Question Number	Answer		Mark
13a	Use of $R = V/I$ (to find resistance of whole circuit) Subtracts 9 Ω from 11 Ω (to get 2 Ω) Use of resistors in parallel formula R = 6.0 Ω (MP3 - Allow $2 = \frac{3R}{3+R}$) **OR** Use of $R = V/I$ (to find V across 9.0 Ω resistor) Subtracts 1.26V from 1.54V (to get 0.28V) Conservation of charge used to establish current in R (0.467 A) R = 6.0 Ω <u>Example of calculation</u> $R = V/I$ for whole circuit = 1.54 V / 0.14 A = 11 Ω Resistance of parallel section = 11 Ω − 9 Ω = 2 Ω $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$, so $\frac{1}{R} = \frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ So R = 6 Ω **OR** $V = IR$ for 9.0 Ω resistor = 0.14 A × 9.0 Ω = 1.26 V p.d. across 3.0 Ω resistor and resistor R = 1.54 V – 1.26 V = 0.28 V (for 3.0 Ω resistor) $I = V / R$ = 0.28 V / 3.0 Ω = 0.0933 A Current in resistor R = 0.14 A – 0.0933 A = 0.0467 A $R = V / I$ = 0.28 V / 0.0467 A = 6.0 Ω	(1) (1) (1) (1) (1) (1) (1) (1)	**4**

13bi	Use of cross-sectional area = πr^2 (1) Cross-sectional area = 1.8×10^{-8} (m^2) (1) ("Show that" so units not required) (MP1 – not awarded if diameter is used) Example of calculation cross-sectional area = $\pi r^2 = \pi \left(\frac{0.15 \times 10^{-3} \text{m}}{2}\right)^2 = 1.77 \times 10^{-8}$ m^2	**2**
13bii	Use of $R = \rho l/A$ (1) Length of copper wire = 9.5 m (1) (e.c.f. from (b)(i)) (Answer using "show that" value = 10.7 m) Example of calculation $l = \frac{RA}{\rho} = \frac{(9.0\ \Omega)(1.77 \times 10^{-8} m^2)}{(1.68 \times 10^{-8} \Omega \text{m})} = 9.48$ m	**2**
13biii	Use of $I = nqvA$ (1) $v = 5.8 \times 10^{-4}$ m s^{-1} (1) (e.c.f. from b(i)) (Answer using "show that" value = 5.2×10^{-4} m s^{-1}) (ignore minus sign on answer) Example of calculation $v = \frac{I}{nqA} = \frac{(0.14\ \text{A})}{(8.49 \times 10^{28} m^{-3})(1.60 \times 10^{-19} C)(1.77 \times 10^{-8} m^2)} = 5.8 \times 10^{-4}$ m s^{-1}	**2**
	Total for question 13	**10**