Rewarding Learning

General Certificate of Secondary Education
2025

Science: Physics

Unit 2

Higher Tier

[GPY22]

MONDAY 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.

Where one response is required to gain a mark, candidates will not gain credit if a correct response is given alongside one or more incorrect responses. This is referred to as listing.

AVAILABLE MARKS

1 **(a)** **(i)** 5000 [1]
waves or vibrations or oscillations [1]
(take place) every second [1]

(ii) Half the amplitude = one square [1]
Half the frequency = one complete wave [1]

(iii) In a transverse wave vibrations/oscillations are perpendicular to direction of travel/energy flow [1]
In a longitudinal vibrations/oscillations are parallel to direction of travel/energy flow [1] [7]

(b) **(i)** (Wavelength =) 3 (cm) [1]

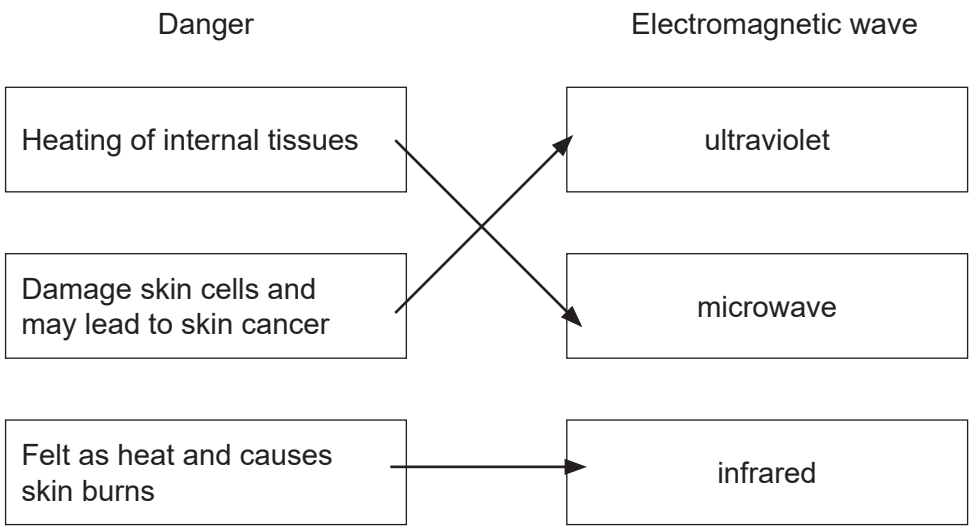
(ii) Frequency = $\frac{v}{\lambda}$ [1]
= $\frac{21}{3}$ [1]
= 7(Hz) ecf from **(i)** [1]

(iii) Speed – decreases [1]
Frequency – same [1]
Wavelength – decreases [1]

(iv) Region X
The wavelength or speed is greater in (deep water) [1] [8]

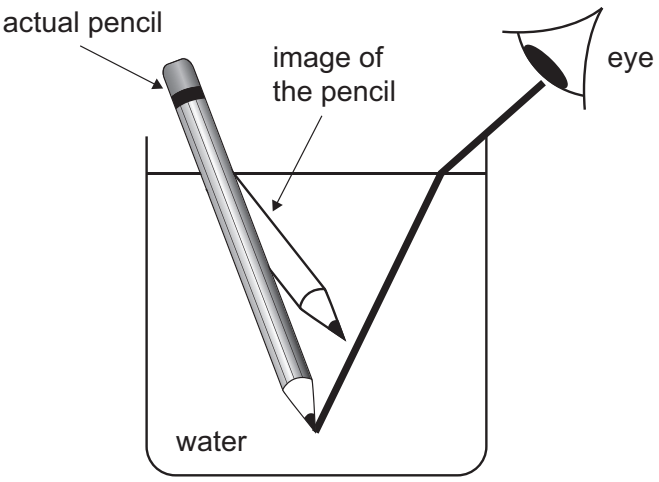
(c) **(i)** X rays
ultraviolet
microwaves
radio waves $\frac{1}{2}$ each round down [2]

(ii)



[2]

