



2025 Sec 4 Physics Assignment 14 Current of Electricity (Sample Solutions)

Reminders:

1. Use subscripts for similar quantities belonging to different components, e.g. R_1 , R_2 .
2. Write down the **basic formulae** before substitution.
3. Show all key mathematical steps clearly.
4. Evaluate your final answer!

AS 14

1 $I = Q / t$

Current in lightning = $120 \text{ C} / 0.20 \text{ s} = 600 \text{ A}$

2 (a) Current through Resistor A = $2 \times 0.5 \text{ A} = 1.0 \text{ A}$
Same p.d. = $I_1 R_1 = I_2 R_2$

Note: Resistor A is connected in parallel to the path where point X lies. Point X lies along a path with 2 resistors. Therefore, the current through Resistor A will be twice that at X.

(b) Current through Resistor B = $0.5 \text{ A} + 1.0 \text{ A} = 1.5 \text{ A}$
Resistor B is in series with the battery, where the two paths (one with Resistor A and one with point X) converge.

3 $R = \rho L / A = \rho L / \pi r^2 = (7.0 \times 10^{-7} \Omega \text{ m} \times 600 \text{ m}) / \pi (5.0 \times 10^{-4})^2 \text{ m}^2$
 $= 534.76 \Omega$
 $= 530 \Omega$ (2 sf)

4 $R = \rho L / A = \rho L / \pi r^2$

$R_x = \rho L / A = \rho L / \pi r^2 = \rho L / \pi (d/2)^2 = 10 \Omega$

$R_y = \rho 2L / \pi (2d/2)^2 = \frac{2}{4} (\rho L / \pi (d/2)^2) = \frac{1}{2} (10 \Omega) = 5.0 \Omega$

5 Given $L_x : L_y = 4 : 1 \Rightarrow \frac{L_x}{L_y} = \frac{4}{1}$ and $D_x : D_y = 1 : 2 \Rightarrow \frac{D_x}{D_y} = \frac{1}{2}$

$$R_x : R_y = \frac{R_x}{R_y} = \frac{\frac{\rho L_x}{A_x}}{\frac{\rho L_y}{A_y}} = \frac{L_x}{L_y} \times \frac{A_y}{A_x} = \frac{4}{1} \times \frac{\pi y^2}{\pi x^2} = \frac{4}{1} \times \frac{\pi (\frac{D_y}{2})^2}{\pi (\frac{D_x}{2})^2} = \frac{4}{1} \times \frac{(2)^2}{1} = 16$$

- 6 (a) Rheostat or variable resistor
- (b) (i) 0.053 A OR 0.052 A
- (ii) $R = V / I = 2.5 \text{ V} / 0.053 \text{ A} = 47 \Omega$ (2 sf)
- (iii) $I = V / R = 2.5 / 200 = 0.0125 \text{ A} = 0.013 \text{ A}$ (2 sf)
- (iv) $I = 0.053 + 0.0125 = 0.066 \text{ A}$ (3 d.p, not 3sf)