Rewarding Learning

General Certificate of Secondary Education
2023

Science: Physics

Unit 2

Higher Tier

[GPY22]

FRIDAY 16 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.

1 **(a)** **(i)** wavelength = 0.2 m [1]

(ii) Frequency = 1 wave in 0.4 s or $\frac{1}{0.4}$ [1]

= 2.5 [1]

Hz or Hertz [1] [3]

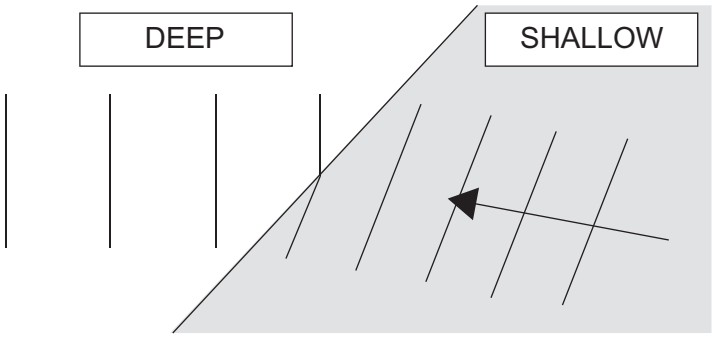
(iii) v = fλ [1]

= 2.5 × 0.2 [1]

= 0.5 (m/s) [1] [3]

Allow ecf for frequency and wavelength

(b) **(i)**



[1]

(ii) The wavelength is greater in the deep
or
Waves travel faster in deep water [1]
or the converse

(c) **(i)** Ultrasound greater than 20 kHz [1]

(ii) A is from top of the rail
B is from the crack in the rail
C is from bottom of the rail or bottom of the crack
All must be correct [1]

(iii) Distance = speed × time [1]

= 5900 × 2 × 10^{-6} [1]

Halving at any point in calculation [1]

= 5.9 × 10^{-3} or 0.0059 (m) [1] [4]

(d) Gamma X ray UV (Visible) IR Micro Radio
[$\frac{1}{2}$] each round down [3]
All correct but in reverse order award 1 mark

(e) EM waves are transverse
EM waves can pass through a vacuum
EM waves travel faster than sound waves
Any two [1] each [2]

AVAILABLE MARKS

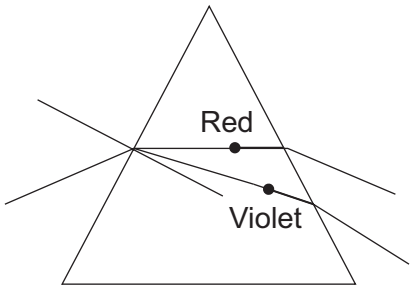
20

AVAILABLE MARKS

2 (a) (i) At entry correct refraction must be correct for any marks

Red above violet [1]

Both refracted towards the normal [1]



At exit correct refraction must be correct for any marks

Red above violet [1]

Both refracted away from the normal [1] [4]

(ii) Different colours travel at different speeds (give [1]) [1]

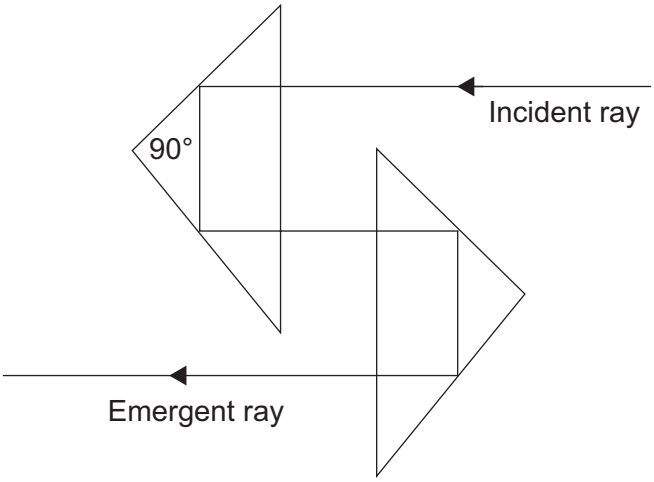
Different colours experience a **different change of speed** [1] [2]

(b) (i) Light move from glass to air or from more dense to less dense or equivalent words [1]

The angle of incidence in the glass must be greater than critical angle [1] [2]

