



**General Certificate of Secondary Education
June 2013**

Additional Science

AS1HP

(Specification 4409)

Unit 5: Additional Science 1 (Higher Tier)

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: aqa.org.uk

Copyright © 2013 AQA and its licensors. All rights reserved.

Copyright

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

Quality of Written Communication and levels marking

In Question 4(b) candidates 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.

Candidates 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 1

| question | answers | extra information | mark |
|----------|--|---|---------------------|
| 1(a) | any one from: <ul style="list-style-type: none"> • (same) sized beads / amount of <i>Chlorella</i> (in each bead) • (same) number of beads (in each beaker) • (same) temperature • (same) power of light bulbs • (same) carbon dioxide (concentration) | do not accept (same) light intensity / distance between lamp and beaker allow (same) wavelength(s) / type of bulb allow (same) volume / amount of (pond) water ignore (same) type of (pond) water ignore size / type of beaker | 1 |
| 1(b) | oxygen | | 1 |
| 1(c)(i) | light (intensity) increases (between A and B) (so) photosynthesis faster (therefore) more oxygen / gas produced or oxygen / gas is produced more quickly | allow light limiting allow more photosynthesis accept ecf named gas from (b) | 1 1 1 |
| 1(c)(ii) | any one from: <ul style="list-style-type: none"> • limited by / not enough carbon dioxide • limited by temperature / too cold / not warm enough | allow there is another limiting factor ignore light no longer limiting ignore references to water | 1 |

Question 1 continues on the next page

Question 1 continued

| | | | |
|------------------------|---|---|-------------------|
| <p>1(d)(i)</p> | <p><i>Advantage</i> any one from:</p> <ul style="list-style-type: none"> • does not depend on seasonality • less time to grow • easy to transport • easy to grow • does not need soil • does not go mouldy • self-reproducing / does not need replanting <p><i>Disadvantage</i> any one from:</p> <ul style="list-style-type: none"> • reference to taste / flavour • need to process Chlorella to make them like 'food' • lack of (named) vitamins / minerals / nutrients / energy • reference to allergies | <p>ignore references to cost</p> <p>allow grows faster</p> <p>allow does not need to be stored</p> <p>allow constant supply</p> <p>allow a lot needed</p> <p>allow idea of monotonous</p> | <p>1</p> <p>1</p> |
| <p>1(d)(ii)</p> | <p>any one from:</p> <ul style="list-style-type: none"> • produce oxygen • use up / remove carbon dioxide | <p>do not allow (direct / indirect) reference to food</p> <p>allow reference to use in research</p> | <p>1</p> |
| <p>Total</p> | | | <p>9</p> |

Question 2

| question | answers | extra information | mark |
|-----------------|--|---|----------|
| 2(a)(i) | any two from <ul style="list-style-type: none"> • spots / colours are at different levels • spots have different colours / shades • B / red food colouring has more than 1 spot / colour <p>or</p> B / red food colouring contains a different spot | allow spots / colours are in different places ignore spots have different sizes / shape accept B / red food colouring has 3 spots | 2 |
| 2(a)(ii) | (because it contains) Allura Red | allow reference to possible harm or specific examples of harm (e.g. allergies) | 1 |
| 2(b) | any two from: <ul style="list-style-type: none"> • (more) accurate • (more) sensitive • fast(er) • small(er) sample size | ignore reference to cost / precision / reliability accept detects small(er) amounts | 2 |
| Total | | | 5 |

Question 3

| question | answers | extra information | mark |
|--------------|---|--|----------|
| 3(a) | (protons) 27 27 | | 1 |
| | (neutrons) 32 33 | | 1 |
| | (mass number) 59 60 | allow ecf from sum of proton + neutron numbers for both mass numbers | 1 |
| 3(b) | logo used to inform customers (that ^{60}Co has been used) | allow so people who can't read can tell or easier than reading the label ignore references to harm / danger and allergies ignore idea of food being radioactive | 1 |
| | <i>idea of so can make their own choice</i> | | 1 |
| Total | | | 5 |

Question 4

| question | answers | extra information | Mark |
|----------|---|--|--|
| 4(a)(i) | (thinking distance is the) distance the car travels during the (driver's) reaction time or distance travelled between seeing a hazard and applying the brakes (braking distance is the) distance the car travels during the braking force or distance travelled between applying the brakes and stopping | ignore references to time / how long the car travels for ignore distance travelled whilst thinking allow distance travelled whilst braking | 1 1 |
| 4(a)(ii) | (thinking distance) 20 (braking distance) 90 | allow correct answer to 110 - the thinking distance given (eg if thinking distance given as 30, allow braking distance of 80) | 1 1 |

