

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

3430U50-1



S19-3430U50-1

SCIENCE (Double Award)

**Unit 5 – CHEMISTRY 2
FOUNDATION TIER**

THURSDAY, 16 MAY 2019 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	14	
3.	6	
4.	6	
5.	13	
6.	15	
Total	60	

3430U501
01

ADDITIONAL MATERIALS

In addition to this examination paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question **5(c)** is a quality of extended response (QER) question where your writing skills will be assessed.

The Periodic Table is printed on the back cover of this paper and the formulae for some common ions on the inside of the back cover.



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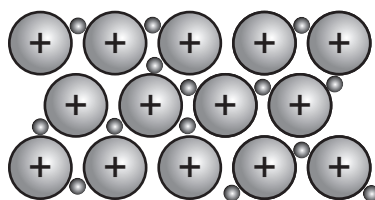
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Answer all questions.

1. The following diagram can be used to represent the structure of silver.



- (a) Select the correct words from the box to complete the sentences that follow. [3]

electrons	tightly	protons
malleable	neutrons	brittle
ductile	irregularly	loosely

Silver is a solid because the metal ions are packed.

Silver is a good conductor of electricity because the are delocalised and free to move.

Silver dents when hammered because it is

- (b) Silver can also exist as nano-sized particles. These are used in plasters, socks and deodorant sprays.

- (i) **Underline** the correct word in the brackets to complete each sentence. [2]

Nano-sized silver particles range from (**1-100 mm** / **1-100 nm** / **1-100 cm**) in size.

Nano-sized silver particles have (**the same** / **different** / **stronger**) properties compared to bulk silver.

- (ii) Give the property of nano-sized silver particles that allows them to be used in plasters, socks and deodorants. [1]

.....



2. A teacher was marking the exercise book of a student who had completed a topic of work on acids and alkalis.

- (a) The table below shows the results the student had recorded from an experiment to investigate the pH values of some common laboratory chemicals.

The teacher has circled three errors for the student to correct.

Chemical name	Chemical formula	Colour with universal indicator	pH	Acid, alkali or neutral
sulfuric acid	H_2SO_4	green	1	acid
ethanoic acid	CH_3COOH	orange	4	alkali
calcium hydroxide	$\text{Ca}(\text{OH})_2$	purple	12	alkali
water	H_2O	green	5	neutral
sodium carbonate	NaCO_3	blue	10	alkali

error 1

error 3

error 2

- (i) Correct the errors the teacher has circled.

[3]

Correction to **error 1**

Correction to **error 2**

Correction to **error 3**

- (ii) There is another error in the table that the teacher has not spotted.
Circle this error in the table.

[1]



- (b) Another piece of work in the exercise book showed the results of some tests that the student had carried out to identify some of the ions in the chemicals being investigated. However the table had not been fully completed by the student.

Ion being identified	Test	Result
carbonate CO_3^{2-}	add hydrochloric acid	bubbles formed as gas is produced
sulfate SO_4^{2-}	add solution	white precipitate is formed

- (i) Use the names of chemicals from the box below to complete the table. [2]

silver nitrate	hydrogen	sodium hydroxide
barium chloride	oxygen	
universal indicator	carbon dioxide	chlorine

- (ii) Describe the test that can be used to identify the gas produced when hydrochloric acid is added to a compound containing carbonate ions. [1]

