

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A172/01

TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A

Modules C4 C5 C6

(Foundation Tier)

MONDAY 10 JUNE 2013: Afternoon

DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED 18pt

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil


Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer ALL the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 60.
- Any blank pages are indicated.
- The Periodic Table is printed on page 35.
- A list of qualitative tests for ions is printed on pages 4 and 5.

BLANK PAGE

TWENTY FIRST CENTURY SCIENCE DATA SHEET

QUALITATIVE ANALYSIS

TESTS FOR IONS WITH A POSITIVE CHARGE

Ion	Test	Observation
calcium Ca²⁺	add dilute sodium hydroxide	a white precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
copper Cu²⁺	add dilute sodium hydroxide	a light blue precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(II) Fe²⁺	add dilute sodium hydroxide	a green precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
iron(III) Fe³⁺	add dilute sodium hydroxide	a red-brown precipitate forms; the precipitate does not dissolve in excess sodium hydroxide
zinc Zn²⁺	add dilute sodium hydroxide	a white precipitate forms; the precipitate dissolves in excess sodium hydroxide

TESTS FOR IONS WITH A NEGATIVE CHARGE

Ion	Test	Observation
carbonate CO_3^{2-}	add dilute acid	the solution effervesces; carbon dioxide gas is produced (the gas turns lime water from colourless to milky)
chloride Cl^-	add dilute nitric acid, then add silver nitrate	a white precipitate forms
bromide Br^-	add dilute nitric acid, then add silver nitrate	a cream precipitate forms
iodide I^-	add dilute nitric acid, then add silver nitrate	a yellow precipitate forms
sulfate SO_4^{2-}	add dilute acid, then add barium chloride or barium nitrate	a white precipitate forms

Answer ALL the questions.

- 1 Hydrogen reacts with the elements in Group 7 of the Periodic Table.**

Hydrogen and fluorine explode when they are mixed together.

The word equation for the reaction is

hydrogen + fluorine → hydrogen fluoride

- (a) Join the boxes to show the correct formula for each chemical in the reaction.**

hydrogen

HF

fluorine

F₂

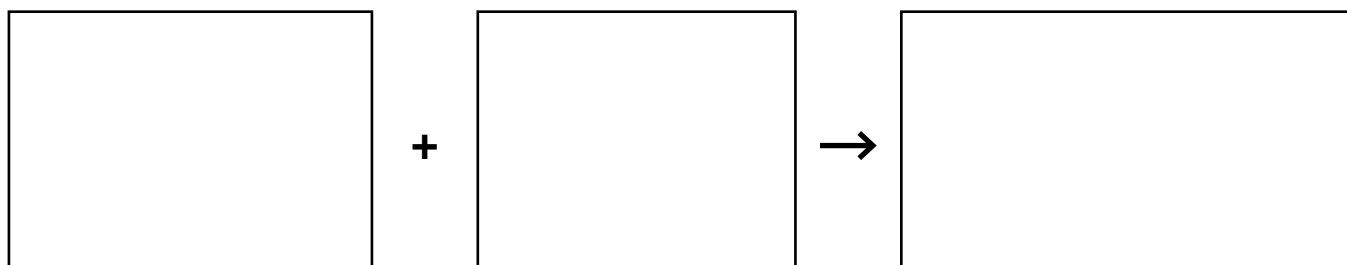
hydrogen fluoride

H₂

[2]

(b) Chlorine is also in Group 7.

Fill in the boxes to show the WORD EQUATION for the reaction between HYDROGEN and CHLORINE.



[2]

(c) Iodine is another Group 7 element.

It also reacts with hydrogen.

Predict the correct formula for the compound that is made when hydrogen reacts with IODINE.

Put a ring around the correct answer.

Cl_2

H_2

I_2

HI

HCl

[1]

(d) The table below shows what happens when fluorine, chlorine and iodine react with hydrogen.

Element	Reaction when mixed with hydrogen
fluorine	explodes at room temperature
chlorine	a small spark is enough to make the mixture explode
iodine	reacts slowly when heated strongly

(i) Look at the order of fluorine, chlorine and iodine in Group 7 of the Periodic Table.

How does the reactivity of the Group 7 elements with hydrogen change as you go down the group?

[1]

(ii) What do you predict about the reaction between bromine and hydrogen?

Put a tick (✓) in the box next to the best answer.

Hydrogen reacts with bromine when it is heated.

