Rewarding Learning

General Certificate of Secondary Education
2013

Physics

Unit 2

Higher Tier

[GPH22]

MONDAY 24 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 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)	Frequency = 15/60 = 0.25	[1]		
			Hz (no alternative)	[1]	[2]	
		(ii)	v = f λ (or equivalent) or v = 0.25 × 8	[1]		
			= 2 (m/s)	[1]	[2]	
			Allow e.c.f. from **(i)** for frequency			
			Use of speed = distance/time give [0]			
	(b)	(i)	Dotted line from barrier with i = r along diagonal	[1]		
			Must be to **right** of barrier			
			3 (or more) reflected waves crossing this dotted line	[1]		
			all normal to dotted line (along diagonal)	[1]		
			Reflected and incident wavelengths equal	[1]	[4]	
		(ii)	Wavelength marked		[1]	
		(iii)	Frequency Unchanged	[1]		
			Speed Unchanged	[1]		
			Wavelength Unchanged	[1]	[3]	
	(c)	(i)	Values 0.6, 1.3, 1.7, 2.4, 3.0 (ms) At least 4 correct		[1]	
		(ii)	Any suitable values, e.g. 1.0/0.003	[1]		
			= 333 (m/s)	[1]		
			Convert ms → s	[1]	[3]	
		(iii)	Points plotted, using their values (+/–1 division)	[2]		
			If maximum of two points incorrect give [1]			
			Best fit **straight** line/curve – ignore not passing 0,0	[1]	[3]	
		(iv)	0.48 to 0.52 (m) No e.c.f. from graph in **(iii)**		[1]	20

						AVAILABLE MARKS
2	(a)	(i)	Ray entering glass bent towards normal	[1]		
			Reflected ray at mirror so that i = r	[1]		
			Ray entering air bent away from normal and parallel to reflected ray. Judge by eye.	[1]	[3]	
		(ii)	Light from glass (water) to air/more dense into a less dense **or** from low speed material to higher speed material	[1]		
			Angle of incidence greater than **critical** angle	[1]	[2]	
		(iii)	Refracted ray bent away from normal (even along boundary)	[1]		
			But only 1 ray must be refracted			
			Reflected ray i = r with no refraction	[1]	[2]	
		(iv)	TIR at the sloped sides × 2, both required at right angles	[1]		
			Reflected ray back to headlamp and parallel to incident	[1]	[2]	
	(b)	(i)	F marked on RHS 3 cm from lens		[1]	
		(ii)	Ray from top of O undeviated through centre of lens	[1]		
			Ray from top of O parallel to Pr axis passes through F then	[1]		
			rays extrapolated back until they meet, intersection marked I/image	[1]	[3]	
			Not meeting [0]			
		(iii)	Arrows left to right (both needed)		[1]	
			Conflicting arrows [0] incl. extrapolated rays			
		(iv)	Virtual	[1]		
			Light only appears to pass through it/cannot be formed on a screen/light rays only appear to meet	[1]	[2]	
		(v)	E to the right of lens or 		[1]	
	(c)	(i)	Magnification = $\frac{\text{image distance}}{\text{object distance}} = \frac{\text{distance I from lens}}{\text{distance O from lens}}$			
			Calculations such as $\frac{100}{25} = 4$ and $\frac{60}{30} = 2$	[1]	[2]	
			At least two calculations required			
			also accept any mathematical form that is correct – squaring or inverse	[1]		
		(ii)	Becomes diminished/smaller		[1]	20
			Magnification < 1 give [0]			

						AVAILABLE MARKS
3	(a)	(i)	Switch in series	[1]		
			Ammeter in series	[1]		
			Voltmeter in parallel with box	[1]		
			Variable resistor in series with power supply	[1]	[4]	
			Correct symbols required for full marks			
			If not all correct symbols give maximum [2]/[4]			
		(ii)	Value of current read from graph = 0.62 A			
			Look for evidence on graph if that is only work shown	[1]		
			R = 5/0.62 = 8.1 (Ω) Accept 8.0, 8.06 or 8.1	[1]	[2]	
		(iii)	Not proportional	[1]		
			Graph is not a straight line (passing through 0,0)			
			or I does not double when V doubles			
			or graph is a curve/not increasing at same rate	[1]	[2]	
		(iv)	No	[1]		
			Gradient changes **or** at least two values of resistance calculated	[1]	[2]	
			Resistance increases give [0] unless supported with calculations			
		(v)	(Filament) bulb/lamp		[1]	
	(b)	(i)	Parallel resistors 1/R = 1/8 + 1/6 = 7/24 [1] **or** $\frac{8 \times 6}{8 + 6}$	[1]		
			R = 3.4 (Ω)	[1]		
			Total R = 3.4 + 3 = 6.4 (Ω)	[1]	[3]	
			No e.c.f. within a part			
			$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R}$ [0] – must be substitutions			
		(ii)	I = V/R = 12/6.4 = 1.88 (1.9) (A) Allow e.c.f. for R from **(i)**		[2]	
	(c)		**Electrons** are transferred from jacket to comb			
			Negative charge on comb repels electrons in the paper			
			Paper nearer the comb is now positive			
			Opposite/unlike charges then attract		[4]	20

