Organic Chemistry (F)

1. 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]**

2. 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]**

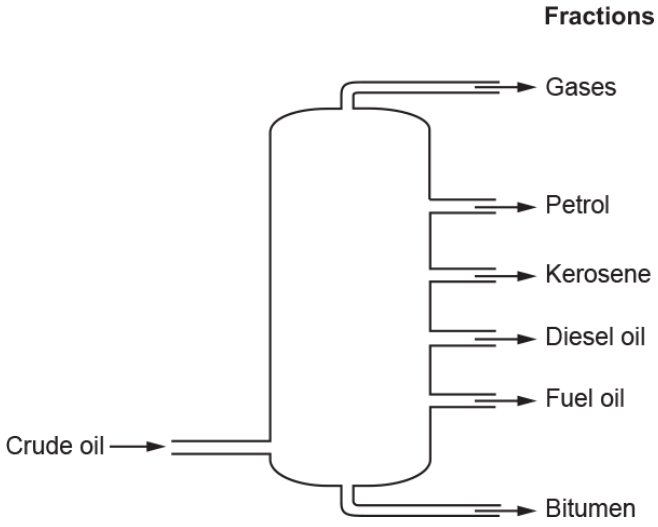
3. What happens to the potential difference of a chemical cell once the reactants are used up?

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

Your answer ☐ **[1]**

4. 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]**

5. 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]**

6. Crude oil is a mixture of hydrocarbons.

Crude oil is separated into useful fractions.

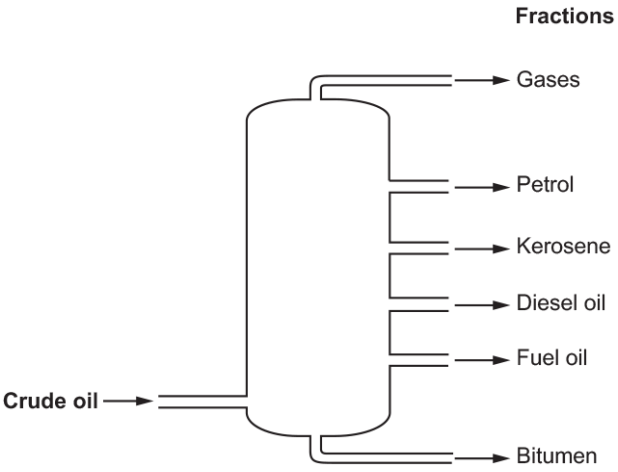
Which of these mixtures of substances could be in a fraction from crude oil?

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]**

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]**

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

A Addition
B Dehydration
C Neutralisation
D Thermal decomposition

Your answer ☐ **[1]**

9 (a). 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]**

(b). 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]**

(c). 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]

ii. Which fraction is **needed** in the **smallest** percentage?

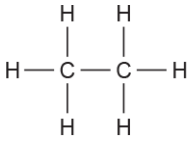
Tick (✓) **one** box.

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

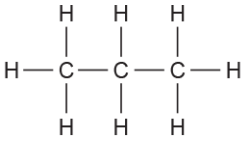
[1]

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

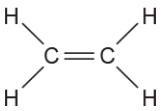
Look at the displayed formulae of ethane, propane and ethene.



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).

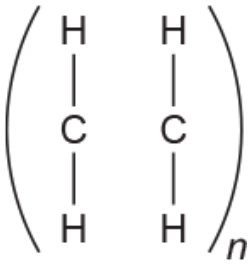
This reaction is called **polymerisation**.

i. Why do ethene molecules undergo polymerisation but ethane molecules do not?

_____

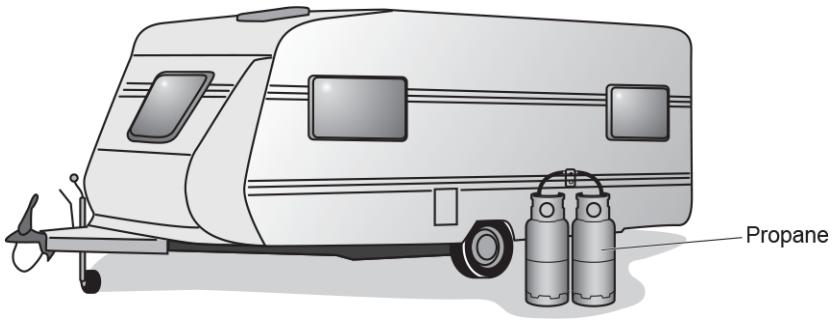
_____ **[1]**

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.



