GCSE
CHEMISTRY
8462/2F

Paper 2 Foundation Tier

Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown.
Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

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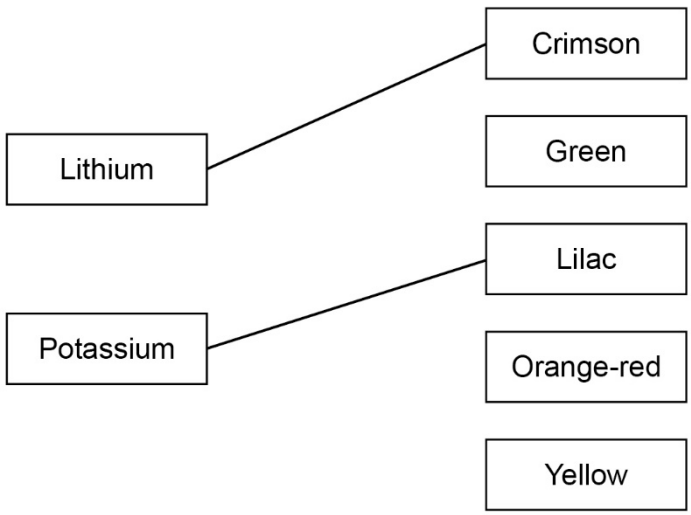
Question 1

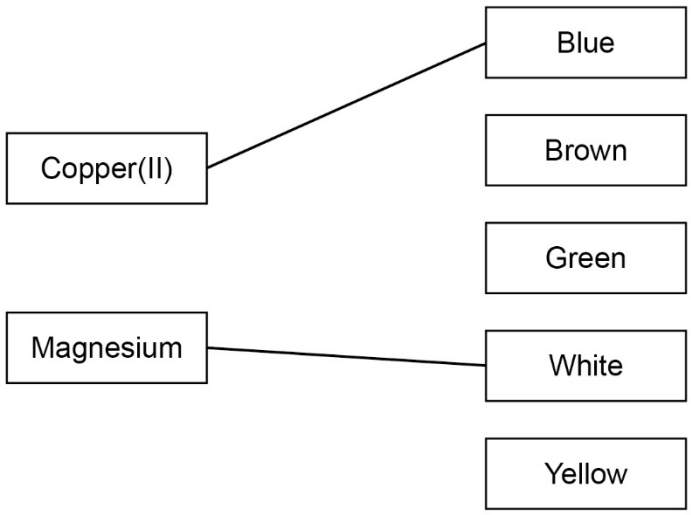
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	put sample on (metal) wire hold wire in (blue / non-luminous) flame	ignore references to cleaning	1 1	AO1 4.8.3.1 RPA7

Question	Answers	Mark	AO / Spec. Ref.
01.2	**Metal ion** **Flame colour**  do **not** accept more than one line from a box on the left	1 1	AO1 4.8.3.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	carbon dioxide		1	AO1 4.8.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	barium chloride solution		1	AO1 4.8.3.5 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	solid		1	AO1 4.2.2.1 4.8.3.5

Question	Answers	Mark	AO / Spec. Ref.
01.6	**Metal ion** **Colour of precipitate**  do **not** accept more than one line from a box on the left	1 1	AO1 4.8.3.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	yellow		1	AO1 4.8.3.4

Total Question 1	**10**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	propene		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	9		1	AO2 4.1.1.1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	making a polymer		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(*y*-axis 0, 20), 40, 60, 80, (100)	ignore intermediate values	1	AO2 4.7.2.1
	carbon bar drawn to 86%	allow a tolerance of ± ½ a small square	1	
	carbon bar labelled		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(test) add bromine (water) (result) (bromine water) turns (from orange to) colourless	 allow (bromine water) decolorises ignore clear MP2 is dependent upon MP1 being awarded	1 1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	$C_{10}H_{22} \longrightarrow C_3H_6 + C_7H_{16}$		1	AO2 4.1.1.1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	fuels		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	the molecules collide more frequently at 750 °C		1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	(at 750 °C the rate of reaction is) higher	allow (at 450 °C the rate of reaction is) lower	1	AO2 4.6.1.2

