

Write your name here	
Surname	Other names
Centre Number	Candidate Number
<b>Edexcel GCSE</b>	
<b>Chemistry/Additional Science</b>	
<b>Unit C2: Discovering Chemistry</b>	
<b>Higher Tier</b>	
Wednesday 7 November 2012 – Morning <b>Time: 1 hour</b>	Paper Reference <b>5CH2H/01</b>
<b>You must have:</b> 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 ►

P41750A

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**PEARSON**

# The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>O</b> oxygen 8	16 <b>F</b> fluorine 9	17 <b>Ne</b> neon 10
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>Sc</b> scandium 21	24 <b>Ti</b> titanium 22	25 <b>V</b> vanadium 23	26 <b>Cr</b> chromium 24	27 <b>Mn</b> manganese 25	28 <b>Fe</b> iron 26	29 <b>Co</b> cobalt 27
37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium 43	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	58 <b>Hf</b> hafnium 58	59 <b>Ta</b> tantalum 59	60 <b>W</b> tungsten 60	61 <b>Re</b> rhenium 61	62 <b>Os</b> osmium 62	63 <b>Ir</b> iridium 63
87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	90 <b>Rf</b> rutherfordium 90	91 <b>Db</b> dubnium 91	92 <b>Sg</b> seaborgium 92	93 <b>Bh</b> bohrium 93	94 <b>Hs</b> hassium 94	95 <b>Mt</b> meitnerium 95
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	178 <b>Hf</b> hafnium 72	181 <b>Ta</b> tantalum 73	184 <b>W</b> tungsten 74	186 <b>Re</b> rhenium 75	190 <b>Os</b> osmium 76	192 <b>Ir</b> iridium 77
207 <b>Pb</b> lead 82	208 <b>Bi</b> bismuth 83	209 <b>Po</b> polonium 84	210 <b>At</b> astatine 85	211 <b>Rn</b> radon 86	212 <b>Fr</b> francium 87	213 <b>Ac</b> actinium 88	214 <b>Ra</b> radium 88	215 <b>Ac*</b> actinium 89
115 <b>In</b> indium 49	116 <b>Sn</b> tin 50	117 <b>P</b> phosphorus 15	118 <b>Te</b> tellurium 52	119 <b>Sb</b> antimony 51	120 <b>I</b> iodine 53	121 <b>Xe</b> xenon 54	122 <b>Te</b> tellurium 52	123 <b>At</b> astatine 85
108 <b>Cd</b> cadmium 48	109 <b>Pd</b> palladium 46	110 <b>Ag</b> silver 47	111 <b>Cu</b> copper 29	112 <b>Zn</b> zinc 30	113 <b>Ga</b> gallium 31	114 <b>Ge</b> germanium 32	115 <b>As</b> arsenic 33	116 <b>Se</b> selenium 34
197 <b>Au</b> gold 79	198 <b>Pt</b> platinum 78	199 <b>Hg</b> mercury 80	200 <b>Ni</b> nickel 28	201 <b>Cu</b> copper 29	202 <b>Ni</b> nickel 28	203 <b>Co</b> cobalt 27	204 <b>Fe</b> iron 26	205 <b>Co</b> cobalt 27
204 <b>Tl</b> thallium 81	205 <b>Pb</b> lead 82	206 <b>Bi</b> bismuth 83	207 <b>Po</b> polonium 84	208 <b>At</b> astatine 85	209 <b>Rn</b> radon 86	210 <b>Fr</b> francium 87	211 <b>Ac</b> actinium 88	212 <b>Ra</b> radium 88
272 <b>Rg</b> roentgenium 111	271 <b>Ds</b> darmstadtium 110	268 <b>Mt</b> meitnerium 109	266 <b>Sg</b> seaborgium 106	264 <b>Bh</b> bohrium 107	262 <b>Db</b> dubnium 105	261 <b>Rf</b> rutherfordium 104	257 <b>Lr</b> lawrencium 103	256 <b>Yb</b> ytterbium 102
Elements with atomic numbers 112-116 have been reported but not fully authenticated								

1	<b>H</b>
hydrogen	1

relative atomic mass
atomic symbol
name
atomic (proton) number

\* 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
	<b>A</b>														<b>D</b>		<b>E</b>
	<b>B</b>																
									<b>C</b>								

(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)

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.