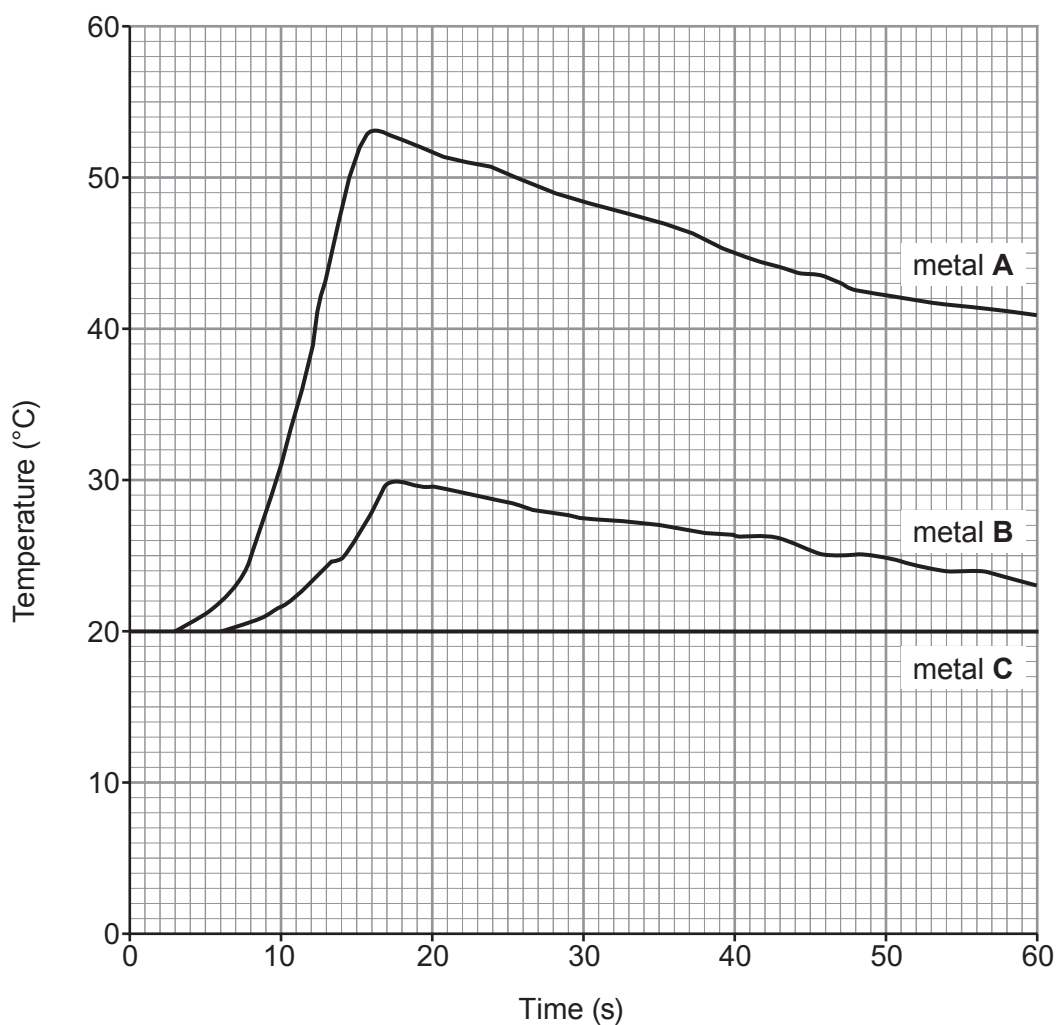
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- (c) The final piece of work marked by the teacher was an experiment that had been completed to investigate the temperature change when different metals react with hydrochloric acid.

The graphs of the results obtained by the student are shown below.



- (i) Use the graphs to give

I. the **letter** of the metal that did not react with hydrochloric acid. [1]

.....

II. the maximum temperature **rise** for metal **A**. [1]

..... °C

- (ii) State the term used to describe a reaction that gives out heat. [1]

.....



(d) When metals react with acids they form a salt and hydrogen gas.

- (i) Complete the word equation for the reaction between magnesium and sulfuric acid. [1]

magnesium + sulfuric acid $\longrightarrow$ + hydrogen

- (ii) Give the test that can be used to identify hydrogen gas. Include the expected observation. [1]

.....
.....

- (iii) The salt formed when zinc reacts with hydrochloric acid is zinc chloride.

