EDEXCEL GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C2 FOUNDATION TIER 5CH2F PAPERS

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | Candidate Number

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Monday 22 January 2018 – Morning
Time: 1 hour

Paper Reference
5CH2F/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.
- 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
							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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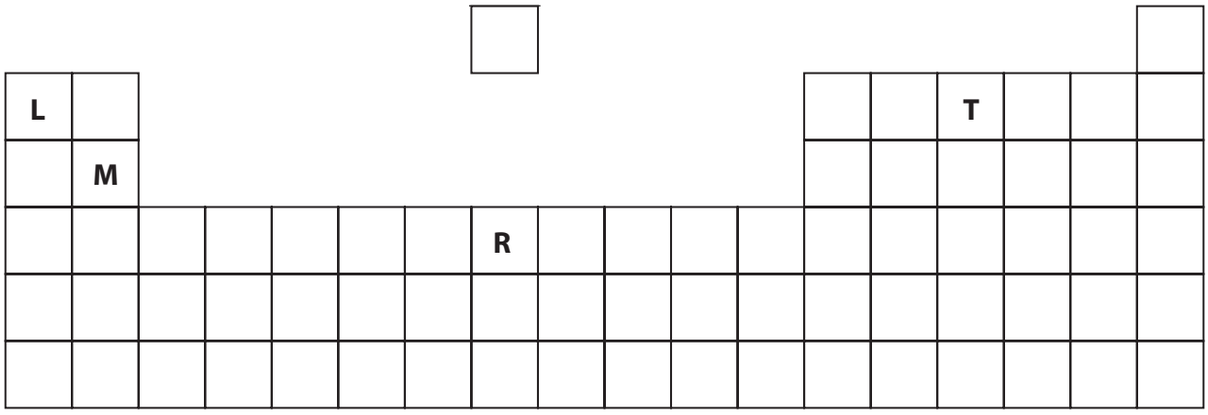
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Answer ALL questions

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**.



(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^{-3}	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)

.....

.....

(Total for Question 1 = 9 marks)

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Atomic structure

2 (a) The formula for beryllium hydroxide is $Be(OH)_2$.

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

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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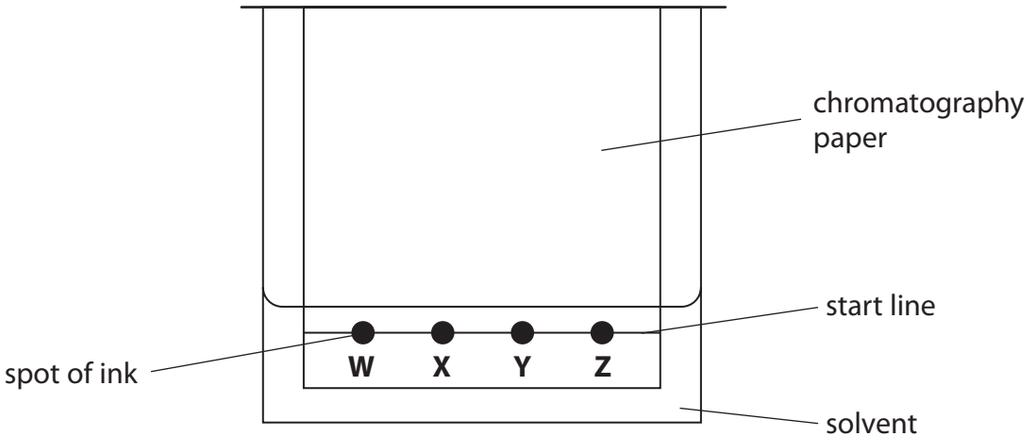
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Chromatography and covalent compounds

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)

.....

.....

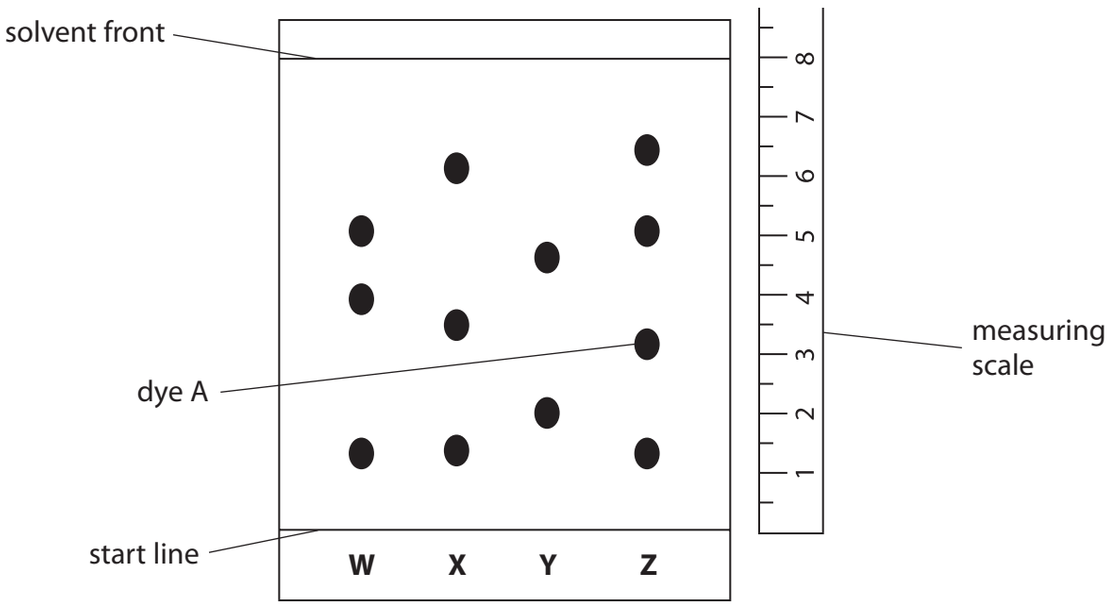
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(b) Another student set up the apparatus correctly and obtained the following chromatogram.



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

(2)

(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)

R_f value = ...

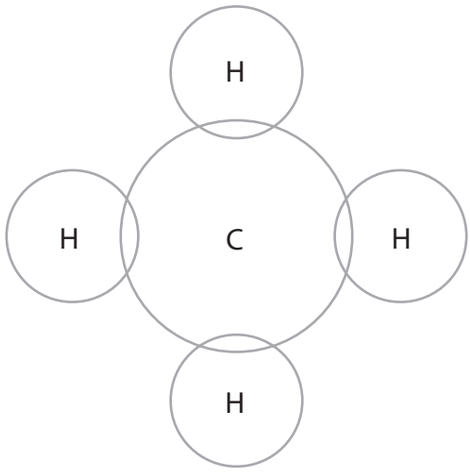
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(c) Methane has the formula CH_4.
A carbon atom has four electrons in its outer shell.
A hydrogen atom has one electron in its shell.

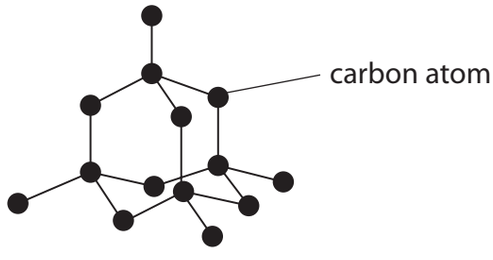
Complete the dot and cross diagram for a molecule of methane.
Show outer electrons only.

(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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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)

$$CuCl_2 + \ldots\ldots KOH \rightarrow Cu(OH)_2 + \ldots\ldots KCl$$

(b) Which of the following is the relative formula mass of copper hydroxide, $Cu(OH)_2$?
(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)

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)

.....

.....

.....

.....

percentage yield = ...

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

(2)

reason 1 .....

.....

reason 2 .....

.....

(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)

.....

.....

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

(1)

.....

(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)

☒ **A**



☒ **B**



☒ **C**



☒ **D**



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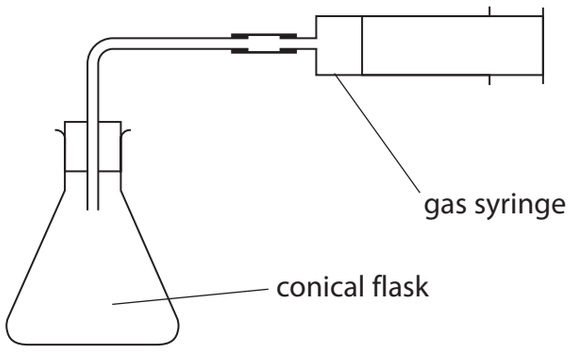
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*(c) The rate of the reaction between magnesium and hydrochloric acid can be changed by changing the concentration of the acid.

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)

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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)

.....

.....

(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)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

January 2018

Pearson Edexcel GCSE
In Chemistry (5CH2F)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1(a)(i)	**R**		1

Question number	Answer	Notes	Marks
1(a)(ii)	**D** are malleable		1

Question number	Answer	Notes	Marks
1(b)(i)	(chlorine –) yellow-green (1) (bromine –) liquid / l (1) (iodine -) solid / s (1)	accept green-yellow / green ignore yellow alone	3

Question number	Answer	Notes	Marks
1(b)(ii)	**D** simple molecular, covalent		1

Question number	Answer	Notes	Marks
1(c)(i)	density allow any number 1.41 to 3.51 (1) boiling point allow any number -185 to -109 (1)		2

Question number	Answer	Notes	Marks
1(c)(ii)	(helium is) non-flammable / inert / unreactive / ORA		1

Total for Question 1 = 9 marks

Question number	Answer	Notes	Marks
2(a)	**B** 3		1

Question number	Answer	Notes	Marks
2(b)	<table><tr><th></th><th>relative mass</th><th>relative charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr><tr><td>electron</td><td>$\frac{1}{1837}$</td><td>-1</td></tr></table>	all four correct (2) any 2 or 3 correct (1) allow words eg one / nil / zero	2

Question number	Answer	Notes	Marks
2(c)	A description including protons **and** neutrons in the nucleus (1) electrons in shells (around the nucleus) (1)		2

Question number	Answer	Notes	Marks
2(d)(i)	**B** 6		1

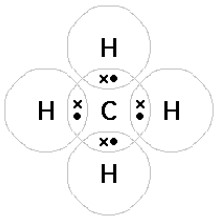
Question number	Answer	Notes	Marks
2(d)(ii)	An explanation linking EITHER • (beryllium atoms have) 2 electrons (1) • in outer (electron) shell (1) OR • number of outer shell electrons (1) • is the group number (of the periodic table)(1)		2

Total for Question 2 = 8 marks

Question number	Answer	Notes	Marks
3(a)	An explanation linking • ink spots below solvent level / solvent level above ink spots (1) • inks dissolve into solvent / inks do not move with solvent (1)	allow ORA	**2**

Question number	Answer	Notes	Marks
3(b)(i)	An explanation linking • ink **Z** (1) • has four spots (on chromatogram) / the others have fewer (1)		**2**

Question number	Answer	Notes	Marks
3(b)(ii)	(distance moved by dye) = 3 to 3.5 **and** (distance moved by solvent) = 8 (1) 3 to 3.5 / 8 = (0.375 to 0.4375) (1)		**2**

Question number	Answer	Notes	Marks
3(c)	 (2)	one shared pair (1) remaining three shared pairs (1) use of any non-shared electrons on H (max 1) allow use of dots or crosses or mixture of both	**2**

Question number	Answer	Notes	Marks
3(d)	An explanation linking • strong (covalent) bonds / large number of bonds (1) • large amount of heat / energy (needed to break bonds) (1)	allow lattice allow bonds hard to break ignore high temperature needed	**2**

Total for Question 3 = 10 marks

Question number	Answer	Notes	Marks
4(a)	$CuCl_2 + 2KOH \rightarrow Cu(OH)_2 + 2KCl$		2

Question number	Answer	Notes	Marks
4(b)	C 97.5		1

Question number	Answer	Notes	Marks
4(c)	$\frac{39.0}{74.5}$ (1) their fraction x 100 (1)	0.52 (1) Allow two marks for 52/52.5/52.35%	2

Question number	Answer	Notes	Marks
4(d)	$\frac{3.6}{4.0}$ (1) their fraction x 100 (1)	0.9 (1) correct answer alone scores 2 marks	2

Question number	Answer	Notes	Marks
4(e)	any **two** from • practical losses during experiment(1) • incomplete reactions (1) • side reactions (1)	allow inaccurate measurements (1)	2

Total for Question 4 = 9 marks

Question number	Answer	Notes	Marks
5(a)(i)	magnesium + hydrochloric acid → magnesium chloride + hydrogen LHS (1) RHS (1)		**2**

Question number	Answer	Notes	Marks
5(a)(ii)	H_2	do not allow h, H2, H^2 etc.	**1**

Question number	Answer	Notes	Marks
5(a)(iii)	B		**1**

Question number	Answer	Notes	Marks
5(b)	A description including two of the following use thermometer (1) measure temperature {before and after/change/during the reaction} (1) temperature rises (1)	 use hand (1) feel it getting hotter (1)	**2**

Question number		Indicative content	Mark
QWC	*5c	A description to include some of the following points Experiment • measure volume of acid/stated volume • measure {length / mass} of magnesium / stated {length / mass} • add magnesium to acid in conical flask • collect the hydrogen in a gas syringe • measure {amount/volume} of hydrogen • time/measure how long the reaction takes • fixed volume of hydrogen / fixed time • repeat experiment again • same volume of acid • same {length / mass / surface area} of magnesium • same temperature • different concentration Results • (with a higher concentration) same volume of hydrogen in shorter time / in the same time larger volume of hydrogen formed • the higher the concentration of the acid the higher the rate of reaction / the faster the reaction	6
Level	0	No rewardable content	
1	1 – 2	• a limited description e.g. add same volume of acid of different concentration to magnesium • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	3 – 4	• a simple description e.g. add same volume of different concentration of acids to same amount of magnesium, measure volume of gas • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	5 – 6	• a detailed description e.g. add same volume of different concentration of acids to same amount of magnesium, measure volume of gas, larger volume of gas should be produced in same amount of time with the more concentrated acid • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 5 = 12 marks

Question number	Answer	Notes	Marks
6(a)	K_2SO_4	reject lower case s or o reject incorrect subscripts eg K2, K^2 etc.	**1**

Question number	Answer	Notes	Marks
6(b)	**B** lilac		**1**

Question number	Answer	Notes	Marks
6(c)(i)	sodium carbonate + calcium nitrate → calcium carbonate + sodium nitrate (2)	left hand side (1) right hand side (1)	**2**

Question number	Answer	Notes	Marks
6(c)(ii)	A description to include • add (dilute hydrochloric) acid to / heat (solid) (1) • gas given off turns limewater {cloudy / milky} (1)		**2**

Question number		Indicative content	Mark
QWC	*6(c)(iii)	A description including some of the following points **reactants** • dissolve sodium carbonate in water • dissolve calcium nitrate in water • use of appropriate apparatus • add one solution to the other • stir / mix **separate product** • filter • use of filter paper and funnel **making pure, dry salt** • solid on filter paper • wash with water • use of distilled / deionised water • dry in warm oven / leave to dry / in a warm place	6
Level	0	No rewardable content	
1	1 - 2	• a limited description e.g. mix solutions of the reactants in a beaker • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	3 - 4	• a simple description e.g. mix solutions of the reactants in a beaker and then filter off the solid • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	5 - 6	• a detailed description e.g. mix solutions of the reactants in a beaker then filter off the solid, wash solid and leave to dry in a warm place • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 12 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Wednesday 14 June 2017 – Morning
Time: 1 hour

Paper Reference
5CH2F/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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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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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 ☒.

Chemical reactions

1 (a) Pieces of zinc react with dilute hydrochloric acid to produce zinc chloride and hydrogen gas.

(i) State what you would **see** when zinc is added to dilute hydrochloric acid.

(1)

(ii) Write the word equation for this reaction.

(2)

(iii) Describe a test to show that this reaction is exothermic.

(2)

(iv) State what can be done to the pieces of zinc to make the reaction with the dilute hydrochloric acid faster.

(1)

(b) State the effect of adding a catalyst on the rate of a reaction.

(1)

(Total for Question 1 = 7 marks)

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Ions and precipitates

2 (a) Some metal ions can be detected using a flame test.

A flame test involves the following steps.
These steps are not in the correct order.

1 hold the flame test wire in a Bunsen flame
2 dip the flame test wire into the substance
3 clean the flame test wire

What is the correct order of steps for a flame test?

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

(1)

☒ **A** 1 – 3 – 2

☒ **B** 2 – 1 – 3

☒ **C** 2 – 3 – 1

☒ **D** 3 – 2 – 1

(b) Tests for two ions are described and the observations given.

Draw one straight line from each test to the ion it shows to be present.

(2)

description of test and observation	**ion shown**
Add dilute hydrochloric acid followed by barium chloride solution. A white precipitate forms.	carbonate ion, CO_3^{2-}
	chloride ion, Cl^-
Add dilute nitric acid followed by silver nitrate solution. A white precipitate forms.	nitrate ion, NO_3^-
	sulfate ion, SO_4^{2-}

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(c) Potassium nitrate contains potassium ions, K^+, and nitrate ions, NO_3^-.

Give the formula of potassium nitrate.

(1)

.....

(d) Copper sulfate solution is added to sodium carbonate solution.

A green precipitate of copper carbonate is formed.

(i) Complete the word equation for this reaction.

(2)

copper sulfate + ... → copper carbonate + ...

(ii) Describe how to obtain a pure, dry sample of solid copper carbonate from the mixture.

(3)

.....

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(Total for Question 2 = 9 marks)

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Simple molecular, covalent compounds

3 Hydrogen chloride and water are simple molecular, covalent compounds.

(a) The formula of a molecule of water is H_2O.

Describe what this formula shows about a molecule of water.

(2)

(b) Covalent bonds join atoms together in a molecule of water.

Describe what is meant by a **covalent bond**.

(2)

(c) A chlorine atom has seven electrons in its outer shell.
A hydrogen atom has one electron only.

Draw a dot and cross diagram of a molecule of hydrogen chloride, HCl.

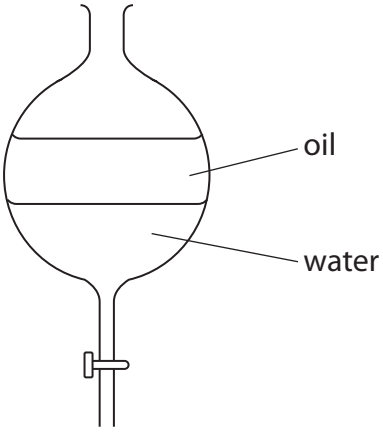
Show outer shell electrons only.

(2)

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(d) Water and oil do not mix.

(i) The following apparatus can be used to separate a mixture of water and oil.



Give the name of this piece of apparatus.

(1)

.....

(ii) What term is used to describe two liquids that do not mix?

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

(1)

☒ **A** immiscible

☒ **B** inert

☒ **C** insoluble

☒ **D** ionic

(e) Water freezes to form ice.
Ice has a melting point of 0 °C.

Explain, in terms of its structure, why water has a low melting point.

(2)

.....

.....

.....

.....

(Total for Question 3 = 10 marks)

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Compounds

4 Lead nitrate solution reacts with sodium iodide solution to form solid lead iodide and sodium nitrate solution.

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

(1)

This reaction is an example of

☒ **A** combustion

☒ **B** separation

☒ **C** neutralisation

☒ **D** precipitation

(ii) The balanced equation for this reaction is shown.

Complete the equation by filling in the state symbols for the products.

(2)

$$Pb(NO_3)_2(aq) + 2NaI(aq) \rightarrow PbI_2(\ldots\ldots) + 2NaNO_3(\ldots\ldots)$$

(iii) Calculate the relative formula mass of sodium nitrate, $NaNO_3$.

(relative atomic masses: Na = 23, N = 14, O = 16)

(1)

relative formula mass = ...

(iv) The formula of lead iodide is PbI_2.

Calculate, using this formula, the percentage by mass of lead in lead iodide.

(relative atomic masses: Pb = 207, I = 127;
relative formula mass of PbI_2 = 461)

(2)

percentage by mass = ...%

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(b) In an experiment, lead nitrate solution was reacted with sodium iodide solution to produce lead iodide.

(i) The yield of lead iodide from this experiment was 3.5 g.

The theoretical yield of lead iodide for this experiment was 5.0 g.

Calculate the percentage yield of lead iodide in this experiment.

(2)

.....

.....

.....

.....

percentage yield = ...%

(ii) State two reasons why the percentage yields of experiments are often less than 100%.

(2)

reason 1 .....

.....

reason 2 .....

.....

(Total for Question 4 = 10 marks)

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Atoms and the periodic table

5 Mendeleev's original periodic table is different from the modern periodic table.

(a) Give one difference between Mendeleev's early periodic table and the modern periodic table.

(1)

.....

(b) An atom of argon contains 18 electrons, 22 neutrons and 18 protons.

(i) State the atomic number of argon.

(1)

.....

(ii) Argon is in group 0 of the periodic table.

Give the symbol of another element in the same group as argon.

(1)

.....

(iii) Which row of the table shows the correct relative charges of an electron, a neutron and a proton?

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

(1)

		relative charge of		
		electron	**neutron**	**proton**
☒	**A**	−1	+1	0
☒	**B**	+1	0	−1
☒	**C**	−1	0	+1
☒	**D**	0	−1	+1

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(c) The electronic configuration of an aluminium atom is 2.8.3.

