Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Sample Assessment Material **Time: 1 hour**	Paper Reference **5CH2F/01**

You do not need any other materials.	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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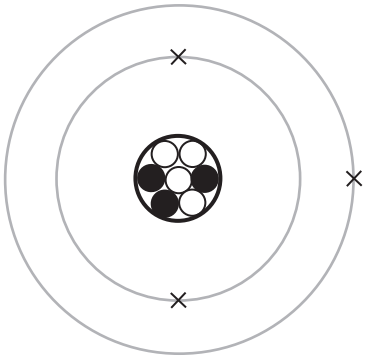
Answer ALL questions

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Atoms of elements

1 (a) The diagram shows the particles in a lithium atom.



Use the diagram to complete the table below for this atom.

(2)

number of protons	
mass number	

(b) Which row of the table shows the charges on a proton, a neutron and an electron?

Put a cross (☒) in the box next to your answer.

(1)

		proton	neutron	electron
☒	**A**	positive	negative	no charge
☒	**B**	positive	no charge	negative
☒	**C**	negative	no charge	positive
☒	**D**	positive	positive	negative

(c) Lithium is a metal.

How can you tell this by looking at the periodic table?

(1)

(d) Most of the mass of an atom is found in its nucleus.

Use ideas about the relative masses of atomic particles to explain why.

(2)

(e) When Mendeleev produced his periodic table, he left a gap between silicon and tin and predicted the properties of the element that would fit in the gap.

State why Mendeleev left this gap **and** what information he used to predict the properties of the missing element.

(2)

(Total for Question 1 = 8 marks)

Rates of reaction

2 Some chemical reactions are fast and some are slow.

frying an egg	an iron nail rusting	paper burning
a firework exploding	hydrochloric acid on marble chips	

(a) Which reaction in the box above is the fastest reaction?

(1)

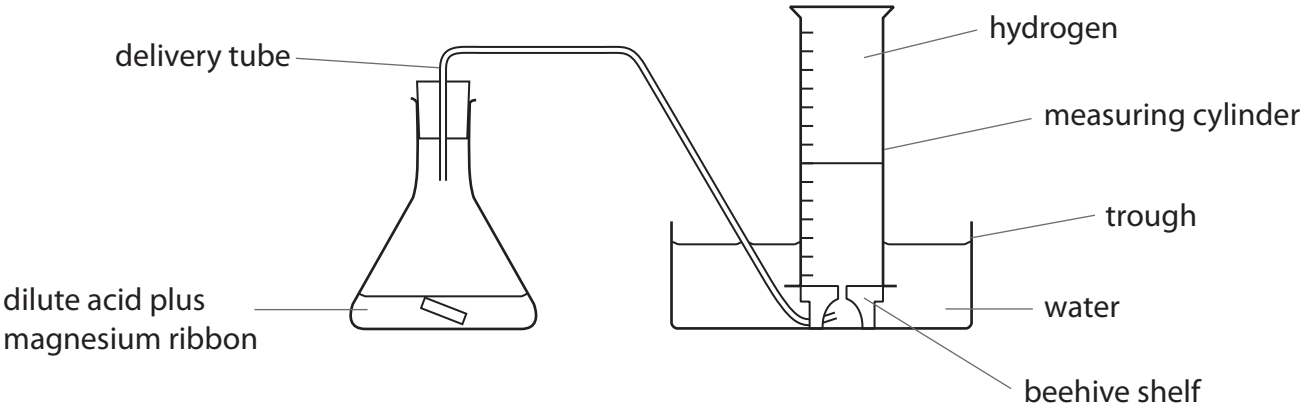
.....

.....

