

GCSE

Chemistry A

Unit **A173/01**: Module C7 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.








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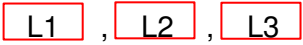














Annotations

Used in the detailed Mark Scheme:

| Annotation | Meaning |
|---------------------|---|
| / | alternative and acceptable answers for the same marking point |
| (1) | separates marking points |
| not/reject | answers which are not worthy of credit |
| ignore | statements which are irrelevant - applies to neutral answers |
| allow/accept | answers that can be accepted |
| (words) | words which are not essential to gain credit |
| <u>words</u> | underlined words must be present in answer to score a mark |
| ecf | error carried forward |
| AW/owtte | credit alternative wording / or words to that effect |
| ORA | or reverse argument |

Available in RM Assessor to annotate scripts:

| | |
|---|---|
|  | indicate uncertainty or ambiguity |
|  | benefit of doubt |
|  | contradiction |
|  | incorrect response |
|  | error carried forward |
| | draw attention to particular part of candidate's response |
|  | no benefit of doubt |
|  | reject |
| | correct response |

| | |
|---|---|
|  | draw attention to particular part of candidate's response |
|  | information omitted |
|  | indicate uncertainty or ambiguity |
|  | benefit of doubt |
|  | contradiction |
|  | incorrect response |
|  | error carried forward |
|  | draw attention to particular part of candidate's response |
|  | draw attention to particular part of candidate's response |
|  | draw attention to particular part of candidate's response |
|  | no benefit of doubt |
|  | reject |
|  | correct response |
|  | draw attention to particular part of candidate's response |
|  | information omitted |

Subject-specific Marking Instructions

Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).

Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:

| | | | |
|--|--|---|--|
| <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| | <input checked="" type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| | <input checked="" type="checkbox"/> <input type="checkbox"/> | <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> | <input type="checkbox"/> <input checked="" type="checkbox"/> |
| | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |

This would be worth 1 mark.

This would be worth 0 marks.

This would be worth 1 mark.

The list principle:

If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

| | |
|-------------|--------------------------|
| Edinburgh | <input type="checkbox"/> |
| Manchester | <input type="checkbox"/> |
| Paris | <input type="checkbox"/> |
| Southampton | <input type="checkbox"/> |

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

| | | | | | | | | | | |
|---------------|--------------------------|----------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-----------|
| Edinburgh | | | <input type="checkbox"/> | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Manchester | <input type="checkbox"/> | x | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | <input type="checkbox"/> | |
| Paris | | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Southampton | <input type="checkbox"/> | x | | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | |
| Score: | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | NR |

For answers marked by levels of response:

- i. **Read through the whole answer from start to finish**
- ii. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
- iii. **To determine the mark within the level**, consider the following:

| Descriptor | Award mark |
|--------------------------------------|------------------------------|
| A good match to the level descriptor | The higher mark in the level |
| Just matches the level descriptor | The lower mark in the level |

- iv. Use the **L1**, **L2**, **L3** annotations in RM Assessor to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

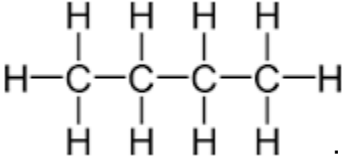
- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

| Question | | Answer | Marks | Guidance |
|----------|-----|---|--|---|
| 1 | (a) | <p>stage needed</p> <p>measure mass of solid</p> <p>dissolve solid in water and stir</p> <p>make solution up to exactly 250 cm³</p> | <p>equipment</p> <p>burette</p> <p>volumetric flask</p> <p>beaker and glass rod</p> <p>balance</p> <p>thermometer</p> | <p>3</p> <p>(1) for each correct line.</p> <p>If more than one line either to or from a box, that box does not 'count'.</p> |

| Question | Answer | Marks | Guidance |
|----------|---|-------|--|
| 1 b | <p>[Level 3] Makes statements about sampling, storing and handling and making solutions. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Makes a statement about two different aspects of the procedure. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Makes a basic statement about one aspect of the procedure. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to D</p> <p>Indicative scientific points may include: Level 3 (Accuracy)</p> <p>Level 2 and 3 (Use of equipment)</p> <p>Sampling</p> <ul style="list-style-type: none"> <input type="checkbox"/> random sampling/ spread of samples <input type="checkbox"/> idea of different times during the day <input type="checkbox"/> regular spacing of times <input type="checkbox"/> more than one sample at each time <input type="checkbox"/> idea of taking lots of samples to take a mean value <p>Storing and Handling</p> <ul style="list-style-type: none"> <input type="checkbox"/> using containers for different tablets <input type="checkbox"/> idea of keeping samples separate / not mixing up <input type="checkbox"/> labels on samples <input type="checkbox"/> not contaminating / wear gloves / make sure equipment is clean <input type="checkbox"/> separate glassware/equipment <p>Making solutions</p> <ul style="list-style-type: none"> <input type="checkbox"/> control of volume or amount of water/ total volume or amount of solution <input type="checkbox"/> control of number/amount of tablets (used to make solution) <input type="checkbox"/> idea of not contaminating glassware / using clean equipment. <p>Allow 'repeat' idea for L1 (1) mark as evidence of partial engagement with science</p> <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p> |

