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**Pearson** Centre Number  Candidate Number

**Edexcel GCSE**

**Chemistry/Additional Science**  
**Unit C2: Discovering Chemistry**

**Foundation Tier**

|   |                                    |
|---|------------------------------------|
| Monday 22 January 2018 – Morning<br><b>Time: 1 hour</b> | Paper Reference<br><b>5CH2F/01</b> |
|---|------------------------------------|

|  |             |
|--|-------------|
| <b>You must have:</b><br>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.
- You should use a calculator in this examination.

Turn over ►

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# The Periodic Table of the Elements

|  | 1                                    | 2                                  | 3  | 4  | 5                                    | 6                                       | 7                                     | 0                                    |   |   |  |   |                                  |                                    |                                      |                                      |                                   |                                  |
|--|--------------------------------------|------------------------------------|--|--|--------------------------------------|---|---------------------------------------|--------------------------------------|---|---|--|---|----------------------------------|------------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|----------------------------------|
|  | 7<br><b>Li</b><br>lithium<br>3       | 9<br><b>Be</b><br>beryllium<br>4   | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">                     1<br/><b>H</b><br/>hydrogen<br/>1                 </div>  |  |                                      |   |                                       | 19<br><b>F</b><br>fluorine<br>9      | 4<br><b>He</b><br>helium<br>2           |   |  |   |                                  |                                    |                                      |                                      |                                   |                                  |
|  | 23<br><b>Na</b><br>sodium<br>11      | 24<br><b>Mg</b><br>magnesium<br>12 | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">                     relative atomic mass<br/>atomic symbol<br/>name<br/>atomic (proton) number                 </div> |  |                                      |   |                                       | 16<br><b>O</b><br>oxygen<br>8        | 20<br><b>Ne</b><br>neon<br>10           |   |  |   |                                  |                                    |                                      |                                      |                                   |                                  |
|  | 39<br><b>K</b><br>potassium<br>19    | 40<br><b>Ca</b><br>calcium<br>20   | 45<br><b>Sc</b><br>scandium<br>21  | 48<br><b>Ti</b><br>titanium<br>22          | 51<br><b>V</b><br>vanadium<br>23     | 52<br><b>Cr</b><br>chromium<br>24       | 55<br><b>Mn</b><br>manganese<br>25    | 56<br><b>Fe</b><br>iron<br>26        | 59<br><b>Co</b><br>cobalt<br>27         | 59<br><b>Ni</b><br>nickel<br>28           | 63.5<br><b>Cu</b><br>copper<br>29        | 65<br><b>Zn</b><br>zinc<br>30   | 70<br><b>Ga</b><br>gallium<br>31 | 73<br><b>Ge</b><br>germanium<br>32 | 75<br><b>As</b><br>arsenic<br>33     | 79<br><b>Se</b><br>selenium<br>34    | 80<br><b>Br</b><br>bromine<br>35  | 84<br><b>Kr</b><br>krypton<br>36 |
|  | 85<br><b>Rb</b><br>rubidium<br>37    | 88<br><b>Sr</b><br>strontium<br>38 | 89<br><b>Y</b><br>yttrium<br>39  | 91<br><b>Zr</b><br>zirconium<br>40         | 93<br><b>Nb</b><br>niobium<br>41     | 96<br><b>Mo</b><br>molybdenum<br>42     | [98]<br><b>Tc</b><br>technetium<br>43 | 101<br><b>Ru</b><br>ruthenium<br>44  | 103<br><b>Rh</b><br>rhodium<br>45       | 106<br><b>Pd</b><br>palladium<br>46       | 112<br><b>Cd</b><br>cadmium<br>48        | 115<br><b>In</b><br>indium<br>49  | 119<br><b>Sn</b><br>tin<br>50    | 122<br><b>Sb</b><br>antimony<br>51 | 127<br><b>I</b><br>iodine<br>53      | 128<br><b>Te</b><br>tellurium<br>52  | 131<br><b>Xe</b><br>xenon<br>54   |                                  |
|  | 133<br><b>Cs</b><br>caesium<br>55    | 137<br><b>Ba</b><br>barium<br>56   | 139<br><b>La*</b><br>lanthanum<br>57   | 178<br><b>Hf</b><br>hafnium<br>72          | 181<br><b>Ta</b><br>tantalum<br>73   | 184<br><b>W</b><br>tungsten<br>74       | 186<br><b>Re</b><br>rhenium<br>75     | 190<br><b>Os</b><br>osmium<br>76     | 192<br><b>Ir</b><br>iridium<br>77       | 195<br><b>Pt</b><br>platinum<br>78        | 201<br><b>Hg</b><br>mercury<br>80        | 204<br><b>Tl</b><br>thallium<br>81  | 207<br><b>Pb</b><br>lead<br>82   | 209<br><b>Bi</b><br>bismuth<br>83  | [209]<br><b>Po</b><br>polonium<br>84 | [210]<br><b>At</b><br>astatine<br>85 | [222]<br><b>Rn</b><br>radon<br>86 |                                  |
|  | [223]<br><b>Fr</b><br>francium<br>87 | [226]<br><b>Ra</b><br>radium<br>88 | [227]<br><b>Ac*</b><br>actinium<br>89  | [261]<br><b>Rf</b><br>rutherfordium<br>104 | [262]<br><b>Db</b><br>dubnium<br>105 | [266]<br><b>Sg</b><br>seaborgium<br>106 | [264]<br><b>Bh</b><br>bohrium<br>107  | [277]<br><b>Hs</b><br>hassium<br>108 | [268]<br><b>Mt</b><br>meitnerium<br>109 | [271]<br><b>Ds</b><br>darmstadtium<br>110 | [272]<br><b>Rg</b><br>roentgenium<br>111 | 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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(b) (i) Chlorine, bromine and iodine are halogens.