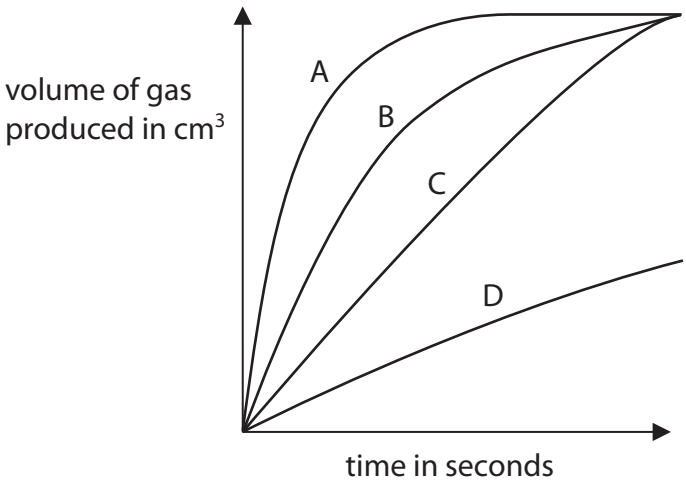
(b) Charlotte investigated the rate of reaction between magnesium ribbon and excess dilute hydrochloric acid. The reaction produces hydrogen gas.

She used the equipment shown in the diagram to carry out four experiments, A, B, C and D.

She **only** changed the temperature of the acid each time.



The graph shows her results.



(i) Which experiment had the fastest rate?

(1)

(ii) Which experiment has not finished?

(1)

(iii) Which of these could Charlotte use to speed up the reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** more of the same acid

☒ **B** less magnesium

☒ **C** smaller pieces of magnesium with the same total mass

☒ **D** a smaller conical flask

(c) (i) Omar investigated the use of possible catalysts in a chemical reaction.

He carried out the reaction without a catalyst.
He then carried out the same reaction a further three times. In each of these three experiments he added a small amount of X, Y or Z.

The results are shown in the table.

substance added	time to complete reaction (s)
none	120
X	10
Y	118
Z	118

Use these results to explain why X could be a catalyst but Y and Z are probably not catalysts.

(2)

(ii) Catalytic converters are used in many cars.
They are fitted in the exhaust system to convert harmful gases into less harmful ones.

Explain why the catalytic converter works better when the exhaust system is hot.

(2)

.....

.....

.....

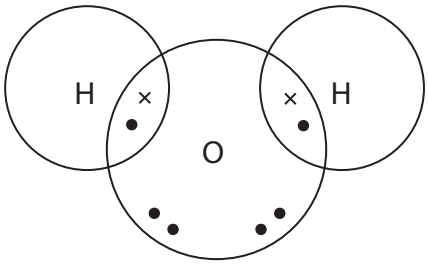
.....

(Total for Question 2 = 8 marks)

Water as a solvent

3 Water is often used as a solvent.

(a) The diagram shows the electrons in a water molecule.
On the oxygen atom, only the outer electrons are shown.



(i) Name the type of bonding present in a water molecule?

(1)

.....

(ii) Explain how this type of bond forms.

(2)

.....

.....

.....

.....

(iii) Water has a boiling point of 100 °C. Copper has a boiling point of 2600 °C.

Explain why water has a lower boiling point.

(2)

