



*Rewarding Learning*

**General Certificate of Secondary Education  
2024**

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**Science: Physics**

Unit 2

Higher Tier

**[GPY22]**

**TUESDAY 18 JUNE, MORNING**

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**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:

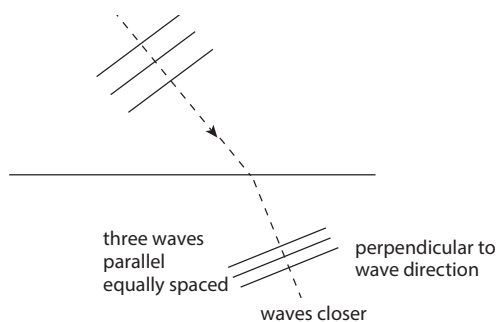
**Level A (Excellent):** The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation and spelling, punctuation 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.

- 1 (a) (i) Vibrations/oscillations [1]  
 Transverse – perpendicular to wave direction or energy flow [1]  
 Longitudinal parallel to wave direction or energy flow [1]
- (ii) Radio  
 Micro  
 Visible  
 Gamma [2] [5]  
 ½ each round down  
 All correct but in reverse order award [1]
- (b) (i) 2 s [1]
- (ii) 0.5 Hz [2]  
 ecf from (i)  
 Accept hertz but not hz
- (iii)  $v = f\lambda$  [1]  
 $= 0.5 \times 0.8$  [1]  
 $= 0.4 \text{ m/s}$  [1] [6]  
 ecf for frequency from (ii)

(c) (i)



- Three wavefronts shown parallel, [1]  
 equally spaced [1]  
 Waves are closer [1]  
 Perpendicular to refracted direction [1]  
 Deduct [1] if refraction direction is wrong

(ii) Frequency [1] [5]

AVAILABLE  
 MARKS

(d) **Indicative content**

Microwaves faster than sound

Microwave is reflected/bounced/echo

To allow the reflected wave to be detected (allow separation of pulses)

(Measure) time

The speed (of the microwave)

Distance = time × speed

Dividing by two

[6]

Response	Mark
Candidate describes in detail using good spelling, punctuation and grammar <b>5 or more</b> 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 <b>3 or 4</b> 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 <b>1 or 2 of the main points</b> 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]

AVAILABLE  
MARKS

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<b>2</b>	<b>(a) (i)</b>	Erect	[1]			
		Same size as object	[1]			
		Virtual	[1]			
		If more than three ticks deduct 1 mark				
		<b>(ii)</b>	Normal	[1]		
		<b>(iii)</b>	60°	[1]		
		<b>(iv)</b>	60° No ecf from <b>(iii)</b>	[1]	[6]	
	<b>(b)</b>	<b>(i)</b>	Ray from top of O parallel to PA through F	[1]		
			Ray from top of O through OC undeviated	[1]		
			(Threshold both rays must be correct before further credit)			
			Refracted rays traced backwards to meet on left side	[1]		
			Correct arrows shown on real rays with no arrows on virtual rays	[1]		
			Image drawn as a vertically UP arrow between intersection of rays and the PA	[1]		
				Conflicting arrows on real rays deduct [1]		
			<b>(ii)</b>	3.8 cm ≤ Height ≤ 4.2 cm	[1]	
			<b>(iii)</b>	2 {ecf with candidate's response to <b>(ii)</b> } do not accept fractions	[1]	
			<b>(iv)</b>	Magnifying glass	[1]	[8]
	<b>(c)</b>		Move lens or screen	[1]		
			Until sharp image observed on screen. Accept clear/focussed	[1]		
			Measure distance between screen and lens	[1]	[3]	
<b>(d)</b>	<b>(i)</b>	Short sight/myopia/near sight	[1]			
	<b>(ii)</b>	Lens named as diverging/concave	[1]			
	<b>(iii)</b>	Both rays diverge between correcting lens and eye	[1]			
		Both rays bend so as to converge in eye	[1]			
		Rays come together on retina (and do not go beyond)	[1]	[5]		

