Rewarding Learning

General Certificate of Secondary Education
2019

GCSE Physics

Unit 1
Higher Tier

[GPY12]

THURSDAY 30 MAY, 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) (i) Scale – at least half both axes [1]
Velocity and time labelled with units [2]
Ruled line through 0,0 and 14,70 – ignore line beyond 14,70 [1] [4]

(ii) Acc = gradient **or** change in velocity(speed)/time [1]
= 70/14 **or** (70 – 0)/14 [1]
= 5.0 (m/s^2) [1] [3]

$a = \frac{displ}{time}$ is XP – award 0 marks

For partial credit accept $a = \frac{v - u}{t}$ **not** $a = \frac{v}{t}$

(iii) F = ma [1]
= $8.9 \times 10^4 \times 5.0$ **ecf from (ii) for acc** [1]
= 4.5×10^5 (4.45×10^5) (N) **or** 445000 [1] [3]

(b) (i) Between 5 and 10 s **or** 10 and 5 – threshold mark [1]
Explanation – largest deceleration/retardation/
largest or larger gradient/most negative gradient [1] [2]

(ii) Distance = area under graph – only award [1] if no working
= $5 \times 55 + \frac{1}{2}(15 \times 5) + \frac{1}{2}(40 \times 40) + 5 \times 40$ [4]
= 275 + 37.5 + 800 + 200
= 1312.5 (m) [1] [5]

(c) Indicative content

Timer started at Camera 1/Marker 1 **or** time recorded
Timer stopped at Camera 2/Marker 2 **or** time recorded
If time interval too small or too short/
Time interval too quick – award [0]
Speed calculated using d/t or 2000/t
Photograph identifies driver/car/not to mix up the cars
Slows between the cameras
It only measures average speed

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]

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AVAILABLE MARKS

2 **(a)** **(i)** In the absence of unbalanced forces/forces balanced/$F_{res} = 0$ [1]
constant speed or at rest (both) [1] [2]

(ii) 55 (N) [1]

(iii) F = ma
= 80 × 0.2 } [3]
= 16

Thrust = 55 + 16 = 71 (N)

or F – 55 = ma **no ecf from (ii)** [1]
= 80 × 0.2 = 16 [1]
(F) = 55 + 16 [1]
= 71 (N) [1] [4]

(b) **(i)** F = ke [1]
1 = k × 2 k = $\frac{1}{2}$ = 0.5 [1]
(N/cm) [2]

(ii) 5 = 0.5 × e giving e = 10 (cm) [1]
Total length = 10 + 10 = 20 (cm) [1] [2]

(c) **(i)** Air resistance present on the Earth [1]
Any reference to gravity – [0]
or weight

(ii) P = F/A [1]
= 300/0.15 Accept: $P = \frac{\text{weight}}{\text{area}}$ or $\frac{W}{A}$ [1]
= 2000 (Pa or N/m^2) [1] [3]

(d) Indicative content

Wind power – renewable. Limitless supply/replaced in a human lifetime
Nuclear fission – non-renewable. Uranium – limited supplies
Wind – no atmospheric pollution named CO_2 or SO_2 – no greenhouse contribution
Nuclear fission – no atmospheric pollution/CO_2 or SO_2
Wind power – noise/habitat destruction/visual/kills birds
Nuclear fission – **radioactive** waste – **not** nuclear waste
Wind power unreliable – not always windy.
Nuclear fission always available.

In all parts wind and fission must be linked with the response.
'Reused' **not** acceptable for wind.

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
(e)	**(i)**	$v = u + gt$ **or** $v = 3 \times 10$	[1]		
		$= 30$ (m/s)	[1]	[2]	
		for part credit gt or at – award [0]			
	(ii)	$s =$ **average velocity** $\times$ time **or** $\left(\frac{u+v}{2}\right)t$	[1]		
		$s = \frac{1}{2}(0 + 30) \times 3$ **ecf for velocity from (i)**	[1]		
		$= 45$ (m)	[1]	[3]	
		Alternative methods			
		$s = ut + \frac{1}{2}at^2$ part credit $\frac{1}{2}at^2$ – award [0]	[1]		
		$= (0) + \frac{1}{2} \times 10 \times 3^2$	[1]		
		$= 45$ (m)	[1]		
		or			
		$v^2 = u^2 + 2as$ part credit 2as – award [0]	[1]		
		$30^2 = (0) + 2 \times 10 \times s$	[1]		
		ecf from **(i)**			
		$s = 45$ (m)	[1]		26
		Accept:			
		$mgh = \frac{1}{2}mv^2$ [1]			
		$gh = \frac{1}{2} \times 30^2$ $h = \frac{900}{20}$ } [1]			
		$= 45$ m [1]			

