

GCE Physics - PH1

Question			Marking details	Marks Available	
1.	(a)	(i)	[A quantity with] magnitude / size and direction.	[1]	
		(ii)	Any suitable quantity (e.g force) other than velocity or acceleration.	[1]	
	(b)	(i)	<i>ut shown</i> to have units: $\text{m s}^{-1} \times \text{s} \rightarrow [\text{m}]$ (1) $(\frac{1}{2})at^2$ <i>shown</i> to have units: $\text{m s}^{-2} \times \text{s}^2 \rightarrow [\text{m}]$ (1) Comment: all terms have same units or equivalent e.g. LHS=RHS (1)	[3]	
		(ii)	(I)	$u = 8 \text{ m s}^{-1}$ UNIT MARK	[1]
			(II)	$\frac{1}{2} a = 3$ $a = 6 [\text{m s}^{-2}]$	[1]
			(III)	Substitution and answer $x = 115 [\text{m}]$	[1]
			(IV)	Equation (1) Substitution (1) ecf for u, a and x $v = 38 [\text{m s}^{-1}]$ (1)	[3]
		Question 1 total			[11]
2.	(a)	(i)	[electric] current	[1]	
		(ii)	$I = 6 [\text{A}]$	[1]	
	(b)	(i)	Parallel combinations calculated: 4Ω (1); 2Ω (1) Series addition: $6 [\Omega]$ (1) ecf	[3]	
		(ii)	XY $\rightarrow \frac{2}{3} \times 12 = 8 [\text{V}]$ (1) or $I = 12/6 = [2 \text{ A}]$ (1) YZ $\rightarrow \frac{1}{3} \times 12 = 4 [\text{V}]$ (1) $V_{xy} = 8 [\text{V}]$ and $V_{yz} = 4 [\text{V}]$ (1)	[2]	
			ecf		
		(iii)	No Change (1) Correct explanation in terms of: Either: Ratio of <u>resistances</u> stays the same } (1) ecf Or: New current calculated ($1\frac{1}{3} \text{ A}$) and used }	[2]	
		(iv)	$R = 12/1.5 = 8 [\Omega]$ (1) S_1 open and S_2 closed (1)	[2]	
(v)	$P = (12)^2/9$ or $P = 1\frac{1}{3} \times 12$ or $P = (1\frac{1}{3})^2 \times 9$ (1) $P = 16 [\text{W}]$ (1)	[2]			
(vi)	Strategy - various switch settings and corresponding powers calculated e.g. Close S_1 : $R = 7 \Omega$ or Close S_2 : $R = 8 \Omega$ } (1) $P = 20.6 \text{ W}$ $P = 18 \text{ W}$ } Close both: $R = 6 [\Omega]$ (1) and $P = 24 [\text{W}]$ (1) e.g. $P = V^2/R$ (1) largest P when R smallest or smallest R identified as $6 [\Omega]$ [must be linked to $P = V^2/R$] (1) S_1 and S_2 closed (1) e.g. $P = I^2 R$ (1) largest P when I greatest when R smallest [must be linked to $P = I^2 R$] (1) S_1 and S_2 closed (1) (N.B. $P=IV$ could be used here) In both of the above the 3 rd mark can be awarded as a standalone mark provided some sensible reasoning is given.	[3]			
Question 2 total			[16]		

