



Rewarding Learning

General Certificate of Secondary Education

Single Award Science Physics

Unit 3
Higher Tier

[GSA32]

Assessment

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for GCSE Single Award Science

Candidates must:

- AO1** Demonstrate knowledge and understanding of scientific ideas, scientific techniques and procedures;
- AO2** Apply knowledge, skills and understanding of scientific ideas, scientific enquiry, techniques and procedures; and
- AO3** Analyse information and ideas to interpret and evaluate; make judgements and draw conclusions; develop and improve experimental procedures.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'own figure rule' so that candidates are not penalised more than once for a computational error.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Intermediate performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Quality of written communication

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is basic.

Level 2: Quality of written communication is good.

Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level 1 (Basic): The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

Level 2 (Good): The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Level 3 (Excellent): The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

General marking guidance for GCSE SA Science – Physics

1. Alternative responses

- A solidus (/) used in mark schemes indicates alternative answers. Where a solidus may be confused with part of the answer (for example as a division sign or as part of units) “or” may be used to show alternatives.

Example: Give **one** property that is different for all electromagnetic waves. [1]

MS: Frequency/wavelength/energy [1]

- Any of these answers as a response would be acceptable. If two or more are given this is accepted.

2. Brackets in a response

- Normal parentheses used in a response means that a term is **not required** for the response to be marked correct.

Example: Describe fully how a teacher would use this apparatus to show convection currents in water. [1]

MS: **Heat** water (under the purple dye) [1]

- ‘Heat the water’ on its own is an acceptable response to this question as the focus is on the experimental process.

3. Bolding in a response

- If part of a mark scheme response is in **bold** this is an essential word or phrase needed to gain credit for the response.

Example: What is meant by the term **ultrasound**? [1]

MS: Above 20 000 **Hz**/20 **kHz** [1]

To gain credit the candidate must use the units in the correct format.

4. Marking of spelling

- Where candidates give an incorrectly spelt response, credit can be given if the word is recognisable phonetically and cannot be confused with another word.

Example: Complete the following sentence. A radioactive nucleus has an unstable combination of neutrons and _____. [1]

MS: Protons [1]

Response	Candidate Response	Marks awarded	Notes
1	Protons	1	Correct response
2	photons	0	Incorrect response – can be confused for another scientific word
3	protens	1	Correct response – phonetic spelling
4	prottons	1	Correct response – phonetic spelling

5. Marking of lists

- Where candidates give extra responses, additional correct responses can be ignored.
- Additional neutral responses can also be ignored. A neutral response is one which does not have a bearing on the question but is not incorrect.
- Additional incorrect responses **cancel out** a correct response to the marking point to which they pertain.

Example: Give **one** use for radioactive materials in medicine. [1]

MS: Imaging/radiotherapy/treating cancer/sterilising equipment [1]
(Do not accept X-rays)

Response	Candidate Response	Marks awarded	Notes
1	Imaging (X-rays)	0	X-rays is incorrect
2	sterilising and cleaning equipment	1	cleaning is a neutral answer

6. Marking of responses – ‘Choose from’

- Where candidates choose extra responses from a list of prompts, additional responses **cannot** be ignored.
- Additional incorrect responses **cancel out** a correct response to the marking point to which they pertain.

Example: What is the unit of weight?
Choose from:

newton **kilogram** **joule** [2]

MS: Newton [1]

Response	Candidate Response	Marks awarded	Notes
1	Newton	1	correct response
2	Newton and kilogram	0	kilogram is incorrect

7. Marking values where a range is given

- Where a numerical range is given, correct responses are any value in the range, the range itself or any other range given which falls within the MS range.

Example: Suggest a value for the wavelength of infrared radiation.

[1]

MS: Any value greater than $740 \times 10^{-9} \text{ m}$

Response	Candidate Response	Marks awarded	Notes
1	750	0	incorrect response must have magnitude ($\times 10^{-9}$)
2	$750 \times 10^{-9} \text{ m}$	1	A single value within the accepted range
3	$900 \times 10^{-9} \text{ m}$	1	A single value within the accepted range
4	$750\text{--}760 \times 10^{-9} \text{ m}$	1	A range given within the accepted range
5	$730 \times 10^{-9} \text{ m}$	0	A single value not within the accepted range
6	$740 \times 10^{-9} \text{ m}$	0	A single value not within the accepted range
7	$740\text{--}760 \times 10^{-9} \text{ m}$	0	Range given outside the accepted range

8. QWC

- Quality of written communication is marked using indicative content and a banded mark scheme.
- The initial marking is for the indicative content. The number of indicative content marks places a candidate in a specific band. The overall marks awarded should be in that band based on the standard of the written communication.
- A typical banded grid from a mark scheme is shown below:

Band	Response	Mark
A	Candidates must use appropriate specialist terms including a minimum of 7 points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms including a minimum of 5 points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates provide a brief and partial response including a minimum of 2 points of indicative content. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

- A candidate who provides 5 indicative content points is placed in band B and can be awarded 3 or 4 overall marks out of 6 for their response.
- Responses would only be given the lower mark in the band if there were multiple spelling, punctuation and grammar errors.