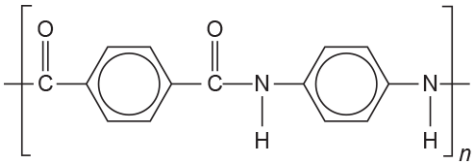
Incomplete combustion of propane can occur if the campers do not take sensible precautions.

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]

11. Look at the structure of Kevlar®.



What type of molecule is Kevlar®?

_____ **[1]**

12(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]

(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.

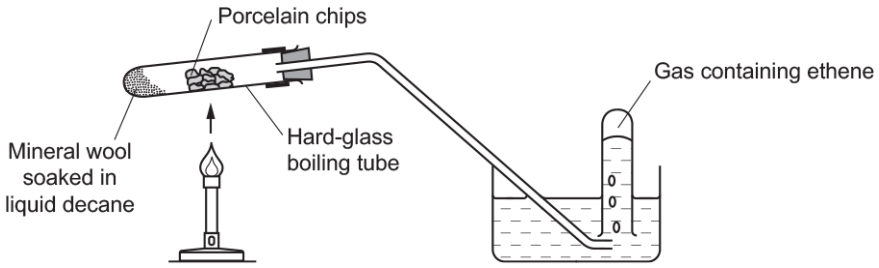
Alkanes have the general formula C_nH_{2n+2}.

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

_____ **[1]**

(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**.

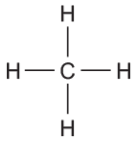
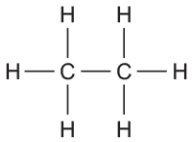
$C_{10}H_{22} \rightarrow 2C_2H_4$ + product **Z**

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

_____ **[1]**

13(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]**

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

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

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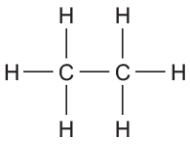
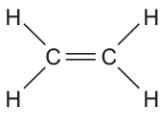
[2]

(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

Ethene

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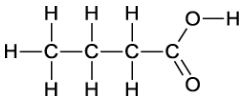
[2]

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

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

_____ **[1]**

14. Look at the displayed formula of an organic compound.



What is the name of this compound?

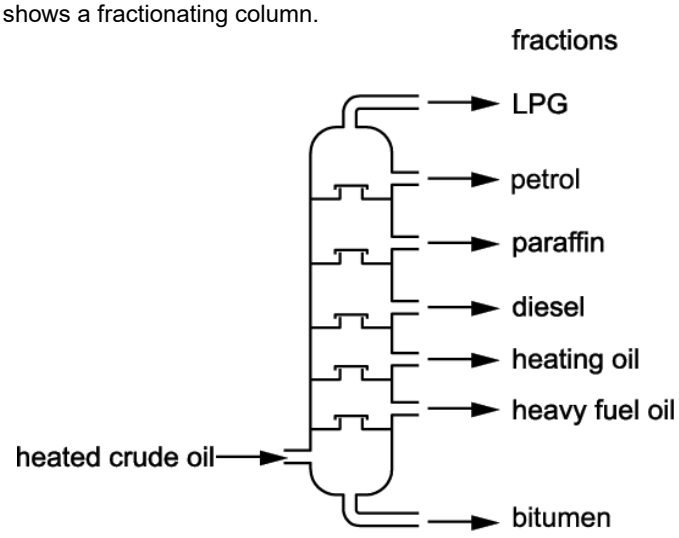
A. butanoic acid
B. butanol
C. propanoic acid
D. propanol

Your answer ☐

[1]

15(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.

_____

_____

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[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.

