



GCSE CHEMISTRY 8462/1F

Paper 1 Foundation Tier

Mark scheme

June 2019

Version: 1.0 Final

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.

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 his or her judgement
- the Assessment Objectives, level of demand 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.

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**. Different terms in the mark scheme are shown by a / ; e.g. 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 error / 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 planets in the solar system.

[2 marks]

| Student | Response | Marks awarded |
|---------|--------------------------|---------------|
| 1 | Neptune, Mars, Moon | 1 |
| 2 | Neptune, Sun, Mars, Moon | 0 |

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, 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. Full marks can, however, be given for a correct numerical answer, without any working shown.

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

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **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 not 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.

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 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.

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, i.e. 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.

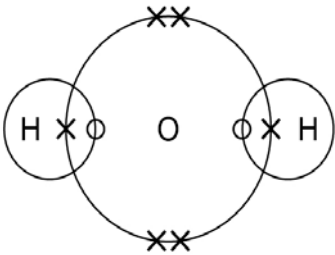
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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 | A nucleus | | 1 | AO1 4.1.1.4 |
| | B electron | | 1 | 4.1.1.7 |
| 01.2 | electron | | 1 | AO1 4.1.1.5 |
| 01.3 | 3 / three | | 1 | AO2 4.1.2.1 |
| 01.4 | (atomic number) 5 | | 1 | AO2 4.1.1.5 |
| | (mass number) 11 | | 1 | |
| 01.5 | isotope | | 1 | AO1 4.1.1.5 |
| 01.6 | there are the same number of $^{79}_{35}\text{Br}$ atoms and $^{81}_{35}\text{Br}$ atoms | | 1 | AO2 4.1.1.6 |
| Total | | | 8 | |

Question 2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---|---|-------------------|---------------------------|
| 02.1 | H ₂ O ₂ | | 1 | AO2 4.1.1.1 4.2.1.4 |
| 02.2 | covalent | | 1 | AO1 4.2.1.4 |
| 02.3 | transition metals | | 1 | AO1 4.1.3.2 |
| 02.4 | B | | 1 | AO1 4.5.1.2 |
| 02.5 | A | | 1 | AO2 4.5.1.2 |
| 02.6 | exothermic | | 1 | AO1 4.5.1.1 |
| 02.7 | <p>1 bonding pair of electrons in the right hand overlap</p> <p>4 non-bonding electrons on oxygen</p> |  <p>scores 2 marks</p> <p>allow dots, crosses, circles or e⁽⁻⁾ for electrons</p> <p>do not accept any change to the number of electrons in the left hand overlap</p> <p>do not accept non-bonding electrons on hydrogen</p> <p>ignore inner shell electrons drawn on oxygen</p> | <p>1</p> <p>1</p> | AO1 4.2.1.4 |
| Total | | | 8 | |

Question 3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|--|-------------------|--------------------|---------------------------|
| 03.1 | B | | 1 | AO2 4.1.1.1 4.1.1.2 |
| 03.2 | D | | 1 | AO2 4.1.1.1 4.1.1.2 |
| 03.3 | E | | 1 | AO2 4.1.1.1 4.1.1.2 |
| 03.4 | <div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">chromatography</div> <div style="border: 1px solid black; padding: 2px; margin-left: 20px;">blue food colour from a mixture of food colours</div> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 10px; width: 100%;">copper from an alloy of copper and zinc</div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px; margin-right: 10px;">crystallisation</div> <div style="border: 1px solid black; padding: 2px; margin-left: 20px;">copper sulfate from copper sulfate solution</div> </div> <div style="border: 1px solid black; padding: 2px; width: 100%;">ethanol from a mixture of ethanol and water</div> </div> <p>additional line from a box negates the mark for that box</p> | | 1 1 | AO2 4.1.1.2 |
| 03.5 | (filter) funnel containing filter paper | | 1 | AO1 |
| | suitable vessel for collecting filtrate | | 1 | AO1 |
| | sand and water labelled in correct place | | 1 | AO2 4.1.1.2 |
| 03.6 | 100 °C | | 1 | AO2 4.1.1.2 |