9. Marking calculations

- Any errors a candidate makes in a single calculation or between parts of a multipart calculation may be carried forward to calculate the final answer, thus giving partial credit for the calculation method. ECF may be used to indicate where an error is carried forward.
- Full marks can be awarded for a correct numerical answer to any calculation even if no working out is shown.
- Units are required where they are not provided at the end of an answer line.

1	(a) Heat water (under the purple dye) [1] dye moves to show convection current [1]	[2]	AVAILABLE MARKS															
	(b) (i) Less Accept alternative words for less, e.g. lower	[1]																
	(ii) Same volume of water/same temperature/same material/same time (accept left for 5 mins)	[1]																
	(c) Less Accept alternative words for less, e.g. lower	[1]																
2	(a) Indicative content: - Moves from A to B at a constant speed - Travels 200 m from A to B - Takes 30 s to move from A to B - Stops at B - Is stopped for 10 s - Moves from C to D with constant speed - Travels 300 m from C to D - Takes 10 s to move from C to D - CD speed faster than AB speed	Accept correct calculation of speed (6.7 m/s) and award both bullet points Accept correct calculation of speed (30 m/s) and award both bullet points	5															
<table><tr><th>Band</th><th>Response</th><th>Mark</th></tr><tr><td>A</td><td>Candidates must use appropriate specialist terms throughout to describe the journey of the motorbike (using six or more of the above points) in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.</td><td>[5]–[6]</td></tr><tr><td>B</td><td>Candidates use some appropriate specialist terms to describe the journey of the motorbike (using four or five of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.</td><td>[3]–[4]</td></tr><tr><td>C</td><td>Candidates describe the journey of the motorbike (using one to three of the above points). They use limited spelling, punctuation and grammar and have made little use of specialist scientific terms. The form and style are of a limited standard.</td><td>[1]–[2]</td></tr><tr><td>D</td><td>Response not worthy of credit.</td><td>[0]</td></tr></table>				Band	Response	Mark	A	Candidates must use appropriate specialist terms throughout to describe the journey of the motorbike (using six or more of the above points) in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]	B	Candidates use some appropriate specialist terms to describe the journey of the motorbike (using four or five of the above points) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]	C	Candidates describe the journey of the motorbike (using one to three of the above points). They use limited spelling, punctuation and grammar and have made little use of specialist scientific terms. The form and style are of a limited standard.	[1]–[2]	D	Response not worthy of credit.	[0]
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			10															
(b) (i) 48 ÷ 100 [1] 0.48/48% [1] (Do not accept 0.48%)																		
(ii) Energy changed from one form to another [1] total energy does not change/energy cannot be created or destroyed [1]			[2]															

			AVAILABLE MARKS
3	(a) (i) Frequency/pitch [1] above 20 000 Hz/20 kHz [1]	[2]	5
	(ii) Signal/ultrasound/echo will return in shorter time/quicker	[1]	
	(b) Sound travels fastest in solids/steel [1] sound travels fastest at higher temperature [1] (Accept converse statements)	[2]	
4	(a) (i) Down arrow	[1]	8
	(ii) Electrons	[1]	
	(iii) Decrease decrease (Accept alternative words for decrease, e.g. goes down)	[1]	
	(b) Oven/volume	[1]	
	(c) (i) Magnet and coil [1] moving relative to each other [1]	[2]	
	(ii) Step-up voltage/decrease current/increase voltage [1] reduces heat loss [1]	[2]	
5	(a) X – as greatest distance off ground/height (explanation essential to award mark)	[1]	4
	(b) B	[1]	
	(c) $v^2 = 2(3000) \div 60$ or 100 [1] $v = 10$ [1]	[2]	
6	(a) Equals/is the same as	[1]	6
	(b) (i) 1100 N	[1]	
	(ii) Accelerate [1] upwards [1]	[2]	
	(c) (i) Will run out/cannot be made in a human lifetime/finite/limited supply (Do not accept: cannot be used again)	[1]	
	(ii) Uranium/nuclear	[1]	

			AVAILABLE MARKS
7	(a)	Clouds/nebula of hydrogen [1] pulled together by gravity [1] (Do not accept 'pushed together') nuclear fusion begins [1]	[3]
	(b) (i)	(Massive) collection of stars	[1]
	(ii)	Milky Way	[1]
	(c) (i)	Both galaxies moving away from the Sun [1] galaxy 2 farther away/moving faster [1]	[2]
	(ii)	Big Bang (Theory)	[1]
8	(a)	$3 \times 10^8 \times 1 \times 10^{-4}$ [1] divide by 2 [1] 15 000 [1]	[3]
	(b) (i)	As wavelength increases energy decreases Accept converse statement	[1]
	(ii)	Green	[1]
	(c) (i)	Any value greater than 740×10^{-9}	[1]
	(ii)	Ultraviolet/x-ray/gamma	[1]
9	(a) (i)	Unstable nucleus [1] neutrons and protons [1]	[2]
	(ii)	Removes electrons	[1]
	(b) (i)	60, 30, 15	[1]
	(ii)	All three points plotted correctly [1] smooth curve [1] (Do not accept points joined with a ruler)	[2]
	(c)	Centimetres/millimetres/cm/mm	[1]
Total			60