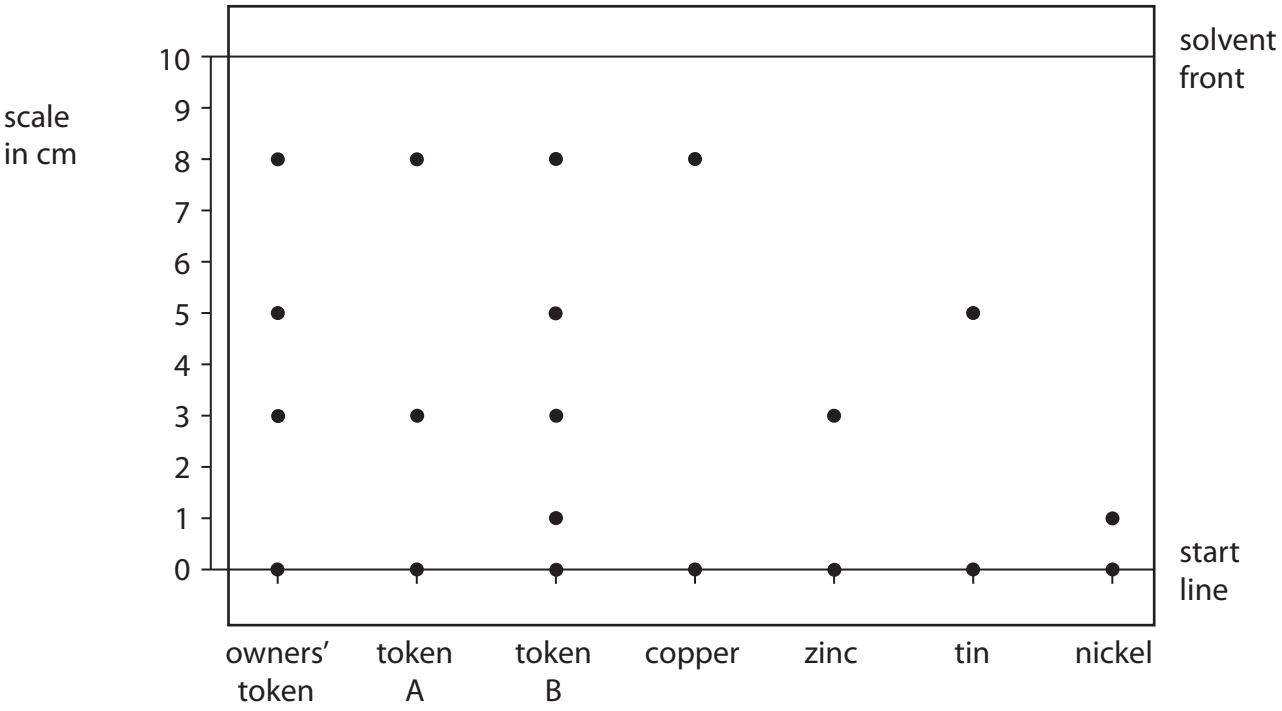
.....

.....

.....

.....

(b) Chromatography experiments often use water as a solvent.
A chemist helped the owners of a car wash to analyse the metal tokens being used in the car wash using chromatography.
The owners suspected that some fake tokens were being used.
The chemist reacted the metal tokens with an acid to make solutions.
He also used reference solutions of metal compounds in his experiment.
The diagram shows the chromatogram the chemist obtained.



(i) Use evidence from the chromatogram about the metals present in the tokens to explain how the chemist knows that both tokens A and B are fake.

(2)

.....

.....

.....

.....

(ii) Calculate the R_f value for the copper compound.

(2)

R_f = ...

(iii) Which of these techniques could also be used to identify the metals present in the tokens?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** paper chromatography

