

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Monday 22 May 2023

Morning (Time: 1 hour 10 minutes) **Paper reference 1SC0/1CF**

Combined Science

PAPER 2

Foundation Tier

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.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

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.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

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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Answer ALL questions. Write your answers in the spaces provided.

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 ☐.

- 1 In an experiment, paper chromatography was used to separate the coloured dyes in four different inks, **W**, **X**, **Y** and **Z**.

(a) Figure 1 shows the chromatogram at the end of the experiment.

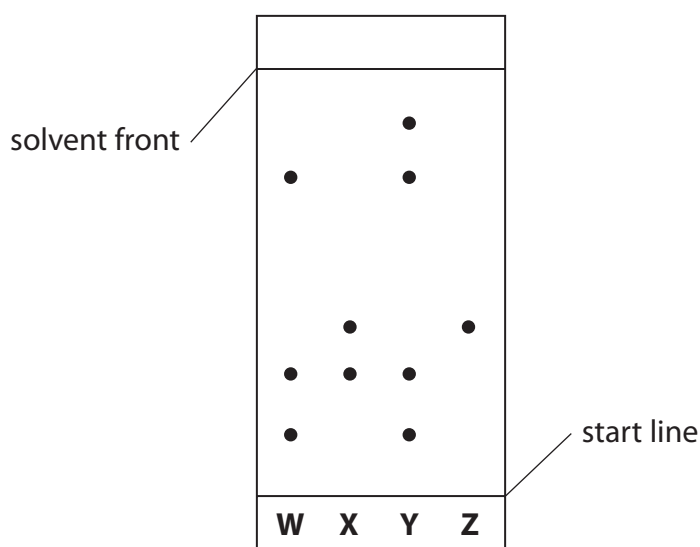


Figure 1

- (i) The chromatogram shows that only one of the inks contains a single dye.

Which ink contains a single dye?

(1)

- | | | |
|--------------------------|---|---|
| ☐ | A | W |
| ☐ | B | X |
| ☐ | C | Y |
| ☐ | D | Z |

- (ii) Which ink contains the greatest number of dyes?

(1)

- | | | |
|--------------------------|---|---|
| ☐ | A | W |
| ☐ | B | X |
| ☐ | C | Y |
| ☐ | D | Z |

(iii) The R_f value of a dye can be calculated using the equation

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

At the end of the chromatography one dye had moved 3.60 cm and the solvent front had moved 9.20 cm.

Calculate the R_f value for this dye.

Give your answer to 2 decimal places.

(2)

$R_f =$



- (b) The substance used as the solvent in the chromatography was heated for 8 minutes.

Figure 2 shows how the temperature of the substance changed with time.

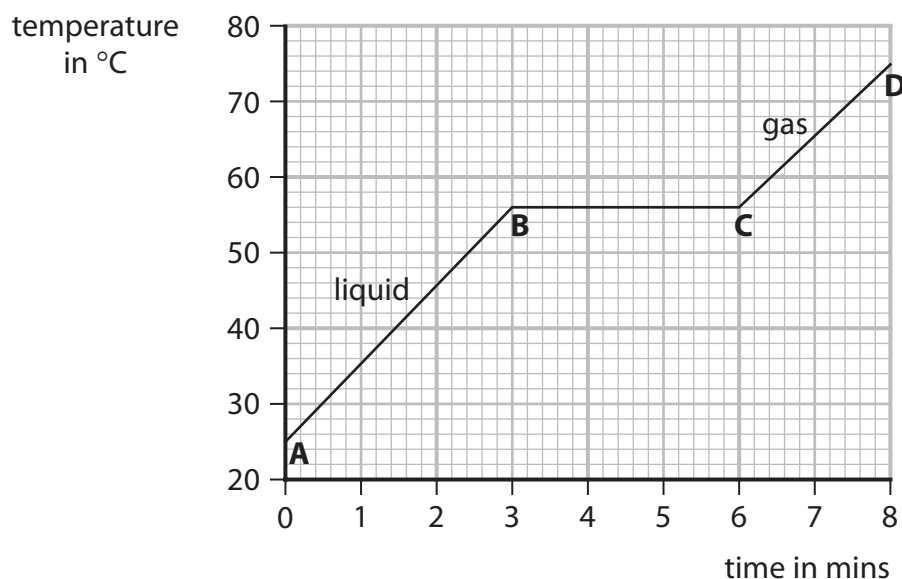


Figure 2

From **A** to **B** the substance was a liquid.

