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**Pearson**  
**Edexcel GCSE**

Centre Number	Candidate Number
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**Chemistry/Additional Science**  
**Unit C2: Discovering Chemistry**

**Foundation Tier**

Monday 22 January 2018 – Morning <b>Time: 1 hour</b>	Paper Reference <b>5CH2F/01</b>
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<b>You must have:</b> Calculator, ruler	Total Marks
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### 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 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>Mg</b> magnesium 12	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>F</b> fluorine 9	18 <b>Ne</b> neon 10									
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36	
	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	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54	
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86	
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[268] <b>Mt</b> meitnerium 109	[277] <b>Hs</b> hassium 108	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated								

1  
**H**  
hydrogen  
1

**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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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 ☒.

The periodic table

1 (a) The positions of four elements in the periodic table are shown by **L**, **M**, **R** and **T**.

<b>L</b>													<b>T</b>		
	<b>M</b>														
						<b>R</b>									

(i) Iron is a transition metal.

Which letter shows the position of iron in this periodic table?

(1)

(ii) Which of these is a property of most transition metals?

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

(1)

- A** do not conduct an electric current
- B** form colourless compounds
- C** have a low melting point
- D** are malleable

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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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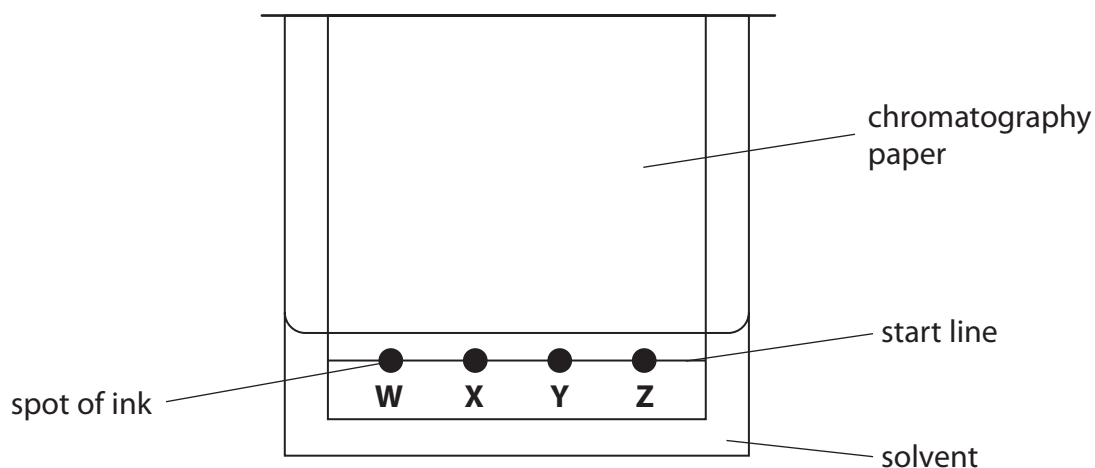