This table gives information about the colours and physical states at room temperature of chlorine, bromine and iodine.

Complete the table.

(3)

| halogen  | colour at room temperature | physical state at room temperature |
|----------|----------------------------|------------------------------------|
| chlorine |                            | gas                                |
| bromine  | red-brown                  |                                    |
| iodine   | grey                       |                                    |

(ii) Chlorine has a low boiling point.  
Chlorine does not conduct electricity.

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

These properties suggest that the structure of chlorine is

(1)

- A giant molecular, covalent
- B ionic
- C metallic
- D simple molecular, covalent

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(c) This table shows the noble gases and some of their properties.

(i) Complete the table by suggesting values for the density and boiling point of krypton. (2)

| noble gas | atomic number | density / g dm <sup>-3</sup> | boiling point / °C |
|-----------|---------------|------------------------------|--------------------|
| helium    | 2             | 0.15                         | -269               |
| neon      | 10            | 1.20                         | -246               |
| argon     | 18            | 1.40                         | -186               |
| krypton   | 36            |                              |                    |
| xenon     | 54            | 3.52                         | -108               |

(ii) Helium and hydrogen are both used to fill balloons so they rise in the air.

Give one reason why it is better to use helium rather than hydrogen.

(1)

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**(Total for Question 1 = 9 marks)**



### Atomic structure

2 (a) The formula for beryllium hydroxide is  $\text{Be}(\text{OH})_2$ .

How many different elements are combined together in beryllium hydroxide,  $\text{Be}(\text{OH})_2$ ?

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

(1)

- A 2
- B 3
- C 4
- D 5

(b) Complete the table to show the relative mass and relative charge of a proton, a neutron and an electron.

(2)

|          | relative mass    | relative charge |
|----------|------------------|-----------------|
| proton   |                  | +1              |
| neutron  |                  |                 |
| electron | $\frac{1}{1837}$ |                 |

(c) Describe the positions of the protons, neutrons and electrons in atoms.

(2)

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(d) An atom of beryllium has an atomic number of 4 and a mass number of 10.

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

The number of neutrons in this atom of beryllium is

(1)

A 4

B 6

C 10

D 14

(ii) Explain, in terms of its electronic configuration, why beryllium is placed in group 2 of the periodic table.

(2)

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**(Total for Question 2 = 8 marks)**

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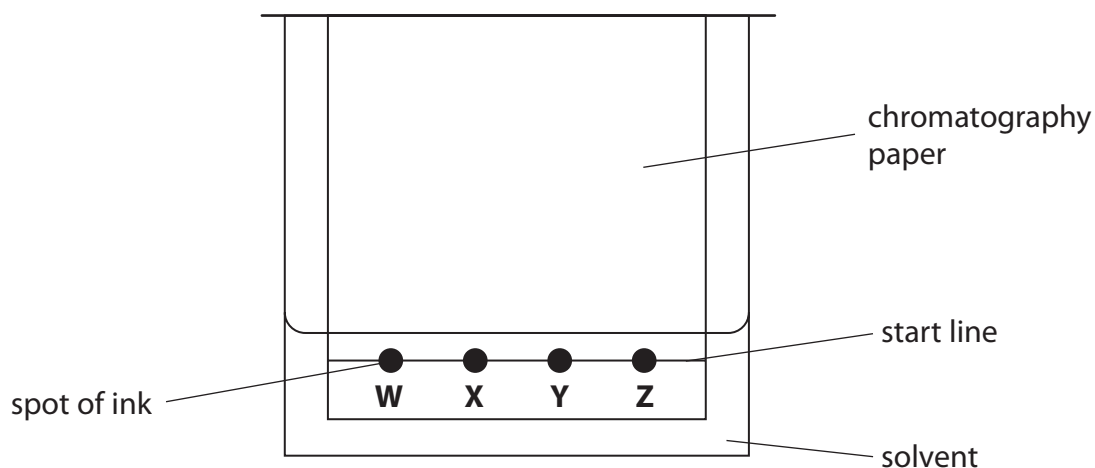




### Chromatography and covalent compounds

- 3 (a) Some students were asked to separate and identify the dyes in four inks, **W, X, Y** and **Z**.

