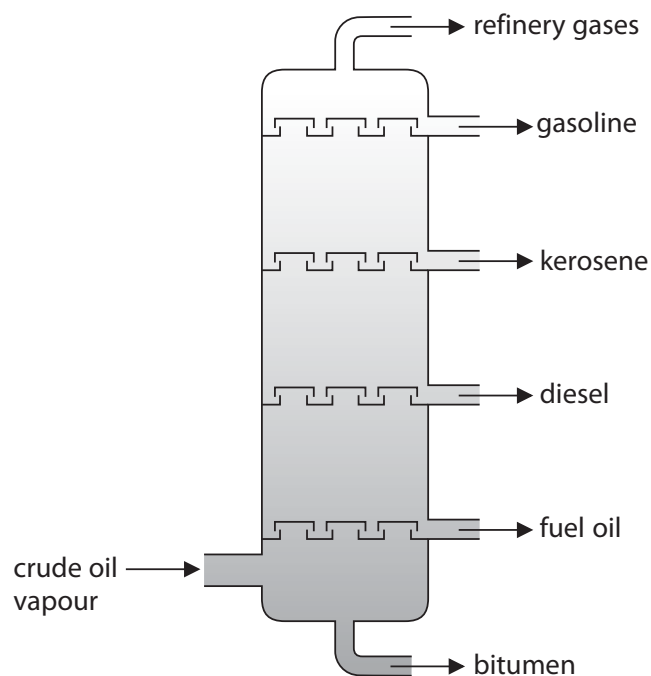


- 1 Crude oil is a complex mixture of organic compounds called hydrocarbons. It is separated into fractions using a fractionating tower.



(a) Which fraction has the lowest boiling point?

(1)

(b) Which fraction is the most viscous?

(1)

- (c) (i) Some fractions containing long-chain hydrocarbons are cracked. The cracking of octadecane, (C₁₈H₃₈), produces octane, (C₈H₁₈), and one other product.

Write a chemical equation for this cracking reaction.

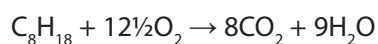
(1)

- (ii) Explain why it is important to crack long-chain hydrocarbon fractions.

(2)

- (d) Octane is one of the hydrocarbons in the petrol used in cars.

The equation for the complete combustion of octane is



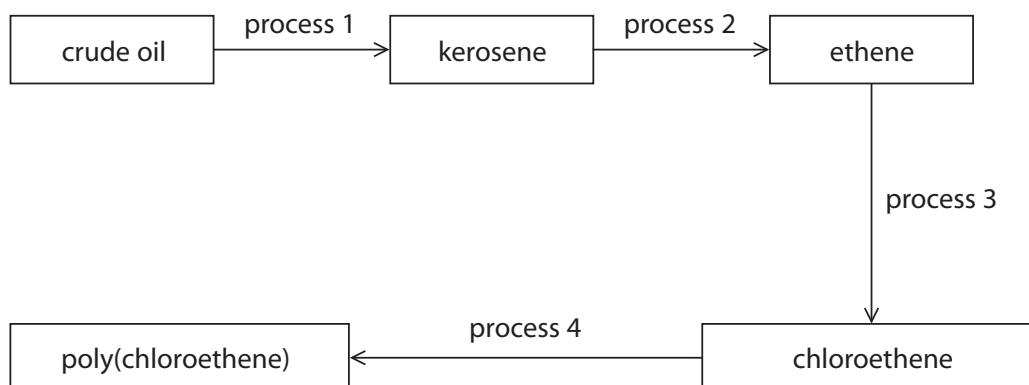
The incomplete combustion of octane produces a poisonous gas that reduces the capacity of blood to carry oxygen.

Write a chemical equation for this incomplete combustion of octane.

(2)

(Total for Question 1 = 7 marks)

2 The diagram shows some important conversion processes used in the oil industry.



(a) Process 1 is called

(1)

- ☐ A catalytic cracking
- ☐ B condensation polymerisation
- ☐ C fractional distillation
- ☐ D thermal decomposition

(b) Describe the differences between crude oil and kerosene. In your answer you should refer to

- the average size of the molecules in the two liquids
- the covalent bonding in the molecules
- the viscosities of the two liquids

(3)

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(e) Poly(chloroethene) is formed by addition polymerisation.

Nylon is formed by condensation polymerisation.

(i) How does condensation polymerisation differ from addition polymerisation?

(1)

(ii) Poly(chloroethene) and nylon do not biodegrade easily.

What is meant by the term **biodegrade**?

(2)

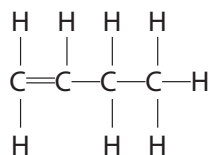
(iii) What feature of addition polymers makes it difficult for them to biodegrade?

(1)

(Total for Question 2 = 13 marks)

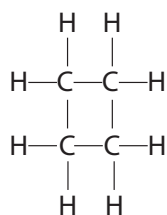
- 1 But-1-ene is a member of the homologous series of alkenes.

The displayed formula of but-1-ene is



The saturated compound cyclobutane is an isomer of but-1-ene.

The displayed formula of cyclobutane is



- (a) (i) State what is meant by the term **isomers**.

(2)

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- (ii) Draw the displayed formula of another isomer of but-1-ene.

(1)

- (iii) Describe a test that would distinguish between but-1-ene and cyclobutane.

(3)

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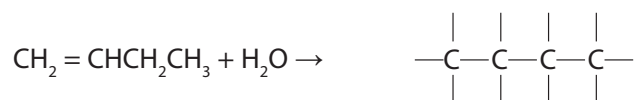
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(b) Using your knowledge of the reactions of ethene, complete the two chemical equations to show the formula of the organic product.

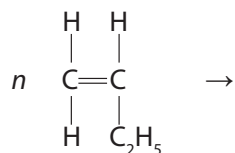
(i) The reaction between but-1-ene and steam.

(1)



(ii) The polymerisation of but-1-ene.

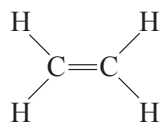
(2)



(Total for Question 1 = 9 marks)

2 Here are some statements about the compound ethene.

- ethene has the displayed formula



- ethene is a gas at room temperature
- ethene burns with a smoky flame
- ethene is unsaturated
- ethene is insoluble in water
- ethene can be prepared from ethanol
- ethene is used to make the polymer poly(ethene)

(a) (i) State why ethene is described as **unsaturated**.

(1)

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(ii) Describe a chemical test to show that ethene is an alkene.

(2)

Test

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Result

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- (b) (i) Complete the following equation that represents the preparation of ethene from ethanol.

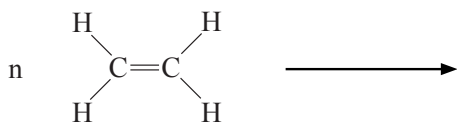


- (ii) What is the name given to this type of reaction?

(1)

-
- (c) Complete the equation to show the formation of poly(ethene) from ethene.

(2)



(Total for Question 2 = 7 marks)