| Question | | | Answer | Marks | Guidance |
|--------------|------|------|--|-----------|---|
| 1 | (c) | | sodium chloride ; (1) CO ₂ ; (1) | 2 | |
| 1 | | ii | reacts with/ neutralises (hydrochloric) acid/HCl ; (1) Carbon dioxide/CO ₂ quoted as the product; (1) | 2 | Do not allow second marking point if other products are listed |
| Total | | | | 13 | |
| Question | | | Answer | Marks | Guidance |
| 2 | (a) | (i) | <i>Any 2 from:</i> Range is wide/ results vary ; Identifies range 8.0 / 19.0 to 27 ; 19.0/ result 4 is an outlier ; Rough reading should be above accurate ; | 2 | Alternatives to first point results not concordant/consistent/repeatable/ values are quite far away from each other / fluctuates too much/ there is a range Ignore reliable outlier must be identified |
| | (ii) | | a pipette | 1 | |
| | (b) | (i) | 21.0 20.5 21.5 | 1 | All three needed |
| | | (ii) | 21(.0) (2 marks) For (1) mark adds ringed values ; (1) | 2 | Allow ecf on three ringed values from (b) (i) for (2) marks Allow 22.2 / 22(.0) for (1) mark (includes all five or last four in average) |
| | (c) | | concentration is 4% ; (1) which is too low / below 5 % / different to 5% / best estimate/it should be 25.0; (1) | 2 | Ignore 'different' alone |
| Total | | | | 8 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|--|
| 3 | <p>[Level 3] Makes statement about a similarity and a difference to include activation energy <u>and</u> energy change of reaction.</p> <p>Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Gives a similarity and a difference between the two diagrams. OR Gives differences or similarities between the two diagrams.</p> <p>Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Makes a statement about a similarity or a difference between the diagrams. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <p>Similarities</p> <ul style="list-style-type: none"> <input type="checkbox"/> energy given out when hydrogen burns is the same as the energy taken in when it forms. <input type="checkbox"/> Both reactions involve hydrogen, oxygen and water <input type="checkbox"/> the energy of water OR hydrogen and oxygen is the same in both reactions <p>Differences</p> <ul style="list-style-type: none"> <input type="checkbox"/> making has larger activation energy / burning has smaller <input type="checkbox"/> making endothermic <input type="checkbox"/> burning exothermic <input type="checkbox"/> making energy needed/taken in <input type="checkbox"/> burning energy given out <input type="checkbox"/> <u>energy</u> change of reaction is in different direction/opposite. <input type="checkbox"/> <p>Allow 'energy decreases when burning hydrogen and increases when making hydrogen'</p> <p>If activation energy point is made but 'activation' is omitted, consider QWC impeded e,g, 'larger amount of energy <u>needed/ t aken in</u>' for making hydrogen</p> <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p> |
| | | 6 | |

| Question | | | Answer | | Marks | Guidance | | | | | | | | | | | | | | | |
|---|--------------------------|--------------------------|--|---|----------|--|-------|---|--------------------------|--------------------------|-------------------------------------|--------------------------|--------------------------|---------------------------------|--------------------------|--------------------------|---|--------------------------|--------------------------|---|---|
| 4 | (a) | (i) | C ₁₀ ; (1) H ₂₂ ; (1) | | 2 | | | | | | | | | | | | | | | | |
| | | (ii) | | <table border="1"> <thead> <tr> <th></th> <th>true</th> <th>false</th> </tr> </thead> <tbody> <tr> <td>decane has a higher relative formula mass than octane</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>both molecules contain double bonds</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>both molecules are hydrocarbons</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>both molecules give off carbon dioxide gas when they burn</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table> | | true | false | decane has a higher relative formula mass than octane | <input type="checkbox"/> | <input type="checkbox"/> | both molecules contain double bonds | <input type="checkbox"/> | <input type="checkbox"/> | both molecules are hydrocarbons | <input type="checkbox"/> | <input type="checkbox"/> | both molecules give off carbon dioxide gas when they burn | <input type="checkbox"/> | <input type="checkbox"/> | 3 | all correct (3) 3 correct (2) 1/2 correct (1) |
| | true | false | | | | | | | | | | | | | | | | | | | |
| decane has a higher relative formula mass than octane | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | |
| both molecules contain double bonds | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | |
| both molecules are hydrocarbons | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | |
| both molecules give off carbon dioxide gas when they burn | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | |
| | (b) | (i) |  ; (1) butane ; (1) | | 2 | NO ecf on the name All bonds and hydrogen atoms should be shown | | | | | | | | | | | | | | | |
| Total | | | | | 7 | | | | | | | | | | | | | | | | |

