Rewarding Learning

General Certificate of Secondary Education
2014

GCSE Physics

Unit 1
Higher Tier

[GPH12]

THURSDAY 12 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) time = 100/10.44 [1]
= 9.58 s **or** 9.6 **or** 9.5785 **not** 9.5 [1] [2]

(ii) His speed changes during the race/he has accelerated [1]

(iii) **Indicative content**
Timer starts when car passes camera 1
Timer stops when car passes camera 2
Time interval calculated/or known
Distance between cameras is known/or measured
Average speed = distance/time interval

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **all the main 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 of the 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 **one or two 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]

(b) (i) Distance = area under the graph [1]
= (20 × 4) [1] + $\frac{1}{2}$(4 × 20) **or** $\frac{1}{2}$ (8 + 4) × 20 [1] [2]
= 120 (m) [1] [4]

(ii) Deceleration = slope or gradient or 20/4 ignore – sign [1]
= 5 (m/s^2) or a = $\frac{v - u}{t}$ or v = u + at [1] [2]
Do not penalise v, u confusion – 20 = 0 + 4a [1]

(iii) F = ma = 800 × 5 [1] for recall of formula [1] for substitution
= 4000 (N) **e.c.f. from (ii)** ignore +/– signs [3]

(iv) Larger mass [1] means smaller deceleration [1]
not weight or greater kinetic energy
Greater momentum [1] – longer stopping time [1] [2]
The 2nd mark only if first mark gained

20

						AVAILABLE MARKS
2	**(a)**	**(i)**	120 kJ [$\frac{1}{2}$] of chemical [1] 80 kJ [$\frac{1}{2}$] of wasted heat 40 kJ [$\frac{1}{2}$] of useful heat $\frac{1}{2}$ marks round down 16 kJ [$\frac{1}{2}$] of wasted energy 24 kJ [1] of electrical energy		[4]	
		(ii)	Conservation of energy conversion [0]	[1]		
			Energy cannot be created or destroyed	[1]	[2]	
	(b)		Efficiency = $\frac{\text{useful output energy}}{\text{total input energy}}$ $\frac{\text{UOE}}{\text{TIE}}$ [1] for part credit	[1]		
			Work or power can be used in place of energy Output/input score [0] for part credit formula wrong **XP** even if answer correct			
			0.35 = useful output/800	[2]		
			Useful output = 800 × 0.35 = 280 (MJ) Power of 10 error give **max** [3]	[1]	[4]	
	(c)	**(i)**	$P = KH^2$ – box is the definitive answer		[2]	
		(ii)	$2.0 = K \times 1^2$ **or** $8 = K2^2$ **or** corresponding pts from graph	[2]		
			$K = 2 \pm 0.2$ **no ecf**	[1]	[3]	15
			Allow K = 2000 if P → watts i.e. $2000 = K \times 1^2$ or $8000 = K \times 2^2$			

AVAILABLE MARKS

3 (a) (i) **1 cm^3** or a cm^3 of aluminium has a **mass** of 2.7 g Unit volume [0] [1]

(ii) Volume 1m^3 = 100 × 100 × 100 cm = 1 000 000 [1]

(iii) Mass = 2.7 × 1 000 000 = 2 700 000 ecf from **(ii)**
or 2.7 × their answer to **(ii)** [1]

(iv) $\left(D = \frac{M}{V} =\right) \frac{2\,700\,000}{1000\ [1]} = 2700$ [1] ecfs from **(ii)** and **(iii)**
or their answer to $\frac{\textbf{(iii)}}{1000}$ [2]
– no marks for $D = \frac{M}{V}$

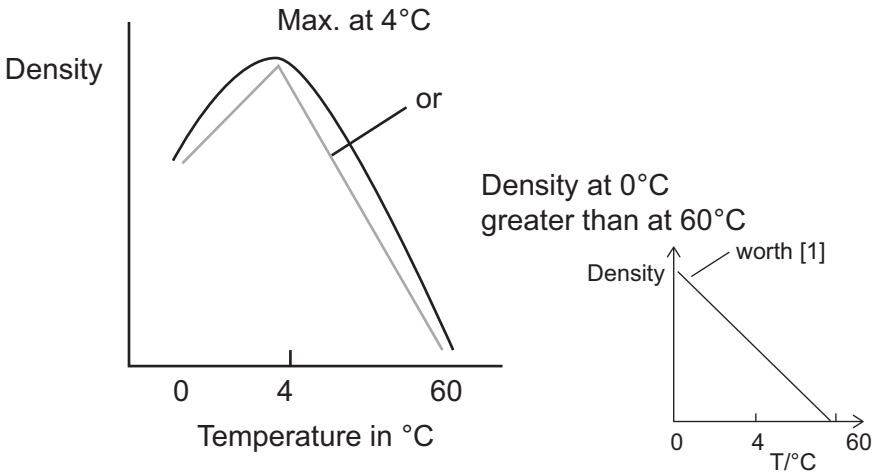
(v)

Measure length, width and depth Using a ruler/tape measure Calculate volume by l × w × d Measure the mass Using a balance/scales Density = mass/volume or $D = \frac{M}{V}$	DISPLACEMENT METHOD Initial V_1 Final V_2 } [1] Vol of object = $V_2 - V_1$ Measuring cylinder [1]	EUREKA CAN Fill to spout Collect overflow Measuring cylinder to measure volume

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **at least 5 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 **at least 3 of the main 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 **one 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]

Mark for physics, then [1] for QWC [6]

(b) (i)