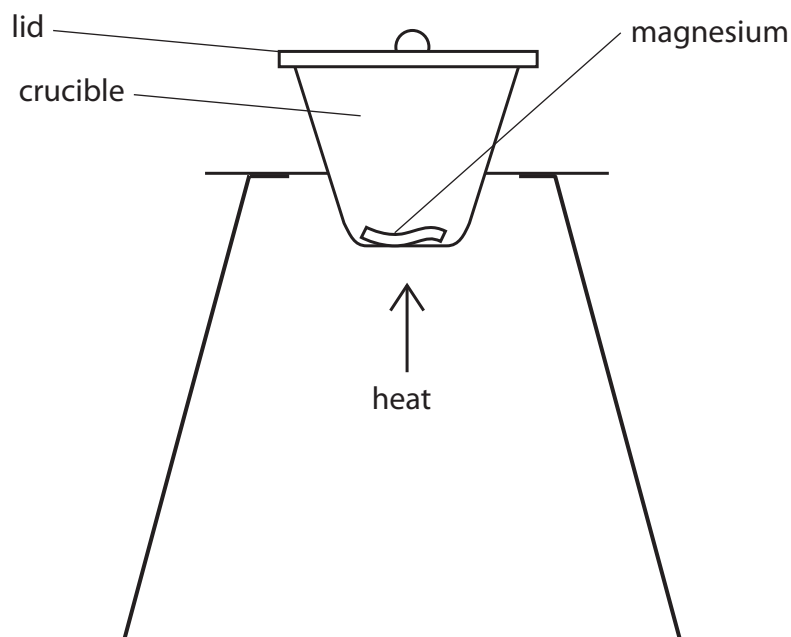
(2)

