



Rewarding Learning

**General Certificate of Secondary Education
2017**

Science: Physics

Unit 2

Higher Tier

[GPH22]

FRIDAY 23 JUNE, MORNING

**MARK
SCHEME**

General Marking Instructions and Mark Grids

Introduction

Mark schemes are intended to ensure that the GCSE examination is 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 that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

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, the examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of 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

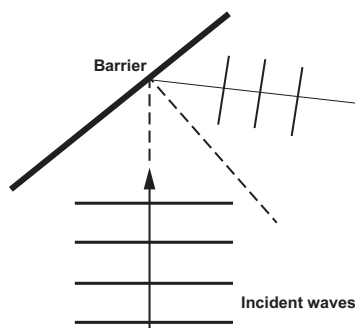
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme

Mark Schemes for 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.

- 1 (a) (i) [Number of (440)] waves pass/produced per second [1]
- (ii) $\lambda = v/f$ or equivalent, e.g. $v = f \lambda$ [1]
 $= 330/440$ [1]
 $= 0.75$ (m) or $\frac{3}{4}$ [1] [3]
- (b) (i) It is also **longitudinal** [1]
- (ii) Its frequency is greater than 20 kHz or equivalent [1]
- (iii) They measure the **time** it takes or for the **reflection** [1]
the distance is then determined [1] [2]
- (c) (i) The angle of reflection equal to the angle of incidence [1]
The wavelength/spacing of waves of reflected same as incident [1]
At least three waves shown [1] [3]



- (ii) Two, 2 [1]
- (d) (i) Sound waves travel too slowly or slower/EM waves travel much faster [1]
- (ii) Distance = $\frac{1}{2}$ (speed \times time) or distance = speed \times time [1]
 $= \frac{1}{2} \times 300\,000 \times 0.001$ [2]
 $= 150$ (km) [1] [4]
Failure to convert milliseconds to seconds max [3]
Failure to halve max [3]/[4]

AVAILABLE
MARKS

(e) Indicative content:

1. They are transverse waves
2. They can travel through a vacuum
3. They travel at the same speed
4. Short wavelength to long wavelength gamma, ultraviolet, infrared or γ , uv, i.r
5. Ultraviolet – **skin** cancer, sunburn, conjunctivitis, cataracts
6. Infrared – **burns**, damages eyes **NOT sunburn**
7. Gamma rays – cell damage/cancer/or kills cells/causes mutation

} Any two from here

Response	Mark
Candidates describe 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]
Candidates describe 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 describe in detail using good spelling, punctuation and grammar one or two of the points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[1]–[2]
Response not worthy of credit.	[0]

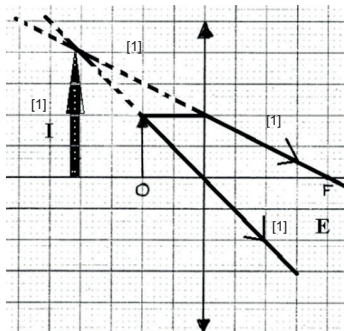
[6]

AVAILABLE
MARKS

23

- 3 (a) (i) parallel [1]
(ii) thicker, wider, fatter, bigger [1]
(iii) inverted, upside down **NOT INVERSE** [1] [3]

(b) (i)



Ray from top of object parallel to PA refracts through F [1]
Ray through OC continues without refraction [1]

Rays traced backwards until they meet [need not be dashed] [1]

Image marked [1] [4]

(ii) Arrows on **real** rays shown left to right, but allow L to R arrows on constant lines [1]
(at least one arrow, no contradictions)

(iii) Upward arrow on image to show it is erect, conflicting arrows even on constant lines gets [0] [1]

(iv) 4.0 ± 0.4 (cm) [1]

(v) **Letter E** on right side of lens [1]

(vi) $M = (4 \pm 0.4)/2$ $M = 2 \pm 0.2$ ignore unit [2]
[1]

(vii) Magnifying glass [1]
(simple microscope)

(c) **Indicative content**

1. Move lens to left/away from screen or closer to tree/object
2. Until image (of distant object on screen) is sharp/focussed/clear
3. & 4. Image is inverted (upside down)/laterally inverted/smaller (diminished) than object (any **two** properties)
5. Measure distance between screen and lens
6. **Repeat** and **average** or until distance is constant/consistent

Response	Mark
Candidates describe 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]
Candidates describe 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 describe in detail using good spelling, punctuation and grammar one or two of the points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[1]–[2]
Response not worthy of credit	[0]

[6]

