GCSE
CHEMISTRY
8462/1F

Paper 1 Foundation Tier

Mark scheme

June 2023

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236G8462/1F/MS

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.

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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 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.

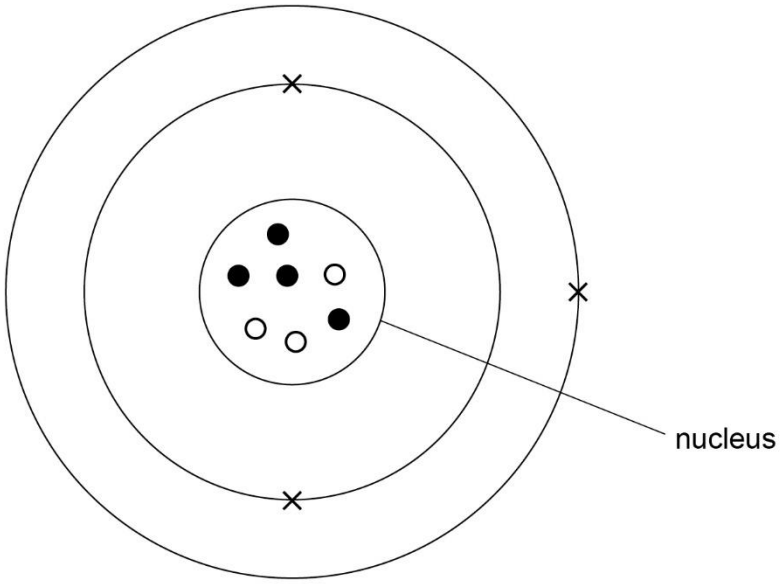
Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	neutron		1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	a neutron and a proton		1	AO1 4.1.1.5

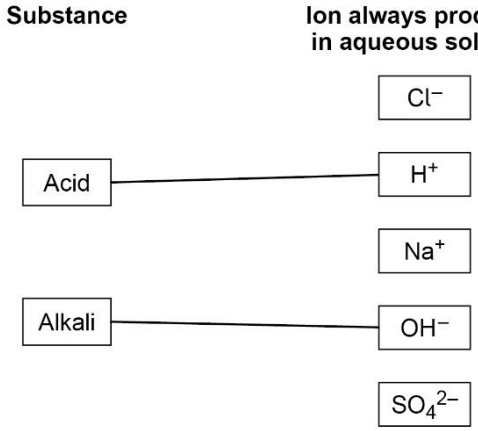
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(nitrogen) 2 / two (oxygen) 1 / one		1 1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	lithium	allow Li	1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	3 x protons (○) in the nucleus		1	AO1
	4 x neutrons (●) in the nucleus		1	AO1
	3 x electrons (×) in the shells		1	AO1
	electrons (×) arranged 2, 1		1	AO2
	an answer of  scores **4** marks			4.1.1.4 4.1.1.7

Total Question 1	**9**

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	 do **not** accept more than **one** line from a box on the left	1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	alkaline		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	pipette		1	AO1 4.4.2.5 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	burette		1	AO1 4.4.2.5 RPA2

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **one** from: • (hydrochloric acid) not added drop by drop • did not swirl • did not rinse apparatus (after previous trial) • did not use a white tile • misread pipette / burette	allow measured out too much alkali	1	AO3 4.4.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	$\left(25.0\ cm^3 = \frac{25.0}{1000} =\right)\ 0.025\ (dm^3)$		1	AO2 4.3.2.5
	(mass =) 0.025 × 4.00	allow correct use of incorrect / no conversion of volume	1	
	= 0.1 (g)		1	
	alternative approach:			
	$\left(\text{concentration} = \frac{4.00}{1000} =\right)$ $0.004\ (g/cm^3)$ (1)			
	(mass =) 0.004 × 25.0 (1)	allow correct use of incorrectly determined concentration in g/cm^3		
	= 0.1 (g) (1)			