- I. Give the formulae of the ions present in zinc chloride. [1]

..... and

- II. Give the formula of zinc chloride. [1]

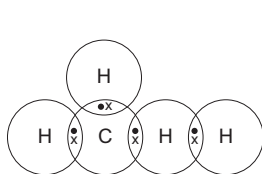
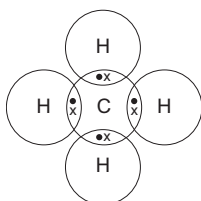
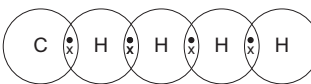
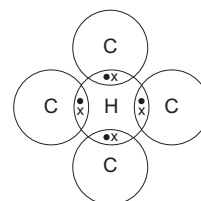
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3. (a) Methane gas, CH_4 , contains the elements carbon and hydrogen.

Element	Electronic structure
carbon	2,4
hydrogen	1

- (i) I. Put a **tick** (✓) in the box below the diagram which shows how the atoms are bonded in one molecule of methane. [1]


☐

☐

☐

☐

- II. **Circle** the name given to the type of bonding found in methane. [1]

covalent

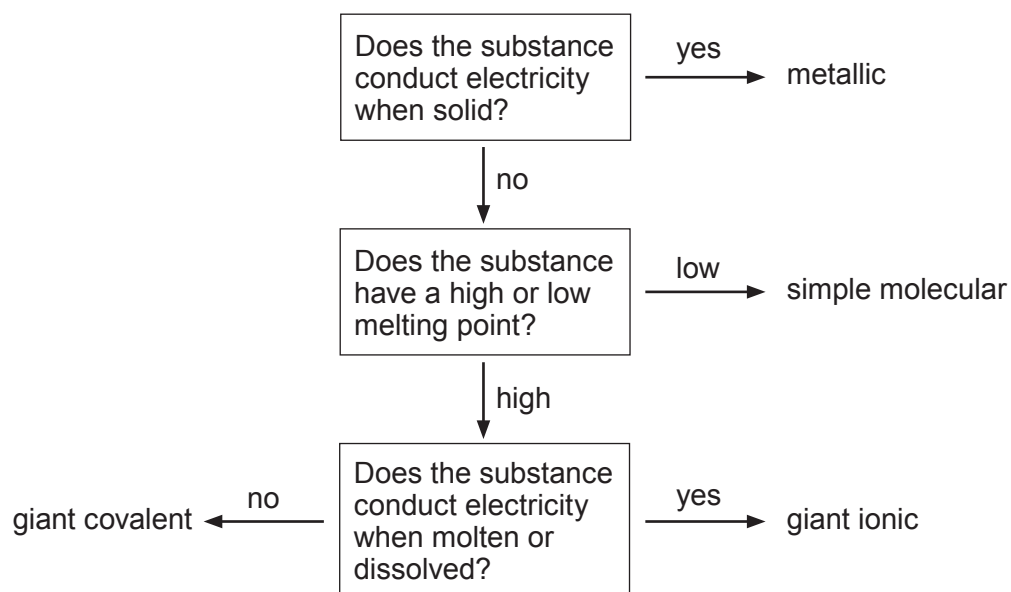
ionic

giant covalent

metallic



- (ii) The flow chart below can be used to identify the type of structure found in different substances.



- I. Use the flow chart to complete the table.

[1]

Substance	Melting point (°C)	Electrical conductivity	Type of structure
A	2072	conducts only when molten	
B	-182	does not conduct electricity	
C	1610	does not conduct electricity	

- II. Give the **letter** of the substance, **A**, **B** or **C**, that is most likely to be methane. [1]

Substance



- (b) Butene, C_4H_8 , also contains the elements carbon and hydrogen. Calculate the percentage by mass of hydrogen in butene. [2]

$$A_r(H) = 1 \quad A_r(C) = 12$$

Percentage = %

6



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4. An alloy is a material composed of a mixture of elements, at least one of which is a metal. The table lists the composition and common uses of different alloys containing silver and gold.

