A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Chemistry Paper 1H

H

8464/C/1H

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

For this paper you must have:
- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **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 70.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1

This question is about the periodic table.

0 1 . 1

FIGURE 1 shows part of Mendeleev's version of the periodic table.

FIGURE 1

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

Which group of elements had NOT been discovered when Mendeleev's version of the periodic table was published? [1 mark]

_____

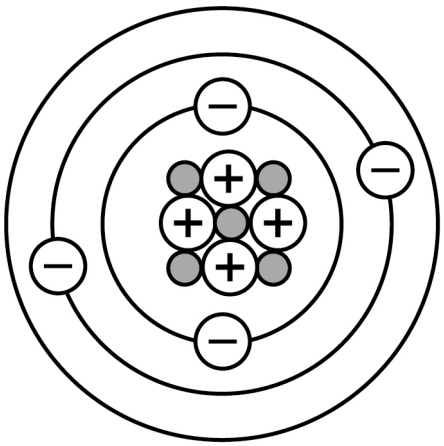
_____

[Turn over]

FIGURE 2 represents different models of the atom.

FIGURE 2

A



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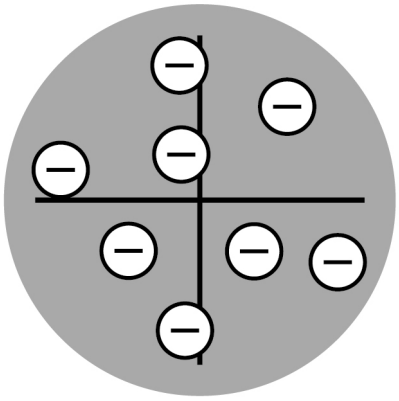

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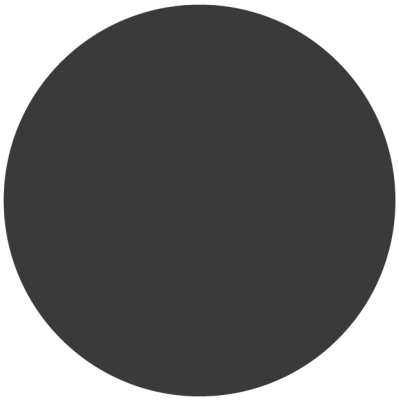

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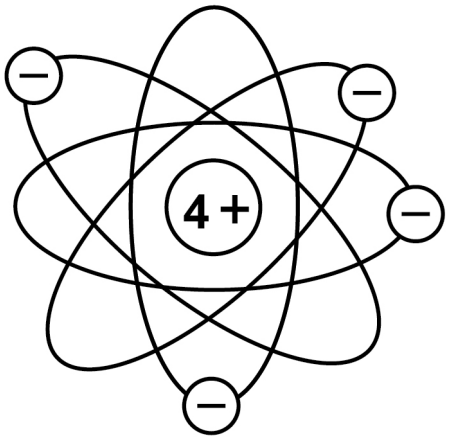


0 1 . 2

Which model represents the plum pudding model?
[1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

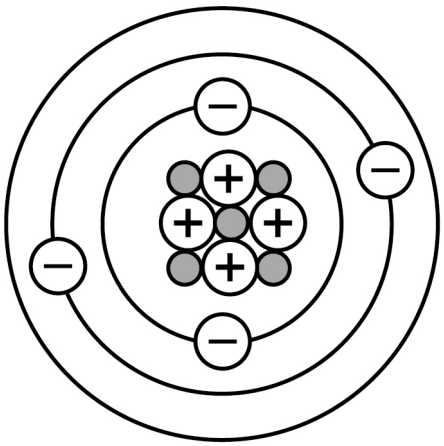
☐ **C**

☐ **D**

[Turn over]

REPEAT OF FIGURE 2

A



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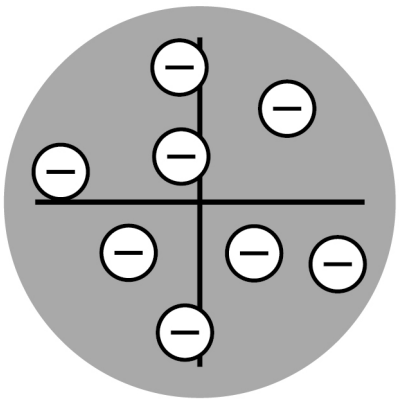