AVAILABLE MARKS

20

- 4 (a) (i) Box X +, Box Y – **both required,** [1]
- (ii) Box Z – arrow vertically upwards, INSIDE BOX essential [1]
- (iii) Coulomb(s) **spelling** must be correct [1]
- (iv) $Q = It$ or equivalent [1]
 ($Q =$) 0.16×60 sight of this gets an immediate 2 marks [1]
 $Q = 9.6$ (C) or 9600 mC [1] [3]
- (v) No. of electrons = total charge/charge on 1 electron [1]
or
 No. of electrons = $9.6/1.6 \times 10^{-19}$ **no ecf from (iv)**
 $= 6 \times 10^{19}$ [1] [2]
- (b) 45, 40, 15, 10 [4]
- (c) (i) Record readings/read V and I, read voltage and current, read volts and amps on voltmeter (V) and ammeter (I) [1]
 Calculate resistance **or** $R = V/I$ **or**
 plot V–I graph **or** gradient of V–I graph **or** I–V graph and find 1/gradient [1]
 (Adjust rheostat,) repeat and average [1] [3]
- (ii) Resistance increases when csa decreases (or vice versa) [1]
or
 (Ratio) $\frac{R}{\text{csa}}$ is not constant **or** using numbers **or** doubling one doesn't double the other
- (iii) $\frac{1}{\text{csa}}$ **or** reciprocal of csa **or** equivalent [1]
- (iv) 6 [1]
 Ωcm^2 **or** $\text{cm}^2 \Omega$ [1]
- (v) 2.4 ecf from (iv) [1]

AVAILABLE
MARKS

20

- 5 (a) 2 (parallel) lines joining switches [1]
 RH switch lines to lower terminal (RH switch down) [1] [2]
- (b) (i) Neutral, Live, (NOT ground) Earth and Fuse must be words [2]
 $\left[\frac{1}{2}\right]$ each round **down**
 Lower left – clockwise
- (ii) To prevent damage to equipment **or** break or disconnect
 circuit **or** blow/**melt** if too much **current or** prevent fire/
 overheating [1]
 To protect (user) from electric shock/provide low resistance
 path **or** take current to ground/earth **or** take current **safely** away [1] [2]
- (iii) All metal parts or components enclosed in plastic or outer
 casing of appliance is made from an insulating material [1]
 User cannot get a shock from it (so no earth wire required)
 or user cannot touch any live part [1] [2]
- (c) Cost = Power in kW × Unit Cost × Time in Hours [1]
 Cost = 3 × 15 × 2 [1]
 Cost = 90(p) [1] [3]
- (d) A – AC Generator B – Step-up transformer
 C – Transmission lines D – Step-down transformer
 $\left[\frac{1}{2}\right]$ each round down [2]
- (e) (i) Coil must be rotated/turned/spun NOT moved [1]
- (ii) Spin the coil **faster or** Larger number of turns NOT stronger
 magnet, iron core or more wire/area [1]
- (iii) Graph B [1]
- (f) $N_p/N_s = V_p/V_s$ **or** equivalent [1]
or $\frac{2000}{32000} = \frac{25000}{V_s}$ **or** $2000/32000 = 25/V_s$
or $V_s = 25 \times 32000/2000$ [1]
 $= 400$ (kV) or 400 000 V [1] [3]
- Sight of $\frac{16}{1}$ or $\frac{1}{16}$ give [1] if no further

AVAILABLE
MARKS

19

			AVAILABLE MARKS
6	(a) (i)	(Nuclear) Fusion (spelling for fusion must be correct) [1]	15
		Fusion of hydrogen nuclei or light nuclei joining to giving heavier nucleus or $H + H \rightarrow He$ [1]	
		accept smaller nuclei to larger	
	(ii)	A gravity [1]	
		B radiation pressure or gas pressure or radiation force [1]	
	(iii)	Equal (and opposite)/balanced/in equilibrium/cancel each other [1] [5]	
	(b)	A large gathering or cloud of gas and dust or hydrogen and dust (in space) [1]	
	(c) (i)	There are many more asteroids or large number of asteroids [1]	
		or their positions may not be known exactly or random motion or unpredictable orbits or hard to track [1] [2]	
		(so collision could occur)	
		(ii) Time = Distance/speed or equivalent [1]	
		= $7.5 \times 10^9 / 3 \times 10^5$ [1]	
		= 25 000 (seconds) [1]	
		= 6.9 (hours) or 6.94 or 7 [1] [4]	
(d)	The plates move (against each other)/collide/rub [1]		
	sometimes stick /catch [1]		
	sudden release /jolt/lurch/jerk [1] [3]		
Total			115