Name of alloy	Composition of alloy by mass (%)	Uses of alloy
amalgam	mercury 48 %, silver 25 %, tin 15 %, copper 12 %	dental fillings, mining
green gold	gold 75 %, silver 6-24 %, copper %	Nobel Prize medals, decoration
nordic gold	gold 89 %, aluminium 5 %, zinc 5 %, tin 1 %	coins, decoration
solder	tin 90 %, silver 5 %, copper 5 %	joining electrical components
sterling silver	silver 92.5 %, platinum 4 %, germanium 1.5-3 %, zinc 0.5-2 %	decoration, plumbing, instruments, jewellery
white gold	gold 75 %, palladium 10 %, nickel 10 %, zinc 5 %	decoration, jewellery

- (a) **Circle** the number of alloys that contain an element from Group 4 of the Periodic Table.

[1]

0 1 2 3 4 5 6

- (b) **Circle** the correct percentage range for the mass of copper that can be found in green gold.

[1]

0-25 % 1-19 % 19-25 % 6-24 %



(c) Tick (✓) the statement that **best** describes the composition of the alloys listed. [1]

the alloys all contain at least one metal

☐

the alloys all contain at least two metals

☐

the alloys all contain at least three metals

☐

the alloys all contain at least four metals

☐

(d) Tick (✓) the statement that **best** describes the decorative uses of the alloys listed. [1]

all of the alloys are used for decorative purposes

☐

all of the alloys containing gold are used for decorative purposes

☐

all of the alloys containing silver are used for decorative purposes

☐

none of the alloys containing silver are used for decorative purposes

☐

(e) A solder joint in an electrical circuit contains 0.00011 kg of silver.

Use this information and the composition of solder given in the table to calculate the mass of tin in the solder joint. [2]

Mass = kg

6



5. (a) Metal ores are the materials found in the Earth's crust from which metals can be extracted. The following table gives information about some common metal ores.

Name of metal ore	Metal extracted from ore	Formula of ore
anglesite	lead	PbCl_2
copper pyrite	copper	CuFeS_2
cryolite	aluminium	Na_3AlF_6
salt petre	potassium	KNO_3
syberite	gold	AgAuTe_2
tin pyrite	tin	$\text{Cu}_2\text{FeSnS}_4$

Use the information in the table to give

- (i) the **total** number of atoms shown in the formula of cryolite, [1]

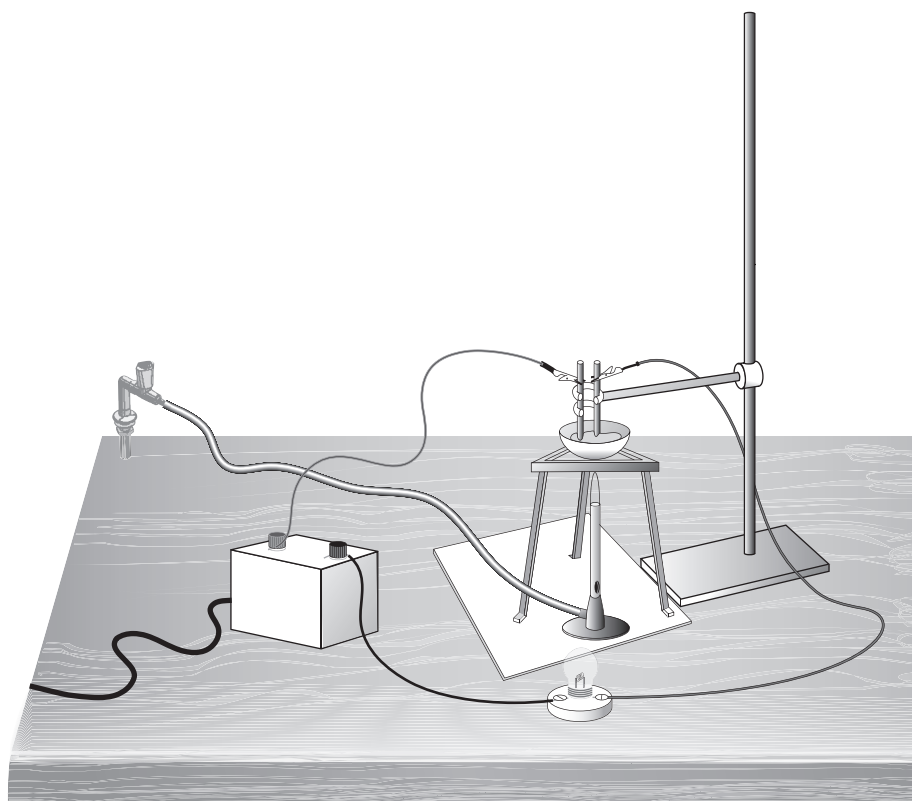
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- (ii) the name of the ore that contains a ratio of 1:4 metal to non-metal atoms. [1]

.....



