

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

---

Forename(s)

---

Candidate signature

---

# GCSE CHEMISTRY

# H

Higher Tier

Paper 2H

Specimen 2018 (set 2)

Time allowed: 1 hour 45 minutes

## Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (enclosed).

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

## Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

0 1

Burgundy Mixture is a formulation used to kill fungi on grapevines.

It is made by mixing two compounds, **A** and **B**.

The ratio by mass of **A** : **B** in the mixture is 1 : 8

0 1 . 1

Calculate the mass of **A** needed in a mixture containing 125 g of **B**.

[2 marks]

---



---

Mass of **A** = \_\_\_\_\_ g

Scientists test a solution of compound **A**.

**Table 1** shows their results.

**Table 1**

Test	Result
Add sodium hydroxide solution	Blue precipitate
Add dilute hydrochloric acid and barium chloride solution	White precipitate

0 1 . 2

Which **two** ions are in compound **A**?

Choose answers from the box.

[2 marks]

bromide	chloride	copper
iron(II)	iron(III)	sulfate

\_\_\_\_\_ ions and \_\_\_\_\_ ions

**0 1 . 3** The scientists think that compound **B** is sodium carbonate.

Describe how the scientists can test a solution of **B** to see if sodium ions are present.

Give the result of the test if sodium ions are present.

**[2 marks]**

---

---

---

---

**0 1 . 4** Describe how the scientists can test a solution of **B** to see if carbonate ions are present.

Give the result of the test if carbonate ions are present.

**[3 marks]**

---

---

---

---

---

---

9

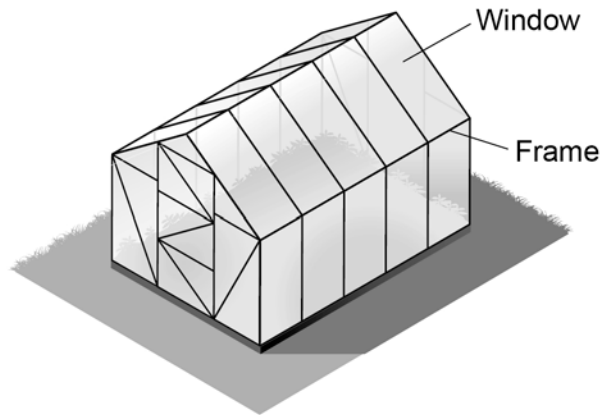
**Turn over for the next question**

**Turn over ►**

0 2

Figure 1 shows a greenhouse.

Figure 1



A greenhouse frame can be made from wood or aluminium.

Table 2 gives some information about wood and aluminium.

Table 2

	Wood	Aluminium
Raw material	Renewable	Non-renewable
Mass of greenhouse frame in kg	80	20
Useful lifetime in years	20	50
End of useful life	Can be chopped up and used as fuel	Can be recycled into new aluminium products



0 2 . 3

It is more sustainable to make greenhouse frames from recycled aluminium than from aluminium from aluminium ore.

Give **two** reasons why.

[2 marks]

1 \_\_\_\_\_

2 \_\_\_\_\_

0 2 . 4

Greenhouse windows can be made from glass or from polymers.

**Table 3** gives information about glass and a polymer.

**Table 3**

	<b>Glass</b>	<b>Polymer</b>
<b>Density in g/cm<sup>3</sup></b>	2.8	1.2
<b>Cost in £ per m<sup>2</sup></b>	20	28
<b>Effect of sunlight</b>	No effect	Discolours over time

Suggest **one** advantage of making greenhouse windows from the polymer rather than from glass.

Use **Table 3**.

[1 mark]

\_\_\_\_\_

\_\_\_\_\_



Pentene and butene are produced from crude oil.

