GCSE

Additional Science (Route 2)

AS1HP

Mark scheme

4409

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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

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

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 errors / 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 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is 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.

4. Quality of 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 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 1

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)(i)	to let light in / through (to the plant) for photosynthesis	ignore ref to seeing the plant allow absorb by chlorophyll **or** to produce glucose / starch / sugar / carbohydrates / biomass	1 1	AO1 AO2 B2.3.1a/b/c/d
1(a)(ii)	protein		1	AO1 B2.3.1g
1(b)(i)	any **one** from: • temperature • light (intensity / wavelength) • mineral ion (type / concentration) • volume / amount of water	accept named, eg nitrate (amount / concentration) do **not** allow carbon dioxide / pressure	1	AO3 B2.3.1a/c/d
1(b)(ii)	greater (mass) by factor of 2	allow bigger / faster growth allow 180 (g) rather than 90 (g) allow a difference of 90 (g) award **2** marks for 'twice as heavy / big'	1 1	AO2 AO3 B2.3
1(b)(iii)	increase oxygen / O_2 **or** decrease carbon dioxide / CO_2	ignore references to changing water (vapour) content allow plant gives out oxygen allow plant takes in carbon dioxide	1	AO1 B2.3.1a/b
1(c)(i)	mass / growth does not increase (with greater carbon dioxide concentration)	allow mass levels off allow graph / line levels off	1	AO3 B2.3.1c/d

Question 1 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(c)(ii)	any **one** from: • temperature • light (intensity) • mineral ions	ignore water allow named ions eg nitrate allow (air) pressure	1	AO1 B2.3.1c/d
Total			**9**	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	(magnesium oxide) No Yes (silicon dioxide) giant covalent (sulfur trioxide) No No	in this order only allow macromolecular ignore lattice	1 1 1	AO1 C2.2.1c C2.2.2b C2.2.3a
2(b)	(very) high melting point	allow will not melt in the furnace ignore references to boiling point	1	AO3 C2.2.2a C2.3.3a
2(c)(i)	80	allow **1** mark for evidence of $32 + (16 \times 3)$ provided no subsequent working	2	AO2 C2.3.1f
2(c)(ii)	53.3 (%)	allow 53.33 (%) or 53 (%) allow **1** mark for evidence of: $\frac{32}{60} \times 100$ **or** 0.533	2	AO2 C2.3.3a
2(c)(iii)	40 g / grams	must have correct unit	1	AO1 C2.3.1g
Total			**9**	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)	3500		1	AO2 P2.1.1c
3(a)(ii)	accelerating in the direction of the resultant force	allow speed is increasing accept forwards	1 1	AO2 P2.1.1e

Question 3 continues on the next page

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(b)			6	AO1 AO2 AO3 P2.1.3a P2.1.4a/c

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	At least one statement is made about the force or motion of the car or van.	At least one similarity or one difference is given between the motion of the car and the van, with a simple link to horizontal forces **or** at least one similarity **and** one difference is given between the car and the van.`	At least one similarity **and** at least one difference is given between the motion of the car and the van **and** there is at least one explained link with horizontal forces.

