Rewarding Learning

General Certificate of Secondary Education
2015

GCSE Physics

Unit 1

Higher Tier

[GPH12]

FRIDAY 12 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 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)**	The ball is accelerating/getting faster/increasing speed or velocity	[1]		
			The distance or gap between the balls is increasing First point needed before second mark gained	[1]	[2]	
		(ii)	(Ave) speed = distance/time	[1]		
			= 1.2/0.5	[1]		
			= 2.4 (m/s) *Award [1] for realising time = 0.5 s if no other working shown* *Use of g (9.8 or 10) give [0]*	[1]	[3]	
		(iii)	Ave velocity = $\frac{1}{2}$ (u + v)			
			2.4 = $\frac{1}{2}$(0 + Final speed) [1] each side	[2]		
			Final speed = 4.8 (m/s) ecf for average velocity *Use of g (9.8 or 10) give [0]*	[1]	[3]	
		(iv)	Acc = (v – u)/t or equivalent ignore minus in –9.6	[1]		
			(4.8 – 0)/0.5	[2]		
			= 9.6 (m/s^2) ecf for final velocity ecf for time $a = \frac{u - v}{t}$ [0] if no more working	[1]	[4]	
			Alternative approach $v^2 = u^2 + 2as$ [1] $s = \frac{1}{2}at^2$ [1] $4.8^2 = 0 + 2 \times a \times 1.2$ [1] **or** $1.2 = \frac{1}{2} \times a \times 0.5^2$ [1] a = 9.6 (m/s^2) a = 9.6 (m/s^2) [1]			
	(b)	**(i)**	Smooth curve Points joined by short lines give [0] Straight line give [0] Curve does **not** have to pass through 0, 0		[1]	
		(ii)	$1200 = k \times (0.5)^2$	[1]		
			k = 1200/0.25	[1]		
			k = 4800 **Any value** 4800–5200 Any values taken from their curve/line are allowable	[1]	[3]	
	(c)	**(i)**	F = ma F = mg [0] – no further credit	[1]		
			= 1600 × 0.5 = 800 (N)	[1]	[2]	
			F = ma Then 1000 – 800 give [1] = 1600 × 0.5 = 800			
		(ii)	Resultant force = 1000 – friction or			
			800 = 1000 – friction	[1]		
			Friction = 200 (N) ecf for resultant force ignore minus	[1]	[2]	20

AVAILABLE MARKS

2 (a) (i) KE = $\frac{1}{2}$ mv^2 = $\frac{1}{2}$ × 1 × 15^2
[1] for the equation and [1] for subs [2]
= 112.5 (J) [1] [3]

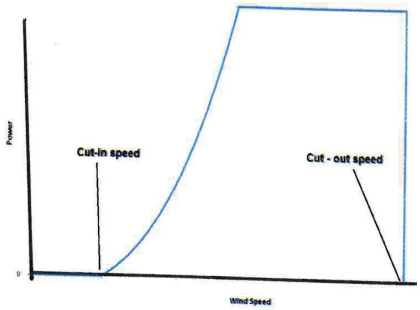
(ii) KE = $\frac{1}{2}$ × 1 × 9^2 = 40.5 [1]
Loss of KE = (112.5 – 40.5) = 72 allow ecf from **(i)** > 40.5 [1]
Rotational energy = 0.5 × 72 = 36 (J) [1] [3]

(iii) Output energy = input × 0.3 or equivalent (must include energy/power/work) [1]
= 1000 × 0.3 = 300 (J) [1] [2]

(b) (i) Maximum efficiency = 0.51 to 0.52 Ratio = 0.3 no tolerance [2]
0.505 → 0.524

(ii) It is not moving/air is still/no wind/calm/stopped [1]

(iii)



must be a + value
on speed axis
Both
Cut-In **and** Cut-Off marked [1]
Increase to constant output [1]
Abrupt cut-off [1] [3]
steeper than the increase

(c) Indicative content

1. Measure the weight lifted or known weight – Force [0]
2. Measure the (vertical) height it is raised/distance moved/distance pulled down
3. Calculate the work done = weight × distance
   or work done = weight × distance × (number of lifts)
4. Determine time for one lift or time for a number of lifts
5. Power = work done/time

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar **all 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 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]

