Rewarding Learning

General Certificate of Secondary Education
2024

GCSE Physics

Unit 1
Higher Tier

[GPY12]

FRIDAY 7 JUNE, AFTERNOON

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)**	Average speed = $\frac{\text{distance}}{\text{time}}$	[1]		
		= $\frac{36000000}{7200}$	[2]		
		= 5000 (m/s)	[1]	[4]	
	(b)	Greater than (threshold)	[1]		
		The final speed is greater The initial speed is zero	[2]	[3]	
	(c)	**(i)** Distance has size only or is a scalar	[1]		
		Displacement has size and direction or is a vector	[1]		
		(ii) 31 m	[1]		
		(iii) 7 m	[1]		
		Right Right/East	[1]	[5]	
	(d)	**(i)** Velocity = $\frac{\text{displacement}}{\text{time}}$	[1]		
		Velocity = $\frac{60}{10}$	[1]		
		6 (m/s)	[1]		
		(ii) average speed = $\frac{160}{25}$	[2]		
		= 6.4	[1]	[6]	
	(e)	**(i)** Distance = 5 × 2	[1]		
		= 10 m	[1]		
		(ii) a = gradient or $\frac{(v-u)}{t}$	[1]		
		= $\frac{10}{3}$	[1]		
		= 3.3	[1]		
		(iii) Same speed	[1]		
		Different direction or velocity	[1]	[7]	25

					AVAILABLE MARKS
2	**(a)**	**(i)**	Resultant/unbalanced [1] Proportional [1]		
		(ii)	F = ma [1] = 0.5 × 6 conversion mark g ⟶ kg [2] = 3 (N) [1] Friction = 5 − 3 = 2 (N) [1]	[7]	
	(b)		F = ke or F = kx [1] 1 = k × 3 [1] k = 0.33 [1] N/cm stand alone [1]	[4]	
	(c)	**(i)**	A force 10 N acts on [1] every cm^2 [1]		
		(ii)	F = PA or equivalent [1] = 10 × 1200 [1] = 12 000 (N) [1]	[5]	

(d) Point
Where the weight acts
Diagonals meet
Does not have a moment
The lower the CoG the more stable
The wider the base the more stable

Candidate describes in detail using good spelling, punctuation and grammar **5 or 6** 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]

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						AVAILABLE MARKS
3	**(a)**	**(i)**	Solid ⟶ 1 6 Liquid ⟶ 2 5 Gas ⟶ 3 4 5 [$\frac{1}{2}$] each round up for each row	[2]		
		(ii)	Volume increases	[1]	[3]	
	(b)	**(i)**	V = 10 × 3 × 0.05 or V = length × breadth × height = 1.5 (m^3)	[1] [1]		
		(ii)	M = D × V = 2400 × 1.5 ecf from **(i)** for V = 3 600 (kg) = 3.6 T	[1] [1] [1] [1]	[6]	
	(c)		Use of measuring cylinder Subtract the two readings Read scale at eye level/At bottom of meniscus/ Avoid parallax or avoid splashing	[1] [1] [1]	[3]	12

					AVAILABLE MARKS
4	**(a)**	Conduction	[1]		
		Convection	[1]	[2]	
	(b)	$K = 68 \times 0.4^2 = 10.88$ } $K = 30 \times 0.6^2 = 10.80$ }	[1]		
		Calculation of average = 10.84	[1]		
		Average K = 11 – conversion to a whole number	[1]	[3]	
	(c) **(i)**	Ep = mgh	[1]		
		$3.0 = 0.2 \times 10 \times h$	[2]		
		h = 1.5 (m)	[1]	[4]	
	(ii)	Ek at B = 3.0−0.5 = 2.5 J	[1]		
		kinetic energy = $\frac{1}{2}\ mv^2$	[1]		
		$\frac{1}{2} \times 0.2 \times v^2 = 2.5$	[1]		
		$v^2 = 25$ or $v = \sqrt{25}$	[1]		
		v = 5 (m/s)	[1]	[5]	
	(iii)	Energy transferred = force × distance			
		or Work = force × distance	[1]		
		2.5 = F × 2 ecf for 2.5 J from **(ii)**	[1]		
		F = 1.25 (N)	[1]	[3]	
	(d) **(i)**	Efficiency = $\frac{\text{useful output energy}}{\text{total input energy}}$	[1]		
		$= \frac{450}{500}$	[1]		
		= 0.9 or 90%	[1]	[3]	
	(ii)	Power = $\frac{\text{energy transferred}}{\text{time taken}}$	[1]		
		$= \frac{450}{5}$	[1]		
		= 90	[1]		
		W or J/s	[1]	[4]	24

						AVAILABLE MARKS
5	**(a)**	**(i)**	Named source of background radiation e.g. rocks, X-rays, cosmic rays, radon gas, soil	[1]		
		(ii)	128 to 64 = 1 half-life 0 to 100 s or 90 to 45 = 1 half-life 50 to 150 Half-life = 100 s	[1] [1]		
		(iii)	128 to 64 64 to 32 32 to 16 16 to 8 4 half-lives 4 × 100 = 400 s	[1] [1] [1]	[6]	
	(b)	**(i)**	$^{24}_{11}\text{Na} \rightarrow \boxed{\begin{matrix}24\\12\end{matrix}}\text{Mg} \rightarrow \boxed{\begin{matrix}0\\-1\end{matrix}}\ \boxed{\beta/e}$	[5]		
		(ii)	Alpha particles will be absorbed by the soil or can only travel few cm in air or has low penetrating power or cannot reach the detector	[1]		
		(iii)	The soil would remain radioactive too long or water or area	[1]	[7]	
	(c)	**(i)**	Fusion	[1]		
		(ii)	Light nuclei join to form heavier nuclei with release of energy dependent on 1st marking point	[1] [1]		
		(iii)	In the Sun	[1]	[4]	17
					Total	**100**