☐

Bromine is too unreactive to react with hydrogen.

☐

Hydrogen reacts with bromine more quickly than with chlorine.

☐

Hydrogen reacts with bromine more slowly than with iodine.

☐

[1]

[TOTAL: 7]

2 Sodium and potassium are elements in Group 1 of the Periodic Table.

Jake watches a video of the reaction between sodium and water. A small piece of the sodium bursts into flames on top of the water.

(a) What is made when sodium reacts with water?

Put a ring around each of the TWO correct answers.

CARBON DIOXIDE

HYDROGEN

OXYGEN

SODIUM CHLORIDE

SODIUM HYDROXIDE

[2]

(b) Jake thinks that the reaction makes an alkali.

How could you show that a solution has an alkaline pH?

[2]

(c) Jake watches another video. This video shows the reaction of POTASSIUM with water.

How is this reaction different from the reaction of sodium with water?

Put ticks (✓) in the boxes next to the TWO correct answers.

The two reactions make different gases.

☐

The reaction of sodium takes less time than the reaction of potassium.

☐

The reaction with potassium makes an acid.

☐

The two reactions have different rates.

☐

The two reactions make different alkalis.

☐

[1]

(d) Why is it a good idea for Jake to watch videos of the reactions rather than do them himself?

Put a tick (✓) in the box next to the correct answer.

The reactions are too slow.

☐

Sodium and potassium are hazardous to handle.

☐

The chemicals must be heated to a very high temperature before they react.

☐

The gas that is made is toxic.

☐

[1]

[TOTAL: 6]

- 3 Alex plans to write an article about flame colours for a school science magazine.**

He researches the flame colours of some compounds of metals from Group 1 in the Periodic Table.

He talks about his findings with other science students in an internet chat room.

ALEX Hi everyone. Have any of you done any research into flame test colours for Group 1? I have found out that potassium and rubidium both give purple flames. I think that each group has its own flame colour.

BEA I've checked out your research and I agree about the flame colours for potassium and rubidium. I just looked up caesium and that's purple too!

CARL I flame-tested some Group 2 elements, none of them were purple. They were all different colours.

DAN Sodium is in Group 1 and gives a yellow flame.

ELLY I've looked on the internet and I can't find any elements that give purple flame colours except the ones in Group 1.

FAY Lithium doesn't have a purple flame.

(a) Why is it a good idea for Alex to chat to other students about his work before he writes his article?

[2]

(b) Alex's ideas are that in flame tests:

**all the elements in a group of the Periodic Table
have the same flame colour**

each group has its own flame colour.

**Explain how each piece of evidence in the chat
SUPPORTS or DOES NOT SUPPORT Alex's ideas.**



**The quality of written communication will
be assessed in your answer.**

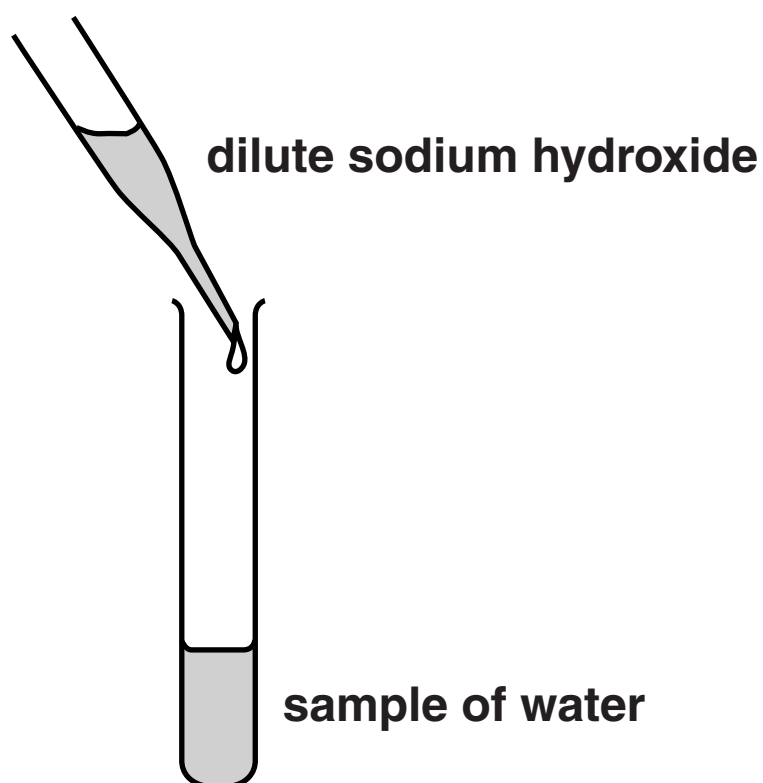
[6]

[TOTAL: 8]

4 Joe investigates water that contains calcium ions.

(a) Joe knows that dilute sodium hydroxide can be used to show if water contains calcium ions.

