

# task\_70jjg4yzznocarsq\_with\_calculation

## Student Group

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

A thermistor, which exhibits a linear effect, is sensitive to temperature variations. The thermistor has a resistance of  $10 \text{ k}\Omega$  at  $25^\circ\text{C}$ . Its temperature coefficients are:  $\alpha = 0.01 \text{ } ^\circ\text{C}^{-1}$  and  $\beta = 71 \cdot 10^{-6} \text{ } ^\circ\text{C}^{-2}$ .

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

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

$$R = 6.5 \text{ k}\Omega$$

The power transfer resistor  $P$  is  $P = U^2 / R$  and  $Q = P \cdot t$ . Therefore, a solution is to increase the heat flow.

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

$$R = R_0 \cdot (1 + \alpha \cdot \Delta T + \beta \cdot \Delta T^2) \quad | \quad \Delta T = T_{\text{end}} - T_{\text{start}} \\ R = 10 \text{ k}\Omega \cdot \left(1 + 0.01 \cdot (-40 - 25) + 71 \cdot 10^{-6} \cdot (-40 - 25)^2\right)$$

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