**Table 4** shows the percentages of different fractions in two samples of crude oil.

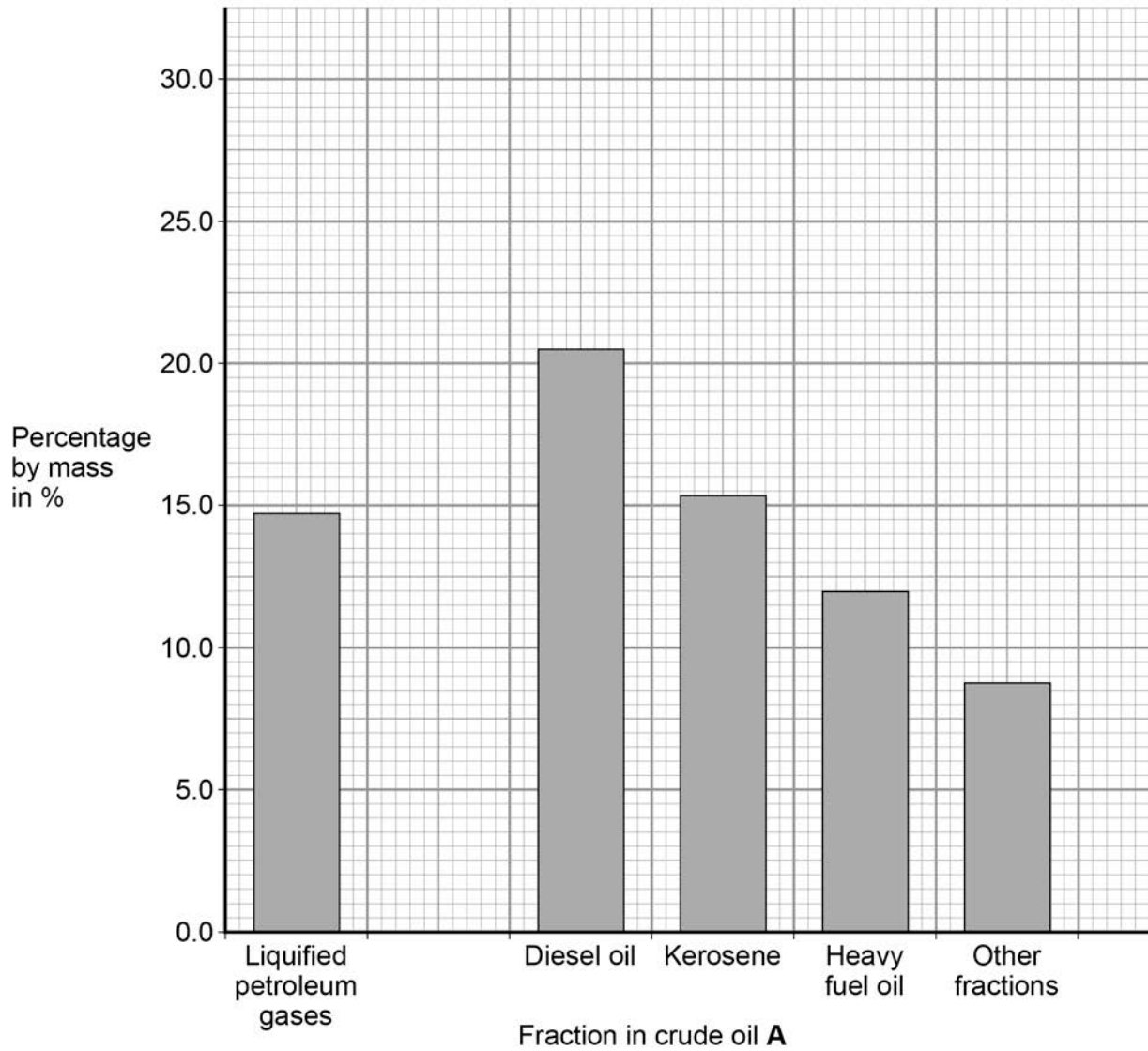
**Table 4**

Fraction	Percentages by mass in %	
	Crude oil A	Crude oil B
Liquefied petroleum gases	14.7	7.1
Petrol	28.6	11.1
Diesel oil	20.5	17.2
Kerosene	15.4	38.5
Heavy fuel oil	12.0	16.0
Other fractions	8.8	10.1



Figure 3 shows the percentages of different fractions in crude oil A.

Figure 3



0 3 . 3 Plot the data for petrol in Table 4 on Figure 3.

