2.3 Problem Solving Procedure

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Preview

- In the previous sequence, *problem solving* skills and approach were presented.

- In this sequence, a 13 step *problem solving* procedure will be presented.

Problem Solving Procedure

1. Draw a picture of the physical system.
2. Indicate all given values on the diagram.
3. State any assumptions.
4. Label the unknown quantities with a question mark.

Problem Solving Procedure

5. Write the main equation that contains the desired quantity.

6. Manipulate the equation to isolate the desired quantity.

7. Write subordinate equations for the unknown quantities in the main equation.

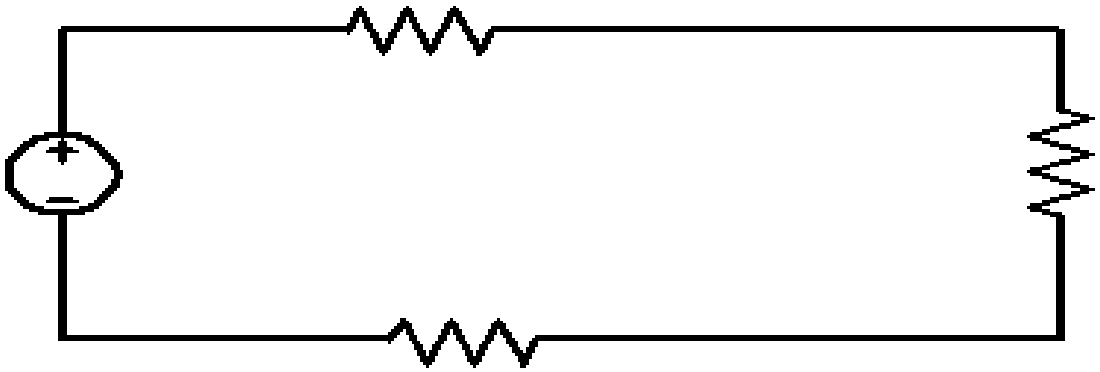
Problem Solving Procedure

8. Insert numerical values (with their units) in the equations.
9. Ensure that the units are correct.
10. Compute the answer.
11. Mark the final answer.
12. Check that the final answer makes physical sense.
13. Ensure that all questions have been answered.

