Question			Answers	Notes	Total
8.	a	i	equating centripetal to electrical force $\frac{2ke^2}{r^2} = \frac{mv^2}{r}$ to get result ✓		1
8.	a	ii	uses (a)(i) to state $E_k = \frac{ke^2}{r}$ ***OR*** states $E_p = -\frac{2ke^2}{r}$ ✓ adds «$E_{TOT} = E_k + E_p = \frac{ke^2}{r} - \frac{2ke^2}{r}$» to get the result ✓		2
8.	a	iii	the total energy decreases ***OR*** by reference to $E_{TOT} = -\frac{ke^2}{r}$ ✓ the radius must also decrease ✓	*Award **[0]** for an answer concluding that radius increases*	2

(continued…)

Question			Answers	Notes	Total
9.	a	i	$E = \frac{1}{2}m\frac{GM}{r} - \frac{GMm}{r} = -\frac{1}{2}\frac{GMm}{r}$ ✓ comparison with $V = -\frac{GM}{r}$ ✓ «to give answer»		2
9.	a	ii	***ALTERNATIVE 1*** «at the position of the planet» the potential depends only on the mass of the star /does not depend on the radius of the star ✓ the potential will not change and so the energy will not change ✓ ***ALTERNATIVE 2*** r / distance between the centres of the objects / orbital radius remains unchanged ✓ since $E_{Total} = -\frac{1}{2}\frac{GMm}{r}$, energy will not change ✓		2
9.	b		$\frac{kQ}{(0.600+0.820)^2} = \frac{kq}{0.820^2}$ ✓ $\frac{Q}{q} = «\frac{(0.600+0.820)^2}{0.820^2} = 2.9988 \approx» 3$ ✓		2

Question			Answers	Notes	Total
8.	**a**		force per unit charge ✓ acting on a small/test positive charge ✓		**2**
8.	**b**		horizontally to the left ✓	*Arrow does not need to touch X*	**1**
8.	**c**		proton moves to the right/they move in opposite directions ✓ force on each is initially the same ✓ proton accelerates less than electron initially **«**because mass is greater**»** ✓ field is stronger on right than left **«**as lines closer**»** ✓ proton acceleration increases **«**as it is moving into stronger field**»** ***OR*** electron acceleration decreases **«**as it is moving into weaker field**»** ✓	*Allow ECF from (b)* *Accept converse argument for electron*	**4 max**