Question Number	Answer		Mark
16(a)	Corresponding values from best fit line Use of $P = VI$ Minimum potential difference = 9.0 V Example of calculation $P = VI$ At 9.0 V, P = 9.0 V × 3.9 A = 35.1 W	**(1)** **(1)** **(1)**	**3**
16(b)(i)	In parallel, each headlight receives 12 V **Or** In series, each headlight receives 6 V In parallel, headlights will have higher power/brightness **Or** In series, headlights will have lower power/brightness In parallel, if one headlight breaks/fails, the other one remains on **Or** In series, if one headlight breaks/fails, the other one goes out	**(1)** **(1)** **(1)**	**3**
16(b)(ii)	Use of $R = V/I$ Use of resistors in parallel formula to calculate R_T in parallel Rseries is not 4 × Rparallel, so student not correct Example of calculation (Using data from the graph): R of single headlight in parallel = $\frac{V}{I} = \frac{12.0\text{ V}}{4.6\text{ A}} = 2.61\Omega$ (for parallel headlights), $\frac{1}{R_T} = \frac{1}{2.61\ \Omega} + \frac{1}{2.61\ \Omega}$, so R_T = 1.30 Ω R of single headlight in series = $\frac{V}{I} = \frac{6.0\text{ V}}{3.2\text{ A}}$ = 1.88 Ω (for series headlights), R_T = 1.88 Ω + 1.88 Ω = 3.76 Ω 3.76 / 1.30 = 2.9, so is 2.9 × less in parallel, not 4 × less	**(1)** **(1)** **(1)**	**3**
16(c)	Use of $R = \rho l/A$ Use of $I = nqvA$ Drift velocity = 3.4×10^{-4} m s^{-1} Example of calculation $R = \rho l/A$, so $A = \frac{\rho l}{R} = \frac{1.72 \times 10^{-8}\ \Omega\text{ m}}{0.0175\ \Omega\text{ m}^{-1}} = 9.83 \times 10^{-7}$ m^2 $v = \frac{4.60\text{ A}}{8.49 \times 10^{28}\text{m}^{-3} \times 1.60 \times 10^{-19}\text{C} \times 9.83 \times 10^{-7}\text{m}^2} = 3.4 \times 10^{-4}$ m s^{-1}	**(1)** **(1)** **(1)**	**3**
	Total for question 16		**12**