Total Question 2	10

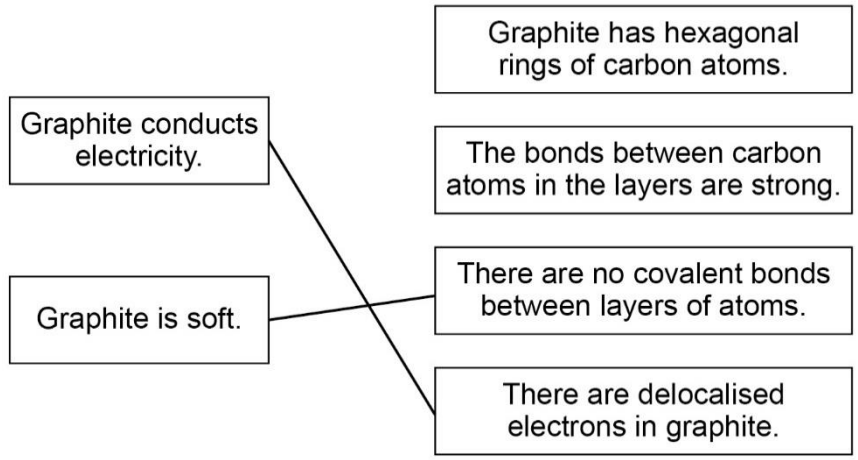
Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	element		1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	protons neutrons	must be in this order allow electrons	1 1	AO1 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$\frac{12}{6.02 \times 10^{23}}$		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	B		1	AO1 4.2.3.3

Question	Answers	Mark	AO / Spec. Ref.
03.5	**Property** / **Structural feature**  do **not** accept more than **one** line from a box on the left	1 1	AO1 4.2.3.2

Total Question 3	**7**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(total atoms =) 30		1	AO2 4.2.2.7
	(percentage =) $\frac{6}{30} \times 100$	allow correct use of an incorrectly determined total number of atoms	1	
	= 20 (%)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	sizes	allow diameters do **not** accept shapes	1	AO1
	slide (over each other)	allow move over each other	1	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(as the percentage by mass of tin increases the) melting point (of solder) decreases		1	AO2 4.2.2.7
	to 183 ºC	allow a value in the range 182–184 ºC allow to 62% (tin)	1	
	then increases		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	232 ºC		1	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the atoms gain energy and their arrangement becomes less ordered		1	AO1 4.2.2.1

Total Question 4	**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	coarse particle		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	20 times		1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(surface area) = 6×3^2 = 54 (nm^2) (surface area : volume) = 54 : 27 (simplest ratio) = 2 : 1	 allow correct ratio from an incorrectly determined surface area 	1 1 1 1	AO2 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	a smaller mass of nanoparticles is needed to be effective		1	AO3 4.2.4.1 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	TiO_2		1	AO2 4.1.1.1

Total Question 5	**8**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any one from: • unreactive • appearance • easily shaped	 allow does not react with air / water / skin allow does not tarnish allow aesthetic reasons allow malleable allow easily moulded ignore references to cost ignore references to hardness / strength ignore references to melting / boiling point	1	AO3 4.4.1.2 4.4.1.3

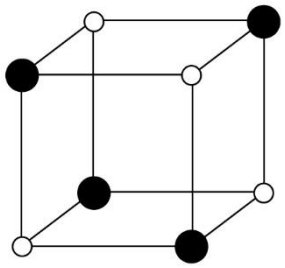
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any **two** from: • bubbles • moves • floats • melts • disappears	 allow forms a ball allow catches fire	2	AO1 4.1.2.5 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	copper is harder copper is less reactive		1 1	AO1 4.1.3.1

Question	Answers	Mark	AO/ Spec. Ref
06.4	**Level 2:** Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3 4.2.2.7 4.2.2.8
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • copper is the better conductor • so heats food more quickly • copper has the higher density • so the pan is heavier • copper costs more per kilogram • so the pan is more expensive to buy • simple judgement		

Total Question 6	**9**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		allow **1** mark for 2 Na^+ and 2 Cl^-	2	AO1 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the ions can move (in the liquid)	do **not** accept reference to moving / delocalised electrons	1	AO1 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3				AO2 4.4.3.2