[1 mark]

Question 3 continues on the next page

Turn over ►

**0 3 . 4** What mass of crude oil **A** is needed to obtain 12 tonnes of heavy fuel oil?

[1 mark]

Use **Table 4**.

Tick **one** box.

10 tonnes

100 tonnes

1000 tonnes

10 000 tonnes

**0 3 . 5** Liquefied petroleum gases, petrol and diesel oil are used as car fuels.

Calculate the total mass of car fuel that can be produced from 2000 kg of crude oil **B**.

Use **Table 4**.

[3 marks]

---

---

---

---

Mass of car fuel = \_\_\_\_\_ kg

**0 3 . 6** Crude oil **B** is a better source of hydrocarbons for cracking than crude oil **A**.

Suggest why.

Use **Table 4**.

[1 mark]

---

---



**0 4**

When sodium thiosulfate solution reacts with dilute hydrochloric acid, the solution becomes cloudy.

The equation for the reaction is:

**0 4****1**

Why does the solution become cloudy?

**[2 marks]**

---

---

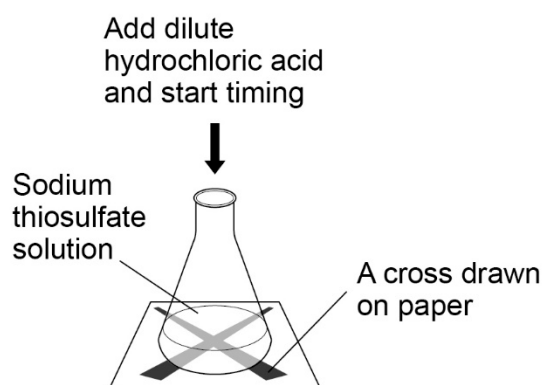
---

---

Some students used this reaction to investigate the effect of concentration on rate of reaction.

**Figure 4** shows the apparatus used.

**Figure 4**



This is the method used.

1. Measure 25 cm<sup>3</sup> sodium thiosulfate solution into a conical flask.
2. Stand the conical flask on a cross drawn on paper.
3. Add 10 cm<sup>3</sup> of dilute hydrochloric acid.
4. Time how long it takes the cross to become no longer visible.
5. Repeat steps 1–4 with sodium thiosulfate solutions of different concentrations.

**0 4 . 2** The students used a measuring cylinder to measure 25 cm<sup>3</sup> of sodium thiosulfate solution.

Suggest a more accurate way of measuring 25 cm<sup>3</sup> of sodium thiosulfate solution.

