



Rewarding Learning

**General Certificate of Secondary Education
2022**

Science: Physics

Unit 2

Higher Tier

[GPY22]

THURSDAY 23 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.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

1 (a)	Wavelength – decreases	[1]	
	Frequency – remains same	[1]	
	Speed – decreases	[1]	[3]
(b) (i)	Amplitude = 0.8 (m)	[1]	
	Wavelength = 5 (m)	[1]	[2]
(ii)	2 waves in 5 s	[1]	
	2/5 waves in 1 s	[1]	
	Frequency = 0.4 Hz	[1]	
	Alternative $f = 1/T$ = $1/2.5$ = 0.4 Hz	[1]	[4]
(iii)	$v = f\lambda$ (or equivalent)	[1]	
	$v = 0.4 \times 5$ (ecf from (i) and (ii))	[1]	
	= 2 (m/s)	[1]	[3]
(c) (i)	Time = distance/speed	[1]	
	Time = $3840/1500$	[1]	
	= 2.56 (s)	[1]	
	Doubling gives 5.12 (s)	[1]	[4]
Alternative scheme for (c)(i)			
	Time = distance/speed	[1]	
	Time = $2 \times 3840/1500$	[2]	
	= 5.1 (5.12) (s)	[1]	
(ii)	Sonar (sound) travels too slowly		[1]
(d) (i)	1×10^{-9} m X-rays	[1]	
	1×10^{-7} m Ultraviolet	[1]	
	3×10^{-2} m Microwaves	[1]	
	300 m Radio	[1]	[4]
(ii)	They can travel in a vacuum or		
	They travel at the speed of light		[1]

AVAILABLE
MARKS

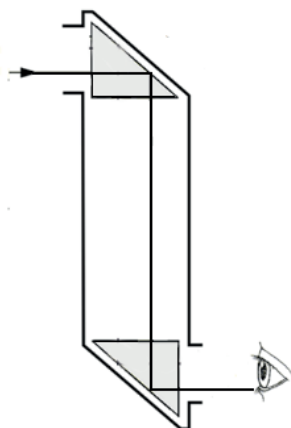
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- 2 (a) *Equipment* Ray box and prism [1]
Process Dispersion [1]
Spread of colours Spectrum [1]
Colours Red, Orange, Yellow, Green, Blue, Indigo, Violet [1]
in correct order [1]
Why they appear Red refracted least or travels fastest in glass [1]
Violet refracted most/travels the slowest in glass [1]
Different colours travel at different speeds in glass [1]
Different colours refract by different amounts [1]

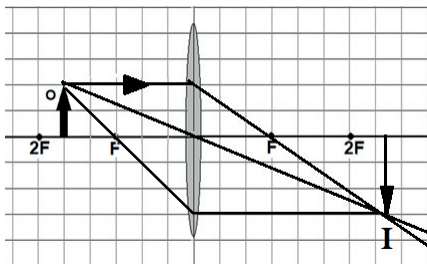
Response	Mark
Candidate describes in detail using good spelling, punctuation and grammar 5 or more points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidate describes in detail using good spelling, punctuation and grammar 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]

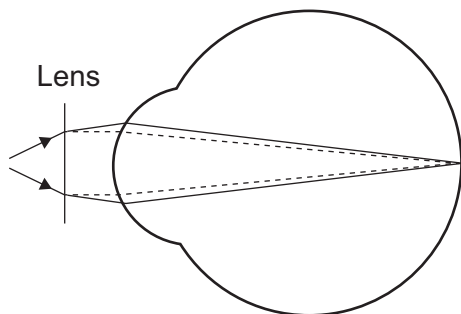
- (b) (i) Light ray enters prism at 0° or normal incidence [1]
(ii) Ray reflected through 90° at both prisms [2]
(iii) Total internal reflection [1]



- (c) (i) Angles of incidence and refraction correctly marked [1]
- (ii) The angle of incidence to remain constant [1]
- (iii) Both axes labelled with unit [1]
 All points correctly plotted [2]
 Line of best fit drawn [1] [4]
- (iv) $k = D/W = \text{gradient}$ or evidence of use of the equation [1]
 two subs from table or graph [1]
 Range of k 0.45 to 0.50 [1] [3]
- (d) Two rays correctly drawn [2]
 Arrows on at least one ray [1]
 Image clearly marked I as ↓ [1] [4]



- (e) (i) Converging lens [1]
- (ii) Rays must be less divergent or parallel or converging between lens and the eye [1]
 Rays must converge inside the eye after second converging [1]
 Rays must meet on retina [1] [3]