Molten compound	Product at the negative electrode	Product at the positive electrode	Mark
Magnesium bromide	Magnesium	**Bromine**	1
Potassium chloride	**Potassium**	Chlorine	1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	the mixture has a lower melting point than pure aluminium oxide		1	AO1 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	water		1	AO1 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	hydrogen is less reactive than sodium		1	AO2 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	the volume of hydrogen is twice the volume of oxygen	allow the volume of hydrogen is greater than the volume of oxygen allow the volume of hydrogen is (directly) proportional to the volume of oxygen	1	AO3 4.4.3.4

Total Question 7	**9**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	Fe_2O_3 + 3 C → **2** Fe + **3** CO	allow multiples allow **1** mark for 2 Fe **or** allow **1** mark for 3 CO	2	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	(iron oxide) loses oxygen	ignore references to gain of electrons	1	AO2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	(M_r =) (2 × 56) + (3 × 16) = 160	allow 112 + 48	1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(percentage atom economy =) $\frac{63.5}{2 + 79.5}$ × 100 = 77.9 (%)	 allow 77.914110 (%) correctly rounded to at least 2 significant figures	1 1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	any **one** from: • colour change (in solution) • colour change (in metal) • change of temperature	 allow bubbles	1	AO3 4.1.1.1 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(most reactive) **D** **B** **A** (least reactive) **C**		1	AO3 4.4.1.2
	(reason) more reactive (metals) displace less reactive (metals)	allow **D** has most (displacement) reactions **and C** does not react allow the more reactive metals have more (displacement) reactions	1	

Total Question 8	**10**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	a ball of positive charge with (negative) electrons embedded	do **not** accept references to protons, nuclei, neutrons	1 1	AO1 4.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	(earliest) electrons protons (latest) neutrons		1	AO1 4.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	(number of outer shell electrons) 7 (reason) (tennessine is in) Group 7	 allow the number of outer electrons is the same as the group number allow tennessine is a halogen MP2 is dependent on MP1 being awarded	 1 1	AO2 4.1.2.1 4.1.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(time needed for) peer review	allow the idea that other scientists had to check the results	1	AO3 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(A_r =) $\frac{(6 \times 7.6) + (7 \times 92.4)}{100}$ = 6.924 = 6.9	 allow $\frac{45.6 + 646.8}{100}$ allow (6 × 0.076) + (7 × 0.924) allow 0.456 + 6.468 allow an answer correctly rounded to 1 decimal place from an incorrect calculation which uses all the data in the table	 1 1 1	AO2 4.1.1.6

Total Question 9	**9**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(independent variable) mass (of ammonium nitrate) (dependent variable) (lowest) temperature (reached by solution)	 allow change in temperature (of solution)	1 1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	all 6 points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow **1** mark for 4 or 5 points plotted correctly	2 1	AO2 AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	line extrapolated to *y*-axis (initial temperature) value for temperature where extrapolated line meets *y*-axis	 allow a tolerance of ± ½ a small square	1 1	AO3 AO2 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	temperature decreased	ignore correct references to energy transfer	1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	(0.3 °C) is the uncertainty (because 0.3 °C) is the range about the mean value	 allow values are (a maximum of) 0.3 (°C) either side of the mean allow (because) 16.8 = 16.5 + 0.3 **and** 16.2 = 16.5 – 0.3	1 1	AO2 4.3.1.4 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	random error		1	AO3 4.5.1.1 RPA4

Total Question 10	**11**

Question 11

Question	Answers	Mark	AO/ Spec. Ref
11.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.4.2.2 4.4.2.3 RPA1
	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 • use zinc carbonate and hydrochloric acid • **add zinc carbonate to the (hydrochloric) acid** • in a beaker • stir • **continue adding until the zinc carbonate is in excess** • shown by excess solid • and no more effervescence • **filter (the reaction mixture)** • to remove the excess zinc carbonate • **heat the solution** • using a water bath or electric heater • to crystallisation point • **leave the solution to crystallise** • pat crystals dry with filter paper		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.2	any **two** from: • zinc • zinc oxide • zinc hydroxide	 allow Zn allow ZnO allow $Zn(OH)_2$	2	AO2 4.4.2.3

Total Question 11	**8**