**[1 mark]**

---

---

**0 4 . 3** Name **one** control variable the students should use in this investigation.

**[1 mark]**

---

**Question 4 continues on the next page**

**Turn over ►**

**Table 5** shows the students' results.

**Table 5**

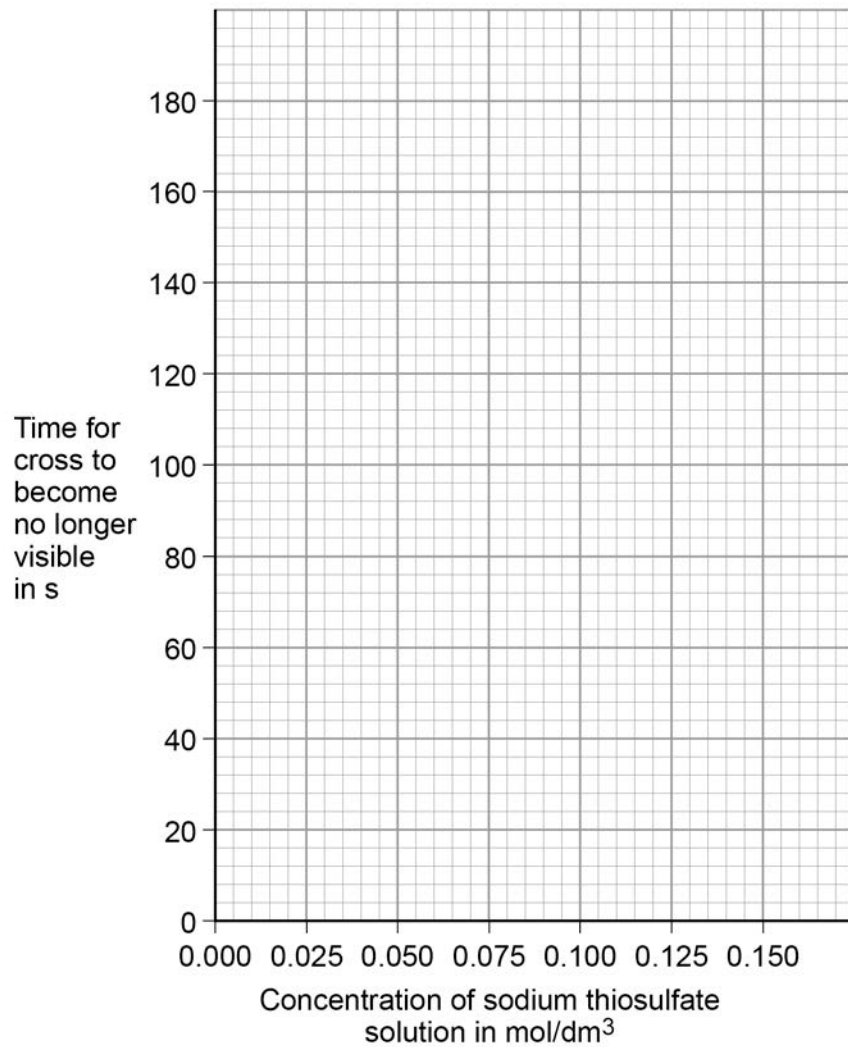
<b>Concentration of sodium thiosulfate solution in mol/dm<sup>3</sup></b>	<b>Time for cross to become no longer visible in s</b>
0.020	170
0.040	90
0.060	82
0.080	42
0.100	34
0.120	30
0.140	28

**0 4 . 4** Plot the data from **Table 5** on **Figure 5**.

Draw a line of best fit.

**[3 marks]**

**Figure 5**



**Question 4 continues on the next page**

**Turn over ►**

The students repeated the investigation two more times.

They obtained similar results each time.

0 4 . 5

What word describes an investigation by the same students which gives similar results each time?

**[1 mark]**

---

0 4 . 6

Describe how the students can use their results to improve the accuracy of the investigation.

**[2 marks]**

---

---

---

---



0 4 . 7

The students analysed their results to give a conclusion and an explanation for their investigation.

**Conclusion:** 'The higher the concentration, the lower the rate of reaction.'

**Explanation:** 'At higher concentrations, the particles have more energy, so they are moving faster. Therefore the collisions are more energetic.'

The students are **not** correct.

Give a **correct** conclusion **and** explanation for the results of the investigation.

[3 marks]

Conclusion \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

0 4 . 8

A solution containing 0.18 g of sodium thiosulfate reacts with dilute hydrochloric acid in 2 minutes.

Calculate the mean rate of reaction in g/s.

Give your answer in standard form.

[3 marks]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Mean rate of reaction = \_\_\_\_\_ g/s

16

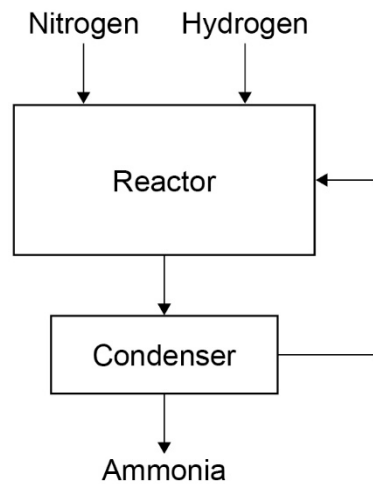
Turn over ►

**0 5**

Nitrogen and hydrogen react to produce ammonia in the Haber process.

**Figure 6** shows the Haber process.

**Figure 6**



A gaseous mixture of ammonia, hydrogen and nitrogen leaves the reactor.

