

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCSE

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Higher Tier

Wednesday 7 November 2012 – Morning

Time: 1 hour

Paper Reference

5CH2H/01

You must have:

Calculator, ruler

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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PEARSON



The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
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
207 Pb lead 82	208 Bi bismuth 83	209 Po polonium 84	210 At astatine 85	211 Rn radon 86	212 Fr francium 87	213 Ra radium 88	214 Ac* actinium 89	215 Th thorium 90
119 In indium 49	120 Cd cadmium 48	121 Ag silver 47	122 Cd cadmium 48	123 Pd palladium 46	124 Cd cadmium 48	125 Ag silver 47	126 Pd palladium 46	127 Cd cadmium 48
204 Tl thallium 81	205 Pb lead 82	206 Bi bismuth 83	207 Po polonium 84	208 At astatine 85	209 Rn radon 86	210 Fr francium 87	211 Ra radium 88	212 Ac* actinium 89
201 Hg mercury 80	202 Tl thallium 81	203 Pb lead 82	204 Bi bismuth 83	205 Po polonium 84	206 At astatine 85	207 Rn radon 86	208 Fr francium 87	209 Ra radium 88
108 Ag silver 47	109 Cd cadmium 48	110 Pd palladium 46	111 Cd cadmium 48	112 Ag silver 47	113 Pd palladium 46	114 Cd cadmium 48	115 Ag silver 47	116 Pd palladium 46
65 Cu copper 29	66 Zn zinc 30	67 Ni nickel 28	68 Cu copper 29	69 Ni nickel 28	70 Zn zinc 30	71 Ni nickel 28	72 Cu copper 29	73 Zn zinc 30
131 Xe xenon 54	132 I iodine 53	133 Te tellurium 52	134 I iodine 53	135 Xe xenon 54	136 At astatine 85	137 Rn radon 86	138 Fr francium 87	139 Ra radium 88
84 Kr krypton 36	85 Br bromine 35	86 Se selenium 34	87 Br bromine 35	88 Kr krypton 36	89 Se selenium 34	90 Br bromine 35	91 Kr krypton 36	92 Se selenium 34
40 Ar argon 18	39 Cl chlorine 17	38 S sulfur 16	39 Cl chlorine 17	40 Ar argon 18	41 S sulfur 16	42 Cl chlorine 17	43 Ar argon 18	44 S sulfur 16
20 Ne neon 10	19 F fluorine 9	18 O oxygen 8	19 F fluorine 9	20 Ne neon 10	21 O oxygen 8	22 F fluorine 9	23 Ne neon 10	24 O oxygen 8
4 He helium 2	3 H hydrogen 1	2 He helium 2	3 H hydrogen 1	4 He helium 2	5 H hydrogen 1	6 He helium 2	7 H hydrogen 1	8 He helium 2

Key
relative atomic mass
atomic symbol
name
atomic (proton) number

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* 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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Questions begin on next page.



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 ☒.

Compounds

1 The table shows some properties of six compounds.

compound	melting point / °C	boiling point / °C	solubility in water	electrical conductivity of solution
copper sulfate	200	decomposes	soluble	high
hexane	-95	69	insoluble	does not dissolve
hydrogen chloride	-112	-85	soluble	high
octane	-57	126	insoluble	does not dissolve
silicon(IV) oxide	1610	2230	insoluble	does not dissolve
sodium chloride	801	1413	soluble	high

(a) Which of the following lists of compounds from the table contains only ionic compounds?

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

(1)

- A copper sulfate, octane and sodium chloride
- B silicon(IV) oxide and sodium chloride
- C copper sulfate and sodium chloride
- D copper sulfate and silicon(IV) oxide

(b) Two of the compounds in the table produce a colour in a flame test.

Give the name of **one** of these compounds and the colour it produces in the flame test.

(2)

compound

colour



(c) Hexane is a covalent compound containing simple molecules.
It has a low boiling point.

(i) Explain why it has a low boiling point.

(2)

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(ii) Hexane and water are immiscible.

Describe how separate samples of hexane and water can be obtained from a mixture of hexane and water.

