Answer on Question # 78097, Physics -Electric Circuits:

Question: A battery of 10 Volts is connected to a resistance of 20 ohms through a variable resistance R. The amount of charge which has passed in the circuit in 4 minutes, if the variable resistance R is increasing at the rate of 5 ohms/min , will be ?

Solution: $I = \dfrac{dq}{dt} = \dfrac{V}{R}$ [I = current, V = voltage, R = resistance, dq = change in charge and dt = change in time.]

Now, $\dfrac{dq}{dt} = \dfrac{dq}{dR} \cdot \dfrac{dR}{dt}$

And $\dfrac{dR}{dt}$ = 5 ohms/ min = $\dfrac{1}{12}$ ohms/sec.

So, $\dfrac{dq}{dR} \cdot \dfrac{dR}{dt} = \dfrac{V}{R}$

Now, dq = 12 x V x $\dfrac{dR}{R}$ [As $\dfrac{dR}{dt} = \dfrac{1}{12}$]

So, q = 12 X 10 $\int_{20}^{40} \dfrac{dR}{R}$

   = 120. log 2 Coulomb.

   = 83.18 Coulomb.

Answer: So, charge will be 83.18 Coulomb.