He tests a sample of pure water and a sample of water that contains calcium ions.



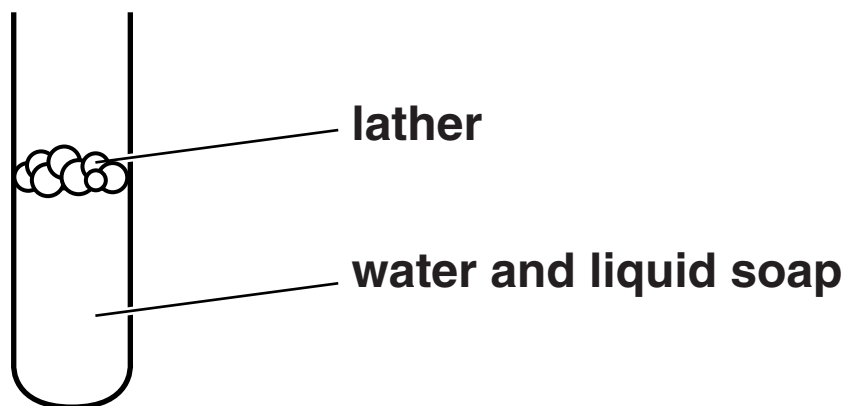
Describe what Joe sees when he adds excess sodium hydroxide to each sample of water.

Use the data sheet on pages 4 and 5 to help you.

[3]

- (b) Joe finds out that adding liquid soap to water gives a 'lather'.**

A lather is a layer of bubbles on the water.



**Joe counts how many drops of soap he needs to make a lather with pure water and with water that contains calcium ions.
He also tests samples of water from different places.**

- (i) What must Joe keep the same to make his experiment a fair test?**

[1]

(ii) These are Joe's results.

Type of water	Pure water	Water containing calcium ions	Water from London	Water from Birmingham	Water from Plymouth
Number of drops of soap to make a lather	3	18	17	11	4

What conclusions can Joe make from his results?



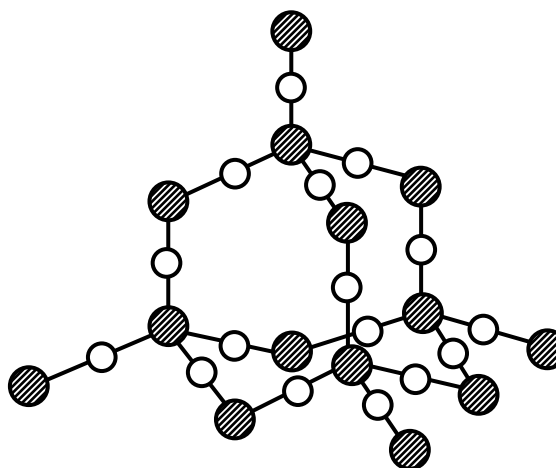
The quality of written communication will be assessed in your answer.

[6]

[TOTAL: 10]

5 Carbon dioxide and silicon dioxide are compounds that occur naturally.

Their structures are shown below.



The table shows some information about the two compounds.

	carbon dioxide	silicon dioxide
formula	CO₂	SiO₂
melting point in °C	-78	1710
boiling point in °C	-57	2230
electrical conductivity	does not conduct	does not conduct

- (a) Which of the statements are **ONLY TRUE FOR CARBON DIOXIDE**, **ONLY TRUE FOR SILICON DIOXIDE** or **TRUE FOR BOTH**?
Put one tick (✓) in each row.

	Only true for carbon dioxide (✓)	Only true for silicon dioxide (✓)	True for both (✓)
contains small molecules with a few atoms in each			
has a giant structure			
contains covalent bonds			
is a gas at room temperature			

[3]

(b) Which statement about where carbon dioxide and silicon dioxide are found is correct?

Put a tick (✓) in the box next to the correct answer.

They are both found in the atmosphere.

