Current, Resistance and Circuits

1. A metallic wire has resistivity 10 μΩ–cm, length L = 50 cm and the diameter d =2 mm. What is its resistance?

2. A current of 5 A exists in the wire for 3 min. What is the total charge passed through any cross-sectional area of the wire?

3. If a piece of wire is stretched by n times what happens to the resistance?

4. Wire B is three times longer than wire A, and the two wires have the same volume. If both wires are made of the same substance and if the resistance of wire A is 9 Ohms, what is the resistance of wire B (in Ohms).

5. What is the drift velocity of the electrons for the current of 1.6 A passing thru the wire which has a cross-sectional area of 1 mm^2. (Assume that typical density of the electrons is 10^{30} electrons/m^3).

6. A uniform wire of resistance R is stretched until its length doubles. Assuming its density and resistivity remain constant, what is its new resistance?

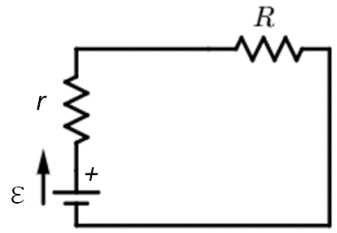
7. What electric field is necessary to drive a 7.5-A current through a silver wire 0.95 mm in diameter?

8. A 1.0-cm-diameter rod carries a 50-A current when the electric field in the rod is 1.4 V/m. What is the resistivity of the rod material?

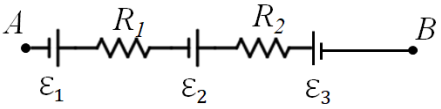
9. The free-electron density in aluminum is 2.1×10^{29} m^{-3}. What is the collision time in aluminum?

10. How much money you will spend per day for having a bulb working in the house circuit with the voltage of 110V and the current of 1 A. (Assume that 1 kW-hour costs 10 cents)

11. A circuit consists of the real battery (E=10V, r= 2 Ω) and the resistor R= 3Ω. Calculate current and the total power released in the circuit.



12. A fragment of the circuit is shown on the Figure. What is the potential difference between the points B and A? R_1=3Ω, R_2=3Ω, E_1=2V, E_2=3V, E_3=5V.



13. A bulb is connected to the battery of some EMF equal to E. Will the bulb be brighter or dimmer if it will be reconnected to a new battery of $E_n = 2E$. By how much?

14. A constant power P is supplied to a transmission line of resistance R by a power station. If the power dissipated in the transmission line is 200 Watts when the power station delivers an EMF of 10 Volts, how much power is dissipated in the transmission line (in W) when the power station delivers an EMF of 20 Volts (assuming the same power is supplied in both cases)?

15. A capacitor C with an initial charge Q discharges through a resistor R. How many time constants $\tau = RC$ must elapse in order for the capacitor to lose 2/3 of its charge?

16. A charged capacitor C has a resistance R connected across its terminals to form the RC circuit. If it takes 2 seconds for the capacitor to loose one-half of its stored energy, how long does it take (in s) for it to loose 90% of its initial charge?