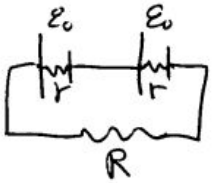
key yellow

8. (10 pts) A flashlight bulb is powered by two 1.4 V batteries in series, each with internal resistance 0.15 Ω. The batteries each lose chemical energy at the rate of 5.6 W. Determine the resistance of the lightbulb.



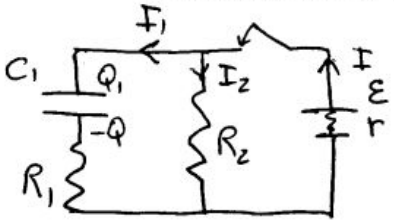
$U = \mathcal{E}_0$.

$2P = I^2(R+2r) = \frac{(2U)^2}{R+2r} = 5.6W \times 2$.

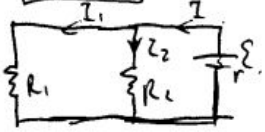
$\therefore R = \frac{(2U)^2}{2P} - 2r = 11.2\Omega - 0.3\Omega$
$= 10.9\Omega$.

9. The capacitor is uncharged initially. The switch is then closed at $t = 0$. Let $\mathcal{E} = 12$ V, $r = 4\ \Omega$, $R_1 = 12\ \Omega$, $R_2 = 6\ \Omega$, $C_1 = 8\ \mu$F.

a. (10 pts) Find I, Q_1, I_1, and I_2 just after the switch is closed. Explain.



① $Q_1 = 0$ at $t = 0$. so circuit like

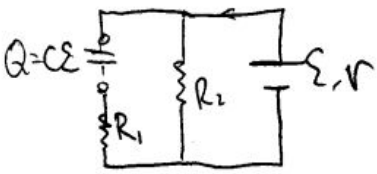


$\therefore I = \frac{\mathcal{E}}{r + (R_1 // R_2)} = \frac{12\,A}{4+4} = 1.5A$

$I_1 + I_2 = I$.

$I_1/I_2 = R_2/R_1 = 0.5$. $\Rightarrow$ $I_1 = 0.5A$ $I_2 = 1A$.

b. (10 pts) Find I, Q_1, I_1, and I_2 a long time after the switch is closed. Explain.

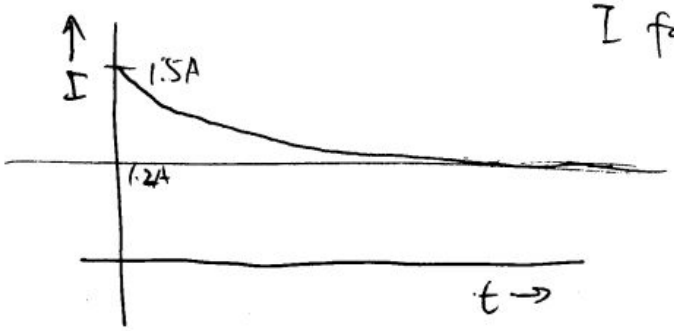


$I = I_2 = \frac{\mathcal{E}}{r + R_2} = \frac{12V}{(4+6)\Omega} = 1.2A$

$I_1 = 0$.

$Q = C\mathcal{E} = 8\mu F \cdot 12V = 96\mu C$.

c. (5 pts) Sketch I as a function of time.



I falls from 1.5A to 1.2A.