CIRCUITS DAY 12: JUNCTION RULE & A TWO-LOOP CIRCUIT

CED 11.7 · Skill 2.B · FRQ: MR

PREDICT

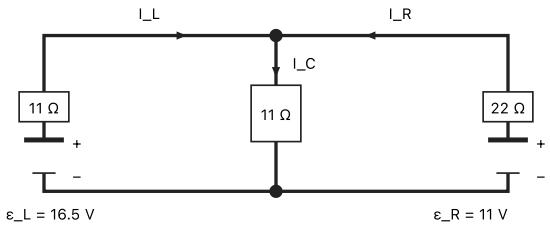
$3.0\ \text{A}$ enters a junction and splits into two outgoing branches. Circle one for the sum of the outgoing currents: **1.5 A / 3.0 A / 6.0 A / cannot tell**.

JUNCTION RULE

$$\sum I_{in} = \sum I_{out}$$

Steady charge does not accumulate at a junction.

FIX EVERY CURRENT ARROW BEFORE WRITING EQUATIONS



NOTES / REASONING

WRITE THREE EQUATIONS

Use the arrows shown: I_L and I_R enter the top node; I_C leaves downward.

$$I_L + I_R = I_C$$

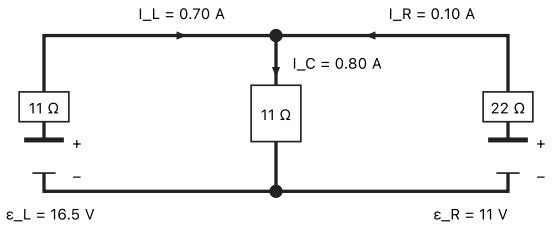
$$\varepsilon_L - I_L R_L - I_C R_C = 0$$

$$\varepsilon_R - I_R R_R - I_C R_C = 0$$

TRANSLATE Substitute $R_L = 11\ \Omega$, $R_R = 22\ \Omega$, $R_C = 11\ \Omega$, $\varepsilon_L = 16.5\ \text{V}$, and $\varepsilon_R = 11\ \text{V}$. Simplify the equations before solving.

SOLVE AND CHECK

CURATED TWO-LOOP SOLUTION



SOLVE Find I_L, I_R, and I_C. Then verify the junction equation and both loop equations with units.

If a current is negative, the actual current runs opposite the assumed arrow. Do not discard the sign.

PRACTICE

1. 4.2 A enters a junction; 1.7 A leaves one branch. Find the other outgoing current.

2. $I_L = 0.40\ \text{A}$ and $I_R = 0.25\ \text{A}$ enter a node. Find I_C.

3. In a loop, $\varepsilon = 12\ \text{V}$, $R = 20\ \Omega$, and another element has a 4 V drop. Find current.

4. A solution gives $I_R = -0.15\ \text{A}$. State its physical meaning.