AVAILABLE  
MARKS

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<b>3 (a) (i)</b>	Earth pin marked and with label Fuse marked and with label	[1] [1]	
<b>(ii)</b>	Any <b>three</b> from ([1] for each): Earth wire has low resistance Large current flows in earth wire or live wire Fuse melts and fuse blows Power is switched off/breaks circuit	[3]	
<b>(iii)</b>	$P = IV$ $700 = I \times 220$ $I = 700/220 = 3.2 \text{ A}$ 5 A fuse	[1] [1] [1] [1]	[9]
<b>(b) (i)</b>	Total resistance = $3 + 6 = 9$ Current = $V/R$ $= 6/9$ $= 0.66 \text{ A}$ accept 0.6/0.67/7.0	[1] [1] [1] [1]	
<b>(ii)</b>	$V = IR$ $= 0.66 \times 6$ $= 3.9 (4)$ accept 4.0 or voltage split 3 to 6 1 to 2 so 2V to 4V ecf for current from (i)	[1] [1]	[6]
<b>(c) (i)</b>	Parallel section 2 Total resistance = $2 + 2 = 4$	[1] [1]	
<b>(ii)</b>	A1 reads $6/4$ $= 1.5 \text{ A}$ ecf for resistance from (i)	[1] [1]	
<b>(iii)</b>	$0.75 \text{ A}$ half the value in (ii) or $I = \frac{V}{R} = \frac{3}{4} = 0.75$ ecf for current from (ii)	[1]	[5]
<b>(d) (i)</b>	Adjust the variable resistor	[1]	
<b>(ii)</b>	Resistance at $1\text{V} = 1/0.02 =$ $= 50 (\Omega)$  Resistance at $4 \text{ V} = 4/0.04$ $= 100 (\Omega)$ Failure to convert to A from mA max [2]	[1] [1]  [1] [1]	
<b>(iii)</b>	Collisions between electrons and atoms or ions	[1]	[6]

AVAILABLE MARKS
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			AVAILABLE MARKS			
<b>4</b>	<b>(a) (i)</b>	Moves	[1]			
		Direction – up	[1]			
		<b>(ii)</b>	(Fleming's) left hand rule		[1]	[3]
	<b>(b) (i)</b>	A current/voltage is induced/produced/created/flows			[1]	
		<b>(ii)</b>	The pointer moves to the left then right + to – or one side to other repeatedly/continuously		[1] [1]	[3]
	<b>(c)</b>		B		[1]	
		C	[1]			
		D	[1]			
		A	[1]		[4]	
	<b>(d) (i)</b>	(Stepping up the voltage) reduces the current So less energy lost (or heat in the cables)			[1] [1]	
<b>(ii)</b>		$N_s/N_p = 125/25$ or $\frac{N_s}{N_p} = \frac{V_s}{V_p}$	[1]			
	$N_s = 500 \times 5$	[1]				
	$N_s = 2500$ (turns)	[1]	[5]			
				15		

5	(a) (i) (Light has a) longer wavelength	[1]		<table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: black; color: white;"> <th style="padding: 5px;">AVAILABLE MARKS</th> </tr> </thead> <tbody> <tr><td style="height: 600px;"></td></tr> <tr> <td style="text-align: right; padding-right: 10px;">15</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;"><b>100</b></td> </tr> </tbody> </table>	AVAILABLE MARKS		15	<b>100</b>
AVAILABLE MARKS								
15								
<b>100</b>								
	(ii) Galaxies moving away from each other or space expanding	[1]	[2]					
(b)	(i) (Nuclear) fusion	[1]						
	(ii) Main Sequence	[1]						
	↓							
	White dwarf	[1]						
	↓							
	Black dwarf	[1]						
	(iii) Our sun has smaller mass These stars have greater mass	[1]	[5]					
(c)	(i) Any <b>two</b> from: Too far away Spacecraft too slow Take too long/not in a lifetime Resources, e.g. food/water/oxygen/energy	[2]						
	(ii) Distance (threshold idea) Travelled by light in one year	[1] [1]						
	(iii) Time = distance/speed (credited elsewhere) Time = $3.8 \times 10^{16} / 3 \times 10^8$ = <b>1.267 × 10<sup>8</sup></b> (s) [2] = $1.267 \times 10^8 / 3.15 \times 10^7$ = <b>4.02</b> (years) [1] Distance = <b>4</b> (ly) (nearest whole number) [1]	[2] [1] [1]	[8]					
	<b>Or</b>							
	1 ly = speed × time = $3 \times 10^8 \times 3.15 \times 10^7$ = <b>9.45 × 10<sup>15</sup></b> (m) [2] No. of ly = $3.8 \times 10^{16} / 9.45 \times 10^{15}$ = 4.02 ly [1] Distance = <b>4</b> (ly) (nearest whole number)							

**Total**

15

**100**