- (b) The following diagram shows how the electrolysis of anglesite (lead chloride) can be carried out in the laboratory.



- (i) Give the reason why lead chloride needs to be melted for electrolysis to take place. [1]

- (ii) Explain why the chloride ions move towards the positive electrode. [2]

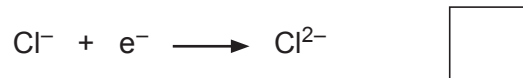
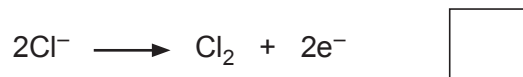
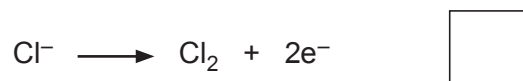
- (iii) The process occurring at the negative electrode is shown by the following equation.



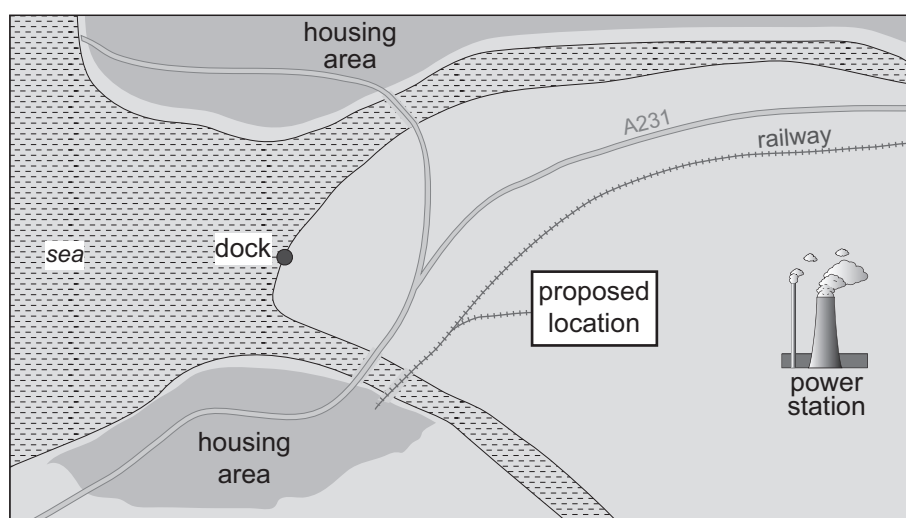
Use this **equation** to state what is meant by reduction. [1]



- (iv) Tick (✓) the equation that shows the reaction taking place at the positive electrode. [1]



- (c) The following diagram shows a proposed location for a new aluminium works in Wales.



Use the information in the diagram to explain why this would make a suitable location for an aluminium works. [6 QER]

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6. Crude oil can be separated into simpler mixtures, called fractions, which contain hydrocarbon compounds with boiling points in a similar range.

(a) The table lists the properties of some fractions obtained from crude oil.

Fraction	Number of carbon atoms in fraction	Boiling point range (°C)	Colour of fraction	Flame when burning	Ease of burning
fuel oil	1-4	-170 to 20	colourless	clean	very easy
petrol	5-10	20 to 70	pale yellow	clean	easy
naphtha	8-12	70 to 120	yellow	some soot	quite easy
kerosene	10-16	120 to 240	dark yellow	smoky	quite difficult
diesel oil	15-30	240 to 350	brown	smoky	difficult

Use the information in the table to describe how the burning of the fractions depends upon the size of the molecules. [2]

