OCR
Oxford Cambridge and RSA

# GCSE

# Chemistry A

Unit **A173/02**: Module C7 (Higher Tier)

General Certificate of Secondary Education

# Mark Scheme for June 2015

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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.

**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 |
| words | 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 scoris to annotate scripts:

| | |
|---|---|
| BP | Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response. |
|  | correct response |
|  | incorrect response |
| BOD | benefit of doubt |
| NBOD | no benefit of doubt |
| ECF | error carried forward |
| 0 , L1 , L2 , L3 | indicate level awarded for a question marked by level of response |
| Λ | information omitted |
| CON | contradiction |
| R | reject |
|  | indicate uncertainty or ambiguity |
|  | draw attention to particular part of candidate's response |

1. **ADDITIONAL OBJECTS:** You **must** assess and annotate the additional objects for each script you mark. Where credit is awarded, appropriate annotation must be used. If no credit is to be awarded for the additional object, please use annotation as agreed at the SSU.

2. **Subject-specific Marking Instructions**

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

b. 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 <u>and</u> fourth boxes are required for the mark:*

*This would be worth 1 mark.*

*This would be worth 0 marks.*

*This would be worth 1 mark.*

c. 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 | |
| Manchester | |
| Paris | |
| Southampton | |

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

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Edinburgh | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Manchester | ✓ | × | ✓ | ✓ | ✓ | | | | ✓ | |
| Paris | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| Southampton | ✓ | × | | ✓ | | ✓ | ✓ | | ✓ | |
| **Score:** | **2** | **2** | **1** | **1** | **1** | **1** | **0** | **0** | **0** | **NR** |

