

# GCSE ADDITIONAL SCIENCE COMBINED (ROUTE 2)

AS1HP Paper 5 Higher Tier  
Mark scheme

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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](http://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 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. Boldening

- 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 boldened. 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 / ; e.g. allow smooth / free movement.

### 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 error / 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 are 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 Ignore / Insufficient / Do **not** 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.

## **Quality of Written Communication and levels marking**

In Question 3 students 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.

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	spec ref	I.D.
<b>1(a)</b>	any <b>four</b> from: <ul style="list-style-type: none"> <li>• ref to transect</li> <li>• (transect) from sea to trees <b>or</b> trees to sea</li> <li>• ref to use of quadrat</li> <li>• ref to a suitable interval along transect</li> <li>• record presence / absence (<i>in quadrat</i>)</li> <li>• <i>repeat to check results or repeat to calculate a mean</i></li> </ul>	eg tape / string allow across the habitat  accept description of quadrat  eg every 1 – 10 metres <b>or</b> continuous  allow eg % cover / number  <i>ignore repeat unqualified</i>	4	B2.4.1b	E
<b>1(b)(i)</b>	sea rocket	<i>accept rocket</i>	1	B2.4.1	G
<b>1(b)(ii)</b>	marram grass	<i>accept marram</i>	1	B2.4.1	G
<b>1(b)(iii)</b>	(as age increases number of species) increases  then decreases		1  1	B2.4.1	E
<b>1(c)</b>	insufficient / low light (intensity)          so little / not much photosynthesis	accept too dark or only 52 / 27 (%) light  allow these species need less light  do <b>not</b> accept no light  accept no (net) photosynthesis  allow other species need more light (to grow)  <i>accept insufficient nutrients / water (1) because of competition from pine trees (1)</i>	1          1	B2.4.1	E
<b>Total</b>			<b>10</b>		

## Question 2

question	answers	extra information	mark	spec ref	I.D.
<b>2(a)</b>	ammonia + hydrogen chloride ( $\rightleftharpoons$ ) ammonium chloride	accept hydrogen chloride + ammonia <i>accept NH<sub>3</sub> for ammonia</i> <i>accept HCl for hydrogen chloride</i> <i>accept NH<sub>4</sub>Cl for ammonium chloride</i>	1	C2.3.3f	E
	$\rightleftharpoons$		1		
<b>2(b)(i)</b> Mark with <b>2(b)(iii)</b>	107 (g)		1	C2.3.3e	G
<b>2(b)(ii)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>some (product) left in apparatus</li> <li>reversible reaction</li> </ul>	<i>ignore weighing errors</i> <i>ignore references to evaporation</i>  <i>accept reaction does not go to completion</i> <i>allow loss of (reactant) gas</i>	1	C2.3.3d	E
<b>2(b)(iii)</b> Mark with <b>2(b)(i)</b>	89.7 / 90	allow ecf from <b>part (b)(i)</b>  allow for 1 mark evidence of <u>96</u> or <u>96</u> 107 <i>answer to (b)(i)</i>	2	C2.3.3c	E
<b>Total</b>			<b>6</b>		

**Question 3**

question	answers	extra information	mark	Spec ref	I.D.
3			6	C2.1.1g C2.2.3a/c	E
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 information	<i>A relevant statement is made about the structure of graphite <b>or</b> at least one property of graphite is given.</i>	<i>There is a description of the structure <b>and</b> a description of at least one property of graphite <b>or</b> an attempt at explaining how at least one property is linked to the structure</i>	<i>There is a good description of the structure and properties of graphite <b>and</b> an attempt at explaining how at least one property is linked to the structure.</i>		
<b>examples of the points made in the response</b> <i>Structure:</i> <ul style="list-style-type: none"> <li>(only) carbon atoms</li> <li>giant structure</li> <li>hexagonal rings</li> <li>layers</li> <li>covalent bonds (between carbon atoms)</li> <li>strong bonds (between carbon atoms)</li> <li>each (carbon) bonds to three others</li> <li>no (covalent) bonds between layers</li> </ul> <i>Property:</i> <ul style="list-style-type: none"> <li>soft</li> <li>slippery</li> <li>high melting point</li> <li>does not decompose when heated</li> <li>conducts electricity</li> </ul> <i>Explanation:</i> <ul style="list-style-type: none"> <li>layers are free to slide</li> <li>(high melting point due to) strong / many bonds within layers</li> <li>because no covalent / strong bonds between layers</li> </ul>		<b>extra information</b>  allow macromolecular  accept weak (intermolecular) forces (between layers) accept delocalised electrons  accept streaking or leaves a mark  allow high boiling point  accept there are weak (intermolecular) forces between layers  accept parts break off because the layers are so thin accept delocalised electrons are free to move			