☒ **B** a filter funnel and filter paper

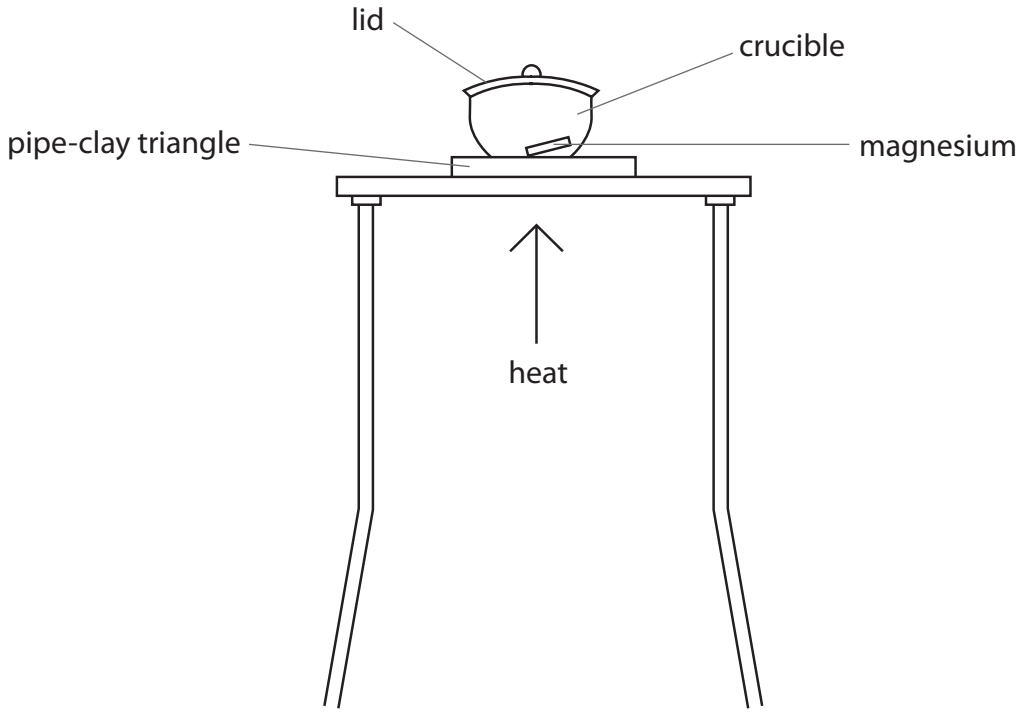
☒ **C** a separating funnel

☒ **D** precipitation

(Total for Question 3 = 10 marks)

Making compounds

4 Edward was making magnesium oxide by heating magnesium in a crucible.



(a) Occasionally, during the experiment, Edward lifted the lid of the crucible for a few seconds.

(i) Why did he lift the lid during the experiment?

(1)

.....

.....

(ii) The reaction is exothermic.

Complete the sentence by putting a cross (☒) in the box next to your answer.

An exothermic reaction is a reaction in which

(1)

☒ **A** two substances react to form one substance

☒ **B** energy is taken in

☒ **C** bonds are broken but new bonds are made

☒ **D** energy is given out

(iii) Complete and balance this equation for the reaction.

(2)

..... + ... → ..... MgO

(iv) Calculate the relative formula mass of magnesium oxide, MgO.
(Relative atomic masses: Mg = 24, O = 16)

(1)

.....

(b) These are Edward's results.

mass of crucible		= 12.00 g
mass of crucible +	magnesium	= 12.24 g
mass of crucible +	magnesium oxide	= 12.32 g
mass of magnesium		= 0.24 g
mass of magnesium oxide		= 0.32 g

The theoretical yield for this reaction was 0.40 g.

Calculate the percentage yield for Edward's experiment.

(2)

.....

.....

.....

.....

yield = ... %

(c) Explain why it is important when making compounds in industry that the production of waste products is kept to a minimum.

(3)

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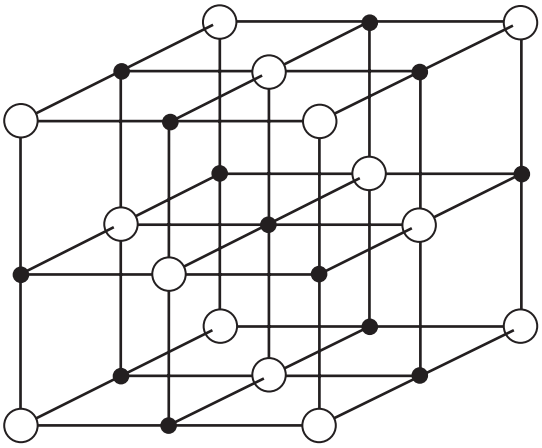
(Total for Question 4 = 10 marks)

5 Potassium chloride is an ionic solid made up of potassium ions and chloride ions.
The diagram shows the structure of potassium chloride.



(a) Describe the formation of potassium ions and chloride ions from potassium atoms and chlorine atoms.

(2)

.....

.....

.....

.....

(b) Which of these is most likely to be the melting point of potassium chloride?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** –8 °C

☒ **B** 8 °C

☒ **C** 80 °C

☒ **D** 800 °C

(c) What colour flame would be produced by potassium chloride in a flame test?

(1)

.....

(d) Explain why a precipitate forms when silver nitrate solution is added to sodium chloride solution.

(2)

*(e) Lead iodide is an insoluble salt.

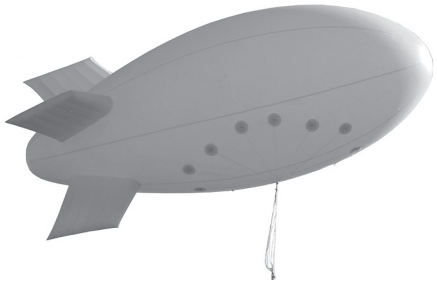
Describe the steps needed to prepare a pure, dry sample of lead iodide from solutions of lead nitrate and potassium iodide.
Your description should include safety precautions.

