Rewarding Learning

General Certificate of Secondary Education
2017

GCSE Physics

Unit 1
Higher Tier

[GPH12]

MONDAY 19 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.

1 (a) (i) 16 s [1]

(ii) 40 m ignore minus [1]
(To the) LEFT (of starting post) not L [1] [2]

(iii) (Average) velocity = displacement/time or $\frac{s}{t}$ or $\frac{D}{t}$ or $s = \frac{D}{t}$ [1]
= –80/24 [1]
= –3.3 (m/s) or $\frac{10}{3}$ or $3\frac{1}{3}$ [1]
negative sign gets 4th mark **only** if 3.3 [1] [4]
or $\frac{10}{3}$ or $3\frac{1}{3}$ given
ignore negative sign until final answer

[1] [1] + [1]

(b) (i) Thrust –30 = 90 × 0.2 **or** F = ma [1] [3]
Thrust = 48 (N) = 90 × 0.2 = 18 [1] 90 × 0.2 give [1]
sight of 18 – give [2] but **not** on answer line
(Thrust) = 30 + 18 = 48 [1] [4]
[1] [1]

(ii) v = u + at [1]
v = 4 + 0.2 × 4 [1]
= 4.8 (m/s) [1] [3]

(c) Indicative content

1. Vary the mass of the trolley or adding 0.5 kg masses accept weight
2. Measure the distance (moved) – using the metre rule/tape etc
   length of ramp
3. Measure the time (to move this distance) – using the stop clock
   how long to move down ramp
4. Repeat the **time** – ignore other quantities
5. Calculate the **average** time
6. Calculate (average) speed
7. (Graph of) mass (x-axis) and (average) speed (y-axis)
   axis not required

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **5 points** shown above and the precaution is clearly stated. 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 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]

AVAILABLE MARKS

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2 **(a)** **(i)** Light 95 (J) [1]
Heat 5 (J) [1] [2]

(ii) 9 J = 0.95 of input Eff = $\frac{E_o}{E_I}$ [1] [1]
Input energy = 9/0.95 [1]
= 9.5 (J) 0.95 = $\frac{9}{E_I}$ [1] [1] [3]
E_I = 9.47 or 9.5 or $\frac{180}{19}$ [1]

(b) **(i)** **1 joule** [1]
of electrical **energy per second** [1] [2]

(ii) Filament bulb 800/50 = 16 lumens/W [1]
LED bulb 800/10 = 80 lumens/W [1] [2]

(iii) LED bulb identified as 10 W bulb [1]
Cost per day = 6/5 = 1.2(p) rounding up to 1p –(0) [1] [2]

(iv) LED bulb 1.2 × 365 = **£4.38** allow ecf from **(iii)** [1]
Saving = 21.90 – 4.38 or 4.8 × 365 = £17.52 [1]
ecf for 1p only 18.25 is the answer
= £17.52 [2] [1] [1] [3]

(c) **(i)** E_p gained = mgh or work done = force × distance [1]
= 0.5 × 10 × 0.75 accept g = 9.81 [1]
= 3.75 (J) or 3.8 [1] [3]

(ii) Calculation of average time = 3.8 [1]
allow ecf for energy
Power = energy/time = $\frac{3.75}{3.8}$ or $\frac{3.8}{3.8}$ or $\frac{\text{Any energy}}{3.8}$ [1]
= 0.99 (W) [1] [3]

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Alternative method – calc av. power

