GCSE
CHEMISTRY
8462/1F

Paper 1 Foundation Tier

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

226G8462/1F/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.

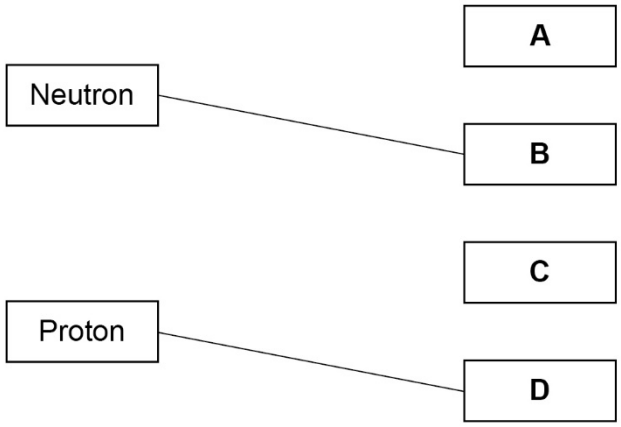
You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

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	**Name** **Label**  do **not** accept more than one line from a box on the left		1 1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	(number of electrons) 9 (number of neutrons) 10		1 1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3 **Mark with question 01.4**	(relative atomic mass =) $\frac{(39 \times 93.3) + (41 \times 6.7)}{100}$	allow (relative atomic mass =) $\frac{(3638.7) + (274.7)}{100}$ allow (relative atomic mass =) 36.387 + 2.747	1	AO2 4.1.1.6
	= 39.134		1	
	= 39.1	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses all the values in **Table 1**	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4 **Mark with question 01.3**	potassium / K	allow ecf from question **01.3**	1	AO3 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	neutrons		1	AO1 4.1.1.5

Total Question 1		**9**

Question 2

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	**A**		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	**B**		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	filtration	allow filtering allow a description of filtration	1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	**C**	allow 78 (°C)	1	AO3 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	increases	allow becomes warmer / hotter	1	AO3 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	heat (the solution) until crystallisation point is reached	allow heat (the solution) until crystals start to form allow heat (the solution) to reduce the volume allow heat (the solution) to evaporate (some of the water)	1	AO1 4.1.1.2 4.4.2.3 RPA1
	leave the solution (to cool / crystallise)	if no other mark is awarded allow **1** mark for heat the solution to dryness	1	

Total Question 2		**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	**B**		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	**C**		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	zinc (oxide) sulfuric (acid)	allow ZnO allow H_2SO_4	1 1	AO2 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	**pH** / **Colour of universal indicator** 1 → Green 7 → Yellow 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.
03.5	neutralisation		1	AO1 4.4.2.4

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

Total Question 3		**8**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	for elements that had not been discovered (at that time) **or** so that elements with similar properties are grouped together	ignore references to atomic number / mass / weight allow for missing elements	1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	Mendeleev		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	noble gases		1	AO3 4.1.2.2 4.1.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	the elements all have one electron in the outer shell		1	AO1 4.1.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	63 (°C)	allow a value in the range 49 to 88 (°C)	1	AO3 4.1.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any **one** from: • floats • moves (on the surface) • melts • fizzes / bubbles • flame	allow forms a ball ignore colour of flame allow explodes / disappears ignore references to heat / temperature / sounds	1	AO1 4.1.2.5

Question	Answers				Extra information	Mark	AO / Spec. Ref.
04.7							AO3 4.1.2.6

Element	**State at 150 °C**	**Symbol**	**Formula of the compound with hydrogen**
Fluorine	gas	F	HF
Chlorine	**gas**	Cl	HCl
Bromine	gas	Br	HBr
Iodine	liquid	I	HI
Astatine	solid	At	**HAt**

1

1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	Br_2		1	AO1 4.1.2.6

Total Question 4		**9**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	hydrogen		1	AO1 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	length of magnesium ribbon		1	AO2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	any **one** from: • volume of (hydrochloric) acid • concentration of (hydrochloric) acid • width / thickness of magnesium ribbon	allow temperature of (hydrochloric) acid allow temperature of solution	1	AO3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(trial) 1	allow 19 (cm^3)	1	AO3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any **one** from: • some gas escaped before the stopper was put in • apparatus leaked • reaction not finished (when reading taken) • less than 25cm^3 of (hydrochloric) acid used • magnesium (ribbon) not long enough	allow the stopper was not replaced quickly enough	1	AO3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6 **View with Figure 8**	all six points correctly plotted	allow a tolerance of ± ½ a small square allow **1** mark for four or five points correctly plotted	2	AO2 4.4.2.1
	line of best fit		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	increases		1	AO2 4.4.2.1

Total Question 5		**9**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	**C**		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	**D**		1	AO1 4.2.1.4 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	4 / four		1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	very hard		1	AO1 4.2.2.6 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	C_2H_6		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	H^+		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	(M_r =) (1 × 2) + 12 + (16 × 3) = 62	allow (M_r =) 2 + 12 + 48	1 1	AO2 4.3.1.2