(6)

(Total for Question 5 = 12 marks)

Elements in the periodic table

6 Helium is a gas that is used to fill balloons so that they rise in the air.



(a) Early gas-filled balloons contained hydrogen.

Why is it safer to use helium instead of hydrogen?

(1)

.....

.....

(b) (i) The table contains information about helium and other elements in group 0 of the periodic table.

name	atomic number	density (g dm^{-3})	boiling point (°C)
helium	2	0.17	–269
neon	10	0.84	–246
argon	18	1.66	–186
krypton	36	3.46	–153

The density of air is 1.21 g dm^{-3}

Explain why helium, instead of any other gas from group 0, is used to fill balloons.

(2)

.....

.....

.....

(ii) Explain why helium does not form compounds.

(2)

.....

.....

.....

.....

(c) Sodium and potassium are metallic elements.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Solid sodium and potassium conduct electricity because

(1)

☒ **A** they contain ions that move

☒ **B** they contain delocalised electrons that move

☒ **C** the electrons knock into each other passing on the current

☒ **D** friction between electrons and ions generates electricity

*(d) Both sodium and potassium react with water.

Compare the reactions of the two metals with water. Your comparison should include similarities and differences.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Unit C2: Discovering Chemistry (Foundation Tier)

Question Number	Answer	Acceptable answers	Mark
1(a)	3 7	answers must be in this order	 **(2)**

Question Number	Answer	Mark
1(b)	**B**	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)	(it is) on the left-hand side/(it is) in group 1/alkali metals	**not** from the position/where it is	**(1)**

Question Number	Answer	Mark
1(d)	an explanation linking the following: protons and neutrons are in the nucleus (1) (and) they are both heavy/heavier than electrons/have relative mass of 1 (1)	 **(2)**

Question Number	Answer	Mark
1(e)	to keep elements with similar properties in the same group/column (1) the properties of silicon and tin/other elements in the group/column (1)	 **(2)**

TOTAL: 8 MARKS

Question Number	Answer	Mark
2(a)	a firework exploding	**(1)**

Question Number	Answer	Mark
2(b)(i)	experiment A	**(1)**

Question Number	Answer	Mark
2(b)(ii)	experiment D	**(1)**

Question Number	Answer	Mark
2(b)(iii)	**C**	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	an explanation that links the following: X reduces the time/increases the rate (1) (unlike) Y and Z that cause a small decrease (1)	 Y and Z do not change the reaction time/rate (significantly)	**(2)**

Question Number	Answer	Mark
2(c)(ii)	an explanation that links the following: rate of reaction increased/reaction faster (1) (because) particles molecules moving faster/with more energy more (frequent/successful) collisions (1)	**(2)**

TOTAL: 8 MARKS

Question Number	Answer	Mark
3(a)(i)	covalent	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	An explanation that includes the following: sharing of electrons to form a bond (1) pair/two electrons (one from hydrogen and one from oxygen) (1)	dependent on 1st mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)(iii)	an explanation that links the following: weak forces between water molecules (1) (so) little energy/heat to overcome (these forces) (1)	Stronger forces between particles in copper (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	an explanation for each token: A does not contain tin (whereas the original token does) (1) B also contains nickel (whereas the original token does not) (1)	A only contains two metals B contains four metals "patterns for A and B are different from the owners' token" is worth (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	8 and 10 chosen (1) 0.8 (1)	0.8 alone gains two marks	**(2)**

Question Number	Answer	Mark
3(b)(iii)		**(1)**

TOTAL: 10 MARKS

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	to let in oxygen/to ensure all magnesium has reacted	to let in air	**(1)**

Question Number	Answer	Mark
4(a)(ii)	**D**	**(1)**

Question Number	Answer	Mark
4(a)(iii)	$2Mg + O_2 \rightarrow 2MgO$ correct formulae reactants (1) balancing of correct formulae (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iv)	40	ignore any units	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	$\frac{0.32}{0.40} \times 100$ (1) 80 (%) (1)	 accept final answer for 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	an explanation to include: producing waste uses up raw materials (1) and has to be disposed of properly (1) (so) less waste means higher profit (1)	 waste causes environmental/social/health problems (1) (so) has to be disposed of properly (1) (which) costs money (1)	**(3)**