Question 4 continues over the page

Question 4 continued

| question | answers | extra information | mark |
|--|--|---|--|
| 4(b) | | | 6 |
| <p>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 3 and apply a best fit approach to the marking.</p> | | | |
| 0 marks | Level 1 (1-2 marks) | Level 2 (3-4 marks) | Level 3 (5-6 marks) |
| No relevant information. | At least one factor that affects stopping distance or one factor with its effect on stopping distance or one factor with an attempt at an explanation. | Factors with their effects on stopping distance or factors and at least one attempt at an explanation or one factor, its effect on stopping distance and an attempt at an explanation. | Factors with their effects on stopping distance and at least one explanation. |
| <p>Examples of physics points made in the response:</p> <p>Factors affecting the thinking / stopping distance:</p> <ul style="list-style-type: none"> (F) fatigue, drugs, alcohol, distractions, age (Ef) (The thinking distance increases) overall stopping distance increases (Ex) each factor increases reaction time <p>or</p> <ul style="list-style-type: none"> (F) speed / velocity of the vehicle (Ef) (increasing speed / velocity) increases the stopping distance (Ex) the distance travelled during the reaction time increases / thinking distance increases <p>Factors affecting the braking / stopping distance:</p> <ul style="list-style-type: none"> (F) poor road conditions (ice / rain / gravel / mud) (F) poor condition of vehicle (brake condition / tyres) (Ef) (each of these will) increase the stopping distance (Ex) the braking force is reduced (less friction / grip) and therefore (the vehicle travels further during braking and) the braking distance increases <p>or</p> <ul style="list-style-type: none"> (F) speed / velocity or mass (Ef) (increasing speed / velocity or mass) increases the stopping distance (Ex) (the kinetic energy increases and) more work needs to be done to stop the vehicle which increases the braking distance (if the force is constant) <p>or</p> <p>a higher speed will take longer to stop if the deceleration is constant and therefore a longer braking distance</p> <p>or</p> <p>a higher speed / mass increases momentum which increases the time taken to stop (if the force is constant) and therefore longer braking distance</p> | | | <p>extra information</p> <p>accept converse arguments throughout</p> <p>allow max 4 marks if reference to time rather than distance</p> <p>ignore reference to visibility eg fog / eye sight</p> <p>ignore slows down reaction time</p> <p>do not accept explanations of factors linked to incorrect distance</p> <p>ignore (bad) weather</p> |
| Total | | | 10 |

Question 5

| question | answers | extra information | mark |
|----------|---|--|------------|
| 5(a) | diffusion | ignore absorption | 1 |
| 5(b)(i) | <p>any three from</p> <ul style="list-style-type: none"> • (the number of) A decreases in the cell • (the number of) A increases in the water • until (number of) A is equal inside and outside cell or until (number of) A is half what it was at beginning (in cell) • (the number of) B stays the same in the cell • there are no (molecules of) B in the water | <p>max 2 marks for A or B only</p> <p>if neither of first two bullet points given allow 1 mark for A moves out of cell / membrane or A moves into water</p> <p>accept the idea that the concentrations of A in the cell and in the water will become (close to) equal</p> <p>if neither bullet point 4 nor 5 is given allow 1 mark for B does not move out of cell or B does not move into the water</p> | 3 |
| 5(b)(ii) | <p>(molecules of) A small enough to pass through holes / membrane or (molecules of) B too large to pass through holes / membrane</p> <p>once concentration of molecules of A is the same inside and outside cell there will be no (net) movement or A moves from high concentration (in cell) to low concentration (in water)</p> | <p>allow membrane permeable to A or membrane not permeable to B</p> <p>allow reference to size of holes (in membrane) being too small for B or large enough for A, to pass through</p> <p>allow this idea in terms of numbers of molecules</p> | 1 1 |
| 5(c)(i) | for (aerobic) respiration or to respire | ignore references to energy or uses of energy eg contraction do not accept anaerobic respiration | 1 |