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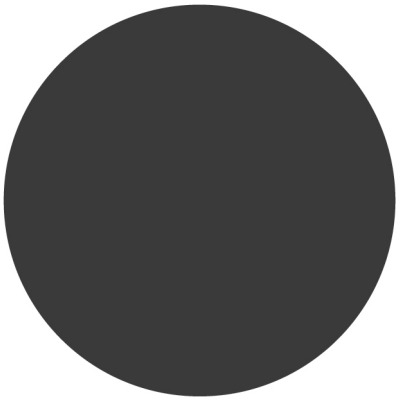

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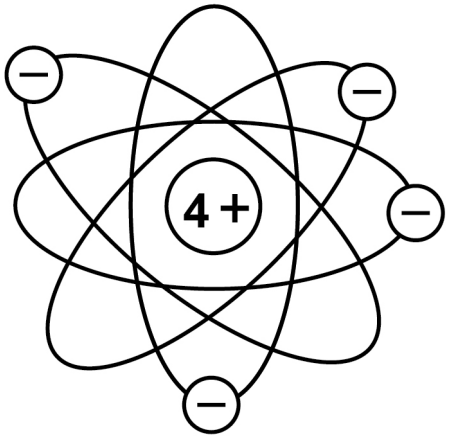


0 1 . 3

Which model resulted from Chadwick's experimental work? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

[Turn over]

Potassium has different isotopes.

0 1 . 4

What is meant by 'isotopes'?

You should refer to subatomic particles. [2 marks]

0 1 . 5

TABLE 1 shows the mass numbers and the percentage abundance of two isotopes of potassium.

TABLE 1

Mass number	Percentage abundance
39	93.1
41	6.9

Calculate the relative atomic mass (A_r) of potassium.

Give your answer to 1 decimal place. [3 marks]

Relative atomic mass (1 decimal place) = _____

[Turn over]

8

0 2

Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

0 2 . 1

Give the colour change when nitric acid is added to the mixture of universal indicator and water. [1 mark]

Tick (✓) ONE box.

- ☐ **Blue to red**
- ☐ **Green to purple**
- ☐ **Green to red**
- ☐ **Red to purple**

0 2 . 2

What happens to the pH of water when nitric acid is added? [1 mark]

Tick (✓) ONE box.

- ☐ **Decreases**
- ☐ **Stays the same**
- ☐ **Increases**

0 2 . 3

What is the state symbol for nitric acid? [1 mark]

_____

[Turn over]

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:

zinc carbonate (white solid) + nitric acid ⟶ zinc nitrate (colourless solution) + water + carbon dioxide

0 2 . 4 Give TWO observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess. [2 marks]

1 _____

_____

2 _____

_____

0 2 . 5

The formula of the zinc ion is Zn^{2+}

The formula of the nitrate ion is NO_3^-

What is the formula for zinc nitrate? [1 mark]

Tick (✓) ONE box.

- ☐ $ZnNO_3$
- ☐ $Zn(NO_3)_2$
- ☐ Zn_2NO_3
- ☐ $Zn_2(NO_3)_2$

0 2 . 6

Acids react with insoluble metal oxides to produce salts.

Plan a method to produce a pure, dry sample of the soluble salt copper chloride from an acid and a metal oxide. [6 marks]

[Turn over]

12

0 3

This question is about energy change.