| | | | | |
|--------------|---|-------------------------------|-----------|----------------|
| 03.7 | any four from: <ul style="list-style-type: none">• solution is heated• water evaporates• the vapour cools in the condenser• the vapour condenses or the vapour turns to a liquid• (pure) water collects in the beaker | allow water boils / vaporises | 4 | AO1 4.1.1.2 |
| Total | | | 13 | |

Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|--|--|------|---------------------------|
| 04.1 | concentration (of solution / electrolyte) | | 1 | AO3 4.5.2.1 |
| | temperature (of solution / electrolyte) | ignore room temperature allow volume (of solution / electrolyte) allow size of electrodes allow distance between electrodes do not accept electrode X unqualified do not accept (measured) voltage | 1 | |
| 04.2 | (most reactive) magnesium zinc (least reactive) cobalt | allow Mg allow Zn allow Co | 1 | AO3 4.4.1.2 4.5.2.1 |
| 04.3 | 0 (volts) | | 1 | AO3 4.5.2.1 |
| | two different metals are needed to produce a voltage | dependent on voltage being given as 0 volts allow the two electrodes are the same metal allow there is no difference in reactivity (between the electrodes) | 1 | |
| 04.4 | connect cells (in series) | ignore putting cells together | 1 | AO1 |
| | use $\left(\frac{12}{1.5} =\right)$ 8 cells | | 1 | AO2 4.5.2.1 |
| 04.5 | electric toy | | 1 | AO3 4.5.2.1 4.5.2.2 |

Question 4 continued

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---|---|-----------|---------------------------|
| 04.6 | (advantage) any one from: <ul style="list-style-type: none"> • faster to refuel (than recharging) • can travel further (before refuelling) • hydrogen can be renewable • produces a constant voltage • no toxic chemicals released after disposal | allow lasts longer allow hydrogen is renewable allow the only product is water ignore no emissions | 1 | AO3 4.5.2.1 4.5.2.2 |
| | (disadvantage) any one from: <ul style="list-style-type: none"> • hydrogen is made from fossil fuels • hydrogen is made from non-renewable resources • hydrogen is difficult to store • hydrogen is flammable / explosive • costs more to refuel (than recharging) • costs more to manufacture • not many hydrogen filling stations | ignore expensive unqualified | 1 | |
| Total | | | 10 | |

Question 5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---------------------------------------|---|----------|-----------------|
| 05.1 | s | | 1 | AO2 4.2.2.2 |
| 05.2 | a gas escapes | | 1 | AO2 4.3.1.3 |
| 05.3 | from 0.47 (g) to 0.86 (g) | allow from 0.86 (g) to 0.47 (g) | 1 | AO2 4.3.1.4 |
| 05.4 | $\frac{0.84+0.79+0.86}{3}$ = 0.83 (g) | an answer of 0.83 (g) scores 2 marks an answer of 0.74 (g) scores 1 mark | 1 | AO3 |
| | | | 1 | AO2 4.3.1.3 |
| 05.5 | independent | | 1 | AO2 4.3.1.3 |
| 05.6 | increases | | 1 | AO2 4.3.1.3 |
| 05.7 | 1.3 (g) | allow 1.30 (g) | 1 | AO2 4.3.1.3 |
| Total | | | 8 | |

Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|--|--|------|-----------------|
| 06.1 | $\frac{184}{(232 + 6)} \times 100$ $= 77 (\%)$ | an answer of 77 (%) scores 2 marks | 1 | AO2 4.3.3.2 |
| | | an answer of 78.63247863 (%) correctly rounded to at least 2 significant figures scores 1 mark | | |
| 06.2 | $\frac{38}{100} \times 40$ $= 15 (\text{kg})$ | an answer of 15 (kg) scores 2 marks | 1 | AO2 4.4.1.3 |
| | | allow 15.2 (kg) | 1 | |
| 06.3 | $(2 \times 27) + (3 \times 16)$ $= 102$ | an answer of 102 scores 2 marks | 1 | AO2 4.3.1.2 |
| | | ignore units | 1 | |
| 06.4 | $\frac{28.4}{31.8} \times 100$ $= 89.3081761 (\%)$ $= 89.3 (\%)$ | an answer of 89.3 (%) scores 3 marks | 1 | AO2 4.3.3.1 |
| | | allow 89.3081761(%) correctly rounded to at least 2 significant figures | 1 | |
| | | allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the masses in the question | 1 | |

| | | | | |
|--------------|---|--|-----------|--------------------------------------|
| 06.5 | aluminium is more reactive than carbon | allow aluminium is above carbon in the reactivity series | 1 | AO1 4.4.1.1 4.4.1.2 4.4.1.3 |
| | (so) carbon cannot displace aluminium or (so) carbon cannot reduce aluminium oxide | allow (so) carbon cannot replace aluminium allow (so) carbon cannot remove oxygen from aluminium oxide allow (so) carbon will not react with aluminium oxide | 1 | 4.4.3.3 |
| Total | | | 11 | |

Question 7

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---------------------------------------|--|-----------|-----------------|
| 07.1 | sports injury pack | | 1 | AO1 4.5.1.1 |
| 07.2 | D | | 1 | AO1 4.5.1.1 |
| 07.3 | systematic error | | 1 | AO1 4.5.1.1 |
| 07.4 | polystyrene cup | allow other insulating containers | 1 | AO1 4.5.1.1 |
| 07.5 | all six points plotted correctly | allow a tolerance of $\pm \frac{1}{2}$ a small square allow 1 mark for at least 3 points plotted correctly | 2 | AO2 4.5.1.1 |
| | line of best fit | ignore extrapolation to y-axis | 1 | |
| | line extrapolated correctly to y-axis | | 1 | |
| 07.6 | 20.4 (°C) | allow ecf from question 07.5 allow a tolerance of $\pm \frac{1}{2}$ a small square | 1 | AO2 4.5.1.1 |
| 07.7 | the mixture was not stirred | | 1 | AO3 4.5.1.1 |
| | too little sulfuric acid was added | | 1 | |
| Total | | | 11 | |

Question 8

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|---|---|---------------------|-----------------|
| 08.1 | any one from: <ul style="list-style-type: none"> • so elements / iodine / tellurium were in groups with similar properties • iodine has similar properties to Br / Cl / F / Group 7 • iodine has different properties to Se / S / O / Group 6 | ignore reference to atomic structure ignore references to Cr, Mn and Mo allow corresponding argument in terms of tellurium | 1 | AO1 4.1.2.2 |
| 08.2 | Mendeleev had predicted properties of missing elements elements were discovered (that filled the spaces / gaps) properties (of these elements) matched Mendeleev's predictions | ignore reference to atomic structure allow atomic weights (of these elements) fitted in the spaces / gaps if no other mark awarded, allow 1 mark for in previous versions of the periodic table the pattern of similar properties broke down | 1 1 1 | AO1 4.1.2.2 |
| 08.3 | relative atomic mass | | 1 | AO1 4.1.1.6 |
| 08.4 | (increasing) atomic / proton number | ignore (increasing) electron number do not accept relative atomic / proton number | 1 | AO1 4.1.2.1 |
| 08.5 | (formula) At ₂ (state) solid | ignore incorrect state symbol allow (s) ignore s | 1 1 | AO1 4.1.2.6 |

| | | | | |
|--------------|--|--|-----------|----------------|
| 08.6 | any two from: <ul style="list-style-type: none">• flame• (white) solid forms• colour of gas / chlorine disappears / fades | allow burns allow (white) smoke forms | 2 | AO1 4.1.2.5 |
| Total | | | 10 | |