From **C** to **D** the substance was a gas.

- (i) Give the name of the change when a liquid becomes a gas.

(1)

- (ii) Use Figure 2 to give the temperature of the substance at 4 minutes.

(1)

..... °C

- (iii) Use Figure 2 to give the time when the substance has completely changed into a gas.

(1)

..... minutes

- (iv) The temperature of the substance at **A** was 25 °C.

Calculate the temperature rise of the substance from **A** to **D**.

(1)

..... °C

(Total for Question 1 = 8 marks)



2 This question is about electrolysis.

(a) Which statement describes what happens during electrolysis?

(1)

- ☐ **A** atoms are decomposed
- ☐ **B** ionic compounds are decomposed
- ☐ **C** mixtures are separated
- ☐ **D** molecules are separated

(b) Figure 3 shows the electrolysis of copper chloride solution.

(i) Use the words from the box to complete the labelling of the diagram in Figure 3.

(2)

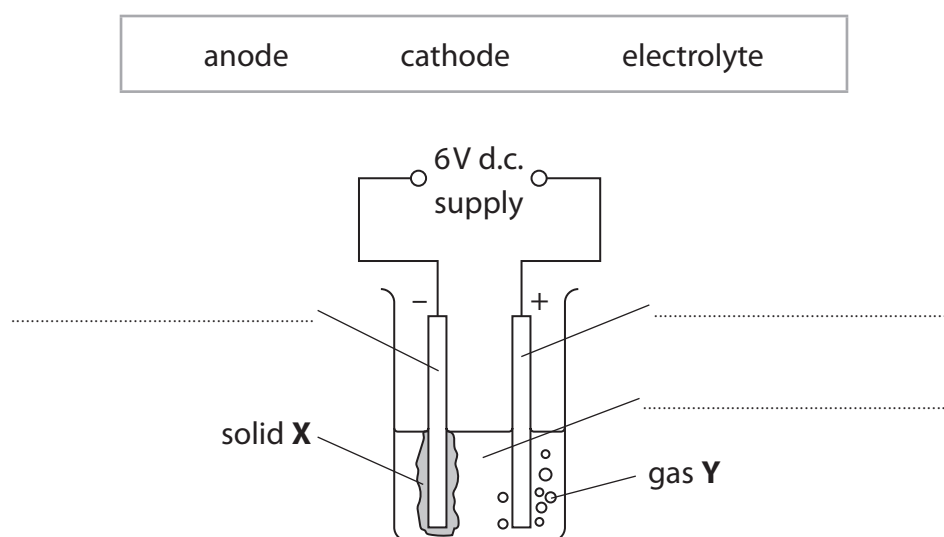


Figure 3

(ii) The products of the electrolysis shown in Figure 3 are solid **X** and gas **Y**.

Draw **one** straight line from each product to its name.

(2)

product

name

solid **X**

carbon

chlorine

copper

gas **Y**

hydrogen

(iii) The experiment is repeated using powdered solid copper chloride instead of copper chloride solution.

Nothing happens and no products are formed.

Explain why nothing happens and no products are formed.

(2)

(Total for Question 2 = 7 marks)

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- 3 (a) When lead nitrate solution and potassium chloride solution are mixed, potassium nitrate and a precipitate of lead chloride are formed.

(i) Complete the word equation for this reaction.

(1)

lead nitrate + → + lead chloride

(ii) Lead nitrate is toxic.

Which hazard symbol should be on a container of lead nitrate?

(1)



A



B



C



D



- (b) A student put 5 cm^3 of potassium carbonate solution into a test tube and added 2 cm^3 of calcium nitrate solution.

A precipitate formed and was allowed to settle as shown in Figure 4.

The height of the precipitate was measured.

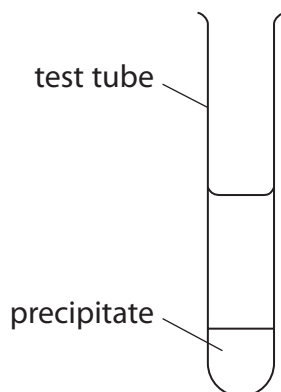


Figure 4

- (i) Give the name of the piece of apparatus the student should use to find the volume of the potassium carbonate solution.