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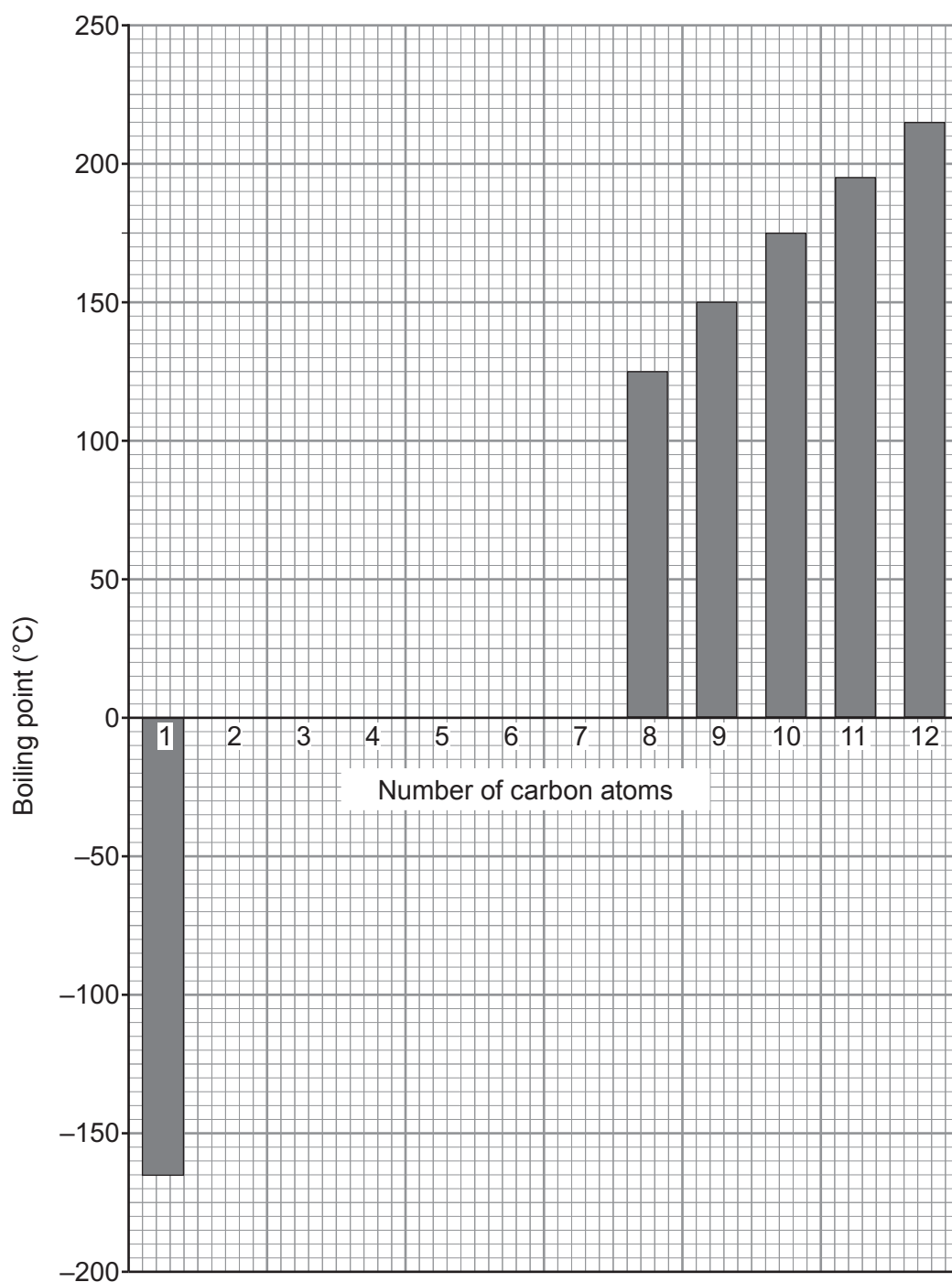
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- (b) The boiling points of hydrocarbons containing 1 to 12 carbon atoms are shown in the table below. The boiling point for the hydrocarbon with 7 carbon atoms is missing.