| Question | | Answer | Marks | Guidance |
|--------------|-----|---|----------|---|
| 5 | (a) | reversible; | 1 | |
| | (b) | <p><i>any 2 from:</i> does not all react / so all ethene is used ;</p> <p>to avoid waste idea / saves resources / crude oil / sustainable;</p> <p>to increase yield / to make more ethanol ;</p> | 2 | <p>Ignore 'to use it again'</p> <p>Ignore atom economy / saves energy ;</p> <p>Allow 'no waste'</p> <p>Allow saves <u>fossil</u> fuel (crude oil)</p> |
| | (c) | <p><i>Any 2 from :</i> high temperature ;</p> <p>high pressure;</p> <p>catalyst;</p> | 2 | Allow 'optimum' temperature |
| | (d) | <p>cools / goes into cooler ;</p> <p>condenses ;</p> | 2 | |
| | (e) | <p>fermentation of sugar <input type="checkbox"/></p> <p>using genetically modified bacteria on biomass <input type="checkbox"/></p> <p>in the Haber process using gas <input type="checkbox"/></p> <p>chromatography <input type="checkbox"/></p> <p>by titration <input type="checkbox"/></p> | 2 | |
| Total | | | 9 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|---|
| 6 | <p>[Level 3] Gives a benefit and risk and makes a statement about the data. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Gives a benefit or risk and makes a statement about the data. OR gives a benefit and a risk without clear reference to data. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Makes a statement about risk, benefit or data. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include: Risks</p> <ul style="list-style-type: none"> <input type="checkbox"/> methane and/or octane may be <u>too/very</u> flammable / cause a fire risk <input type="checkbox"/> gas can escape/difficult to store <p>Benefits</p> <ul style="list-style-type: none"> <input type="checkbox"/> liquid fuels/heptane/decane easier to carry or store as fuel / less likely to leak / can see leaks easily ORA <input type="checkbox"/> ignites/burns in cold (weather) <input type="checkbox"/> liquid fuels/decane/octane easy to carry/store as fuel / less likely to leak / can see/deal with leaks easily <input type="checkbox"/> compares energy output from 2 fuels <input type="checkbox"/> decane gives out the most energy when burned. <p>Data</p> <ul style="list-style-type: none"> <input type="checkbox"/> methane is a gas / heptane and/or decane/octane are liquids <input type="checkbox"/> methane has the lowest flashpoint / decane has the highest flashpoint / methane/octane ignites/burns easily / flammable /decane does not ignite/burn easily <input type="checkbox"/> methane and/or octane have flashpoints below room temperature / decane has a flashpoint above room temperature. <input type="checkbox"/> decane is less of a fire risk <input type="checkbox"/> methane gives out the least energy when burned <p>Use the L1, L2, L3 annotations in RM Assessor; do not use ticks.</p> |
| | | 6 | |

| Question | | Answer | Marks | Guidance |
|----------|-----|--|--------------------------|---|
| 7 | (a) | old process has a waste (product)/ sodium sulfite ; (1) new process has no waste (product) / all products are useful ; (1) | 2 | ignore statements about yield ignore 'less waste' ignore 'all the atoms are used' |
| | (b) | <i>any 3 from:</i> higher yield ; higher atom economy ; does not have any waste (products) / only by-products / all products useful ; (waste from older process) toxic/harmful ; needs less/fewer raw materials/ does not use sulfuric acid/ sodium hydroxide | 3 | ignore statements about energy "releases no harmful by-products" is this last point only [it may be releasing other by-products, but none of them are harmful] |
| | (c) | i | | |
| | | using renewable raw materials | <input type="checkbox"/> | 2 |
| | | using a higher temperature and pressure | <input type="checkbox"/> | |
| | | finding more uses for phenol | <input type="checkbox"/> | |
| | | finding ways to increase the yield of phenol | <input type="checkbox"/> | |

| | | | | | | |
|--|-----|----|--|--------------------------|--------------------------|--|
| | (d) | ii | to make sure that other scientists do not take credit for their work | <input type="checkbox"/> | 2 | |
| | | | to reduce the safety risks during their experiments | <input type="checkbox"/> | | |
| | | | so that other scientists can check their data | <input type="checkbox"/> | | |
| | | | so that they can discuss their conclusions | <input type="checkbox"/> | | |
| | | | to stop other scientists from working on the same idea | <input type="checkbox"/> | | |
| | (d) | | | adv | disadv | 2 All correct (2) 2 or 3 correct (1) |
| | | | enzymes speed up reactions | <input type="checkbox"/> | | |
| | | | reactions with enzymes can work at a lower temperature | <input type="checkbox"/> | | |
| | | | enzymes only work in narrow ranges of pH and temperature | | <input type="checkbox"/> | |
| | | | enzymes can be denatured | | <input type="checkbox"/> | |
| | | | | Total | | 11 |

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