$\frac{3.75}{3.5}$ $\frac{3.75}{4.1}$ $\frac{3.75}{3.8}$

AVAILABLE MARKS

					AVAILABLE MARKS
3	**(a)**	Momentum before (collision) = Momentum after (collision) **or** Total momentum of a closed system is constant		[1]	
	(b)	**(i)** $0.060 \times 4 = 0.055 \times 3 + 0.060 \times v$ [1] for each side		[2]	
		$0.240 = 0.165 + 0.060 \times v$		[1]	
		$v = 1.25$ (m/s) sight of $0.06 \times 4 = 0.240$ give [1] or $0.055 \times 3 + 0.06V$ give [1]		[1]	
		Direction: (left to) right		[1]	[5]
		(ii) $KE = \frac{1}{2}mv^2$ (sight of inside L.H. box)		[1]	
		KE of white ball = 0.047 or 0.05 (J)		[1]	
		ecf for velocity of white ball			
		KE of black ball = 0.248 or 0.25 (J)		[1]	
		Collision was inelastic (ticked)		[1]	[4]
		(iii) Change in momentum = Force × time		[1]	
		$= 7.5 \times 0.04$		[1]	
		$= 0.3$		[1]	
		kg m/s or N s.		[1]	[4]
	(c)	**(i)** Energy cannot be created or destroyed –			
		required before 2nd point		[1]	
		but change form		[1]	[2]
		(ii) (KE at bottom = PE at top – Energy lost (OR equivalent))			
		(KE at bottom = (175 – 75)) = 100 (kJ)			[1]
		(iii) Converting 175 kJ to 175 000 J		[1]	
		$m = 175\,000/(10 \times 250)$		[1]	
		$= 70$ (kg)		[1]	[3]
		alternative			
		$175\,000 = m \times 10 \times 250$ [2] must be an equation			
		[1] [1]			
		$m = 70$ [1]			
		sight of 175 000 J give [1]			
		0.07 kg gets [1]			

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AVAILABLE MARKS

4 **(a)** **(i)** D [1]

(ii) A, B and C all three required [1]

(b) **(i)** Density = mass/volume or D = M/V [1]

= 794/105 [2]

= 7.6 (7.56) g/cm^3 [1]

$\frac{0.794}{105 \times 10^{-6}}$

= 7600 kg/m^3 [1] [5]

(ii) Measured volume of iron increased [1]

Density decreases [1] [2]

Accept volume decreased density increased [2] or [0]

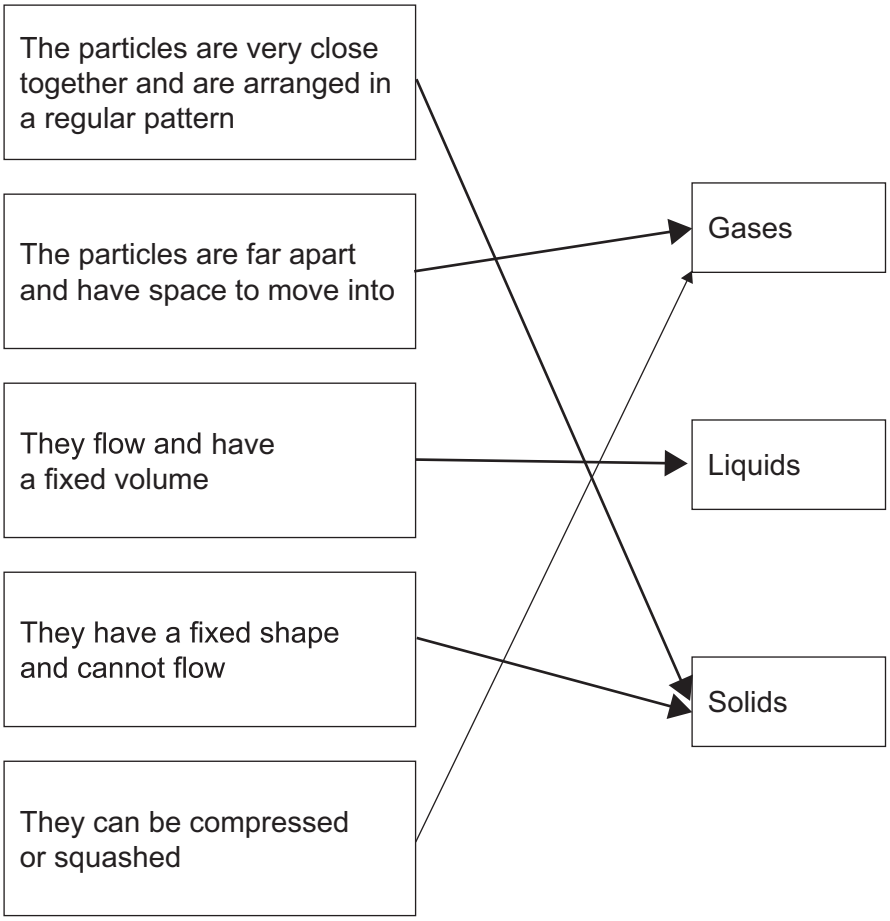
(iii) Same [1]