Question 5 continues on the next page

Question 5 continued

| | | | |
|------------------------|---|--|-----------------|
| <p>5(c)(ii)</p> | <p>any two from:</p> <ul style="list-style-type: none"> • removes oxygen that has diffused / passed into blood • keeps difference (in concentration) between lungs and blood high • increases speed of diffusion / passage of oxygen into blood | <p>accept idea of maintaining diffusion / concentration gradient</p> <p>if no other mark given allow 1 mark for so oxygen can reach the cells / (named) parts of the body</p> | <p>2</p> |
| <p>Total</p> | | | <p>9</p> |

Question 6

| question | answers | extra information | mark |
|-----------------|---|--|-------------|
| 6(a) | any one from: <ul style="list-style-type: none"> • prevents reactions / enzymes / products / reactants from one reaction interfering with another reaction • products can be made where they will be needed / used | allow references to being easy to control or faster allow if one reaction goes wrong only one part of the cell is affected allow if one cell part is damaged the rest of the cell can work | 1 |
| 6(b)(i) | (ribosomes / they) make protein or protein synthesis | accept to make named proteins eg enzymes / hormones allow to join amino acids together | 1 |
| 6(b)(ii) | respiration (in mitochondria) (respiration / mitochondria) releases energy (energy / respiration) needed for protein synthesis | do not allow produce energy do not allow energy is used for (respiration) allow energy needed to join amino acids allow energy / respiration needed for synthesis of substance given in part (b)(i) | 1 1 1 |
| Total | | | 5 |

Question 7

| question | answers | extra information | mark |
|-----------------|--|---|------------|
| 7(a) | any one from: <ul style="list-style-type: none"> to avoid bias to obtain a representative sample | ignore reference to fair test / reliability / accuracy allow to get valid results allow to ensure whole of field is sampled | 1 |
| 7(b)(i) | as the size of the quadrat increases the range decreases and levels off at 50 x 50(cm) | ignore reference to mean allow levels off above 40 x 40(cm) | 1 1 |
| 7(b)(ii) | 50 x 50(cm) (as) allows identification of greatest number of species or smallest range | allow larger size would give same mean / range (but unwieldy to use) | 1 1 |
| 7(c)(i) | line / tape placed across area (of possible change in environment) | allow series of quadrats next to each other allow line / tape to sample the plants | 1 |
| 7(c)(ii) | any one from: <ul style="list-style-type: none"> temperature (availability of) (named) nutrients / minerals light (intensity) (availability of) water soil type / pH | ignore biotic factors eg herbivores ignore weather unqualified ignore pollution | 1 |
| Total | | | 7 |

Question 8

| question | answers | extra information | mark |
|--------------|---------|---|----------|
| 8(a)(i) | 44 | award 2 marks for correct answer irrespective of working allow 1 mark for evidence of $(14 \times 2) + 16$ providing no subsequent working ignore any units | 2 |
| 8(a)(ii) | 63.6 | award 2 marks for correct answer irrespective of working accept 63.64 / 64 for 2 marks allow 63.63 for 2 marks allow ecf from part (a)(i) correctly calculated for 2 marks $\frac{28}{44} \times 100$ part (i) allow 1 mark for evidence of (providing no subsequent working) $\frac{28}{44} \times 100$ 44 or $\frac{28}{44} \times 100$ part (i) allow 1 mark for 0.64 (or equivalent) or answer to $\frac{28}{44}$ part (i) | 2 |
| 8(b) | 44g | allow ecf from part (a)(i) must have correct unit | 1 |
| Total | | | 5 |

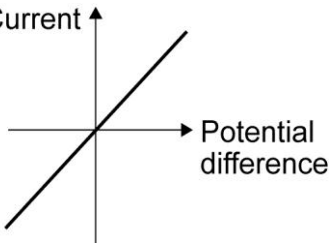
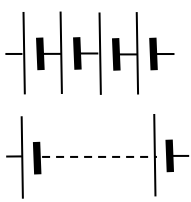
Question 9

| question | answers | extra information | mark |
|-----------------|---|---|----------|
| 9(a)(i) | any two from <ul style="list-style-type: none"> • giant structure or lattice • of atoms or positive ions • metallic bonding | max 1 mark if reference to intermolecular forces / covalent / ionic bonding or molecules | 2 |
| | electrons (in highest occupied energy levels) are delocalised / free | | 1 |
| | so (delocalised / free) electrons can move (throughout the structure) | | 1 |
| 9(a)(ii) | layers (of atoms / ions) | allow layers (of particles) do not accept molecules | 1 |
| | (able to) slide over each other | allow move over each other | 1 |
| 9(b) | (copper is used because) | ignore references to melting point | |
| | it is a <u>relatively</u> good conductor | allow it is the second best conductor | 1 |
| | (and) it is <u>relatively</u> inexpensive | if no other mark awarded allow 1 mark for reference to low cost and high conductivity | 1 |
| Total | | | 8 |

