TD 1 DC CIRCUIT BASES

Exercise 1.

Consider the diagram in figure 1, then answer the following questions:

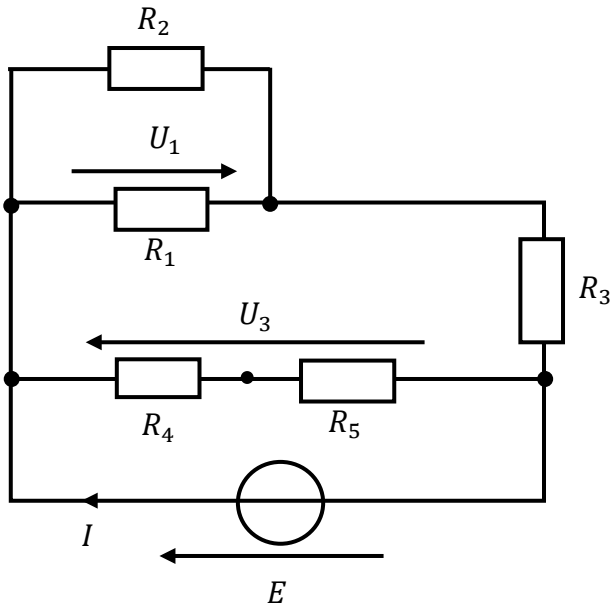


Figure 1

1. How many nodes, branches and loops are in the scheme?

3 NODES 5 BRANCHES 6 LOOPS

2. Are there any resistances in series? If so, identify them?

R4 & R5

3. Are there any resistances in parallel? If so, identify them?

R1 & R2

Let's set: $R_1 = R_2 = 4R$, $R_3 = R_4 = R$ et $R_5 = 2R$

4. What is (function of R) the equivalent resistance seen by the generator E ?

Req=1.5*R

5. Give the expressions of voltages U_3 and U_1.

$$U_3 = E \ \ and \ U_1 = 2E/3$$

Exercise 2.

Consider the diagram in figure 2. Let's set:

- $E = V_A - V_B = 240V$
- $U_1 = V_F - V_B = 184V$
- $U_4 = V_C - V_D = -110V$
- $U_5 = U_{AD} = 46V$

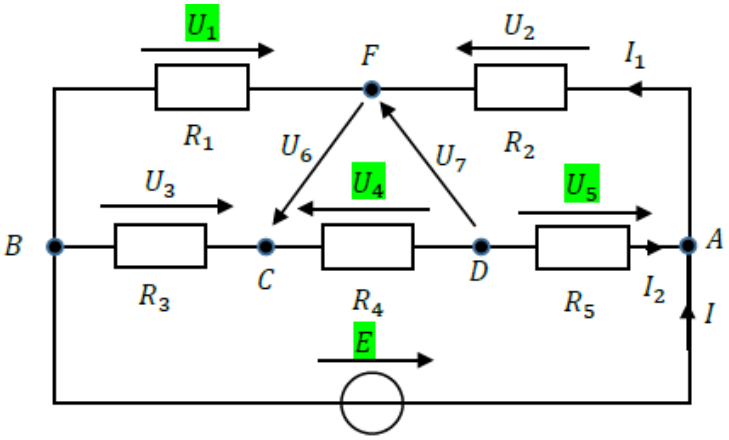


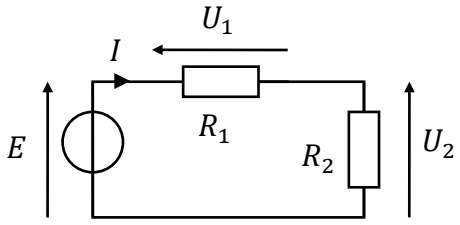
Figure 2

1. Place the points A, B, C, D and F on the figure.

2. Calculate the values of voltages U_2, U_3, U_6 et U_7.

3. Calculate the intensity of currents I_1, I_2 and I present in figure 2. Let's set $R_1 = R_3 = 100\Omega$. Please comment the chosen directions for the given currents?

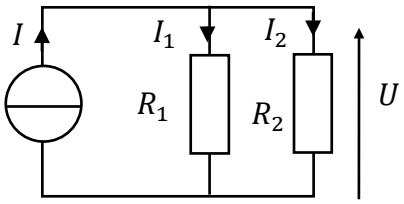
Exercise 3. Voltage Divider



Consider the loop on the right:

1. Write Kirchhoff's Voltage Law.
2. Could resistors R_1 and R_2 be associated? If yes, give the expression of R_{eq} resulting of the association of R_1 and R_2. Redo the loop. Could we set voltages U_1 and U_2 on the new dr? Same questions for current I.
3. Find the formula of I in terms of $E$and R_{eq}, then in terms of E, R_1 and R_2.
4. Derive a formula for U_2 in terms of E, R_1 and R_2.

