Rewarding Learning

General Certificate of Secondary Education
2018

Science: Physics

Unit 2

Higher Tier

[GPH22]

FRIDAY 22 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.

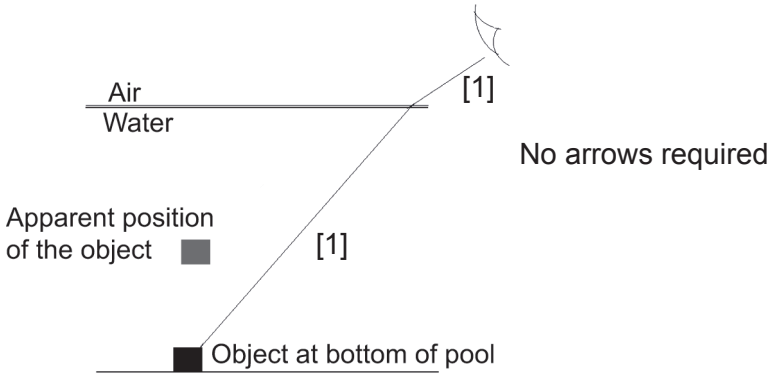
					AVAILABLE MARKS
1	(a)	(i)	Longitudinal – **oscillations or vibrations parallel** (to wave/energy transfer direction) [1] Transverse – **oscillations or vibrations perpendicular** (to wave/energy transfer direction) [1]	[2]	
		(ii)	Transverse – any em wave or water wave/S waves [1] Longitudinal – sound/ultrasound/P waves [1]	[2]	
	(b)	(i)	Wavelength correctly labelled between two crests/troughs	[1]	
		(ii)	Amplitude correctly labelled peak to axis or trough to axis	[1]	
	(c)	(i)	Period T identified as 0.25 s [1] Frequency = $\frac{1}{T}$ [1] $= \frac{1}{0.25}$ = 4 [1] Hz or hz – free standing mark [1]	[4]	
		(ii)	v = fλ [1] = 4 × 25 allow ecf for frequency from **(i)** [1] wrong physics [0] = 100 or 1 [1] cm/s m/s [1] The unit must be consistent with the wavelength unit	[4]	
	(d)	(i)	From left to right X-rays Ultraviolet Infrared Radio [$\frac{1}{2}$] each round down	[2]	
		(ii)	Wavelength or λ	[1]	
	(e)	(i)	<u>Three waves so that angle of incidence = angle of reflection</u> – threshold mark [1] same wavelength as incident waves [1]	[2]	
		(ii)	<u>Refracted towards the normal</u> – threshold mark [1] Three waves parallel to each other [1] smaller and equal and perpendicular to direction wavelength than incident waves [1]	[3]	22

*Threshold mark means the response must be correct before any further credit can be given.

AVAILABLE MARKS

2 **(a)** Ray 2 – threshold mark [1]
Angles incidence and reflection not equal or i < r or r > i
or Ray 2 appears not to come from image position [1] [2]

(b) **(i)** Ray bent away from the normal at the surface [1]
Refracted ray appears to come from apparent position of the object [1] [2]



(ii) The ray passes without deviation/no bending/no refraction/ same/no direction change/same direction/nothing/follows the normal [1]

(iii) Ray refracted away from the normal to the right of normal [1]
(Weak) reflected ray in glass so that i = r (by eye) [1] [2]

(iv) Refracted ray travels along the air–glass boundary or angle of refraction equals 90° [1]
Weak reflected inside the glass so that angle of reflection equals the critical angle or 42° [1] [2]

(v) The ray is totally reflected into the glass
or total internal reflection occurs or all of the light is reflected into the glass or TIR [2]

(c) **(i)** Both arrows on the rays to the right [1]
Contradiction arrows [0]

(ii) Ray through the centre of lens extended back to top of image [1]
Ray through the focus extended back parallel to principal axis [1]
Top of object marked at the intersection of rays as O or ↑ [1] [3]

(iii) E marked to the right [1]

(iv) Rays do not pass through it/only appear to pass through it [1]

*Threshold mark means the response must be correct before any further credit can be given.

					AVAILABLE MARKS
(d)	**(i)**	The object is not at infinity or not distant or rays entering the lens are not parallel/rays are diverging object close give [0]		[1]	
	(ii)	At least three ratios calculated, e.g. $\frac{10}{10} = 1$ $\frac{15}{7.5} = 2$ $\frac{20}{6.7} = 3$ min of two	[1]		
		Ratio of $\frac{u}{v}$ not constant	[1]	[2]	
	(iii)	It equals the focal length (of the lens) or distance from lens to the focus		[1]	
	(iv)	Infinity or 200 cm plus Far beyond 100 cm		[1]	22

AVAILABLE MARKS

3 (a) (i) Electron flow (clockwise) and conventional current anticlockwise
Both must be correct and must be labelled. [1]

(ii) Charge = 0.5 × 60 = **30** Do not apply XP rule [1]
coulombs (in words) [1] [2]

(iii) $I = \frac{P}{V}$ [1]

$= \frac{55}{12}$ [1]

