

the rod. When the terminals are connected to the ends of a wooden rod, no current flows. Explain why, when the wooden rod also has a large number of electrons.

- Define electric current and state its unit. How can Ohm's law be used to define ohm?
- Deduce the expression for the equivalent resistance of the parallel combination of two resistances R_1 and R_2 .
- Deduce the expression for the equivalent resistance of the two resistances R_1 and R_2 connected in series.
- Derive an expression for the heat produced in time t in a wire of resistance R , which is carrying a current i .

D. Numerical Problems

- When a particle of charge $10 \mu\text{C}$ is brought from infinity to a point P , 2.0 mJ of work is done by the external forces. What is the potential at P ?
- Calculate the work done in taking a charge of 0.02 C from A to B if the potential at A is 20 V , and that at B is 30 V .
- How much charge flows through a wire in 10 minutes if the current through it is 2.5 A ?
- A 2-V cell is connected to a $1\text{-}\Omega$ resistor. How many electrons come out of the negative terminal of the cell in 2 minutes?
- The amount of charge passing through a cell in 4 seconds is 12 C . What is the current supplied by the cell?
- A 6-V battery is connected across a $5\text{-}\Omega$ resistor. Calculate the current passing through the resistor.
- When a 24-V battery is connected to a resistor, the current in it is 0.4 A . What is the resistance of the resistor? What would be the current through it when it is connected to a battery of 6 V ?
- In an experiment, the current flowing through a resistor and the potential difference across it are measured. The values are given below. Show that these values confirm Ohm's law, and find the resistance of the resistor.

i (ampere)	1.0	1.5	2.0	2.5	3.0
V (volt)	4.0	6.0	8.0	10.0	12
- The resistivity of copper is $1.7 \times 10^{-8} \Omega \text{ m}$. (a) What length of copper wire of diameter 0.1 mm will have a resistance of 34Ω ? (b) Another copper wire of the same length but of half the diameter as the first is taken. What is the ratio of its resistance to that of the first wire?
- Three resistors, each of resistance 12Ω , are connected in parallel. What is the equivalent resistance?
- A uniform wire of resistance R is cut into two equal pieces, and these pieces are joined in parallel. What is the resistance of the combination?
- You have three resistors of 9 ohms each. By combining them what can be (a) the highest resistance, and (b) the lowest resistance? (c) How can you combine them to get a resistance of 12Ω ?
- How will you join the resistors of resistances 3Ω , 6Ω and 8Ω to get an equivalent resistance of 10Ω ?

- Find the current through the circuit shown in Figure 4.E1. Also, find the potential difference across the $20\text{-}\Omega$ resistor.

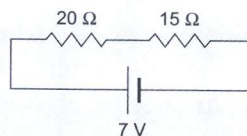


Fig. 4.E1

- Find (a) the equivalent resistance, (b) the current passing through the cell, and (c) the current passing through the $30\text{-}\Omega$ resistor in the circuit shown in Figure 4.E2.

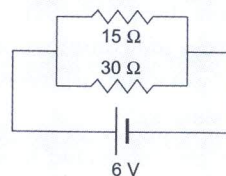


Fig. 4.E2

- Find the current supplied by the cell in the circuit shown in Figure 4.E3.

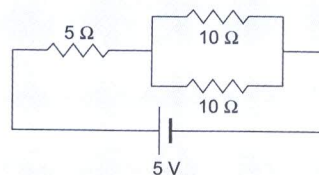


Fig. 4.E3

- In the circuit shown below, calculate the total resistance of the circuit and the current flowing through it. (2005)

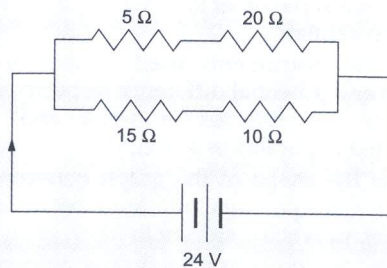


Fig. 4.E4

- Figure 4.E5 shows a part of an electric circuit. The reading of the ammeter is 3.0 A . Find the currents through the $10\text{-}\Omega$ and $20\text{-}\Omega$ resistors.

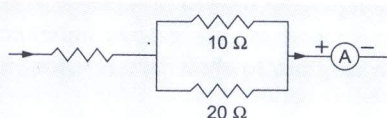


Fig. 4.E5

