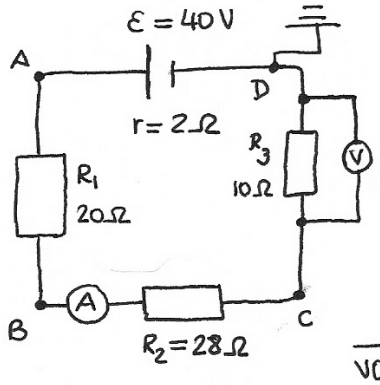
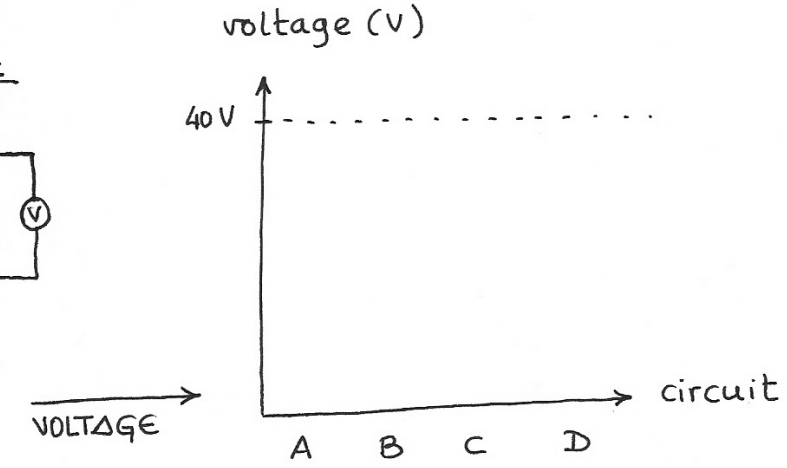
Conceptual Exercise

Complete the graphics related to the electric circuit below:





Determination of potentials (voltages)

"D" point is connected to the ground. Therefore, $V_D = 0$ V

"A" point is next to the postive electrode of the battery, but the charges need to overcome the internal resistance.

From Ohm's Law, we can get the value of I:

$$I = \frac{\varepsilon}{R_{equiv}} = \frac{40\ V}{2\ \Omega + 20\ \Omega + 28\ \Omega + 10\ \Omega} = 0.67\ A$$

It means that $V_A = 40\ V - 2\ \Omega * 0.67\ A = 38.66\ V$

The potential difference between "A" and "B" (the voltage "lost") is:

$V_A - V_B = I * R = 0.67\ A * 20\ \Omega = 13.4\ V$

The potential (voltage) at "B" is:

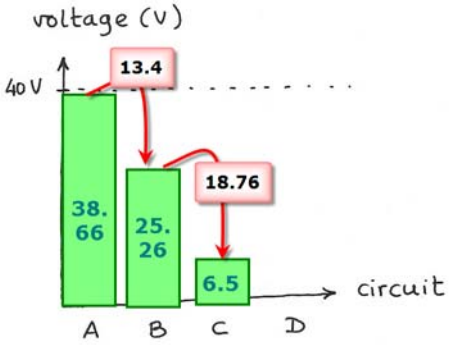
$V_A - V_B = 13.4\ V \xrightarrow{V_A = 38.66\ V} 38.66\ V - V_B = 13.4\ V \rightarrow V_B = 25.26\ V$

The potential difference between "B" and "C" is:

$V_B - V_C = I * R = 0.67\ A * 28\ \Omega = 18.76\ V$

The potential (voltage) at "C" is:

$V_B - V_C = 18.76\ V \xrightarrow{V_B = 25.26\ V} 25.26\ V - V_C = 18.76\ V \rightarrow V_C = 6.5\ V$



Determination of powers

The electric power (energy per second) supplied by the battery is:

$P_{supplied} = \varepsilon * I = 40\ V * 0.67\ A = 26.8\ W$

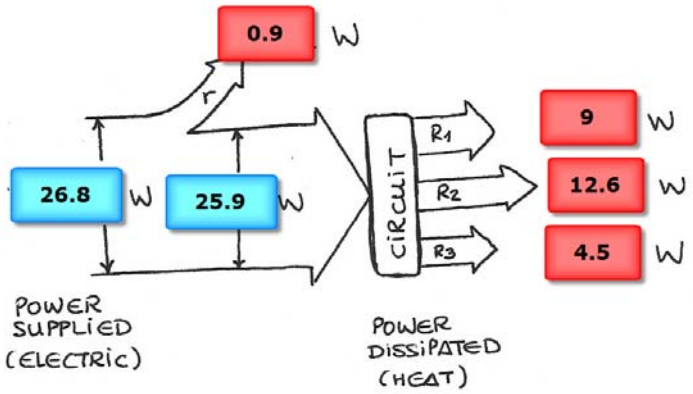
The power dissipated (as heat) by each resistor is:

$P_r = I^2 * R = (0.67\ A)^2 * 2\ \Omega = 0.9\ W$

$P_{R1} = I^2 * R = (0.67\ A)^2 * 20\ \Omega = 9\ W$

$P_{R2} = I^2 * R = (0.67\ A)^2 * 28\ \Omega = 12.6\ W$

$P_{R3} = I^2 * R = (0.67\ A)^2 * 10\ \Omega = 4.5\ W$



Determination of the readings

The reading of the ammeter gives the value of the current. The reading of the voltmeter gives the value of the potential difference between two points: