

# task\_rj0r6j4apumukrj6\_with\_calculation

## Student Group

First Name	Surname	Matrikel Nr.

## Table of Contents

Exercise E1 Resistance of a Wire by Resistivity (written test, approx. 6 % of a 60-minute written test, WS2022) ..... 2

resistivity, power, exam ee1 WS2022

### Exercise E1 Resistance of a Wire by Resistivity (written test, approx. 6 % of a 60-minute written test, WS2022)

A heating element made of nichrome wire with a temperature coefficient of resistance of  $\alpha = 0.00180 \text{ } ^\circ\text{C}^{-1}$  is used. Electric power dissipation (= heat flow) of  $P = 40 \text{ W}$  is necessary. Calculate the current  $I$  and the operating voltage  $U$  for heating elements. The nichrome wire has a resistivity of  $\rho = 1.10 \cdot 10^{-6} \text{ } \Omega \cdot \text{m}$ . The heating element is  $l = 3 \text{ m}$  long and has a diameter of  $d = 3.57 \text{ mm}$ .  
 Solution:  $R = 10^{-3} \text{ } \Omega$   
 ∴ Calculate the resistance  $R$  of the heating element.

Solution

$$P = U \cdot I = R \cdot I^2 \quad \rightarrow \quad I = \sqrt{\frac{P}{R}} = \sqrt{\frac{40 \text{ W}}{0.33 \text{ } \Omega}}$$

$$R = \rho \cdot \frac{l}{A} \quad | \quad A = r^2 \cdot \pi = \frac{1}{4} d^2 \cdot \pi \quad \parallel \quad R = \rho \cdot \frac{4 \cdot l}{d^2 \cdot \pi} \quad \parallel \quad R = 1.10 \cdot 10^{-6} \text{ } \Omega \cdot \text{m} \cdot \frac{4 \cdot 3 \text{ m}}{(3.57 \cdot 10^{-3} \text{ m})^2 \cdot \pi}$$

From: <https://wiki.mexle.org/> - MEXLE Wiki  
 Permanent link: [https://wiki.mexle.org/electrical\\_engineering\\_1/task\\_rj0r6j4apumukrj6\\_with\\_calculation?rev=1680389091](https://wiki.mexle.org/electrical_engineering_1/task_rj0r6j4apumukrj6_with_calculation?rev=1680389091)  
 Last update: 2023/04/02 00:44