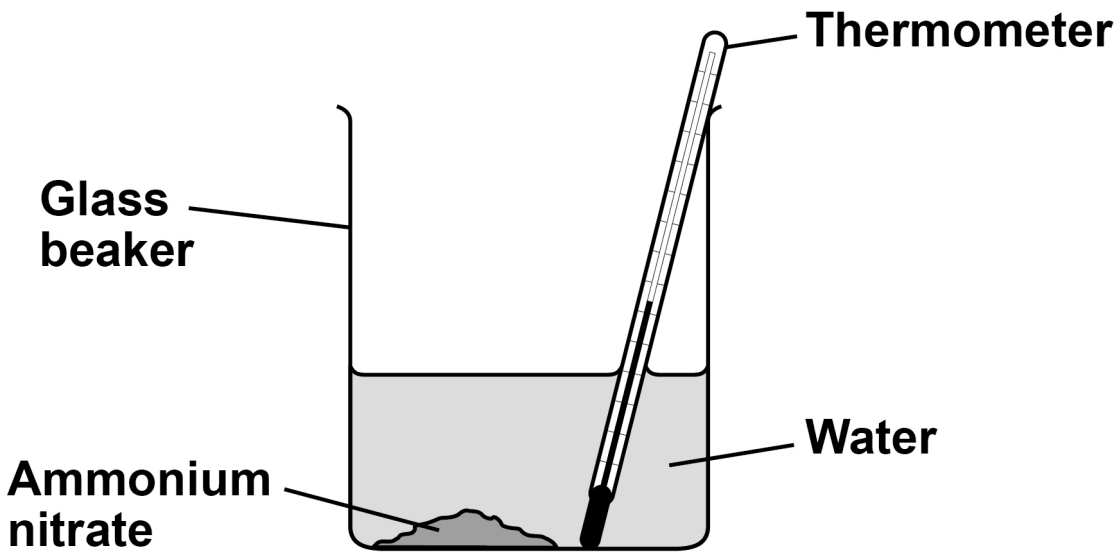
A student investigated the temperature change when 10 g of ammonium nitrate was added to 100 cm^3 of water.

This is the method used.

1. **Measure the temperature of 100 cm^3 of water.**
2. **Add 10 g of ammonium nitrate.**
3. **Stir once.**
4. **Measure the temperature of the solution every minute for 7 minutes.**

FIGURE 3 shows the apparatus.

FIGURE 3



0 3 . 1

What is the dependent variable in this investigation? [1 mark]

0 3 . 2

Give THREE improvements to the investigation to make the results more accurate. [3 marks]