(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

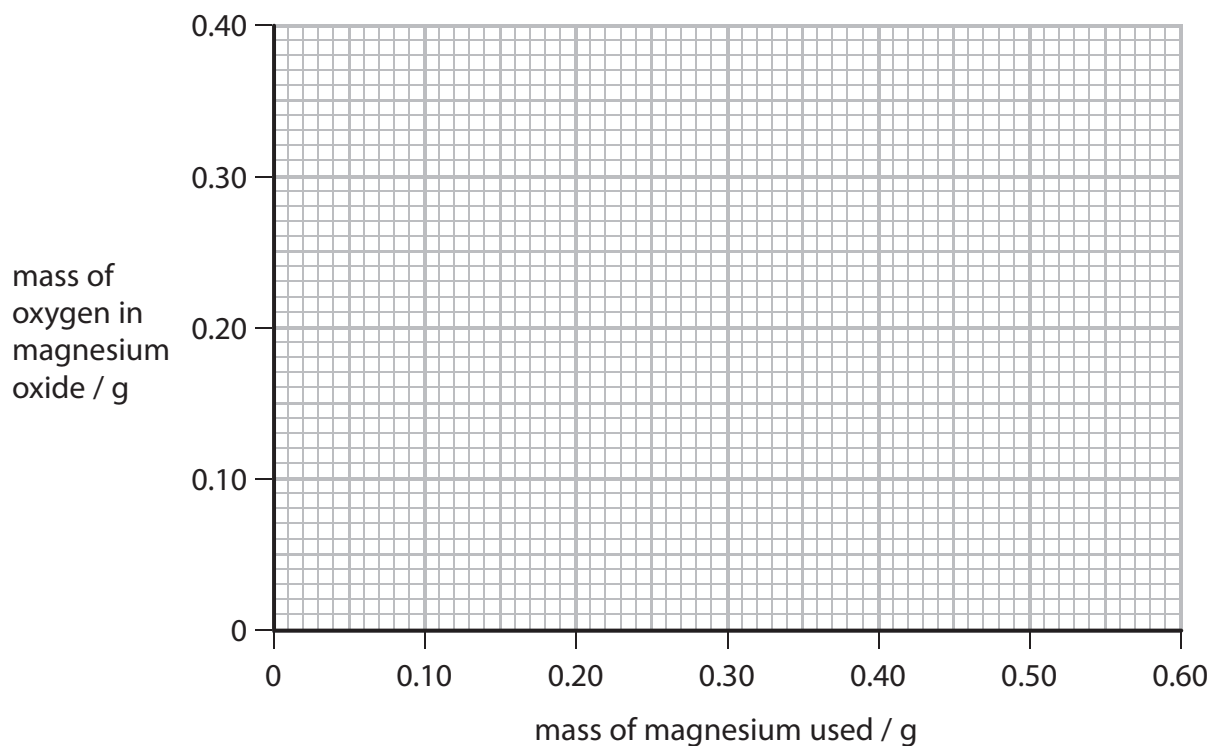


(a) Suggest why the lid had to be raised from time to time during the experiment.

(1)

(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)

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

(3)



- (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)

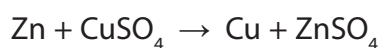
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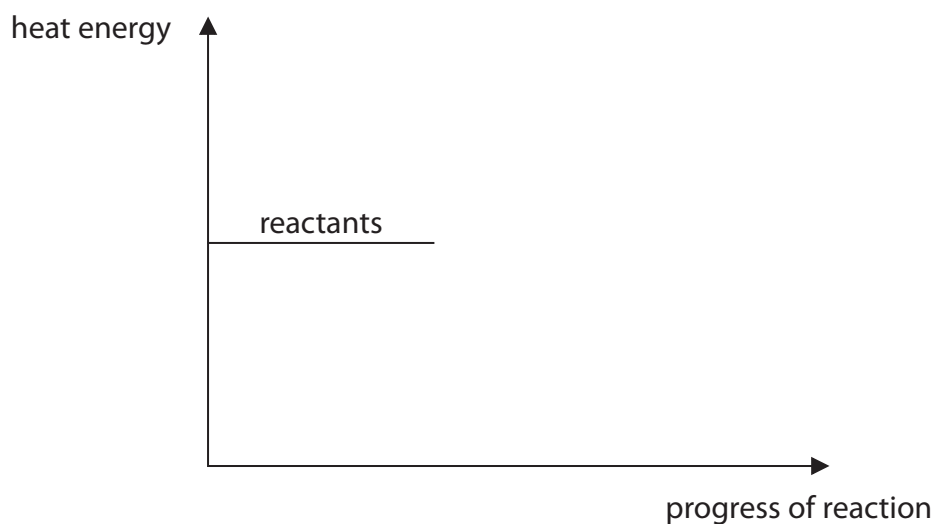
- (b) When zinc reacts with copper sulfate solution, copper and zinc sulfate solution are formed.



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)

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



\*(d) Reactions can occur when particles collide.  
Rates of reactions can be altered by changing conditions.

Explain how the rate of reaction between a solid and a liquid is altered by changing the size of the pieces of solid and by changing the temperature of the liquid.

(6)

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**(Total for Question 5 = 11 marks)**





**Ionic substances**

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

name of ion	formula of ion
calcium	$\text{Ca}^{2+}$
nitrate	$\text{NO}_3^-$
phosphate	$\text{PO}_4^{3-}$

What is the formula of calcium nitrate?

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

(1)

- A**  $\text{Ca}_2\text{NO}_3$
- B**  $\text{CaNO}_3$
- C**  $\text{Ca}_3\text{NO}_2$
- 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.

	<b>sodium</b>	<b>sulfur</b>
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)**

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**TOTAL FOR PAPER = 60 MARKS**



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