Explain, using this information, why aluminium is placed in group 3 of the periodic table.

(2)

.....

.....

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*(d) Sodium fluoride is an ionic compound, containing sodium ions, Na^+, and fluoride ions, F^-.

Sodium and fluoride ions are formed from sodium and fluorine atoms.

Some information about sodium and fluorine atoms is given in the table.

	protons	neutrons	electron configuration
sodium	11	12	2.8.1
fluorine	9	10	2.7

Use the information in the table to describe the structure of sodium and fluorine atoms and how they combine to form sodium and fluoride ions in sodium fluoride.

You may use diagrams to help your answer.

(6)

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(Total for Question 5 = 12 marks)

Groups of the periodic table

6 (a) Chlorine, bromine and iodine are elements in group 7 in the periodic table.

(i) Chlorine is a toxic gas.

Which of the following hazard symbols would you expect to see on a container filled with chlorine?

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

(1)

☒ **A**



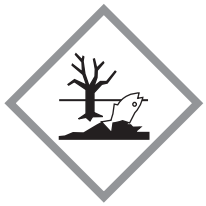
☒ **B**



☒ **C**



☒ **D**



(ii) At room temperature, chlorine is a yellow-green gas and iodine is a grey solid.

Describe the appearance of bromine at room temperature.

(2)

.....

.....

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(iii) Chlorine reacts with hydrogen to form hydrogen chloride.
Hydrogen chloride dissolves in water to form a solution.

Explain how this solution affects universal indicator.

(2)

.....

.....

.....

.....

(b) Which of the following statements is true for **all** the transition metals?

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

(1)

☒ **A** They have low melting points.

☒ **B** They float when placed in water.

☒ **C** They are good conductors of electricity.

☒ **D** They are magnetic.

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*(c) Lithium, sodium, potassium, rubidium and caesium are all metals in group 1 of the periodic table.

group 1 of the periodic table

7 **Li** lithium 3
23 **Na** sodium 11
39 **K** potassium 19
85 **Rb** rubidium 37
133 **Cs** caesium 55

The reaction of rubidium and caesium with water can be predicted from the reactions of lithium, sodium and potassium with water.

Describe the similarities and differences in the reactions of these five metals with water.

You may use word equations or balanced equations to help your answer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE
In Chemistry (5CH2F) Paper 01

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Summer 2017
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Acceptable answers	Marks
1 (a) (i)	bubbles / effervescence / fizzes / {solid/zinc} {disappears/dissolves}	ignore other descriptions eg cloudy	**(1)**

Question number	Answer	Acceptable answers	Marks
1 (a) (ii)	zinc + hydrochloric acid → zinc chloride + hydrogen (2) LHS (1) RHS (1)	allow complete equation $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (2) ignore 'dilute', 'gas' ignore any state symbols reject symbol for either side of equation	**(2)**

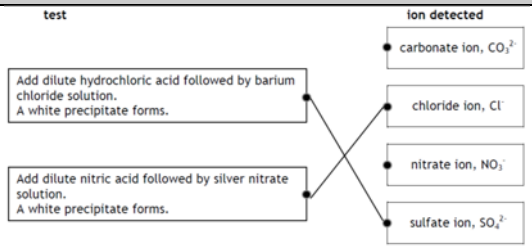
Question number	Answer	Acceptable answers	Marks
1 (a) (iii)	a description to include • test : measure temp of liquid before and after / (use a) thermometer (1) • result : {if temp increases / becomes warmer} (1)	allow feel it ignore temp change ignore heat rises	**(2)**

Question number	Answer	Acceptable answers	Marks
1 (a) (iv)	decrease size of pieces of zinc / use a powder / increase surface area / OWTTE (1)	allow crush the zinc allow cut into small pieces, but ignore just cut ignore use less reject other means of changing rate eg use of catalyst	**(1)**

Question number	Answer	Acceptable answers	Marks
1 (b)	increases / speeds up / makes it faster (1)	reject faster time reject time gets quicker reject speeds up reaction time	**(1)**

(Total for Question 1 = 7 marks)

Question number	Answer	Marks
2 (a)	**D** 3 – 2 – 1 **The only correct answer is D** **A** is not correct because cleaning the wire must be first step (step 3) **B** is not correct because cleaning the wire must be first step (step 3) **C** is not correct because cleaning the wire must be first step (step 3)	**(1)**

Question number	Answer	Acceptable answers	Marks
2 (b)	 (2) Each correct line (1)	Max 1 line from each test	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (c)	KNO_3 / $K^+NO_3^-$	Not KNO3 / KNO^3 / KNo3 / KNo_3 / Kno_3 ignore brackets eg $K(NO_3)$ (1)	**(1)**

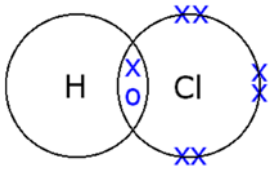
Question number	Answer	Acceptable answers	Marks
2 (d) (i)	LHS - sodium carbonate (1) RHS – sodium sulfate (1)	ignore 'solution' ignore any state symbols RHS – sodium sulphate do not accept formulae	**(2)**

Question number	Answer	Acceptable answers	Marks
2 (d) (ii)	A description including • filter / decant off liquid (1) • wash (with (distilled/deionised/pure) water) (1) • (leave to) dry / leave in a warm place / dry in a warm oven (1) mps 2 and 3 depend on mp 1	ignore sieve filter funnel alone (0) allow use of filter paper (1) ignore clean allow other methods such as between filter papers etc reject heat to dry/**hot** oven points should be credited in that order – so filter and leave to dry scores 2, wash & filter scores 1 etc ignore anything before filtration	**(3)**

(Total for Question 2 = 9 marks)

Question number	Answer	Acceptable answers	Marks
3 (a)	A description to include • hydrogen **AND** oxygen (atoms) (1) • 2(hydrogen) **and** 1 (oxygen) (1) 2nd mp dependent on mention of hydrogen and oxygen	ignore H and O / bonds / elements reject molecules for 1st mp if mentioned only 1 element eg 2 hydrogen atoms: scores 0	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (b)	A description to include • shared electron(s) (1) • {pair of / two} (electrons) (1) 2nd mp dependent on 1st	allow one electron from each (1) any idea of ionic = 0 allow more than one shared pair	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (c)	 one shared pair between Cl and H (1) rest of diagram correct (1)	circles do not have to be there remaining electrons on Cl either singly or paired ignore symbols even if incorrect ignore any inner shells shown 2nd mark dependent on 1st allow all dots or all crosses	**(2)**

Question number	Answer	Acceptable answers	Marks
3 (d) (i)	**separating** funnel	separating tube ignore separator	**(1)**

Question number	Answer	Marks
3 (d) (ii)	**A** immiscible **The only correct answer is A** **B** is not correct because inert refers to reactivity **C** is not correct because insoluble refers to a solid not dissolving **D** is not correct because ionic is a type of bonding	**(1)**

Question number	Answer	Acceptable answers	Marks
3 (e)	An explanation linking • weak {forces/attractions} between {molecules/particles} / water is a simple molecule / simple covalent structure (1) • little energy needed to separate {molecules/particles} (1)	allow intermolecular forces ignore bonds between molecules ignore break bonds (between atoms) ignore references to temperature	**(2)**

(Total for Question 3 = 10 marks)

Question number	Answer	Marks
4 (a) (i)	**D** precipitation **The only correct answer is D** **A** is not correct because combustion is a reaction of a fuel **B** is not correct because separation is a physical process **C** is not correct because neutralisation is a reaction between an acid and an alkali	**(1)**

Question number	Answer	Acceptable answers	Marks
4 (a) (ii)	$Pb(NO_3)_2$ (aq) + 2NaI (aq) → PbI_2 (s) + $2NaNO_3$ (aq) s (1) aq (1)	not solid not aqueous	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (a) (iii)	23 + 14 + (16x3) (1) = (85)	85 alone (1)	**(1)**

Question number	Answer	Acceptable answers	Marks
4 (a) (iv)	$\frac{207}{461}$ (= 0.45 / 0.449) (1) (207/461) x 100 (= 45% / 44.9%) (1)	(any fraction) x 100 (1) 45 or 44.9% no working (2)	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (b) (i)	$\frac{3.5}{5.0}$ (= 0.7) (1) (3.5/5.0) x 100 (= 70%) (1)	70% no working (2) (any fraction) x 100 (1)	**(2)**

Question number	Answer	Acceptable answers	Marks
4 (b) (ii)	Any two from • loss of {reactants/products/substances/ chemicals} (during {process/transfer}) (1) • incomplete reactions (1) • {competing/unwanted/side} reactions (1)	ignore impure reactants / impurities ignore spillage allow not all used up allow it could react with air (1) do not allow loss of gas	**(2)**

(Total for Question 4 = 10 marks)

Question number	Answer	Acceptable answers	Marks
5 (a)	arranged by order of (relative) atomic mass / (in Mendeleev's early periodic table) gaps / fewer elements / elements in wrong place / noble gases were not present reverse arguments apply	unless specifically referred to modern table, assume answer refers to Mendeleev's table	**(1)**

Question number	Answer	Acceptable answers	Marks
5 (b) (i)	18 / eighteen		**(1)**

Question number	Answer	Acceptable answers	Marks
5 (b) (ii)	He/Ne/Kr/Xe/Rn	do not accept pairs of uppercase /lowercase letters eg HE, xe ignore names and atomic number	**(1)**

Question number	Answer	Marks
5 (b) (iii)	**C** -1, 0, +1 **The only correct answer is C** **A** is not correct because incorrect charges on neutron and proton **B** is not correct because incorrect charges on electron and proton **D** is not correct because incorrect charges on electron and neutron	**(1)**

Question number	Answer	Acceptable answers	Marks
5 (c)	An explanation linking • three (electrons) (1) • electrons in outer shell (1)	 allow in outer ring / energy level allow 'needs to lose 3 electrons' (1)... 'to have a full outer shell' (1)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5d**	An explanation to include some of the following points • protons and neutrons in nucleus / use of diagram • electrons in shells • electron shells surround nucleus / use of diagram • sodium has 3 electron shells • fluorine has 2 electron shells • sodium atoms lose 1 electron • from outer shell / to obtain full outer shell • to form {sodium ions / Na^+} • fluorine atoms gain 1 electron • in outer shell / to obtain full outer shell • to form {fluoride ions / F^-} • electron transfers from sodium to fluorine • opposite ions attract	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation e.g. protons and neutrons are in the nucleus. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation e.g. the atomic structure of either sodium or fluorine atoms OR how ions of sodium or fluorine are formed • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation e.g. the atomic structure of atoms of both elements OR how ions of both elements are formed OR atomic structure of one element and how the atom of that element forms the ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 5 = 12 marks)

Question number	Answer	Marks
6 (a) (i)	**C**  **The only correct answer is C** **A** is not correct because symbol is for a flammable substance **B** is not correct because symbol is for a corrosive substance **D** is not correct because symbol is for a substance harmful to the environment	**(1)**

Question number	Answer	Acceptable answers	Marks
6 (a) (ii)	A description to include • red-brown (1) • liquid (1)	allow dark red (mark independently)	**(2)**

Question number	Answer	Acceptable answers	Marks
6 (a) (iii)	A description to include • (indicator) turns red (1) • (solution) is acidic (1)	accept other colours such as yellow and orange showing pH<7 allow pH<7	**(2)**

Question number	Answer	Marks
6 (b)	**C** They are good conductors of electricity **The only correct answer is C** **A** is not correct because transition metals have high melting points **B** is not correct because transition metals are more dense than water **D** is not correct because not all transition metals are magnetic	**(1)**

Question Number		Indicative Content	Mark
QWC	*6(c)	A description to include some of the following points similarities • move about • bubbles formed • heat given out • hydrogen produced / metal + water → metal hydroxide + hydrogen • metal hydroxide solution formed / metal + water → metal hydroxide + hydrogen • purple solution if universal indicator present (accept suitable colour for other indicators) differences • lithium, sodium and potassium float on water, rubidium and caesium sink • reactivity increases down the group • lithium slowly disappears • sodium forms a ball / melts • potassium burns with a lilac flame • rubidium burns with coloured flame • caesium explosive	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of at least one metal reacting with water e.g. sodium floats on water • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description of some relevant similarities or differences involving a limited number of these metals OR similarities between all metals OR differences between all metals • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed explanation of some similarities and differences of all three metals reacting with water including several relevant observations or suggesting how rubidium and / or caesium would behave • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 6 = 12 marks)

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Wednesday 15 June 2016 – Afternoon
Time: 1 hour

Paper Reference
5CH2F/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.
- 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
							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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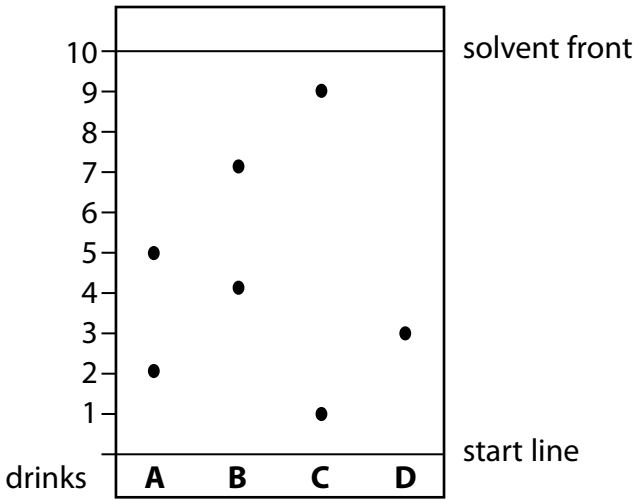
Questions begin on next page.

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 ☒.

Separation techniques

1 The diagram shows a chromatogram of the coloured substances in four different drinks, **A**, **B**, **C** and **D**.



(a) (i) State the letter of the drink that contains only one coloured substance.

(1)

.....

(ii) An illegal coloured substance has an R_f value of 0.71.

Which of the drinks, **A**, **B**, **C** or **D**, contains the illegal coloured substance?

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

(1)

☐ **A**

☐ **B**

☐ **C**

☐ **D**

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(iii) Starting with a piece of chromatography paper and the four drinks, describe how an experiment would be set up to produce the chromatogram in the diagram.

(3)

(b) Liquid **X** and liquid **Y** are immiscible.
Liquid **X** is denser than liquid **Y**.

Describe how you could use a separating funnel to obtain a pure sample of liquid **X** and a pure sample of liquid **Y** from a mixture of the two liquids.

(2)

(c) Oxygen and nitrogen are two gases present in the air.

Give the name of the process used to obtain oxygen and nitrogen from liquid air.

(2)

(Total for Question 1 = 9 marks)

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Atomic structure

2 (a) State the relative charge on a proton.

(1)

.....

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

(1)

An atom of sodium has an atomic number of 11 and a mass number of 23.

The number of protons in this atom of sodium is

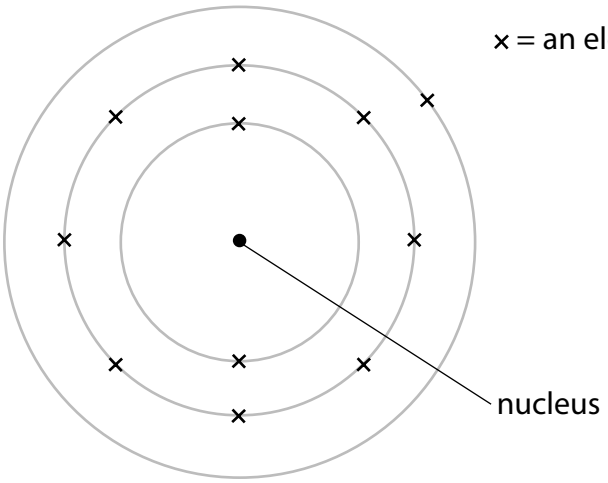
☒ **A** 11

☒ **B** 12

☒ **C** 23

☒ **D** 34

(c) The diagram shows the arrangement of electrons in a sodium atom.



(i) State the electronic configuration of sodium.

(1)

.....

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(ii) Explain, in terms of its electronic configuration, why sodium is placed in group 1 of the periodic table.

(2)

.....

.....

.....

.....

(d) Elements can be classified as metals or non-metals.
Metals and non-metals appear in different sections of the periodic table.

Use the periodic table to answer the following questions.

(i) Which of the following is a non-metal?

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

(1)

☐ **A** iridium, Ir

☐ **B** ruthenium, Ru

☐ **C** selenium, Se

☐ **D** strontium, Sr

(ii) Elements are arranged in the periodic table in order of increasing atomic number.

In terms of electronic configurations, describe a similarity between elements in the same period.

(1)

.....

.....

.....

(Total for Question 2 = 7 marks)

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Salts

3 (a) Insoluble salts are prepared by precipitation reactions.

Lead nitrate solution reacts with potassium iodide solution to form a lead iodide precipitate and potassium nitrate solution.

(i) What is the name of the insoluble salt?

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

(1)

☐ **A** lead nitrate

☐ **B** potassium iodide

☐ **C** lead iodide

☐ **D** potassium nitrate

(ii) Write the word equation for the reaction.

(2)

.....

.....

(iii) Two solid, soluble salts were used to make an insoluble salt in a precipitation reaction.

The statements below show the steps used in an experiment to make a pure, dry insoluble salt from the two solid, soluble salts.

They are not in the correct order.

A filter the mixture

B dissolve each of the soluble salts in water

C put in an oven to dry

D wash the solid with distilled water

E mix the solutions together

Write the letters in the boxes to put the steps in the correct order.

B is the first step.

(2)

B				

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(b) Sodium and potassium salts produce colours in a flame test.

Draw a line from each salt to the colour that it produces in a flame test.

(2)

salt	**colour in flame test**
potassium salt	blue / green
sodium salt	lilac
	red
	yellow

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(c) Potassium chloride contains potassium ions, K^+, and chloride ions, Cl^-.

(i) State the formula of potassium chloride.

(1)

.....

(ii) Explain how a chlorine atom, Cl, forms a chloride ion, Cl^-.

(2)

.....

.....

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.....

(Total for Question 3 = 10 marks)

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Quantitative chemistry

4 (a) Calculate the relative formula mass of calcium carbonate, $CaCO_3$.

(relative atomic masses: C = 12, O = 16, Ca = 40)

(1)

.....

relative formula mass = ...

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

(1)

Magnesium reacts with sulfur to form magnesium sulfide

magnesium + sulfur → magnesium sulfide

In magnesium sulfide 24 g of magnesium are combined with 32 g of sulfur.

The ratio of magnesium atoms to sulfur atoms in magnesium sulfide is

(relative atomic masses: Mg = 24, S = 32)

		ratio of magnesium atoms : sulfur atoms
☒	**A**	1 : 1
☒	**B**	1 : 2
☒	**C**	2 : 1
☒	**D**	3 : 4

(c) The simplest ratio of aluminium atoms to chlorine atoms in aluminium chloride is 1 : 3.

The empirical formula of aluminium chloride is $AlCl_3$.

The simplest ratio of aluminium atoms to oxygen atoms in aluminium oxide is 2 : 3.

Give the empirical formula of aluminium oxide.

(1)

.....

(d) The answers shown are the molecular formulae of four hydrocarbons.

What is the molecular formula of the hydrocarbon with the empirical formula CH_2?

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

(1)

☒ **A** CH_4

☒ **B** C_2H_6

☒ **C** C_2H_4

☒ **D** C_3H_8

(e) Zinc oxide is formed by decomposition of zinc carbonate

zinc carbonate → zinc oxide + carbon dioxide

(i) In an experiment to decompose some zinc carbonate, the actual yield of zinc oxide was 7.2 g.

The theoretical yield of zinc oxide for this experiment is 9.0 g.

Calculate the percentage yield of zinc oxide.

(2)

.....

.....

.....

.....

percentage yield = ... %

(ii) Explain why the actual yield of a product in an experiment is usually lower than the theoretical yield.

(2)

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.....

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(iii) Calculate the percentage by mass of zinc in zinc oxide, ZnO.

(relative atomic masses: O = 16, Zn = 65
relative formula mass of ZnO = 81)

(2)

.....

.....

.....

.....

percentage by mass of zinc = ... %

(Total for Question 4 = 10 marks)

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5 (a) (i) When lithium is placed in water it reacts to form lithium hydroxide and hydrogen gas.

Describe what you would **see** during this reaction.

(2)

.....

.....

.....

(ii) The following hazard symbol is attached to cylinders of hydrogen gas.



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

(1)

This symbol shows that hydrogen is

- ☒ **A** corrosive
- ☒ **B** flammable
- ☒ **C** oxidising
- ☒ **D** toxic

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(b) Magnesium and iron are both metals.

(i) They both conduct electricity.

Explain, in terms of their structures, how metals conduct electricity.

(2)

(ii) Magnesium is in group 2 of the periodic table.

Iron is a transition metal.

Both magnesium and iron can form salts.

State a difference in the appearance of magnesium salts and iron salts.

(1)

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*(c) The three halogens chlorine, bromine and iodine are mixed with solutions of their potassium salts.

The table shows the results.

solution of	chlorine	bromine	iodine
potassium chloride		×	×
potassium bromide	✓		×
potassium iodide	✓	✓	

The three ticks in the table show where there are reactions.

