Answer on Question #50518, Engineering, Electric Circuits

Two batteries of emf and internal resistance connected in series with each other and with an external load resistor. The current is 3 A. When the polarity of one battery is reversed the current becomes 1 A. The ratio of the emfs of the two batteries is?

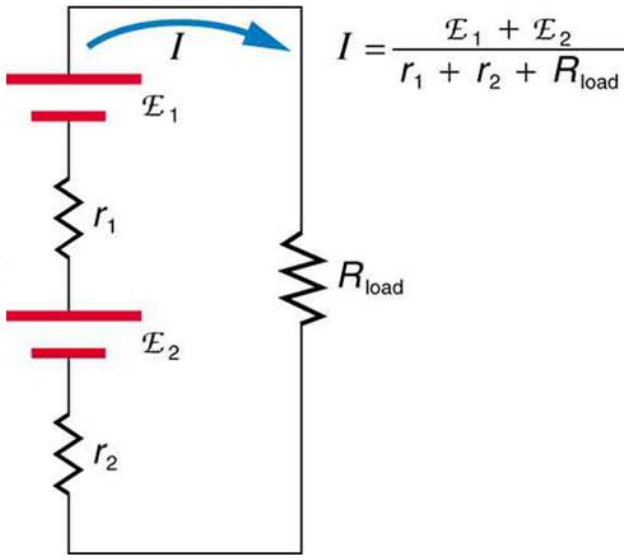
1) 2.5

2) 2

3) 1.5

4) 1

Solution:



$$I_1 = \frac{E_1 + E_2}{r_1 + r_2 + R} = 3 \text{ A}$$

But, if the cells oppose one another—such as when one is put into an appliance backwards—the total emf is less, since it is the algebraic sum of the individual emfs. When it is reversed, it produces an emf that opposes the other, and results in a difference between the two voltage sources .

$$I_2 = \frac{E_1 - E_2}{r_1 + r_2 + R} = 1 \text{ A}$$

Thus,

$$\frac{I_1}{I_2} = \frac{E_1 + E_2}{E_1 - E_2} = 3$$

$$E_1 + E_2 = 3(E_1 - E_2)$$

$$4E_2 = 2E_1$$

$$\frac{E_1}{E_2} = 2$$

Answer: 2) 2