(1)

- (ii) The student repeated the experiment.

The results are shown in Figure 5.

experiment	height of precipitate in cm
1	2.4
2	2.7
3	2.4

Figure 5

Use the data in Figure 5 to calculate the mean height of the precipitate.

(2)

mean height of precipitate = cm

- (iii) Describe how a pure, dry sample of the precipitate could be obtained from the mixture in the test tube.

(3)

.....

.....

.....

.....

.....

.....

- (iv) The student investigated whether increasing the volume of calcium nitrate solution increased the height of the precipitate formed.

They repeated the experiment using different volumes of calcium nitrate.

State **one** variable that should be controlled in this investigation.

(1)

.....

(Total for Question 3 = 9 marks)

.....

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4 (a) Magnesium is a metal.

(i) State **one** physical property of magnesium.

(1)

(ii) Which element is in the same group of the periodic table as magnesium?
Use the periodic table to help you answer this question.

(1)

- ☐ **A** carbon
- ☐ **B** chromium
- ☐ **C** sodium
- ☐ **D** strontium

(b) (i) Magnesium atoms have 12 electrons.

Complete the electronic configuration of a magnesium atom.

(1)

2.8.

(ii) The electronic configuration of a chlorine atom is 2.8.7

Explain how the electronic configuration of chlorine is linked to its period in the periodic table.

(2)



- (c) 1.20 g of magnesium reacts completely with 3.55 g of chlorine to form magnesium chloride.

Calculate the empirical formula of the magnesium chloride.

(relative atomic masses: Mg = 24.0, Cl = 35.5)

You must show your working.

(3)

empirical formula =



(d) Sodium reacts with chlorine to form sodium chloride, which contains ionic bonds.

Hydrogen reacts with chlorine to form hydrogen chloride, which contains covalent bonds.

Figure 6 shows dot and cross diagrams of these compounds.

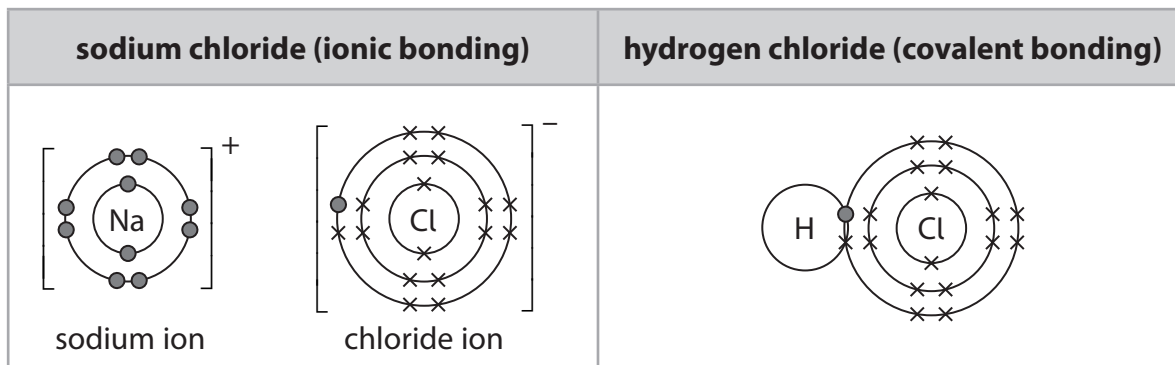


Figure 6

Describe the differences between an ionic bond and a covalent bond.

(4)

(Total for Question 4 = 12 marks)

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- 5 In an experiment, powdered calcium hydroxide was added to dilute hydrochloric acid and the pH was measured.

The method used was

step 1 measure 200 cm^3 dilute hydrochloric acid into a beaker

step 2 add 0.1 g of powdered calcium hydroxide to the beaker

step 3 find the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

- (a) State what should be done after **step 2** to make sure that any reaction is complete.

(1)

- (b) Complete the word equation for the reaction.

(2)

calcium hydroxide + hydrochloric acid $\rightarrow$

- (c) Which row of the table shows the state symbols for powdered calcium hydroxide and dilute hydrochloric acid in the balanced chemical equation?