d. 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 Scoris 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 | i | energy | 1 | |
| | | ii | A [no marks]<br>discusses bonds between carbons = 1<br><br>*Only* single bonds between carbons = 2<br>*No* double bonds between carbons = 2<br><br>Maximum number of hydrogens to carbons = 2 | 2 | If they choose B, max 1 mark<br><br>**Ignore** comments about 'saturation' [stem]<br>Ignore 'double bonds' |
| | b | | $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$<br><br>Formulae correct [1 mark]<br>[Correct formulae] balanced [1 mark] | 2 | accept multiples<br>Ignore state symbols |
| | c | | Level 3<br>Discusses properties from the table.<br>Explains advantages or disadvantages, including one correct level 3 response, and comes to a conclusion.<br>*Quality of written communication does not impede communication of the science at this level.*<br>(5 – 6 marks)<br>Level 2<br>Discusses properties from the table.<br>Explains at least one advantage or disadvantage, and comes to a conclusion.<br>*Quality of written communication partly impedes communication of the science at this level.*<br>(3 – 4 marks)<br>Level 1<br>Answers in terms of the properties from the table, and comes to a conclusion.<br>*Quality of written communication impedes communication of the science at this level.*<br>(1 – 2 marks) | 6 | **This question is targeted at grades up to A***<br>**Indicative scientific points may include:**<br>**From the point of view of lipase**<br>**Level 3**<br>• [coated on solid] – can be recovered / separated<br>• [speeds up this reaction only] – fewer side reactions, less waste, less purification needed<br>**Level 2**<br>• [damage] - **nature** of damage [enzyme denatured]<br>• [damage] –**consequence** [needs more tightly controlled conditions / enzyme doesn't last as long / needs to be replaced more often]<br>• [warm] – lower energy / costs **Ignore** more risky / **Ignore** more easily made<br>• [enzyme speeds up this reaction only] – realises this is an advantage<br>• [cost] – justified by greater productivity<br>**Level 1**<br>• [speed] -- enzyme very fast |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | | | Level 0<br>*Insufficient or irrelevant science. Answer not worthy of credit.*<br>(0 marks) | | • [damage] – enzyme easily damaged<br>• Enzyme warm conditions<br>• etc<br><br>If one correct L3 and one incorrect L3, QWC impeded<br>If one correct L3 and then L1 responses only, level 2<br><br>**incorrect** L1&2 responses, ignore, only mark the correct material<br><br>Accept reverse arguments for sodium hydroxide<br>Conclusion must be present to gain the higher mark in any level.<br><br>**Use the L1, L2, L3 annotations in Scoris; do not use ticks.** |
| | | | **Total** | **11** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| **2** | **a** | **i** | COOH | **1** | |
| | | **ii** | its formula contains carbon, hydrogen and oxygen<br>it is more dilute than acids such as hydrochloric<br>it is less reactive than acids such as hydrochloric ✓<br>it is more runny than acids such as hydrochloric | **1** | |
| | | **iii** | a weak acid has a higher pH ✓<br>a weak acid has the same pH<br>a weak acid has a lower pH<br>a weak acid has a much lower pH | **1** | |
| | **b** | **i** | alcohol<br>alkane<br>ester ✓<br>ether | **1** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | b | ii | 88, 8.8 | 2 | ecf if second number is 1/10$^{th}$ of first |
| | c | i | 'strong acid' / named strong acid | 1 | accept 'dilute' named strong acid as the concentration is not on the spec<br>ignore 'acid' or 'concentrated acid'<br>ignore 'enzyme' |
| | c | ii | lower [energy / energy hump]<br>this energy is the *activation* energy<br>alternative pathway | 3 | 'means less activation energy needed for reaction' = 2 marks<br>'more energy' is CON for first mark<br>**ignore** comments about surface area or increased rate of collision, catalysts |
| | | | **Total** | 10 | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 3 | a | | $N_2 + 3H_2 \rightleftharpoons 2NH_3$<br><br>Formulae correct = 1<br>[Correct formulae] balanced = 1 | 2 | equilibrium sign optional,<br>accept '=' as alternative to ➔<br>accept multiples |
| | b | | fertiliser<br>detail – for plants / crops/ food supply | 2 | 'to help growth and kill pests' CON for 2nd mark<br>**Ignore** as a source of nitrates<br>**Ignore** other uses |
| | c | i | 38-40 [minutes] | 1 | |
| | | ii | Discusses reverse reaction [1]<br><br>Understands that both reactions happen at the same time [1]<br><br>at same rate/speed = 1 | 3 | the reaction is reversible / ammonia is broken down = 1<br><br>The "same time" point may be by implication<br>Forward and backward reaction occur = 2<br>ammonia is made and broken down = 2<br>both reactants and products are reacting = 2<br><br>Forward and backward reactions cancel out = first 2 marking points only<br><br>**Ignore** 'dynamic equilibrium' |
| | | iii | active equilibrium ☐<br>dynamic equilibrium ☐<br>fixed equilibrium ☐<br>static equilibrium ☐ | 1 | |
| | d | | not all nitrogen and hydrogen react / so more can react;<br><br>comment on how little reacts / low efficiency / initial yield low;<br><br>increase [yield] / more ammonia | 3 | ignore 'recycled' [stem]<br><br>'only a small amount reacts' = 2<br>If % yield quoted, accept anything below 50% |
| | | | **Total** | 12 | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 4 | a | | 0.7 [3 marks] | 3 | If not correct, **maximum** of 2 marks from<br><br>Rf = spot distance/solvent distance = 1 mark<br><br>Look for the numbers 5 AND 3.2 to 3.7 = 1 mark<br><br>3.2 to 3.7 [ 2 marks]<br>5<br><br>Special case one mark answer<br>3.5 [ 1 mark]<br>5.4<br><br>Accept measurements in mm |
| | b | | Level 3<br>Makes suitable comparison of attractions of both spots with both phases<br>Links that comparison to movement of spots.<br>*Quality of written communication does not impede communication of the science at this level.*<br>(5 – 6 marks)<br>Level 2<br>Makes suitable comparison of attractions of each spot with one phase only. Links that difference to movement of spot.<br>OR<br>Makes suitable comparison of attractions of only one spot with each phase. Links that difference to movement of spot.<br>*Quality of written communication partly impedes communication of the science at this level.*<br>(3 – 4 marks)<br>Level 1 | 6 | **This question is targeted at grades up to A *<br><br>Indicative scientific points may include:<br>Level 3 minimum response**<br>• [Spot 1] ***more*** attracted to mobile phase AND [spot 2] ***more*** attracted to stationary phase therefore [Spot 1] moves further<br><br>**Level 2 minimum response**<br>• [Spot 1] ***more*** attracted to mobile phase therefore moves further<br>• [Spot 1] ***more*** attracted to stationary phase therefore moves less<br><br>**Level 1**<br>• [spot 1] is attracted to the mobile phase<br>• [spot 2] is attracted to the stationary phase<br><br>At level 2&3 if not linked to movement, QWC impeded |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | | | Discusses attractions of at least one spot with at least one phase.<br>*Quality of written communication impedes communication of the science at this level.*<br>(1 – 2 marks)<br>Level 0<br>*Insufficient or irrelevant science. Answer not worthy of credit.*<br>(0 marks) | | **Accept** 'the spot that moves further' = Spot 1<br>**Accept** 'moves faster' instead of 'moves further'<br><br>**Accept** 'solvent' or 'liquid' instead of 'mobile phase' and 'paper' instead of 'stationary phase'<br><br>Spot 1 may ***like/ prefer/ favours / has affinity for*** the mobile phase more – QWC impeded<br>**Ignore** spends more time in the mobile phase<br>**Ignore** reference to attractions between the spot and the ink<br>**Ignore** equilibrium arguments, the question is about attractions<br><br>**Use the L1, L2, L3 annotations in Scoris; do not use ticks.** |
| | **c** | | **simple similarity**<br>Both use a liquid / solvent [as the mobile phase] / same mobile phase<br><br>**simple difference**<br>idea that a different solid/ stationary phase is used<br>[tlc] solid is mounted on a glass or plastic plate<br>[tlc] quicker | **2** | **Ignore** 'uses the same method'<br>**Ignore** 'both have a mobile phase and a stationary phase' [ie this is a general statement about chromatography.]<br><br>**Accept** '[tlc] uses silica gel' |
| | **d** | | Any three points from<br><br>[Jane]<br>gives feedback on the technique<br>idea of accurate / reproducible / reliable<br>can take an average<br>remove outliers | **3** | Marks for arguments only<br><br>Arguments may be in reverse e.g. Jane's method does not show up changes as soon as they happen |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| | | | [Mike]<br>Gives checks throughout the day / regular check/ continuous<br>Shows up if a drift / pattern / change with time<br>Shows up if a sudden change / problem | | Ignore 'Sample taken every hour' [stem] |
| | | | Total | **14** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| **5** | **(a)** | | Water / $H_2O$<br>[made in] the reaction of methane / burning methane/ methane contains hydrogen | **2** | water comes from the methane = 1 [for the water point]<br>water, because hydrogen reacts with oxygen = 1<br><br>accept hydrocarbon as alternative to methane<br><br>**ignore** 'condensation' |
| | **b** | **i** | C-H = 4 C=O = 2<br>[O=O = 2] O-H = 4 | **2** | Left hand column = 1<br>Right hand columns = 1<br><br>bonds can be written either way round, eg C-H or H-C<br>Right hand bonds in either order [but numbers must match!] |
| | | **ii** | Answer = -730 [3 marks] | **3** | If not correct, look for<br><br>Answer = 730 [2 marks]<br><br>Use of 2736 or 3466 [1 mark] |
| | | | **Total** | **7** | |

