GCSE
CHEMISTRY
8462/1F

Paper 1 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

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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.

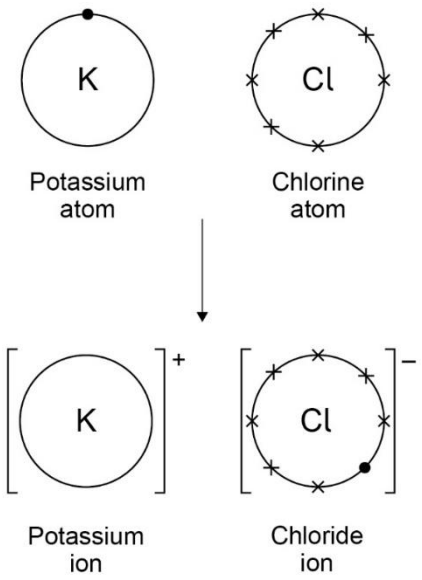
Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	D		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	C		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	sections **A**, **B** and **C**		1	AO1 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	can be bent and shaped good conductor of electricity		1 1	AO1 4.1.2.3 4.1.3.1 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		allow any combination of ×, ●, ○, $e^{(-)}$ for electrons ignore any inner shells		AO2 4.1.2.5 4.2.1.2
	evidence of the outer electron on the potassium atom moving to leave a potassium ion with no outer electrons	allow potassium ion with eight outer electrons	1	
	chloride ion with eight outer electrons		1	
		an answer of  scores **2** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	B		1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	A		1	AO1 4.1.1.2

Total Question 1	**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(**A**) pipette (**B**) conical flask (**C**) burette		1 1 1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	methyl orange (solution) **or** phenolphthalein (solution)	allow litmus (solution) do **not** accept universal indicator	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	colour change	ignore clear	1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **two** from: • swirl • add the acid drop by drop • read (burette) at eye level • ensure no bubbles in burette • use a white tile • repeat **and** take a mean	allow read (burette) at the bottom of the meniscus	2	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	16.6 cm^3		1	AO2 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	trial 2 and trial 3		1	AO3 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$BaCl_2$		1	AO2 4.1.1.1 4.4.2.2

Total Question 2	**10**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	displacement		1	AO1 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(percentage =) $\frac{63.5}{159.5} \times 100$		1	AO2 4.3.1.2
	= 39.81191 (%)		1	
	= 39.8 %	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both the values in the question	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	volume of copper sulfate solution		1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	0.8(0) g		1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(maximum temperature change) = 47 – 22 (ºC) = 25 (ºC)	 allow correct use of incorrectly determined value(s) from the graph	1 1	AO2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(conversion 25 cm^3 =) 0.025 dm^3 (concentration =) $\frac{6.75}{0.025}$ (g/dm^3) = 270 (g/dm^3)	 allow correct use of an incorrectly determined or unconverted volume	1 1 1	AO2 4.3.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	line of best fit using the first five points line of best fit using the last four points	max **1** mark if the lines do not intersect	1 1	AO2 4.5.1.1 RPA4

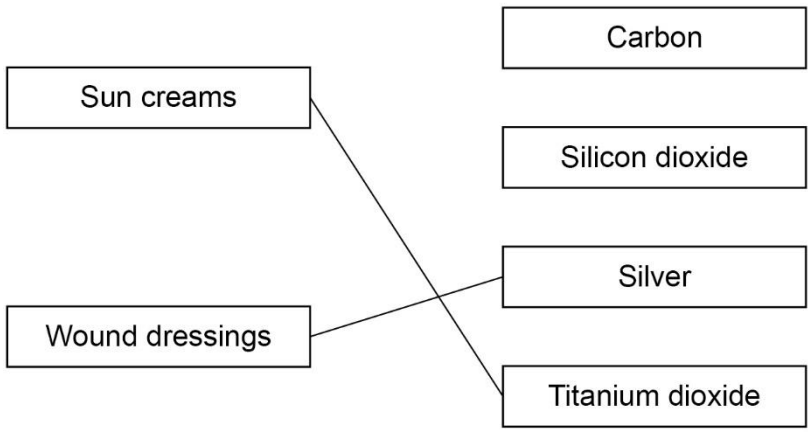
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	energy is **taken in from** the surroundings so the reaction is **endothermic**		1	AO3 4.5.1.1 RPA4

Total Question 3	**14**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	a few hundred atoms		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	iron		1	AO3 4.1.3.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Use** **Substance**  do **not** accept more than one line from a box on the left	1 1	AO3 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(surface area =) 6×4^2		1	AO2 4.2.4.1
	= 96 (nm^2)		1	
	(volume =) 4^3		1	
	= 64 (nm^3)		1	
	(ratio =) 96 : 64	allow correct use of incorrectly determined area and/or volume	1	
	= 3 : 2	allow correct use of an incorrectly determined ratio	1	

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	6		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	7		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	6		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	C_2F_6		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	only intermolecular forces are weak		1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	spherical		1	AO1 4.2.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	3		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	giant structure	allow lattice	1	AO1 4.2.3.1
	(of atoms joined by) covalent bonds		1	
	each carbon / atom forms four bonds		1	