19

					AVAILABLE MARKS
2	**(a)**	**(i)**	Image 1 clearly labelled at correct position (threshold) [1] 1 ray correctly extended back to image [1] 2nd ray correctly extended back to image [1]		
		(ii)	Image is turned from right to left or vice versa [1]	[4]	
	(b)	**(i)**	 Straight line from tip of pencil to water surface [1] Ray refracted away from normal to the eye – must be able to be extended back to tip of image of pencil [1]		
		(ii)	Light travels faster in air than in water **or** Refraction of light as it travels from water to air [1]	[3]	
	(c)	**(i)**	Focus identified with the letter F 4 cm from lens (either side) [1]		
		(ii)	Ray parallel to principal axis refracted through F [1] Ray through optical centre un-deviated [1] Arrow on at least one ray [1] Rays shown traced back to point of convergence [1] **I** drawn in and labelled [1]		
		(iii)	Virtual [1] Upright [1] Magnified [1] Formed on same side as object (further from screen)		
		(iv)	Magnifying glass/simple microscope [1]	[10]	
	(d)	**(i)**	Rays converge inside the eye [1] meet/would meet behind retina to right [1]		
		(ii)	Converging (convex) [1]		
		(iii)	Rays less divergent from lens to eye [1] Rays converge in the eye [1] And meet on the retina [1]	[6]	

					AVAILABLE MARKS
(e)	**(i)**	Total internal reflection [1]			
	(ii)	Greater than the critical angle [1]			
	(iii)	(Applications of total internal reflection) endoscope, borescope, broadband [1]	[3]		26

AVAILABLE MARKS

3 **(a)** **(i)** Electron flow [1]

(ii) Q = It **or** charge = current × time [1]
= 0.5 × 20 [1]
= 10 (C) [1]

(iii) 1.5(V) [1] [5]

(b) **(i)** Parallel section = $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

or

$R = \frac{R_1 R_2}{R_1 + R_2}$ [1]

R = 4Ω [1]

Total resistance = 12.0(Ω) [1]

(ii) $I = \frac{V}{R}$ [1]

$= \frac{6}{12}$ ecf for resistance from **(i)** [1]

= 0.5(A) [1]

(iii) V = 4 × 0.5 **or** $\frac{1}{3}$ of 6 [1]

= 2.0(V) [1] [8]

ecf for I from **(ii)**

(c) Live, neutral, earth (all three required) [1]
Earth wire [1]
Earth provides a low resistance [1]
Large current flows [1]
Fuse blows or melts [1]
Appliance disconnected from mains [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]

						AVAILABLE MARKS
	(d)	**(i)**	$P = IV$ **or** $I = \frac{P}{V}$	[1]		
			$\frac{72}{6}$	[1]		
			12(A)	[1]		
		(ii)	$I = \frac{V}{R}$ **or** $R = \frac{V^2}{P}$ **or** $R = \frac{P}{I^2}$	[1]		
			$12 = \frac{6}{R}$ **or** $R = \frac{6}{12}$ $= \frac{6^2}{72}$ $= \frac{72}{12^2}$	[1]		
			R = 0.5(Ω) ecf from **(i)** = 0.5(Ω) = 0.5(Ω)	[1]		
		(iii)	0.5Ω needs $\frac{1}{10}$ of 100cm = 10cm ecf for R from **(ii)**	[1]	[7]	26
4	**(a)**	**(i)**	Top is S bottom is N	[1]		
		(ii)	Increase current	[1]		
			Increase number of turns	[1]		
			Insert soft iron core	[1]	[4]	
	(b)	**(i)**	To link the coils magnetically **or** to ensure the magnetic field passes through both coils	[1]		
		(ii)	Primary turns greater than secondary turns **or** converse	[1]		
		(iii)	Turns ratio $\frac{Ns}{Np} = \frac{Vs}{Vp}$ **or** equivalent	[1]		
			$\frac{Ns}{600} = \frac{6}{240}$	[1]		
			Ns = 15	[1]		
		(iv)	Part 2 = a.c.			
			Part 3 = a.c.	[2]	[7]	
	(c)	**(i)**	Fleming's left-hand rule	[1]		
		(ii)	Downwards	[1]	[2]	13

						AVAILABLE MARKS
5	**(a)**	**(i)**	14 billion years (accept 13.8 billion years)	[1]		
		(ii)	Red shift	[1]		
		(iii)	Space is expanding **or** galaxies are moving apart	[1]	[3]	
	(b)		hydrogen and helium Fusion	[2] [1]	[3]	
	(c)	**(i)**	A = Protostar **or** Nebula B = Red giant C = Black dwarf D = Supernova E = Neutron star $\frac{1}{2}$ each round up	[3]		
		(ii)	Gravity Thermal expansion/radiation pressure Correct directions for both forces	[1] [1] [1]		
		(iii)	The distance (threshold) light travels in a year	[1] [1]		
		(iv)	Distance = $3 \times 10^5 \times 4.4 \times 3.15 \times 10^7$ $= 4.16 \times 10^{13}$(km)	[1] [1]	[10]	16
					Total	**100**