Answer on Question 59061, Physics, Electric Circuits

Question:

A galvanometer with coil resistance 12 Ω shows full scale deflection for a current of 2.5 mA. How would you convert it into a voltmeter of range 0 to 10.0 V?

a) 3988 Ω in series

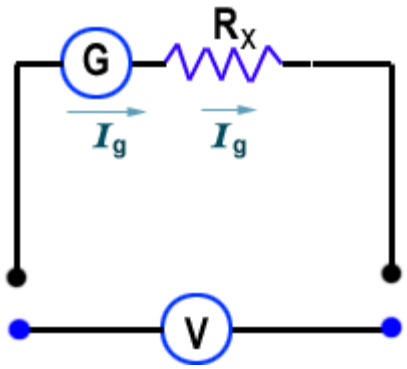
b) 0.43 Ω in parallel

c) 2000 Ω in parallel

d) 1.62 Ω in series

Solution:

In order to convert a galvanometer into voltmeter, a very high resistance is connected in series with galvanometer as we can see in the scheme below:



Let the resistance of galvanometer be R_g and high resistance R_x is connected in series to it. Then combined resistance will be $(R_g + R_x)$. Therefore, from the Ohm's law we can write the potential between the points to be measured:

$$V = I_g(R_g + R_x).$$

From this formula, we can find the high resistance R_x:

$$V = I_g R_g + I_g R_x,$$

$$I_g R_x = V - I_g R_g,$$

$$R_x = \frac{V}{I_g} - R_g = \frac{10\,V}{2.5 \cdot 10^{-3} A} - 12\ \Omega = 3988\ \Omega$$

Answer:

a) 3988 Ω in series.