(2)

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(d) Draw a dot and cross diagram of a molecule of hydrogen chloride.

Show outer electrons only.

(2)

(Total for Question 1 = 9 marks)



Alkali metals

- 2 Lithium, sodium and potassium are metals in group 1 of the periodic table. They are good conductors of heat and electricity. The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

(1)

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

(2)

(b) A small piece of potassium is added to water.

(i) Describe what you would **see** in this reaction.

(2)

(ii) Which of these is the balanced equation for this reaction?

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

(1)

- A** $2\text{K} + 2\text{H}_2\text{O} \rightarrow \text{K}_2\text{O} + 2\text{H}_2$
- B** $2\text{K} + \text{H}_2\text{O} \rightarrow \text{K}_2\text{O} + \text{H}_2$
- C** $4\text{K} + 3\text{H}_2\text{O} \rightarrow 4\text{KOH} + \text{H}_2$
- D** $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$



(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.

Explain this increase in reactivity.

(2)

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(Total for Question 2 = 8 marks)



Elements in the periodic table

3 The positions of five elements, **A**, **B**, **C**, **D** and **E**, are shown in the periodic table.

These letters are not the atomic symbols of these elements.

1	2							3	4	5	6	7	0
											D		E
A													
B													
							C						

(a) Use only elements **A**, **B**, **C**, **D** and **E** to answer (i) and (ii).

(i) Give the letters of **all** the elements that are metallic.

(1)

(ii) Give the letters of the **two** elements that have the most similar chemical properties.

(1)

(b) An atom of element **B** contains more protons than an atom of element **A**.

State how many more protons there are in an atom of element **B** than in an atom of element **A**.

(1)



(c) An atom of element **E** has atomic number 10 and mass number 22.

(i) How many electrons does this atom contain?

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

(1)

A 10

B 12

C 22

D 32

(ii) 10% of the atoms in a sample of element **E** have a mass number of 22.
All the other atoms in this sample have a mass number of 20.

Calculate the relative atomic mass of element **E**.

(3)

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relative atomic mass =

(d) The element below **E** in the periodic table is used to fill filament light bulbs.

Explain why this element is suitable for this use.

(2)

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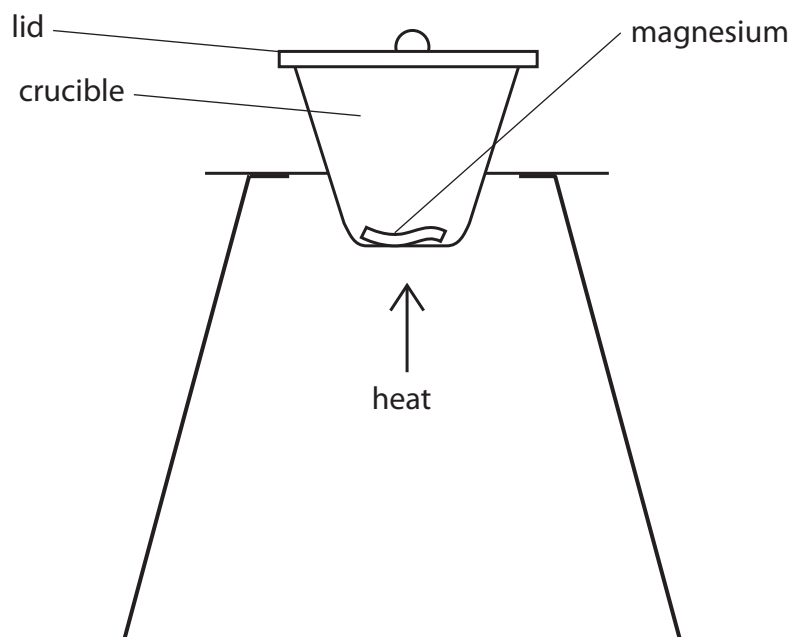
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(Total for Question 3 = 9 marks)



Magnesium oxide

4 The diagram shows a piece of magnesium ribbon being heated.



During the heating, the magnesium reacts with oxygen from the air. The lid of the crucible was raised slightly from time to time. Magnesium oxide was formed as a white powder. The experiment was repeated with different masses of magnesium.