## Question 4

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
4(a)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• make sure no one is looking over the ball</li> <li>• ensure everyone is beyond the area it will fall.</li> <li>• watch the ball during its entire flight.</li> <li>• wear safety spectacles / goggles</li> </ul>	<i>ignore reference to finger injuries</i>  <i>allow aim away from people</i>	1	P2.1	E
4(b)	elastic potential energy		1	P2.1.5b	G
4(c)(i)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• meter rules not being <i>vertical</i></li> <li>• parallax</li> <li>• difficult to see where ball stops</li> <li>• ball not close to ruler</li> <li>• can measure from top or bottom of ball</li> </ul>	<i>allow eyes not being in line with ball and ruler</i> <i>allow ball only stops for a short time</i> <i>allow ball does not travel straight up</i>  <i>ignore ball moves too fast</i> <i>ignore reference to reaction time</i>  if no other mark awarded allow <b>one</b> mark for misreading ruler	2	P2.1	E

<b>4(c)(ii)</b>	0.36	allow <b>1</b> mark for correct substitution, i.e. $E_p = 0.02 \times 10 \times 1.8$	2	P2.2.1f	E
	J or joules	allow <b>1</b> mark for an answer of 360 irrespective of working  do not accept j allow mJ or millijoules if an answer of 360 is given	1		
<b>4(d)(i)</b>	(A) drag / air resistance / friction	<i>allow upthrust</i>	1	P2.1.4b	E
	(B) weight / gravity		1		
<b>4(d)(ii)</b>	increases		1	P2.2	A
<b>Total</b>			<b>10</b>		

## Question 5

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
<b>5(a)(i)</b>	has chloroplast(s)	<i>allow chlorophyll</i>	1	B2.1.1	E
	has (cell) wall		1		
<b>5(a)(ii)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>• has flagellae / flagellum</li> <li>• has eye (spot) / is sensitive to light</li> <li>• no (permanent) vacuole</li> </ul>	allow idea <i>Volvox</i> can move	1	B2.1.1	E
<b>5(a)(iii)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>• no differentiation / specialisation</li> <li>• (different) cells don't have different functions</li> </ul>	allow all cells the same (structure / appearance) allow all cells have same functions <i>allow has no organs / tissues</i>	1	B2.2.1	E
<b>5(b)</b>	mitochondria <i>provide/release energy</i>	allow respiration in mitochondria <i>do not allow mitochondria produce / make energy</i>	1	B2.4.1	E
	(for) flagellae to move		1		
<b>Total</b>			<b>6</b>		

## Question 6





## Question 8

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
8(a)	<u>atoms</u> of same element <b>or</b> (atoms with the) same number of protons	<i>ignore reference to electrons</i>  accept ( <i>atoms have</i> ) same atomic number accept both atoms have 17 protons	1	C2.3.1a/c/d	E
	with different number of neutrons	<i>accept different mass number</i>  accept one atom has 18 neutrons, one has 20	1		
8(b)(i)	35.5	<i>do <b>not</b> accept with incorrect unit e.g. g</i>	1	C2.3.1.1e	E
8(b)(ii)	<i>average value for the isotopes (of the element)</i>	<i>accept average value for mass of all atoms (in chlorine)</i>  allow mean for average	1	C2.3.1.1e	E
<b>Total</b>			<b>4</b>		

## Question 9

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
<b>9(a)</b>	<i>plastic bags</i> [LD poly(ethene)] is more flexible so can change shape		1	C2.2.5a	E
	<i>garden chairs</i> [HD poly(ethene)] is stronger so less likely to break <b>or</b> [HD poly(ethene)] is rigid so maintains shape	<i>accept [HD poly(ethene)] is stronger so holds higher weight</i>	1		
<b>9(b)(i)</b>	<i>thermosoftening polymers do melt (when heated)</i>	<i>accept thermosetting polymers do not melt (when heated)</i> <i>accept poly(ethene) has a low melting point / melts</i>	1	C2.2.5b	E
<b>9(b)(ii)</b>	weak (intermolecular) forces  between the (polymer) chains	<i>ignore references to tangled chains</i>		C2.2.5b	E
		<i>allow bonds for forces</i> <i>accept no cross-links</i>	1 1		
<b>9(c)</b>	made using different catalysts		1	C2.2.5a	E
	made using different (reaction) conditions	<i>accept made using different temperatures / pressures (ignore values)</i>	1		
<b>Total</b>			<b>7</b>		