(1)

	calcium hydroxide	hydrochloric acid
☐ A	aq	l
☐ B	l	aq
☐ C	s	aq
☐ D	s	l



(d) The results of the experiment are shown in Figure 7.

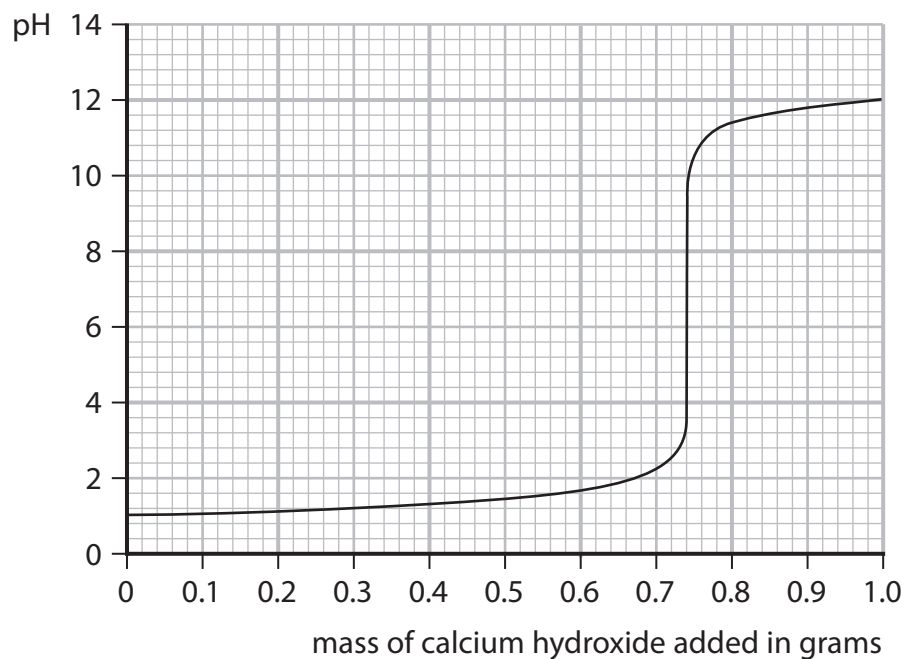


Figure 7

(i) Using Figure 7, give the pH of the acid at the start of the experiment.

(1)

pH =

(ii) Using Figure 7, give the mass of calcium hydroxide required to make a neutral mixture.

(1)

mass of calcium hydroxide = g

(iii) Explain why the pH starts at a low value and ends at a higher value.

(3)

.....

.....

.....

.....

.....

.....

(e) State what should be used to measure the pH of the mixture in this experiment.

(1)

(f) The calcium hydroxide used is corrosive to the eyes and an irritant to skin.

Using this information, state **one** safety precaution that should be taken during the experiment when using any corrosive substance.

(1)

(Total for Question 5 = 11 marks)



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6 Figure 8 shows part of the reactivity series of metals.

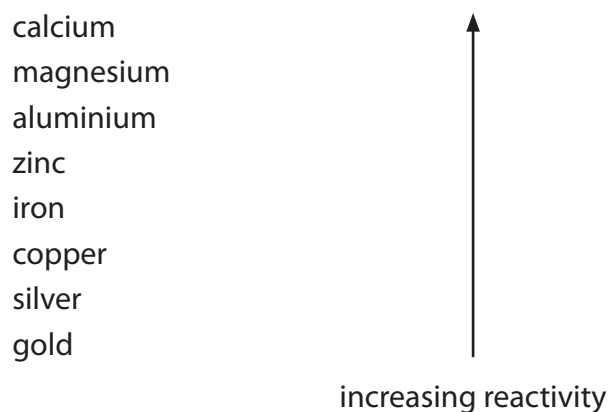


Figure 8

(a) Which metal reacts when added to cold water?

(1)

- ☐ **A** calcium
- ☐ **B** copper
- ☐ **C** gold
- ☐ **D** silver

(b) A student investigates the reactivity of four different metals.

The student adds an equal-sized piece of each metal to separate test tubes containing dilute hydrochloric acid.

The student's observations for zinc and copper are recorded in Figure 9.

metal	observations
magnesium	
zinc	bubbles produced at a steady rate test tube feels slightly warm
iron	
copper	no reaction

Figure 9



- (i) Use the information in Figure 8 and in Figure 9 to predict the observations for the reactions of magnesium and of iron with dilute hydrochloric acid.