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
	examples of physics points made in the response: **similarities** both car and van increase in velocity both the car and the van reach constant / terminal velocity **differences** car has a higher velocity (than van) car reaches higher max velocity (than van) car accelerates more quickly (than the van) van reaches maximum velocity before the car **forces** a simple link could be that the van is less streamlined explained links could be: • both car and van have greater forward / driving force than backward / resistant force • resistance force increases as speed / velocity increases • eventually driving force balances resistance force	**extra information** allow speed for velocity throughout		
Total			**9**	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	specialised / adapted for particular function	allow changed	1 1	AO1 B2.2.1a
4(b)	liver produces / releases / secretes bile	do **not** award if marking point 1 not given	1 1	AO1 AO2 B2.2.1d
4(c)	any **3** from: • no end (cell) walls • cells long(er) • (cell) walls thick(er) • (xylem / cells) narrow(er) • no (cell) contents	if neither of these given allow **1** mark for tubular ignore cells bigger allow (xylem / cells) thin(ner) allow for **2** marks any **two** from: • no nucleus • cytoplasm • chloroplasts • vacuole • mitochondria • ribosomes	3	AO1 AO2 B2.1.1a/b/e B2.2.2b
Total			**7**	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)(i)	0.1 (mol per dm^3) allow **1** mark for indication of 0.4 and 0.3 in working		2	AO2 B2.1.2a/b
5(a)(ii)	(ref to) diffusion (as) difference in concentration greater	 allow greater concentration gradient	1 1	AO1 AO3 B2.1.2a/b
5(b)(i)	respiration	ignore aerobic / anaerobic	1	AO1 B2.3.1e
5(b)(ii)	oxygen	do **not** allow if anaerobic respiration is given in part **(b)(i)** apply ecf from part **(b)(i)**	1	AO1 B2.1.2c
Total			**6**	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)	any **four** from: • reference to transect • lay tape from top to bottom of shore • place quadrat on / by tape • every 5 metres • record / estimate % / amount of (each) species (in quadrat) • repeat for **B** / **A** / other shore	 allow lay tape down / up shore ignore lay tape across / on / along shore ignore ref to those on edges of quadrat allow count seaweeds	4	AO1 AO2 B2.4.1b
6(b)(i)	any **two** from: • more *Chondrus* on shore **A** • more *Enteromorpha* on shore **B** • *Enteromorpha* only grows on upper part of shore **A** • *Chondrus* only grows on upper part of shore **B**	 accept less *Chondrus* on shore **B** accept less *Enteromorpha* on shore **A** accept *Enteromorpha* grows on all parts of shore **B** accept *Chondrus* grows on all parts of shore **A** allow other comparisons shown on **Figure 10**	2	AO2 B2.4.1a
6(b)(ii)	(sea) snails eat (mainly) *Enteromorpha* any **one** from: • (so) more *Enteromorpha* eaten on shore **A** • (so) less *Enteromorpha* eaten on shore **B** • (so) *Enteromorpha* outcompetes *Chondrus* on shore **B**	accept snails eat fewer / no *Chondrus* accept fewer *Chondrus* eaten on shore **A**	1 1	AO3 B2.4.1a
Total			**8**	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(a)(i)	potassium atom loses one electron **and** chlorine atom gains one electron	accept for **2** marks a correctly drawn diagram allow for **1** mark potassium atoms lose electrons **and** chlorine atoms gain electrons **or** reference to 1 electron being transferred	2	AO1 AO2 C2.1.1a/b/c/d/e/f
	ionic bond formed **or** both ions have full outer shell of electrons **or** electrostatic attraction between ions	do **not** allow references to covalent bonding or sharing of electrons	1	
7(a)(ii)	argon	allow Ar ignore references to numbers of electrons	1	AO2 C2.1.1c
7(b)	24.8	accept 24.83(3333) **or** 25 allow for **2** marks: $\frac{74.5 \times 13}{39}$ **or** $\frac{149 \times 13}{78}$ allow for **1** mark M_r KCl = 74.5 **or** 2 M_r KCl = 149 allow maximum **2** marks for ecf from incorrect M_r	3	AO2 C2.3.3c
Total			**7**	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)	solvent level above start line so colours dissolved into solvent		1 1	AO3 C2.3.2b
8(b)	**A** contains red, green and yellow **B** contains red and blue **and** has 2 unknown colours	if no other mark awarded allow for **1** mark **A** has three colours **and B** has four colours	1 1	AO3 C2.3.2b
Total			**4**	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. ref.
9	**silver** metallic bonding	accept a lattice of positive ions	1	AO1 C2.1.1h/i
	electrons in highest energy level are delocalised	allow a sea of delocalised / free electrons **or** allow delocalised / free electrons between ions	1	C2.2.3c/d C2.2.4a
	graphite covalent bonding **or** each (carbon) atom forms 3 bonds	allow layers containing hexagonal rings of (carbon) atoms **or** allow layers held together by weak intermolecular forces	1	
	one electron per atom delocalised	allow delocalised / free electrons between layers	1	
	silver / graphite delocalised / free electrons carry the current / charge		1	
		if no other mark obtained allow for **1** mark both silver **and** graphite contain delocalised / free electrons		
Total			**5**	