One student put a drop of each ink onto a line on chromatography paper and set up the chromatography apparatus as shown in the diagram.



Explain the error made by the student when the apparatus was set up.

(2)

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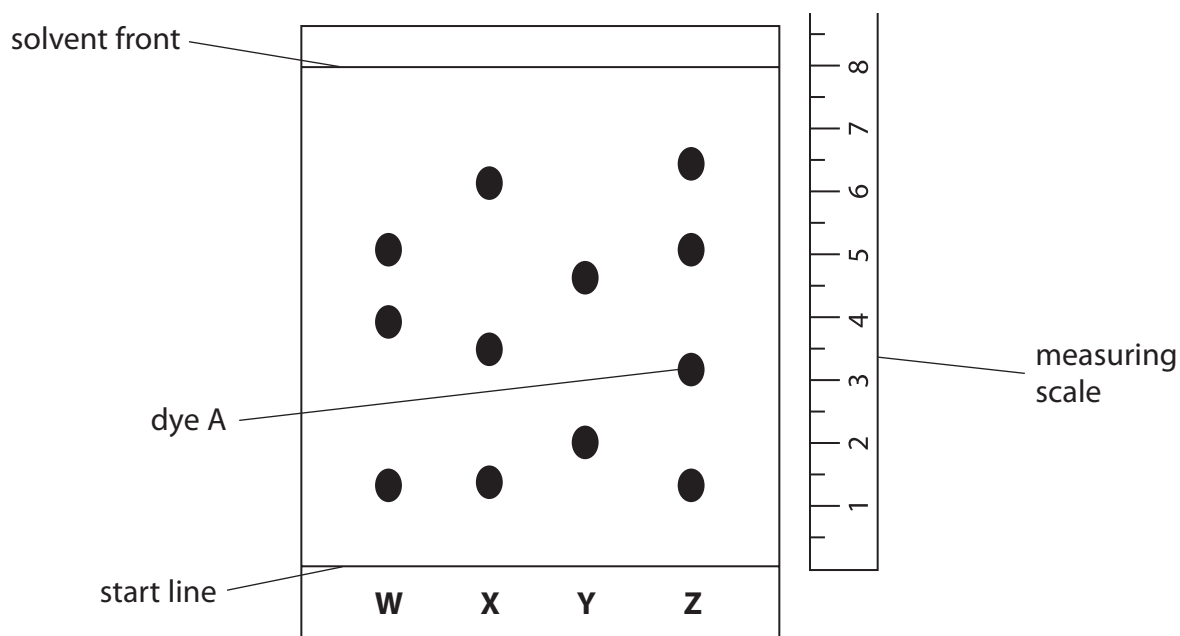
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(b) Another student set up the apparatus correctly and obtained the following chromatogram.



(i) Explain which of the inks contained the most dyes.

(2)

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(ii) The dyes can be identified by their  $R_f$  values.

$$R_f = \frac{\text{distance moved by the dye}}{\text{distance moved by the solvent front}}$$

Calculate the  $R_f$  value of dye A.

(2)

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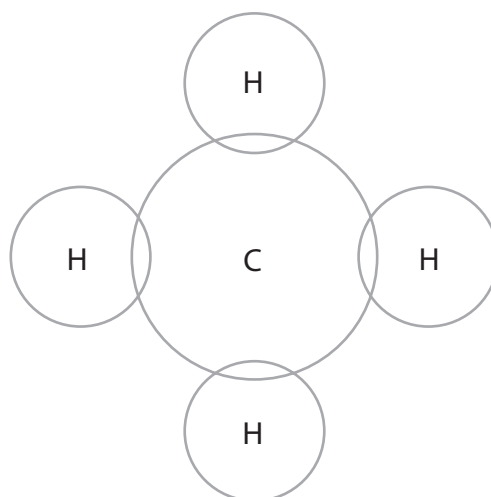
$R_f$  value = .....



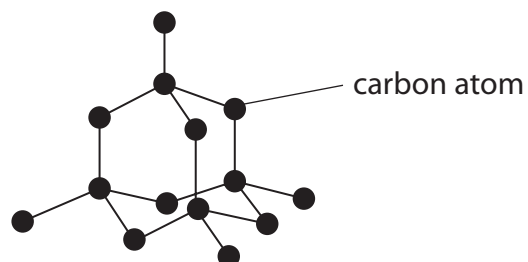
- (c) Methane has the formula  $\text{CH}_4$ .  
A carbon atom has four electrons in its outer shell.  
A hydrogen atom has one electron in its shell.

