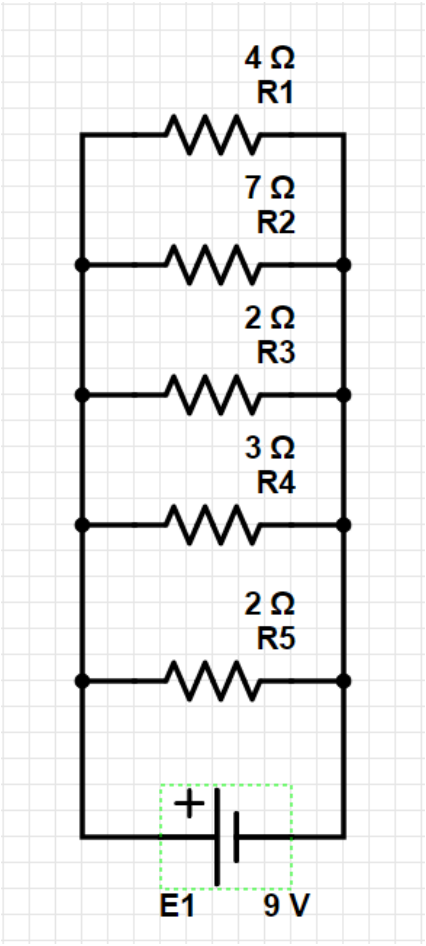
Answer on Question #66058 - Physics | Electric Circuits

At the most recent meeting of the physicists-who-look-to-torture-students club, there was great discouragement at how the students had solved the evil capacitor network problem. What could be done? A timid voice2 from the back said, “We could try again with resistors?” Yes... resistors! Mwa-ha-ha-ha! Find the equivalent resistance of the network pictured here, then find the current and potential difference across each resistor.

4ohms
7ohms
2ohms
3ohms
2ohms
9V

Solution:



1. Finding equivalent resistance

General formula for parallel connection of resistance

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_1} + \cdots + \frac{1}{R_n}$$

Our case

$$\frac{1}{R_T} = \frac{1}{4} + \frac{1}{7} + \frac{1}{2} + \frac{1}{3} + \frac{1}{2} = \frac{21+12+42+28+42}{84} = \frac{145}{84}$$

$$R_T = \frac{84}{145} = 0{,}5793 \approx 0{,}58 \text{ Ohm}$$

R_T – equivalent resistance of circuit.

2. Potential differences across each resistor:

$$V_1 = V_2 = V_3 = V_4 = V_5 = E1 = 9 \text{ V}$$

Ohm’s Law

$$I = \frac{V}{R}$$

Current through resistor R_1

$$I_1 = \frac{V_1}{R_1} = \frac{9}{4} = 2.25 \text{ A}$$

Current through resistor R_2

$$I_2 = \frac{V_2}{R_2} = \frac{9}{7} \approx 1.29 \text{ A}$$

Current through resistor R_3

$$I_3 = \frac{V_3}{R_3} = \frac{9}{2} = 4.5 \text{ A}$$

Current through resistor R_4

$$I_4 = \frac{V_4}{R_4} = \frac{9}{3} = 3 \text{ A}$$

Current through resistor R_5

$$I_5 = \frac{V_5}{R_5} = \frac{9}{2} = 4.5 \text{ A}$$