Question 10

| question | answers | extra information | mark |
|--------------|---|---|----------|
| 10(a) | covalent (bonding) | do not accept ionic / metallic / intermolecular (bonding) | 1 |
| | any four from <ul style="list-style-type: none"> • C 2, 4 and H 1 • shared (pair of) electrons • 4 (shared) pairs of electrons • all atoms now have a complete outer shell • forms strong bonds | accept carbon has 4 electrons in outer shell and hydrogen has 1 electron in outer shell a correct dot and cross diagram gains bullet points 2, 3 and 4 accept in methane the electronic structure of carbon is 2, 8 and hydrogen is 2 | 4 |
| 10(b) | (because methane) has weak forces | do not accept intramolecular forces / covalent bonds are weak | 1 |
| | between molecules / intermolecular | do not accept intramolecular do not accept reference to ions do not accept intermolecular forces between atoms accept it is made of small / simple molecules with weak forces of attraction for 2 marks allow weak bonds between molecules for 2 marks if no other marks awarded allow for 1 mark made of small / simple molecules | 1 |
| Total | | | 7 |

Question 11

| question | answers | extra information | Mark |
|-----------|--|--|-----------------------------|
| 11(a)(i) | Current ↑  Potential difference → | straight line accept a straight line from bottom left to top right in either bottom left or top right quadrant going through / to origin (2 nd mark only applies if a correct straight line has been drawn) | 1 1 |
| 11(a)(ii) | constant temperature | allow <u>not</u> a variable resistor or has fixed resistance | 1 |
| 11(b)(i) | 4 cells connected correctly or battery  | allow either orientation but not oppositely facing cells allow 4 cells without interconnecting lines | 1 |
| 11(b)(ii) | Region A it is not at the origin or there is an intercept or there is no current but a p.d. / voltage zero error on ammeter / faulty ammeter Region B the rate of current increase decreases (with increasing p.d.) the wire is heating up or the resistance increases | allow it does not go through the origin if value for p.d. given, must be in range 0.04 – 0.06 accept anomalous result allow current is levelling off (with increasing p.d.) | 1 1 1 |

Question 11 continues on the next page

Question 11 continued

| | | | |
|--------------------------|--|---|------------------|
| <p>11(b)(iii)</p> | <p>any two from:</p> <ul style="list-style-type: none"> • use a digital ammeter • take more readings (at each p.d.) and calculate a mean or identify anomalous results • compare your results with someone else's • use a greater range for p.d. / voltage • smaller interval of p.d. / voltage • straighten the wire • use voltmeter / ammeter with greater resolution • keep temperature of wire constant • use ammeter with no zero error | <p>use a greater variable resistor range allow greater range of current</p> | <p>2</p> |
| <p>Total</p> | | | <p>10</p> |

Question 12

| question | answers | extra information | Mark |
|--------------|---|---|-----------|
| 12(a) | zero (newtons) | allow equivalent terms to zero (newtons) allow 0 | 1 |
| | accelerate | allow increases speed / velocity | 1 |
| 12(b) | 500 000 | award 3 marks for correct answer irrespective of working <i>allow 2 marks for correct substitution, ie</i> $12 = \frac{6\,000\,000}{m}$ or $6\,000\,000 = 12 \times m$ allow 2 marks for an answer of 500 irrespective of working <i>allow 1 mark for correct substitution, ie</i> $12 = \frac{6\,000}{m}$ or $6\,000 = 12 \times m$ if no other marks awarded allow 1 mark for evidence of 6 000 000 | 3 |
| 12(c) | (acceleration will) increase | ignore reference to air resistance | 1 |
| | (as the) mass / weight decreases or (as the) resultant force increases | allow lighter | 1 |
| 12(d) | 450 | award 2 marks for correct answer irrespective of working allow 1 mark for $15\,000 \times (0.05 - 0.02)$ or $15\,000 \times 0.03$ or $(15\,000 \times 0.05) - (15\,000 \times 0.02)$ or $750 - 300$ provided no subsequent working | 2 |
| | kg m/s | allow N s | 1 |
| Total | | | 10 |

 UMS Conversion Calculator: www.aqa.org.uk/umsconversion