The table shows the mass of magnesium used and the mass of the magnesium oxide formed in each experiment.

experiment	mass of magnesium used /g	mass of magnesium oxide formed /g	mass of oxygen in magnesium oxide /g
1	0.10	0.16	0.06
2	0.15	0.24	0.09
3	0.25	0.40	0.15
4	0.30	0.48	0.18
5	0.35	0.49	0.14
6	0.50	0.80	0.30

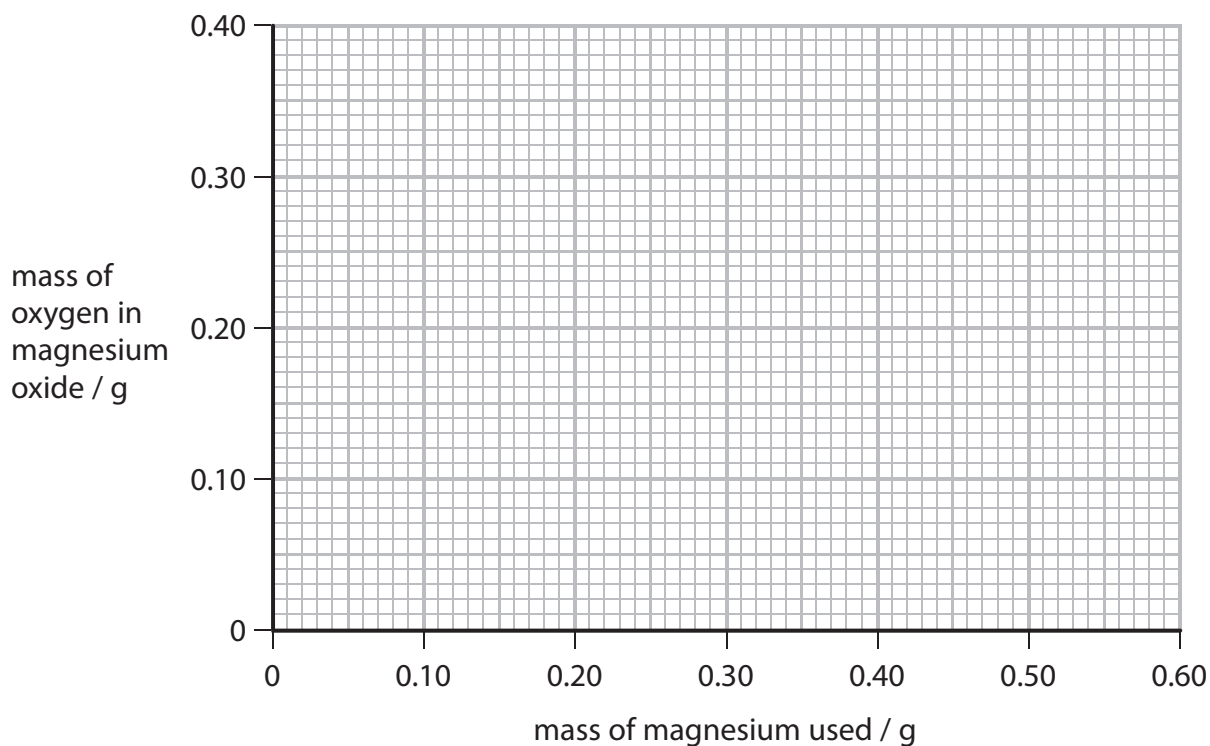


(a) Suggest why the lid had to be raised from time to time during the experiment. (1)

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(b) (i) On the grid provided, draw a graph of the mass of oxygen in magnesium oxide against the mass of magnesium used. (3)



(ii) The result of experiment 5 is anomalous. The masses were all measured accurately. Suggest what might have caused this anomalous result. (1)

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(c) Write the balanced equation for the reaction of magnesium with oxygen to form magnesium oxide. (3)

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(d) An oxide of lead was analysed.
0.414 g of lead was combined with 0.064 g of oxygen in this oxide.

