Rewarding Learning

General Certificate of Secondary Education
2013

Science: Physics

Unit P1
Higher Tier

[GPH12]

THURSDAY 13 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)	$KE = \frac{1}{2}mv^2$	[1]		
			$= \frac{1}{2} \times 2000 \times 3^2$	[1]		
			$= 9000$ (J)	[1]	[3]	
		(ii)	Work = Force × distance	[1]		
			$50\,000 = F \times 50$	[1]		
			$F = 1000$ (N)	[1]	[3]	
		(iii)	PE = mgh **or** W = Fd	[1]		
			$30\,000 = 2000 \times 10 \times h$ $30\,000 = 20\,000d$	[1]		
			$h = 1.5$ (m) $d = 1.5$ (m)	[1]	[3]	
		(iv)	$\frac{1}{2}mv^2 = 28\,000$ **or** sight of 28 000	[1]		
			(not for the formula but knowing KE = 28 000 J)			
			$v^2 = 28$	[1]		
			v = 5.3 (m/s) **or** 5.29 **or** 5 **accept 5 → 5.3**	[1]	[3]	
	(b)	(i)	**Indicative content**			
			Measure the weight or known weight or mass – balance/ newtonmeter	[1]		
			Two markers – measure distance between them – use metre rule or from floor to table/motor	[1]		
			Time how long weight takes to move between markers/to lift load – using stopclock W = Fd **or** mgh [1]	[1]		
			Power = weight × vertical distance/time **or** P = w/t [1]	[2]		
			Repeat take average **or** ensure load moves at constant speed	[1]	[6]	
			Do **not** credit length of string if unqualified			
		(ii)	Information needed – input energy **or** power **or** work **or** wasted energy **or** power **or** work		[1]	
			Do **not** credit wasted heat			
		(iii)	Some of the input energy is wasted **or** Efficiency cannot be greater than 1 or 100% **or** Efficiency must be ⩽ 1		[1]	20

					AVAILABLE MARKS
2	**(a)**	**(i)**	(Average) speed = distance/time **or** $s = \frac{d}{t}$ [1] = 76/4 [1] = 19 (m/s) [1]	[3]	
		(ii)	600 = m × 10 [1] m = 60 (kg) [1]	[2]	
		(iii)	F = m a $\quad$ $S = (ut) + \frac{1}{2}at^2$ [1] 600 – 200 = 60 a $\quad$ $76 = \frac{1}{2} \times a \times 4^2$ [1] a = 400/60 = 6.7 (m/s^2) $\quad$ a = 9.5 (m/s^2) [1] Allow ecf from **(ii)** for the mass	[3]	
			v = u + at No marks for eqn alone 38 = 0 + 4a [2]/[3] a = 9.5 (m/s^2)		
	(b)	**(i)**	Error is time = 10 s and velocity = 30 **or** point indicated on grid	[1]	
		(ii)	Smooth curve drawn *No marks for short straight lines*	[1]	
		(iii)	Acceleration = 18/2 **or** $a = \frac{v - u}{t}$ (**not** v = u + at) [1] = 9 (m/s^2) [1]	[2]	
		(iv)	The gradient = the acceleration [1] gradient is decreasing – give [2] The gradient is changing – give [1] **or** graph levels off or plateaus	[2]	
		(v)	15s to 16s	[1]	15

AVAILABLE MARKS

3 **(a)** Volume = (3 × 3 × 3) = **27** (cm^3) $D = \frac{M}{V}$ **or** in words [0]
The mark is for this [1]
Density = 240.3/27 [2]
= 8.9 (g/cm^3) [1] [4]

(b) A C D If any wrong max is [1]/[4], if any missing max is [3]/[4] [2]
two blocks give [1], *more than 3 give* [0]

They have the same density [1]
because ratio M/V the same for each
or supported by calculations [1]
or they are on same straight line **that passes through 0,0** [4]
Essential

(c) (Heat gives) atoms/molecules gain kinetic energy/move more freely
or move/faster **or** increases the amount of vibration/amplitude [1]
Eventually the bonds are overcome [1] [2]

(d) Mass of 500 cm^3 of salty water = 1.1 × 500 = 550 g [2]
Mass of salt = 550 – 500 [1]
= 50 (g) [1] [4]

Alternative method
difference in density = 0.1 [2]
mass = 500 × 0 [1]
= 50 (g) [1]

