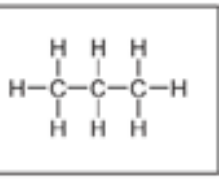
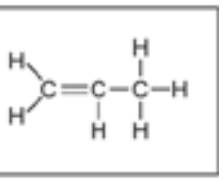
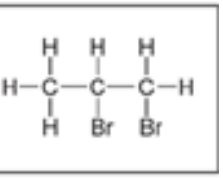
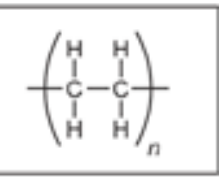
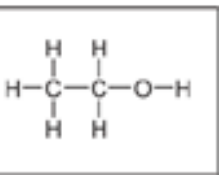
(c). Fractional distillation produces a large amount of long chain molecules.

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]

(d). 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]

2. Which substance is an **unsaturated** hydrocarbon?

A CH_4
B C_2H_6
C C_3H_6
D C_3H_8

Your answer ☐ **[1]**

3. 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]**

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

A 2
B 3
C 4
D 5

Your answer ☐ **[1]**

5. What is the functional group in an alcohol molecule?

A –C–H
B –C=C–
C –COOH
D –O–H

Your answer ☐ **[1]**

6(a). 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

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

The equation shows the cracking of octacosane.

$$\underset{\text{octacosane}}{C_{28}H_{58}} \longrightarrow \underset{\text{dodecane}}{C_{12}H_{26}} + \underset{\text{molecule X}}{8C_2H_4}$$

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

---

[1]

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]

(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]**

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

---

[1]

7(a). Propane, C_3H_8, is an alkane.

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

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

---

[2]

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

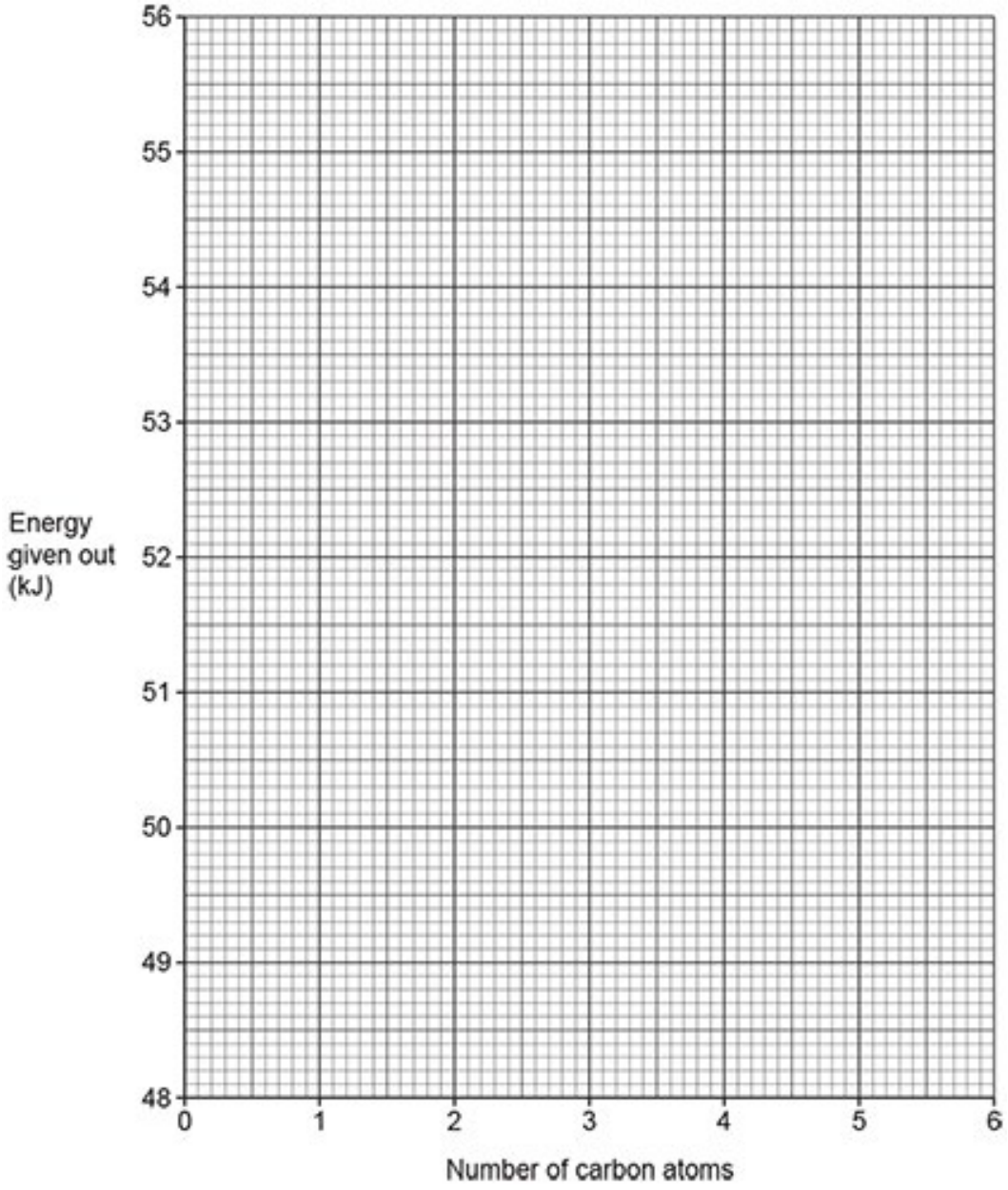
Alkane	Number of carbon atoms	Energy given out (kJ)
methane	1	55.6
ethane	2	52.6
propane	3	50.4
butane	4	
pentane	5	48.7
hexane	6	48.4

