

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 1H

Time allowed: 1 hour 15 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.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



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	Ca		Ti	V	Cr	Mn	
Cu	Zn			As	Se	Br	Fe Co Ni
Rb	Sr	Y	Zr	Nb	Mo		
Ag	Cd	In	Sn	Sb	Te	I	Ru Rh Pd

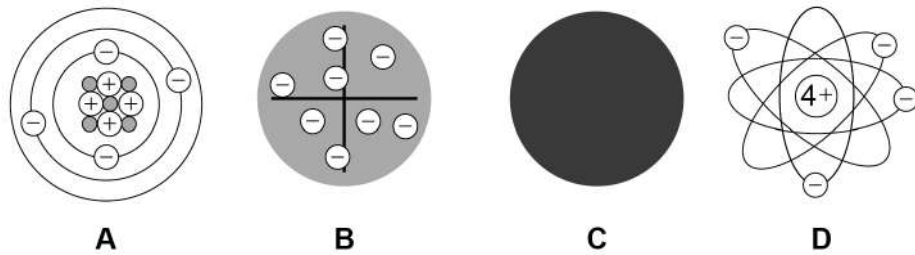
Which group of elements had **not** been discovered when Mendeleev's version of the periodic table was published?

[1 mark]



Figure 2 represents different models of the atom.

Figure 2



0 1 . 2 Which model represents the plum pudding model?

[1 mark]

Tick (✓) **one** box.

A ☐

 B ☐

 C ☐

 D ☐

0 1 . 3 Which model resulted from Chadwick's experimental work?

[1 mark]

Tick (✓) **one** box.

A ☐

 B ☐

 C ☐

 D ☐

Question 1 continues on the next page

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) = _____

8



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ANSWER IN THE SPACES PROVIDED**

Turn over ►



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**

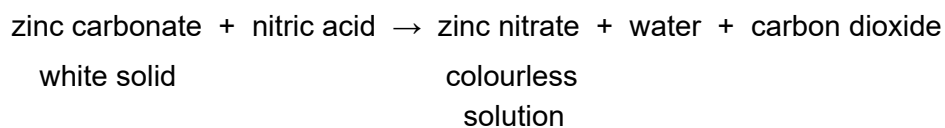
What is the state symbol for nitric acid?

[1 mark]



Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:



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

☐

$\text{Zn}(\text{NO}_3)_2$

☐

Zn_2NO_3

☐

$\text{Zn}_2(\text{NO}_3)_2$

☐

Question 2 continues on the next page

Turn over ►



Acids react with insoluble metal oxides to produce salts.

[6 marks]

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12



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0 3

This question is about energy change.

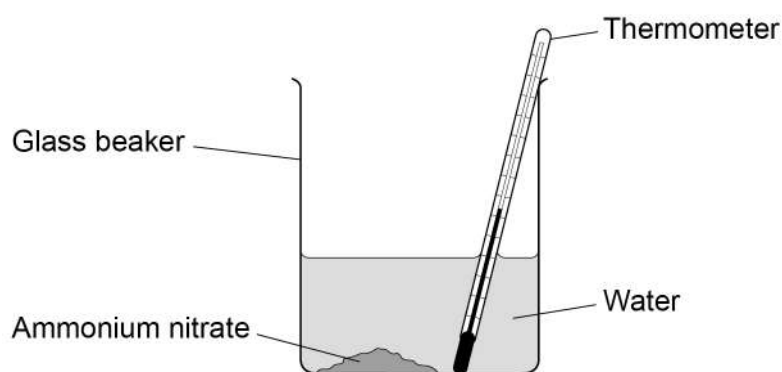
A student investigated the temperature change when 10 g of ammonium nitrate was added to 100 cm³ of water.

This is the method used.