Describe and explain what you would **see** in each of these three reactions and what it would tell you about the relative reactivity of the halogens, bromine, chlorine and iodine.

(6)

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(Total for Question 5 = 12 marks)

Reactions

6 (a) This question is about three different reactions, **P**, **Q** and **R**.

As the reactions are carried out, the initial and final temperatures are recorded.

reaction	initial temperature / °C	final temperature / °C
P	16	12
Q	15	34
R	17	17

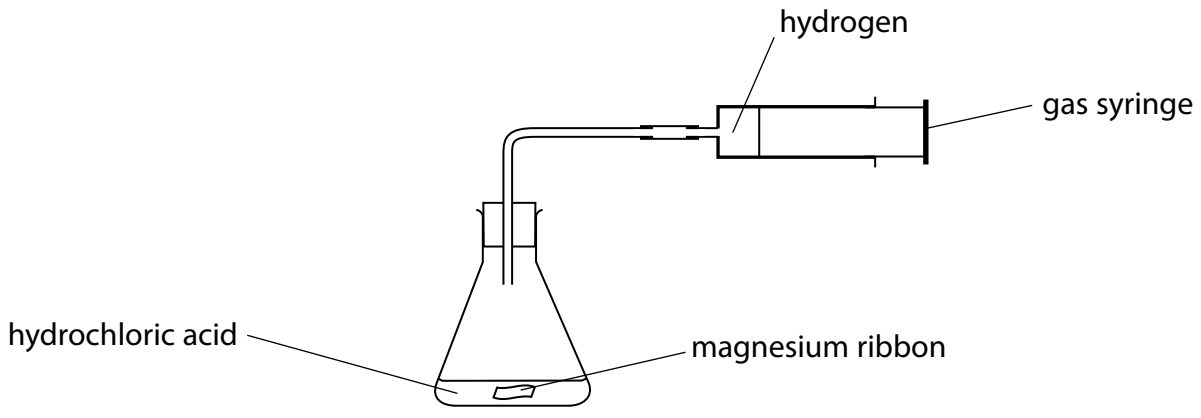
Explain which of these reactions, **P**, **Q** or **R**, is exothermic.

(2)

(b) Magnesium ribbon and hydrochloric acid are reacted in the apparatus shown in the diagram.

The equation for the reaction is

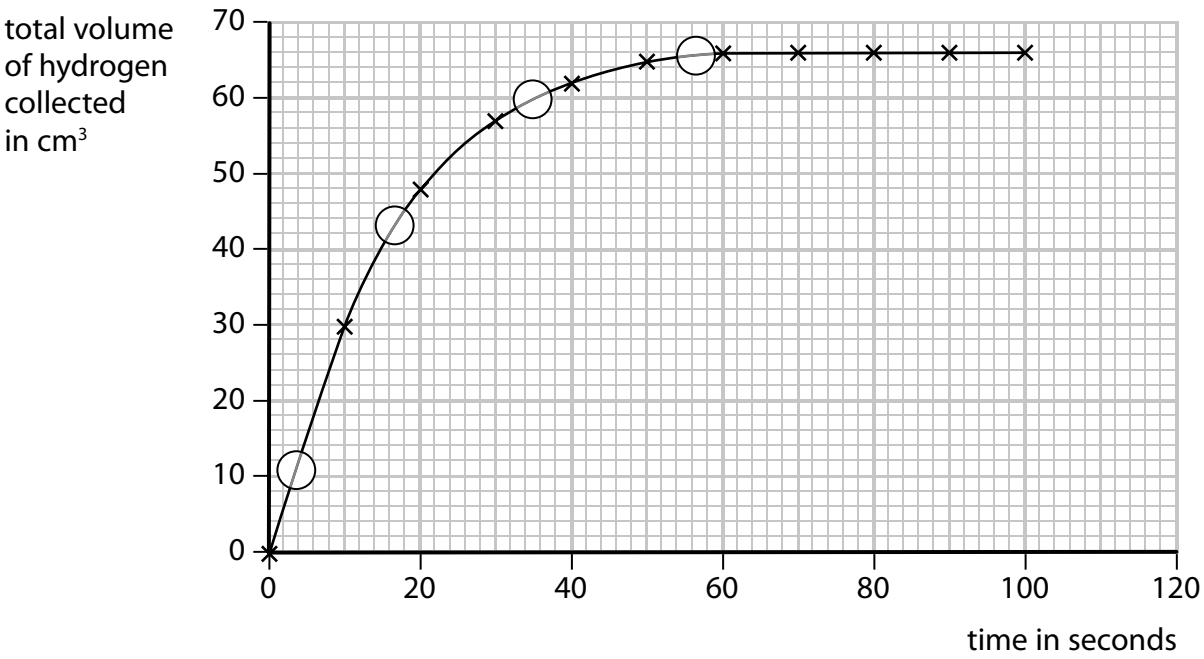
$$\text{magnesium} + \text{hydrochloric acid} \rightarrow \text{magnesium chloride} + \text{hydrogen}$$



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(i) The volume of hydrogen in the gas syringe is recorded every 10 seconds for 100 seconds.

The results are plotted on the graph.



Place a cross in a circle on the graph to show where the reaction is at its fastest rate.

(1)

(ii) The experiment is repeated, keeping all conditions exactly the same, except that the hydrochloric acid is more dilute.

This change causes the reaction to take place more slowly.

On the graph, sketch a line to show the results you would expect in this experiment.

(1)

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(c) Powdered coal is burnt in coal-fired power stations.

Explain why powdered coal burns in air at a faster rate than lumps of coal.

(2)

*(d) At room temperature, hydrogen peroxide decomposes slowly to form water and oxygen gas.
The equation for the reaction is

$$\text{hydrogen peroxide} \rightarrow \text{water} + \text{oxygen}$$

The progress of the reaction can be followed by measuring the volume of gas given off.

This reaction can be catalysed by the addition of solid manganese(IV) oxide.

Two properties of a catalyst are

- it increases the rate of a reaction
- its mass is unchanged at the end of the reaction.

Using hydrogen peroxide solution and manganese(IV) oxide, describe experiments to show that manganese(IV) oxide has these properties when used as a catalyst in this reaction.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Chemistry (5CH2F/01) Paper 01
Unit C2: Discovering Chemistry

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Summer 2016
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	B		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	a description including three of the following • draw on start line (in pencil) • stated distance up from bottom • put spots of {drink/sample} on paper (in positions shown) • allow spots to dry and repeat • solvent level below start line OWTTE		**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	A description including • allow layers to {form / separate} / liquids to separate (1) • operate tap / OWTTE (1) • run out {liquid X/most dense liquid} from the bottom OWTTE(1) • pour liquid Y from the top (1)	ignore liquid Y through tap	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	fractional (1) distillation (1)	allow max 1 for fractionation	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	+1	positive / +ve / 1+ / + / one plus	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	**A** 11		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	2.8.1	allow description giving numbers	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	An explanation linking • 1 electron **(1)** • (in the) {outer/last/final/end} {shell/energy level} **(1)**	allow the group number is the same as the number of electrons on the outer shell (1)	**(2)**

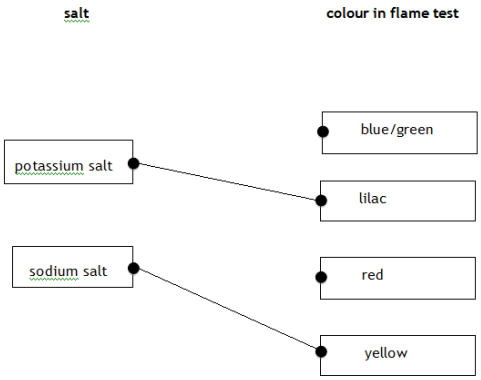
Question Number	Answer	Acceptable answers	Mark
2(d)(i)	**C** selenium, Se		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)(ii)	same number of shells (contain electrons) (1)	with each successive element, one electron is added to same shell	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	C lead iodide		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	lead + potassium → lead + potassium nitrate iodide iodide nitrate LHS 1 mark RHS 1 mark	ignore state symbols allow reactants in any order allow products in any order allow = instead of arrow if formula used they must be correct ignore formula if word and formulae are given for any substance do not allow a mixture of formula for both marks. e.g. lead nitrate + potassium iodide → PbI_2 + KNO_3 scores 1 mark. iodine for iodide = 1mark max	**(2)**

Question Number	Answer	Acceptable answer	Mark
3(a)(iii)	B E A D C all correct = 2 marks any three steps (ignoring B) in the correct order = 1 mark		**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	one single line from sodium to yellow (1) One single line from potassium to lilac (1) Do not accept multiple lines  		**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	KCl	ClK reject KCL/kcL/Kcl ignore charges unless incorrect 'correct' charges would be K^+Cl^-	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	an explanation linking • gain (of electrons)(1) • {one/an} electron (1)	reference to sharing electrons/covalent bonding = 0 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	40 + 12 + (16x3) **(1)** (= 100)	100 **(1)** with {no/incorrect} working 40 + 12 + (16x3) with {no/wrong} answer **(1)**	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	A 1 : 1		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	Al_2O_3	Ignore al_2o_3 / Al^2O^3 / AL_2O_3 / Al2O3 etc	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)	**C** C_2H_4		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(e)(i)	<u>7.2</u> **(1)** 9.0 their fraction x 100 **(1)** (= 80%)	0.8 **(1)** 80 (%) with {no/incorrect} working **(2)** correct working with {no/wrong} answer **(2)**	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)(ii)	An explanation linking two of the following • incomplete reaction **(1)** • practical losses during experiment **(1)** • side reactions taking place **(1)**	allow inaccurate measurements **(1)**	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)(iii)	$\frac{65}{81}$ **(1)** their fraction x 100 **(1)** (=80.2%)	0.802 or 0.8 **(1)** 80 / 80.2 with {no/incorrect} working **(2)** correct working with {no/wrong} answer **(2)**	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A description including two of the following • fizzes /bubbles • moves around surface of water • floats/on surface of water • disappears	dissolves	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	B flammable		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)(i)	An explanation linking • (delocalised/free) electrons (1) • (electrons) move/flow (to carry the current) (1)	reject ions moving	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(b)(ii)	magnesium salts colourless / iron salts coloured	magnesium salts are white any correct colour of iron salt allow colour	**(1)**

Question Number		Indicative Content	Mark
QWC	*5(c)	A explanation including some of the following points Reaction of chlorine with potassium bromide • colour change seen • bromide ions are displaced • yellow-orange colour of bromine appears in solution • chlorine is more reactive than bromine • chlorine + potassium bromide → bromine + potassium chloride Reaction of chlorine with potassium iodide • colour change seen • iodide ions are displaced • brown colour of iodine appears in solution (allow any colour from yellow to dark red) • chlorine is more reactive than iodine • chlorine + potassium iodide → iodine + potassium chloride Reaction of bromine with potassium iodide • colour change seen • iodide ions are displaced • solution darkens/orange-brown colour seen (allow any colour from yellow to dark red) • bromine is more reactive than iodine • bromine + potassium iodide → iodine + potassium bromide Conclusions • more reactive halogens displace less reactive halogens • order of reactivity is that chlorine is the most reactive of the three, followed by bromine and then iodine.	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	a limited description e.g. There is a colour change where there is a reaction, chlorine displaces bromide ions. Spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. iodine is the least reactive as iodide ions are displaced by both bromine and chlorine, a colour change is seen in each of these reactions. Showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	a detailed description e.g. chlorine is most reactive as it displaces bromide and iodide ions causing a colour change in each case, bromine is more reactive than iodine as bromine displace iodide ions. The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. Spelling, punctuation and grammar are used with few errors.	

Question Number	Answer	Acceptable answers	Mark
6(a)	An explanation linking two of the following • (reaction) Q (1) • temperature increase (of 19 ^{o}C) **(1)** • heat (energy) {released /given out} **(1)**	 ignore incorrect temperature rise do not allow just 'heat increases' If reaction P or R is identified as the exothermic reaction max 1 mark for heat (energy) released	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	A cross in the circle furthest to the left		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	similar curve to original but lower starting at origin **(1)**		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(c)	An description including • (powder has) a higher surface area **(1)** • more (frequent particle) collisions **(1)**		**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description including some of the following points **Practical detail for increased rate** • measure volume of hydrogen peroxide solution / stated volume • collect the gas in a {gas syringe / measuring cylinder over water / tube over water} • time for the reaction to be completed / fixed volume of gas to be collected • measure {amount/volume} of oxygen produced • no catalyst present **Practical detail for mass of catalyst** • repeat experiment but keeping everything the same • but with addition of manganese(IV) oxide / catalyst • take known mass of manganese(IV) oxide • after reaction filter (catalyst off) • wash (catalyst) • dry (catalyst) • find mass of catalyst **Results** • small volume of {gas / oxygen} produced before addition of catalyst • larger volume of gas produced with catalyst in specified time • this shows that the rate has increased on adding catalyst • this shows that the mass of catalyst is unchanged	**(6)**
Level	**0**	No rewardable content	
1	**1 – 2**	• a limited description of rate or mass effect e.g. repeat experiment again but add catalyst to the hydrogen peroxide solution • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 – 4**	• a description of the rate experiments or mass effect experiments. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 – 6**	• a detailed description of the rate experiments or mass effect experiments and a discussion of the results of the experiment with regards to either mass or rate OR a simple description of the rate and mass effect experiments • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Tuesday 9 June 2015 – Afternoon
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 4 6 8 3 A 0 2 2 0

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 ☒.

Halogens

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

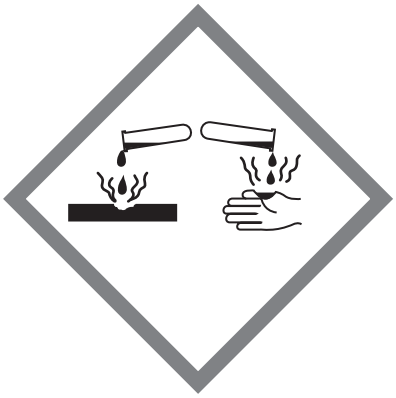
(a) Complete the table.

(3)

name	colour at room temperature	physical state at room temperature
chlorine		gas
bromine		liquid
iodine	grey	

(b) These two hazard symbols are attached to a container of liquid bromine.





A chemist uses bromine in an experiment.

Use the hazard symbols to suggest safety precautions the chemist should take when using the bromine.

(2)

.....

.....

.....

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(c) Magnesium reacts with bromine to form magnesium bromide.

Write the word equation for this reaction.

(2)

.....

(d) Sodium reacts with chlorine to form sodium chloride.

Which of these is the formula for sodium chloride?

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

(1)

☒ **A** SCl

☒ **B** NaOCl

☒ **C** NaCl

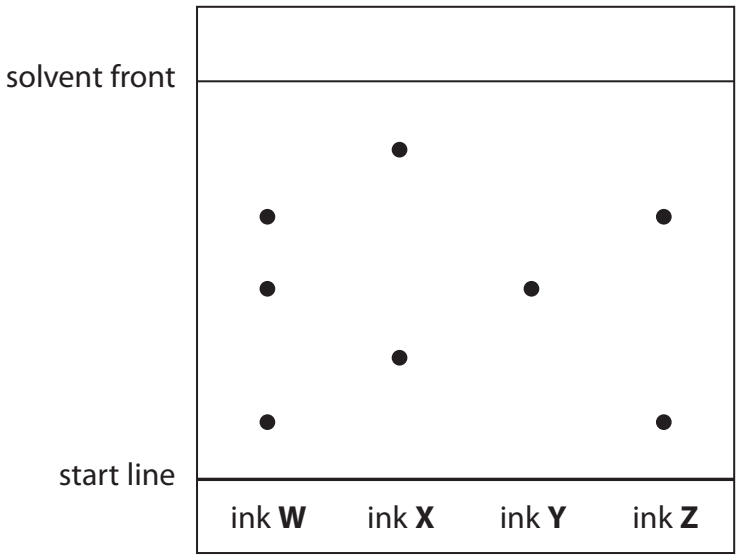
☒ **D** SOCl

(Total for Question 1 = 8 marks)

2 (a) Paper chromatography can be used to separate the coloured dyes in inks.

A student carried out a chromatography experiment on four inks, **W**, **X**, **Y** and **Z**.

The diagram shows the result.



(i) State the letter of the ink that contained only one coloured dye.

(1)

.....

(ii) Ink **W** has been made by mixing two of the other inks together.

State the two inks that could have been mixed to make ink **W**.

(1)

..... and .....

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

Oil and water are immiscible liquids.
A mixture of oil and water is best separated by using

(1)

☒ **A** distillation

☒ **B** evaporation

☒ **C** a filter funnel

☒ **D** a separating funnel

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(c) Which row of the table correctly shows the boiling point and ability to conduct electricity of a simple molecular, covalent liquid?

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

(1)

	boiling point	ability to conduct electricity
☒ **A**	low	good
☒ **B**	high	poor
☒ **C**	low	poor
☒ **D**	high	good

(d) Hydrogen chloride, HCl, can be formed by the reaction of hydrogen, H_2, with chlorine, Cl_2.

Write the balanced equation for this reaction.

(2)

(e) The electronic configuration of hydrogen is 1.
The electronic configuration of chlorine is 2.8.7.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of hydrogen chloride, HCl.

Show outer electrons only.

(2)

(Total for Question 2 = 8 marks)

Ions and analysis

3 (a) Which of the following is the formula of a cation?

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

(1)

- ☒ **A** Mg
- ☒ **B** Na^+
- ☒ **C** H_2O
- ☒ **D** F^-

(b) (i) The formula of a potassium ion is K^+ and of a carbonate ion is CO_3^{2-}.

Which of the following is the formula of potassium carbonate?

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

(1)

- ☒ **A** KCO_3
- ☒ **B** $K(CO)_3$
- ☒ **C** K_2CO_3
- ☒ **D** $K(CO_3)_2$

(ii) When dilute hydrochloric acid is added to potassium carbonate, a gas is evolved.

Describe the test for this gas.

(2)

.....

.....

.....

.....

(c) Barium nitrate solution is added to potassium sulfate solution in a beaker.
A white precipitate of barium sulfate forms in a mixture with potassium nitrate solution.

Describe how you would obtain a pure, dry sample of barium sulfate from the mixture in the beaker.

(3)

(d) Magnesium oxide is an ionic compound.

The electronic configuration of magnesium is 2.8.2.
The electronic configuration of oxygen is 2.6.

Describe, in terms of electrons, how a magnesium atom and an oxygen atom form ions in magnesium oxide, MgO.

(3)

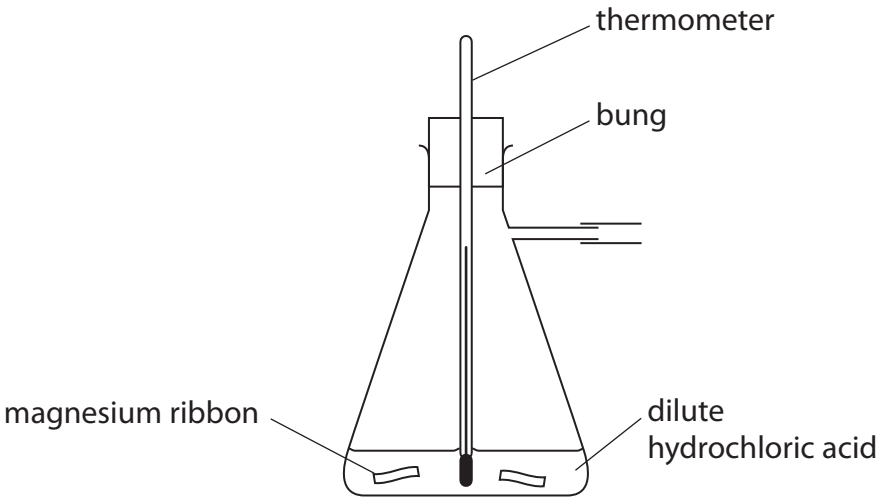
(e) Calculate the relative formula mass of magnesium oxide, MgO.
(relative atomic masses: O = 16; Mg = 24)

(1)

relative formula mass = ...

(Total for Question 3 = 11 marks)

4 The apparatus shown was used by a student to investigate the reaction between strips of magnesium ribbon and **excess** dilute hydrochloric acid.



The word equation for the reaction is

$$\text{magnesium(s)} + \text{hydrochloric acid(aq)} \rightarrow \text{magnesium chloride(aq)} + \text{hydrogen(g)}$$

(a) States of substances in reactions can be shown by state symbols.

Explain the difference between magnesium chloride(aq) and magnesium chloride(l).

(2)

.....

.....

(b) Describe what you would **see** when magnesium ribbon reacts with dilute hydrochloric acid.

(1)

.....