AVAILABLE MARKS

4 (a) Indicative content

1. A momentary deflection when magnet moved in
2. No deflection when magnet stationary
3. A momentary deflection when magnet moved out
4. When moved out deflection is larger
5. Direction is opposite

Response	Marks
Candidates describe in detail using good spelling, punctuation and grammar **all the main points** shown above and the precaution is clearly stated. The form and style is 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 points** shown above. The form and style is of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to **one or two of the main points** shown above using satisfactory spelling, punctuation and grammar. The form and style is of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response is not worthy of credit.	[0]

[6]

(b) (i) 6 (V) input to 100 turn coil [1]
24 (V) output from the 400 turn coil [1] [2]

(ii) Both a.c. ticked [1] each [2]

(iii) Current is reduced [1]
– resistance reduced give [0]
so there is reduced energy losses (in the cables) [1] [2]

(c) (i) Thumb = motion/force [1]
First finger = magnetic **field** direction or **N** → **S** [1]
Second finger = current [1] [3]

(ii) Up [1]

(iii) It would reverse direction repeatedly
or increase and decrease in magnitude repeatedly
or vibrate up and down repeatedly
or vibrate [1]
Change give [0]

(d) (i) Adjust the variable resistor/change the resistance of variable resistor [1]
change R [0]

(ii) Top is North and bottom is South [1]
go → 0 give [0]
linking not a conductor with weakened magnetic field [0]

(iii) It would reduce [1]
It goes to zero give [0]
Linking wood with insulator or is not a conductor give [0]

20

					AVAILABLE MARKS
5	**(a)**	**(i)**	Hydrogen and helium *both needed*	[1]	
		(ii)	(Nuclear) fusion – *exact spelling*	[1]	
		(iii)	Gravity and gas or radiation pressure *both needed* outward pressure/radiation [0]	[1]	
	(b)		1. Gas and dust cloud shrinks 2. This is due to gravity 3. It heats up or fusion occurs 4. Eventually hot enough for a star to shine 5. Small clumps form the planets } any 3 of 5 for [3]		
			Evidence – all planets lie in same plane **or** orbit the Sun in the same direction **or** rocky planets close and gas planets further away	[4]	
	(c)	**(i)**	(Cosmic) **Microwave background or** CMBR **or** 3 cm background	[1]	
		(ii)	Afterglow/echo/ remnant/residual/leftover energy from Big Bang Big Bang without qualification [0]	[1]	
	(d)	**(i)**	The light from the galaxy is shifted to longer wavelengths **or** is red shifted	[1]	
		(ii)	The **more distant** the galaxy the **greater the velocity** Velocity proportional to distance give [1] Their velocity is increasing give [0]	[2]	
		(iii)	Velocity = 25 × 670 [1] = 16 750 (km/s) [1]	[2]	
	(e)	**(i)**	Big Freeze – upward curve [1] Big Crunch – closed loop [1]	[2]	
		(ii)	The galaxies continue to move apart (forever) **or** Universe/Space continues to expand [1] Temperature of the Universe falls [1] Any mention of planets moving apart give [0]	[2]	
		(iii)	Gravity [1] pulls the galaxies back/stops Space/Universe expanding Universe collapses on itself, collapses to singularity [1] Planets getting closer [0]	[2]	20

AVAILABLE MARKS

6 (a) (i)

A	Crust [1]	Solid [1]	
B	Mantle [1]	Any one of: Solid (can flow) Liquid Semi-solid Semi-liquid Solid/liquid [1]	
C			
D		Solid [1]	Nickel/iron [1]

[6]

(ii) The (**crust** of the) Earth is made up of **plates** [1]

(iii) The plates are moving (slowly) [1]
Some parts of the plates stick [1]
then move suddenly essential [1] [3]

(iv) **Friction** between moving plates [1]
produces heat [1]
melts rock – makes magma [1] [3]

Alternative answer:
plates move apart [1]
magma/lava fills the gaps [1]
this comes from deep in Earth [1]
or as a result of friction heating/melting rocks

(b) Continents are on plates **or** Earth made up of plates [1]
These plates have moved [1] [2]
Continental Drift without more detail give [1]

Alternative answer:
Convection currents in the mantle [1]
cause plates to move [1]

15

Total **115**