Electricity - Resistor Networks

21 February 2020 11:25

Really, the rule is "reach for Ohm's Law". Mostly questions on resistor networks or potential dividers come down to thinking through Ohm's Law...

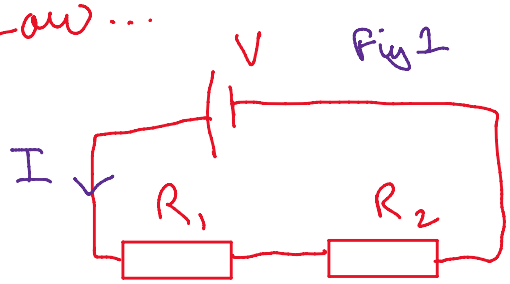


Fig 1

Two resistors in series make a "potential divider".

$V = IR$

In fig 1 : $I = \frac{V}{R_1 + R_2}$ .... ①

So what is the p.d. across R_1? $V_{R_1} = IR_1$ ... ②

now sub for I in ② using ①

$V_{R_1} = \frac{V}{R_1+R_2} \times R_1$ ... which is often written as

$V_{R_1} = V \frac{R_1}{R_1+R_2}$

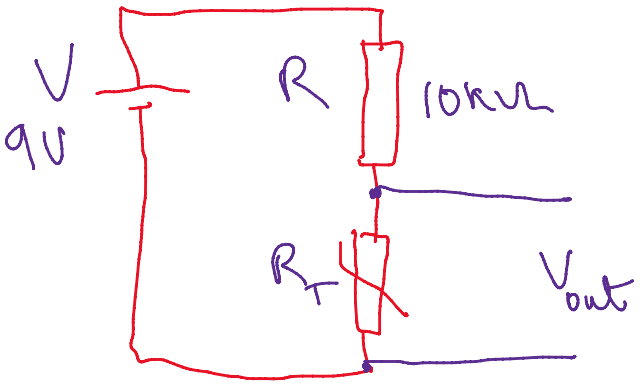
Using the same logic we can get

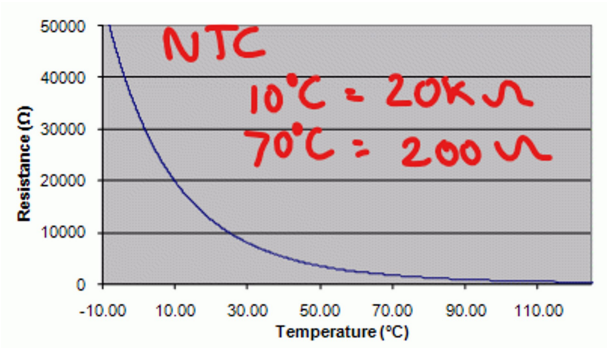
$V_{R_2} = V \frac{R_2}{R_1+R_2}$

There are many uses for potential dividers, based around the idea that you can reduce a voltage by a known amount. It is also worth nothing that the potential divider formula has no current in it. As you know voltage is shared out according to the ration of the resistances.

One key use of potential dividers is in simple switching devices. Here's an example.

Thermistor in a Sensing Circuit.





Q: What happens to V_{out} as temperature falls? You've been given data on the graph.....

$$V_{out} = \frac{V R_T}{R_T + R}$$

Cool ie 10°C $\quad V_0 = \dfrac{9 \times 20K}{20K + 10K} \Rightarrow V_0 = 6V$

Warm ie 70°C $\quad V_0 = \dfrac{9 \times 0.2K}{0.2K + 10K} \Rightarrow V_0 = 0.17V$

So, voltage has dropped considerably. Some fairly simple logic (ie digital) circuitry could turn on/off a heater etc.