Number of carbon atoms	Boiling point (°C)
1	-165
2	-90
3	-40
4	10
5	35
6	70
7	
8	125
9	150
10	175
11	195
12	215



- (i) Complete the bar chart below. Some of the bars have already been drawn. [2]



- (ii) Use a ruler to draw a trend line **on the chart** and use this to estimate the boiling point of the hydrocarbon with 7 carbon atoms. [2]

Boiling point °C



(c) Many of the fractions obtained from crude oil are used as fuels.

(i) The fire triangle shows the factors necessary to start and maintain a fire.

State **one** method that could be used to safely put out a small amount of spilled petrol burning on the floor. Give the reason why your chosen method would work. [1]

Method

Reason

.....

(ii) One of the hydrocarbons in petrol is pentane, C_5H_{12} .

Complete and balance the symbol equation for the complete combustion of pentane. [2]



(iii) Hydrogen fuel cells are now used in many cars instead of petrol. The overall change inside a hydrogen fuel cell is the same as when hydrogen burns.

Explain why using hydrogen fuel cells in cars is better for the environment than petrol. [2]

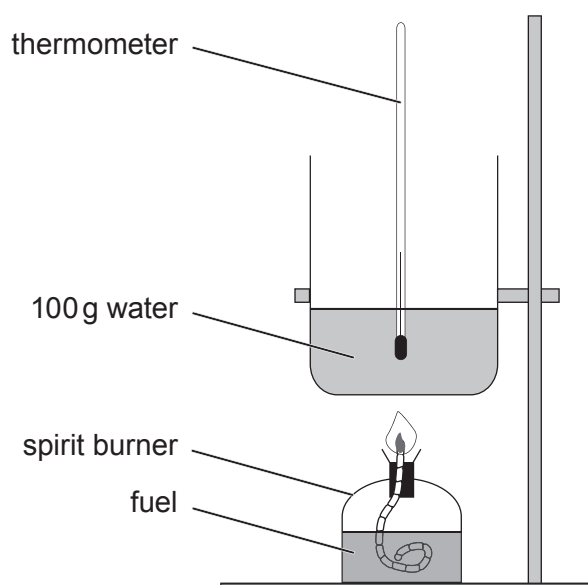
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- (d) It is possible to compare the energy released when different fuels are burned using the following apparatus.



To calculate the energy released per gram of fuel burned, the following equation is used.

$$\text{energy released per gram of fuel (J/g)} = \frac{\text{mass of water} \times 4.2 \times \text{temperature rise (}^{\circ}\text{C)}}{\text{mass of fuel used (g)}}$$

- (i) Apart from measuring the mass of water, describe **all** the measurements that would need to be taken to be able to calculate the energy released per gram of fuel burned. [2]

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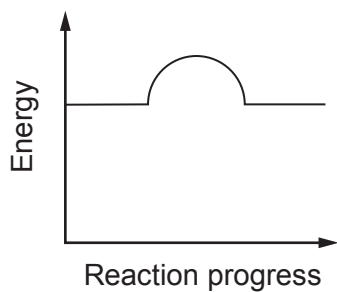
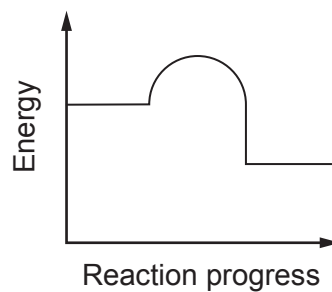
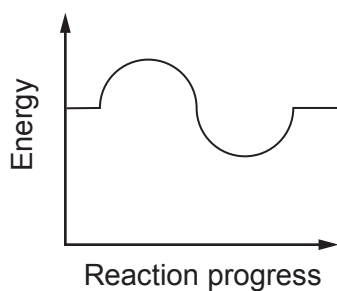
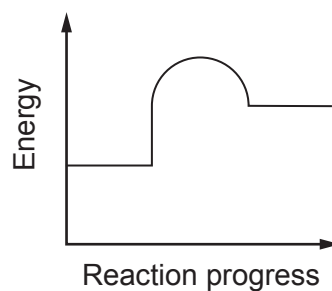
- (ii) When comparing the energy released from different fuels, 100 g of water should be used each time. State **one** other variable that should be controlled. [1]

.....

