Rewarding Learning

General Certificate of Secondary Education
January 2019

GCSE Physics

Unit 1
Higher Tier

[GPH12]

THURSDAY 17 JANUARY, 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.

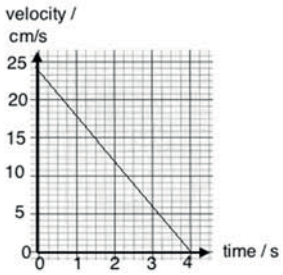
Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

AVAILABLE MARKS

1 **(a)** **(i)** Average speed = distance/time [1]
= 48/4 [1]
= 12 (cm/s) [1] [3]

(ii) Av. velocity = $\frac{1}{2}(u+v)$ or $12 = \frac{1}{2}(u + 0)$ [1]
or equivalent
u = 24 (cm/s) [1] [2]
ecf for ave speed from **(i)**

(iii) Linear scale on vertical axis, covering half axis up to 24 [1]
Straight line of negative slope between axes [1]
Passing through both (0,24) and (4,0) [1] [3]



(iv) a = (v – u)/t **or** a = gradient } or $\frac{24-0}{4}$
a = (0 – 24)/4 **or** equivalent } [1]
a = –6 (cm/s^2) Insist on minus for full marks [1] [2]
Allow ecf for 24 from **(iii)**

(v) F = ma [1]
F = 0.08 × 0.09 [2]
F = 0.0072 **or** 7.2 × 10^{-3} (N) [1] [4]
If F = 80 × 0.09 award max [2]

(b) Indicative content
Direction: towards centre (of circle)
Factors: mass
speed
radius (of circle)
Dependence: force increases with (increasing) mass
force increases with (increasing) speed
force decreases with (increasing) radius

Response	Mark
Candidates describe in detail **at least 5** of the above points using good SPG. The form and style are of a high standard and specialist terms are used appropriately.	[5]–[6]
Candidates describe in detail **3 or 4** of the above points using satisfactory SPG. The form and style are of a satisfactory standard and they have made some use of specialist terms.	[3]–[4]
Candidates describe **1 or 2** of the above points. The SPG is limited. The form and style are of a limited standard and there is no use of specialist terms.	[1]–[2]
Response not worthy of credit	[0]

[6]

20

						AVAILABLE MARKS
2	(a)	(i)	(120 (kJ)) chemical	[1]		
			80 (kJ wasted heat energy)	[1]		
			40 (kJ useful energy)	[1]		
			16 (kJ wasted energy)	[1]		
			24 (kJ useful electrical energy)	[1]	[5]	
		(ii)	Energy cannot be created or destroyed;	[1]		
			It can only change from one form to another	[1]	[2]	
	(b)	(i)	(Total) energy in = (useful) energy out/efficiency (or equiv.)	[1]		
			= 840/0.35 ([1] + [1] for subs)	[2]		
			= 2400 (MJ)	[1]	[4]	
		(ii)	Carbon dioxide		[1]	
		(iii)	Global warming/climate change or equivalent		[1]	
		(iv)	Cannot be replaced in a human lifetime or will run out or is not a limitless supply		[1]	
	(c)	(i)	$P = KH^2$		[1]	
		(ii)	Evidence of selecting values from graph	[1]		
			$8 = k \times 2^2$ (**or** $18 = k \times 3^2$ etc)	[1]		
			$k = 2$	[1]		
			Unit: kW/m^2	[1]	[4]	19
			Allow ecf for unit consistent with their choice of equation			
3	(a)	(i)	$E_p = mgh$	[1]		
			$= 0.02 \times 10 \times 1.8$	[1]		
			= 0.36 (J)	[1]	[3]	
		(ii)	E_k = 0.36 (J) or ecf from **(i)**		[1]	
		(iii)	KE = $\frac{1}{2}mv^2$	[1]		
			$\frac{1}{2} \times 0.02 \times v^2 = 0.36$	[1]		
			$v^2 = \frac{0.36}{0.01} = 36$	[1]		
			v = 6 (m/s)	[1]	[4]	
			Possible ecf from **(ii)**			
	(b)	(i)	Work done = initial kinetic energy or Force × Distance	[1]		
			F × distance = 0.36 **or** F × 0.9 = 0.36	[1]		
			Force = 0.36/0.9 = 0.4 (N)	[1]	[3]	
			Allow ecf from **(ii)** for energy			
		(ii)	No change	[1]		
			Initial KE is the same	[1]	[2]	
	(c)		momentum before = momentum after	[1]		
			$(0.5 \times 3) + (0.75 \times 0) = (0.5 + 0.75) \times v$	[2]		
			$1.5 = 1.25 \times v$	[1]		
			$v = \frac{1.5}{1.25} = 1.2$ (m/s)	[1]	[5]	18

						AVAILABLE MARKS
4	(a)	Mass is a measure of the amount of material in an object	[1]			
		Weight is the force exerted by gravity acting on the object	[1]	[2]		
	(b)	(i) Weight on Jupiter = 100 N	[1]			
		Weight on earth = 40 N	[1]			
		Difference = (100 – 40) = 60 (N)	[1]	[3]		
		(ii) Straight line through (0,0) and (4,60) or suitable point		[1]		
	(c)	(i) 4/5 points correctly plotted	[2]			
		2/3 points correctly plotted give [1]				
		Best line of fit	[1]	[3]		
		(ii) Read as intercept on mass axis = 80 g (possible ecf from graph)		[1]		
		(iii) Any evidence of readings from graph with mass of cylinder having been allowed for or density referred to as gradient of graph award one mark if no further work shown.				
		$D = \left(\frac{\text{Mass}}{\text{Volume}}\right) = \left(\frac{160 - 80}{100}\right)$	[2]			
		or any acceptable points				
		$D = 0.8\ (g/cm^3)$	[1]			
		Liquid identified as ethanol	[1]	[4]		
		(iv) Straight line starting at (0,80) and steeper		[1]		15
5	(a)	When a lever is balanced (equilibrium)	[1]			
		Clockwise moments = anticlockwise moments	[1]	[2]		
	(b)	(i) 1.5 m		[1]		
		(ii) CM = ACM				
		600 × 0.8 = W × (4 – 2.5)	[2]			
		W = 320 (N)	[1]	[3]		
	(c)	(i) No	[1]			
		The weight acts inside the base	[1]	[2]		
		(ii) Raises the CoG	[1]			
		Reduces the stability	[1]	[2]		10

AVAILABLE MARKS

6 (a) Indicative content

Proton	In the nucleus and/or Positive
Neutron	In the nucleus and/or No charge
Electron	Orbits the nucleus and/or Negative
Alpha	Helium nucleus or 2p and 2n
Beta	Electron (high speed)
Gamma	EM radiation

Response	Mark
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Response not worthy of credit	[0]

[6]

(b) (i) Subtract from activity [1]

(ii) 120 60 30 15 8 4 [1]

(iii) Points correctly plotted [1]
Smooth curve (Straight lines give [0]) [1] [2]

(iv) Half-life = 2 hrs [2]

(v) Doubling the activity [1]
Activity = 2 × 2 × 120 = 480 [1] [2]

(c) Fission Splitting [1]
of a massive nucleus [1]
Fusion Two light nuclei [1]
Join to produce a more massive one [1] [4] 18

Total **100**