☐

Silicon dioxide is only found in the hydrosphere, carbon dioxide is only found in the lithosphere.

☐

Both carbon dioxide and silicon dioxide are only found in the lithosphere.

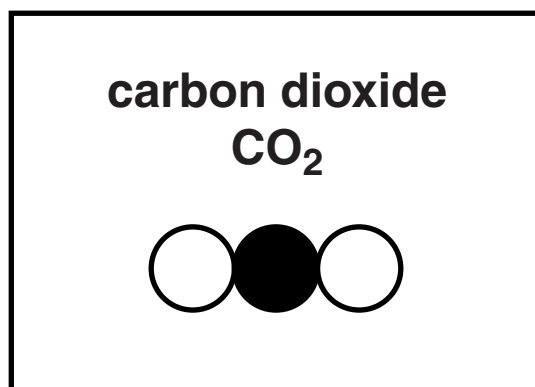
☐


Carbon dioxide is found in the atmosphere, silicon dioxide is found in the lithosphere.

☐

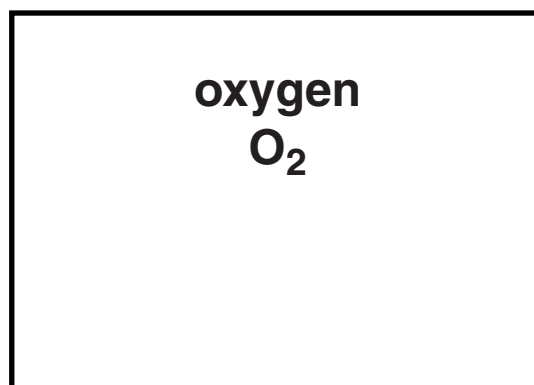
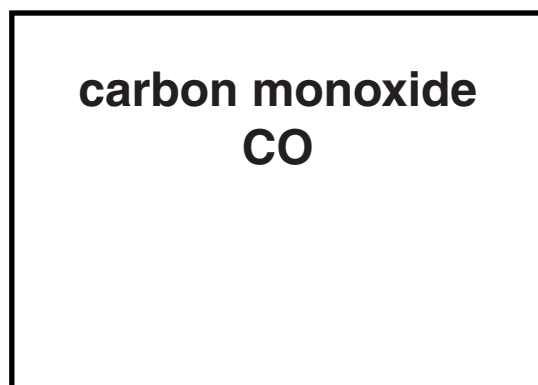
[1]

(c) A molecule of carbon dioxide is shown in the box.



Use the symbols  and  to draw molecules of carbon monoxide and oxygen.

You can use each symbol more than once.



[2]

[TOTAL: 6]

- 6 A mining company wants to find a new area to mine for metals.

The company tests rock from two possible sites for a new mine.

The table shows their results.

Elements in the rock	Percentage of each element in rock from site A	Percentage of each element in rock from site B
oxygen	47	38
silicon	28	21
aluminium	8	18
iron	5	10
copper	0	0.5
other elements		12.5

- (a) What percentage of OTHER ELEMENTS are in the rock taken from site A?

_____ % [2]

(b) What are the main SIMILARITIES between the rocks taken from the two sites?

[2]

(c) The company wants to mine for metals.

Which site is better?

Explain your reasoning.

[2]

[TOTAL: 6]

- 7 (a) Two different copper compounds react with sulfuric acid to make copper sulfate.**

Complete the word equations opposite.

Choose from this list.