**Table 6** shows the boiling points of the gases.

**Table 6**

Gas	Boiling point in °C
Ammonia	-33
Nitrogen	-196
Hydrogen	-253

**0 5 . 1** Suggest how ammonia is separated from the other gases.

**[2 marks]**

---

---

---

---

---

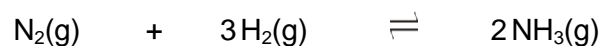
**0 5 . 2** What happens to the unreacted hydrogen and nitrogen?

**[1 mark]**

---

---

The equation for the reaction is:



The forward reaction is exothermic.

**0 5 . 3** Calculate the volume of ammonia produced from the complete reaction of 825 dm<sup>3</sup> of hydrogen.

**[2 marks]**

---

---

---

---

Volume of ammonia = \_\_\_\_\_ dm<sup>3</sup>

**Question 5 continues on the next page**

**Turn over ►**

0 5 . 4

The Haber process uses a temperature of 450 °C and a pressure of 200 atmospheres.

Why are these conditions used?

[2 marks]

Tick **two** boxes.

A higher pressure is maintained using less energy

A higher temperature would increase the equilibrium yield

A lower pressure would decrease the equilibrium yield

A lower temperature would make the reaction too slow

There are more product molecules than reactant molecules

Most of the ammonia produced is used to make fertilisers.

**Table 7** shows information about compounds used as fertilisers.

**Table 7**

Compound	Formula	Cost in £/tonne
<b>A</b>	$\text{NH}_4\text{NO}_3$	220
<b>B</b>	$(\text{NH}_4)_2\text{HPO}_4$	350
<b>C</b>	KCl	235

0 5 . 5

Which element in compound **A** improves agricultural productivity?

[1 mark]

---

**0 5 . 6** Which **two** compounds can be mixed to make a fertiliser containing **three** elements that improve agricultural productivity?

Give a reason why you have chosen these compounds.

**[2 marks]**

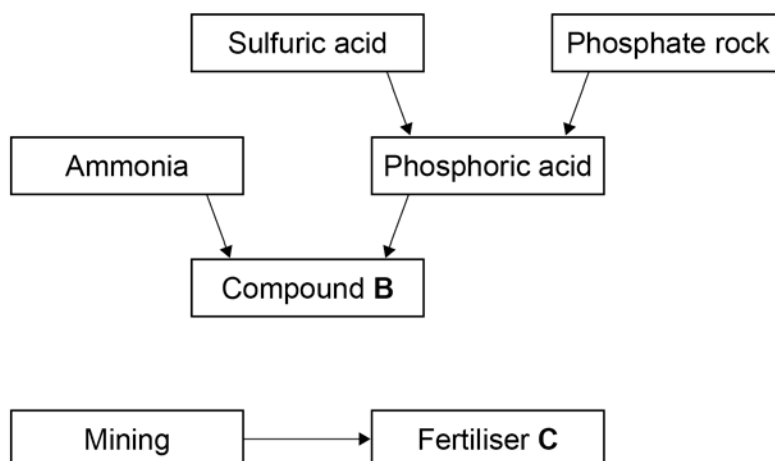
Compounds \_\_\_\_\_ and \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

**0 5 . 7** **Figure 7** shows a flow chart for the production of compounds **B** and **C**.

**Figure 7**



Suggest **two** possible reasons for the difference in cost between compounds **B** and **C**. **[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

0 6

This question is about polymers.

0 6 . 1

Name the monomer used to form poly(chloroethene).

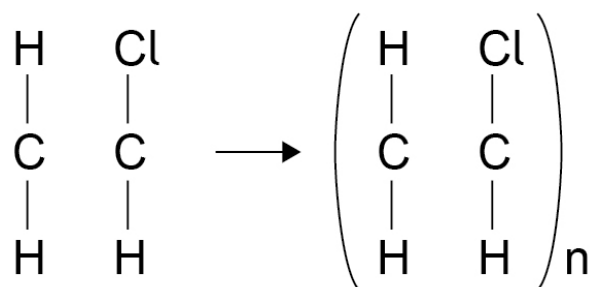
[1 mark]

---

0 6 . 2

**Figure 8** shows the equation for the formation of poly(chloroethene).Complete **Figure 8**.

[3 marks]

**Figure 8**

0 6 . 3

Poly(chloroethene) is the only product.

