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)		*ut* **shown** to have units: $m\,s^{-1}$ x s→ [m] (1) (½)at^2 **shown** to have units: $m\,s^{-2}$ x s^2 → [m] (1) Comment: **all terms** have same units or equivalent e.g. LHS=RHS (1)	[3]
		(ii)	(I)	$u = 8\,m\,s^{-1}$ **UNIT MARK**	[1]
			(II)	½ a = 3 $a = 6\,[m\,s^{-2}]$	[1]
			(III)	Substitution and answer $x = 115\,[m]$	[1]
			(IV)	Equation (1) Substitution (1) **ecf** for u, a and x $v = 38\,[m\,s^{-1}]$ (1)	[3]
				Question 1 total	**[11]**
2.	*(a)*	(i)		[electric] current	[1]
		(ii)		$I = 6\,[A]$	[1]
	(b)	(i)		Parallel combinations calculated: 4 Ω (1); 2 Ω (1) Series addition: 6 [Ω] (1) [**ecf**]	[3]
		(ii)		XY→ ⅔ x 12 =8 [V] (1) **or** I = 12/6 = [2 A] (1) YZ→ ⅓ x 12 =4 [V] (1) V_{xy} = 8 [V] **and** V_{yz} = 4 [V] (1) **ecf**	[2]
		(iii)		No Change (1) Correct explanation in terms of: Either: Ratio of <u>resistances</u> stays the same } (1) **ecf** Or: New current calculated (1⅓ A) and used }	[2]
		(iv)		R = 12/1.5 = 8 [Ω] (1) S_1 open **<u>and</u>** S_2 closed (1)	[2]
		(v)		$P = (12)^2/9$ **or** P = 1⅓ x 12 **or** $P = (1⅓)^2$ x 9 (1) P = 16 [W] (1)	[2]
		(vi)		Strategy - various switch settings and corresponding powers calculated e.g Close S_1: R = 7 Ω **or** Close S_2: R = 8 Ω } (1) P = 20.6 W P = 18 W } Close both: R = 6 [Ω] (1) and P = 24 [W] (1) e.g. $P = V^2/R$ (1) largest P when R smallest or smallest R identified as 6 [Ω] [must be linked to $P = V^2/R$] (1) S_1 and S_2 closed (1) e.g. $P = I^2R$ (1) largest P when I greatest when R smallest [must be linked to $P = I^2R$] (1) S_1 and S_2 closed (1) (N.B. P=IV could be used here) In both of the above the 3rd 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 ± ½ small square division (1) Line of best fit (1) (no requirement → y axis)	[3]
	(c)	(i)	E = 1.48 [V] (± 0.01 V) **ecf** from graph	[1]
		(ii)	Gradient attempted or $r = \dfrac{E-V}{I}$ (by implication) (1) r = 0.83 [Ω] (1) **ecf** from graph	[2]
	(d)		$I = \dfrac{E}{R+r}\left\{\dfrac{1.48}{6+0.83}\right\}$ (1) (**ecf** on E and r) I = 0.22 A (1) t = 20 x 60 [1 200 s] (1) Q = 0.22 **(ecf)** x 1 200 (**ecf**) = 264 [C] (1)	[4]
			Question 3 Total	**[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) ρ = grad x area or substitution into $\rho = RA/l$ (1)	[3]
	(b)		Vol = Al = ⅓A x 3l (CSA reduced to ⅓ original) (1) $R = \dfrac{\rho 3l}{A/3}$ (1) ρ = constant stated (or implied) (1) **OR**: A = vol/l so $R = \rho\, l^2$/vol (1) $R \propto l^2$ (1) New $R \propto (3l)^2$ so new R = 9R (1)	[3]
			Question 4 Total	**[10]**

Question			Marking details	Marks Available
5.	*(a)*		Energy cannot be created or destroyed, only converted to other forms.	[1]
	(b)	(i)	½ $mv^2 = mgh$ shown **or** use of $v^2=u^2+2ax$ (1) (no mark for $E_k = E_p$ only) Clear manipulation (1)	[2]
		(ii)	v = 48.5 [m s^{-1}]	[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% x 48.5] = 38.8 m s^{-1} (1) **(ecf)** Actual E_k = 210 762 [J] (1)	[2]
		(iii)	**Either** [½ x 280 x (48.5)^2 – 210 762] **or** [280 x 9.8 x 120 – 210 762] (**ecf** on 48.5 or 210 762) (1) Work done against resistive forces = 118 500 J (1) =F x 1 400 (1) **ecf** F = 85 [N] (1) **ecf** for use of 1.4 km	[4]
			Question 5 Total	**[12]**
6.	*(a)*	(i)	cos 40º (1); 600 cos 40º = 460 [N] (1)	[2]
		(ii)	386 [N] no **ecf** if sin or cos mixed up	[1]
	(b)		(90 x 9.8) – 386 (1) (**ecf**) N.B. if 10 used **-**1 mark) = 496 [N] (1)	[2]
	(c)		0.8 x 496 = 397 N (1) **ecf** $\Sigma F_{\text{horizontal}}$ = (460 – 397) = 63 N (1) (**ecf**) a = 0.7 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)		$wx + F_2x_2$	[1]
	(c)	(i)	1.2 [m] **and** 2.8 [m] – correctly labelled	[1]
		(ii)	w x 0.8 = 90 x 1.2 + 100 x 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]**