1

$$\text{Blue} = 6, \quad \text{Grey} = 8, \quad \text{Brown multiplier} = 10^1, \quad \text{Gold tolerance} = \pm 5\%.$$

$$68 \times 10^1 = 680\,\Omega \quad (\pm 5\%).$$

2

$$R = 0.05\,\Omega/\text{m}, \quad (22\,\text{AWG conductor}).$$

22 AWG wire is 0.6438 mm in diameter, so radius is $r = 0.3219\,\text{mm}$. The cross-sectional area A is:

$$A = \pi r^2 = \pi(0.3219\,\text{mm})^2 \approx 0.325\,\text{mm}^2.$$

$$A \approx 0.325 \times 10^{-6}\,\text{m}^2 = 3.25 \times 10^{-7}\,\text{m}^2.$$

$$R = \frac{\rho\, L}{A}.$$

$$\rho = \frac{R\, A}{L} = 0.05 \times 3.25 \times 10^{-7}\,\Omega \cdot \text{m} \approx 1.63 \times 10^{-8}\,\Omega \cdot \text{m}.$$

This resistivity is close to the resistivity of copper ($1.68 \times 10^{-8}\,\Omega \cdot \text{m}$). Therefore, the material is most likely copper.

3

$$R = 2.6\,\Omega, \quad L = 1000\,\text{m}, \quad \rho_{\text{Cu}} = 1.72 \times 10^{-8}\,\Omega \cdot \text{m}.$$

$$R = \frac{\rho L}{A} \quad \Longrightarrow \quad A = \frac{\rho L}{R}.$$

$$A = \frac{(1.72 \times 10^{-8}\,\Omega \cdot \text{m})(1000\,\text{m})}{2.6\,\Omega} = \frac{1.72 \times 10^{-5}}{2.6}\,\text{m}^2 \approx 6.615 \times 10^{-6}\,\text{m}^2.$$

$$A = \pi \left(\frac{d}{2}\right)^2 \quad \Longrightarrow \quad d = 2\sqrt{\frac{A}{\pi}}.$$

$$d = 2\sqrt{\frac{6.615 \times 10^{-6}}{\pi}} \approx 2 \times 1.45 \times 10^{-3} \approx 2.9\,\text{mm}.$$

From the AWG wire tables, a diameter of 2.9 mm corresponds to 9 AWG. Therefore, the wire is probably 9 AWG

4

1. A broken or cut wire in a circuit.
2. A switch in the “open” or “off” position.
3. A disconnected terminal in the circuit preventing current flow.