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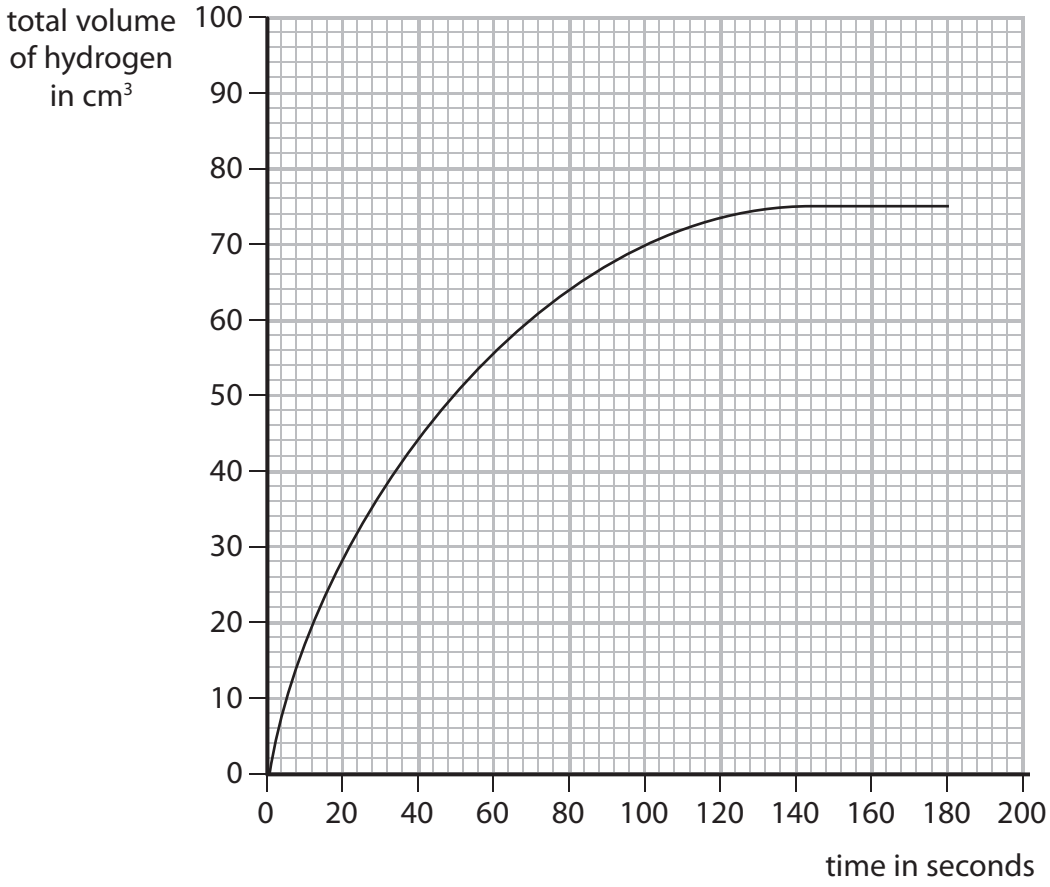
(c) Every 20 seconds, the student recorded the total volume of hydrogen produced in the reaction.

(i) Name a piece of apparatus the student should use to measure the volume of hydrogen produced.

(1)

.....

The results are shown on the graph.



(ii) After how many seconds had all the magnesium reacted?

(1)

..... seconds

(iii) The experiment is repeated using the same volume of a more concentrated hydrochloric acid solution.
All other conditions were kept the same.

On the graph draw a curve to show how the volume of hydrogen changes with time during this experiment.

(2)

(d) A student repeated the original experiment using the same mass of magnesium as a powder instead of as ribbon.
All other conditions were the same as in the first experiment.

Explain the effect on the rate of reaction of using magnesium powder instead of magnesium ribbon.

(2)

(e) When magnesium reacts with dilute hydrochloric acid there is a change in temperature.

In an experiment the results were
temperature at start = 21 °C
temperature at end = 62 °C

Explain what conclusion can be made about the type of reaction, from these results.

(2)

(Total for Question 4 = 11 marks)

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5 (a) Complete the table to show the relative mass of a neutron and of an electron.

(2)

particle	relative mass
proton	1
neutron	
electron	

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

An atom has no overall charge because it contains

(1)

- ☒ **A** more protons than electrons
- ☒ **B** the same number of electrons and protons
- ☒ **C** the same number of electrons and neutrons
- ☒ **D** more neutrons than electrons

(c) The atomic number of lithium is 3.
The mass number of an atom of lithium is 7.

State the name and number of each of the particles in the nucleus of this atom.

(2)

.....

.....

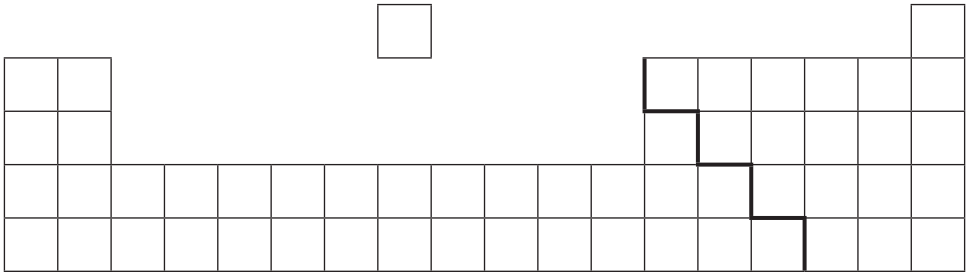
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*(d) Here is some information about the periodic table.

In the periodic table elements are arranged in rows and columns.
The position of an element in the periodic table depends on its atomic structure.
Elements with similar chemical properties are found in the same parts of the periodic table.

Identify different parts of the periodic table and explain how the position of an element in the periodic table is linked to its chemical properties and atomic structure.

(You are provided with an outline of the periodic table below and you may use this to help your answer.)

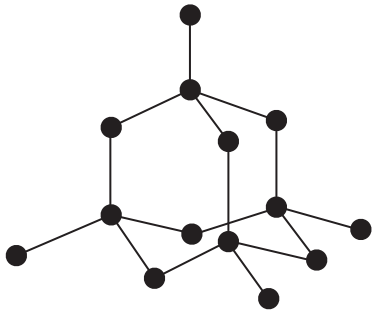


(6)

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(Total for Question 5 = 11 marks)

6 (a) The arrangement of carbon atoms in diamond is shown.



diamond

Explain why diamond has a very high melting point.

(2)

.....

.....

.....

.....

(b) (i) Calculate the percentage by mass of calcium in calcium chloride, $CaCl_2$.

(relative atomic masses Cl = 35.5; Ca = 40;
relative formula mass $CaCl_2$ = 111)

(2)

.....

.....

.....

.....

percentage by mass = ... %

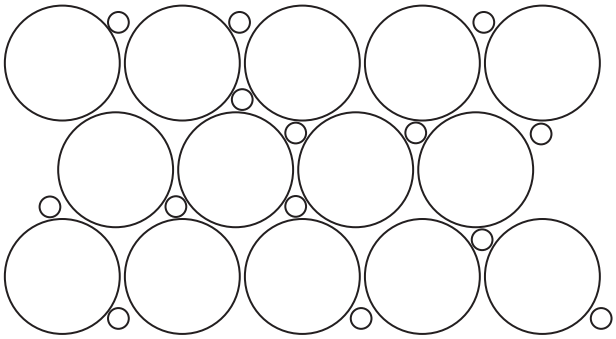
(ii) Which row of the table correctly shows the solubility of calcium chloride and barium sulfate in water?

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

(1)

	calcium chloride	barium sulfate
☒ **A**	soluble	soluble
☒ **B**	insoluble	insoluble
☒ **C**	insoluble	soluble
☒ **D**	soluble	insoluble

*(c) The diagram shows the structure of a metal.



Use the diagram to describe the structure of a metal and to explain why metals are malleable and conduct electricity.

(6)

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(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Chemistry (5CH2F/01) Paper 01

Unit C2: Discovering Chemistry

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)	<table><tr><th>colour</th><th>physical state</th></tr><tr><td>**(yellow-)green (1)**</td><td>gas</td></tr><tr><td>**red-brown (1)**</td><td>liquid</td></tr><tr><td>grey</td><td>**solid (1)**</td></tr></table>	chlorine: any shade of green eg light/pale do not allow any colour in combination with green except yellow do not allow yellow on its own bromine: accept brown or red alone OR any shade of red or brown eg light/dark brown reject orange/combinations with orange reject yellow/combinations with yellow	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(b)	A description linking any two of use fume cupboard (1) do not inhale/breathe in vapour (1) (use) gloves (1) do not spill on the skin (1)	 keep room well ventilated use gas mask ignore face mask/respirator goggles/safety glasses/safety spectacles /do not splash in the eyes Ignore wear protective clothing/equipment Ignore cover mouth Ignore do not spill it/drink it/eat it/swallow it/spill on surfaces/wash off spills Ignore burns skin	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	magnesium + bromine → magnesium bromide LHS (1) RHS (1)	allow reactants in either order allow = instead of arrow if formulae are used, do not allow MG or BR or superscripts $Mg + Br_2$ $MgBr_2$ Ignore formulae if both names and formulae given for any substance do not allow a mixture of words and formulae for both marks eg magnesium + bromine → $MgBr_2$ scores 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	C NaCl		**(1)**

Total for Question 1 = 8 marks

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	Y 0 marks if any additional letters		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	Y and Z 0 marks if any additional letters	in either order both needed for the mark	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	D a separating funnel		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	C low poor		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)	$H_2 + Cl_2 \rightarrow 2HCl$ M1 correct formulae on LHS and RHS **(1)** M2 correctly balanced **(1)**	In M1 do not allow incorrect use of upper/lower case/subscripts but M2 can be awarded for correct balancing dependent on M1 being awarded (but note special case above) accept multiples	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(e)	M1 shared pair of electrons between one H and one Cl **(1)** M2 remaining outer electrons correct (**1**)	Accept all permutations of dots and crosses for electrons If any indication of ionic bonding including charges 0/2 symbols not required ignore incorrect symbols eg C/CL M2 dependent on M1 electrons do not need to be in pairs ignore inner shells electrons can be on/in ring or no ring	**(2)**

Total for Question 2 = 8 marks

Question Number	Answer	Acceptable answers	Mark
3(a)	B Na^+		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	C K_2CO_3		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	A description linking M1 (bubble gas through) limewater/calcium hydroxide solution (1) M2 turns cloudy/milky/white precipitate (1)	 if limewater added directly to the solution/mixture then only M1 can be awarded white ppt second mark dependent on use of limewater if mention any gas other than carbon dioxide or make reference to any other gas test/result then max 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)		maximum 2 marks if heat or evaporate or crystallisation method used on mixture or filtrate	**(3)**
	First mark filter (the mixture) **(1)**	description or diagram of filtering ie (filter) funnel **and** filter paper do not allow sieving/sifting/draining /decanting do not allow separating funnel	
	Second and third marks A description including **two** of the following barium sulphate/the solid/the residue/precipitate is left on (filter) paper/in the funnel (1)		
	wash/rinse (the solid/residue/barium sulfate with distilled water) **(1)**	pour water over/through solid (in filter paper) clean solid with water do not allow this mark if washing is done after drying	
	any method of drying **(1)**	eg in an oven /on a windowsill / on a radiator /with filter paper warm it heat it evaporate the water Allow 'leave to dry' Do not allow just "dry it (out/off)" must have filtered and/or washed to score the mark for drying	

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking **transfer of electrons (1)** **correct direction of transfer (1)** **two** electrons (transferred) **(1)**	Marks can be scored from diagrams If any reference to electrons shared **0/3** If any reference to covalent bonds MAX 2 transfer of atoms/ions in place of electrons MAX 2 if transfer of electrons to/from ions MAX 2 Ignore charges on ions	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(e)	(24 + 16) (1) (= 40)	40 (with no working)	**(1)**

Total for Question 3 = 11 marks

Question Number	Answer	Acceptable answers	Mark
4(a)	An explanation linking (aq) (means) aqueous/dissolved in water (1) (l) (means) liquid (1)	 ignore diluted ignore can be dissolved in water/ magnesium chloride is soluble in water do not allow mixed with a solution/a liquid solution	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	effervescence/bubbles/ fizzing OR magnesium/solid/it disappears OR temperature rise	ignore hydrogen/gas released/ formed /given off dissolves / gets smaller ignore reacts ignore heat given out but any incorrect observation scores 0	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	(gas) syringe	(upturned) burette/measuring cylinder/graduated flask (filled with water)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii) Clip (iii) + graph	140	range 136-144	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(iii) Clip (ii) + graph	curve above original(1) levels at same volume (1)	curve must start at origin does not need to finish at same time as original curve no marks for over-writing original curve (after 10 cm^3 volume)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	Explanation linking (rate of reaction/it) increases (1) larger surface area (1)	 speed (of reaction) increases reaction/it is faster/quicker ignore takes less time more frequent collisions more collisions per second ignore just more collisions ignore greater chance of collisions	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	An explanation linking: increase in temperature (1) (so) exothermic (reaction) (1)	 temperature went up (by 41ºC) it got hot(ter) ignore just 'heat increases' heat (energy) produced/released /given out/lost	**(2)**

Total for Question 4 = 11 marks

<table>
<tr><th>Question Number</th><th>Answer</th><th>Acceptable answers</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>particle</th><th>relative mass</th></tr>
<tr><td>proton</td><td>1</td></tr>
<tr><td>neutron</td><td>1 (1)</td></tr>
<tr><td>electron</td><td>1/1837 / negligible / very small (1)</td></tr>
</table>
</td><td>if any minus sign(s) MAX 1

anything less than 1/1500 or 0.00067/(almost) 0</td><td>(2)</td></tr>
</table>

Question Number	Answer	Acceptable answers	Mark
5(b)	**B** the same number of electrons and protons		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(c)	3 protons **(1)** {4/7-3} neutrons **(1)** maximum 1 mark if electrons mentioned	 if numbers incorrect but state both protons and neutrons (and not electrons) allow (1) but can score both marks if clearly stated electrons not in nucleus eg in shells	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	A description and explanation including some of the following points **CREDIT CAN BE GIVEN FOR LABELS/ANNOTATIONS ON DIAGRAM** **Parts of the periodic table** • periods • (periods) are (horizontal) rows • groups • (groups) are (vertical) columns • group 1 are alkali metals • group 7 are halogens • group 0 are noble gases • transition elements in the middle of the table • metals on the left (and centre) • non-metals on the right **Position of element/Atomic structure** • elements arranged in order of increasing atomic number/number of protons • group number is equal to number of electrons in outer shell • period number is equal to the number of shells **Position of element/Chemical properties** • elements in same group have similar chemical properties • eg elements in group 1 become more reactive with increasing atomic number/down group • eg elements in group 7 become less reactive with increasing atomic number /down group	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description e.g. correctly identifies one part of the periodic table **OR** states one aspect of positioning/atomic structure **OR** one aspect of positioning/chemical property of elements • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description e.g. identifies some/several parts of the periodic table **OR** identifies one part of the periodic table and attempts to link the position of an element(s) to either atomic structure or chemical properties • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description e.g. identifies some/several parts of the periodic table **AND** attempts to link the position of an element(s) to at least two aspects of atomic structure and/or chemical properties • relate atomic structure to at least two aspects of positioning and/or chemical properties of the elements • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 11 marks

Question Number	Answer	Acceptable answers	Mark
6(a)	An explanation linking any two of • giant (covalent structure)/ giant molecule /macromolecule /large number of bonds (1) • strong (covalent) bonds (1) • large amount of heat /energy (needed to break bonds) (1)	Any reference to ionic bonding or intermolecular forces scores 0/2 lattice lots of/many bonds hard to break ignore hard to melt/high temperature needed	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	(40/111) (1) x 100 (1) (= 36.04)	36.(04) alone scores 2 marks If first mark not awarded allow second mark for any fraction x 100	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	D soluble insoluble		**(1)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description / explanation including some of the following points **CREDIT CAN BE GIVEN FOR LABELS/ANNOTATIONS ON DIAGRAM** **Structure of a metal** • positive ions/cations/atoms • in regular arrangement/lattice • delocalised/sea of electrons **Metals are malleable** • malleable means can be bent/hammered into shape because • rows/sheets/layers of ions/ atoms • slide over each other • electrons fill spaces **Metals conduct electricity** • free electrons • (electrons) can move/flow • through structure • (electrons) transfer charge	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description eg a limited description of one of structure, malleability, and conduction • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description eg a limited description of **two** from structure, malleability and conduction **OR** an explanation of **one** of structure, malleability and conduction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description eg a description of all three of structure, malleability, and conduction **OR** a detailed explanation of one of them and a limited description of another • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Total for Question 6 = 11 marks

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Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Tuesday 10 June 2014 – Afternoon
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- 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
							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 ☒.

Elements in the periodic table

1 (a) Copper is a metal.

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

In the periodic table copper is in

(1)

☐ **A** group 0

☐ **B** group 1

☐ **C** group 7

☐ **D** the transition metals

(ii) Which of these is a property of copper metal?

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

(1)

☐ **A** does not conduct an electric current

☐ **B** forms colourless compounds

☐ **C** has a low melting point

☐ **D** is malleable

(b) Helium and argon are noble gases.

(i) Choose the correct word from this box to complete the sentence below.

non- flammable	odourless	reactive

(1)

Argon can be used to put out fires because it is .....

(ii) Choose the correct phrase from this box to complete the sentence below.

has a high density	has a low density	is colourless



(1)

Helium is used in airships because it .....

(c) Chlorine, bromine and iodine are halogens.

(i) The table shows the appearance of bromine and iodine at room temperature.

Complete the table to show the appearance of chlorine at room temperature.

(2)

halogen	appearance at room temperature
chlorine	
bromine	dark red liquid
iodine	grey solid

(ii) Chlorine reacts with hydrogen to form hydrogen chloride.

Write the word equation for this reaction.

(2)

..... + ... → .....

(Total for Question 1 = 8 marks)

Elements and atoms

2 Beryllium, Be, has atomic number 4.

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

From its position in the periodic table (page 2), beryllium is most likely to be a

(1)

☒ **A** metal

☒ **B** halogen

☒ **C** compound

☒ **D** gas at room temperature

(ii) Give the symbol of an atom of another element in the same period of the periodic table as beryllium.

(1)

.....

(b) The atomic number of beryllium is 4.

The mass number of an atom of beryllium is 9.

(i) State the numbers of protons, electrons and neutrons in this atom of beryllium.

(3)

..... protons

..... electrons

..... neutrons

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

The relative charge on an electron is

(1)

☒ **A** +1

☒ **B** 0

☒ **C** −1

☒ **D** −2

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(c) The electronic configuration of phosphorus is 2.8.5.

Explain, in terms of its electronic configuration, why phosphorus is in group 5 of the periodic table.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

Salts

3 (a) Solutions of soluble salts can react together to form an insoluble salt.

What name is given to this type of reaction?

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

(1)

- ☒ **A** combustion
- ☒ **B** neutralisation
- ☒ **C** precipitation
- ☒ **D** separation

(b) Information about the solubility of some salts is given below.

- all nitrates are soluble
- all common carbonates are insoluble except sodium carbonate, potassium carbonate and ammonium carbonate.

Copper carbonate can be made by reacting together solutions of sodium carbonate and copper nitrate.

Complete this equation by filling in the missing state symbols.

(2)

$$\text{sodium carbonate}(aq) + \text{copper nitrate}(aq) \rightarrow \text{copper carbonate}(\ldots\ldots) + \text{sodium nitrate}(\ldots\ldots)$$

(c) The symbol for a copper ion is Cu^{2+}.

The symbol for a carbonate ion is CO_3^{2-}.

Write the formula for copper carbonate.

(1)

.....

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(d) In an experiment, solid lead iodide is produced in a mixture with a solution of a soluble salt.

Describe how a pure, dry sample of solid lead iodide can be obtained from this mixture.

(3)

.....

.....

.....

.....

.....

.....

.....

(e) Two tests were carried out to identify the ions in salt **X**.

(i) Test: flame test on solid salt **X**.

Result: lilac flame.

Identify the ion in salt **X** that gives the lilac flame.

(1)

ion in salt **X** .....

(ii) Test: addition of dilute nitric acid and silver nitrate solution to a solution of salt **X**.

Result: white solid formed.

Identify the ion in salt **X** that produces the white solid.

(1)

ion in salt **X** .....

(Total for Question 3 = 9 marks)

Compounds

4 (a) (i) Balance the equation for the reaction between sodium and chlorine to produce sodium chloride by putting numbers in the spaces provided.

(2)

..... Na + Cl_2 → ..... NaCl

(ii) In an experiment to make sodium chloride, the yield is 2.5 g.
The theoretical yield of sodium chloride for this experiment is 4.0 g.

Calculate the percentage yield of sodium chloride in this experiment.

(2)

.....

.....

.....

percentage yield = ... %

(iii) Sodium chloride has a high melting point.
Sodium chloride does not conduct electricity when solid but does conduct electricity when molten.

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

These properties show that the structure of sodium chloride is

(1)

☒ **A** ionic

☒ **B** giant molecular, covalent

☒ **C** simple molecular, covalent

☒ **D** metallic

(iv) Calculate the relative formula mass of sodium chloride, NaCl.
(relative atomic masses: Na = 23, Cl = 35.5)

(1)

.....

relative formula mass = ...

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(b) Calculate the percentage by mass of magnesium in magnesium sulfate, $MgSO_4$.

(relative atomic masses: O = 16, Mg = 24, S = 32
relative formula mass: $MgSO_4$ = 120)

(2)

.....

.....

.....

percentage of magnesium = ... %

(c) The formula of a molecule of ethane is C_2H_6.

(i) Give the empirical formula of ethane.

(1)

.....

(ii) Ethane is a simple molecular, covalent compound.

Ethane has a low boiling point.