Question 9

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|------------------------------|-------------------------------------|--------|-----------------|
| 09.1 | H ⁺ | | 1 | AO1 4.4.2.4 |
| 09.2 | hydrochloric (acid) water | allow HCl allow H ₂ O | 1 1 | AO2 4.4.2.2 |
| 09.3 | burette | do not accept biuret | 1 | AO1 4.4.2.5 |
| 09.4 | 27.6 (cm ³) | allow 27.60 (cm ³) | 1 | AO2 4.4.2.5 |

Question 9 continued

| Question | Answers | Mark | AO/ Spec. Ref |
|--------------|--|-----------|------------------|
| 09.5 | Level 3: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. | 5–6 | AO3 AO1 |
| | Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced. | 3–4 | AO1 x 2 |
| | Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. | 1–2 | AO1 x 2 |
| | No relevant content | 0 | |
| | <p>Indicative content</p> <p>allow converse using acid added to alkali</p> <p>Key steps</p> <ul style="list-style-type: none"> • measure the volume of acid • add indicator to the acid • add sodium hydroxide solution • until the colour changes • record volume of sodium hydroxide solution added • repeat procedure with the other acid <p>Use of results</p> <ul style="list-style-type: none"> • compare the two volumes of sodium hydroxide solution to find which sample P or Q is more concentrated <p>Other points</p> <ul style="list-style-type: none"> • pipette to measure volume of acid • use a few drops of indicator • swirl • use a white tile • rough titration to find approximate end point • add dropwise near the endpoint • read volume from bottom of meniscus • repeat and take a mean | | 4.4.2.5 |
| Total | | 11 | |

Question 10

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|--|--|------|-----------------|
| 10.1 | contain delocalised electrons | allow contain free electrons | 1 | AO1 4.2.3.3 |
| | (so) electrons can move through the structure / nanotube | allow (so) electrons can carry charge through the structure / nanotube | 1 | |
| | | ignore throughout for through ignore current / electricity for charge | | |

| Question | Answers | Mark | AO / Spec. Ref. |
|----------|--|------|---------------------------|
| 10.2 | Level 2: Some logically linked reasons are given. There may also be a simple judgement. | 3–4 | AO3 4.2.3.3 4.2.2.7 |
| | Level 1: Relevant points are made. They are not logically linked. | 1–2 | |
| | No relevant content | 0 | |
| | Indicative content | | |
| | <ul style="list-style-type: none"> • wood is the least dense so lightest to use • aluminium is the most dense so will make the racket too heavy • carbon nanotube is the strongest so least likely to break • wood / aluminium are too weak so the racket will break more easily • carbon nanotube is the stiffest so least likely to bend out of shape • wood / aluminium are not very stiff so could bend out of shape • justified conclusion | | |

Question 10 continued

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|--------------|---|---|-----------|-----------------|
| 10.3 | (82 ² =) 6724 (nm ²) | an answer of 4.0 x 10 ⁴ (nm ²) scores 3 marks | 1 | AO2 4.2.4.1 |
| | (6 x 6724 =) 40344 (nm ²) | an answer of 40344 (nm ²) scores 2 marks | 1 | |
| | = 4.0 x 10 ⁴ (nm ²) | allow 40344 (nm ²) correctly rounded to any number of significant figures allow correct calculation using incorrectly calculated value of area of one face from step 1 allow 4.0344 x 10 ⁴ (nm ²) correctly rounded to 1 or more significant figures allow a correctly calculated and rounded conversion to standard form of an incorrect calculation of surface area | 1 | |
| 10.4 | any one from: <ul style="list-style-type: none"> less can be used (for the same effect) greater surface area (to volume ratio) | allow converse statements about fine particles ignore nanoparticles are smaller | 1 | AO3 4.2.4.2 |
| Total | | | 10 | |