Total Question 5	**10**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	ions can move through the molten substance to the electrodes		1	AO1 4.4.3.1

Question	Answers			Mark	AO / Spec. Ref.
06.2	**Molten compound**	**Product at negative electrode**	**Product at positive electrode**		AO2 4.4.3.2
	Lead chloride	**Lead**	Chlorine	1	
	Potassium iodide	Potassium	**Iodine**	1	
	Zinc bromide	Zinc	Bromine	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$2Al_2O_3 \rightarrow 4Al + 3O_2$	allow **1** mark for 4 Al allow **1** mark for 3 O_2	2	AO2 4.1.1.1 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(M_r =) (27 × 2) + (16 × 3) = 102		1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	(by electrolysis) any **one** from: • potassium / K • lithium / Li	allow aluminium / Al allow sodium / Na allow calcium / Ca allow magnesium / Mg	1	AO3 4.4.1.2 4.4.1.3 4.4.3.3
	(by carbon reduction) any **one** from: • zinc / Zn • tin / Sn	allow iron / Fe allow copper / Cu	1	

Total Question 6	**10**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	6 (V)		1	AO2 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	sodium chloride solution		1	AO3 4.4.3.1 4.5.2.1

Question	Answers	Mark	AO / Spec. Ref.
07.3	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO3 4.5.2.1
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • set up a cell • **add an electrolyte** • into a beaker • **add two (different) metals** • **measure the voltage** • using a voltmeter • **repeat using different metals** • same volume of electrolyte • same concentration of electrolyte • same type of electrolyte • one metal kept the same each time		

Total Question 7	**8**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	copper sulfate water	allow $CuSO_4$ allow H_2O	1 1	AO2 AO1 4.4.2.2 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	solid remains (in the mixture) **or** no more effervescence / bubbles / fizzing	ignore references to colours allow copper carbonate remains (in the mixture)	1	AO1 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	to remove copper carbonate	allow to remove excess (copper carbonate)	1	AO1 4.1.1.2 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	electric heater **or** water bath	ignore Bunsen burner	1	AO1 4.4.2.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	$92.8 = \frac{\text{mass produced}}{12.5} \times 100$	allow mass produced = $\%\text{ yield} \times \frac{\text{max theoretical mass}}{100}$	1	AO2 4.3.3.1
	$(\text{mass produced}) = \frac{92.8}{100} \times 12.5$		1	
	= 11.6 (g)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(copper) does not react with (sulfuric) acid	allow is unreactive allow will not displace hydrogen allow is below hydrogen in the reactivity series ignore is not reactive enough	1	AO1 AO3 4.4.1.2 4.4.2.3
	(sodium) could explode **or** could get too hot	allow (the reaction is) dangerous	1	

Total Question 8	**10**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1		allow energy level for shell		AO1 4.1.2.1
	(similarity) both have one outer (shell) electron	allow same number of outer (shell) electrons	1	
	(difference) sodium has 3 shells but potassium has 4 shells	allow potassium has more shells allow (different) number of shells	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	any **two** from: • effervescence / bubbles / fizzing • (potassium) floats • (potassium) moves around • (potassium) becomes smaller • (potassium) melts • flame • explosion	ignore gas produced allow (potassium) forms a ball ignore colour of flame	2	AO1 4.1.2.5 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	blue / violet / purple		1	AO2
	(the solution is) alkaline	allow (the solution) contains OH^- (ions) allow (the solution) contains hydroxide ions allow the solution is basic	1	AO1 4.1.2.5 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	all five points correctly plotted	allow a tolerance of ± ½ a small square allow **1** mark for three or four points correctly plotted	2	AO2 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	3.4 (mg/cm^3)	allow a value in the range 3.0 to 3.8 (mg/cm^3)	1	AO3 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	chlorine and potassium bromide		1	AO2 4.1.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	relative molecular mass increases and boiling point increases		1	AO1 4.1.2.6

Total Question 9	**11**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(model **A**) plum pudding (model **B**) Bohr	allow Thomson (model) allow nuclear (model) allow planetary (model) allow Rutherford-Bohr (model)	1 1	AO1 4.1.1.3

Question	Answers	Mark	AO / Spec. Ref.
10.2	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3–4	AO1 4.1.1.3
	Level 1: Relevant features are identified and differences noted.	1–2	
	No relevant content	0	
	Indicative content **Similarities** • both contain electrons • both are neutral overall **Differences** • model **A** has no nucleus **or** the model used today has a nucleus • model **A** has no protons **or** the model used today has protons • model **A** has no neutrons **or** the model used today has neutrons • model **A** has positive charge spread throughout the atom **or** model **A** is a ball of positive charge • the model used today has the positive charge in the centre • model **A** the electrons are distributed randomly • the model used today has electrons in shells / energy levels • the mass was spread throughout model **A** • the mass is concentrated at the centre of the model used today • model **A** does not have empty space • model used today is mostly empty space		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	atoms with the same number of protons	allow atoms of the same element allow atoms with the same atomic number ignore references to electrons	1	AO1 4.1.1.5
	with different numbers of neutrons		1	

Total Question 10	**8**