Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Higher Tier

Wednesday 14 June 2017 – 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 8 5 8 2 A 0 1 2 0

Pearson

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
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	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
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	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
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	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[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						

Key

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 ☒.

Energy changes

1 (a) The neutralisation reaction between ethanoic acid and sodium carbonate is an endothermic reaction.

Describe what is meant by the term **endothermic reaction**.

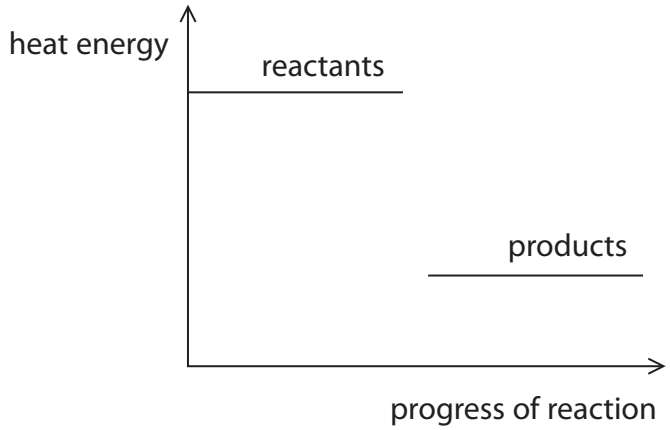
(2)

.....

.....

(b) The reaction between magnesium ribbon and dilute hydrochloric acid produces magnesium chloride and hydrogen.

The diagram shows the energies of the reactants and the products.



Explain what the diagram shows about the type of reaction occurring between the magnesium ribbon and dilute hydrochloric acid.

(2)

.....

.....

.....

.....

(c) The rate of the reaction between magnesium ribbon and hydrochloric acid can be increased by increasing the concentration of the acid.

(i) State **two other** ways of increasing the rate of this reaction.

(2)

1 .....

2 .....

(ii) Explain, in terms of particles, why increasing the concentration of the acid increases the rate of this reaction.

(2)

.....

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.....

.....

(Total for Question 1 = 8 marks)

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Ions and ionic compounds

2 (a) The formula of an aluminium ion is Al^{3+}.

The formula of a sulfate ion is SO_4^{2-}.

(i) Which of the following is the correct formula of aluminium sulfate?

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

(1)

☒ **A** $AlSO_4$

☒ **B** Al_2SO_4

☒ **C** $Al_2(SO_4)_3$

☒ **D** $Al_3(SO_4)_2$

(ii) To test for the presence of sulfate ions in a solid, the solid is first dissolved in water and then **two** solutions are added.

Give the names of the **two** solutions that are added.

(2)

1 .....

2 .....

(b) Which of these substances is insoluble in water?

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

(1)

☒ **A** ammonium carbonate

☒ **B** copper nitrate

☒ **C** lead sulfate

☒ **D** potassium hydroxide

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(c) Calcium reacts with oxygen to form calcium oxide, CaO, an ionic compound.
Calcium has an electronic configuration of 2.8.8.2.
Oxygen has an electronic configuration of 2.6.

Describe, in terms of their electronic configurations, how calcium and oxygen atoms react to form calcium and oxide ions.

You may use diagrams to help your answer.

(4)

(Total for Question 2 = 8 marks)

Elements

3 (a) Use the periodic table to help you answer the following question.

Which of these metals will form coloured cations?

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

(1)

☒ **A** gallium, Ga

☒ **B** chromium, Cr

☒ **C** strontium, Sr

☒ **D** sodium, Na

(b) Lithium and caesium are two metals in group 1 of the periodic table.
Caesium is more reactive than lithium.

Explain, in terms of the structure of their atoms, why caesium is more reactive than lithium.

(3)

(c) When a small piece of potassium is dropped into water, there is a vigorous reaction.
Bubbles of gas are evolved and the solution formed is alkaline.

Write the balanced equation for this reaction.

(3)

(d) When chlorine is bubbled through potassium bromide solution, potassium chloride and bromine are formed.

