Rewarding Learning

General Certificate of Secondary Education
2019

Science: Physics

Unit 2

Foundation Tier

[GPY21]

FRIDAY 14 JUNE, MORNING

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 Physics

Candidates must:

AO1 Demonstrate knowledge and understanding of scientific ideas, scientific techniques and procedures;

AO2 Apply knowledge 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 (QWC) 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 A: Quality of written communication is excellent.
Level B: Quality of written communication is good.
Level C: Quality of written communication is basic.

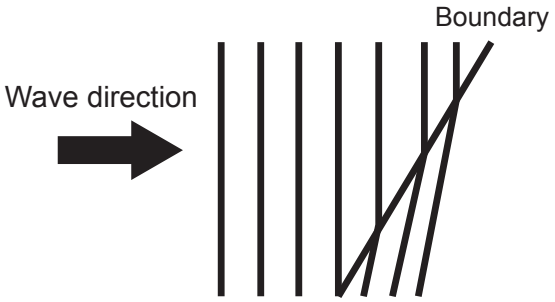
In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

Level A (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 and spelling, punctuation and grammar (SPG) are of a sufficiently high standard to make meaning clear.

Level B (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 and spelling, punctuation and grammar (SPG) are sufficiently competent to make meaning clear.

Level C (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 and spelling, punctuation and grammar (SPG) may be such that intended meaning is not clear.

			AVAILABLE MARKS
1	**(a)**	Transverse waves – (vibrations) perpendicular to/at right angle or 90° up and down wave direction [1] *Both statements required*	
	(b)	**(i)** Amplitude = 10 cm [1]	
		(ii) Wavelength = 30 cm [1]	
		(iii) $v = f\lambda$ or equivalent, e.g. $f = \frac{v}{\lambda}$ [1] Frequency = 45/30 [1] = 1.5 [1] [2] Allow ecf for wavelength from **(ii)**	
	(c)	**(i)** Boundary marked as shown below [1]	



		(ii) Refraction [1]	
		(iii) Speed [1] Wavelength [1] [2]	
	(d)	**(i)** Echo [1]	
		(ii) Angle of incidence equal angle of reflection [1] Or for x = y	
		(iii) A, angle of incidence equal angle of reflection for A [1]	
	(e)	**(i)** Infrared [1]	
		(ii) Ultraviolet [1]	
		(iii) **Visible** light or visual [1]	
		(iv) Microwaves, micro, radio [1]	
	(f)	Radar [1]	
	(g)	They travel at the speed of light ($3.0 \times 10^{8)}$ They can travel through vacuum/ They travel at the same speed **in a vacuum** Any **two** [2]	20

AVAILABLE MARKS

2 **(a)** One ray from tip of (or any point on object) object to the plane mirror reflected to eye [1]
One ray drawn to eye must appear to come from tip of image or [1]
Angle of incidence = Angle of reflection
Arrow on incident or reflected ray (independent mark) [1] [3]

(b) **(i)** Dispersion [1]

(ii) Different colours travel at different speeds (in the glass) [1]
Different colours refracted by different amounts

(iii) Red above violet [1]

(c) **(i)** Rays refracted at front [1]
meet at retina [1] [2]

(ii) Rays refracted at front
meet behind the retina [1]

(iii) Eye lens too weak or eyeball too short [1]

(iv) Rays converge from lens to eye [1]
Rays converge more inside the eye [1]
then meet at retina [1]
Convex lens [1] [4]

(d) **Indicative content:**

Apparatus
Ray box (glass block assumed) or light box
Path of the ray
Outline of glass block marked
Path of incident ray marked
Path of emergent ray marked
Path of refracted ray marked
Measurement of angles
*Normal **drawn** at boundary*
Angles measured using a protractor
Angles measured from the normal
Investigation
Change angle of incidence (and measure angle of refraction)
Repeat for different angles
Graph and what it tells us/relationship
Graph of i vs r
As i increases so does r
not in proportion

Response	Mark
Candidate describes in detail using good spelling, punctuation and grammar **5 or more** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	**[5]–[6]**
Candidate describes in detail using good spelling, punctuation and grammar **3 or 4** points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	**[3]–[4]**
Candidates make some reference to **1 or 2 of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	**[1]–[2]**
Response not worthy of credit.	**[0]**

[6]

AVAILABLE MARKS

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3 **(a)** Correct symbol for resistor **and** fuse identified [1] [1]

(b) 6 V [1]
3 V [1]
0 V [1] [3]

(c) **(i)** Ammeter in series **and** correct symbol [1]
Variable resistor in series **and** correct symbol [1]
Voltmeter in parallel **and** correct symbol [1] [3]

(ii) to obtain voltage and current values or
to enable sufficient or set of values to be obtained
to change the current give [0], to change the voltage give [0]
to change resistance give [0] [1]

(iii) Anomalous point circled I = 1A, V = 3.25 [1]

(iv) Straight line through (0,0) and ignoring (3.25 V/1A) reading [1]

(v) Yes
Graph is a straight line passing through (0,0) [1]
or doubling V, doubles I

(vi) $R = \frac{V}{I}$ [1]
Resistance = $\frac{5.0}{1.25}$ **or**
other valid values from graph [1]
Resistance = 4 (Ω) [1] [3]

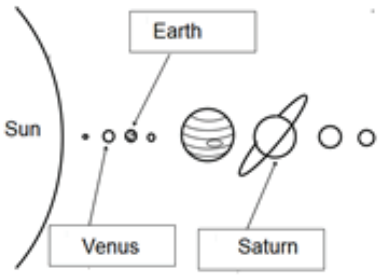
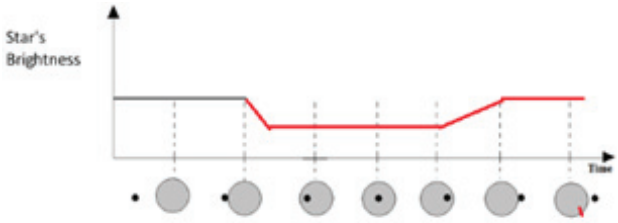
(d) **(i)** 6 V [1]

(ii) 12 V [1]

(iii) Circuit number 2 [1]

(iv) P = I × V or equivalent [1]
24 = I × 12 or equivalent [1]
I = 2A [1] [3]

20

					AVAILABLE MARKS
4	(a)	Momentary deflection of meter (then returns to zero) [1] (Momentary) deflection or deflect (as long as coil is moving) [1] (Momentary) deflection **opposite** to first one/direction [1] No deflection [1]		[4]	
	(b)	(i) Step down transformer		[1]	
		(ii) Coil A connected to 240 V		[1]	
		(iii) Alternating or a.c.		[1]	
	(c)	(i) 5 kW or 1 hour = 5 × 1 = 5 kW hr		[1]	
		(ii) 10 kW × 15 min = 10 × 0.25 = 2.5 kWh [1] Cost = 2.5 × 14 = 35 p [1]		[2]	10
5	(a)	(i) 		[3]	
		(ii) Gravity		[1]	
		(iii) Hydrogen [1] Helium [1]		[2]	
	(b)	(i) Dip [1] Constant level (do not accept zero) [1]		[2]	
					
		(ii) Oxygen		[1]	
		(iii) Speed of spacecraft too slow, the journey would take a very long time or longer than human lifetime		[1]	10
			Total		**80**