Question		Marking details	Marks Available
3.	(a)	[Electrical] energy [or work done] transferred to whole of circuit [or through cell] (1) per coulomb [or unit charge] (1)	[2]
	(b)	Sensible scale and axes labelled with units (1) All points correct $\pm \frac{1}{2}$ small square division (1) Line of best fit (1) (no requirement \rightarrow y axis)	[3]
	(c)	(i) $E = 1.48$ [V] (± 0.01 V) ecf from graph	[1]
		(ii) Gradient attempted or $r = \frac{E - V}{I}$ (by implication) (1) $r = 0.83$ [Ω] (1) ecf from graph	[2]
	(d)	$I = \frac{E}{R + r} \left\{ \frac{1.48}{6 + 0.83} \right\}$ (1) (ecf on E and r) $I = 0.22$ A (1) $t = 20 \times 60$ [1 200 s] (1) $Q = 0.22$ (ecf) \times 1 200 (ecf) = 264 [C] (1) Question 3 Total	[4] [12]
4.	(a)	(i) Ruler and wire (1) Moving pointer (or crocodile clip shown) (1) Ohmmeter connected correctly with no power supply or voltmeter and ammeter positioned correctly with power supply (1)	[3]
		(ii) Straight line through origin	[1]
		(iii) Gradient = R/l or pair of R and l values from graph (1) Measure diameter to calculate area (1) $\rho = \text{grad} \times \text{area}$ or substitution into $\rho = RA/l$ (1)	[3]
	(b)	$\text{Vol} = Al = \frac{1}{3}A \times 3l$ (CSA reduced to $\frac{1}{3}$ original) (1) $R = \frac{\rho 3l}{A/3}$ (1) $\rho = \text{constant}$ stated (or implied) (1) OR: $A = \text{vol}/l$ so $R = \rho l^2/\text{vol}$ (1) $R \propto l^2$ (1) New $R \propto (3l)^2$ so new $R = 9R$ (1) Question 4 Total	[3] [10]

Question		Marking details	Marks Available
5.	(a)	Energy cannot be created or destroyed, only converted to other forms.	[1]
	(b)	(i) $\frac{1}{2}mv^2 = mgh$ shown or use of $v^2 = u^2 + 2ax$ (1) (no mark for $E_k = E_p$ only)	[2]
		(ii) $v = 48.5 \text{ [ms}^{-1}\text{]}$	[1]
	(c)	(i) Air resistance /drag (1) Friction between bobsleigh and ice or surface or track or on surface /ice/snow (1)	[2]
		(ii) Actual $v = [48.5 - 20\% \times 48.5] = 38.8 \text{ ms}^{-1}$ (1) (ecf) Actual $E_k = 210\,762 \text{ [J]}$ (1)	[2]
(iii) Either $[\frac{1}{2} \times 280 \times (48.5)^2 - 210\,762]$ or $[280 \times 9.8 \times 120 - 210\,762]$ (ecf on 48.5 or 210 762) (1) Work done against resistive forces = 118 500 J (1) $= F \times 1\,400$ (1) ecf $F = 85 \text{ [N]}$ (1) ecf for use of 1.4 km		[4]	
		Question 5 Total	[12]
6.	(a)	(i) $\cos 40^\circ$ (1); $600 \cos 40^\circ = 460 \text{ [N]}$ (1)	[2]
		(ii) 386 [N] no ecf if sin or cos mixed up	[1]
	(b)	$(90 \times 9.8) - 386$ (1) (ecf) N.B. if 10 used -1 mark $= 496 \text{ [N]}$ (1)	[2]
	(c)	$0.8 \times 496 = 397 \text{ N}$ (1) ecf $\Sigma F_{\text{horizontal}} = (460 - 397) = 63 \text{ N}$ (1) (ecf) $a = 0.7 \text{ m s}^{-2}$ (1) UNIT MARK	[3]
	(d)	gravitational pull of tree trunk on earth	[1]
		Question 6 Total	[9]

Question		Marking details	Marks Available	
7.	(a)	No net force / all forces acting on the body are balanced / $\sum F=0$	[1]	
	(b)	$w x + F_2 x_2$	[1]	
	(c)	(i)	1.2 [m] and 2.8 [m] – correctly labelled	[1]
		(ii)	$w \times 0.8 = 90 \times 1.2 + 100 \times 2.8$ (1) (ecf on 1.2 and 2.8) $w = 485$ [N] (1)	[2]
		(iii)	$R = 675$ [N] (ecf on w)	[1]
		(iv)	Anticlockwise and clockwise moments calculated correctly (even as ecf) (1) Both = 2 160 [N m] or \sum moments about Q shown=0 (1)	[2]
		(v)	To the left (or towards P) (1) Increased clockwise moment needed to counteract increased anti-clockwise moment or sensible statement related to weight and distance (1)	[2]
Question 7 Total			[10]	