

GCSE

Chemistry A

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

General Certificate of Secondary Education

Mark Scheme for June 2014

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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 |
| 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:

| | |
|---|--|
|  | 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 |
|  | benefit of doubt |
|  | no benefit of doubt |
|  | error carried forward |
|  | indicate level awarded for a question marked by level of response |
|  | information omitted |
|  | contradiction |

| | |
|---|---|
|  | reject |
|  | indicate uncertainty or ambiguity |
|  | draw attention to particular part of candidate's response |

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.

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 and 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 | <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 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Manchester | ✓ | x | ✓ | ✓ | ✓ | | | | ✓ | |
| Paris | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| Southampton | ✓ | x | | ✓ | | ✓ | ✓ | | ✓ | |
| 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.

Here is the mark scheme for this question paper.

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|-----|----|--|------|--|
| 1 | a | F | methane + steam → hydrogen + carbon dioxide | 1 | reactants in either order Allow water products in either order Allow correctly balanced symbol equation |
| | bi | E | 44 [tonnes] | 1 | |
| | bii | EF | One from waste, and one from effect Waste: Most of reactants form a product which is not useful /a lot of waste/carbon dioxide (gas) is made/ process has a low/poor atom economy (1) Effect: Product is a greenhouse gas/ causes global warming/ Product causes <u>air/atmospheric</u> pollution (1) | 2 | |
| | c | CD | Discusses both production and intake of CO ₂ : When trees are burned the CO ₂ is released, however, this CO ₂ was taken in by trees for photosynthesis = 2 marks Carbon neutral/ attempts a description of carbon dioxide being given out being used by trees(1) | 2 | If no other mark is achieved then allow 1 mark for: wood is renewable/you can grow more trees ORA |
| | | | TOTAL | 6 | |

| Question | Answer/Indicative content | Mark | Guidance |
|----------|---|------|--|
| 2 | <p>EE FF GG</p> <p>[Level 3] Discusses why the catalyst is used AND why the gases are recycled AND what happens; must include indicative points from all three categories. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Includes indicative points from two of the three categories OR an indicative point from each of the three categories. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Includes some indicative points. 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 E Indicative scientific points may include:</p> <p>What happens:</p> <ul style="list-style-type: none"> • Nitrogen comes from air • Hydrogen comes from methane • Gases go to a reaction vessel • Which contains a catalyst • Catalyst is not used up • The catalyst is iron • Cooling turns ammonia gas to liquid • (Liquid) ammonia is removed from the system • Unreacted gases are recycled • (The forward reaction) is exothermic • Conditions are a compromise/are not optimum • The pressure used is 200 atm/ high pressure used • The temperature is 450°C/ high temperature <p>Why it uses a catalyst:</p> <ul style="list-style-type: none"> • to speed up the reaction/make ammonia more quickly • Catalyst lowers activation energy • Catalyst provides an alternative route for reaction <p>Why the gases are recycled:</p> <ul style="list-style-type: none"> • Reaction is reversible/ reaches equilibrium • Not all the chemicals react • Recycling is more cost-effective/ improves efficiency • Reduces waste/ more sustainable/ improved atom economy/ increases yield <p>Accept annotations to the diagram in lieu of text.</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |
| | Total | 6 | |

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|---|---------|--|------|---|
| 3 | a | EF | Alcohol, [carboxylic] acid, ester | 2 | all three correct = 2 one or two correct = 1 |
| | b | C DD | [Mary] – no mark Less than 100% conversion, So some reagents/ reactants/ named reactants still present/ the reaction does not run out of acid or alcohol Reaction can't have stopped/ reversible reaction/ there are both reactants and products; | 3 | Ignore choice of Steve Allow reaction can go both ways/ reaction can go backwards and forwards Dynamic equilibrium = 1 mark The ester is still breaking down into the alcohol and carboxylic acid at the same rate as the alcohol and carboxylic acid combines to form the ester = 2 marks |
| | c | EE | Carbon dioxide, water | 2 | Allow correct formulae Allow carbon monoxide in place of carbon dioxide |
| | | | Total | 7 | |