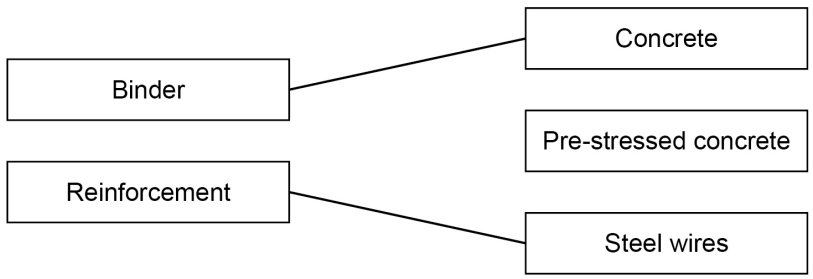
Total Question 2	**12**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(the sign) ⇌	allow a description of the reversible sign	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	endothermic	allow (thermal) decomposition	1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(energy released =) $\frac{4}{20}$ × 23 = 4.6 (kJ)		1 1	AO2 4.6.2.2

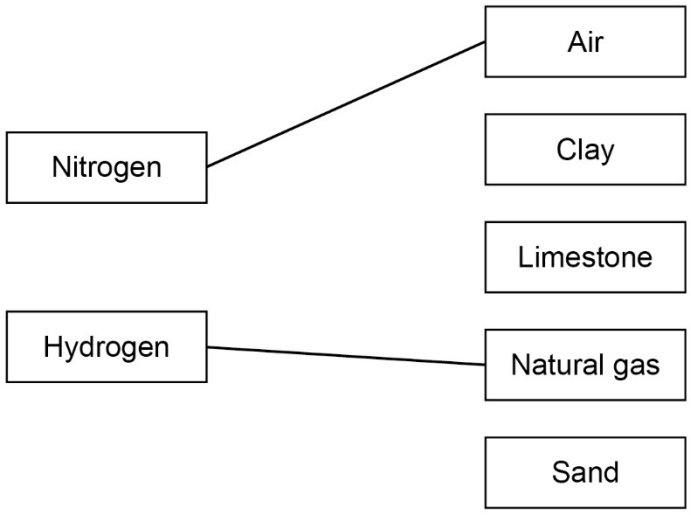
Question	Answers	Mark	AO / Spec. Ref.
03.4	**Component of composite** — **Material in pre-stressed concrete**  do **not** accept more than one line from a box on the left	1 1	AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	iron	allow Fe	1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	clay		1	AO1 4.10.3.3

Total Question 3	**8**

Question 4

Question	Answers	Mark	AO / Spec. Ref.
04.1	**Element** **Source of element**  do **not** accept more than one line from a box on the left	1 1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	cooling		1	AO3 4.2.2.1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	catalyst		1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(world production of ammonia) increased		1	AO3 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(change in mass = 165 – 130 =) 35 (arbitrary units)		1	AO2 4.10.4.1
	(number of years = 2020 – 2000 =) 20		1	
	(mean change =) $\frac{35}{20}$	allow correct use of incorrectly determined change in mass and / or number of years	1	
	= 1.75 (arbitrary units per year)	allow 1.75 (arbitrary units per year) correctly rounded to at least 2 significant figures	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	change in world population		1	AO3 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	$Ca(NO_3)_2$		1	AO2 4.1.1.1 4.10.4.2
	$(NH_4)_2SO_4$		1	

Total Question 4	**12**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	labelled paper in solvent	allow paper touching solvent	1	AO1 4.8.1.3 RPA6
	labelled start line above solvent level	do **not** accept start line touching solvent	1	
	labelled ink spot on start line		1	
		if no other mark awarded allow **1** mark for a complete unlabelled diagram		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(so the start line) does not smudge / run / dissolve **or** pencil is insoluble	allow (because an ink line) would smudge / run / dissolve	1	AO1 4.8.1.3 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$0.80 = \frac{5.2}{\text{distance moved by solvent}}$		1	AO2 4.8.1.3 RPA6
	distance moved by solvent $= \frac{5.2}{0.80}$		1	
	= 6.5 (cm)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	from the start line to the centre of the spot		1	AO1 4.8.1.3 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	use a different solvent use a different type of chromatography paper		1 1	AO1 4.8.1.3 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	1		1	AO2 4.8.1.1 4.8.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	more accurate		1	AO2 4.8.3.6

Total Question 5	**12**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	line of best fit		1	AO2 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	40 (%)		1	AO2 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	carbon dioxide was dissolved in oceans		1	AO3 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	nitrogen was released during volcanic activity		1	AO3 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	2.5 billion years ago		1	AO3 4.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	ammonia methane		1 1	AO1 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	photosynthesis		1	AO1 4.9.1.3