Calculate the empirical formula of this lead oxide.

(relative atomic masses: O = 16, Pb = 207)

(3)

empirical formula

(Total for Question 4 = 11 marks)



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Energy changes

- 5 (a) An experiment is carried out to measure the temperature change when solid ammonium chloride is dissolved in water.

initial temperature of water = 19 °C
final temperature of solution = 15 °C

Explain what the temperature readings show about the type of heat change occurring when ammonium chloride dissolves in water.

(2)

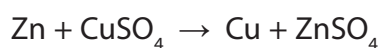
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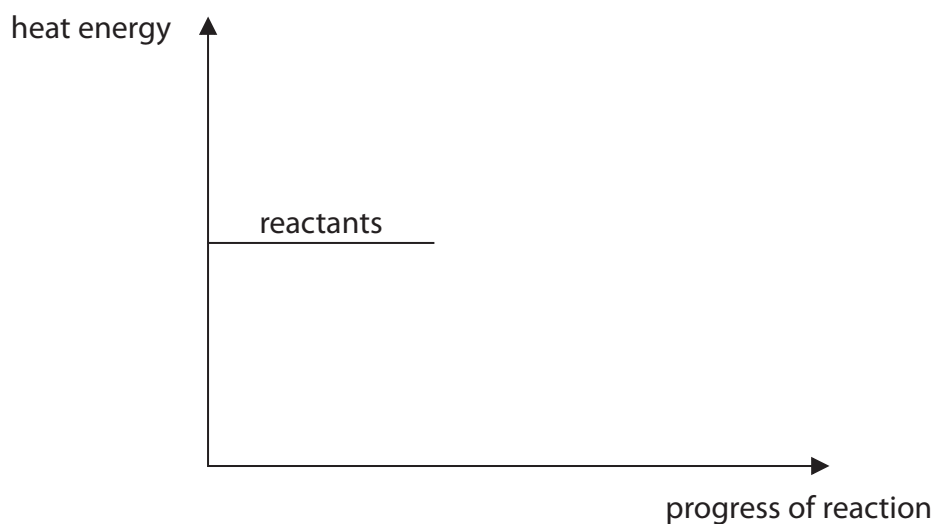
- (b) When zinc reacts with copper sulfate solution, copper and zinc sulfate solution are formed.



This reaction is exothermic.

Use this information to complete the diagram.

(2)



(c) Reactions are accompanied by heat changes.

The heat changes are the results of bonds being broken and bonds being formed.

Which row of the table shows the heat energy changes that occur when bonds are broken and when bonds are formed?

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

(1)

	bonds broken	bonds formed
<input checked="" type="checkbox"/> A	heat energy is released	heat energy is released
<input checked="" type="checkbox"/> B	heat energy is required	heat energy is required
<input checked="" type="checkbox"/> C	heat energy is released	heat energy is required
<input checked="" type="checkbox"/> D	heat energy is required	heat energy is released



Ionic substances

6 (a) The table shows the names and formulae of three ions.

name of ion	formula of ion
calcium	Ca^{2+}
nitrate	NO_3^-
phosphate	PO_4^{3-}

What is the formula of calcium nitrate?

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

(1)

- A Ca_2NO_3
- B CaNO_3
- C Ca_3NO_2
- D $\text{Ca}(\text{NO}_3)_2$

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

The number of oxygen atoms in the formula $\text{Ca}_3(\text{PO}_4)_2$ is

(1)

- A 2
- B 4
- C 8
- D 12



(c) The table gives some information about the elements sodium and sulfur.

	sodium	sulfur
metal or non-metal	metal	non-metal
atomic symbol	Na	S
number of electrons in one atom	11	16

Sodium sulfide is an ionic compound.

Describe, in terms of electron transfer, how sodium atoms react with sulfur atoms to form sodium sulfide.

Your description should include the charges on the ions formed.

(4)

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* (d) Explain the difference in the ability of solid sodium chloride and molten sodium chloride to conduct electricity in terms of their structures.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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