

Answer on Question 62349, Physics, Electric Circuits

Question:

The battery in a circuit has emf of 50 V . The current in the lamp is 2 A and the reading on the voltmeter is 30 V . Calculate the internal resistance of the battery and the resistance of the lamp.

Solution:

a) Let's denote the potential difference across the lamp as V and the potential drop across the battery as V_r . Then, we can write the formula for the electromotive force of the battery:

$$\mathcal{E} = V + V_r.$$

We can find V_r from the Ohm's law:

$$V_r = Ir.$$

Let's substitute V_r into the previous formula, we get:

$$V = \mathcal{E} - Ir,$$

here, V is the potential difference across the lamp, \mathcal{E} is the electromotive force of the battery, I is the current in the lamp, r is the internal resistance of the battery.

From this formula we can find the internal resistance of the battery:

$$r = \frac{\mathcal{E} - V}{I} = \frac{50\text{ V} - 30\text{ V}}{2\text{ A}} = 10\text{ }\Omega.$$

b) We can find the resistance of the lamp from the Ohm's law:

$$R = \frac{V}{I} = \frac{30\text{ V}}{2\text{ A}} = 15\text{ }\Omega.$$

Answer:

a) $r = 10\text{ }\Omega$, b) $R = 15\text{ }\Omega$.