1

2

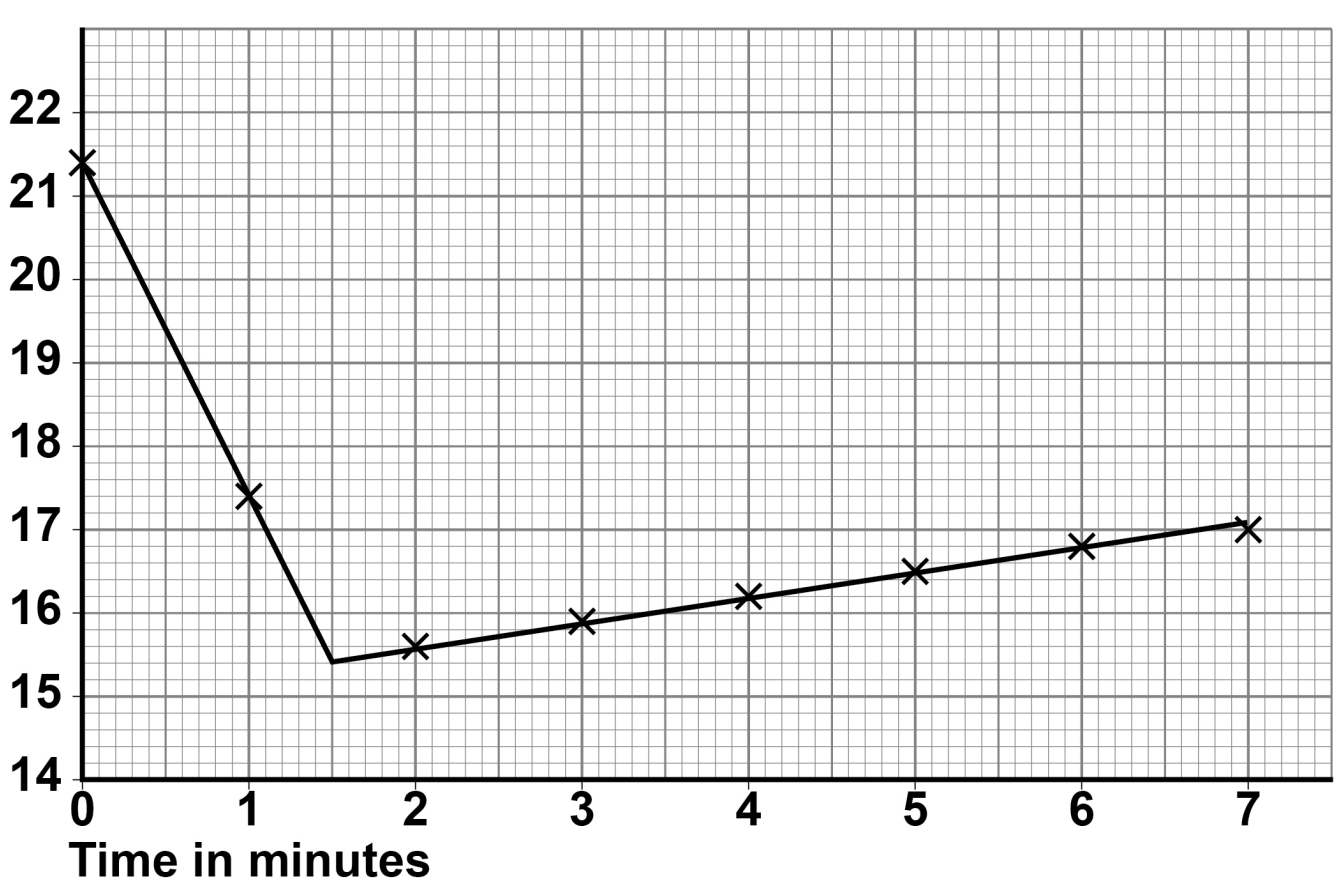
3

[Turn over]

0 3 . 3

FIGURE 4 shows the results.

FIGURE 4



Explain the results. [4 marks]

[Turn over]

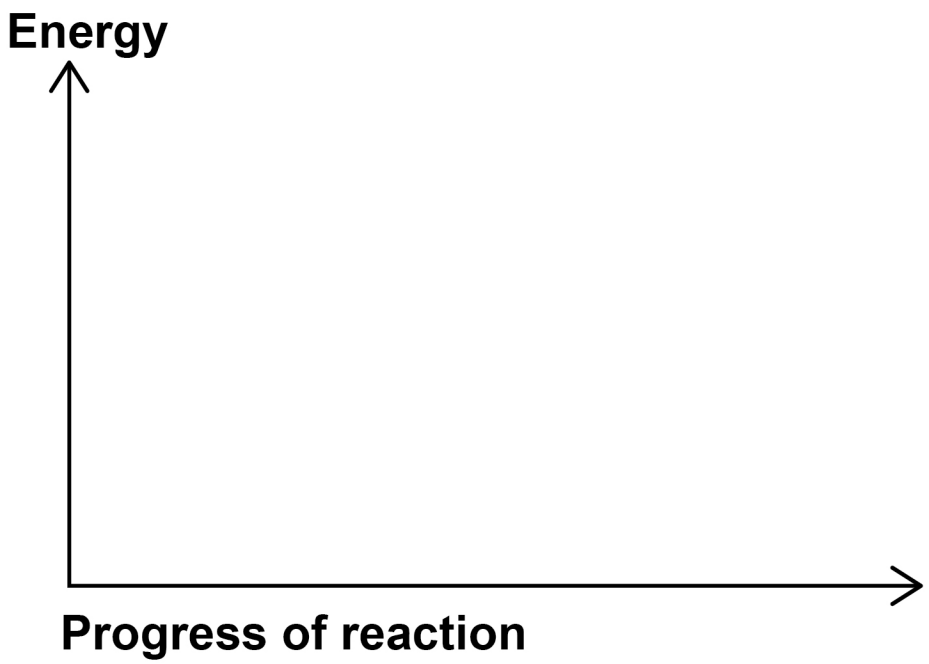
0 3 . 4

Draw a reaction profile for an exothermic reaction.

You should label:

- **the energy level of the reactants and of the products**
- **the activation energy**
- **the overall energy change.**

[4 marks]



12

0 4

Carbon can exist in a number of different structures.

0 4 . 1

The first fullerene to be discovered was Buckminsterfullerene.

