KIT - International Department GmbH

Pre-Semester Physics - Exercises **Summer 2010**

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1. Exercise:

A Nichrome wire ($\rho_s = 1.0 \cdot 10^{-6}\,\Omega\text{m}$) has a radius of $r = 6.5\,\text{mm}$.

(a) What length ℓ of a wire is needed to obtain a resistance of $R = 20\,\text{m}\Omega$?

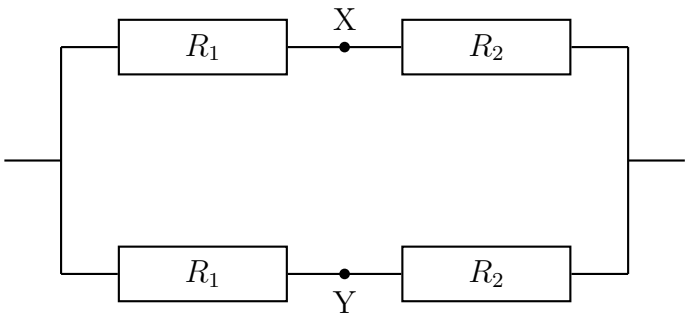
(b) Find the magnitude of the electric field $\mathcal{E}$ in the wire if it is carrying a current of $I = 1.3\,\text{A}$.

(c) What would be the capacitance C of a similar isolating wire made of Barium titanate with $\epsilon_r = 4000$ (and metallic bases)?

(d) How many charges Q would be on its bases if the same electric field is present?

2. Exercise:

Consider the following resistor network:



The resistors have the resistances $R_1 = 3.0\,\Omega$ and $R_2 = 2.0\,\Omega$.

(a) Determine the equivalent resistance R_{tot}.

(b) What would be the current I_0 through the whole circuit if a voltage of $U_0 = 1.5\,\text{V}$ is applied?

(c) How large is the current I_1 which flows through a resistor with resistance R_1 in this case?

(d) Find the voltages U_1 and U_2 which drop at the resistors with resistance R_1 and R_2.

(e) What powers P_1 and P_2 are dissipated at the resistors R_1 and R_2?

(f) Determine the electrical potential at the points X and Y if the left end of the circuit lies at the potential of $\phi_0 = 2.0\,\text{V}$ while the right end is at a lower value.

(g) Which voltage U_{XY} drops between the points X and Y and how large is the current I_{XY} which flows in a wire connecting these points?

Note:

The Vacuum permittivity is given by $\epsilon_0 = 8.85 \cdot 10^{-12} \frac{\mathrm{As}}{\mathrm{Vm}}$