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.

- 3. Define electric current and state its unit. How can Ohm's law be used to define ohm?
- 4. Deduce the expression for the equivalent resistance of the parallel combination of two resistances R_1 and R_2 .
- 5. Deduce the expression for the equivalent resistance of the two resistances R_1 and R_2 connected in series.
- 6. 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

- 1. When a particle of charge 10 μ 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?
- 2. 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.
- 3. How much charge flows through a wire in 10 minutes if the current through it is 2.5 A?
- 4. A 2-V cell is connected to a 1-Ω resistor. How many electrons come out of the negative terminal of the cell in 2 minutes?
- 5. The amount of charge passing through a cell in 4 seconds is 12 C. What is the current supplied by the cell?
- 6. A 6-V battery is connected across a $5-\Omega$ resistor. Calculate the current passing through the resistor.
- 7. 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?
- 8. 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

- 9. The resitivity of copper is $1.7 \times 10^{-8} \Omega$ m. (a) What length of copper wire of diameter 0.1 mm will have a resistance of 34 Ω ? (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?
- 10. Three resistors, each of resistance 12 Ω , are connected in parallel. What is the equivalent resistance?
- 11. 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?
- 12. You have three resisters 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 ?
- 13. How will you join the resistors of resistances 3Ω , 6Ω and 8Ω to get an equivalent resistance of 10Ω ?

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

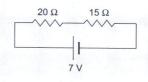
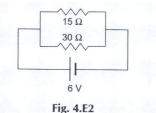


Fig. 4.E1

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



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

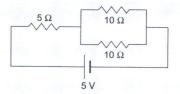
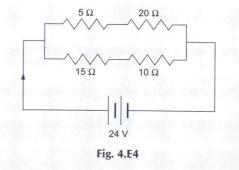


Fig. 4.E3

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



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