Which of these is the balanced equation for this reaction?

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

(1)

☒ **A** $2Cl + KBr \rightarrow KCl + Br_2$

☒ **B** $Cl_2 + KBr \rightarrow KCl + Br_2$

☒ **C** $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$

☒ **D** $Cl_2 + 2KBr \rightarrow 2KCl + 2Br$

(e) For many years, argon was used as the gas in filament light bulbs.

Explain why filament light bulbs were filled with argon rather than left with air inside them.

(2)

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.....

.....

.....

.....

(Total for Question 3 = 10 marks)

Compounds of copper

4 Copper hydroxide, copper oxide and copper sulfide are three compounds of copper.

(a) (i) In solution copper chloride, $CuCl_2$, reacts with potassium hydroxide, KOH, to form copper hydroxide, $Cu(OH)_2$, and potassium chloride.

Write the balanced equation for this reaction.
State symbols are not required.

(3)

(ii) Copper hydroxide is formed as a precipitate.

Which state symbol would be used in the equation to show that copper hydroxide is a precipitate?

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

(1)

☒ **A** (aq)

☒ **B** (g)

☒ **C** (l)

☒ **D** (s)

(b) The formula of copper hydroxide is $Cu(OH)_2$.

(relative atomic masses: Cu = 63.5, O = 16, H = 1)

Which of the following is the relative formula mass for copper hydroxide?

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

(1)

☒ **A** 80.5

☒ **B** 81.5

☒ **C** 97.5

☒ **D** 161.0

(c) In an analysis of copper sulfide, 12.7 g of copper was found to be combined with 3.2 g of sulfur.

Calculate the empirical formula of the copper sulfide.

Show your working.

(relative atomic masses: Cu = 63.5, S = 32)

(3)

empirical formula = ...

(d) Copper reacts with oxygen to form copper oxide.

$$2Cu + O_2 \rightarrow 2CuO$$

Calculate the maximum mass of copper oxide that could be formed by reacting 25.4 g of copper with excess oxygen.

(relative atomic masses: O = 16, Cu = 63.5;
relative formula mass: CuO = 79.5)

(2)

maximum mass of copper oxide = ... g

(Total for Question 4 = 10 marks)

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Atomic structure

5 (a) Which row of the table shows the correct relative mass and relative charge of a proton?

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

(1)

	relative mass of proton	relative charge of proton
☒ **A**	0	0
☒ **B**	1	–1
☒ **C**	1	+1
☒ **D**	0	+1

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

(1)

An atom of an element contains 16 electrons, 16 neutrons and 16 protons.

The element is

☒ **A** oxygen, O

☒ **B** sulfur, S

☒ **C** cadmium, Cd

☒ **D** titanium, Ti

(c) The electronic configuration of an atom of an element is 2.8.5.

Explain, using this electronic configuration, in which group and in which period of the periodic table this element is found.

(4)

*(d) A sample of neon contains 90% neon-20 and 10% neon-22.
An atom of neon-20 contains 10 protons, 10 neutrons and 10 electrons.

Describe the structure of a neon-22 atom and explain why, in this sample, the neon has a relative atomic mass of 20.2.

(6)

(Total for Question 5 = 12 marks)

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Structures of substances

6 (a) Explain, in terms of their structure, how metals conduct electricity.

(2)

(b) Oxygen is a simple molecular, covalent substance.
The electronic configuration of an atom of oxygen is 2.6.

Draw the dot and cross diagram of an oxygen molecule, O_2.
Show outer electrons only.

(2)

(c) Potassium chloride is an ionic substance.

The melting point of potassium chloride is 770 °C.

Explain why potassium chloride has such a high melting point.

(2)

*(d) Graphite and diamond are forms of the element carbon.
Diamond is used in cutting tools.
Graphite is used as a lubricant and in electrodes.

Explain, using ideas about their structures, why diamond and graphite are suitable for these uses.

You may use diagrams to help you explain your answer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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