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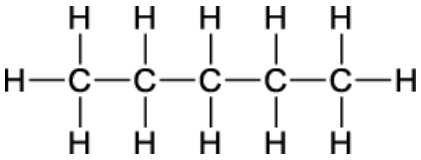
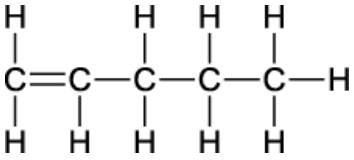
[1]

16. Which displayed formula includes the functional group of an alcohol?

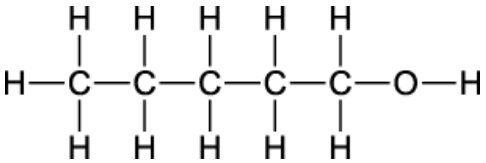
A.



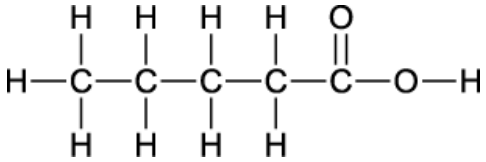
B.



C.



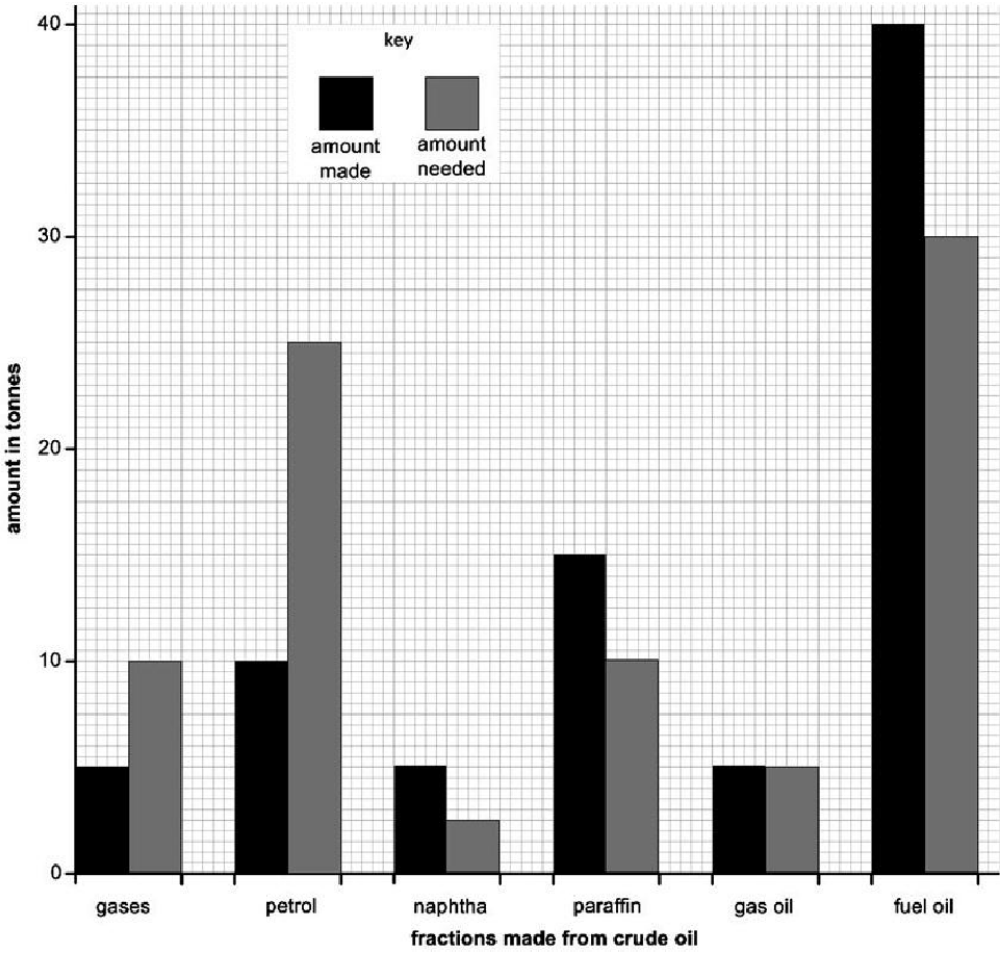
D.



Your answer ☐

[1]

17. 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?

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

Your answer ☐

[1]

18. 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]

19. 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]

END OF QUESTION PAPER