AVAILABLE
MARKS

3 (a) (i) $P = IV$ or Power = voltage \times current [1]

(ii) A in series with wire and V in parallel with wire [1]

(iii)

Length of wire			
Voltage/V		9.0	
Current/A			0.5
Power/W	7.2		

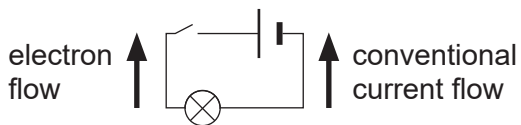
[3]

(iv) Graph C [1]

Graph shows that as L increases P decreases
or power inversely proportional to length [1] [2]

(b) Electron flow upwards [1]

Conventional current upwards [1] [2]



(c) (i) Parallel section $1/R = 1/6 + 1/4 + 1/12$ [1]

$$1/R = 6/12$$

$$R = 12/6 = 2 (\Omega)$$

(ii) Series section $3 + X + 2 = 16$ [1]

$$X = 11 (\Omega) \quad \text{Allow ecf from (c)(i)} \quad [1] \quad [2]$$

(d) (i) The length of each wire [1]

The metal (material) of the wire [1] [2]

(ii) $K = R A/L$ [1]

$$= 2.5 \times 0.1/500$$

$$= 0.0005 \text{ or } 5 \times 10^{-4} \text{ or } 1/2000$$

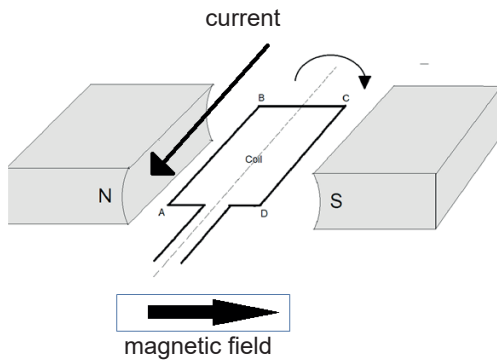
(iii) Units of $K = \Omega \times \text{mm}^2/\text{mm}$ [1]

$$= \Omega \times \text{mm} \quad [1] \quad [2]$$

AVAILABLE
MARKS

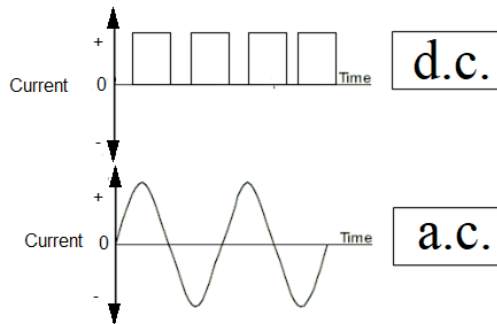
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- 4 (a) (i) Arrow from N to S [1]
(ii) Arrow from B to A [1]
(iii) Fleming's Left Hand Rule [1]

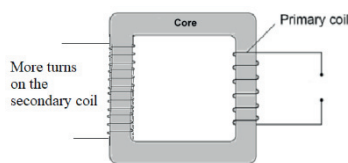


- (b) (i) Alternating current (a.c.) changes/reverses direction [1]
Direct current (d.c.) does not change direction [1] [2]

(ii)



- (c) (i) More turns shown on the secondary coil [1]
(ii) Output voltage greater than input voltage [1]



- (iii) Ratio = $110/15.75 = 6.98$ See notes for guidance [2]

- (d) (i) No. of kWh = 3×6 [1]
Cost = $18 \times 17 = 306$ pence [1] [2]

- (ii) Energy used = power \times time [1]
= $1000 \times 1 \times 60 \times 60$ [2]
= $3\,600\,000$ (J) [1] [4]

AVAILABLE MARKS

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			AVAILABLE MARKS	
5	(a)	Group A = Rocky (planets)	[1]	
		Group B = Gas (planets)	[1]	[2]
	(b)	(i) Thermal expansion/Radiation pressure	[1]	
		Gravity	[1]	[2]
		(ii) (Nuclear) Fusion		[1]
	(iii)	3 5 1 4 2 Also accept 3 5 4 1 2		[2]
		First and last correct give [1] e.g 3 x x x 2		
	(c)	(i) 14 billion years ago		[1]
		(ii) Red shift	[1]	
		Cosmic Microwave Background Radiation	[1]	[2]
		Accept CMBR		
	(d)	Distance = speed × time	[1]	
		= $3 \times 10^8 \times 3.15 \times 10^7 \times 25000$	[1]	
		= 2.36×10^{20} (m)	[1]	
= 2.36×10^{17} (km)		[1]	[4]	
	Total		14	
			100	