

1 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.

fraction	percentage of fraction in crude oil from		
	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.

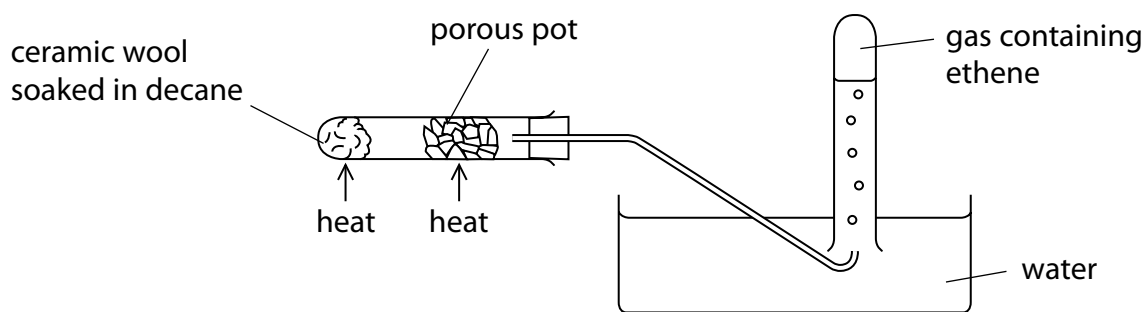


Figure 4

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

(3)

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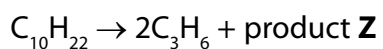
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(ii) One molecule of decane produced two molecules of propene,  $C_3H_6$ , and one molecule of product **Z**.



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

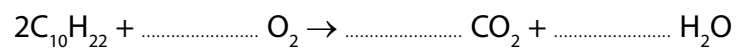
(1)

- 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)



**(Total for Question 1 = 9 marks)**

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- 2 (a) Gases, petrol, kerosene, diesel oil, fuel oil and bitumen are the fractions obtained from crude oil by fractional distillation.

Identify the fraction described in each of the following statements.

- (i) This fraction is more difficult to ignite than most other fractions and is used as a fuel in large ships.

(1)

name of fraction .....

- (ii) This fraction is obtained from the top of the fractionating column.

(1)

name of fraction .....

- (iii) This fraction has a higher boiling point than kerosene and is used as a fuel for some cars.

(1)

name of fraction .....

- (b) When hydrocarbon fuels are burnt, several different products can be formed.

Which of these cannot be a product of burning hydrocarbon fuels?

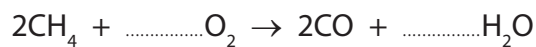
Put a cross (☒) in the box next to your answer.

(1)

- A** carbon
- B** carbon dioxide
- C** hydrogen
- D** water

(c) Carbon monoxide gas, CO, can be formed when methane, CH<sub>4</sub>, undergoes incomplete combustion.

(i) Balance this equation for the incomplete combustion of methane by putting numbers in the spaces provided.



(2)

(ii) Carbon monoxide is a toxic gas and can cause death.

Explain how carbon monoxide can cause death.

(2)

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(d) Biofuels are produced from plants.

Explain a problem caused by growing plants to produce biofuels.

(2)

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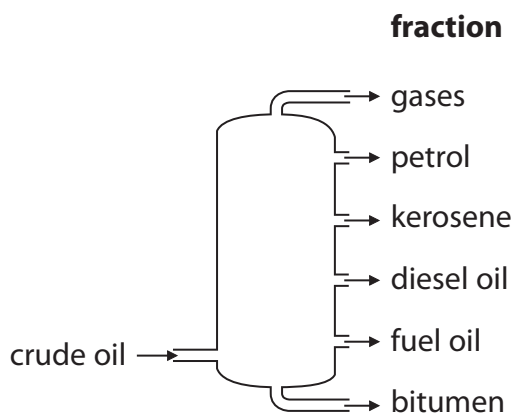
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**(Total for Question 2 = 10 marks)**

- 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.

- 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

(1)

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

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

(2)

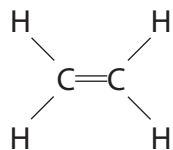
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- (ii) One alkene obtained is ethene.  
The diagram shows the structure of a molecule of ethene.



Ethene is unsaturated.  
Ethene is a hydrocarbon.

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

(3)

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

(2)

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**(Total for Question 3 = 8 marks)**

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

Crude oil is a mixture of mainly

(1)

- A alkenes
- B carbon and hydrogen
- C hydrocarbons
- D polymers

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

Fuel oil is used as a fuel in

(1)

- A aircraft engines
- B car engines
- C cooking stoves
- D power station furnaces

(c) (i) Methane,  $\text{CH}_4$ , is a gas that can be used as a fuel.

During complete combustion, it burns in oxygen to produce carbon dioxide and water.

Write the balanced equation for the complete combustion of methane.

(3)

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(ii) The table shows the amount of heat energy produced when different masses of methane and octane are burnt.

fuel	mass burnt / g	heat energy released / kJ
methane	16	896
octane	114	5472

When 1 g of methane is burnt, 56 kJ of heat energy is produced.

Calculate the heat energy produced when 1 g of octane is burnt.

(1)

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heat energy produced = ..... kJ

(iii) State **two** factors that make a good fuel.

(2)

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**(Total for Question 4 = 8 marks)**

- 5 The picture shows a gas water heater.  
The fuel used in this heater is natural gas which is mainly methane.



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

Natural gas is a good fuel because

(1)

- A** supplies of it will never run out
- B** it always burns with a yellow flame that is easily seen
- C** it produces no waste gases on complete combustion
- D** it produces no solid waste on complete combustion

- (b) The complete combustion of fossil fuels releases gases into the atmosphere.

Explain how these gases could cause an increase in the temperature of the Earth.

(2)

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- (c) Biofuels, made from plants, can be used as alternatives to fossil fuels.

(i) State an advantage of replacing fossil fuels with biofuels made from plants.

(1)

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