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# GCSE

# Science A / Chemistry

CH1HP

Mark scheme

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4405 / 4402

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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 Assessment Writer.

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](http://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 his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- 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.

### 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 / ; 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 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

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

### 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 e.c.f. 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 Ignore / Insufficient / Do not allow

Ignore or insufficient are 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.

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

**Quality of Written Communication and levels marking**

In Question 3(b) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

**Level 1: basic**

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

**Level 2: clear**

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

**Level 3: detailed**

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

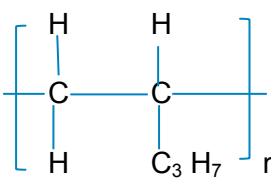
| Question     | Answers                                                                                                                                                                                                                      | Extra information                                                                                                              | Mark       | AO / Spec. Ref.       |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------|
| 1(a)(i)      | protons                                                                                                                                                                                                                      | allow “protons or electrons”, but do not allow “protons and electrons”                                                         | 1          | 1 / 1.1.1g            |
| 1(a)(ii)     | protons plus/and neutrons                                                                                                                                                                                                    |                                                                                                                                | 1          | 1 / 1.1.1g            |
| 1(b)         | (because the relative electrical charges are) –(1) for an electron and +(1) for a proton<br><br>and the number of electrons is equal to the number of protons                                                                | allow electrons are negative and protons are positive<br><br>if no other mark awarded, allow 1 mark for the charges cancel out | 1<br><br>1 | 1 / 1.1.1d/e          |
| 1(c)         | (the electronic structure of) fluorine is 2,7 and chlorine is 2,8,7<br><br>(so fluorine and chlorine are in the same group) because they have the same number of or 7 electrons in their highest energy level or outer shell | allow diagrams for the first marking point<br><br>if no other mark awarded, allow 1 mark for have the same/similar properties  | 1<br><br>1 | 1+2 / 1.1.1a / 1.1.2a |
| 1(d)         | S                                                                                                                                                                                                                            |                                                                                                                                | 1          | 2 / 1.1.1b            |
| 1(e)(i)      | ions                                                                                                                                                                                                                         |                                                                                                                                | 1          | 1 / 1.1.3a            |
| 1(e)(ii)     | molecules                                                                                                                                                                                                                    |                                                                                                                                | 1          | 1 / 1.1.3a            |
| <b>Total</b> |                                                                                                                                                                                                                              |                                                                                                                                | <b>9</b>   |                       |

| Question  | Answers                                                                          | Extra information                                                                                            | Mark | AO / Spec. Ref. |
|-----------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------|-----------------|
| 2(a)(i)   | (calcium) carbonate                                                              | ignore $\text{CaCO}_3$                                                                                       | 1    | 1 / 1.2.1a      |
| 2(a)(ii)  | (thermal) decomposition                                                          |                                                                                                              | 1    | 1 / 1.2.1b      |
| 2(a)(iii) | water                                                                            | allow $\text{H}_2\text{O}$<br>allow hydrogen oxide                                                           | 1    | 1 / 1.2.1d      |
| 2(a)(iv)  | alkali                                                                           | allow base                                                                                                   | 1    | 1 / 1.2.1d      |
| 2(b)(i)   | straight line through the first, second and fourth points                        | allow a straight line through the last three points if the first straight line extrapolates below point four | 1    | 2+3 / 1.2.1g    |
|           | straight line through the last four points                                       |                                                                                                              | 1    |                 |
| 2(b)(ii)  | repeat the experiment (at each mass of aggregate)                                | do not allow repeat at other masses                                                                          | 1    | 3 / 1.2.1g      |
|           | (use the results to) calculate a mean/average value (for each mass of aggregate) |                                                                                                              | 1    |                 |

| Question         | Answers                                                                                                                                                                                                                  | Extra information                                                             | Mark      | AO / Spec. Ref. |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------|-----------------|
| <b>2(b)(iii)</b> | line drawn to y axis showing extrapolation<br>correct value read from graph                                                                                                                                              | allow +/- one small square                                                    | 1         | 2+3 / 1.2.1g    |
|                  |                                                                                                                                                                                                                          | do not allow 0<br>award 1 mark for a value of 34-40 if no extrapolation shown | 1         |                 |
| <b>2(b)(iv)</b>  | at first, the force needed to break a concrete beam increases<br><br>but the force needed to break a concrete beam then decreases<br>mention of 400 g as the point at which the force needed changes or value from graph | allow values<br>allow at first the statement is correct                       | 1         | 3 / 1.2.1g      |
|                  |                                                                                                                                                                                                                          | allow values                                                                  | 1         |                 |
|                  |                                                                                                                                                                                                                          | allow 400g if there is no intercept on graph                                  | 1         |                 |
| <b>Total</b>     |                                                                                                                                                                                                                          |                                                                               | <b>13</b> |                 |

| Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Answers                                                                                                                                                              | Extra information                                                                                              | Mark                                              | AO / Spec. Ref.                       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------|--|
| <b>3(a)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | any <b>one</b> from: <ul style="list-style-type: none"> <li>not enough evidence or proof</li> <li>(life and the Earth were created) billions of years ago</li> </ul> | allow no evidence or no proof<br><br>allow a long time ago<br><br>ignore different beliefs or no one was there | 1                                                 | 2 / 1.7.2d                            |  |
| <b>3(b)</b> Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                      |                                                                                                                |                                                   | 1+2+3 / 1.7.1a/b/c / 1.7.2a/b/c/f/g/h |  |
| <b>0 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Level 1 (1–2 marks)</b>                                                                                                                                           | <b>Level 2 (3–4 marks)</b>                                                                                     | <b>Level 3 (5–6 marks)</b>                        |                                       |  |
| No relevant content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Statements based on diagrams                                                                                                                                         | Description of how one change occurred                                                                         | Descriptions of how at least two changes occurred |                                       |  |
| <b>Examples of chemistry points made in the response could include:</b><br><br><b>Main changes</b> <ul style="list-style-type: none"> <li>oxygen increased because plants / algae developed and used carbon dioxide for photosynthesis / growth producing oxygen; carbon dioxide decreased because of this</li> <li>carbon dioxide decreased because oceans formed and dissolved / absorbed carbon dioxide; carbon dioxide became locked up in sedimentary / carbonate rocks and / or fossil fuels</li> <li>oceans formed because the Earth / water vapour cooled and water vapour in the atmosphere condensed</li> <li>continents formed because the Earth cooled forming a supercontinent / Pangaea which formed the separate continents</li> <li>volcanoes reduced because the Earth cooled forming a crust</li> </ul> <b>Other changes</b> <ul style="list-style-type: none"> <li>nitrogen formed because ammonia in the Earth's early atmosphere reacted with oxygen / denitrifying bacteria</li> </ul> |                                                                                                                                                                      |                                                                                                                |                                                   |                                       |  |
| <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                      |                                                                                                                | <b>7</b>                                          |                                       |  |

| Question         | Answers                                                                                                                                                        | Extra information                                | Mark      | AO / Spec. Ref. |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------|-----------------|
| <b>4(a)</b>      | The ore is not pure or contains impurities or the ore does not contain 100% of the metal compound<br><br>rock / other compounds need to be removed / separated | allow to concentrate the metal or metal compound | 1         | 2+3 / 1.3.1b    |
|                  |                                                                                                                                                                |                                                  | 1         |                 |
| <b>4(b)(i)</b>   | (cast iron is) brittle                                                                                                                                         | allow not strong<br>ignore weak                  | 1         | 1 / 1.3.2a      |
| <b>4(b)(ii)</b>  | the oxygen reacts with carbon reducing the percentage of carbon in the mixture<br><br>or producing carbon dioxide                                              | allow carbon burns in oxygen or is oxidised      | 1         | 2 / 1.3.2b      |
|                  |                                                                                                                                                                |                                                  | 1         |                 |
| <b>4(c)(i)</b>   | aluminium has a low density                                                                                                                                    |                                                  | 1         | 2 / 1.3.3c      |
| <b>4(c)(ii)</b>  | (because copper) is in the central/middle (block of the periodic table)<br><br>whereas aluminium is in Group 3 (of the periodic table)                         |                                                  | 1         | 1 / 1.3.3a      |
|                  |                                                                                                                                                                |                                                  | 1         |                 |
| <b>4(c)(iii)</b> | iron is more reactive (than copper)<br><br>so copper is displaced/reduced                                                                                      | ignore cost                                      | 1         | 1+2 / 1.3.1h/i  |
|                  |                                                                                                                                                                |                                                  | 1         |                 |
| <b>Total</b>     |                                                                                                                                                                |                                                  | <b>10</b> |                 |