TOTAL: 10 MARKS

Question Number	Answer	Acceptable answers	Mark
5(a)	a description that includes the following: **one** electron moves/transferred (1) from potassium (atom) to chlorine (atom) (1)	 chloride	 **(2)**

Question Number	Answer	Mark
5(b)	**D**	**(1)**

Question Number	Answer	Mark
5(c)	lilac	**(1)**

Question Number	Answer	Mark
5(d)	an explanation that links the following: silver ions attract chloride ions/silver chloride forms (1) (which precipitates because) this is (an) insoluble (salt) (1)	 **(2)**

Question Number		Indicative content	Mark
***5(e) QWC**		a description including some of the following: • mixing solutions in suitable container (beaker/ flask) • filtering off the precipitate, including apparatus • washing the precipitate • drying the precipitate (oven/between filter papers) • use of safety spectacles/goggles • awareness that lead salts are toxic, with suitable precautions some credit could be gained from diagrams	**(6)**
Level	**0**	No rewardable material	
1	**1–2**	• a limited description of the steps needed to make the salt, with many of the steps missing **or** in the wrong order, and the process described is unlikely to lead to the desired outcome • little awareness of safety precautions • communicates ideas using simple language and little scientific terminology • spelling, punctuation and grammar are used with little accuracy	
2	**3–4**	• a description of the key steps needed to make the salt, with a few steps either missing or inaccurate, but the process described would in part lead to the desired outcome • some awareness of safety precautions • communicates ideas showing some evidence of clarity and organisation and uses some scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5–6**	• a clear description of the steps involved in making the salt, **and** the steps are in the correct order • good awareness of safety precautions • communicates ideas clearly and uses scientific terminology appropriately • spelling, punctuation and grammar are used with few errors	

TOTAL: 12 MARKS

Question Number	Answer	Acceptable answers	Mark
6(a)	helium inert/not flammable/unreactive	hydrogen burns/flammable/reactive ignore references to noble gas	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	an explanation that links: helium has lowest density/lower density than air (1) (whereas) argon or krypton are more dense than air/neon less dense than air but not as low as helium (1)	do not accept references to other properties	**(2)**

Question Number	Answer	Mark
6(b)(ii)	An explanation that links: 2 electrons in outer shell/full outer shell (1) (which is) a stable electron arrangement that does not need to lose or gain electrons/combine with other atoms to be stable (1)	**(2)**

Question Number	Answer	Mark
6(c)	**B**	**(1)**

Question Number		Indicative content	Mark
*6(d) QWC		responses should include references to the following: • an account of what is seen during the reaction, the metals move quickly around on the surface of the water, form into balls, fizzing/bubbles formed. With potassium, a lilac flame is seen • compare the similarities and differences between the reactions of the two metals, reactions similar but potassium reacts more violently and quickly than sodium • describe the chemical reactions taking place, e.g. metal hydroxides and hydrogen are produced, or a word/balanced equation	(6)
Level	0	No rewardable material	
1	1–2	• a basic description about what would be seen during the reactions; reference to metals moving/whizzing around • a limited attempt to compare the reactions of the two metals; there may be few or no differences noted • a limited attempt to describe the chemical reactions taking place; there may be a reference to a gas being given off • communicates ideas using simple language and little scientific terminology • spelling, punctuation and grammar are used with little accuracy	
2	3–4	• a description of what would be seen in the reactions, referring to the metals moving/whizzing about, possibly mentioning colours and gases given off • the reactions of the two metals are compared, and it is noted that one metal reacts faster/more violently than the other • there is an attempt to describe the chemical reaction taking place. There will be reference to a gas (hydrogen) given off • communicates ideas showing some evidence of clarity and organisation and uses some scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	5–6	• a clear description about what would be seen during each reaction, with the differences noted • the similarities and differences between the two reactions are described, particularly the more violent/faster reaction of potassium • the chemical reaction taking place will be described. Reference will be made to the gas hydrogen being given off. There may be reference to the production of a metal hydroxide in each case • communicates ideas clearly and uses scientific terminology appropriately • spelling, punctuation and grammar are used with few errors	

TOTAL: 12 MARKS

