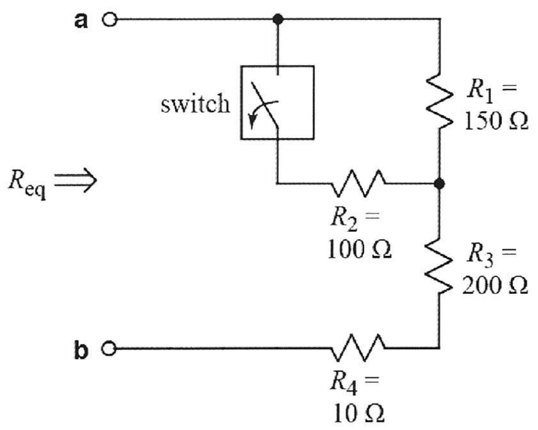
2.



a) Find the equivalent resistance from **a** to **b** with the switch open and then with the switch closed.

b) If a voltage source is connected across **a** and **b** and this causes a voltage drop across R_4 of 2V, what is the voltage drop across R_3?

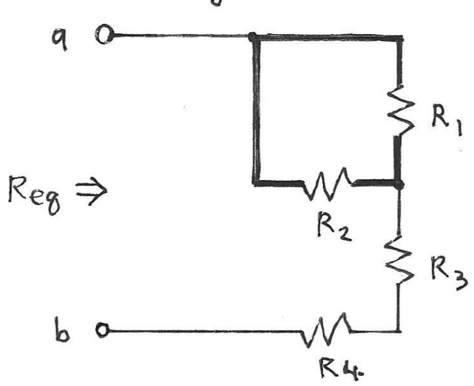
sol'n: a) With the switch open, R_2 is dangling with one end disconnected. So we may ignore R_2, which leaves us with R_1, R_3, and R_4 in series.

$$R_{eq} = R_1 + R_3 + R_4 = 150\,\Omega + 200\,\Omega + 10\,\Omega$$

or

$$R_{eq} = 360\,\Omega \quad \text{with switch open}$$

With the switch closed, we have R_2 in parallel with R_1. (The opposite ends of R_1 and R_2 are connected, as indicated by the heavy lines in the diagram below.)



$$R_{eq} = R_1 \| R_2 + R_3 + R_4$$ switch closed

$$" = 100 \| 150\ \Omega + 200\ \Omega + 10\ \Omega$$

$$" = 50\ \Omega \cdot 2 \| 3 + 200\ \Omega + 10\ \Omega$$

$$" = 50\ \Omega \cdot \frac{6}{5} + 210\ \Omega$$

$$" = 60\ \Omega + 210\ \Omega$$

$$R_{eq} = 270\ \Omega$$ switch closed

b) Since R_3 and R_4 are in series, they carry the same current.

By Ohm's law we have the following current in R_4:

$$i = \frac{2V}{R_4} = \frac{2V}{10\ \Omega} = \frac{1}{5} A$$

By Ohm's law again, we find v_3 (measured with + sign on top and v_4 with + sign on right):

$$v_3 = i R_3 = \frac{1}{5} A \cdot 200\ \Omega = 40 V$$