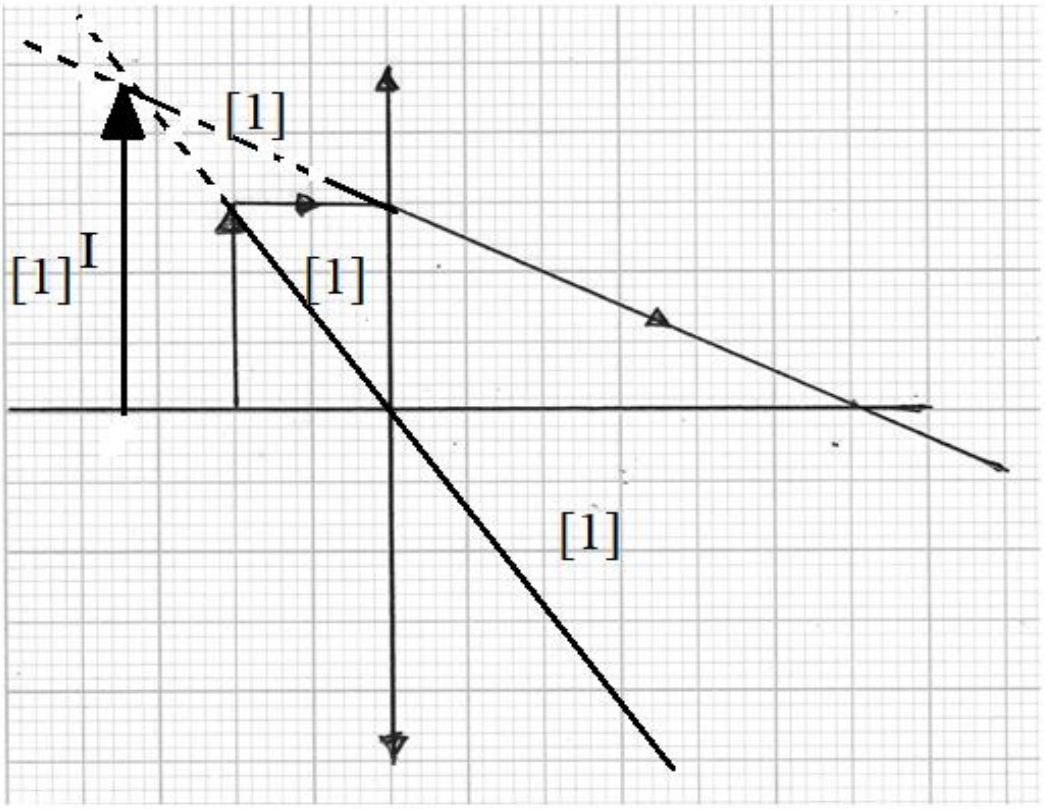
(ii) No refraction at long side of first prism [1]

Rest of diagram as shown below [1] [2]



(c) **(i)** Focus marked [1]

(ii) Ray from top of object through centre of lens [1]
Arrow on the ray (conflicting arrows give [0]) [1]
Both rays extrapolated backwards [1]
Image marked and labelled I [1] [4]



(iii) Erect, magnified, virtual [2]
Any two from three [1] each

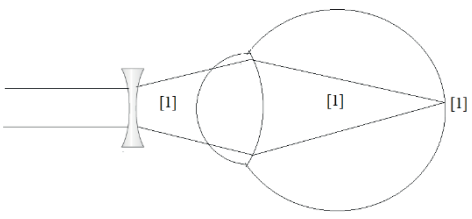
(d) **(i)** Image will be sharp on the screen [1]

(ii) Distance from lens to the screen [1]

(iii) Repeat the measurement [1]
Calculate an average value [1] [2]

(e) **(i)** Diverging lens or concave [1]

(ii) Rays diverge from lens [1]
Rays converge in the eye [1]
Rays meet on the retina [1]



[3]