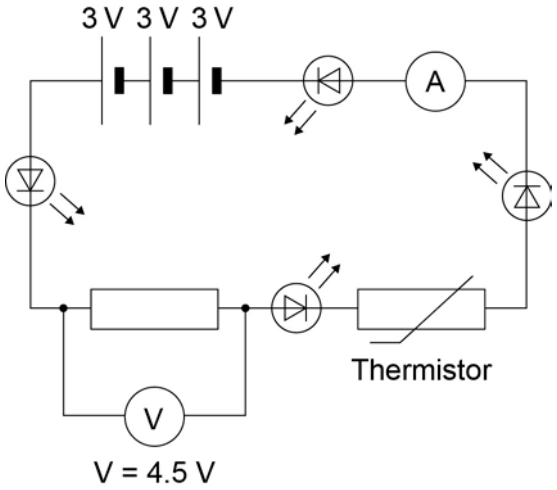
Question 10

Question	Answers	Extra information	Mark	AO / Spec. ref.
10(a)	structure changes as (mouth) warms up wire	accept atoms move as (mouth) warms the wire accept layers / atoms slide as (mouth) warms up the wire	1	AO1 AO2 C2.2.4d
	so goes back to its original shape	accept atoms go back to original positions	1	
10(b)(i)	structure 1–100 nm in size	allow a value within the range accept a few hundred atoms in size	1	AO1 C2.2.6a
10(b)(ii)	nanoparticle much smaller **or** nanoparticle has a higher surface area to volume ratio		1	AO1 AO3 C2.2.6a
	so need less (titanium(IV) oxide or cream) **or** cream spreads more easily	allow absorbed by skin more easily allow transparent when applied ignore references to cost or skin protection factors	1	
Total			**5**	

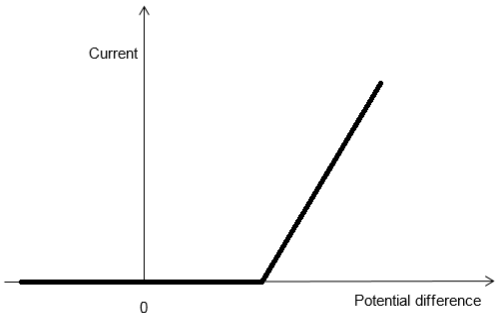
Question 11

Question	Answers	Extra information	Mark	AO / Spec. ref.
11(a)	the rod loses electrons		1	AO1
	(as) electrons are negative(ly charged) **or** (so) leaving more positive than negative (charge)	award the second mark only if the first mark is awarded	1	P2.3.1b
11(b)(i)	the rods have like charges (which repel)	allow both rods are positive(ly charged)	1	AO1 P2.3.1d
11(b)(ii)	copper wire is a (electrical) conductor		1	AO1 P2.3.1e
	(so) the rod (hung by the wire) has gained electrons / negative charge	allow the idea of earthing / grounding	1	
Total			**5**	

Question 12

Question	Answers	Extra information	Mark	AO / Spec. ref.
12(a)		allow voltage / pd instead of potential difference		AO1 P2.3.2h/k
	the (total) potential difference from the cells is 9(.0) (V)		1	
	(and) the potential difference from the cells is shared between the thermistor and resistor (because they are connected in series)		1	
	the potential difference is shared equally because the resistance of the thermistor and resistor are equal		1	
12(b)	reference to the resistance of the thermistor		1	AO1 P2.3.2q
	(which) decreases	award only if first marking point is awarded	1	
12(c)(i)	in series	eg in one of the positions shown	1	AO1/AO2 P2.3.2c
	correct symbol and orientation		1	
				

Question 12 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
12(c)(ii)	 horizontal line along the x-axis followed by a straight line with positive gradient	judge straightness of lines by eye allow any length of horizontal line allow any gradient allow a non-curved transition between the two stages of the graph	1	AO1 P2.3.2n
Total			**8**	

Question 13

Question	Answers	Extra information	Mark	AO / Spec. ref.
13(a)(i)	subtract original length (of spring) from new length (of spring)	allow a practical method of measuring extension	1	AO1 P2.1.5a
13(a)(ii)	12.5 N/m	 allow **1** mark for correct substitution, ie $1.5 = k \times 0.12$	2 1	AO1 AO2 P2.1.5d
13(b)	(weight of) toy means graph line does not go through the origin (then linear because) the spring has not exceeded its limit of proportionality	 allow the spring is elastic	1 1	AO3 P2.1.5d
13(c)	the gradient of the graph will be greater **or** the initial extension will be smaller the extension of the spring will be less for the same force / weight	allow the graph will be steeper	1 1	AO3 P2.1.5d
Total			**8**	