



Currents in assumed direction.

$$\text{Junction a: } I_1 = I_2 + I_3 \quad (1)$$

$$\text{Left loop } \curvearrowright \text{ a: } -I_2 R_2 + \mathcal{E}_1 - I_1 R_1 = 0 \quad (2)$$

$$\text{Right loop } \curvearrowright \text{ a: } \mathcal{E}_2 - I_3 R_3 + I_2 R_2 = 0 \quad (3)$$

Subst. eqn (1)  $\rightarrow$  eqn (2)

$$-I_2 R_2 + \mathcal{E}_1 - (I_2 + I_3) R_1 = 0$$

$$\text{Or, } -I_2 (R_2 + R_1) + \mathcal{E}_1 - I_3 R_1 = 0 \quad (4)$$

Eqn (3) and (4) with numbers:

$$(3) \rightarrow 6 - 3I_3 + 2I_2 = 0$$

$$(4) \rightarrow -8I_2 + 3 - 6I_3 = 0$$

$$\text{Or, } -3I_3 + 2I_2 = -6 \quad (5)$$

$$6I_3 + 8I_2 = 3 \quad (6)$$

Solve the two simultaneous equations.

Take:  $2 \times (\text{equ'n (5)}) + \text{equ'n (6)}$

$$\frac{28-62}{2}$$

$$= 0I_3 + 12I_2 = -9$$

So:  $I_2 = \frac{-9}{12} \text{ A} = \underline{\underline{-0.75 \text{ A}}}$

and:

$$\begin{aligned} \text{equ'n (5)} \rightarrow I_3 &= \frac{2I_2 + 6}{3} \\ &= \underline{\underline{1.5 \text{ A}}} \end{aligned}$$

equ'n (1)  $I_1 = I_2 + I_3 = \underline{\underline{0.75 \text{ A}}}$

∴ power dissipated in  $R_2$  is:

$$\underline{\underline{P_2 = I_2^2 R_2 = 1.125 \text{ W}}}$$

### PHET SOLUTION

The screenshot shows the PhET Circuit Construction Kit DC interface. On the left is a toolbar with components: Wire, Battery, Light Bulb, Resistor, and Switch. The main workspace displays a circuit with a 3.0V battery on the left, a 6.0Ω resistor on the top wire, a 2.0Ω resistor on a vertical branch, a 3.0Ω resistor on the bottom wire, and a 6.0V battery on the right. A current meter is connected to the bottom wire, displaying a current of 0.75 A. On the right side, there are control panels for 'Show Current' (with options for Electrons and Conventional), 'Labels', 'Values', and 'Advanced'. At the bottom, there are navigation icons and the text 'Tap circuit element to edit.' The PhET logo is in the bottom right corner.