i. Plot a graph of the data from the table.

[2]

ii. Draw a curve of best fit on your graph.

[1]



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]**

iv. What name is given to the type of reaction that **gives out energy**?

---

[1]

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

[1]

8. Crude oil is a resource that is being made extremely slowly.

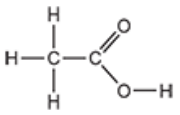
Which word describes a resource that is being made extremely slowly?

A Finite
B Hydrocarbon
C Non-renewable
D Petrochemical

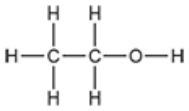
Your answer ☐ **[1]**

9. What is the displayed formula of **ethanol**?

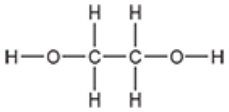
A



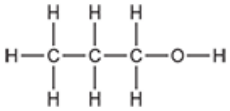
B



C



D



Your answer ☐ **[1]**

10. 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]**

11(a). 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

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

Tick (✓) **one** box.

Alcohols ☐
Alkenes ☐
Carboxylic acids ☐
Esters ☐

[1]

(c). C_2H_4 burns completely in oxygen.

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

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

(d). CH_4 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]

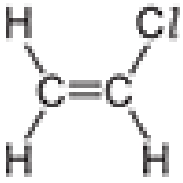
(e). Crude oil is a finite resource.

Explain what is meant by a **finite resource**.

---**[1]**

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

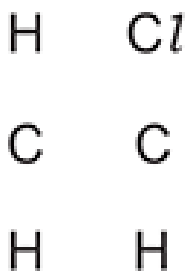
This is the structure of chloroethene.



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

---**[1]**

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



[2]

13. 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.

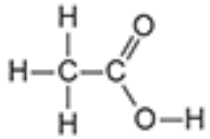
What is the formula of the other product?

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

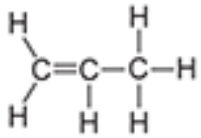
Your answer ☐ **[1]**

14. What is the displayed formula of **propanoic acid**?

A



B



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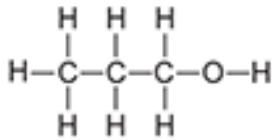
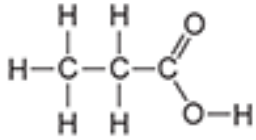


D



Your answer ☐ **[1]**

15. DNA molecules are polymers made from monomers.

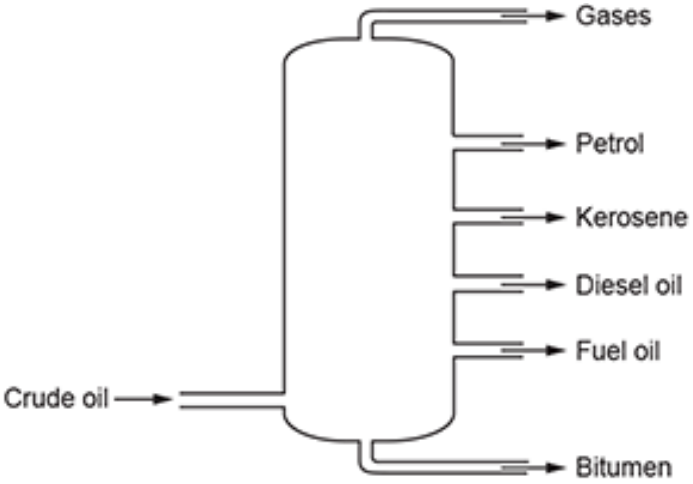
What are the monomers called?

A Alkenes
B Amino acids
C Carbohydrates
D Nucleotides

Your answer ☐ **[1]**

16. 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]**

17. 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]**

END OF QUESTION PAPER