20

						AVAILABLE MARKS
3	(a)	(i)	Density = mass per unit volume $D = \frac{M}{V}$ only if M and V named **or** Density = mass/volume **or** equivalent response		[1]	
		(ii)	kg/m^3 or g/cm^3 or kg/cm^3 or g/m^3		[1]	
	(b)	(i)	**Fill** bottle with water Pour water into measuring cylinder Read the volume of water/take the reading	[1] [1] [1]	[3]	
			Alternative method Fill/pour water into cylinder [1] **Fill** bottle [1] Read difference [1] } use of sand [0]			
		(ii)	Read water level in measuring cylinder Place bottle in cylinder Note difference in levels/displacement	[1] [1] [1]	[3]	
		(iii)	Subtract the volume of water from volume of bottle Subtract volume of inside from volume of bottle Volume of expt 2 – volume of expt 1		[1]	
	(c)	(i)	Density of the steam is **less** than density of water		[1]	
		(ii)	Molecules in steam are further apart Molecules in water are closer		[1]	
	(d)	(i)	Weight on Moon = 8 (N) Weight on Earth = 50 (N) Difference = 50 – 8 = 42 (N)	[1] [1] [1]	[3]	
		(ii)	Straight line from 0,0 through 1, 3.7 and extended ↑ 3.6 to 3.8		[1]	15

AVAILABLE MARKS

4 **(a)** **(i)** Prevents passenger being thrown forward against windscreen
or similar response [1]
increases time **and reduces force/deceleration**

(ii) Airbag or crumple zone or steel cage or ABS
or stability control, or traction control [1]

(iii) Momentum = mass × velocity **or** p = mv [1]
= 48 × 15 720,000 only [1] [1]
= 720 if correct unit [1]
kg m/s or Ns given g m/s [1] [4]

(b) **(i)**

Centripetal force, F, in newtons	0.0	0.5	1.0	1.5	2.0
Speed of bung, v, in m/s	0.0	0.9	1.3	1.6	1.8
v^2 in m^2/s^2	**0.0**	**0.8**	**1.7**	2.6	**3.2**

All correct 1 decimal place only [1]

(ii) Label: v^2 in **m^2/s^2** unit is required [1]
Scale: Covering at least half axis – on both axes [1]
Plotted points ± 1 square, $\frac{1}{2}$ mark per point and round **down** [2] [4]

(iii) Straight line of fit (not point-to-point) [1]

(iv) gradient = 2.0/3.2 = 0.625 **A non-linear scale** [1]
= 0.6 ± 0.05 **on the graph** [1] [2]
values from table ok **no credit**

(v) They are the same/equal [1] 15

5 **(a)** **(i)** P marked clearly on shoulder [1]

(ii) G clearly marked at the midpoint of the ladder – good approximation by eye – 2nd box to LHS of shoulder [1]

(iii) ACM = CM [1]
ACM = CM or $200 \times 0.5 = 80 \times d$ [1]

Alternative

$200 \times 0.5 = 80 \times (1.5 - \mathbf{X})$ give [3]
d = 1.25 m [1]
Distance from **X** = 0.25 m [1] [4]

(iv) Direction to the right/towards the end **X**/away from the window cleaner/away from pivot [1]
To create a larger turning effect/moment/larger CM [1]
to compensate/allow for the larger moment or ACM due to the ladder [1] [3]
Allow calculations for the explanation
If direction wrong – give [0]

(b) 1. Large base area/wide base
2. Heavy base
3. Low CoG
4. CoG still acts within the base
5. Not easily toppled
6. Presents a fire risk/burns
7. CoG in the centre

Response	**Mark**
Candidates describe in detail using good spelling, punctuation and grammar **5 main 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 **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 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

15

						AVAILABLE MARKS
6	**(a)**	**(i)**	Proton, Neutron and Electron ($3 \times$ [1])		[3]	
		(ii)	$^{3}_{2}He$ both figures required and in correct place		[1]	
	(b)	**(i)**	Fission correct spelling		[1]	
		(ii)	**Reasons must be consistent with their choice** e.g. Yes – is a long term energy supply, would provide long term employment, employment of technical skilled persons, employment (cost arguments – give [0] efficiency [0]) during the construction process, reduces the demand for fossil fuels/conserves fossil fuel stocks/lots of energy from little fuel – reliable No CO_2 [0] But SO_2 ✓ No – produces toxic waste, terrorist attack, could increase radiation in the area, possibility of leakage/decommission costs explosion [0] potential for disaster [1] difficult to store waste products [1] radioactive waste causes cancer **or** just radioactive waste (2 x [1])		[2]	
	(c)		It will **strip**/**remove** electrons off atoms **only** removing or adding electrons [0]		[1]	
	(d)	**(i)**	Gamma – must be stated before 2nd mark possible	[1]		
			(Only) gamma will pass through the steel/alpha and beta will not pass through the steel	[1]	[2]	
			Most penetrating [0] Accept source			
		(ii)	If the steel is too thick the detector registers a reduction **or** if the steel is too thin the detector registers an increase	[1]		
			(The control unit) increases the pressure or force on the rollers/the control unit decreases the pressure or force on the rollers	[1]	[2]	
			constant reading means constant thickness so constant pressure } give [1]			
	(e)		20 cps to 5 cps is 2 half-lives	[1]		
			2 half-lives = $\underbrace{2 \times 5600}_{[1]} = \underbrace{11\,200\ y}_{[1]}$	[2]	[3]	15
					Total	**100**