

Solve. A battery charger supplies 10 A to charge a storage battery which has an open - circuit voltage of 5.6V. If the voltmeter connected across the charger reads 6.8V, what is the internal resistance of the battery at this time?

- a. 13Ω
- b. 0.52Ω
- c. 0.12Ω
- d. 21Ω

Solution.

Ohm's principal discovery was that the amount of electric current through a metal conductor in a circuit is directly proportional to the voltage impressed across it, for any given temperature. Ohm expressed his discovery in the form of a simple equation, describing how voltage, current, and resistance interrelate:

$$U = Ir$$

Open-circuit voltage is the difference of electrical potential between two terminals of a device when disconnected from any circuit. There is no external load connected. No external electric current flows between the terminals.

For the series network,

$$U_1 + U_2 + U_3 + \dots = IR_1 + IR_2 + IR_3 + \dots$$

Since the current I is the same in each resistor.

Since the battery is charging

$$E = U + V_{oc} = Ir + V_{oc}$$

where

$$I = 10 \text{ A}$$

$$V_{oc} = 5.6 \text{ V}$$

$$E = 6.8 \text{ V}$$

Then

$$r = \frac{E - V_{oc}}{I} = \frac{6.8 - 5.6}{10} = \frac{1.2}{10} = 0.12 \Omega$$

Answer: c. 0.12Ω