

# task\_70jg4yzznocarsq\_with\_calculation

## Student Group

First Name	Surname	Matrikel Nr.

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## temperature dependent resistance, power, heat, exam ee1 WS2022

### Exercise E1.1 Temperature-dependent Resistance (written test, approx. 6 % of a 60-minute written test, WS2022)

A refrigerator exhibits a temperature coefficient of resistance of  $0.01 \text{ K}^{-1}$  and a quadratic coefficient of  $71 \text{ K}^{-2}$ . The refrigerator has a resistance of  $10 \text{ k}\Omega$  at  $25^\circ\text{C}$ . Its temperature coefficients are:  $\alpha = 0.01 \text{ K}^{-1}$  and  $\beta = 71 \text{ K}^{-2}$ .

Result  
The temperature inside the refrigeration system can reach down to  $-40^\circ\text{C}$ .

Calculate the resistance of the thermostat at  $-40^\circ\text{C}$ .

Resistance of the resistor  $R$  depends on the current  $I$  and generated heat  $P$ . Therefore, a solution exists to the heat flow.

Therefore, with constant  $U$  and increasing  $R$  the power decreases. Ten times more resistance decreases the heat flow to one-tenth.

$$R = R_0 \cdot (1 + \alpha \cdot \Delta T + \beta \cdot \Delta T^2) \quad | \quad \Delta T = T_{\text{end}} - T_{\text{start}}$$

$$R = 10 \text{ k}\Omega \cdot \left(1 + 0.01 \text{ K}^{-1} \cdot (-40^\circ\text{C} - 25^\circ\text{C}) + 71 \text{ K}^{-2} \cdot (-40^\circ\text{C} - 25^\circ\text{C})^2\right)$$

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