### Chromatography and covalent compounds

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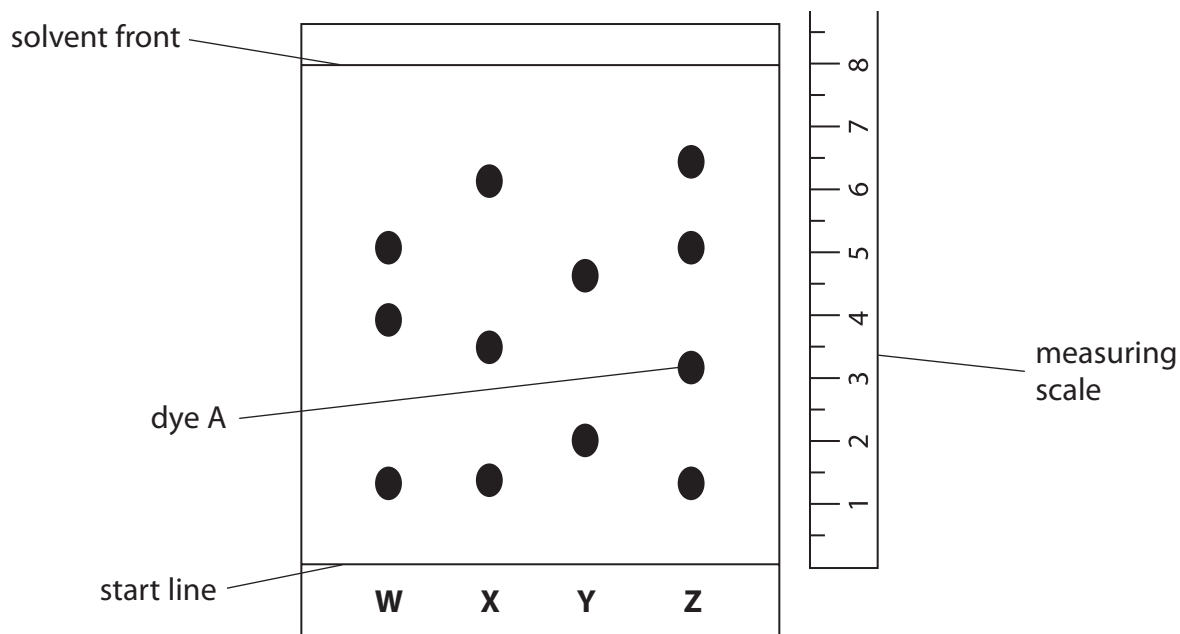
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(b) Another student set up the apparatus correctly and obtained the following chromatogram.



(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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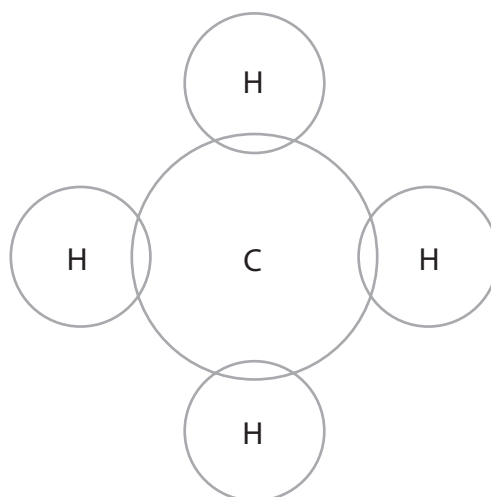
$R_f$  value = .....



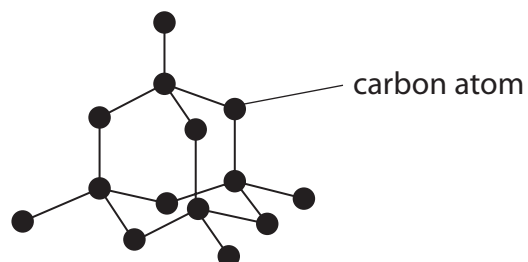
- (c) Methane has the formula  $\text{CH}_4$ .  
A carbon atom has four electrons in its outer shell.  
A hydrogen atom has one electron in its shell.

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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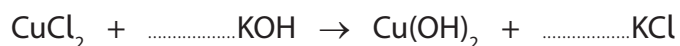


### Quantitative chemistry

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)

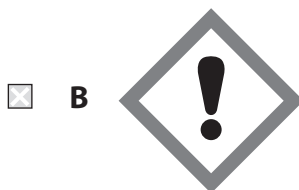
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(iii) Dilute hydrochloric acid is classified as an irritant.

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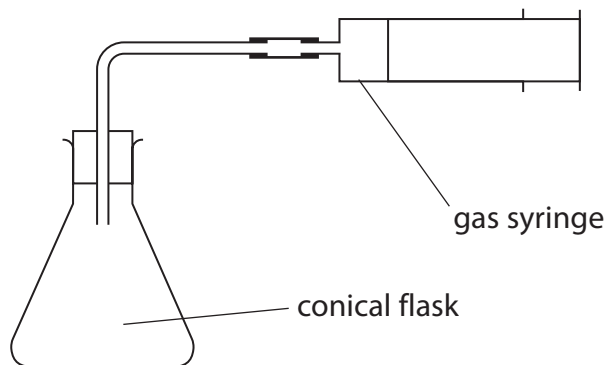
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\*(c) The rate of the reaction between magnesium and hydrochloric acid can be changed by changing the concentration of the acid.

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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Handwriting practice area with 20 horizontal dotted lines.

**(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**