What is the formula of Buckminsterfullerene? [1 mark]

Tick (✓) ONE box.

- ☐ C_{40}
- ☐ C_{50}
- ☐ C_{60}
- ☐ C_{70}

[Turn over]

0 4 . 2

Graphite is a form of carbon.

Explain why graphite conducts electricity. [2 marks]

Steel is an alloy of iron and carbon.

0 4 . 3

Explain why steel is harder than iron. [3 marks]

0 4 . 4

Iron is alloyed with carbon and other metals to make stainless steel.

A stainless steel fork contains 71.92% iron.

TABLE 2 shows the mass of each element in the fork.

TABLE 2

Element	Iron	Carbon	Chromium	Nickel
Mass of element in g	X	0.05	10.44	5.80

Calculate the mass of iron (X) in the fork. [4 marks]

X = _____ g

[Turn over]

10

0 5

This question is about the electrolysis of aqueous solutions.

Hydrogen gas and chlorine gas are produced when sodium chloride solution is electrolysed.

0 5 . 1

Hydrogen ions (H^+) are attracted to the negative electrode.

The half equation for the reaction at the negative electrode is:

$$2\ H^+ + 2\ e^- \longrightarrow H_2$$

What type of reaction happens at the negative electrode?

Give the reason for your answer. [2 marks]

Type of reaction _____

_____

Reason _____

_____

_____

0 5 . 2

Chloride ions are attracted to the positive electrode.

Complete the half equation for the production of chlorine gas (Cl_2). [2 marks]

_____ Cl^- $\longrightarrow$ _____ + _____

[Turn over]

0 5 . 3

Hydrogen gas and oxygen gas are produced when sodium sulfate solution is electrolysed.

Explain how oxygen gas is produced in the electrolysis of sodium sulfate solution. [4 marks]

8

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[Turn over]

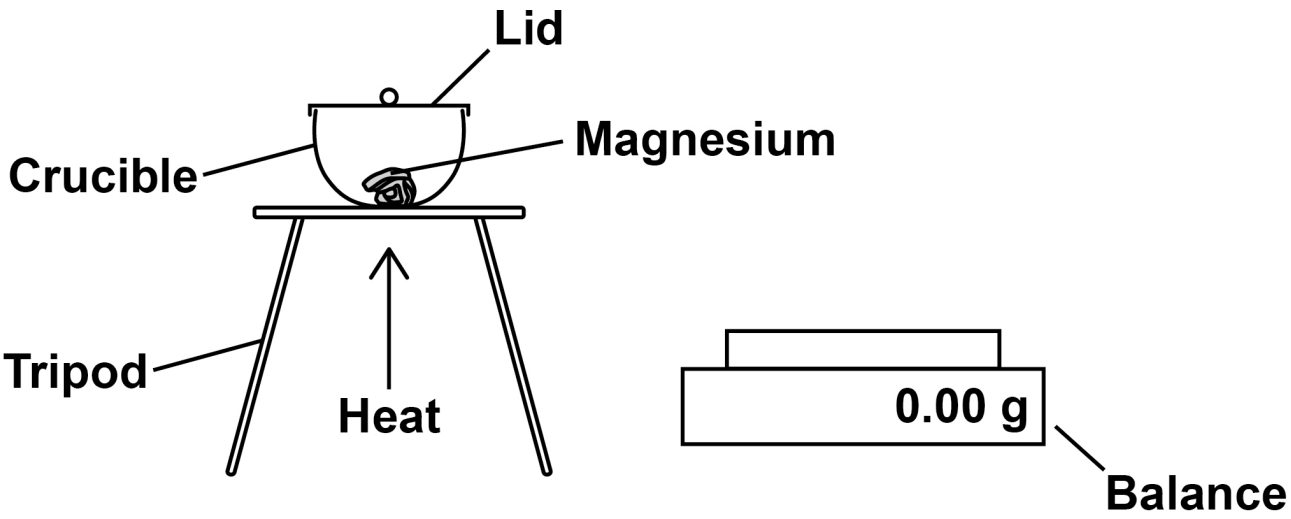
0 6

Metal oxides are produced when metals are heated in air.