What type of polymer is poly(chloroethene)?

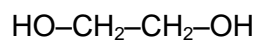
[1 mark]

---

Ethanediol reacts with butanedioic acid to produce a polyester and a small molecule.

**0 6 . 4** **Figure 9** shows the structural formula of ethanediol.

**Figure 9**



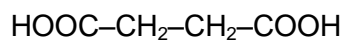
Name the functional group present in ethanediol.

[1 mark]

---

**0 6 . 5** **Figure 10** shows the structural formula of butanedioic acid.

**Figure 10**



Which formula represents the carboxylic acid functional group?

[1 mark]

Tick **one** box.

-CH<sub>2</sub>-

-CH<sub>2</sub>-CH<sub>2</sub>-

-CH<sub>2</sub>-COOH

-COOH

**Question 6 continues on the next page**

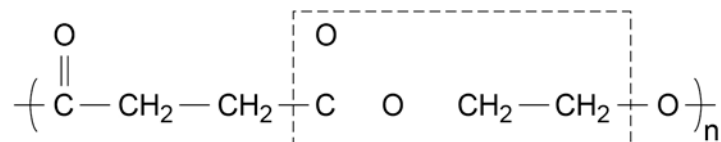
**Turn over ►**

0 6 . 6 Figure 11 shows part of the structure of the polyester.

Complete the box in Figure 11.

[2 marks]

Figure 11



0 6 . 7 Name the small molecule produced when ethanediol reacts with butanedioic acid.

[1 mark]

---



Starch, proteins and DNA are naturally occurring polymers.

**0 6 . 8** Name the monomers from which starch and proteins are produced.

**[2 marks]**

Starch \_\_\_\_\_

Proteins \_\_\_\_\_

**0 6 . 9** Describe the structure of DNA.

**[2 marks]**

---

---

---

---

14

**Turn over for the next question**

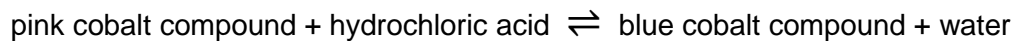
**Turn over ►**

**0 7**

Cobalt forms coloured compounds.

A pink cobalt compound reacts with hydrochloric acid.

The reaction can be represented as:



The forward reaction is endothermic.

When both cobalt compounds are present in a solution at equilibrium, the equilibrium mixture is purple.

**0 7 . 1**

What is meant by equilibrium?

**[2 marks]**

---

---

---

---

**0 7 . 2**

The equilibrium mixture is cooled.

Explain what happens to the concentration of the pink cobalt compound.

**[3 marks]**

---

---

---

---

---

---

**0 7 . 3** More hydrochloric acid is added.

Explain what happens to the colour of the equilibrium mixture.

**[3 marks]**

---

---

---

---

---

---

---

**0 7 . 4** Why does cobalt form different coloured compounds?

**[1 mark]**

---

**0 7 . 5** An oxide of cobalt has the formula  $\text{Co}_2\text{O}_3$

Which cobalt ion is present in this oxide?

**[1 mark]**

Tick **one** box.

$\text{Co}^+$

$\text{Co}^{2+}$

$\text{Co}^{3+}$

$\text{Co}^{4+}$

**Question 7 continues on the next page**

**Turn over ►**

0 7 . 6 Cobalt compounds can act as catalysts.

Which **two** statements about cobalt compounds are correct?

[2 marks]

Tick **two** boxes.

They allow reactions to reach equilibrium more quickly.

They are reactants in reactions catalysed by cobalt compounds.

They are used up when acting as catalysts.

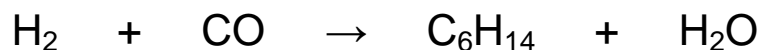
They increase the equilibrium yield of reactions.

They provide a different reaction pathway.

0 7 . 7 The reaction of hydrogen with carbon monoxide is catalysed by cobalt metal.

Balance the equation for the reaction.

[1 mark]



0 7 . 8  $\text{C}_6\text{H}_{14}$  is an alkane.