25

						AVAILABLE MARKS
3	**(a)**	**(i)**	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ or $\frac{1}{R} = \frac{1}{6} + \frac{1}{3} = \frac{3}{6}$ or $\frac{6}{3} = 2$	[1]		
			$R_{total} = 2 + 8$	[1]		
			$= 10\ (\Omega)$	[1]	[3]	
		(ii)	$I = \frac{V}{R}$	[1]		
			$= \frac{9}{10}$	[1]		
			$= 0.9$ (A) Allow ecf for R for **(i)**	[1]	[3]	
		(iii)	$V = 0.9 \times 8$	[1]		
			$= 7.2$ (v) Allow ecf for I for **(ii)**	[1]	[2]	
		(iv)	For the 6 Ω the current $= \frac{1.8}{6}$	[1]		
			Allow ecf for I	[1]	[2]	
	(b)	**(i)**	Anomalous measurement 1.35 Ω		[1]	
		(ii)	Length affects resistance or fair test		[1]	
		(iii)	The resistance decreases as the area increases or product R × A is a constant		[1]	
		(iv)	$K = RA$	[1]		
			$= 0.4 \times 4$ or 1.6×1	[1]		
			$= 1.6$	[1]		
			Ohm × mm^2 or Ω mm^2	[1]	[4]	
			Deduct 1 mark if anomalous result used			
	(c)	**(i)**	$P = IV$ or $I = \frac{P}{V}$	[1]		
			$I = \frac{1800}{240}$	[1]		
			$= 7.5$ (A)	[1]		
			Fuse needed is 13 A	[1]	[4]	
		(ii)	No kWh = 1.8 × 2 = 3.6	[1]		
			Cost = 3.6 × 19	[1]		
			= 68.4 p	[1]	[3]	24

AVAILABLE MARKS

4 (a) Indicative Points

EM Induction	current/voltage created in a conductor by changing magnetic field Each one of the above counts as 1 point
Soft iron core	links the two coils magnetically or strengthens the magnetic field or strengthens the induced current/voltage Only one of the above counts as 1 point
Switch is closed and left closed	pointer on meter deflects then returns to zero Each one of the above counts as 1 point
Switch is re-opened	pointer deflects in opposite direction
Device	Transformer

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) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$ [1]

$\frac{2300}{Ns} = \frac{230}{5}$ [1]

Ns = 50 (turns) [1] [3]

(ii) a.c. reverses direction (periodically, continuously, repeatedly, regularly) [1]

d.c. flows in one/same direction only [1] [2]

(c) (i) Magnetic field direction N → S [1]

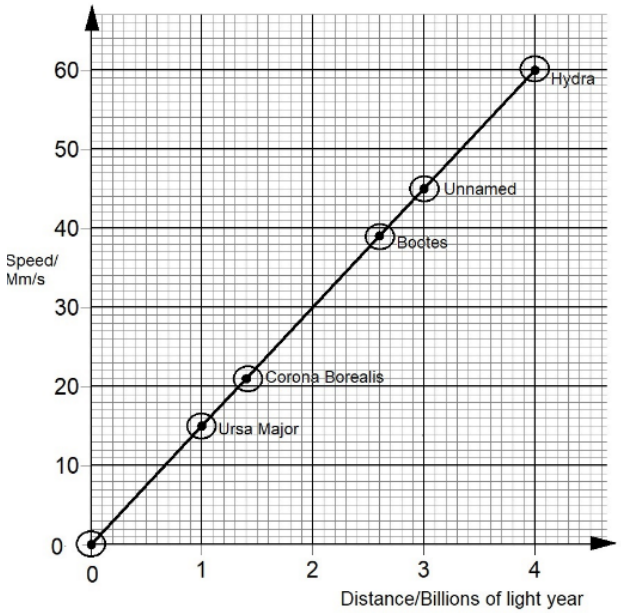
(ii) Side AB Down [1]

Side CD UP [1] [2]

(iii) Coil turns/rotates [1]

15

						AVAILABLE MARKS
5	**(a)**	**(i)**	The distance	[1]		
			Light travels in one year	[1]	[2]	
		(ii)	Time = $\frac{\text{distance}}{\text{speed}}$ or equivalent	[1]		
			= $\frac{4320 \times 10^6 \times 10^3}{3 \times 10^8} = \frac{4320 \times 10^9}{3 \times 10^8}$	[2]		
			= 14 400 s	[1]		
			= 4 hours	[1]	[5]	
	(b)	**(i)**	(A galaxy) is a collection of stars		[1]	
		(ii)	Red Shift		[1]	
	(c)	**(i)**	Five points plotted ± one 2 mm square	[2]		
			[$\frac{1}{2}$] each round down			
			Best fit straight line	[1]	[3]	



		(ii)	Ho = $\frac{v}{d} = \frac{60}{4}$	[1]		
			= 15	[1]	[2]	
	(d)		Main Sequence	[1]		
			White Dwarf	[1]	[2]	16
			Must be in the correct box			
					Total	**100**