

task_rj0r6j4apumukrj6_with_calculation

Student Group

First Name	Surname	Matrikel Nr.

Table of Contents

Exercise E1.1 Resistance of a Wire by Resistivity (written test, approx. 6 % of a 60-minute written test, WS2022) 2

resistivity, power, exam ee1 WS2022

indexmenu_n_100

Exercise E1.1 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 cross-section of 1.80 mm^2 and an 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 $1.10 \cdot 10^{-6} \text{ } \Omega \text{ m}$.

The heating element is 3 m long and has a diameter of 3.57 mm .

Solution: $R = 1.10 \cdot 10^{-6} \text{ } \Omega \text{ m}$

1. Calculate the resistance R of the heating element.

Solution:
$$P = U \cdot I = R \cdot I^2 \quad \rightarrow \quad I = \sqrt{\frac{P}{R}} = \sqrt{\frac{40 \text{ W}}{0.33 \text{ } \Omega}} \quad \rightarrow \quad I = 10.93 \text{ A}$$

$$R = \rho \cdot \frac{l}{A} \quad | \quad A = r^2 \cdot \pi = \frac{1}{4} d^2 \cdot \pi \quad | \quad R = \rho \cdot \frac{4 \cdot l}{d^2 \cdot \pi} \quad | \quad R = 1.10 \cdot 10^{-6} \text{ } \Omega \text{ m} \cdot \frac{4 \cdot 3 \text{ m}}{(3.57 \cdot 10^{-3} \text{ m})^2 \cdot \pi} \quad | \quad R = 0.33 \text{ } \Omega$$

From: <https://mexle.te.hs-heilbronn.de/> - MEXLE Wiki

Permanent link: https://mexle.te.hs-heilbronn.de/electrical_engineering_1/task_rj0r6j4apumukrj6_with_calculation?rev=1680241373

Last update: 2023/03/31 07:42