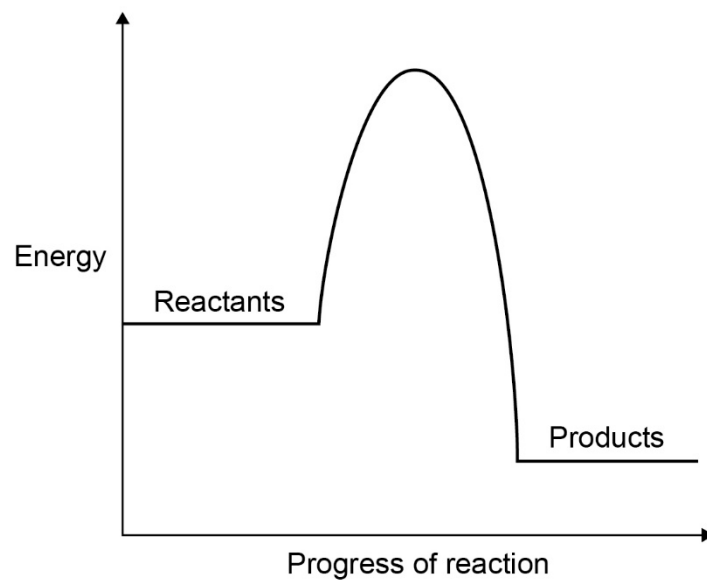
What is the formula of an alkane containing 18 hydrogen atoms?

[1 mark]

\_\_\_\_\_

0 7 . 9 Figure 12 shows a reaction profile diagram for a reaction **without** a catalyst.

Figure 12



On **Figure 12**:

- draw the reaction profile diagram for a catalysed reaction
- draw and label an arrow to show the activation energy for the reaction **without** a catalyst.

[2 marks]

16

Turn over for the next question

Turn over ►

**There are no questions printed on this page**

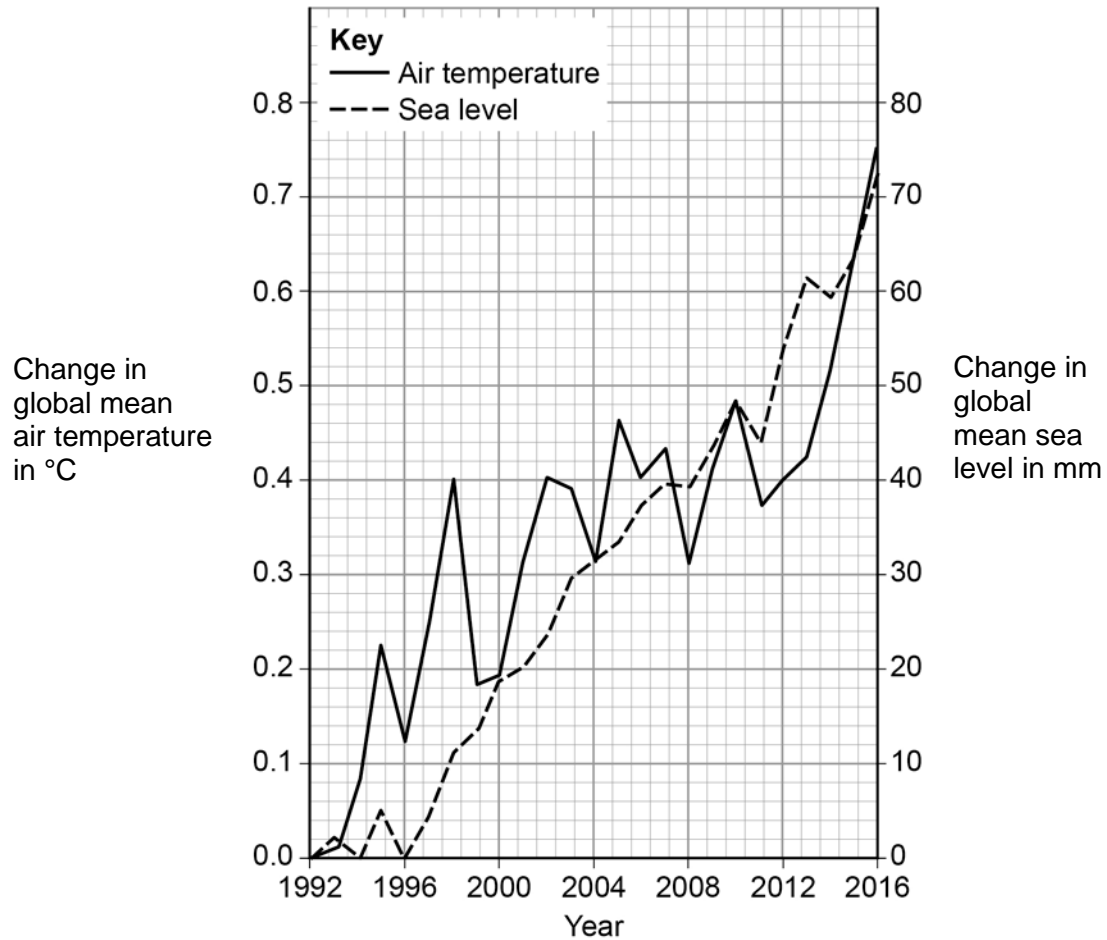
**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