## Question 10

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
10(a)	<p>magnesium atom loses electrons <b>and</b> oxygen atom gains electrons</p> <p>(magnesium atom loses) <u>two</u> electrons <b>and</b> (oxygen atom gains) <u>two</u> electrons</p> <p><i>forms a magnesium ion with a 2<sup>+</sup> charge</i></p> <p><i>forms an oxide ion with a 2<sup>-</sup> charge</i></p>	<p>any reference to incorrect bonding = max 3</p> <p>accept for 2 marks a correctly drawn diagram</p> <p>allow 1 mark for reference to movement of 2 electrons if first mark point not gained</p> <p>allow Mg<sup>2+</sup> (<i>ion</i>) <i>formed</i></p> <p>allow O<sup>2-</sup> (<i>ion</i>) <i>formed</i></p> <p>if neither third or fourth mark point scored, allow 1 mark for mention of ionic bond / ions / electrostatic attraction being formed / <i>both (magnesium and oxide ions) have full outer shells</i></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>C2.1.1b/c/f/ C2.2.2a</p>	E



<b>10(b)</b>		accept electrostatic forces for bonds throughout		C2.1.1f/ C2.2.2a	E
	giant (ionic) structure <b>or</b> lattice		1		
	with strong (ionic) bonds	<i>do not accept intermolecular forces / shared electrons</i>	1		
	(so) large amounts of energy are needed to break the bonds	accept (so) large amounts of energy are needed to overcome the forces	1		
	<b>or</b> large number of bonds to be broken				
<b>Total</b>			<b>7</b>		

## Question 11

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
11(a)(i)	air resistance <b>or</b> drag <b>or</b> friction ( <i>with the air</i> )	<i>ignore wind</i>	1	P2.1.3	E
11(a)(ii)	zero	<i>allow 0 / nothing</i> <i>ignore constant</i> <i>ignore units</i>	1	P2.1.1e	E
11(b)	(the cyclist) accelerates <b>or</b> increases speed <b>or</b> increase velocity  (as) the amount of <i>backward</i> force is lower  (causing a) resultant force	<i>allow drag <b>or</b> friction <b>or</b> air resistance for backward forces throughout</i>  <i>allow goes faster</i>  <i>allow (as) the (frontal) surface area is lower <b>or</b> (more) streamlined <b>or</b> (more) aerodynamic</i>  <i>allow (which means) the forward force / thrust / pedal force is greater than backward force</i>	1  1  1	P2.1	E
11(c)	7.5	<i>allow 1 mark for correct substitution, i.e.</i>  $2 = \frac{18 - 3}{t}$ <b>or</b> $2 = \frac{15}{t}$	2	P2.1.2e	E

<p><b>11(d)</b></p>	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• force applied to pedals</li> <li>• mass of cyclist / bike</li> <li>• aerodynamics of the helmet / wheels / <i>clothing</i></li> <li>• gradient of the ground</li> <li>• wind</li> <li>• altitude</li> <li>• road surface</li> <li>• tyre pressure / <i>type</i></li> </ul>	<p><i>allow pedal faster / slower</i>  allow strength of the cyclist</p> <p><i>allow weight</i>  allow shape</p> <p><i>allow weather if qualified</i></p>	<p>2</p>	<p>P2.1</p>	<p>E</p>
<p><b>Total</b></p>			<p><b>9</b></p>		

## Question 12

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
<b>12(a)(i)</b>	current (through the LDR)	in either order accept amount of amps	1	P2.3.2f	E
	potential difference / voltage across the LDR	accept amount of volts <i>across the LDR</i>	1		
<b>12 (a)(ii)</b>	decrease		1	P2.3.2i	E
<b>12(b)(i)</b>	as the light level increases by a factor of 10 the resistance reduces by a factor of 5	allow for 1 mark as the light level increases the resistance decreases	2	P2.3.2p	E
<b>12 (b)(ii)</b>	4.5		1	P2.3.2k	E
<b>Total</b>			<b>6</b>		

## Question 13

Question	Answers	Extra Information	Mark	Spec Ref	I.D.
13 (a)	the (total) momentum before (an event) is equal to the (total) momentum after (the event)	<i>allow (total) momentum does not change from before to after (the event)</i>	1	P2.2.2a	E
	in a closed system	accept <i>if</i> no external forces acting	1		
13(b)	0.063	accept 0.06 <b>or</b> 0.0625 <i>for 2 marks</i>  allow <b>1</b> mark for correct substitution, ie. $5 = 80 \times v$	2	P2.2.2b	E
13(c)	any <b>one</b> from: <ul style="list-style-type: none"> <li>momentum is a vector quantity</li> <li>shows the direction (the astronaut travels in)</li> <li>opposite to the direction (of the hammer)</li> </ul>	allow motion / velocity is backwards or to the left or opposite the hammer	1	P2.2.2 /P2.2.1	E
<b>Total</b>			<b>5</b>		