Explain, in terms of particles it contains, why ethane has a low boiling point.

(2)

.....

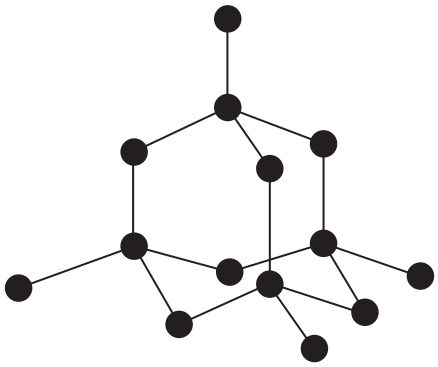
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(Total for Question 4 = 11 marks)

5 (a) The diagram shows the structure of diamond.



(i) Describe what each ● represents.

(2)

.....

.....

(ii) State the type of bonding in the diamond structure.

(1)

.....

(b) Give the name of the process used to obtain oxygen from liquid air.

(2)

.....

.....

(c) A colouring in some sweets was analysed using paper chromatography.

One of the dyes in the colouring moved 2 cm up the paper while the solvent moved 8 cm.

What is the R_f value of this dye?

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

(1)

- ☒ **A** 0.25
- ☒ **B** 2
- ☒ **C** 4
- ☒ **D** 6

*(d) Here is some information about magnesium, oxygen and magnesium oxide.

The electronic configuration of magnesium atoms is 2.8.2
The electronic configuration of oxygen atoms is 2.6
Magnesium oxide is an ionic compound.

When magnesium ribbon is heated, it reacts with oxygen from the air to form magnesium oxide, MgO.

Describe how the reaction can be carried out, including an explanation of what happens to the magnesium and oxygen atoms when they form magnesium oxide.

(6)

(Total for Question 5 = 12 marks)

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Energy changes and rates of reaction

6 (a) When zinc reacts with copper sulfate solution, zinc sulfate solution and copper are formed.

(i) An experiment was carried out to measure the temperature change when zinc powder reacts with copper sulfate solution.

initial temperature of copper sulfate solution = 20 °C
final temperature of mixture after the reaction = 46 °C

Explain what the temperature readings show about the type of heat change that occurs during this reaction.

(2)

.....

.....

.....

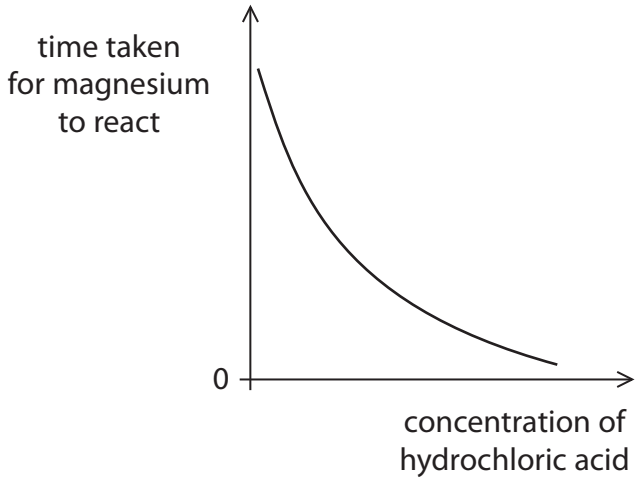
.....

(ii) Complete the equation for the reaction between zinc and copper sulfate by putting formulae in the spaces provided.

(2)

$Zn + CuSO_4 \rightarrow$ ..... + ...

(b) A length of magnesium ribbon was added to excess hydrochloric acid.
The time for all of the magnesium to react was recorded.
The experiment was repeated with the same lengths of magnesium ribbon but different concentrations of the acid.
The graph shows the time taken for the magnesium to react with different concentrations of this acid.



Use the graph to explain how the rate of this reaction changes as the concentration of hydrochloric acid increases.

(2)

.....

.....

.....

.....

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*(c) Marble chips react with dilute hydrochloric acid to produce carbon dioxide gas.
The rate of this reaction can be changed by changing the size of the marble chips.

Describe experiments to investigate what effect using smaller marble chips has on the rate of this reaction.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (results)

Summer 2014

Pearson Edexcel GCSE in Chemistry (5CH2F/01)

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	D the transition metals		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	D malleable		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	non-flammable		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	has a low density		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	A description including (yellow-) green (1) gas (1)	 any shade of green do not allow just 'yellow' do not allow green in combination with other colours eg blue-green	 **(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	hydrogen + chlorine → hydrogen chloride lhs (1) rhs (1) Ignore formulae in addition to all of the names	if formulae are used, do not allow h or CL or superscripts H_2 + Cl_2 on lhs 2HCl on rhs reactants in either order do not allow a mixture of words and formulae for both marks eg H_2 + Cl_2 → hydrogen chloride scores 1 mark for rhs do not allow hydrochloric acid /hydrochloride/hydrogen chlorine	**(2)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	A metal		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	Any one of Li B C N O F Ne Ignore numbers with the symbols eg $^{7}_{3}Li$		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	4 (protons) (1) 4 (electrons) (1) 5 (neutrons) (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	C -1		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation linking 5 electrons (1) (in the) {outer/last/final/end} {shell/energy level} (1)	 it has 5 {outer/valence} electrons fully correct diagram showing electronic configuration **and** electron(s) labelled the group (number) is the number of electrons in the outer shell orbit/ring for shell fully correct diagram showing electronic configuration without labelled electron **OR** 5 in the {outer/last} {shell / energy level} do not allow just '5 at the end' do not award the first mark if proton/neutron/atom (in the outer shell)	**(2)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Acceptable answers	Mark
3(a)	C precipitation		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	copper carbonate (s) (1) sodium nitrate (aq)(1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	$CuCO_3$ Ignore any 'balancing' number in front of $CuCO_3$ Ignore any working to find the formula	$Cu(CO_3)/Cu^{2+}CO_3^{2-}$ / $(Cu)^{2+}(CO_3)^{2-}$ / $(Cu^{2+})(CO_3^{2-})$ do not allow superscript 3 ie $CuCO^3$ do not allow $Cu(CO)_3$	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)		Maximum **2** marks if another chemical is added to the original mixture Maximum **2** marks if heat or evaporate is used on the original mixture or the filtrate	
	First mark filter/filtration/filtering (1)	description or diagram of filtering ie funnel **and** filter paper do not allow sieving/ sifting/ draining /decanting do not allow separating funnel	
	Second and third marks A description including **two** of the following		
	wash/rinse (with distilled water) (1)	pour water through solid in filter paper / clean solid with water do not allow this mark if washing is done after drying	
	any method of drying (1)	leave to dry do not allow just 'dry'	
	{lead iodide/the solid/the precipitate/the insoluble salt} is {the residue/left on the paper} (1)	do not allow other {solids/salts} left with the lead iodide	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(e)(i)	potassium / K^+	K	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(e)(ii)	chloride / Cl^-	chlorine (ion) / Cl do not allow Cl_2	**(1)**

(Total for Question 3 = 9 marks)

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	**2** Na **(1)** + Cl_2 → **2** NaCl (1) Ignore + in front of the 2s	maximum 1 mark if any balancing number is added in front of Cl_2 or if any of the formulae are changed eg 4Na + $2Cl_2$ → 4NaCl or Na + 1/2 Cl_2 → NaCl score (1) do not allow negative signs in front of balancing numbers	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	2.5 (1) 4.0 their fraction x 100 (1) (=62.5)	0.625 or 5/8 62.5/63 with {no/incorrect} working correct working with {no/wrong}	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	A ionic		**(1)**

Question Number	Answer	Acceptable answers	Mark
4 (a)(iv)	23 + 35.5 (=58.5) Ignore g	58.5 with {no/incorrect} working 23 + 35.5 with {no/wrong} answer do not allow 58/59 without working	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	$\frac{24}{120}$ (1) their fraction x 100 (1) (=20%)	1/5 or 0.2 20 with {no/incorrect} working correct working with {no/wrong} answer	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	CH_3	2 CH_3 / C_1H_3 / H_3C do not allow just 1:3	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	An explanation linking any **two** from weak {forces/attractions} (1) between {molecules/particles/them}/ intermolecular (1) little {heat/energy} needed {to separate the molecules/overcome force(s) between molecules} (1)	maximum **1** mark if breaking bonds between atoms/breaking down {molecules/ particles}/breaking covalent bonds specific weak forces eg Van der Waals/London weak bonds do not allow covalent bonds are weak /weak bonds between atoms ignore weak hydrogen bonds weak bonds between {molecules / particles} do not allow intramolecular 'little energy is needed to break the bonds' only if it is clear that {covalent/single} bonds are not being broken	**(2)**

(Total for Question 4 = 11 marks)

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	A description including carbon (1) atom(s) (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	covalent Ignore giant molecular		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	fractional distillation (2)	distillation fractionation	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(c)	**A** 0.25		**(1)**

Question Number		Indicative Content	Mark
QWC	***5(d)**	A description/explanation including some of the following points content could be shown in diagram(s) **practical procedure** • ignite magnesium /put magnesium in (Bunsen) flame • use of tongs/crucible / tube or gas jar of {oxygen/air} • lift lid (to let air in)- if crucible used • magnesium burns/oxidises/exothermic reaction • (bright) white {flame/light} • white powder/ash/solid formed **bonding** • magnesium atoms have 2 electrons in the outer shell • magnesium atoms {lose/transfer} electrons • form Mg^{2+}/ions with positive charge • oxygen atoms have 6 electrons in the outer shell • oxygen atoms gain electrons • forms O^{2-}/ions with negative charge • {8 electrons in /full/complete} outer shell • two electrons transferred/gained/lost • ions with opposite charges attract each other/ Mg^{2+} attracts O^{2-} ions	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. magnesium burns / magnesium atoms lose electrons • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. magnesium burns with a white flame / magnesium forms positive ions and oxygen forms negative ions • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description including the experiment and bonding e.g. magnesium burns with a white flame, magnesium atoms give their 2 outer electrons to oxygen atoms • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 5 = 12 marks)

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	An explanation linking {the temperature/it} {increased / went up (by 26°C)} (1) (so the reaction is) exothermic (1)	 it got hotter/it gets hot heat (energy){released /given out} ignore incorrect temperature rise do not allow just 'heat increases'	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	$ZnSO_4$ (1) Cu (1)	allow formulae in either order maximum if additional formulae are included maximum if balancing numbers added do not allow upper case N /superscript 4	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation linking **First mark – relating concentration to time** (as the concentration/amount of acid increases) the time (taken for the magnesium to react) decreases (1) Ignore any reference to negative correlation Ignore time gets faster/quicker **Second mark – effect on rate** (so){ the rate/it} increases/reaction becomes {faster/quicker} (1) Ignore any reference to positive correlation	Reverse arguments if candidate has related time and rate to decreasing concentration of acid {less/shorter} time	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description including some of the following points **Experiment 1** • measure volume of acid/stated volume • measure mass of marble chips/stated mass • add acid to marble or marble to acid in a suitable container eg flask, beaker, boiling tube, test tube • collect the gas in a {gas syringe/measuring cylinder over water/ tube over water}/bubble gas through limewater/bubble gas through water • measure {amount/volume} of carbon dioxide/count the bubbles/fixed volume of carbon dioxide • measure mass/mass loss (on a balance) • time/measure how long the reaction takes **Experiment 2** • do another experiment with different size marble chips • use the same mass of marble chips • use the same {volume/concentration/mass} of acid/same acid • crush the marble/use powdered marble **Results** • smaller chips (of marble) have a more vigorous reaction/produce more {fizzing/bubbles} ORA • smaller chips take less time to {react/produce a certain volume of gas /have a certain mass loss} ORA • smaller chips have a larger surface area ORA • smaller chips react faster ORA • larger surface gives a faster reaction	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. crush the marble chips/smaller marble chips give more fizzing • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. put marble chips and acid in a flask and repeat with the same mass of small marble chips / collect the gas in a syringe, smaller pieces of marble react faster • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. put marble chips and acid in a flask, repeat the experiment with the same mass of crushed marble, crushed marble takes less time to react • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 6 = 12 marks)

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Write your name here

Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Thursday 13 June 2013 – Morning
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- 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
							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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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 ☒.

Groups in the periodic table

1 The periodic table is very useful to chemists.

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

The periodic table is a table of

(1)

- ☒ **A** mixtures
- ☒ **B** elements
- ☒ **C** compounds
- ☒ **D** solutions

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

Group 1 in the periodic table contains

(1)

- ☒ **A** transition metals
- ☒ **B** noble gases
- ☒ **C** halogens
- ☒ **D** alkali metals

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(c) The table shows some of the gases in group 0 and some of their properties.
The gases are shown in the order in which they appear in group 0.

(i) Fill in the three spaces in the table.

(3)

gas	atomic symbol	density / g dm^{-3}	reaction with metals
helium	He	0.12	no reaction
neon	Ne	1.44	no reaction
argon	Ar		no reaction
krypton		3.00	no reaction
xenon	Xe	3.56	

(ii) Some light bulbs contain a metal filament.



These light bulbs are filled with argon.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

P 4 1 9 3 8 A 0 4 2 0

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(d) The table shows some solids and some properties of solids.

Draw **one** straight line from each solid to properties of that solid.

(2)

solid	**properties of solid**
iodine	a soft metal that reacts vigorously with water
potassium	a grey solid that forms a purple vapour when heated
copper	a yellow solid that does not conduct electricity
	a red-brown solid that reacts to form blue compounds

(Total for Question 1 = 9 marks)

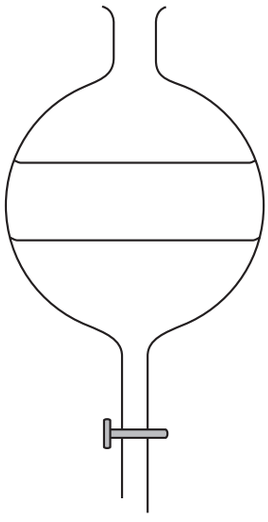
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Water

2 (a) A separating funnel is shown.



The separating funnel can be used to separate two immiscible liquids, such as oil and water.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

.....

.....

.....

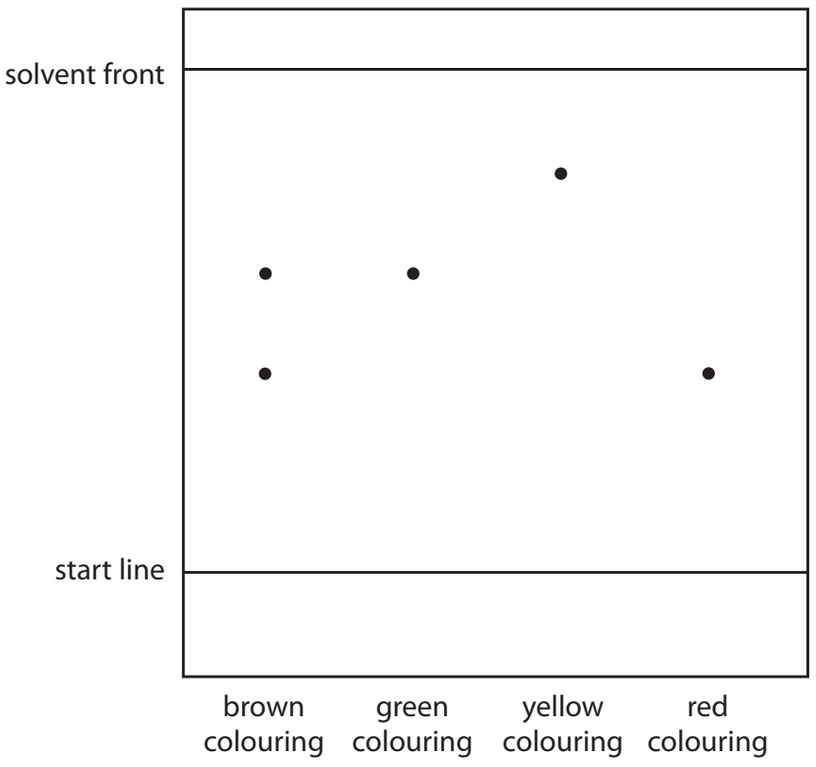
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(b) Paper chromatography can be used to separate coloured substances.

A student carried out a chromatography experiment on four food colourings.
The four food colourings were brown, green, yellow and red.

The diagram shows the results.



Use the results of the chromatography experiment to describe the colours present in the brown food colouring.

(2)

.....

.....

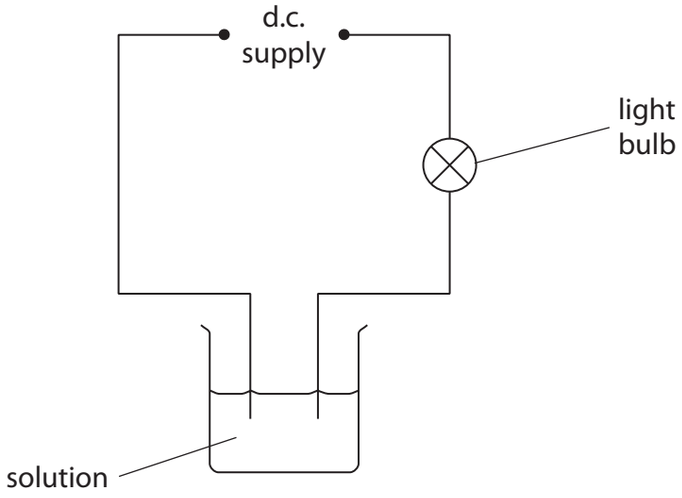
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(c) An experiment is carried out on two solutions to see if they conduct electricity.

The apparatus used is shown.



The two solutions used are sodium chloride solution and sucrose solution.
Sodium chloride is an ionic compound.
Sucrose is a simple molecular, covalent compound.

Explain what happens when each solution is tested in the circuit shown.

(3)

.....

.....

.....

.....

.....

(d) Calculate the relative formula mass of water, H_2O.

(Relative atomic masses: H = 1.0, O = 16)

(1)

.....

.....

relative formula mass = ...

(Total for Question 2 = 8 marks)

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Atomic structure and the periodic table

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

The particles in atoms are electrons, neutrons and protons.

The mass of an electron is

(1)

☒ **A** greater than the mass of a neutron

☒ **B** the same as the mass of a proton

☒ **C** smaller than the mass of a proton

☒ **D** the same as the mass of a neutron

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

.....

.....

.....

.....

(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

.....

.....

.....

.....

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(d) An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

.....

.....

.....

.....

(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond**.

(2)

.....

.....

.....

.....

(ii) The formula of a molecule of phosphorus oxide is P_4O_{10}.

Give the empirical formula of this oxide.

(1)

.....

(Total for Question 3 = 10 marks)

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Calcium carbonate

4 (a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

.....

.....

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

The colour produced in a flame test by calcium ions is

(1)

☒ **A** green

☒ **B** lilac

☒ **C** orange-red

☒ **D** yellow

(ii) Describe how a flame test is carried out on a solid.

(2)

.....

.....

.....

.....

(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

.....

.....

percentage yield of carbon dioxide = ... %

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(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

.....

.....

.....

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

Ionic compounds

(1)

☒ **A** conduct electricity when solid

☒ **B** do not conduct electricity when molten

☒ **C** have low boiling points

☒ **D** have high melting points

(Total for Question 4 = 9 marks)

Barium sulfate

5 (a) Barium sulfate contains

barium ions, Ba^{2+}
sulfate ions, SO_4^{2-}

(i) Give the formula of barium sulfate.

(1)

.....

(ii) Give the meaning of the term **ion**.

(1)

.....

.....

(b) This is an X-ray photograph of part of a patient's body.
Before the photograph was taken a suspension of barium sulfate was introduced into his body to show the required part.



Source: andi-sheba.blogspot.com

Many barium salts are toxic.
Barium sulfate is insoluble in water.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

.....

.....

.....

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*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate. The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

(Total for Question 5 = 12 marks)

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Reactions

6 (a) A technician made some dilute sodium hydroxide solution by carefully adding some solid sodium hydroxide to pure water.

This is the hazard symbol on a bottle of solid sodium hydroxide.



(i) State what this symbol shows about sodium hydroxide.

(1)

.....

(ii) Sodium hydroxide solution reacts with dilute hydrochloric acid. During the reaction heat is released.

What type of reaction is this?

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

(1)

☒ **A** displacement

☒ **B** endothermic

☒ **C** neutralisation

☒ **D** precipitation

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(b) A catalyst is added to some reactions.

Explain the meaning of **catalyst**.

(2)

.....

.....

.....

(c) Dilute hydrochloric acid reacts with calcium carbonate to produce carbon dioxide gas.

Three different experiments were carried out using large pieces of calcium carbonate, small pieces of calcium carbonate and powdered calcium carbonate. The size of the calcium carbonate pieces was the only factor that was changed.

In each experiment the volume of carbon dioxide released in five minutes was measured.

The results are

size of calcium carbonate pieces used	volume of carbon dioxide released in five minutes / cm^3
large	3
small	7
powdered	50

Describe what this shows about the effect of the surface area of calcium carbonate on the rate of this reaction.

(2)

.....

.....

.....