(2)

magnesium

iron

- (ii) When metals react with acids, hydrogen gas is produced.

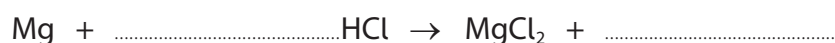
Describe the test to show that the gas is hydrogen.

(2)

- (iii) When magnesium reacts with hydrochloric acid, magnesium chloride and hydrogen are formed.

Complete the balanced equation for the reaction.

(2)



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*(c) There are **three** common methods of obtaining metals from the Earth's crust:

- mine the pure metal
- mine the metal ore and heat it with carbon
- mine the metal ore and electrolyse the molten compound.

The method used to obtain a metal is linked to its position in the reactivity series of metals.

Aluminium, gold, iron, and silver are some commonly used metals.

Use the reactivity series in Figure 8 to state and explain the method chosen to obtain each of these four metals.

(6)



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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS



The periodic table of the elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol name atomic (proton) number															
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

1
H
hydrogen
1

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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P 7 2 5 5 6 A 0 2 4 2 4





Mark Scheme (Results)

Summer 2023

**Pearson Edexcel GCSE
In Combined Science (1SC0)
Paper 1CF**

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Summer 2023

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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.**

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		Command Word	
Strand	Element	Describe	Explain
AO1		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

Chemistry 1SC0/1CF

Question number	Answer	Mark
1(a)(i)	D Z is the only correct answer. A, B and C are incorrect because they have more than one spot	A01-1 (1)

Question number	Answer	Mark
1(a)(ii)	C Y is the only correct answer. A, B and D are incorrect because those inks have fewer spots	A03-1 (1)

Question number	Answer	Additional guidance	Mark
1(a)(iii)	0.39 scores 2 marks with or without working $\frac{3.60}{9.20} = 0.39(1304\dots)$ (1) = 0.39 (1) (rounded to 2dp)	fraction $\frac{9}{23}$ scores 1 mark 1 mark for correct substitution and evaluation $\frac{3.60}{9.20} = 0.4$ scores only 1 for correct evaluation to 1dp Note: 0.4 alone without working scores 0 1 mark for correct rounding (has to use the numbers 3.60 and 9.20 in the calculation) $\frac{9.20}{3.60} = 2.5\mathbf{6}$ scores 1 (for 2dp) Note: by default $3.60 \times 9.20 = 33.12$ has an answer to 2dp, so 2nd mark is given	AO2-1 (2)

Question number	Answer	Additional guidance	Mark
1(b)(i)	evaporation / evaporating	allow boiling / vaporisation do not allow boiling <u>point</u> / bpt	A01-1 (1)

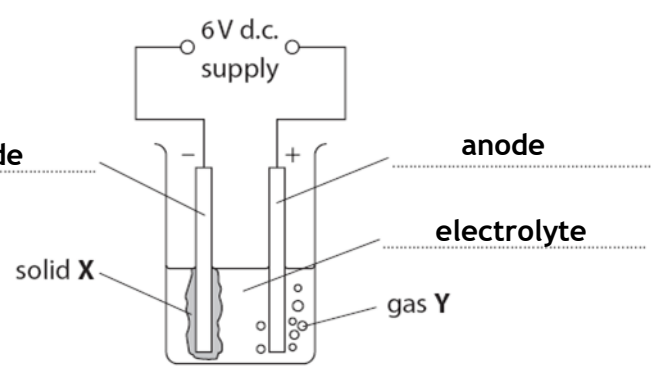
Question number	Answer	Additional guidance	Mark
1(b)(ii)	56 (°C)		A03-1 (1)

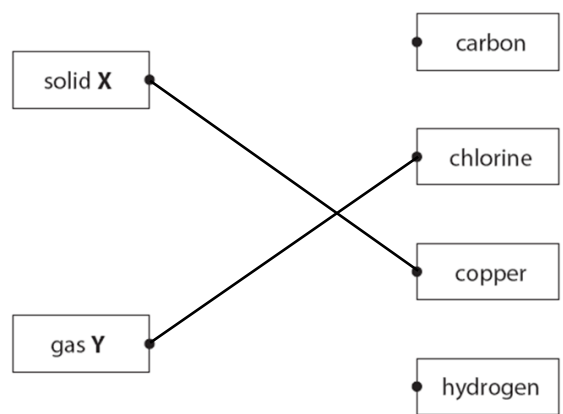
Question number	Answer	Additional guidance	Mark
1(b)(iii)	6 (minutes)		A03-1 (1)

