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Surname

Other names

Pearson
Edexcel GCSE

Centre Number

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Candidate Number

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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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Pearson

The Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 Li lithium 3 | 9 Be beryllium 4 | 23 Na sodium 11 | 24 Mg magnesium 12 | 39 K potassium 19 | 40 Ca calcium 20 | 85 Rb rubidium 37 | 88 Sr strontium 38 | 133 Cs caesium 55 | 137 Ba barium 56 | [223] Fr francium 87 | [226] Ra radium 88 | 139 La* lanthanum 57 | 139 Y yttrium 39 | 91 Zr zirconium 40 | 93 Nb niobium 41 | 181 Ta tantalum 73 | 178 Hf hafnium 72 | 139 La* lanthanum 57 | 139 Y yttrium 39 | 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 | 115 In indium 49 | 119 Sn tin 50 | 128 Te tellurium 52 | 127 I iodine 53 | 131 Xe xenon 54 | 204 Tl thallium 81 | 207 Pb lead 82 | 209 Bi bismuth 83 | [209] Po polonium 84 | [210] At astatine 85 | [222] Rn radon 86 |
| | | | | | | | | | | | | Elements with atomic numbers 112-116 have been reported but not fully authenticated | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | |
|---|----------|---|
| 1 | H | 1 |
| | hydrogen | |

| |
|------------------------|
| relative atomic mass |
| atomic symbol |
| name |
| atomic (proton) number |

Key

* 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 . 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

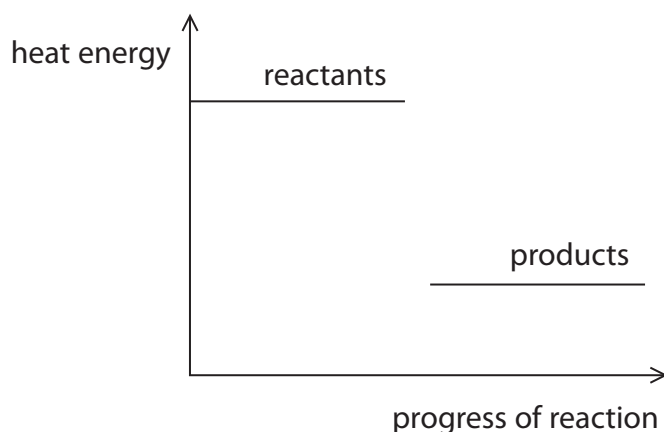
- 1 (a) The neutralisation reaction between ethanoic acid and sodium carbonate is an endothermic reaction.

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)

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(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)

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(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)



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 $\text{Al}_2(\text{SO}_4)_3$
- D $\text{Al}_3(\text{SO}_4)_2$

(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)

Area with horizontal dotted lines for writing the answer.

(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)

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(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)

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(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 (X) in the box next to your answer.

(1)

- A $2\text{Cl} + \text{KBr} \rightarrow \text{KCl} + \text{Br}_2$
- B $\text{Cl}_2 + \text{KBr} \rightarrow \text{KCl} + \text{Br}_2$
- C $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$
- D $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + 2\text{Br}$

(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, $\text{Cu}(\text{OH})_2$, 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 $\text{Cu}(\text{OH})_2$.

(relative atomic masses: $\text{Cu} = 63.5$, $\text{O} = 16$, $\text{H} = 1$)

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

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(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.

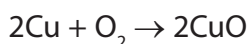
(relative atomic masses: Cu = 63.5, S = 32)

(3)

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empirical formula =

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



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)

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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 |
|----------------------------|-------------------------|---------------------------|
| <input type="checkbox"/> A | 0 | 0 |
| <input type="checkbox"/> B | 1 | -1 |
| <input type="checkbox"/> C | 1 | +1 |
| <input type="checkbox"/> 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)

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*(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)

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(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)

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(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, O₂.
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)

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*(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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