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*(d) Hydrochloric acid reacts with magnesium metal to produce hydrogen gas.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Describe how you could use magnesium ribbon and a solution of hydrochloric acid to show that decreasing the concentration of the hydrochloric acid changes the rate of this reaction.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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edexcel

Mark Scheme (Results)

Summer 2013

GCSE Chemistry (5CH2F)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)	B elements		**(1)**

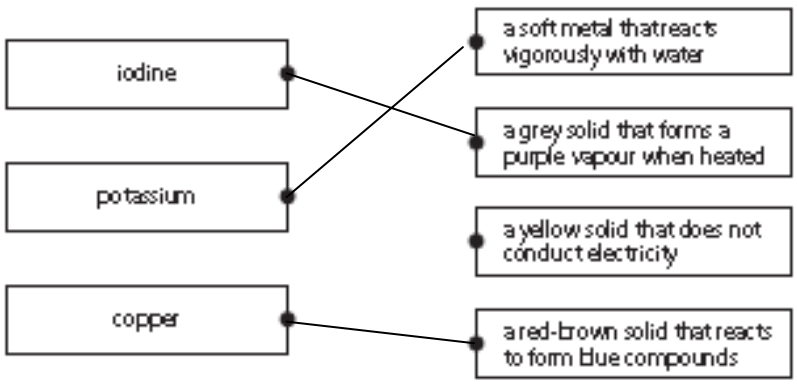
Question Number	Answer	Acceptable answers	Mark
1(b)	D alkali metals		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i) 1	any value in range 1.45 to 2.99	any answer which, to 1 sf, is in the range	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i) 2	Kr	Reject KR, kr	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i) 3	no reaction	'nothing'	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation linking any two of: • argon is {inert / unreactive} (1) • argon does not react with {metal/filament}/{metal/ filament} would react with air or oxygen / ORA (1) • atom has {eight electrons in outer shell / full (outer) shell} (1)	ignore noble gas doesn't react with anything argon does not corrode the metal ignore references to electrical conductivity	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(d)	 all 3 correct – 2 marks any two correct – 1 mark one correct – 0 marks	if two answer lines from one element, then ignore	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	A description to include two from • allow layers to {form / separate} / liquids to separate(1) • operate tap / OWTTE(1) • run out one layer / OWTTE(1) • pour remaining upper layer from top / run out second layer(1)	ignore inverted oil/water layers discard interface	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	A description to include • green (1) • (and) red (1)	{combination of / mixture of / two} colours (1) note: if all three colours mentioned (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	An explanation to include three from • {sodium chloride / ionic compound} – bulb lights / {sucrose / covalent compound} – bulb does not light up (1) • sodium chloride (solution) {conducts / ions present} (1) • sucrose (solution) {does not conduct / no ions present (1)	ignore references to electrolytic processes circuit will work (in place of bulb lights) / ORA	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(d)	2x1 + 16 (=18)		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)	C smaller than the mass of a proton		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	An description linking • 8 protons (1) • (and) {17-8/9} neutrons (1)	ignore references to electrons in shells / charges on particles if electrons in nucleus max 1 protons and neutrons with incorrect numbers (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	Explanation linking • (both have) same number (of electrons) in outer shell(1) • 6 (electrons in outer shell) (consequent on first point) (1)	correct electronic configurations or diagrams alone max 1 'they both have 6 in the outer shell' scores both marks allow 'both need 2 (more) (electrons) to fill outer shell' for both marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	A description to include • 2.8 (in 1st and 2nd shell)(1) • 5 (in outer shell)(1)	suitable diagram in place of 2.8(1).5(1) electrons in {shells / orbits / rings}(1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(e)(i)	A description to include • electron(s) shared (1) • {**pair(s) of / two**} (electrons) (1)	can be shown in a diagram of a covalent bond any mention of ions scores zero	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(e)(ii)	P_2O_5	Reject P2O5 / P^2O^5	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)	sodium carbonate + calcium nitrate → sodium nitrate + calcium carbonate (2) LHS (1) RHS (1)	ignore solution / state symbols ignore incorrect attempts at balanced equation ignore mixtures of words and formulae	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	C orange-red		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	A description including two points from CLEAN • clean (flame test) wire with (hydrochloric) acid (1) SAMPLE • put (wire) into solid (1) TEST • hold (wire) in (Bunsen) flame (1)	• moisten splint • put splint into solid • hold splint in (Bunsen) flame ignore : hold <u>over</u> flame use of tongs / spatula etc for equipment, max 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	40/44 (1) (= 0.909) (any fraction) x 100 (1) (= 90.9 / 90.91 / 91(%))	correct answer (2) Ignore 90(%)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	reaction is incomplete / not hot enough / not heated for long enough / use of impure calcium carbonate	ignore {gas escaping / not all collected / incorrect measurement}	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(d)	D have high melting points		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	$BaSO_4$	SO_4Ba ignore charges unless incorrect	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	charged particle	charged atom / {particle/atom(s)} that has gained or lost electrons ignore any stated charges	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	An explanation linking two of the following points: • barium sulfate does not dissolve (in water) (1) • is not absorbed into blood / body (1) • passes through body (unchanged) (1)	ignore barium sulfate is insoluble in water {mix with / enter} blood allow 'barium sulfate does not dissolve into the bloodstream' for 2 marks allow 'it is insoluble so it is non-toxic' for one mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **reactants** • dissolve reactants (in water) • mix reactants / solutions • use of appropriate apparatus • stir **separate product** • filter • use of filter funnel and paper **making pure dry salt** • solid on filter paper • wash with water • dry in oven / leave to dry / in a warm place	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. mix the two reactants in a beaker OR wash solid and leave to dry. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. mix solutions of the reactants in a beaker and then filter. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. mix solutions of the reactants in a beaker then filter, wash solid and leave to dry. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(d)	$Ba + Cl_2$ (→) (1) → $BaCl_2$ (1) reactants = 1 product = 1	max 1 for any incorrectly balanced equation	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	corrosive	damages skin / clothes causes burns	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	C neutralisation		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation to include • (substance that) increases rate / speeds up reaction (1) • without being {used up / changed} itself (1)	ignore slows down a reaction lowers activation energy reject provides energy / heat (for 2nd mark)	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)	A description to include • smaller pieces have larger surface area / ORA (1) • larger surface area, {higher / faster} rate (1) ORA	small**er** pieces give fast**er** rate (1) ORA allow 'bigger surface area produces more carbon dioxide' (or similarly phrased) for one mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(d)**	A description / comparison/ explanation / etc including some of the following points **method – what needs to be carried out** • dilute the acid • (to make) different concentrations / stated concentration values • add magnesium to acid • in suitable container • equal volumes of the acids • equal lengths of magnesium **observations – to make** • observe/ count bubbles • highest concentration magnesium reacts, lowest concentration magnesium does not react • observe/ time magnesium disappearing • use of timer • measure volume gas produced • measure decrease in mass **conclusion – evidence gathered or seen** • formed bubbles faster • magnesium disappears faster • gas produced faster • mass lost faster	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. add magnesium to acid and time the reaction • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. dilute the acid, add magnesium to both acid solutions and more concentrated one bubbles faster or magnesium reacts quicker • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. add magnesium to different concentrations of acids in beakers: lower concentration longer time therefore slower reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Tuesday 5 March 2013 – Morning
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 4 1 9 6 4 A 0 2 2 2 0

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 ☒.

Salts

1 (a) Lead iodide is an insoluble salt.

Use words from the box to complete the sentences.

Each word may be used once, more than once, or not at all.

(4)

dried	filtered	gas	metal	precipitate	solution

(i) Lead iodide can be prepared by mixing potassium iodide solution and lead nitrate .....

(ii) The lead iodide forms as a solid .....

(iii) To separate the solid lead iodide, the mixture is .....

(iv) To obtain a pure sample of solid lead iodide, the solid is washed and then .....

(b) Solid zinc carbonate reacts with dilute hydrochloric acid.

The word equation for the reaction is

zinc carbonate + hydrochloric acid → zinc chloride + carbon dioxide + water

(i) Describe what is **seen** during this reaction.

(2)

.....

.....

.....

.....

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(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

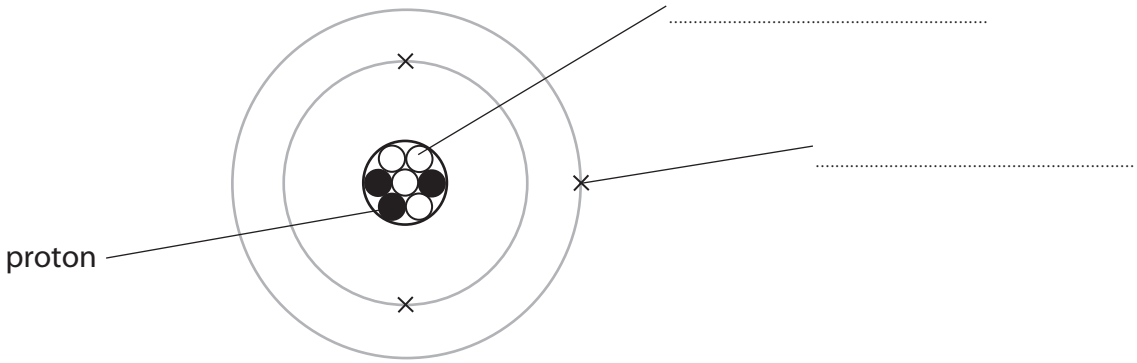
Atomic structure

2 (a) The diagram shows an atom of lithium.

(i) A proton has been labelled.

Complete the diagram by labelling the other two particles shown.

(2)



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

The atomic number of lithium is

(1)

☒ **A** 3

☒ **B** 6

☒ **C** 7

☒ **D** 10

(b) (i) Which row of the table shows the charge on a proton and the charge on an electron?

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

(1)

	proton	electron
☒ **A**	positive	positive
☒ **B**	negative	negative
☒ **C**	negative	positive
☒ **D**	positive	negative

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(ii) Use a number from the box to complete the sentence.

(1)

0	$\frac{1}{1837}$	1

The relative mass of a proton is .....

(c) The electronic configuration of lithium is 2.1.
The electronic configuration of sodium is 2.8.1.

(i) Explain, in terms of their electronic configurations, why lithium and sodium are both in group 1 of the periodic table.

(2)

.....

.....

.....

.....

(ii) Explain, in terms of their electronic configurations, why lithium is placed in period 2 and sodium is placed in period 3 of the periodic table.

(2)

.....

.....

.....

.....

(Total for Question 2 = 9 marks)

Investigating a reaction

3 Zinc is a metal.

Zinc reacts with dilute hydrochloric acid to produce zinc chloride and hydrogen.

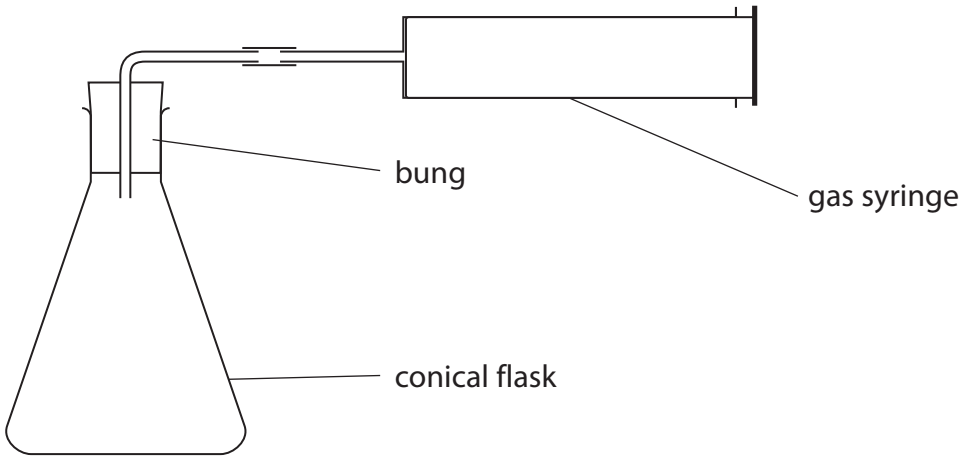
(a) Write the word equation for the reaction of zinc with dilute hydrochloric acid.

(1)

.....

(b) A student wanted to investigate the speed of the reaction between zinc and dilute hydrochloric acid.

Describe how the student could use this apparatus to obtain the results in the table.



time after start of experiment / minutes	volume of hydrogen produced / cm^3
0	0
1	30
2	42
3	50

(3)

.....

.....

.....

.....

.....

.....

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

(i) For a reaction to take place the reacting particles must

(1)

☐ **A** dissolve

☐ **B** boil

☐ **C** collide

☐ **D** evaporate

(ii) The reaction can be slowed down by

(1)

☐ **A** using a bigger volume of the same acid

☐ **B** cooling the hydrochloric acid

☐ **C** increasing the concentration of the hydrochloric acid

☐ **D** adding a catalyst

(d) When zinc powder is used, instead of larger pieces of zinc, the reaction is faster.

Explain, using ideas about particles, why the reaction is faster when zinc powder is used.

(2)

.....

.....

.....

.....

(e) The reaction is exothermic.

Describe how you could prove that this reaction is exothermic.

(2)

.....

.....

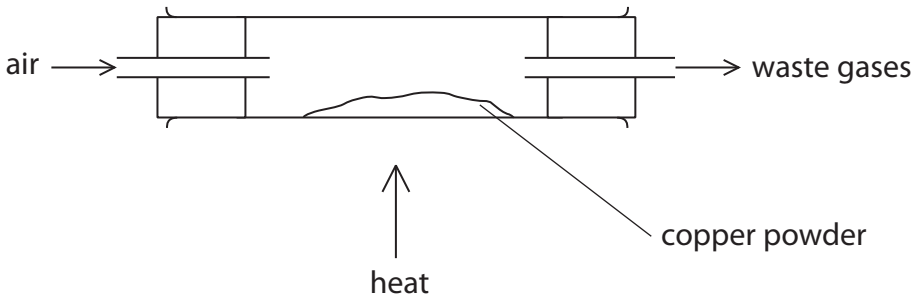
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(Total for Question 3 = 10 marks)

Reactions with oxygen

4 Rosie used this apparatus to prepare a sample of copper oxide.



Oxygen from the air reacted with the hot copper to form copper oxide.

These are Rosie's results

mass of copper used = 3.2 g

mass of copper oxide formed = 3.6 g

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

The yield of copper oxide in Rosie's experiment was

(1)

☒ **A** 0.4 g

☒ **B** 3.2 g

☒ **C** 3.6 g

☒ **D** 6.8 g

(b) What mass of oxygen combined with 3.2 g of copper in this experiment?

(1)

.....

mass oxygen = ... g

(c) The theoretical yield for Rosie's experiment was 4.0 g of copper oxide.

She only obtained 3.6 g of copper oxide.

Calculate the percentage yield of Rosie's experiment.

(2)

.....

.....

percentage yield .....

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

(2)

.....Cu + O_2 → .....CuO

(e) Calculate the percentage of oxygen in copper oxide, CuO.

(Relative atomic masses: Cu = 64, O = 16)

(2)

.....

.....

.....

.....

percentage of oxygen = ...

(f) Many oxides contain oxide ions, O^{2-}.

Explain how an oxygen atom becomes an oxide ion.

(2)

.....

.....

.....

.....

(Total for Question 4 = 10 marks)

Chromatography

5 (a) Some food colourings are a mixture of coloured substances.

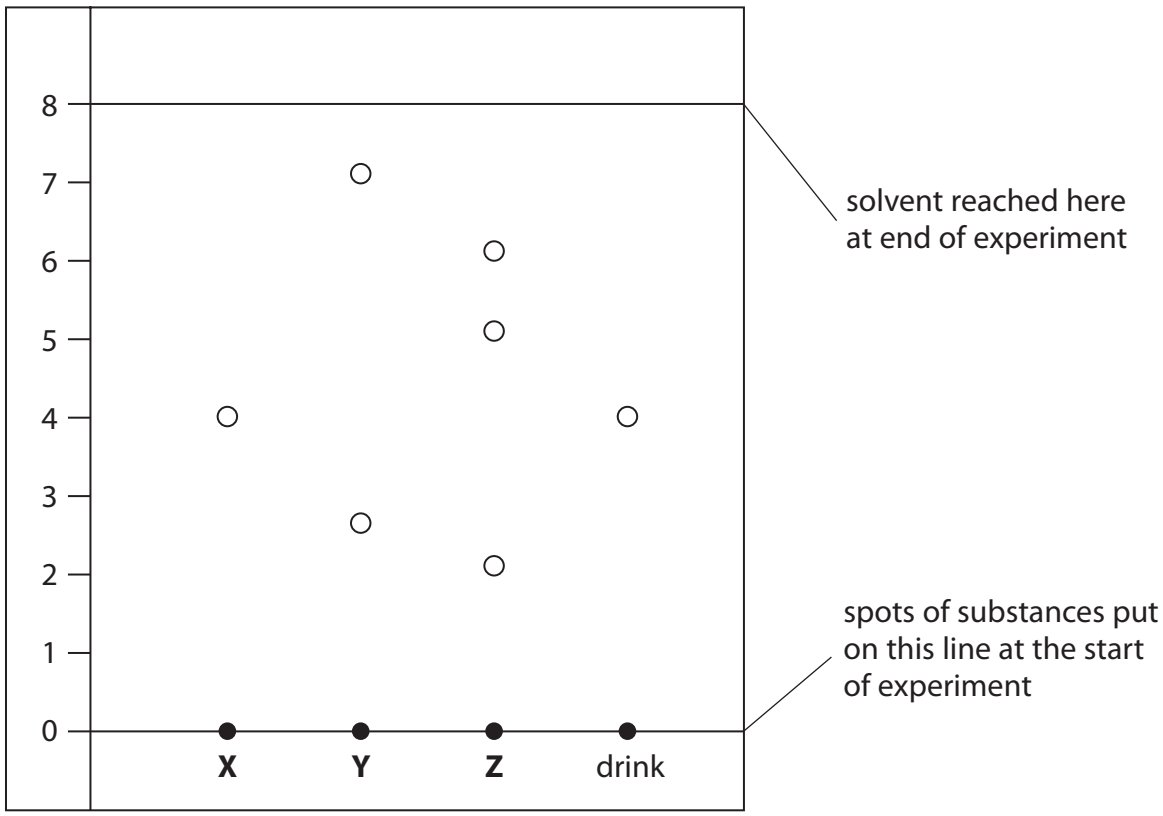
Paper chromatography can be used to separate the coloured substances in food colourings.

Charles carried out a chromatography experiment to test which food colouring was present in a coloured drink.

He used samples of three food colourings, **X**, **Y** and **Z**.

He also tested a sample of the colouring in the drink.

Charles obtained this chromatogram.



(i) Charles looked at the chromatogram to find out which food colourings contained more than one coloured substance.

State all the food colourings that contain more than one coloured substance.

(1)

.....

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(ii) Food colouring **Y** is banned.

Explain how Charles can tell that the drink that he tested did **not** contain the banned food colouring.

(2)

(iii) Calculate the R_f value for the coloured substance in food colouring **X**.

(2)

R_f = ...

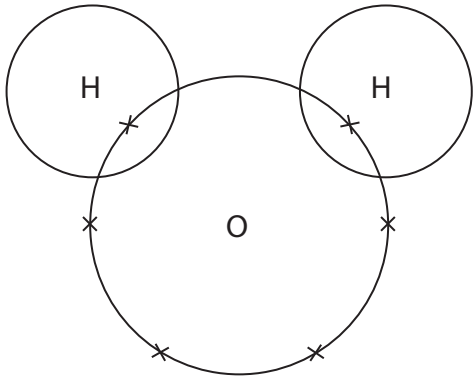
*(b) Describe in detail how the experiment should be carried out to produce the chromatogram shown in (a).

(6)

(c) The drink contained water.

Complete the dot and cross diagram for water by adding the electrons of the hydrogen atoms.

(1)



(Total for Question 5 = 12 marks)

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Patterns in the periodic table

6 (a) The table shows information about the first four elements in group 0 of the periodic table.

name	atomic number	density / g dm^{-3}
helium	2	0.15
neon	10	1.2
argon	18	
krypton	36	2.2

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

The elements in group 0 of the periodic table are

(1)

☒ **A** alkali metals

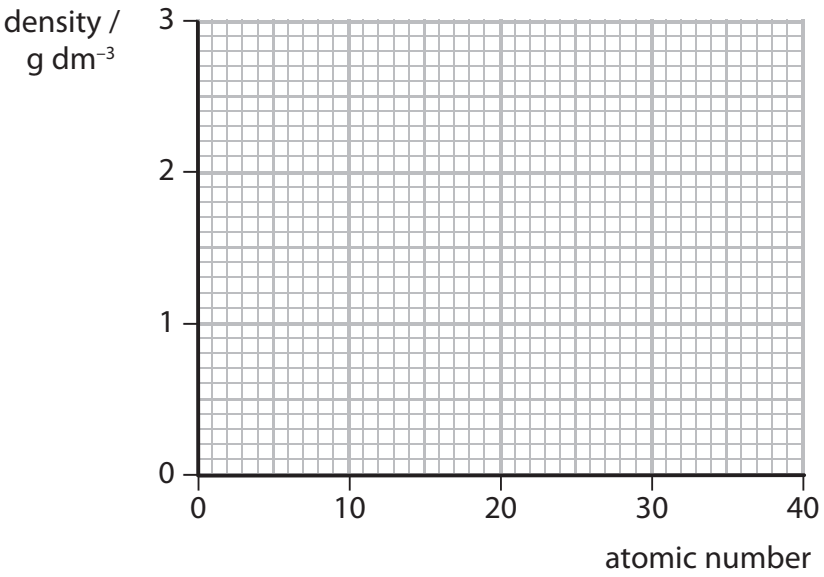
☒ **B** transition metals

☒ **C** halogens

☒ **D** noble gases

(ii) On this grid draw a graph of density against atomic number for the elements helium, neon and krypton.