Question number	Answer	Additional guidance	Mark
1(b)(iv)	answers between 49 and 51 score 1 mark with or without working. 75 – 25 = 50 (1)	allow readings between 74 and 76	A03-1 (1)

Total for Question 1 = 8 marks

Question number	Answer	Mark
2(a)	B the decomposition of ionic compounds is the only correct answer A, C and D are incorrect statements	AO1-1 (1)

Question number	Answer	Additional guidance	Mark
2(b)(i)		All 3 correct scores 2 marks 1 or 2 correct scores 1 mark allow copper chloride solution to replace electrolyte	AO1-2 (2)

Question number	Answer	Additional guidance	Mark										
2(b)(ii)	<table><thead><tr><th>product</th><th>name</th></tr></thead><tbody><tr><td> solid X </td><td> • carbon </td></tr><tr><td></td><td> • chlorine </td></tr><tr><td></td><td> • copper </td></tr><tr><td> gas Y </td><td> • hydrogen </td></tr></tbody></table> 	product	name	solid X	• carbon		• chlorine		• copper	gas Y	• hydrogen	one mark for each line do not award mark if more than one line is drawn from each box on the left	A01-2 (2)
product	name												
solid X	• carbon												
	• chlorine												
	• copper												
gas Y	• hydrogen												

Question number	Answer	Additional guidance	Mark
2(b)(iii)	An explanation linking the following - no current will flow / solid ionic compounds do not conduct electricity (1) (because) ions can't move / ions in a lattice (1)	Allow reverse arguments allow no electricity flows do not accept 'nothing happens' ignore charged particles reject electrons/atoms/molecules can't move if no other mark awarded allow 1 mark for if 'copper chloride isn't dissolved' / 'it will only work if ions are in solution'	AO1-1 (2)

Total for Question 2 = 7 marks

Question number	Answer	Mark
3(a)(i)	ON LEFT: potassium chloride AND ON RIGHT: potassium nitrate	A02-1 (1)

Question number	Answer	Mark
3(a)(ii)	D is the correct answer A, B and C are the hazard symbols for corrosive, flammable and harmful	A02-1 (1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	measuring cylinder	allow burette / pipette / syringe	A03-3 (1)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	2.4 + 2.4 + 2.7 (= 7.5) (1) $\frac{7.5}{3} = 2.5$ (1)	2.5 with or without working scores 2 marks allow ECF for an incorrect evaluation divided by 3 allow 2.4 + 2.4 = 4.8, 4.8/2 = 2.4 (1) 2.4 + 2.4 + 2.7 ÷ 3 = 5.7 (1) 2.4 + 2.7 + 2.4 ÷ 3 = 5.9 (1)	A02-2 (2)

Question number	Answer	Additional guidance	Mark
3(b)(iii)	a description to include the following points First mark Filter (the mixture) (1) Second and third marks A description including two of the following Calcium carbonate / the solid / the residue / precipitate is left on (filter) paper / on the funnel (1) Wash / rinse (the solid/residue/calcium carbonate with distilled water) (1) any method of drying the solid (1)	maximum 1 mark if heat or evaporate or crystallisation method used on mixture or filtrate description or diagram of filtering or diagram of filtering ie (filter) funnel and filter paper do not allow sieving/sifting/draining/decanting do not allow separating funnel pour water over/through solid (in filter paper) clean solid with water do not allow this mark if washing is done after drying eg in an oven / on a windowsill / on a radiator / with filter paper warm it heat it (but not with a Bunsen burner) evaporate the water allow 'leave to dry' do not allow just 'dry it (out/off)'	A02-2 (3)

Question number	Answer	Additional guidance	Mark
3(b)(iv)	any one of the following • volume / concentration of {potassium carbonate / carbonate / potassium solution} • concentration of (calcium) nitrate • time allowed for settling	allow amount of (potassium) carbonate ignore 'volume' alone ignore {amount / volume} of calcium nitrate ignore time (alone) allow temperature allow diameter of test tube	A03-3b (1)