.....



(iii) Tick (✓) the energy profile diagram that represents the combustion of fuels. [1]

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
aluminium	Al^{3+}	bromide	Br^{-}
ammonium	NH_4^{+}	carbonate	CO_3^{2-}
barium	Ba^{2+}	chloride	Cl^{-}
calcium	Ca^{2+}	fluoride	F^{-}
copper(II)	Cu^{2+}	hydroxide	OH^{-}
hydrogen	H^{+}	iodide	I^{-}
iron(II)	Fe^{2+}	nitrate	NO_3^{-}
iron(III)	Fe^{3+}	oxide	O^{2-}
lithium	Li^{+}	sulfate	SO_4^{2-}
magnesium	Mg^{2+}		
nickel	Ni^{2+}		
potassium	K^{+}		
silver	Ag^{+}		
sodium	Na^{+}		
zinc	Zn^{2+}		





THE PERIODIC TABLE

Group

2

1

3

4

5

6

7

0

1	H	Hydrogen	1
---	---	----------	---

7	Li	Lithium	3
23	Na	Sodium	11
39	K	Potassium	19
86	Rb	Rubidium	37
133	Cs	Caesium	55
223	Fr	Francium	87
9	Be	Beryllium	4
24	Mg	Magnesium	12
40	Ca	Calcium	20
88	Sr	Strontium	38
137	Ba	Barium	56
226	Ra	Radium	88
45	Sc	Scandium	21
89	Y	Yttrium	39
139	La	Lanthanum	57
227	Ac	Actinium	89

11	B	Boron	5
27	Al	Aluminium	13
70	Ga	Gallium	31
115	In	Indium	49
204	Tl	Thallium	81
12	C	Carbon	6
28	Si	Silicon	14
73	Ge	Germanium	32
119	Sn	Tin	50
207	Pb	Lead	82
14	N	Nitrogen	7
31	P	Phosphorus	15
75	As	Arsenic	33
122	Sb	Antimony	51
209	Bi	Bismuth	83
16	O	Oxygen	8
32	S	Sulfur	16
79	Se	Selenium	34
128	Te	Tellurium	52
210	Po	Polonium	84
19	F	Fluorine	9
35.5	Cl	Chlorine	17
80	Br	Bromine	35
127	I	Iodine	53
210	At	Astatine	85
20	Ne	Neon	10
40	Ar	Argon	18
84	Kr	Krypton	36
131	Xe	Xenon	54
222	Rn	Radon	86

28

59	Co	Cobalt	27
56	Fe	Iron	26
55	Mn	Manganese	25
52	Cr	Chromium	24
51	V	Vanadium	23
48	Ti	Titanium	22
45	Sc	Scandium	21
59	Ni	Nickel	28
63.5	Cu	Copper	29
65	Zn	Zinc	30
106	Pd	Palladium	46
108	Ag	Silver	47
112	Cd	Cadmium	48
101	Ru	Ruthenium	44
103	Rh	Rhodium	45
104	Pd	Palladium	46
106	Pd	Palladium	46
108	Ag	Silver	47
112	Cd	Cadmium	48
115	In	Indium	49
119	Sn	Tin	50
122	Sb	Antimony	51
128	Te	Tellurium	52
127	I	Iodine	53
131	Xe	Xenon	54
137	Ba	Barium	56
179	Hf	Hafnium	72
181	Ta	Tantalum	73
184	W	Tungsten	74
186	Re	Rhenium	75
190	Os	Osmium	76
192	Ir	Iridium	77
195	Pt	Platinum	78
197	Au	Gold	79
201	Hg	Mercury	80
204	Tl	Thallium	81
207	Pb	Lead	82
209	Bi	Bismuth	83
210	Po	Polonium	84
210	At	Astatine	85
222	Rn	Radon	86

Key

A _r	relative atomic mass
Symbol	
Name	
Z	atomic number