(e) Indicative content

AVAILABLE MARKS

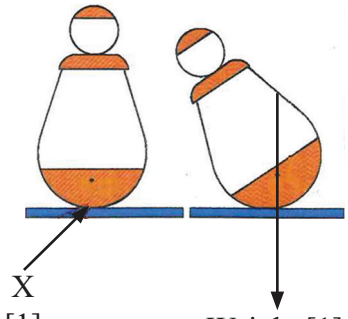
1. Use a balance to find the mass/**or** weigh on a balance
2. Place water in measuring cylinder (and record volume)
   Use of a beaker [0]
3. Place pendant in the water; the change of volume is volume of necklace
   Point 3 could be described as read new volume and subtract volume readings
4. Use formula D = M/V
5. Precaution – avoid splashing **or** repeat and average
   or ensure it is completely covered
   or read to bottom of meniscus

Eureka can method:
fill can
add necklace
collect and measure volume } [2]

Response	**Mark**
Candidates describe in detail using good spelling, punctuation and grammar **all the main points** shown above. The form and style is 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 three of the main points** shown above. The form and style is 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 is 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
4	**(a)**	**(i)**	The mass (of the object) or weight	[1]		
		(ii)	**No** [1], if they were proportional the ratios would be equal 9/32 = 0.28 and 6.4/16 = 0.4 any 2 calculations 4.5/8 = 0.56 and 3.2/4 = 0.8	[1] [2]		
	(b)	**(i)**	Force × time = momentum change F × 0.12 = 1500 × 20 F = 250 000 (N)	[1] [1] [1]	[3]	
			Alternative $a = \frac{v - u}{t} = \frac{20}{0.12} = 167$ F = ma = 1500 × 167 = 250 000			
		(ii)	The crumple zone **increases the time** This means that the force on the car/passengers is reduced	[2] [1]	[3]	
	(c)	**(i)**	Momentum = mass × velocity = (150 + 3) × 20 = 3060 (g cm/s) [1] [1] [1]		[3]	
		(ii)	Momentum before = momentum after 3 × v = 3060 e.c.f. for momentum from **(i)** into **(ii)** v = 1020 (cm/s)	[1] [1] [1]	[3]	15

						AVAILABLE MARKS
5	**(a)**	**(i)**	When an object is in equilibrium/balanced	[1]		
			the clockwise moment = anticlockwise moment	[1]	[2]	
		(ii)	$2 \times 15 = W \times 40$ [1] [1]	Either gets [1], but equal to needed for both marks	[2]	
			$W = 0.75$ (N)	[1]	[3]	
	(b)	**(i)** and **(ii)**	 X [1] Weight [1] Must pass through CoG as shown		[2]	
		(iii)	The weight has a moment **or** weight/CoG outside base	[2]		
			clockwise moment **or** so returns to original position	[1]	[3]	10

						AVAILABLE MARKS
6	(a)	(i)	Activity/radiation from surroundings/walls/rocks/people **or** naturally occurring		[1]	
		(ii)	Subtract		[1]	
		(iii)	3.5 (cm)	[1]		
			Measurements fall to zero	[1]	[2]	
		(iv)	Alpha	[1]		
			Short range **or** travels a few cms in air	[1]	[2]	
		(v)	The removal/addition of an electron to an atom		[1]	
		(vi)	Powder can be breathed in/swallowed/air borne	[1]		
			The above for 1 mark, the 2nd mark for any of the following:			
			• very close to tissues			
			• not stopped by the skin/damages the lungs			
			• difficult to remove	[1]	[2]	
	(b)	(i)	5/6 points correctly plotted give [2]		[2]	
			3/4 points correctly plotted give [1]			
		(ii)	Draw smooth curve		[1]	
			Straight lines give [0]			
		(iii)	The time for the activity/count rate to fall to half (the initial value)		[1]	
		(iv)	Value consistent with their **curve** **2.5 ± 0.2 hr**		[1]	
		(v)	Radioactivity is a **spontaneous/unpredictable/random** process and measurements can vary		[1]	
	(c)	(i)	Fission		[1]	
		(ii)	Uranium/plutonium		[1]	
		(iii)	Low carbon dioxide/sulfur dioxide **or** no contribution to global warming **or** less fossil fuels being used		[1]	
		(iv)	**Less** radioactive waste products	[1]		
			↑ Essential			
			– do **not** accept No radioactive waste			
			Abundant fuel (water)	[1]	[2]	20
			Greenhouse gases – give [0]			
					Total	**100**