Total for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)(i)	any one of the following - shiny - high {melting / boiling} point - good conductor of {electricity / heat} - malleable / ductile - grey coloured	allow reflective surface allow easily shaped / can be drawn into wires allow silver coloured ignore density / sonorous / solid ignore strength / strong / hard	AO1-1 (1)

Question number	Answer	Mark
4(a)(ii)	D strontium is the only correct answer A, B and C are incorrect because they are all in a different group to magnesium.	AO1-1 (1)

Question number	Answer	Mark
4(b)(i)	2.8.2	AO1-1 (1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	an explanation linking any two of (chlorine has) 3 shells / 3 numbers in electronic configuration (1) (so) (chlorine is in) period 3 (1) - number of shells is the period number (1)	reject '3 outer shells' allow electron configuration diagram for 1 st mark	AO1-1 (2)

Question number	Answer	Additional guidance	Mark
4(c)	MP1 for dividing by atomic mass Mg : Cl $\frac{1.20}{24.0} : \frac{3.55}{35.5}$ (1) MP2 for deriving ratio from MP1 0.05 : 0.1 OR 1 : 2 (1) MP3 for formula using ratio in MP2 MgCl₂ (1)	MgCl₂ without working scores 0 allow ECF allow Mg $\frac{24.0}{1.20} : \text{Cl } \frac{35.5}{3.55}$ (0) 20 : 10 OR 2 : 1 (1) empirical formula Mg₂Cl (1) reject superscript numbers for MP3 only	A02-1 (3)

Question number	Answer	Additional guidance	Mark
4(d)	A description to include ionic (max 2 marks) (electrostatic) force between (oppositely charged) ions / between anions and cations (2) covalent (max 2 marks) - atoms share a pair of electrons (2)	Other credible responses (max 1 mark) including any one from: {ions / cations / anions} are charged particles - ionic bonds between metals and non-metals - electrons transferred (from metal to non-metal) - metals lose electrons / non-metals gain electrons reject electrons transferred from non-metal to metals Other credible responses (max 1 mark) including any one from: - covalent bonds are formed when electron(s) are shared - covalent bonds form molecules - covalent bonds between non-metals	A01-1 (4)

Total for Question 4 = 12 marks

Question number	Answer	Additional guidance	Mark
5(a)	stir/ swirl/ shake (the beaker)	allow mix, warm/ heat ignore wait (until reaction over/ until powder disappears)	A01-2 (1)

Question number	Answer	Additional guidance	Mark
5(b)	in either order: calcium chloride (1) water (1)	allow phonetic spellings but reject calcium chlorine allow CaCl ₂ but formula must be correct for the mark ignore 'solution'/ any state symbols allow H ₂ O but formula must be correct for the mark if three products given, allow (1) only if both correct products are given. four or more products scores (0)	A02-1 (2)

Question number	Answer	Mark
5(c)	C s aq is the only correct answer A, B and D are not correct because the calcium hydroxide is a solid and the acid is an aqueous solution.	A02-1 (1)

Question number	Answer	Additional guidance	Mark
5(d)(i)	1	allow 0.9 or 1.1	A03-2 (1)

Question number	Answer	Mark
5(d)(ii)	0.74 (g)	A03-2 (1)

Question number	Answer	Additional guidance	Mark
5(d)(iii)	An explanation linking: START - solution is acidic / acids have low pH / high {concentration/ amount} of H⁺ ions/ excess H⁺ ions (1) REACTION - neutralisation/ H⁺ + OH⁻ → H₂O/ {the hydroxide/ alkali} <u>reacts</u> with the {acid/ H⁺} (1) END {amount/ concentration} of H⁺ ions has reduced/ {amount/ concentration} of OH⁻ ions has increased / excess OH⁻ ions/ (excess of) hydroxide ions have pH > 7 (1)	allow for low pH: pH less than 7 / pH 1-6 / pH =1 ignore there is no alkali ignore references to 'strong' or weak' allow acid → neutral → alkali (2) allow calcium hydroxide is {an alkali/a base} ignore description of pattern – as calcium hydroxide added pH increases (0) ignore 'becomes alkaline'/ is alkaline/ is less acidic	A02-1 (3)

Question number	Answer	Additional guidance	Mark
5(e)	pH meter / pH probe	allow universal indicator / pH paper ignore pH scale do not allow any other named indicator, or 'indicator' alone.	A01-2 (1)