Total Question 6		**8**

Question 7

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	(volume =) 2^3	allow (volume =) 2×2×2	1	AO2 4.2.4.1
	= 8 (nm^3)		1	
	(surface area : volume) = 24 : 8	allow correct use of an incorrectly calculated volume	1	
	(simplest ratio) = 3 : 1		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	high(er) / large(r)		1	AO1 4.2.4.1
	lower / less / smaller		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(advantage) any **one** from: • stops (unpleasant) smells • can stop (foot) infections (disadvantage) any **one** from: • high cost (of socks) • could be harmful if breathed in	 allow specific (foot) infections allow silver can kill bacteria allow silver is (very) expensive	 1 1	AO3 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	100 times		1	AO2 4.1.1.5 4.2.4.1

Total Question 7		**10**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	hydroxide ions		1	AO1 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	27 (cm^3)		1	AO2 4.4.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	ions cannot move (freely in a solid)	allow ions are fixed in place (in a solid)	1	AO1 4.2.2.1 4.2.2.3 4.4.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4			1 1	AO2 4.4.3.2

Molten compound	**Product at negative electrode**	**Product at positive electrode**
Potassium iodide	Potassium	**Iodine**
Zinc bromide	**Zinc**	Bromine

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	carbon is less reactive than sodium		1	AO1 4.4.1.2 4.4.1.3 4.4.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	(I)		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	(percentage atom economy =) $\frac{48}{80} \times 100$ = 60 (%)		1 1	AO2 4.3.3.2

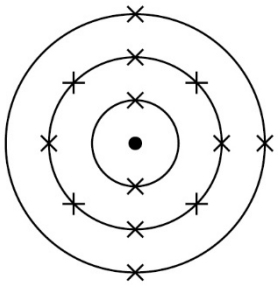
Total Question 8		**9**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**D**		1	AO3 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	**B**		1	AO3 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	any **two** from: (Group 1 elements) • have lower melting / boiling points • have lower densities • are less strong • are softer	allow converse statements for transition elements allow (Group 1 elements are) more malleable / ductile allow (Group 1 elements) are not useful as catalysts ignore transition elements form coloured compounds ignore transition elements form ions with different charges ignore references to chemical properties	2	AO1 4.1.3.1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4		allow any combination of x, •, o, $e^{(-)}$ for electrons	1	AO2 4.1.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	delocalised electrons (the electrons) carry (electrical) charge (the electrons move) through the metal / aluminium / structure	allow free electrons ignore current / electricity for charge ignore throughout for through	1 1 1	AO1 4.2.1.5 4.2.2.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	ionic		1	AO1 4.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	magnesium (atom) loses electrons		1	AO2 4.2.1.1 4.2.1.2
	oxygen (atom) gains electrons		1	
	two electrons (are transferred)		1	
	magnesium ions **and** oxide ions are formed	allow Mg^{2+} (ions) **and** O^{2-} (ions) are formed allow magnesium forms positive ions and oxygen forms negative ions allow (both) form a complete outer shell	1	

Total Question 9		**13**

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.1.1 RPA 4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan 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 • **measure volume of (hydrochloric) acid** • with a measuring cylinder • pour (hydrochloric) **acid into a suitable container** eg polystyrene cup • measure the initial temperature (of hydrochloric acid) • with a thermometer • **add a known mass of sodium carbonate** • measured with a balance • stir • **measure the highest temperature reached** • **repeat with different masses of sodium carbonate** **or** **add successive masses of sodium carbonate to the same mixture** • repeat the whole investigation • use the same starting temperature • use the same volume of (hydrochloric) acid each time • use the same concentration of (hydrochloric) acid each time		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2 View with Figure 17	change in highest temperature	allow a tolerance of ± ½ a small square	1	AO2 4.5.1.1 RPA4
	corresponding change in mass	allow a tolerance of ± ½ a small square	1	
	(gradient =) $\frac{\text{change in highest temperature}}{\text{change in mass}}$	allow correct use of an incorrectly determined change in highest temperature and / or change in mass	1	
	(gradient =) 1.6		1	
	°C/g	allow °C/gram(s)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3 View with Figure 17	extrapolates line to the *y*-axis		1	AO2 4.5.1.1 RPA4
	20.6 (°C)	allow a tolerance of ± ½ a small square allow a correctly determined value from an incorrectly extrapolated line	1	
	alternative approach:			
	(highest temperature at 1.0 g – change in highest temperature per gram =) 22.2 – 1.6 (1)	allow correct use of value determined for gradient in question**10.2**		
	= 20.6 (°C) (1)			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	**C**		1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	(**X**) energy (**Y**) (overall) energy change		1 1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	(level of) products is below (level of) reactants	allow the energy decreases (overall) allow energy is transferred to the surroundings ignore references to bond making / breaking	1	AO1 4.5.1.2

Total Question 10		**17**