Density is independent of mass/Density is a constant [1] [2]

Ratio mass/volume constant

Density independent of mass

(c)



[1] for each correct arrow [4]

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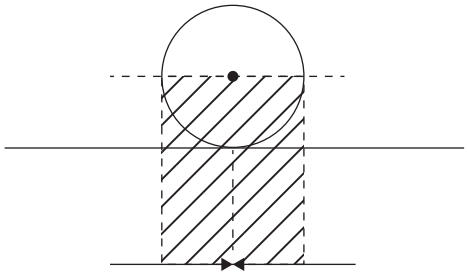
						AVAILABLE MARKS
5	(a)	(i)	ACM = CM required for 2nd mark	[1]		
			when a lever/it is in equilibrium/balanced	[1]	[2]	
		(ii)	**P** clearly labelled at the base at the front Below centre of wheel Above arrowheads Within the diameter		[1]	
		(iii)	9000 × 1 = Load × 4.5 equal sign required for [2]	[1]		
			[1] [1] Load = 2000 (N)	[1]	[3]	
	(b)	(i)	Increase		[1]	
		(ii)	No change		[1]	
		(iii)	To the right or closer to the cab/digger or pivot or inwards	[1]		
			the moment is reduced or kept the same	[1]	[2]	10



P anywhere in shaded region

AVAILABLE MARKS

6 (a) Indicative content

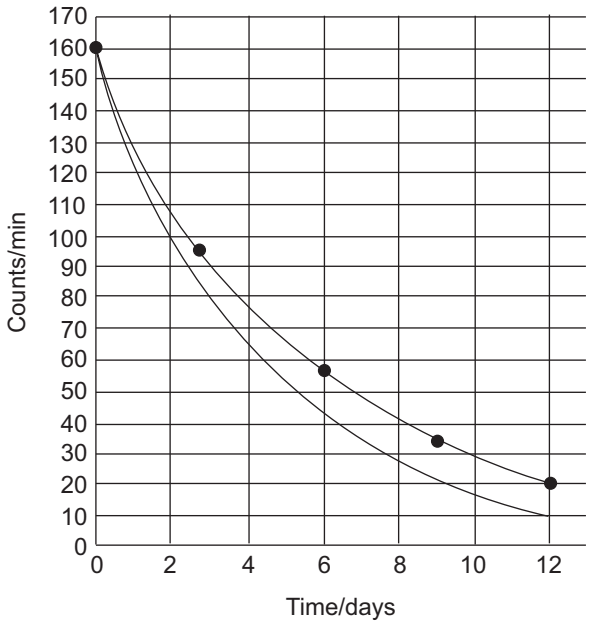
1. Measure activity with no source present or removed
2. Subtract the background/or it count rate (activity of source with no absorber present)
3. To ensure the absorption by the air is constant or effect of the air constant
4. Each absorber is placed **between** the source and the detector (and the count rate measured)
5. Use the paper if count rate falls a lot then the source emits alpha
6. If not, use the aluminium, if the count rate falls a lot the source emits beta
7. If not, confirm that the source emits gamma – use the lead, the rate should decrease

α stopped by paper
β stopped by aluminium
γ stopped by lead
} [3]

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **5 or more points** shown above and the precaution is clearly stated. 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 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) Points – 4 or 5 give [2], 3 points give [1], less than 3 points ± 1 Div ↕ or ↔ give [0] [2]
Smooth curve – generous – Not point to point or straight line [1] [3]



(ii) 4 (days) ± 0.2 days [1]

(iii) Curve to the left and always below first curve (see above) up to 6 days and starting at 0, 160 [1]

(c) Three half-lives identified (8 to 4 to 2 to 1) or 3 × 8 = 24 days [1]
100% – 50% – 25% – 12.5% [1] [2]

(d) Ra 226 [1]
Rn 86 [1] [2]

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Total **100**

AVAILABLE MARKS