						AVAILABLE MARKS
3	**(a)**	**(i)**	1.35		[1]	
		(ii)	(Best value) = (1.05 + 1.06 + 1.04)/3	[1]		
			= 1.05 (g/cm^3)	[1]	[2]	
			no ecf from (i)			
			1.125 – award [0]			
	(b)		(Volume of brass) = (10 × 5 × 5) – (5 × 2 × 2)	[1]		
			= (250) – (20)			
			= 230 (cm^3)	[1]		
			Mass = density × volume **no ecf for volume**	[1]		
			= 8.5 × 230	[1]		
			= 1955 (g)	[1]	[5]	
	(c)	**(i)**	Spacing/distance between the atoms/molecules/particles [1] is greater in the gas than in the solid [1] **or** the converse (comparison needed)		[2]	
		(ii)	(Spacing in ice is) greater		[1]	11
			In place of distance – accept: more tightly packed in solids than in gases			

					AVAILABLE MARKS
4	**(a)**	matt black surface or left hand block	[1]		
		It is **better/quicker/best** absorber (than shiny surface) and emitter	[1]	[2]	
		Arguments in terms of conduction – award [0]			
	(b)	**(i)** (Install cavity wall) insulation		[1]	
		(ii) Rock/mineral wool/fibreglass/urea formaldehyde/polystyrene beads **or** equivalent, e.g. foam – must be a named material		[1]	
	(c)	**(i)** $W = F \times d$ **or** $GPE = mgh$	[1]		
		$= 500 \times 3$	[1]		
		$= 1500$ (J)	[1]	[3]	
		(ii) Energy in = useful energy out/efficiency (or equivalent)	[1]		
		$= 2730/0.7$	[2]		
		$= 3900$ (J)	[1]	[4]	
		(iii) P = work/time (or equivalent) **or** $P = \frac{W}{t}$	[1]		
		$= 2800/3.5$	[1]		
		$= 800$	[1]	[3]	
	(d)	**(i)** Strain or elastic		[1]	
		(ii) $E_k = \frac{1}{2}mv^2$ or equivalent	[1]		
		73.75 [1] $= \frac{1}{2} \times 0.163$ [1] $\times v^2$ [1 subs mark per side]	[2]		
		$v^2 = 900$ **or** 904.9	[1]		
		$v = 30$ **or** 30.08 **or** 30.1 (m/s)	[1]	[5]	
		Selecting the 153g – award max [2]			
		failure to convert g → kg – award max [2]			
		(iii) $E_p = 32$ (J)		[1]	
		(iv) $E_p = mgh$	[1]		
		$32 = 0.16 \times 10 \times h$ **allow ecf for energy**	[2]		
		$h = 20$ (m)	[1]	[4]	25

5 **(a)** **(i)** We cannot say when or which particular nucleus will decay/ unpredictable [1]

(ii) Radioactivity/radioactive decay [1]

Details	Name of the radiation	Relative mass compared to the proton	Relative charge compared to the proton
High energy electromagnetic wave	GAMMA γ		
A helium nucleus consisting of two protons and two neutrons	ALPHA α	4	**(+)2**
A high speed electron	BETA β	**1/1840** $\frac{\mathbf{1}}{\mathbf{1836}}$	**–1**

[$\frac{1}{2}$] each **round up**. [4]

Must be +2 and –1 – award [0] for mass electron = 0

(b) same number of **protons** (threshold mark) [1]
different number of **neutrons** [1] [2]
mention of electrons – award [0]

(c) **(i)** (In 8 hours) the activity decreases by half
or mention of nuclear count rate or radioactivity or mass [1]
not radiation

(ii) 2048 (cps) [1]

(iii) 24 hours = 3 half lives [1]
activity falls to 1/8 × original activity [1]
activity (= 1/8 × 2048) = 256 [1] [3]

$\frac{2096}{8}$ (262) or $\frac{2144}{8}$ (268) } award max [3] provided this number is used in **(c)(ii)** otherwise award max [2]

(iv) [1] [1]

$$\begin{matrix}131\\53\end{matrix} \mathrm{I} \longrightarrow \begin{matrix}131\\54\end{matrix} \mathrm{Xe} + \begin{matrix}0\\-1\end{matrix} \beta$$

[1] for each (mark vertically) [2]

15

Total **100**

AVAILABLE MARKS