| Question | Answers                                                                                                                                                                                                                                                                                                                            | Extra information                                                                                                                                                                                                                                                                                         | Mark        | AO / Spec. Ref.             |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|
| 5(a)     | any <b>four</b> from: <ul style="list-style-type: none"> <li>(crude oil is) heated</li> <li>to evaporate/vaporise/boil (the substances/ hydrocarbons)</li> <li>the column is hotter at the bottom or is cooler at the top</li> <li>(vapours/fractions) condense</li> <li>at their boiling points or at different levels</li> </ul> | marks can be taken from a diagram<br>max 3 marks for reference to cracking<br>allow fractional distillation<br>allow vapours (enter the column)<br>allow temperature gradient or (vapours) cool as they rise<br>allow description e.g. vapour turns to liquid<br>allow they have different boiling points | 4           | 1 / 1.4.1a/b / 1.4.2b       |
| 5(b)     | acid rain is caused by sulfur dioxide or oxides of nitrogen<br>they react with/are neutralised by calcium carbonate or limestone<br><b>OR</b><br>global warming is caused by carbon dioxide<br>carbon dioxide will react or dissolve in suspension of limestone                                                                    | allow consequences of acid rain<br>second marking point is dependent on first marking point<br>allow greenhouse effect is caused by or allow consequences of global warming                                                                                                                               | 1<br>1<br>1 | 2+3 / 1.4.3a/b/c/d / 1.2.1f |
| 5(c)(i)  | C <sub>2</sub> H <sub>4</sub>                                                                                                                                                                                                                                                                                                      | must be formula<br>ignore any name                                                                                                                                                                                                                                                                        | 1           | 2 / 1.1.3b/c / 1.5.1b       |
| 5(c)(ii) | a single bond between carbon atoms<br>other four bonds linking hydrogen atoms and C <sub>3</sub> H <sub>7</sub> group plus two trailing/connecting bonds<br>n at the bottom right hand corner of the bracket                                                                                                                       |  <p>would score 3 marks</p>                                                                                                                                                                                            | 1<br>1<br>1 | 2 / 1.5.2a                  |

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|                  |                                                                                                           |  |           |                   |
|------------------|-----------------------------------------------------------------------------------------------------------|--|-----------|-------------------|
| <b>5(c)(iii)</b> | has a shape memory<br>or<br>(a smart polymer) can return to<br>original shape (when conditions<br>change) |  | <b>1</b>  | <b>2 / 1.5.2b</b> |
| <b>Total</b>     |                                                                                                           |  | <b>12</b> |                   |

| Question     | Answers                                                                                                                                                                                                                                                                                                                                                                                   | Extra information                                                                                                                                                                       | Mark                         | AO / Spec. Ref. |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------|
| 6(a)(i)      | (vegetable oils) provide energy                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                         | 1                            | 1 / 1.6.1b      |
| 6(a)(ii)     | any <b>two</b> from: <ul style="list-style-type: none"> <li>crushing</li> <li>pressing</li> <li>distillation</li> </ul>                                                                                                                                                                                                                                                                   | allow filtering, decanting, centrifuging (for either second or third bullet point)                                                                                                      | 2                            | 1 / 1.6.1a      |
| 6(b)         | vegetable oils have a higher boiling point (than water)<br>so foods are cooked faster (than with water)                                                                                                                                                                                                                                                                                   | allow cooks food at a higher temperature (than water)<br><br>if no other mark awarded allow 1 mark for flavour / texture                                                                | 1<br><br>1                   | 1 / 1.6.1c      |
| 6(c)         | the emulsifier molecules have a 'head' or hydrophilic end which dissolves in/attracted to water<br><br>the emulsifier molecules have a 'tail' or hydrophobic end which dissolves in/attracted to oil<br><br>so forms a (stable) suspension or droplets of oil in water or vice versa<br><br>hydrophilic is the 'head' of the molecule <b>or</b> hydrophobic is the 'tail' of the molecule | allow a diagram for any of the marking points<br><br>allow 1 mark if both attractions are reversed<br><br>allow droplets repel each other<br><br>allow this mark anywhere in the answer | 1<br><br>1<br><br>1<br><br>1 | 1+2 / 1.6.2a/b  |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                         | <b>9</b>                     |                 |