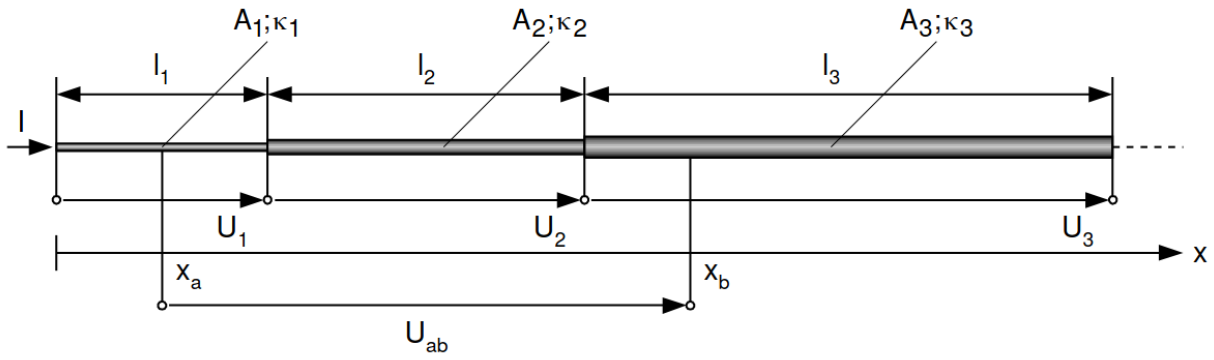
27. Internationale Elektrotechnik-Olympiade der Schulen der Euroregion Neisse

NEISSE-ELEKTRO 2021

Exercise #4

Official formula sheet: hszg.de/neisse-elektro --> Aufgaben --> formula sheet2019.pdf

1) Given are three wires in serial connection with a current I=3A:



$A_1 = 1\ mm^2$
$A_2 = 1{,}5\ mm^2$
$A_3 = 2{,}5\ mm^2$
$\kappa_1 = \kappa_2 = \kappa_3 = \kappa_{Cu} = 56{,}2\ Sm/mm^2$
$l_1 = 3\ m$
$l_2 = 5\ m$
$l_3 = 10\ m$
$x_a = 1{,}6\ m$
$x_b = 9{,}3\ m$

Figure 1

Calculate

a) the current density J_1, J_2, J_3

b) the electrical intensity E_1, E_2, E_3

c) voltages U_1, U_2, U_3

d) voltage U_{ab}

2) An wire of copper (length s_{Cu} = 40m; A_{Cu} = 0.75mm^2; κ_{20Cu} = 56Sm/mm^2; α_{Cu} = 0.0039K^{-1}) and a wire out of constantan (A_{Ko} = 1.0mm^2; κ_{20Ko} = 2Sm/mm^2; α_{Ko} = -5·10^{-5}K^{-1}= -0.00005K^{-1}) are connected in series.

a) Calculate the length s_{Ko} of the wire of constantan, that the resulting resistance is temperature independent.

b) Calculate the resulting total resistance R.

3) Calculate the speed of electrons within an metal with

- I = 12A
- A = 1mm^2
- length s = 7m.
- and density of electrons n = 8,4·10^{28} /m^3.

You are invited to work on a collaborative document for the solution:
https://pad.gwdg.de/OedZi2wnQFi1BHsG7RQGMw