Total Question 6	**8**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(mass =) $\frac{75}{100}$ x 4 = 3 (g)		1 1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	3 : 1		1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	copper silver		1 1	AO1 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(18 carat gold) contains different sized atoms (so the) layers are distorted (so the) layers (of atoms) slide less easily	 allow (so the) atoms cannot slide over each other	1 1 1	AO2 4.2.2.7 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **one** from: • iron rusts • aesthetic reasons		1	AO2 4.10.3.1 4.10.3.2

Total Question 7	**9**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(a burette is) more accurate (than a measuring cylinder)	allow (a burette has) a higher resolution ignore precise	1	AO3 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	the mass of (dissolved) solids		1	AO1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	reheat (the evaporating basin and contents) (and reweigh) until constant mass	 allow for **2** marks heat to constant mass	1 1	AO3 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	subtract the mass of the (empty) evaporating basin from the mass of the evaporating basin and contents (at the end of the experiment)	allow subtract initial mass from the final mass	1	AO1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	(allow mean mass =) $\frac{0.35 + 0.37 + 0.33 + 0.34}{4}$	(allow mean mass =) $\frac{1.39}{4}$	1	AO2 4.3.2.5 4.10.1.2 RPA8
	= 0.3475 (g)		1	
	(conversion 10 cm^3 =) 0.01 dm^3		1	
	(mean concentration =) $\frac{0.3475}{0.01}$	allow correct use of incorrectly determined mean mass allow correct use of incorrect / no conversion of volume	1	
	= 34.75 (g/dm^3)	allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures	1	
	alternative approach 1 (conversion 10 cm^3 =) 0.01 dm^3 (1)			
	(concentrations =) $\frac{0.35}{0.01}$ $\frac{0.37}{0.01}$ $\frac{0.33}{0.01}$ $\frac{0.34}{0.01}$ (1)	allow correct use of incorrect / no conversion of volume		
	= 35 37 33 34 (1)			
	(mean concentration =) $\frac{35 + 37 + 33 + 34}{4}$ (1)	(allow mean concentration =) $\frac{139}{4}$ allow correct use of incorrectly determined concentrations		
	= 34.75 (g/dm^3) (1)	allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures		

	alternative approach 2 using total mass and total volume (total mass = 0.35 + 0.37 + 0.33 + 0.34 =) 1.39 (g) (1) (total volume = 10 + 10 + 10 + 10 =) 40 cm^3 (1) (conversion 40 cm^3 =) 0.04 dm^3 (1) (mean concentration =) $\frac{1.39}{0.04}$ = 34.75 (g/dm^3) (1)	allow correct use of incorrectly determined total mass allow correct use of incorrect / no conversion of total volume allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	the samples were taken from different places		1	AO3 4.10.1.2

Total Question 8	**11**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	fractional distillation		1	AO1 4.1.1.2 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(heater) evaporation (column) condensation	 allow liquid to gas allow boiling allow gas to liquid	 1 1	AO1 4.2.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	petrol		1	AO3 4.7.1.2

Question	Answers	Mark	AO / Spec. Ref.
09.4	heavy fuel oil ⟶ diesel oil ⟶ kerosene	1	AO3 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	C_4H_{10}		1	AO2 4.2.1.4 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	but<u>a</u>ne		1	AO1 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	C_3H_8 + 5 O_2 → **3** CO_2 + **4** H_2O	allow **1** mark for **3** CO_2 allow **1** mark for **4** H_2O	2	AO2 4.1.1.1 4.3.1.1 4.7.1.3

Total Question 9	**9**

Question 10

Question	Answers	Mark	AO / Spec. Ref.
10.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.10.1.1 4.10.1.2 4.10.2.2 4.10.3.1
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	

	Indicative content
	
	• aluminium ore is a finite resource
	• wood is a renewable resource
	• aluminium ore has to be mined / quarried
	  ○ which causes dust / noise pollution
	• trees require land for growing
	  ○ which reduces land for farming
	  ○ which can lead to deforestation
	
	• cost of wood is lower
	  ○ so more doors can be obtained for the same cost
	
	• aluminium is stronger
	  ○ so less easily damaged
	
	• aluminium doors do not need painting
	  ○ so less maintenance required
	
	• both are recyclable
	  ○ so resources are conserved
	  ○ so less goes into landfill
	  ○ so less fossil fuels used
	  ○ so less climate change
	
	• judgement		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	(the oxide coating) acts as a barrier (that) prevents air / oxygen / water reaching the aluminium / metal	do **not** accept sacrificial protection do **not** accept references to rusting do **not** accept sacrificial protection	1 1	AO1 4.10.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	a fixed mass of pigment and a fixed mass of liquid		1	AO1 4.8.1.2

Total Question 10	**9**