0 8

This question is about climate change.

**Figure 13** shows the changes in the global mean air temperature and global mean sea level from 1992 to 2016.

**Figure 13**



0 8

. 1

Calculate the mean yearly increase in sea level between 1992 and 2016.

Use **Figure 13**.

**[2 marks]**

---



---



---

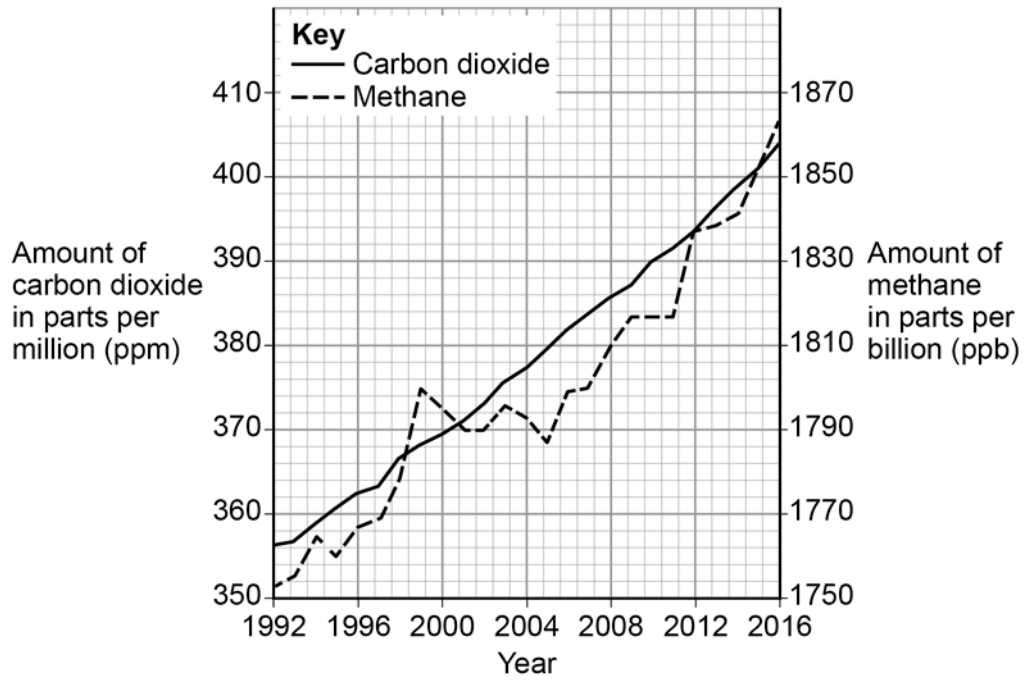
Mean yearly increase in sea level = \_\_\_\_\_ mm/year

Turn over ►

Most scientists think carbon dioxide and methane are a cause of global climate change.

**Figure 14** shows the amounts of these gases in the atmosphere from 1992 to 2016.

**Figure 14**







**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Copyright Information**

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2017 AQA and its licensors. All rights reserved.