COPPER CARBONATE

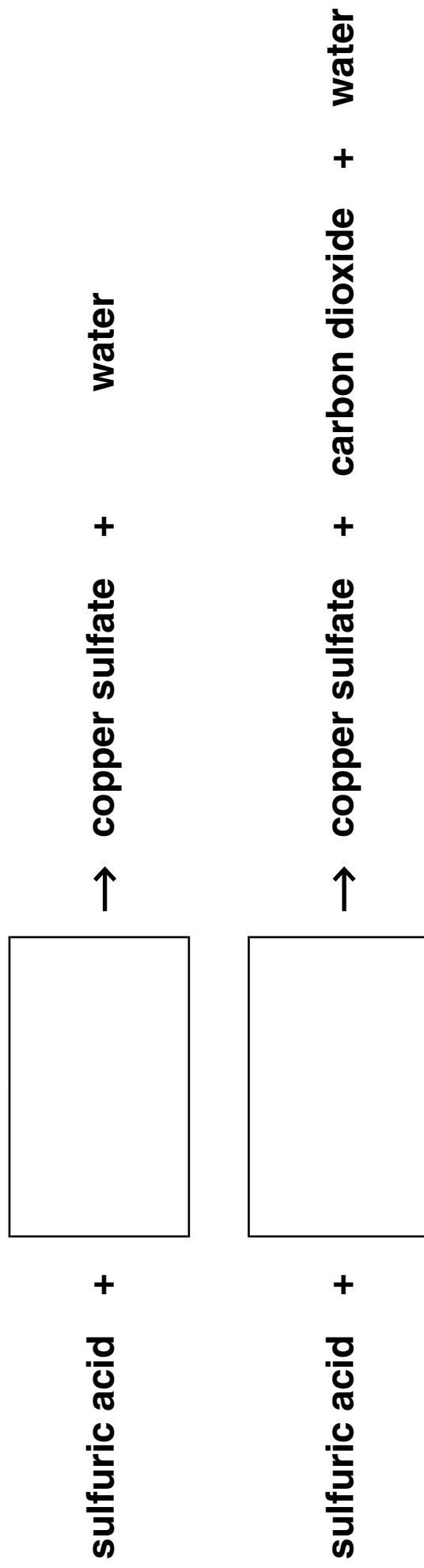
COPPER CHLORIDE

COPPER OXIDE

COPPER NITRATE

COPPER SULFATE

[2]



(b) Other acids also react to make copper compounds.

Draw lines to connect each COPPER COMPOUND on the left to the correct ACID THAT CAN BE USED TO MAKE IT on the right.

**COPPER
COMPOUND**

copper chloride

copper nitrate

copper citrate

**ACID THAT CAN BE
USED TO MAKE IT**

citric acid

ethanoic acid

hydrochloric acid

nitric acid

[2]

- (c) Pure acids have different states. Some are solids, some are liquids and some are gases.

Draw lines to connect each ACID on the left to its correct STATE SYMBOL on the right.

ACID

**STATE
SYMBOL**

(s)

sulfuric acid (liquid)

(g)

citric acid (solid)

(aq)

(l)

[1]

[TOTAL: 5]

8 The table shows some information about the relative formula masses for some compounds.

Name of compound	Formula	Relative atomic masses of atoms in the formula		Relative formula mass of compound
lithium chloride	LiCl	Li	7	$7 + 35.5 = 42.5$
		Cl	35.5	
sodium chloride	NaCl	Na	23	$23 + 35.5 = 58.5$
		Cl	35.5	
potassium chloride	KCl	K	39	$39 + 35.5 = 74.5$
		Cl	35.5	

(a) Explain the differences between the relative formula masses of these three compounds.

[2]

(b) Lithium fluoride is another compound of lithium.

The formula for lithium fluoride is LiF.

- (i) Use the Periodic Table to find the relative atomic mass of fluorine.**

Relative atomic mass of fluorine

= _____ [1]

- (ii) Use your answer to work out the relative formula mass of lithium fluoride.**

Relative formula mass of lithium fluoride, LiF

= _____ [1]

[TOTAL: 4]

9 Tom is doing a presentation on energy changes in reactions.

He uses slides that show the energy changes when lithium chloride and potassium chloride dissolve in water.

Tom uses the slides to explain:

what exothermic and endothermic mean

how you can tell which reaction is exothermic and which is endothermic.