A student investigated the change in mass when 0.12 g of magnesium was heated in air.

FIGURE 5 shows the apparatus.

FIGURE 5



The student measured the mass of magnesium oxide produced.

0 6 . 1

0.12 g of magnesium reacted to produce 0.20 g of magnesium oxide.

Calculate the number of moles of oxygen gas (O_2) that reacted.

Relative atomic mass (A_r): O = 16

[3 marks]

Moles of oxygen gas = _____

[Turn over]

0 6 . 2

The student repeated the experiment WITHOUT a lid on the crucible.

Suggest why the mass of magnesium oxide produced would be different without a lid on the crucible.
[2 marks]

0 6 . 3

Copper reacts with oxygen to produce copper oxide.

63.5 g of copper produces 79.5 g of copper oxide.

Calculate the mass of copper oxide produced when 0.50 g of copper reacts with oxygen.

Give your answer to 3 significant figures. [3 marks]

Mass (3 significant figures) = _____ g

[Turn over]

0 6 . 4

Iron reacts with oxygen to produce an oxide of iron.

0.015 moles of iron reacts with 0.010 moles of oxygen gas (O_2).

Determine:

- **the formula of the iron oxide produced**
- **the balanced symbol equation for the reaction.**

[4 marks]

Formula of iron oxide = _____

Balanced symbol equation _____

12

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[Turn over]

0 7

Methane, ethane, propane and butane all react with oxygen to produce carbon dioxide and water.

0 7 . 1

Suggest why a mixture of methane and oxygen does NOT react at room temperature.

Answer in terms of particles. [2 marks]

0 7 . 2

TABLE 3 shows the energy released when methane, ethane and propane react with oxygen to produce carbon dioxide and water.

TABLE 3

	Compound reacted with oxygen		
	Methane	**Ethane**	**Propane**
Formula of compound	CH_4	C_2H_6	C_3H_8
Energy released in kJ/mol	**680**	**1160**	**1640**

Predict the energy released when butane (C_4H_{10}) reacts with oxygen to produce carbon dioxide and water.
[1 mark]

_____

_____

_____

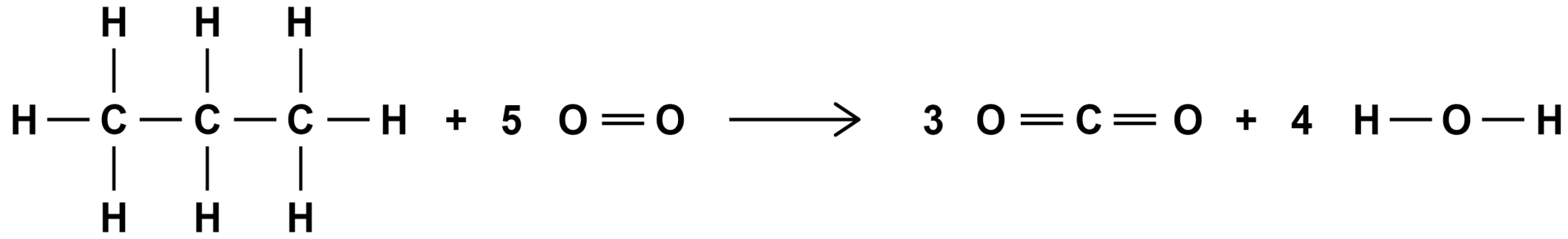
Energy released = _____ kJ/mol

[Turn over]

0 7 . 3

Propane reacts with oxygen to produce carbon dioxide and water.

The displayed formula equation for the reaction is:



The reaction is exothermic.

In the reaction, the energy released when forming new bonds is 1640 kJ/mol greater than the energy needed when breaking bonds.

TABLE 4, on page 42, shows bond energies.

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[Turn over]

TABLE 4

Bond	H–C	C–C	O=O	C=O	O–H
Bond energy in kJ/mol	410	X	500	740	460

Calculate the C—C bond energy (X). [5 marks]

X = _____ kJ/mol

END OF QUESTIONS

8

Additional page, if required.
Write the question numbers in the left-hand margin.

Additional page, if required.
Write the question numbers in the left-hand margin.

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Question	Mark
1	
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TOTAL	

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