= 4.6 (A) or 4.58 Rounding to 5A is worth [2] [1] [3]

(b) (i) Parallel section $\frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$ **R = 4** – sight of [1]

Total = 5 + 4 = 9 (Ω) [1] [2]

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

$I = \frac{1}{4}$ [1]

= 0.25 (A) [1] [3]

(c) Indicative content

Name and colour of the three wires
Colour and name linked
Earth – green and yellow
Live – brown (red)
Neutral – blue (black)
Red and black [0]

All three must be correct give [2]
Two correct give [1]
1 correct give [0]

Role of the earth wire ([1] each)
If the live wire should touch the metal body
The earth wire provides a (low resistance) path for the current/conducts current to earth
This protects the user from (electric) shock or electrocution

Role of the fuse ([1] each)
Voltage [0]
If the current becomes too great the fuse melts/blows/breaks NOT shorts
The circuit is broken
The appliance is protected (from damage or overheating)/wiring from damage)

Response	Mark
Candidates describe in detail using good SPG **at least 5 points**. 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 SPG **at least 3 points**. The form and style are of a high standard and specialist terms are used appropriately on some occasions.	[3]–[4]
Candidates make some reference to one of the points using good SPG. The form and style are of a satisfactory standard but there is limited use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

AVAILABLE MARKS

(d) **(i)** They need swapped or ammeter in series (with cell) **and** voltmeter is parallel (with the wire) [1]
Turned around or reversed give [0]

(ii) To allow the current to flow for a short time/in between readings or for a few secs/turn off between readings/after each expt [1]

(iii) Straighten it or attach it to a metre rule [1]
Remove kinks

(iv) Put the lengths in (increasing) order/(decreasing) order [1]

(v) Units are missing or **all** named units V, A, Ω [1] 22

4 **(a)** **(i)** Electromagnetic induction/EM induction [1]
Mutual induction [0]

(ii) Pointer momentarily moves (left or right) or moves and returns to 0 [1]
No deflection/stays at zero/nothing/none [1]
Pointer (momentarily) deflects in opposite direction (to action 1) [1]
Pointer (momentarily) deflects in same direction as action 3 or opposite direction to action 1 [1] [4]

(iii) Move the magnet **in and out** of coil or move the coil or rotate the magnet (close to the coil) in the coil [0] [1]

(b) **(i)** Increase (the strength) of the magnetic field/stronger magnet make magnetic field larger/bigger [1]

(ii) Turns ratio stated [1]

$\frac{Vs}{Vp} = \frac{30\,000}{12} = 2500$ [1]

$Ns = 200 \times 2500$ [1]

$= 500\,000$ (turns) [1] [4]

(iii) (Power in = power out) $12 \times 2.5 = 30\,000 \times I$ [1]

$I = \frac{2.5}{2500}$ [1]

$I = 0.001$ (A) [1] [2]

				AVAILABLE MARKS
(c)	**(i)**	Left to right Step up Step down	[1]	
	(ii)	Left to right High Low	[1]	
	(iii)	(High voltage) reduces the current [1] this reduces energy losses (in the cables) [1]	[2]	
(d)	**(i)**	Upward arrow on or near the flexible arrow	[1]	
	(ii)	The wires moves up and down/force is up and down [1] because current is reversing direction [1] vibrates give [0] alternating magnetic fields give [0]	[2]	20
5 **(a)**	**(i)**	Red shift Doppler effect give [0]	[1]	
	(ii)	It (the galaxy) is moving away space expanding [0]	[1]	
	(iii)	The Big Bang	[1]	
	(iv)	12–15 BILLION years ago 12 000–15 000 million years ago	[1]	
	(v)	The existence of Cosmic Microwave (if omitted [0]) Background Radiation CMBR give [1] – correct order	[2]	
	(vi)	Gravity [1] Stops the Universe expanding [1] Pulling the galaxies together/collapses/to a singularity [1]	[3]	

(b) A collection or cloud of gas (and dust) or hydrogen
Nebula collapses
at centre temperature or pressure increases or density increases
The planets orbit (the Sun) in same direction
The planets lie in the same plane
Accretion is due to gravity

Response	Mark
Candidates describe in detail using good SPG **at least 5 points**. 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 SPG **at least 3 points**. The form and style are of a high standard and specialist terms are used appropriately on some occasions.	[3]–[4]
Candidates make some reference to one of the points using good SPG. The form and style are of a satisfactory standard but there is limited use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6] 15

						AVAILABLE MARKS
6	(a)	(i)	1. Crust	[1]		
			2. Mantle	[1]		
			3. Outer Core	[1]		
			4. Inner Core	[1]	[4]	
		(ii)	Crust and Inner Core – any order		[2]	
		(iii)	Iron Nickel – any order		[2]	
	(b)		Plates move/slide/rub against/meet	[1]		
			Plates stick	[1]		
			Plates lurch/jolt/jerk/sudden movement	[1]	[3]	
	(c)		Oceanic plate moves subducts/submerges below continental plate	[1]		
			Friction melts rocks/magma forms due to friction	[1]		
			Molten rock/magma / lava flows / rises out through gaps	[1]	[3]	14
					Total	**115**