Physics 4B
Fall 2017

ave. = 7.6
σ = 2.5

Name: Answer Key

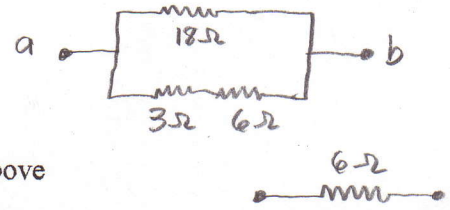
Lab (circle one): 8:00 am 11:15 am 2:45 pm

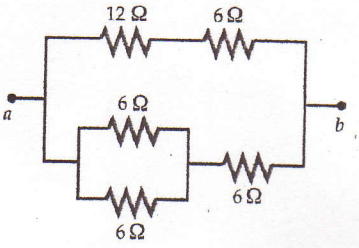
Quiz #6: Circuits

Problem 1 (2 points)
The equivalent resistance between points a and b in the circuit shown to the right is:

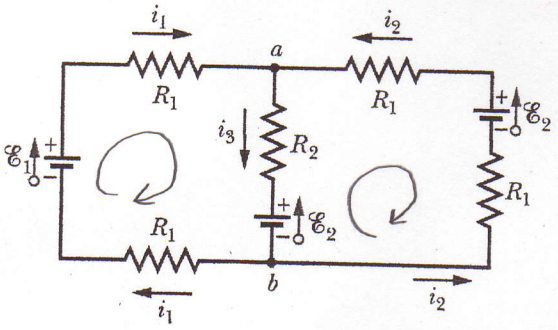
A

a) 6.0 Ω
b) 7.2 Ω
c) 8.0 Ω
d) 9.0 Ω
e) none of the above





Problem 2 (3 points)
Use Kirchoff's rules to write three independent equations for the circuit shown to the right.



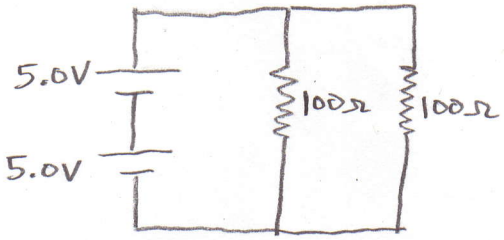
from junction rule: $i_1 + i_2 = i_3$

from left loop: $\mathcal{E}_1 - i_1R_1 - i_3R_2 - \mathcal{E}_2 - i_1R_1 = 0$

$\mathcal{E}_1 - \mathcal{E}_2 - 2i_1R_1 - i_3R_2 = 0$

from right loop: $\mathcal{E}_2 + i_3R_2 + i_2R_1 - \mathcal{E}_2 + i_2R_1 = 0 \longrightarrow 2i_2R_1 + i_3R_2 = 0$

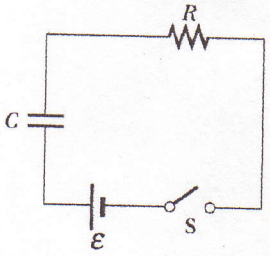
Problem 3 (2 points)
You have two identical 100 Ω resistors and two identical ideal 5.0 V batteries. Draw a circuit diagram of how you would arrange the resistors and batteries in order to get the maximum possible total power out of the resistors.



for a resistor, $P = iV = i^2R$

↳ to maximize P we want to maximize the current through each resistor

Problem 4 (3 points)
In the circuit to the right, R = 750 Ω and the capacitor is initially uncharged. The switch is then closed, and after 0.015 s, the charge on the capacitor has increased to half of its final value. What is the capacitance of the capacitor?



for charging a capacitor: $q = q_0(1 - e^{-t/\tau})$ $\tau = RC$

$q = \frac{1}{2}q_0$ at $t = 0.015s$

$\frac{1}{2}q_0 = q_0(1 - e^{-t/\tau}) \longrightarrow \frac{1}{2} = 1 - e^{-t/\tau} \longrightarrow e^{-t/\tau} = \frac{1}{2}$

$-t/\tau = \ln(\frac{1}{2}) \longrightarrow \tau = \frac{-t}{\ln(\frac{1}{2})} = \frac{-0.015s}{\ln(\frac{1}{2})} \longrightarrow \tau = 0.0216s$

$\tau = RC \longrightarrow C = \frac{\tau}{R} = \frac{0.0216s}{750\Omega} = 28.9\,\mu F$