Question number	Answer	Additional guidance	Mark
5(f)	goggles / gloves / eye protection	allow safety glasses ignore wearing lab coats ignore references to general lab safety, e.g. tie hair back, stand up	A01-2 (1)

Total for Question 5 = 11 marks

Question number	Answer	Mark
6(a)	A calcium is the only correct answer B, C and D are incorrect because copper, silver and gold do not react with cold water	A01-1 (1)

Question number	Answer	Additional guidance	Mark
6(b)(i)	MAGNESIUM many bubbles / bubbles produced quickly / bubbles vigorously OR test tube feels hot / warm / warmer than with zinc (1) IRON few bubbles / bubbles produced slowly / some bubbles OR test tube feels <u>very</u> slightly warm (1)	Mark answer lines first, if blank or only contain statements that can be ignored, then look at the table. Ignore hydrogen / gas / reactivity of metal reject incorrect additional observations for each metal allow 'magnesium disappears/ dissolves' ignore steady bubbling / slightly warm ignore steady bubbling / no bubbling allow does not feel warm ignore test tube feels slightly warm	A03-2 (2)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	a description to include the following points • apply lighted splint (to the gas) (1) • (squeaky) pop (1)	allow apply flame / ignite ignore 'squeaky pop test' reject glowing splint MP2 depends on MP1	A01-2 (2)

Question number	Answer	Additional guidance	Mark
6(b)(iii)	$\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ H_2 (1) 2 (1)	reject H_2 , H^2 , 2H , 2h , h_2 , h^2	A02-1 (2)

Question number	Indicative content	Mark
*6(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. ALUMINIUM • extracted by electrolysis • aluminium is more reactive than carbon / ORA • aluminium compound is reduced / redox reaction • as heating with carbon will not work • a more powerful method / more energy is needed • electrolysis is expensive IRON • heating with carbon • iron is less reactive than carbon • iron compound is reduced / redox reaction • method cheaper than electrolysis SILVER • found uncombined / native state / often just mined • low reactivity • so reduction not needed or • silver is less reactive than carbon • heating with carbon • silver compound is reduced / redox reaction • method cheaper than electrolysis GOLD • found uncombined / native state / often just mined • least reactive / low reactivity • so reduction not needed	A02-1 (6)

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	- The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. - Lines of reasoning are unsupported or unclear.
Level 2	3–4	- The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. - Lines of reasoning mostly supported through the application of relevant evidence.
Level 3	5–6	- The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. - Lines of reasoning are supported by sustained application of relevant evidence.

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material and any references to other metals / discard any contradictory material then:
Level 1	1–2	<u>Additional Guidance</u> Correctly identifies method to obtain 1 named metal Correctly identifies method to obtain 2 named metals Correctly identified method to obtain 1 named metal with a part explanation	<u>Possible candidate response</u> (all examples, not a definitive list) Aluminium is obtained using electrolysis (1) Gold and silver are obtained as the pure metal (2) Aluminium is obtained using electrolysis because it is very reactive (2)
Level 2	3–4	<u>Additional Guidance</u> Correctly identifies methods for all four metals (with no explanation) Correctly identified method to extract at least 1 named metal with a full explanation Correctly identifies method to extract at least 2 named metals with part explanation for one (3) or two (4)	<u>Possible candidate response</u> Aluminium extracted using electrolysis, iron obtained by heating with carbon, gold and silver are found as pure metals (3) Iron is extracted by heating (the ore) with carbon as iron is less reactive than carbon and is cheaper than electrolysis (3) Silver and gold are obtained as the {pure/unreacted} metals as they are {unreactive/low in reactivity} (4)
Level 3	5–6	<u>Additional Guidance</u> Correctly identifies method to extract at least 2 metals with full explanations Correctly identifies method to extract at least 3 metals with a full explanation for one metal	<u>Possible candidate response</u> Iron is extracted by heating (the ore) with carbon as iron is less reactive than carbon and is cheaper than electrolysis, and aluminium is obtained using electrolysis because it is very reactive and heating with carbon will not work Aluminium is extracted by electrolysis, iron by heating (the ore) with carbon and silver is found as the unreacted metal as it is very unreactive and reduction is not needed

Total for Question 6 = 13 marks