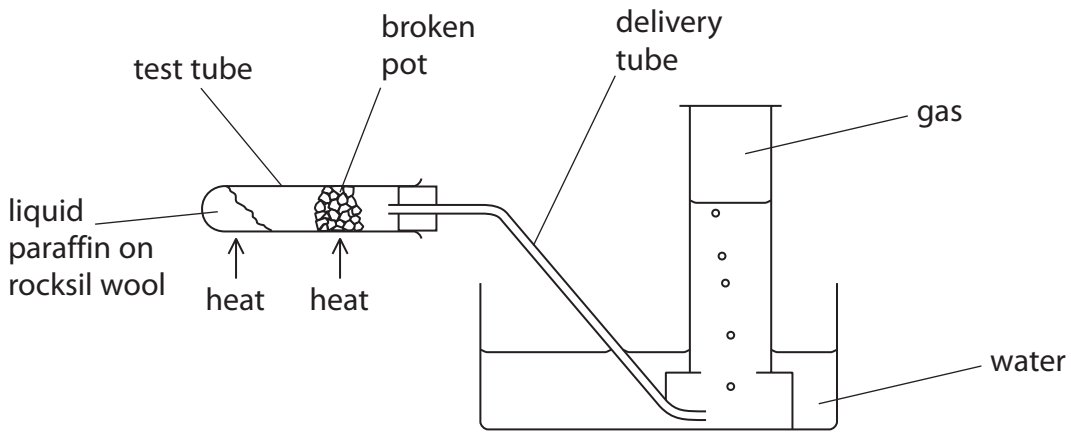
1 (a) In the laboratory this apparatus is used to crack long chain hydrocarbon molecules to form shorter chain hydrocarbon molecules.



When the experiment is complete there is a danger that water will rise up the delivery tube into the hot test tube.

State what you would do to prevent this.

(1)

.....

.....

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The equation for a reaction that occurs during cracking is

$$C_{12}H_{26} \rightarrow C_2H_6 + C_6H_{12} + X$$

In the balanced equation, X is

(1)

☒ **A** C_3H_8

☒ **B** C_4H_8

☒ **C** C_4H_{10}

☒ **D** C_6H_{14}

(c) Alkenes are unsaturated hydrocarbons.

State what is meant by **unsaturated**.

(1)

.....

(d) Propane and propene are bubbled through separate samples of bromine water.

Describe what you would **see** in these tests.

(3)

(e) In industry, long chain hydrocarbon molecules are cracked to form shorter chain hydrocarbon molecules.

Explain why this process is important.

(2)

(Total for Question 1 = 8 marks)

2 Crude oil is a mixture of hydrocarbons.

It can be separated into fractions.

(a) Which of these mixtures shows formulae of substances that could be in the gaseous fraction of crude oil?

(1)

☒ **A** C_2H_4, C_3H_8, $C_4H_{10}O$

☒ **B** C_2H_4, C_3H_7Br, C_4H_{10}

☒ **C** C_2H_6, C_3H_8, C_4H_{10}

☒ **D** C_2H_6, C_3H_7Br, $C_4H_{10}O$

(b) Figure 3 shows the percentages of the fractions in crude oil from three different oil wells.

	percentage of fraction in crude oil from		
fraction	**oil well A**	**oil well B**	**oil well C**
gases	1	6	9
petrol	2	15	24
kerosene	6	14	20
diesel oil	7	10	16
fuel oil	26	28	30
bitumen	58	27	1

Figure 3

(i) State which oil well contains the greatest combined total of diesel oil and fuel oil.

(1)

.....

(ii) State which oil well produces a crude oil containing the highest percentage of the high boiling point fractions.

(1)

.....

(c) Fractions of crude oil contain alkanes.

A sample of decane, $C_{10}H_{22}$, cracked using the apparatus in Figure 4.

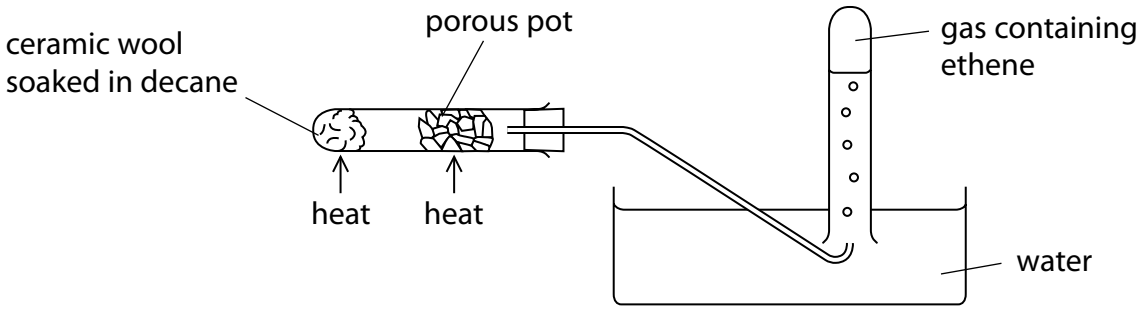


Figure 4

(i) Explain how ethene is produced using the apparatus in Figure 4.

(3)

(ii) One molecule of decane produced two molecules of propene, C_3H_6, and one molecule of product **Z**.

$C_{10}H_{22} \rightarrow 2C_3H_6$ + product **Z**

What is the formula of product **Z**?

(1)

☒ **A** C_4H_8

☒ **B** C_4H_{10}

☒ **C** C_7H_{14}

☒ **D** C_7H_{16}

(iii) When decane undergoes complete combustion, a mixture of carbon dioxide and water is formed.

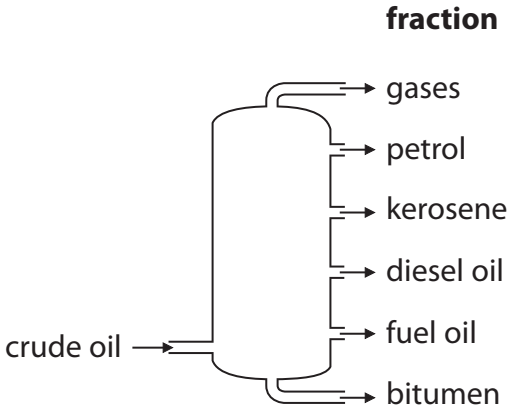
Complete the balanced equation for this reaction.

(2)

$2C_{10}H_{22}$ + ... $O_2 \rightarrow$ ..... CO_2 + ... H_2O

(Total for Question 2 = 9 marks)

3 Fractional distillation is used to separate crude oil into fractions.
A fractionating column is used for the process.
The diagram shows a fractionating column and the fractions obtained when crude oil is fractionally distilled.



(a) Which of the following statements is true?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** fuel oil has a lower boiling point than petrol

☒ **B** kerosene is more viscous than bitumen

☒ **C** molecules in diesel oil are larger than molecules in petrol

☒ **D** diesel oil is easier to ignite than petrol

(b) Some fractions obtained from crude oil are cracked to produce alkenes.

(i) Explain what is meant by **cracking**.

(2)

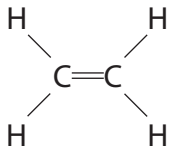
.....

.....

.....

.....

(ii) One alkene obtained is ethene.
The diagram shows the structure of a molecule of ethene.



Ethene is unsaturated.
Ethene is a hydrocarbon.

Explain why ethene is described as an **unsaturated hydrocarbon**.

(3)

(iii) Describe what you would **see** when a sample of ethene is shaken with bromine water.

(2)

(Total for Question 3 = 8 marks)