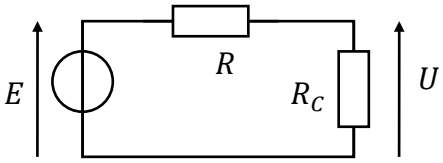
Exercise 4. Current Divider



Consider the scheme on the right:

1. Write Kirchhoff's Current Law.
2. Could resistors R_1 and R_2 be associated? If so, give the expression of R_{eq}, resulting from the association of R_1 and R_2. Redo the loop. Could we set currents I_1 and I_2 on the new diagram? Same questions for voltage U.
3. Find the formula of I in terms of I et de R_{eq}, then in terms of I, R_1 et R_2.
4. Derive a formula for I_2 in terms of I, R_1 and R_2.

Exercise 5.



The generator (E, R) gives a voltage level $U = 2\,V$ if $R_C = 10\ \Omega$ and it doubles the voltage level if $R_C = 25\ \Omega$.

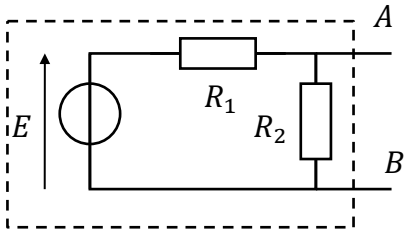
Set a formula for U in terms of $E, R\ and\ R_c$.

What are the values of E and R

Exercise 6.

A black box contains 3 dipoles E, R_1 and R_2. We know that $E = 6V$, but, $R_1$and R_2 are unknown.

If we place a voltmeter between points A and B, we measure 4V. If we place an ammeter between points A and B, we measure 0.5A.



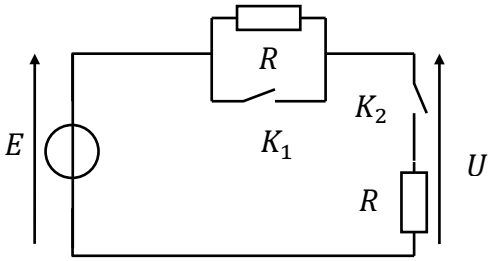
What are the values of R_1 and R_2 ?

Details:

- An ammeter is used to measure the intensity of the current that flows through a component. To do this, the ammeter must be connected in series with the component concerned. In series resistors, the current is the same. It should be noted that an ammeter has a negligible resistance, so it does not modify the current flowing in the circuit.
- A voltmeter is used to measure the electrical potential difference between the terminals of a component. To do this, the voltmeter must be connected in parallel with the component concerned, because the potential difference at the terminals of the components in parallel is the same. As the resistance of the voltmeter is much higher than that of the component to whose terminals it is connected, very little current flows through it. The effect on the circuit is therefore negligible. The resistance of the voltmeter can generally be considered infinite.

Exercise 7.

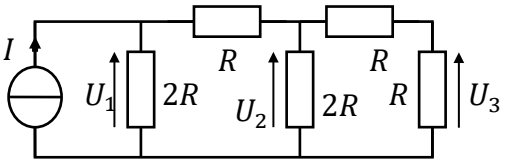
Consider the circuit on the right. Find a formula for U in the 4 possible cases related to interruptors K1 ans K2.



Exercise 8.

Consider the diagram on the right where:
$I = 2\ mA$ et $R = 1\ k\Omega$

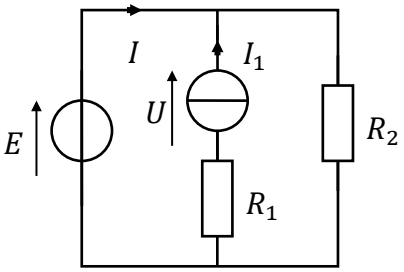
Give the expression and calculate the value of U_1, U_2 and U_3



Exercise 9.

Consider the diagram on the right where:

$E = 15V$ $R_1 = 200\Omega$
$I_1 = 0{,}1A$ $R_2 = 100\Omega$



Give the expression and calculate the value of U and I

Exercise 10.

Consider the circuit on the right , $U = E/4$ is desired
Give the expression of:

- R' in terms of R
- U' in terms of E.