Complete the dot and cross diagram for a molecule of methane.  
Show outer electrons only.

(2)



- (d) Diamond has a giant molecular, covalent structure.  
The diagram shows part of the structure of diamond.



Explain why diamond has a very high melting point.

(2)

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**(Total for Question 3 = 10 marks)**



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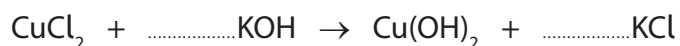


### Quantitative chemistry

4 Copper chloride solution reacts with potassium hydroxide solution to form a precipitate of copper hydroxide and potassium chloride in solution.

(a) Balance the equation for the reaction by putting numbers in the spaces provided.

(2)



(b) Which of the following is the relative formula mass of copper hydroxide,  $\text{Cu(OH)}_2$ ?  
(relative atomic masses: H = 1, O = 16, Cu = 63.5)

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

(1)

- A 80.5
- B 81.5
- C 97.5
- D 161.0

(c) Calculate the percentage by mass of potassium in potassium chloride.  
(relative atomic masses: Cl = 35.5, K = 39  
relative formula mass KCl = 74.5)

(2)

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percentage by mass = .....

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(d) A sample of copper hydroxide was prepared.  
The actual yield in the experiment was 3.6 g.  
The theoretical yield was 4.0 g.

Calculate the percentage yield.

(2)

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percentage yield = .....

(e) Suggest **two** reasons why the actual yield is less than the theoretical yield.

(2)

reason 1 .....

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reason 2 .....

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**(Total for Question 4 = 9 marks)**

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## Reactions

5 Magnesium reacts with dilute hydrochloric acid to produce magnesium chloride and hydrogen gas.

(a) (i) Write the word equation for the reaction.

(2)

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(ii) State the formula of a molecule of hydrogen.

(1)

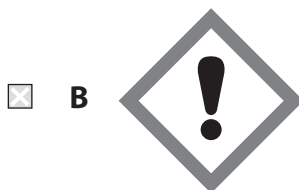
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(iii) Dilute hydrochloric acid is classified as an irritant.

Which of the following hazard symbols warns that a substance is an irritant?

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

(1)



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(b) The reaction between magnesium and dilute hydrochloric acid is exothermic.

Describe how you could show that this reaction is exothermic.

(2)

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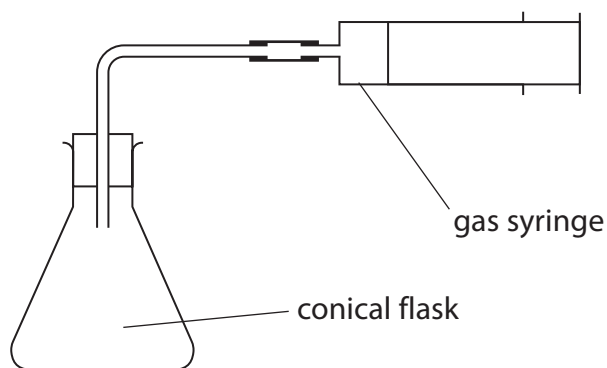
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\*(c) The rate of the reaction between magnesium and hydrochloric acid can be changed by changing the concentration of the acid.

A student is provided with the following  
magnesium ribbon  
two different concentrations of hydrochloric acid  
a measuring cylinder  
stopwatch  
the apparatus shown



Describe how the student should use the apparatus and materials listed to show how changing the concentration of the hydrochloric acid affects the rate of this reaction.

(6)

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(Total for Question 5 = 12 marks)



**Ionic substances**

6 (a) Potassium sulfate contains potassium ions,  $K^+$ , and sulfate ions,  $SO_4^{2-}$ .

Use this information to give the formula of potassium sulfate.

(1)

(b) A flame test is carried out on a solid potassium salt.

What colour is produced in the flame by the potassium ions?

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

(1)

- A green
- B lilac
- C red
- D yellow

(c) Calcium carbonate is formed as a precipitate when sodium carbonate solution is mixed with calcium nitrate solution.

(i) Write the word equation for the reaction.

(2)

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(ii) Describe a test to show that solid calcium carbonate contains carbonate ions.

(2)

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\*(iii) Starting with solid sodium carbonate and solid calcium nitrate, describe how you could prepare a sample of pure, dry calcium carbonate.

You may wish to use diagrams to illustrate your answer.

(6)

Area with horizontal dotted lines for writing the answer.

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(Total for Question 6 = 12 marks)

**TOTAL FOR PAPER = 60 MARKS**

