Thevenin's Theorem states that any two nodes of a linear circuit can be represented by one voltage source and one resistor. We can also simplify the circuit by opening the source, which is useful for measuring the output voltage. If we short the output, the current will flow through the resistor, and we can measure the output voltage.

Voc (no current) = 8 × 1.575 V = 12.6 V
Rth = 8 × (0.328) Ω
Vth = Voc + 20 Ω × 0.1 = 12.9 V
so Vth = Voc + 20 Ω × 0.1

Then short CI+ and measure Voc. Shorting causes damage, so the output voltage should be equal to Voc. If not, a resistor is needed. If the output voltage is equal to Voc, then there is no reasonable current and the test under load instead of short CI+ is 50.

Voc = Vth + 20 Ω × 0.1 = 12.9 V
so Vth = Voc + 20 Ω × 0.1

Rth = Vth + Vout = 0
Then Voc = 15 V
so Vth = Voc + 20 Ω × 0.1

Voc = 15 V
so Vth = Voc + 20 Ω × 0.1
Our Case

\[ V_{\text{LOAD}} = 1.525V \]

\[ V_{\text{LOAD}} = \frac{1.525}{10.52} = 0.15\text{amps} \]

\[ R_{\text{TH}} = 10.52 \]

\[ V_{\text{TH}} = 1.525\text{volts} \]

\[ R_{\text{LOAD}} = 10.52 \]

\[ V_{\text{TH}} = 1.525\text{volts} \]

\[ R_{\text{TH}} = 1.575 - 1.525\text{volts} \]

\[ R_{\text{TH}} = \frac{0.05\text{volts}}{0.15\text{amps}} = \frac{1}{3}\text{ohms} \]

Battery Theory Eq.

\[ V_{\text{BATT}} = 1.525\text{volts} \]

\[ V_{\text{TH}} = \frac{V_{\text{BATT}}}{3.52} \]

Class D

\[ V_{\text{DC}} = 1.675\text{volts} \]

\[ I_{\text{D}} = \frac{1.533}{10} = 0.1533\text{amps} \]

\[ R_{\text{TH}} = \frac{1.575 - 1.533}{0.1533} = 0.1742\text{ohms} \]

C

\[ V_{\text{DC}} = 1.605\text{volts} \]

\[ I_{\text{D}} = \frac{1.543}{10} = 0.1543\text{amps} \]

\[ R_{\text{TH}} = \frac{0.1543}{0.1543} = 0.1022\text{ohms} \]

AA

\[ V_{\text{DC}} = 1.620\text{volts} \]

\[ I_{\text{D}} = \frac{1.564}{10} = 0.1564\text{amps} \]

\[ R_{\text{TH}} = \frac{0.1564}{0.1564} = 0.3589\text{ohms} \]

AAA

\[ V_{\text{DC}} = 1.620\text{volts} \]

\[ I_{\text{D}} = \frac{1.555}{10} = 0.1555\text{amps} \]

\[ R_{\text{TH}} = \frac{0.1555}{0.1555} = 0.1022\text{ohms} \]

QV

\[ V_{\text{DC}} = 9.61\text{volts} \]

\[ I_{\text{QV}} = \frac{6.5}{0.50} = 13\text{amps} \]

\[ R_{\text{TH}} = \frac{9.61 - 6.50}{0.65} = 4.78\text{ohms} \]

How to handle multiple batteries

HW #2

Fricky on paper

Use Thevenin's Theorem (i.e., turn off voltage sources) and develop an expression (variables only) to determine \( R_{\text{TH}} \) for the combined circuit. Work from left to right to get the expression for \( R_{\text{TH}} \) at the output.

Use the battery \( R_{\text{TH}} \) values and \( R_1 = 15, R_2 = 23, R_3 = 33, R_4 = 48 \text{ohms} \) to solve for \( R_{\text{TH}} \) at the output.

Use the Nodal method to form the matrix needed to solve for \( V_A, V_B, V_C, V_{\text{OUT}} \). No Numbers.

Same ground as inside the circuit.