1. Measure the temperature of 100 cm³ 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

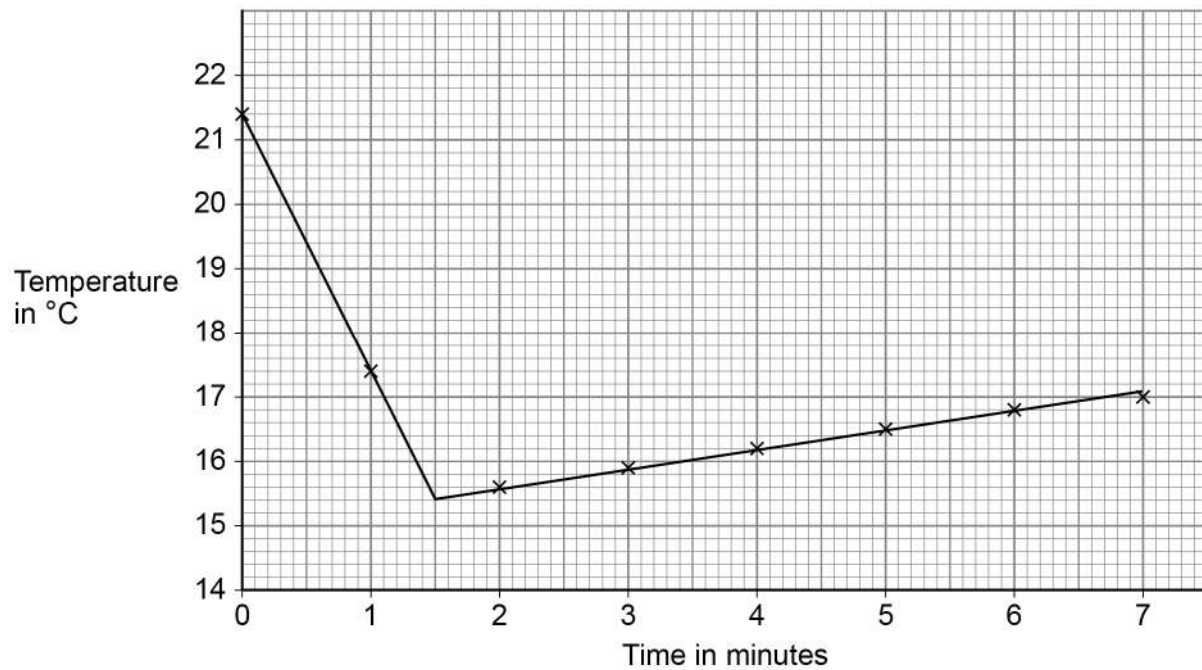
2

3



0 3 . 3 Figure 4 shows the results.

Figure 4



Explain the results.

[4 marks]

Question 3 continues on the next page

Turn over ►

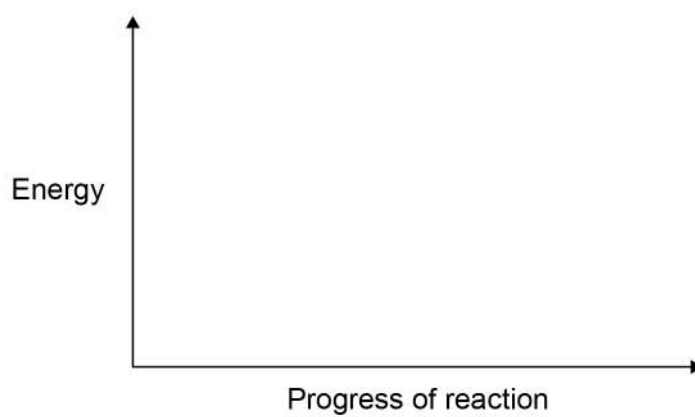


0 3 . 4

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

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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.C₄₀☐C₅₀☐C₆₀☐C₇₀☐**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

10

Turn over ►



0 5

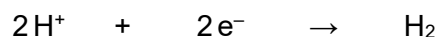
This question is about the electrolysis of aqueous solutions.

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:



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]

0	5	.	3
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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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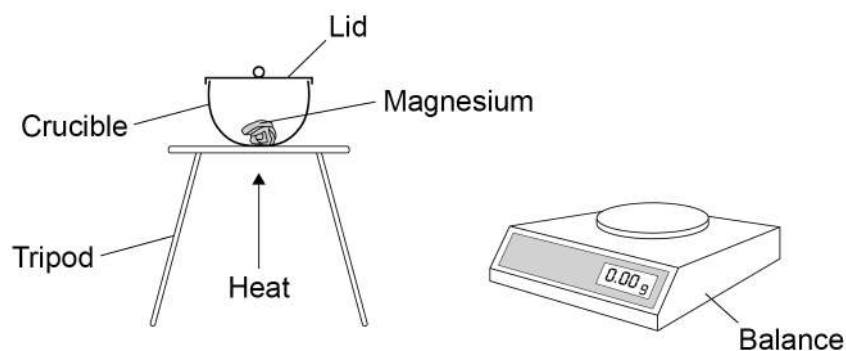
0 6

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 = _____



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

Question 6 continues on the next page

Turn over ►

0	6	.	4
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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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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 ₂ H ₆	C ₃ H ₈
Energy released in kJ/mol	680	1160	1640

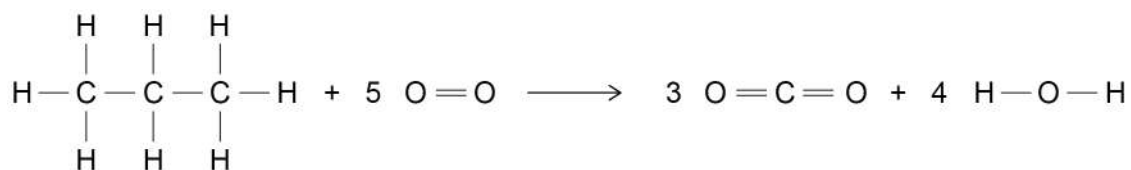
Predict the energy released when butane (C₄H₁₀) reacts with oxygen to produce carbon dioxide and water.

[1 mark]

Energy released = _____ kJ/mol



The displayed formula equation for the reaction is:



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

Table 4 shows bond energies.

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]

[illegible]

X = kJ/mol

END OF QUESTIONS

8



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