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|---|----|--|------|--|
| 4 | a | EE | As a drink, solvent, fuel | 2 | accept any reasonable answers e.g. cleaning products/ treat wounds/ mouthwash/ chemical feedstock/ perfume OR aftershave/ hand sanitizer |
| | b | EE | Yeast Stops working / dies/ gets poisoned At higher alcohol levels | 2 | |

| | | | | |
|--|---|--|---|---|
| | c | <p>CC C DD D</p> <p>[Level 3] Gives operational points AND theoretical points which describe the distillation including a reference to BPt difference [from water]. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Gives operational points AND theoretical points which describe the distillation. OR Makes reference to BPt and operational OR theoretical points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Gives indicative points which describe the distillation. 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 CHECK FOR INFORMATION ON THE DIAGRAM Indicative operational points may include:</p> <ul style="list-style-type: none"> • boil/heat [the dilute ethanol] • antibumping granules control the boiling • condenser used • [condenser] is cold / cooled / water flows through • use of thermometer • keep the liquid that collects around the boiling temperature of the alcohol • stop when temp too high <p>Indicative theoretical points may include:</p> <ul style="list-style-type: none"> • boiling points different • boiling point of alcohol lower than water • gas/ vapour / evaporation (ethanol) • vapour contains both alcohol and water • [vapour] richer in alcohol • [Vapour] condenses / turns to liquid [in the condenser] • vapour contains increasing amounts of water as distillation proceeds <p>If answer includes incorrect points (e.g. BPt of ethanol higher than water) then consider quality of communication to be impeded at level 2 and 3.</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |
|--|---|--|---|---|

| | | | | | |
|--|---|---------|---|----|--|
| | d | CC D | <p>Any three from</p> <p>Ethanol is the alcohol which is collected at 79°C</p> <p>General comparison – ethanol is the least toxic/poisonous/ the largest amount needed to poison a person (of all the alcohols of all the alcohols);</p> <p>Specific - compares toxicity of ethanol to another named alcohol</p> <p>Quotes at least one correct value for toxicity</p> <p>Compares the amount that can be drunk of different alcohols.</p> | 3 | <p>Candidate may either agree or disagree, the marks are for the explanation only</p> <p>Ignore “ethanol <u>does</u> distil over at only one temperature</p> <p>E.g. methanol is more toxic/poisonous</p> <p>”</p> |
| | e | F | 9, 3 | 2 | |
| | | | Total | 15 | |

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|-----|----------------|---|------|--|
| 5 | (a) | EE FF GG | <p>[Level 3] Describes the correct technique for a single titration, including collection of results. Discusses the need for several titrations. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes a single titration and includes some discussion of measurement OR describes the correct techniques for titration and explains the need for repetition, omitting measurements. (may have described the alkali as being inside the burette) Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Discusses the addition of acid to alkali in the presence of an indicator in a qualitative fashion only. 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 E Indicative scientific points may include:</p> <ul style="list-style-type: none"> • Suitable use of terms such as burette, pipette, pipette filler, [conical] flask or other suitable receptacle. • Acid into burette • Read burette at start and end • Subtract the readings to find the titre • Sodium hydroxide measured using pipette • Use of pipette filler • Into a [conical] flask • Few drops of indicator used appropriately • Reference to swirling the flask • Reference to colour change • Reference to neutralisation • Technique for a rough titration • Technique for an accurate titration • Need for several accurate titrations <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |

| | | | | | |
|--|---|-----|---|----|---|
| | b | CD | <p>Any two from</p> <p>He calculated a mean; Ignored 26.4; It is an outlier / rough result;</p> | 2 | <p>Ignore it is in the middle of the other values Ignore take the median $25.2 + 25.6 + 25.4 [=76.2]$ divided by 3 (2)</p> |
| | c | EEF | <p><u>Any three from</u></p> <p>Might be checking for purity Checking the reliability of the process Idea of variation during the process [variation] with time Chance to take corrective action Check the sample quickly before it deteriorates/ becomes contaminated Safety arguments</p> | 3 | |
| | | | Total | 11 | |

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|-----|----------|--|------|--|
| 6 | a | G | Exothermic | 1 | |
| | b | DD EE | Breaks Give out Less Activation | 3 | 4 correct = 3 3 correct = 2 2 correct = 1 1 correct = 0 SSU – may wish to allow 1 or 2 correct = 1 |
| | ci | G | 2 | 1 | |
| | cii | EE | 4, 32 | 2 | Ignore any units |
| | | | Total | 7 | |

| Question | | | Answer/Indicative content | Mark | Guidance |
|----------|-------|----|--|------|--|
| 7 | ai | G | 3 | 1 | |
| | a ii | EF | C, goes further (up the paper) | 2 | Any other choice made scores zero for the question. Accept carried further by water |
| | a iii | EE | $0.75 = 2$ 15 divided by 20 = 1 | 2 | |
| | bi | EE | Insoluble[in water] = 2 not carried [by water] = 1 | 2 | Allow it is permanent marker for 1 mark |
| | bii | E | Idea of a different solvent e.g. ethanol | 1 | |
| | | | Total | 8 | |

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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