Q- A 2.8kΩ and a 2.1kΩ resistor are connected in parallel; this combination is connected in series to a 1.8kΩ resistor. If each resistor is rated at 0.50W, what is the maximum voltage that can be applied across the whole network without damaging resistors?

Power dissipated in a resistor is given by $P = I^2R$ hence maximum current allowed in the three resistors is given by

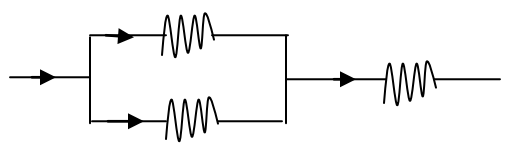
$$I_1 = \sqrt{\frac{P}{R_1}} = \frac{0.5}{2.8*10^3} = 13.4\ mA$$

$$I_2 = \sqrt{\frac{P}{R_2}} = \frac{0.5}{2.1*10^3} = 15.4\ mA$$

And $$I = \sqrt{\frac{P}{R_3}} = \frac{0.5}{1.8*10^3} = 16.7\ mA$$

As the current in 1.8K resistor is divided in the other two and will be less, the maximum current allowed in the circuit is 16.7 mA.

As the two resistors are in parallel, the voltage across them is same and thus



$$I_1R_1 = I_2R_2$$

Or $$\frac{I_1}{I_2} = \frac{R_2}{R_1} = \frac{2.1}{2.8} = \frac{3}{4}$$

Hence current in 2.8K will be $I_1 = (3/7)*16.7 = 7.16$ mA

And in 2.1 K will be $I_2 = (4/7)*16.66 = 9.52$ mA

Thus the maximum voltage will be

$$V = 7.16*10^{-3}*2.8*10^3 + 16.7*10^{-3}*1.8*10^3 = 50.1\ V.$$