(3)



(iii) Use your graph to estimate the density of argon.

(1)

density of argon = ... g dm^{-3}

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*(b) Two elements in group 1 of the periodic table are lithium and sodium.

Very small pieces of lithium and sodium were reacted separately with water.

Describe the similarities and differences in what is seen and in the products of the reactions.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

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Question Number	Answer	Acceptable answers	Mark
1(a)(i)	solution		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	precipitate		**(1)**

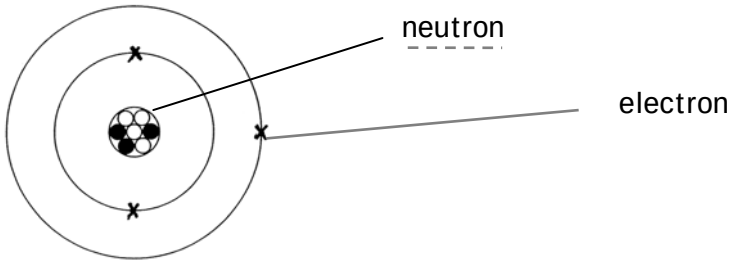
Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	filtered		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iv)	dried		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	A description including any two from • effervescence/fizzing/bubbles (1) • {solid/zinc (carbonate)/it} {becomes smaller/disappears}(1) • {solution/liquid} remains colourless (1)	ignore cloudy/precipitate/misty/gets warm/{gas/carbon dioxide} produced {solid/zinc carbonate} dissolves / a (clear) solution forms (1) colourless solution formed (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	A description including • limewater (1) • becomes {milky/cloudy/white (precipitate)} (1) second mark conditional on limewater if other substances added to limewater eg zinc carbonate maximum 1	ignore test with lighted splint ignore any mention of how the carbon dioxide is produced eg blow through a straw	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	neutron (1) electron (1)	neutrons electrons	**(2)**



Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	A 3		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	D proton positive, electron negative		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	1		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	An explanation linking • (both have) one electron (1) • in the outer {shell/orbit/energy level} (1) do not award first mark if proton/neutron/atom (in outer shell)	both have one outer electron (2) both need to lose 1 electron to have a full outer shell (2) fully correct diagrams of lithium and sodium showing electronic configurations (1) have the same number of electrons in the outer shell (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	An explanation linking • lithium has 2 {shells/orbits/energy levels} (1) • sodium has 3 {shells/orbits/energy levels} (1) max 1 mark if {outer/full} shells max 1 mark if rings/circles/layers	If no marks awarded from 'answer' column, allow any **one** from sodium is more reactive than lithium ORA (1) sodium has more electrons than lithium ORA (1) sodium has more shells than lithium ORA (1) ignore reactivity increases down the group	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	zinc + hydrochloric acid → zinc chloride + hydrogen ignore dilute if any additional reactants or products eg water (0) ignore formulae in addition to word equation, even if incorrect ignore state symbols, even if incorrect	= for → do not allow 'and' for '+' **correct** formulae even if equation unbalanced mixture of **correct** formulae and words but, **do not allow** incorrect formulae, including h, H2	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description including three of the following: • remove/replace bung (1) • put {zinc and acid/reactants/chemicals} in flask (1) • start {timing/stop watch/stop clock} (1) • {measure/record} (volume/amount) {gas/hydrogen} (1) • every minute (1) maximum 2 marks if zinc/hydrochloric acid in (gas) syringe	allow the solution for acid allow 'see how much gas is produced' ignore any description of the apparatus as it is set up in the diagram eg connect the syringe to the bung/make sure the syringe is empty ignore time until {reaction is complete/a stated volume of gas is collected}	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	C collide		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	B cooling the hydrochloric acid		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation linking two of the following • {(zinc) powder/it} has **smaller** {particles/pieces/bits} (1) • {(zinc) powder/it} has a **larger** surface area (1) • (there are) more (frequent) collisions (between the particles/acid and zinc) (1) ORA	ignore more particles collisions are more likely/greater chance of collisions (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(e)	A description including two of the following • use thermometer (1) • measure temperature {before and after/change/during the reaction} (1) • temperature rises/gets hotter (1) maximum 1 mark if temperature falls/gets colder	use hand (1) feel it getting hotter (1) if no other mark awarded 'heat (energy) is given out' (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	C 3.6 g		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)	3.6 – 3.2 (1) (= 0.4) correct working with no answer or wrong answer (1)	0.4	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)	$\frac{3.6}{4(.0)}$ (1) their **fraction** x 100 (1)	90 (%) (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	**2**Cu (1) + O_2 → **2**CuO (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(e)	relative formula mass = 64 + 16 (1) $\frac{16}{\text{their relative formula mass}}$ x 100 (1)	20(%) without working (2) 80 seen in answer(1) allow $\frac{16}{64}$ x 100 (1) if no other mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(f)	An explanation linking • {gains/takes} electrons (1) • two (electrons) (1) maximum 1 mark if electrons lost	electrons shared/protons/neutrons (0) for this question	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	**Y** and **Z** both must be given with no additional substances		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	An explanation linking two of • only one coloured substance in drink/ only one spot (at 4) in drink (1) • this is not present in Y/ no spot at 4 in Y/ no corresponding spot in Y (1) • the spots would rise to the same point if they were the same substance / the drink is X (1) • two coloured substances in Y/ Y has 2 spots (at 2.5 and 7) (1) • drink does not have spot(s) corresponding to spot(s) in Y (1)	allow values ± 0.5 of those given here Y has more than 1 coloured substance/spot do not allow a specified number greater than 2	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	(spot moved) 4 ± 0.5 / solvent (moved) 8 (1) R_f = 4/8 (2) (=0.5) consequential on their value for spot moved	4/8 OR 0.5 on its own (2) 8/4 (1)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(b)**	A description including some of the following points **Preparing the paper** • use of {filter/chromatography/absorbent} paper • **pencil** line (as start line) • put {spots/dots/drop} of colourings on (start) line • well apart / widely spaced • **small** spots • allow spots to dry • second spot to concentrate **Setting up the chromatography tank** • place {solvent/water/named solvent/liquid} in {beaker/container} • level **below** (start) line • {place/hold/support} paper in {beaker/solvent/water/named solvent/liquid} **Producing the chromatogram** • allow solvent to rise (towards top of paper)/wait for solvent to rise • wait for the colours to {rise/separate} • lift paper out of beaker before solvent reaches the top/mark solvent front • allow to dry give credit for correct points on a labelled diagram	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. put spots of colours on filter paper e.g. put paper in a beaker of water e.g. wait for the colours to separate • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. put spots of colours on filter paper and put into beaker containing solvent e.g. draw a pencil line on the paper, add the colours and hold it in a beaker of solvent e.g. put dots of colours on filter paper and wait for the colours to separate • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. put spots on a pencil line on paper and put into beaker containing solvent so that spots not in solvent, wait a few minutes for the solvent to rise e.g. put small spots of colours on a piece of filter paper, put some water in a beaker and hold the paper in the beaker until the colours separate • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(c)	2 electrons to be drawn in, one between each hydrogen and oxygen atom in the overlap region or on the overlapping circles Ignore an inner shell on the oxygen if it has 2 electrons **Do not award the mark** if additional atoms or electrons added to the diagram	dots/crosses/circles/ e/e^- for electrons	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	D noble gases		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	• correct plotting of all points (2) or correct plotting of two points (1) • suitable line dot to dot (1) consequential on their points	± 1/2 small square smooth curve / best fit straight line(1) if a bar chart is drawn, allow 1 mark if all bars are correct height	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	correct value read from candidate graph ± 1/2 small square	if no line drawn on graph but at least two points plotted, allow value between 1.25-2.15 if no points on graph (0)	**(1)**

Question Number		Indicative Content	Mark
QWC	***6(b)**	A description including some of the following points **similarities** both • float/on the surface • move around • effervesce / bubble / fizz • decrease in size / disappear / dissolve • produce hydrogen / H_2 • produce (metal) hydroxide / LiOH and NaOH • produce alkaline solution / solution with pH greater than 7 / add named indicator to the solution and correct colour change give credit to correct products in equations **differences** sodium • more vigorous / more effervescence /moves faster (ignore reaction lasts longer) ORA for lithium • melts • forms ball / sphere • produces a flame / catches fire / sparks ignore any statements about atomic structures	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. both metals float e.g. both cause fizzing • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. both metals float, both metals fizz e.g. both metals fizz but sodium fizzes more • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description including similarities and differences • e.g. both metals float and both produce hydrogen but sodium fizzes more • e.g. both metals fizz but sodium is more reactive so it fizzes more and it melts • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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Surname	Other names

Centre Number | Candidate Number

Edexcel GCSE

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Wednesday 7 November 2012 – Morning
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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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.

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 ☒.

Hand warmers

1 Some people use a hand warmer to warm their hands in winter.



(a) A chemical reaction takes place in the hand warmer.
This reaction gives out heat energy.

Give the name for reactions that give out heat energy.

(1)

.....

(b) In the hand warmer, iron reacts with oxygen.

Complete the word equation for this reaction.

(2)

iron + ... → .....

(c) Some hand warmers contain sodium chloride mixed with the reactants.
If sodium chloride is present, it is not used up but the chemical reaction is faster.

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

In this reaction the sodium chloride is acting as

(1)

☒ **A** a precipitate

☒ **B** a catalyst

☒ **C** an element

☒ **D** an alkali metal

(d) When ammonium nitrate crystals are dissolved in water, heat energy is taken in.

A student puts some water in a beaker.
He puts a thermometer in the water.
He adds some ammonium nitrate crystals and stirs the mixture.

Describe what the student would **see**.

(2)

.....

.....

.....

.....

.....

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(e) In an experiment, the time taken for some potassium chloride crystals to dissolve in water has been measured.

A student is given the same mass of potassium chloride to dissolve in the same volume of water.

State **one** change that could be made to the potassium chloride crystals and **one** change that could be made to the water to make the dissolving faster.

(2)

change made to the potassium chloride crystals

.....

.....

change made to the water

.....

.....

(Total for Question 1 = 8 marks)

Salts

2 (a) Calcium chloride solution reacts with silver nitrate solution.
Solid silver chloride and calcium nitrate solution are formed.

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

The formula of a salt is $Ca(NO_3)_2$.

The name of this salt is

(1)

☒ **A** calcium nitride

☒ **B** calcium nitrate

☒ **C** calcium chloride

☒ **D** silver nitrate

(ii) The mixture produced in the reaction is filtered to obtain the silver chloride.
The solid silver chloride is washed with water and left to dry.
The yield of dry silver chloride was 3.0 g.

The theoretical yield of dry silver chloride in this experiment was 4.0 g.

1. Suggest why the yield was less than 4.0 g.

(2)

.....

.....

.....

.....

2. Calculate the percentage yield of this experiment.

(2)

.....

.....

.....

percentage yield = ... %

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(b) (i) Calculate the relative formula mass of silver chloride, AgCl.
(relative atomic masses: Cl = 35.5, Ag = 108)

(1)

.....

relative formula mass = ...

(ii) Calculate the percentage by mass of silver, Ag, in silver chloride, AgCl.
(relative atomic masses: Cl = 35.5, Ag = 108)

(2)

.....

.....

.....

percentage of silver = ... %

(Total for Question 2 = 8 marks)

Groups in the periodic table

3 The elements lithium, sodium and potassium are all in the same group of the periodic table.

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

These elements are in

(1)

- ☒ **A** group 0
- ☒ **B** group 1
- ☒ **C** group 2
- ☒ **D** group 7

(b) Give the symbol of an atom of another element that is in the same group of the periodic table as lithium, sodium and potassium.

(1)

symbol .....

(c) The table shows the relative hardness and melting points of the three alkali metals, lithium, sodium and potassium, and the three transition metals, iron, copper and nickel.

metal	relative hardness	melting point / °C
lithium	0.6	181
sodium	0.4	98
potassium	0.5	63
iron	5.0	1535
copper	3.0	1083
nickel	4.0	1455

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Alkali metals and transition metals have different typical properties.

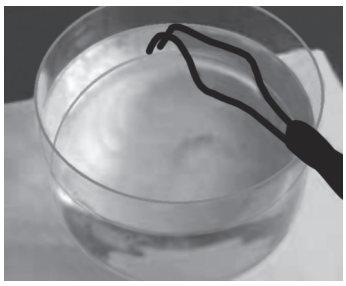
Draw **one** straight line from alkali metals and **one** from transition metals to their typical properties.

(2)

metals	**properties**
alkali metals	strong and have high melting points
	strong and have low melting points
transition metals	soft and have high melting points
	soft and have low melting points

(d) Potassium reacts with water.

In a class demonstration, a teacher drops a piece of potassium on to water.



(i) The teacher ties back her hair and wears a laboratory coat and goggles.

Suggest another safety precaution that the teacher should take.

(1)

.....

.....

(ii) The word equation for this reaction is given below.
Two of the state symbols have been given.

Write the other two state symbols in the spaces provided.

(2)

potassium(s) + water (l) → potassium hydroxide(.....) + hydrogen(.....)

(iii) Describe what you **see** when potassium is added to water.

(2)

.....

.....

.....

.....

(iv) Balance the equation for the reaction between potassium and water by putting numbers in the spaces provided.

(2)

.....K + $2H_2O$ → .....KOH + H_2

(Total for Question 3 = 11 marks)

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Atoms

4 Most atoms contain electrons, protons and neutrons.

(a) Describe the positions of these particles in atoms.

(3)

(b) A chlorine atom contains 17 electrons.

What is the electronic configuration of a chlorine atom?

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

(1)

- ☒ **A** 10.7
- ☒ **B** 8.8.1
- ☒ **C** 17
- ☒ **D** 2.8.7

(c) Chlorine and bromine are in the same group in the periodic table.

(i) Explain, in terms of electrons, why these elements are placed in the same group.

(2)

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(ii) Describe the appearance of bromine at room temperature and pressure.

(2)

.....

.....

.....

.....

(d) An experiment was carried out to see how large a nucleus is compared to the overall size of an atom.

In the experiment a very large number of positively charged particles are fired at a thin sheet of gold.
When one of these positively charged particles comes close to the nucleus of a gold atom it is repelled.

Explain why only about 1 in every 20 000 positively charged particles are repelled.

(2)

.....

.....

.....

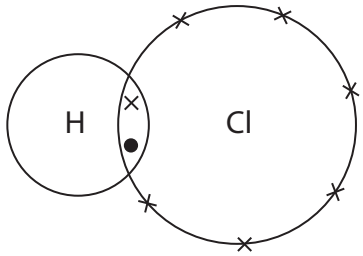
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(Total for Question 4 = 10 marks)

Gases

5 (a) Hydrogen chloride is a gas at room temperature.

The diagram shows the outer shell electrons in a molecule of hydrogen chloride.



(i) Give the name of the type of bond between the hydrogen and chlorine atoms in the molecule.

(1)

.....

(ii) Give the formula of a molecule of hydrogen chloride.

(1)

.....

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

A property of hydrogen chloride is that it

(1)

☒ **A** conducts electricity

☒ **B** has a high melting point

☒ **C** has a low boiling point

☒ **D** exists as a giant structure

(b) Hydrogen, H_2, reacts with fluorine, F_2, to form hydrogen fluoride, HF.

Write the balanced equation for the reaction.

(2)

.....

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*(c) Methane is a gas at room temperature.
It exists as molecules, CH_4.
Methane has a low boiling point.
It does not conduct electricity.

Explain, in terms of the nature of its molecules and the forces between its molecules, why methane has a low boiling point and does not conduct electricity.

(6)

(Total for Question 5 = 11 marks)

Compounds

6 Magnesium flares provide a bright light in an emergency.

When the magnesium burns it reacts with oxygen to form magnesium oxide.

(a) Explain why magnesium oxide is a compound.

(2)

.....

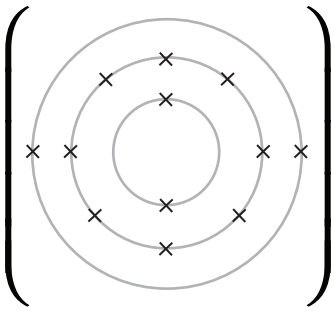
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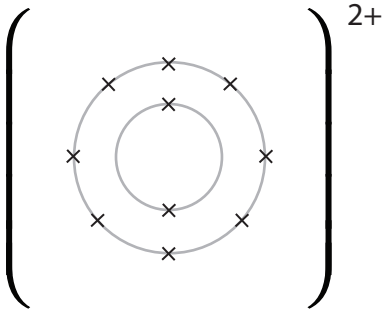
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(b) When magnesium reacts with oxygen, one magnesium atom and one oxygen atom form one magnesium ion and one oxide ion.

These diagrams show the arrangement of electrons in a magnesium atom and in a magnesium ion.



magnesium atom

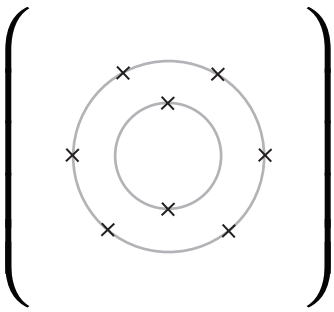


magnesium ion

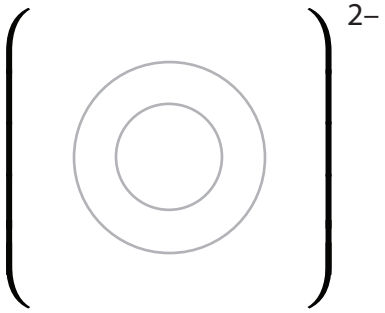
(i) In the diagram below the arrangement of electrons in an oxygen atom is given.

Draw the arrangement of electrons in the oxide ion.

(1)



oxygen atom



oxide ion

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(ii) Explain, in terms of their electrons, how a magnesium atom, Mg, and an oxygen atom, O, react together to form a magnesium ion, Mg^{2+}, and an oxide ion, O^{2-}.

(2)

.....

.....

.....

.....

(iii) Magnesium oxide is an ionic compound.

Which of these is a property of solid magnesium oxide?

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

(1)

☒ **A** it has a high melting point

☒ **B** it has a low boiling point

☒ **C** it conducts electricity

☒ **D** it is malleable

*(c) You are given two solid sodium salts, which are unlabelled.

One of the solids is sodium chloride.
The other solid is sodium carbonate.

