University of Kentucky Department of Physics

Prelab 5: Wheatstone Bridge

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Due 6 Sept 11:59

Problem 2

1 Explain Kirchoffs Loop/Voltage rule (**KVL**) $\sum \Delta V = 0$. 2 When should we apply this rule? 3 Why is it true?

1 $\Delta V = 0 \Leftrightarrow$ the sum of all voltages/potential differences in a circuit loop is 0.

2 Apply KVL to loop

3 $\because$Conservation of energy

Problem 3

1 What formula expresses the definition of resistance in terms of resistivity (and other parameters of the resistor like its thickness)? 2 How is this related to Lab 1 and 2?

1

$$R = \frac{\rho L}{A} \tag{1.1}$$

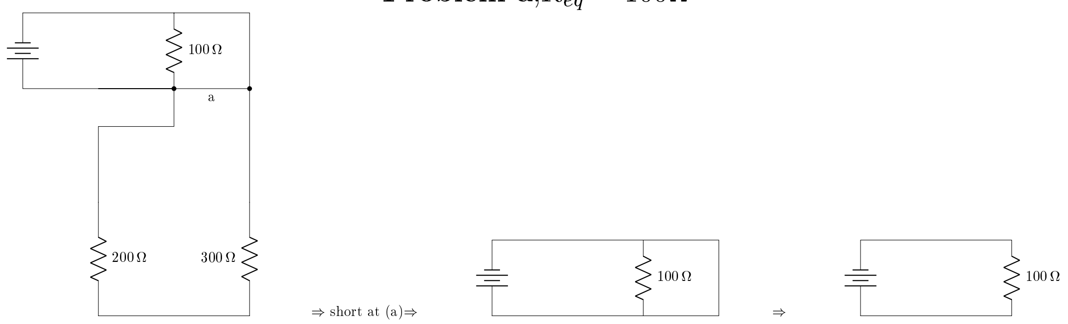
$\rightsquigarrow$ Resistance R expressed in terms of resistivity.

2 In lab 1 and 2, non-ohmic device (lightbulb) and their resistance is examined, i.e. $V = IR$ where the current i is uniform, but R is not constant, in terms of Equation 1.1 the resistivity ρ varied (increased) as the temperature T increased.

Problem 2

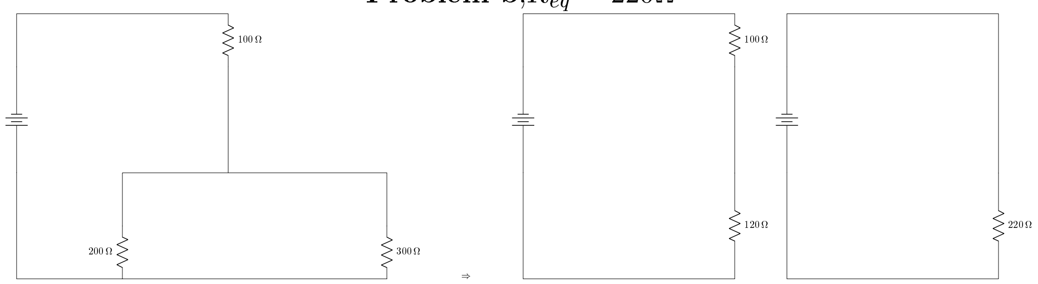
Whats the equivalent resistance of the following three circuits?

Problem a,$R_{eq} = 100\Omega$



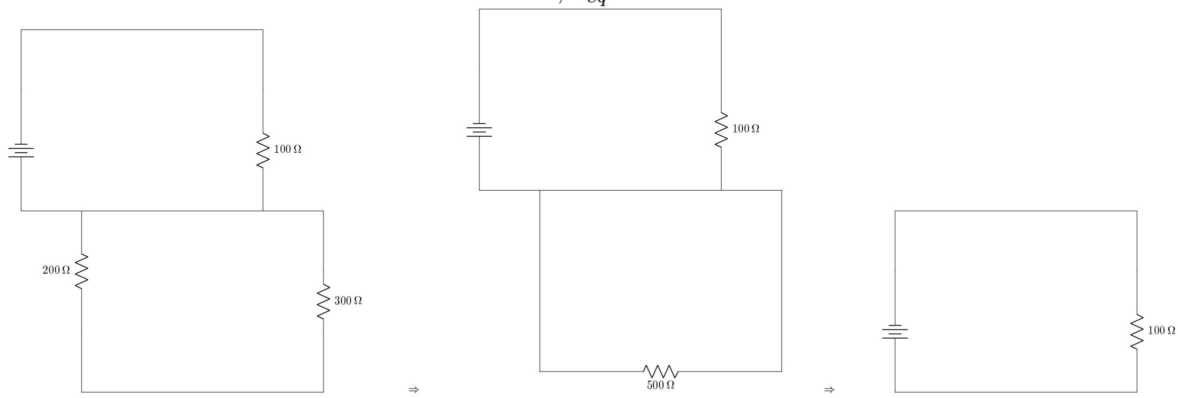
Explanation: there is a **short** at wire labeled (a) in the figure. The potential difference at the two points is the same $\Rightarrow \therefore$ no current flows thru the 200 and 300 Ω resistors $\therefore$ $R_{eq} = 100\Omega$.

Problem b,$R_{eq} = 220\Omega$



Explanation: The 200 & 300 Ω resistors are in parallel, these combine to form 120Ω and with the 100Ω resistor give $R_{eq} = (120 + 100)\,\Omega = 220\,\Omega$.

Problem c, $R_{eq} = 100\Omega$



Explanation: The 200 and 300 Ω resistors are in series but there is a short between them and the loop containing the battery and 100 Ω resistor, because the potential difference on the wire joining the two loops is zero. Therefore no current flows through the loop containing the 200 and 300 Ω resistors, and so the equivalent resistance is 100 Ω.