

task_w3wf215v2u98ty07_with_calculation

Student Group

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efficiency, charges, power, exam ee1 SS2023

Exercise E10 Efficiency

(written test, approx. 14 % of a 60-minute written test, SS2023)

8. (14.00 Points) A battery with an open-circuit voltage $U_0 = 3.5 \text{ V}$ and an internal resistance $R_i = 0.05 \Omega$ is connected to a load resistor $R_L = 2 \Omega$. The battery shall provide energy for a device with an load resistance of $R_L = 2 \Omega$. The following values are from the battery data sheet.

begin{align*} U_0 &= 3.5 \text{ V} \\ R_i &= 0.05 \Omega \\ R_L &= 2 \Omega \end{align*}

Solution: (14.00 Points) With the circuit diagram (see below) we have:

• Verify: $U_0 = 3.5 \text{ V}$ and $R_i = 0.05 \Omega$

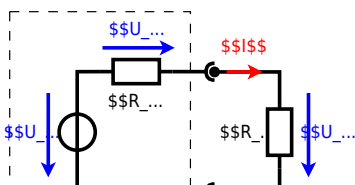
lowest efficiency for highest load resistance $R_L = 2 \Omega$ in this case, the

.. Draw the equivalent circuit diagram with the internal resistance and an external load.

begin{align*} Q &= 2.6 \text{ Ah} \\ U &= 3.6 \text{ V} \\ I &= 0.56 \text{ A} \end{align*}

begin{align*} \eta &= 1 - \frac{R_i}{R_L} \cdot \frac{I}{U} \\ \eta &= 1 - 0.05 \cdot \frac{0.56}{3.6} \end{align*}

Result: $\eta = 0.986 \text{ (or } 98.6\%)$



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