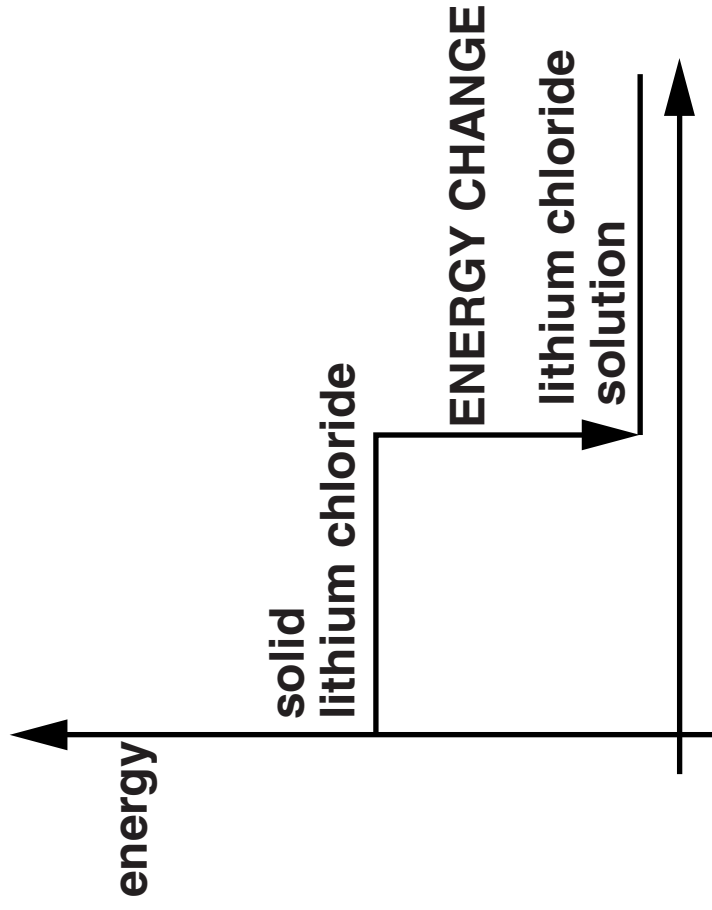
(a) Write down what Tom should say.



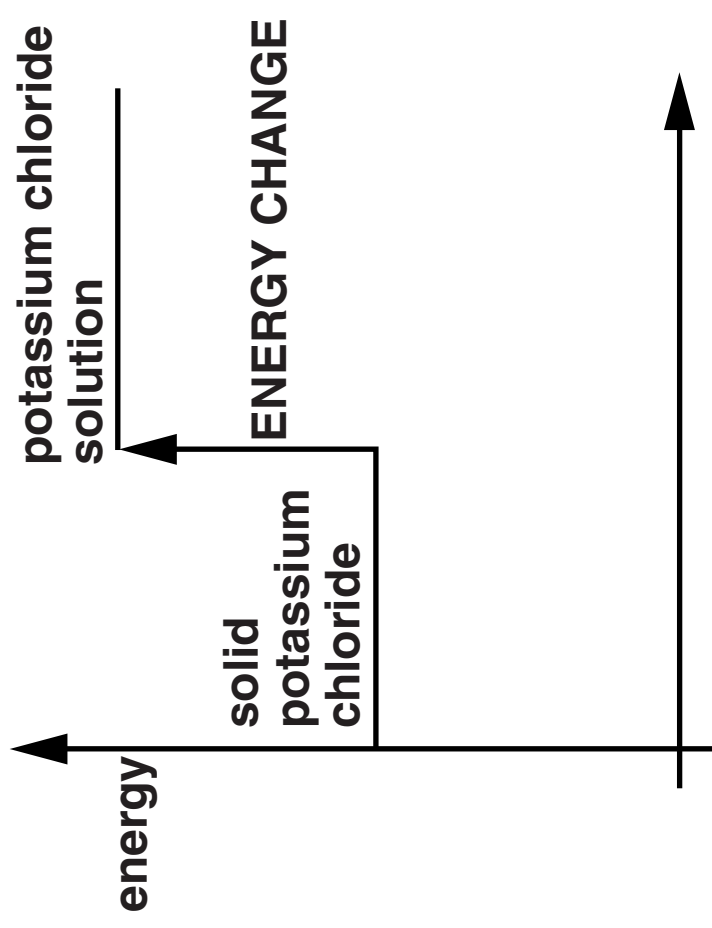
The quality of written communication will be assessed in your answer.

[6]

SLIDE 1



SLIDE 2



- (b) The energy changes for reactions in industry are carefully controlled.
Why is this important?**

Put ticks (✓) in the boxes next to the TWO best answers.

Energy given out by reactions can be used to heat buildings. ☐

Reactions that give out energy use too much fuel to keep them hot. ☐

Energy changes in reactions affect the rate. ☐

Containers for reactions may be damaged by extreme temperatures. ☐

Reactions that take in energy need to be continuously cooled. ☐

[2]

[TOTAL: 8]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2	3					4	5	6	7	0
		1 H hydrogen 1									4 He helium 2
		Key									
		relative atomic mass atomic symbol name atomic (proton) number									
7 Li lithium 3	9 Be beryllium 4										
23 Na sodium 11	24 Mg magnesium 12										
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 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
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	
Elements with atomic numbers 112-116 have been reported but not fully authenticated											
[222] Rn radon 86											

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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