| Question | | | Answer | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | | | Level 3<br>Explains each term and links at least one to sustainability<br>*Quality of written communication does not impede communication of the science at this level.*<br>(5 – 6 marks)<br><br>Level 2<br>Explains each term without reference to sustainability, or explains one term and links it to sustainability<br>*Quality of written communication partly impedes communication of the science at this level.*<br>(3 – 4 marks)<br><br>Level 1<br>Explains either 'renewable' or 'atom economy' or 'sustainability'.<br>*Quality of written communication impedes communication of the science at this level.*<br>(1 – 2 marks)<br><br>Level 0<br>*Insufficient or irrelevant science. Answer not worthy of credit.*<br>(0 marks) | 6 | **This question is targeted at grades up to A**<br><br>**Indicative scientific points may include:**<br><br>**renewable**<br>• replaces itself<br>• detail – eg plants regrow<br>• so does not run out / infinite<br>**Ignore** can be renewed/used again<br><br>**Sustainability links for renewable**<br>• idea of long term use of process<br>• doesn't use up finite resources<br>• available for future generations<br><br>**atom economy**<br>• measure of the amount of **useful** product<br>'Helpful' = QWC impeded<br>• high atom economy means little by-product NOT 'waste'<br>• mass [desired] product divided by mass reactants<br>Don't confuse with % yield<br><br>**sustainability links for atom economy**<br>• desire to limit waste<br>• reduce damage to environment<br><br>**Use the L1, L2, L3 annotations in Scoris; do not use ticks.** |
| | | | **Total** | 6 | |

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