Describe how you could carry out a flame test to show that they are both sodium salts and describe another test to identify one of the salts completely.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

November 2012

GCSE Chemistry
5CH2F/01

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GCSE Chemistry 5CH2F/01 Mark Scheme – November 2012

Question Number	Answer	Acceptable answers	Mark
1(a)	exothermic	exthermic exothermal	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	(iron +) oxygen (1) → iron oxide (1)	accept ironoxide (one word) ignore heat ignore (III) and (II)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	B a catalyst		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	A description including any two of temperature (1) falls /decreases / lowers (1) crystals disappear (1) solution (formed) (1)	 reading on thermometer water becomes colder ignore dissolves ignore fizzing and any other incorrect observations	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)	crystals: crushed / powdered / use smaller crystals (1) water: heat / stir faster (1)	break down (crystals) increase surface area larger surface area ignore reference to change in mass increase its temperature boil ignore reference to change in volume	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	B calcium nitrate		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)1	A suggestion to include two from: the reaction was incomplete (1) unwanted reaction(s) / side reactions took place (1) some was lost (in transfer) / left in the beaker (1) some of the solid remained on the filter paper (1)	 ignore some of reactant solutions lost spillage washed away lost in filtering	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)2	3.0/4.0 (1) (any fraction) X 100 (1) (= 75 %)	3/4 75(%) only scores 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	108 + 35.5 (1) (= 143.5)	143.5 with no working scores the mark	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	108/answer to (b)(i) (1) (any fraction) X 100 (1) (= 75.261 %) x 100 (1)	If no working allow 2 marks for 75 or 75.3 or 75.2 or 75.26 or 75.261 (%)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	B group 1		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)	Rb / Cs / Fr	ONLY reject RB, CS, FR reject rb, cs, fr	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	**one** line from alkali metals to soft and low melting points (1) **one** line from transition metals to strong and high melting points (1)	if more than one line from alkali metals box then 0 mark if more than one line from transition metals box then 0 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	Any one of the following points use small piece of potassium (1) use (safety) screen /shield (1) make sure students safe distance away (1)	 drop at arm's length description of screen teacher steps away (after dropping potassium) wear gloves ignore tongs ignore fume cupboard	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	(potassium hydroxide) aq (1) (hydrogen) g (1)	capital letters	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(iii)	A description including any two of effervescence / fizzing / bubbles (1) potassium floats / on surface (1) moves (1) potassium forms ball / sphere (1) potassium disappears / becomes smaller(1) flame (seen) (1)	 ignore cloudy/white trail ignore reacts ignore dissolve catches fire ignore smoke ignore references to use of / result of adding indicator (to the water)	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(iv)	2 (1) 2 (1)	reject multiples of equation	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	A description to include neutrons in nucleus (1) protons in nucleus (1) electrons in shells / orbits (1)	all marks can be scored from **labelled** diagram description of position of particles without use of "nucleus" or "shell /orbit" BUT if description or labels on diagram do not mention "nucleus" **or** "shell /orbit" at least once then max 2 marks ignore charges / masses / numbers of particles	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)	D 2.8.7		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	an explanation linking outer {shell / orbit} (electrons) (1) 7 / same number (of electrons) (1)	 one / same number of electrons short (of next noble gas)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	a description to include (dark) red (1) liquid (1)	 red-brown / brown-red ignore any references to vapour	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(d)	An explanation linking any two of nucleus very small (by comparison with atom) / atom very large compared to nucleus / most of atom consists of empty space (1) most particles {miss nucleus / go straight through (atom)} / only a few particles (1 in 20 000) {pass close to / hit} nucleus (1) (gold) nuclei positive / both (nucleus and particles) {positively charged / have same charge} (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	covalent		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	HCl	ClH ignore subscript 1 after either or both atoms ignore any working	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	C has a low boiling point		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	$H_2 + F_2 \rightarrow 2\ HF$ correct formulae on correct sides of equation (1) balancing correct formulae (1)	accept = for → multiples reject f for F and h for H BUT allow mark for balancing completely correct equation but reversed scores 1 mark	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **molecules** simple / small molecule separate / discrete molecules covalent bonds (between atoms in molecule) displayed structure for CH_4 weak forces between molecules **properties** to boil need to separate molecules little energy needed (as weak forces between molecules) therefore low boiling point to be able to conduct must have charged particles which must be free to move no charged particles present no delocalised /free electrons / no ions present all electrons are in covalent bonds therefore does not conduct electricity / cannot carry current	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	a limited description e.g. methane is a simple / small molecule e.g. weak forces between molecules the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. methane is a simple / small molecule with weak forces between molecules (so low boiling point) e.g. {it is covalent / there are no charged particles (ions or free electrons)} to move and carry the current the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	a detailed description e.g. methane is a simple / small molecule with weak forces between molecules (so low boiling point) AND any mention of lack of charged particles e.g. does not conduct electricity because {it is covalent /there are no charged particles (ions or free electrons)} to move and carry the current AND any mention of separate molecules or weak forces between them the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	An explanation linking the following two elements / magnesium and oxygen (1) combined / bonded/(chemically) joined together (1)	 ignore mixture ignore reacted together ignore type of bond	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	two electrons in first shell and eight in outer shell	dots or crosses or combination of both	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	An explanation including two of the following points idea of electron(s) transfer in correct direction (1) two (electrons transferred) (1)	 marks can be scored in a diagram any indication of covalent bonding / electron sharing scores 0	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)(iii)	A has a high melting point		**(1)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	A description to include some of the following points **flame test** use a wire / splint concentrated hydrochloric acid / water dip in solid put in flame gives a colour (to flame) yellow (flame) **NB Only ONE of salts needs to be identified** **test for chloride** dissolve salt in water add dilute nitric acid add silver nitrate solution white precipitate formed **test for carbonate** add dilute acid (to solid) effervesces / fizzes /bubbles (pass) gas (given off) (into) limewater turns milky / cloudy / white (so) carbon dioxide (formed)	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	a limited description e.g. put salt in flame e.g. add acid to (suspected) carbonate the answer communicates ideas using simple language and uses limited scientific terminology spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	a simple description e.g. put salt in flame and gives correct colour e.g. add acid to the carbonate and it fizzes e.g. add silver nitrate (solution) and white ppt (forms) e.g. put salt in flame (to show sodium present) and add silver nitrate (solution) to show chloride present the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	a detailed description e.g. salt put in flame produces yellow (flame) and when silver nitrate solution added a white precipitate forms with the chloride e.g. silver nitrate solution to solution of solid gives white ppt showing chloride and sodium salts give yellow flame e.g. solid on wire / splint put into flame gives yellow colour AND silver nitrate (solution) added shows chloride the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately spelling, punctuation and grammar are used with few errors

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Edexcel GCSE

Centre Number	Candidate Number

Chemistry/Additional Science

Unit C2: Discovering Chemistry

Foundation Tier

Monday 21 May 2012 – Morning
Time: 1 hour

Paper Reference
5CH2F/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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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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 ☒.

Temperature changes

1 (a) When a small amount of solid ammonium chloride is shaken with water, a colourless solution forms.

(i) What type of change has occurred?

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

(1)

☐ **A** dissolving

☐ **B** displacement

☐ **C** neutralisation

☐ **D** precipitation

(ii) When this change takes place there is a decrease in temperature.

Describe how you could measure this change in temperature.

(2)

.....

.....

.....

.....

(iii) Some chemical reactions cause a decrease in temperature.

Give the name of the type of chemical reaction that causes a decrease in temperature.

(1)

.....

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(b) Marble is a form of calcium carbonate.
When marble chips are added to cold, dilute hydrochloric acid, the mixture fizzes.

The word equation for the reaction is

calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water

(i) Give the name of the product that causes the mixture to fizz.

(1)

.....

(ii) The experiment is repeated using warm, instead of cold, acid.

State the difference you would **see** when the marble chips react with warm, instead of cold, acid.

(1)

.....

.....

(iii) Explain what must be done to the marble chips so that the reaction with the warm, dilute hydrochloric acid is even faster.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

Salts

2 The table shows some salts that are soluble and some that are insoluble in water.

soluble salts	insoluble salts
copper chloride lead nitrate sodium carbonate	barium sulfate lead carbonate

(a) An insoluble salt can be prepared by mixing two salt solutions.

Choose **two** salts from the table that can be reacted together to form lead carbonate.

(2)

..... and .....

(b) Barium chloride solution reacts with copper sulfate solution.

$$\text{barium chloride} + \text{copper sulfate} \rightarrow \text{barium sulfate} + \text{copper chloride}$$

Explain what is **seen** when solutions of barium chloride and copper sulfate are mixed.

(2)

.....

.....

.....

.....

(c) A 'barium meal' may be given to a patient before an X-ray is taken.
A 'barium meal' is a suspension of barium sulfate in water.

Give **one** reason why barium sulfate is used in this way.

(1)

.....

.....

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

(i) The table shows that copper chloride is soluble in water.

This suggests that the structure of copper chloride is

(1)

☒ **A** simple molecular, covalent

☒ **B** giant molecular, covalent

☒ **C** ionic

☒ **D** metallic

(ii) Sodium carbonate is an ionic compound.

The most likely melting point of sodium carbonate is

(1)

☒ **A** –85 °C

☒ **B** 17 °C

☒ **C** 146 °C

☒ **D** 851 °C

(e) Sodium carbonate contains sodium ions, Na^+, and carbonate ions, CO_3^{2-}.

Give the formula for sodium carbonate.

(1)

.....

(Total for Question 2 = 8 marks)

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Mixtures

3 (a) Water and oil do not mix.

(i) What term is used to describe two liquids that do not mix?

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

(1)

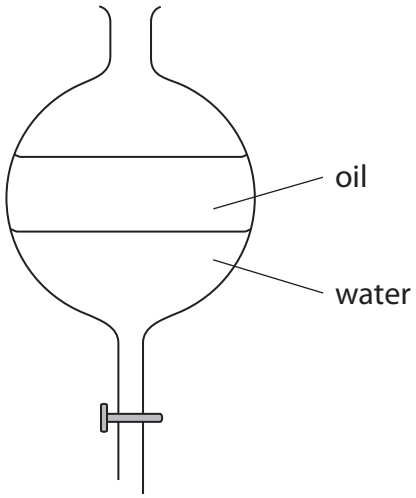
☐ **A** ionic

☐ **B** inflammable

☐ **C** immiscible

☐ **D** insoluble

(ii) The water and oil mixture can be separated using a separating funnel.



Describe how the separating funnel is used to separate samples of water and oil from the mixture.

(2)

.....

.....

.....

.....

(b) Wax and sand are both solids at room temperature.
The wax has a melting point of 64 °C.
The sand has a melting point of 1610 °C.

(i) State what will happen to the wax when it is heated using a Bunsen burner.

(1)

.....

(ii) When the sand is heated using a Bunsen burner there is no visible change.

Explain why.

(2)

.....

.....

.....

.....

(iii) The wax has a low melting point because there are only weak forces between the molecules in the wax.

What type of structure does wax have?

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

(1)

☒ **A** simple molecular, covalent

☒ **B** giant molecular, covalent

☒ **C** ionic

☒ **D** metallic

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(c) A written note was found at a crime scene.
Forensic scientists used chromatography to investigate the dyes in the ink used to write the note.

They put spots of four substances on chromatography paper.

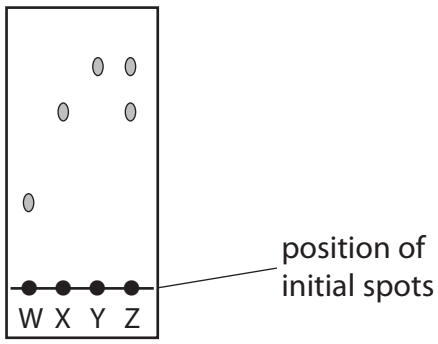
W was pure red dye

X was pure blue dye

Y was pure yellow dye

Z was the ink used on the note

The result of the chromatography is shown.



(i) State how you can tell that dyes W, X and Y are pure.

(1)

.....

.....

.....

(ii) Explain what you can deduce about the ink Z used on the note.

(2)

.....

.....

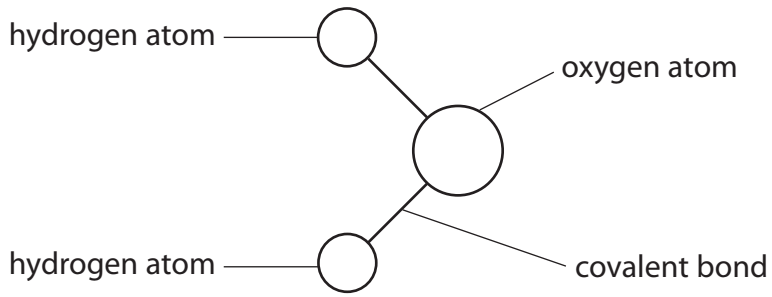
.....

.....

(Total for Question 3 = 10 marks)

Water

4 The diagram shows a model of a water molecule.



(a) Explain, in terms of electrons, how a covalent bond is formed between an oxygen atom and a hydrogen atom.

(2)

.....

.....

.....

.....

(b) Calculate the relative formula mass of water, H_2O.
(Relative atomic masses: H = 1.0, O = 16)

(2)

.....

.....

answer = ...

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(c) Hydrogen burns in oxygen to form water.

(i) Write the balanced equation for this reaction.

(3)

.....

(ii) In an experiment the mass of water obtained was 2.0 g.
The theoretical yield for this experiment was calculated to be 4.0 g.

Calculate the percentage yield.

(2)

.....

.....

percentage yield = ... %

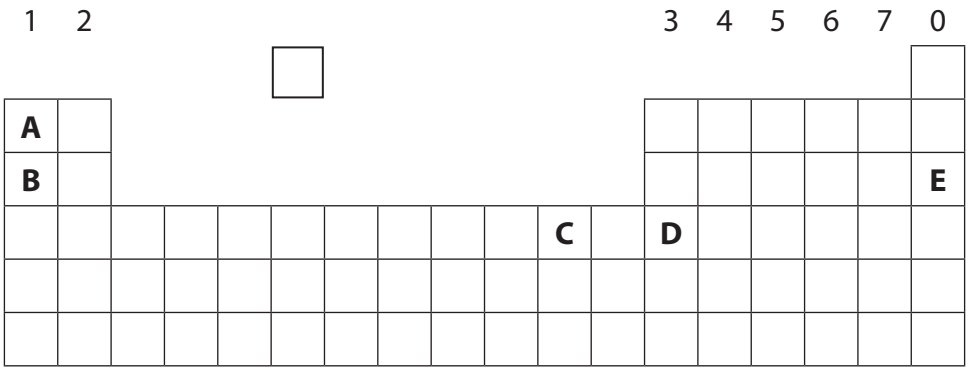
(iii) Suggest **one** reason why less than 4.0 g of water was obtained in this experiment.

(1)

.....

(Total for Question 4 = 10 marks)

5 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.



(a) Which element, **A**, **B**, **C**, **D** or **E**, is a transition metal?

(1)

.....

(b) State why elements **A** and **B** have similar reactions.

(1)

.....

.....

(c) When Mendeleev produced his periodic table, the element labelled **D** had not been discovered.
He predicted the properties of the element and left a space for it in his table.

Explain how Mendeleev was able to predict the properties of element **D**.

(2)

.....

.....

.....

.....

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(d) An atom of element **C** contains 29 protons.

Explain how you can use this information to calculate the number of protons in an atom of element **D**.

(2)

*(e) An atom has an atomic number of 9 and a mass number of 19.

Describe the numbers and positions of electrons, protons and neutrons in this atom.

(6)

(Total for Question 5 = 12 marks)

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

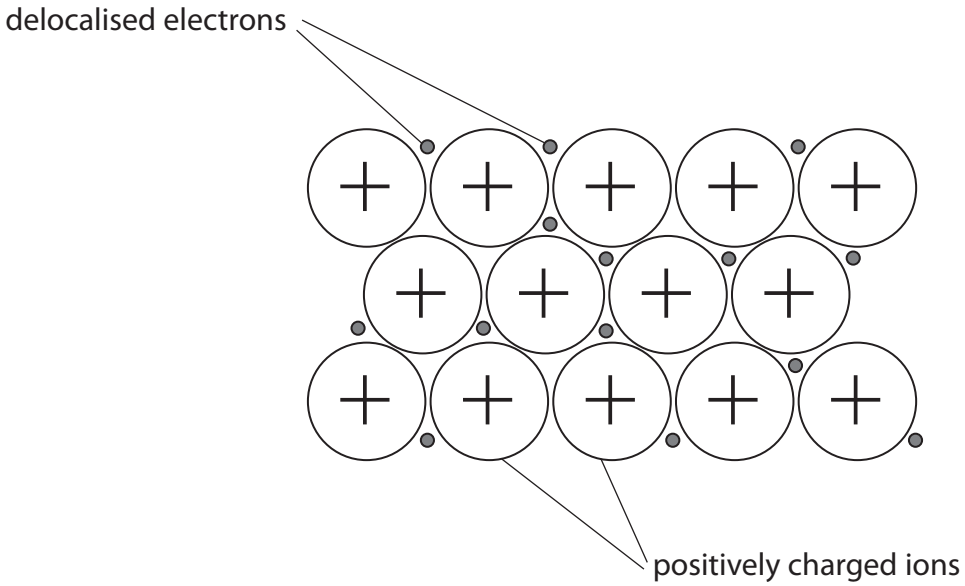
Sodium is an alkali metal.

In the periodic table, sodium is in group

(1)

- ☒ **A** 0
- ☒ **B** 1
- ☒ **C** 4
- ☒ **D** 7

(b) The diagram shows the structure of a metal.



Explain how metals conduct electricity.

(2)

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(c) A sodium chloride crystal contains sodium cations and chloride anions.

(i) State the colour produced by sodium compounds in a flame test.

(1)

(ii) Describe how silver nitrate solution can be used to show that solid sodium chloride contains chloride ions.

(2)

*(iii) Sodium reacts with chlorine to form sodium chloride.

Describe how the reaction can be carried out, explaining what happens when a sodium atom reacts with a chlorine atom.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Mark Scheme (Results)

Summer 2012

GCSE Chemistry
5CH2F/01

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GCSE Chemistry 5CH2F/01 Mark Scheme – Summer 2012

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**A** dissolving		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	A description including the following points • thermometer (1) • take temperature before and after (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	endothermic		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	carbon dioxide	CO_2 reject CO^2 / CO2	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	faster fizzing / dissolves faster	faster reaction more fizzing	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	An explanation including the following points • powder them / use smaller pieces (1) • larger surface area (1)	break them up ignore changes to anything other than marble chips ignore stir	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)	• lead nitrate (1) • sodium carbonate (1)	either order	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	An explanation including the following points • (white) {solid / precipitate / cloudiness} (1) • barium sulfate insoluble (1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	(barium sulfate) opaque to X-rays / shows up on X-rays / safe to use because it does not enter blood / is insoluble	shows up stomach etc so X-ray is clearer ignore does not react with body fluids / water / blood	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)(i)	**C** ionic		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(d)(ii)	**D** 851 ºC		**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (e)	Na_2CO_3	CO_3Na_2	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	**C** immiscible		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(a)(ii)	A description including two of the following points • open tap (1) • run off lower layer / water (1) • pour off remainder/oil through top of funnel (1)	let water out stop before oil comes out	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	melts	turns into liquid reject burns	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	An explanation including **two** of the following points • sand has a giant (molecular), (covalent) structure (1) • strong (covalent) bonds (in sand) (1) • high amounts of energy / heat needed (to break bonds) (1) • (so) high melting point (1) • Bunsen does not get hot enough (1)	ignore forces (so) melting point 1610 ºC (so) does not melt Bunsen cannot reach melting point	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	**A** simple molecular, covalent		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(i)	only one spot / do not separate	reject contain only one colour	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)(ii)	An explanation including two of the following points • mixture / not pure (1) • (contains) X / blue (dye)(1) • (contains) Y / yellow (dye)(1)	contains two dyes	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)	An explanation including **two** of the following points • electrons shared (1) • pair (of electrons)(1) • hydrogen (atom) and oxygen (atom) each supply one electron (to shared pair)		**(2)**

Question Number	Answer	Acceptable answers	Mark
4 (b)	(2 x 1)(1) +16 (1) = 18	18 (2) 17 (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	$2H_2 + O_2 \rightarrow 2H_2O$ • reactant formulae (1) • product formula (1) • balancing correct formulae (1)	reject O^2 H^2 reject H^2O H2O	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	$\frac{2}{4}$ (1) x 100 (%) (1) (=50%)	0.5 / $\frac{1}{2}$ (1) 50(%) (2) 200% (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(iii)	reaction incomplete / losses (during reaction) / spillages (during reaction)	(water) evaporated {water /steam / oxygen / hydrogen /gas} escaped / lost / leaked less hydrogen burned than expected not all hydrogen burned not enough oxygen present (for all hydrogen to burn) reject unwanted / unexpected reactions occurred	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	they are in same group / group 1/(both) have one outer electron	both alkali metals	**(1)**

Question Number	Answer	Acceptable answers	Mark
5(c)	An explanation including the following points • elements in same group have similar properties (1) • so looked at elements {above /below / in group 3} (1)	across a period elements show gradual / regular variation in properties	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(d)	An explanation including the following points • two places further on (in period) (1) • (so) 29 + 2 (=31) / 31 (1)	in each successive element (in period) one more (proton) /atomic number increases by one 31 with no explanation (1)	**(2)**

Question Number		Indicative Content	Mark
QWC	***5(e)**	A description including some of the following points • protons in nucleus • 9 protons • neutrons in nucleus • 10 neutrons • electrons in shells • 9 electrons • first shell 2 • second shell 7 • electronic configuration 2.7 • (some or all of this could be shown on a diagram)	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. gives the number of protons • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. protons and neutrons in the nucleus and electrons around the nucleus OR e.g. has 9 protons 9 electrons 10 neutrons • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. gives the electronic configuration and the position of the protons and neutrons OR e .g. has 9 protons (9 electrons) 10 neutrons and gives electronic configuration • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)	**B** 1		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)	An explanation including the following points • (delocalised) electrons (1) • (electrons) move (through metal structure) (1)	ions and electrons move worth (1) only	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(c)(i)	yellow	reject orange-yellow etc	**(1)**

Question Number	Answer	Acceptable answers	Mark
6(c)(ii)	A description including the following points • make solution of sodium chloride (1) (add (dilute) nitric acid) • when silver nitrate solution added white {solid / precipitate} (formed) (1) **OR** A description including the following points • add sodium chloride to silver nitrate (solution) (1) (add (dilute) nitric acid) • white {solid / precipitate} (formed) (1)	react sodium chloride with silver nitrate	**(2)**

Question Number		Indicative content	Mark
QWC	***6(c)(iii)**	A description including some of the following points **practical procedure** • burning (sodium) • placed in chlorine in gas jar /conical flask /tall beaker • white (fumes) • (sodium chloride forms) as a solid **safety** • done in fume cupboard • (because) chlorine toxic **theoretical** • sodium (atoms) lose electrons • one electron • forms sodium ions • Na^+ / with positive charge • chlorine (atoms) gain electrons • one electron • forms chloride ions • Cl^- / with negative charge • forms NaCl • attraction between opposite charged ions • ionic bond	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• a limited description e.g. put burning sodium in chlorine OR e.g. sodium atoms lose electrons • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a simple description e.g. put burning sodium into a gas jar of chlorine in a fume cupboard OR e.g. sodium atoms lose electrons and chlorine atoms gain electrons • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5-6**	• a detailed description e.g. put burning sodium into a gas jar of chlorine in a fume cupboard because chlorine is toxic, white solid formed OR e.g. a sodium atom loses one electron which is transferred to a chlorine atom, forms Na^+ and Cl^- / ionic bond formed • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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