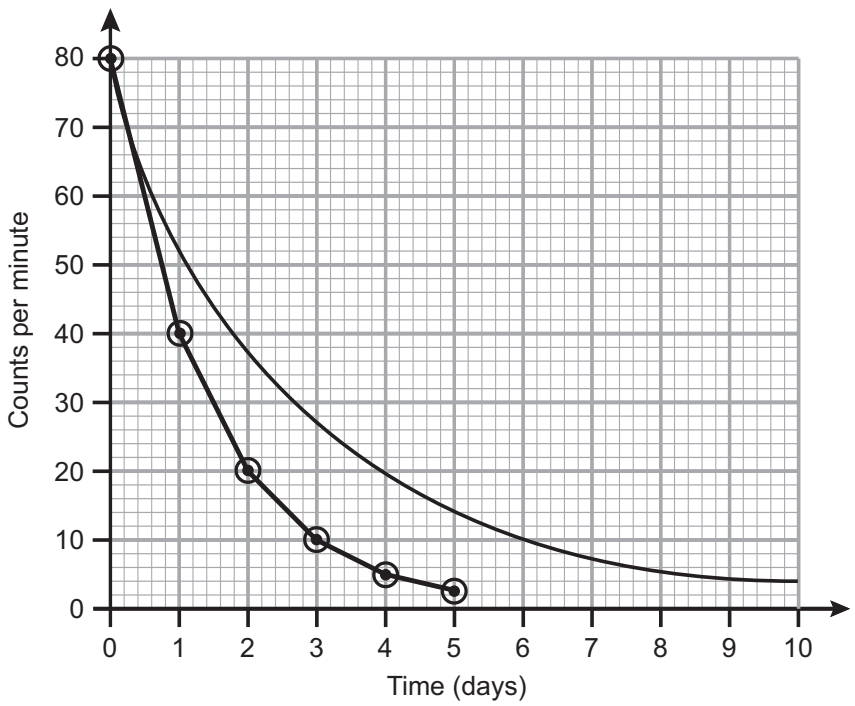


Max. at 4 °C [1]
Density at 0 °C > 60 °C [1] [2]

(ii) 60 to 4 distance between molecules is **decreasing** [1]
4 to 0 distance between molecules is **increasing** [1] [2]

15

						AVAILABLE MARKS
4	(a)	(i)	Centripetal		[1]	
		(ii)	Towards the **centre** (of the circle) centre seeking inward [0] towards person [0]		[1]	
		(iii)	Tension (in the cable)		[1]	
		(iv)	The **direction** of hammer/displ. is changing **or** velocity is a vector vel = $\frac{\text{displ}}{\text{time}}$ [0]		[1]	
		(v)	Increases Decreases No effect/same	[1] [1] [1]	[3]	
	(b)	(i)	Momentum **change** = Force × Time or Ft = m(v – u) ΔmaΔp = Ft not F = ma	[1]		
		(ii)	9000 × 0.0012 if 9000 × 1.2 give [1] if no further work sight of 0.0012 [1] Momentum change = 10.8 (kg m/s) 9000 × 0.001 [0]	[2] [1]	[3]	
		(iii)	Momentum = mass × velocity Award equation [1] if no further work shown = 0.06 × 50 = 3 (kg m/s)	 [1] [1]	 [2]	
	(c)	(i)	Before collision Velocity of A = 0.8 Momentum of A = 0.4 Momentum of B = 0 Total momentum = 0.4 Units are not required	After collision [1] Velocity of A+B = 0.5 [1] [1] [1] [1] Momentum of A+B = 0.4 [1]	[6]	
		(ii)	Momentum before the collision equals the momentum after the collision Equilibrium of forces – **BOD**		[1]	20
5	(a)	(i)	ACM = CM only give [1] if no further work or ↺ = ↻ W × 5 = 8 x 10 000 W = 16 000 (N)	 [3] [1]	 [4]	
		(ii)	W moves LEFT/further away/west Creating a larger moment/turning effect **or** Compensates for increased moment/turning effect of heavier boat anti-clock – clockwise [0], to the right [0]/[2] mention increasing force give [0]	[1] [1]	[2]	
	(b)	(i)	**Point** **not** region/area/space where the weight/mass acts gravity acts [0]	[1] [1]	[2]	
		(ii)	Position 2 (raised) or Z Higher CoG – more likely to topple Raised CoG allow references to narrower base Allow converse, i.e. lower CoG more stable	[1] [1]	[2]	10

					AVAILABLE MARKS
6	**(a)**	**(i)**	7	[1]	
		(ii)	Number of nucleons **or** number of protons plus neutrons Nucleon number [0] At. mass no. [0] Mention of electrons [0]	[1]	
		(iii)	8	[1]	
	(b)	**(i)**	The nucleus is small	[1]	
		(ii)	The nucleus is positively charged/same charge as α particle	[1]	
		(iii)	The nucleus is very dense/small/massive **or** the nucleus is positively charged heavier [0] much heavier [1] nucleus is larger than α particle [0]	[1]	
	(c)	**(i)**	2 (days)	[1]	
		(ii)	 Any 3 correct points [2] Tolerance $\pm \frac{1}{2}$ square Any 2 correct points [1] Any curve [1] consistent with points – must be points shown if curve reduces before 5 days [0]	[3]	
	(d)		$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\text{e}$ No ecf	[4]	
	(e)	**(i)**	**(**Nuclear) fission correct spelling	[1]	
		(ii)	Neutron	[1]	
		(iii)	The **uranium** nucleus (particle 2) named nucleus [1] breaks/splits [1] (into small nuclei) fragments [1] (particle 3) [1] breaks up [1] fissions [1]	[2]	
		(iv)	The neutrons released in the breakup [1] cause other (uranium) nuclei to fission [1] general description of a chain reaction [0] No ecf for wrongly named particle, e.g. α, β	[2]	20
				Total	**100**