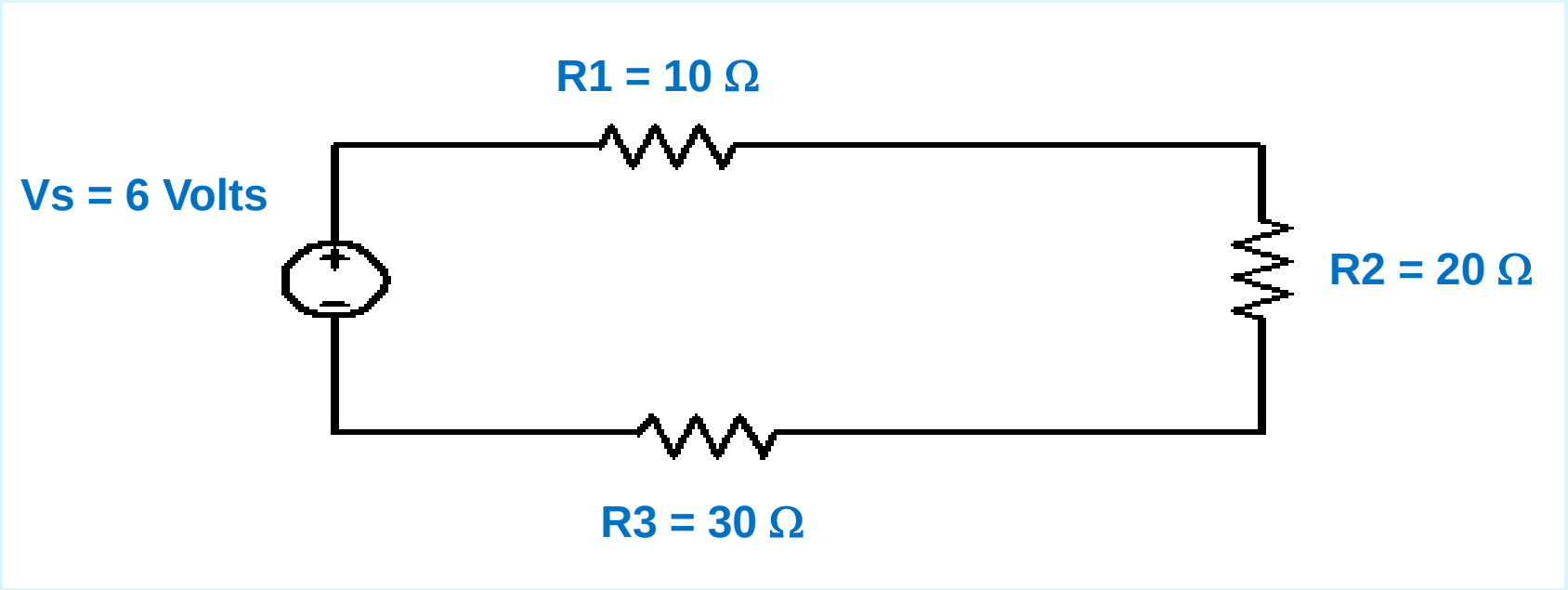
Sample Problem 1

- Three resistors (10, 20 and 30 Ohm) are placed in series. How much current flows from a 6 V battery? How much is the voltage drop across the 20 Ohm resistor?

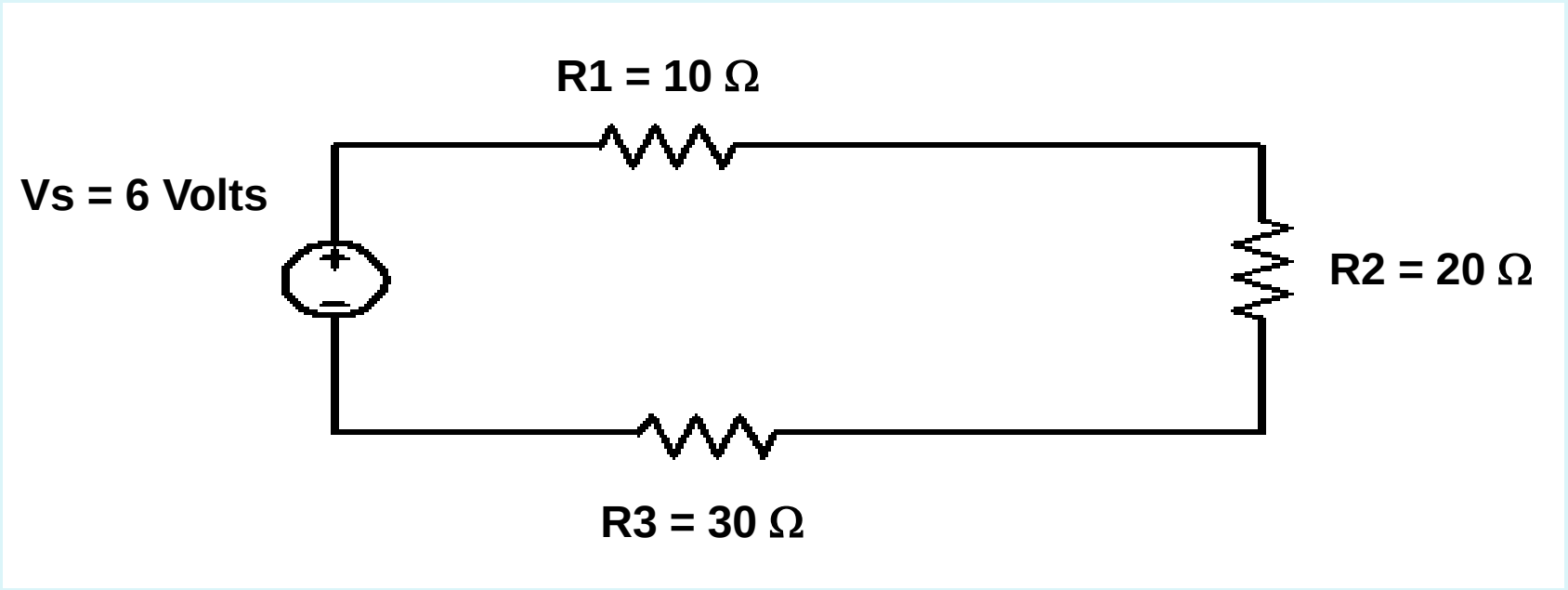
1. Draw a picture of the system



2. Indicate all the values

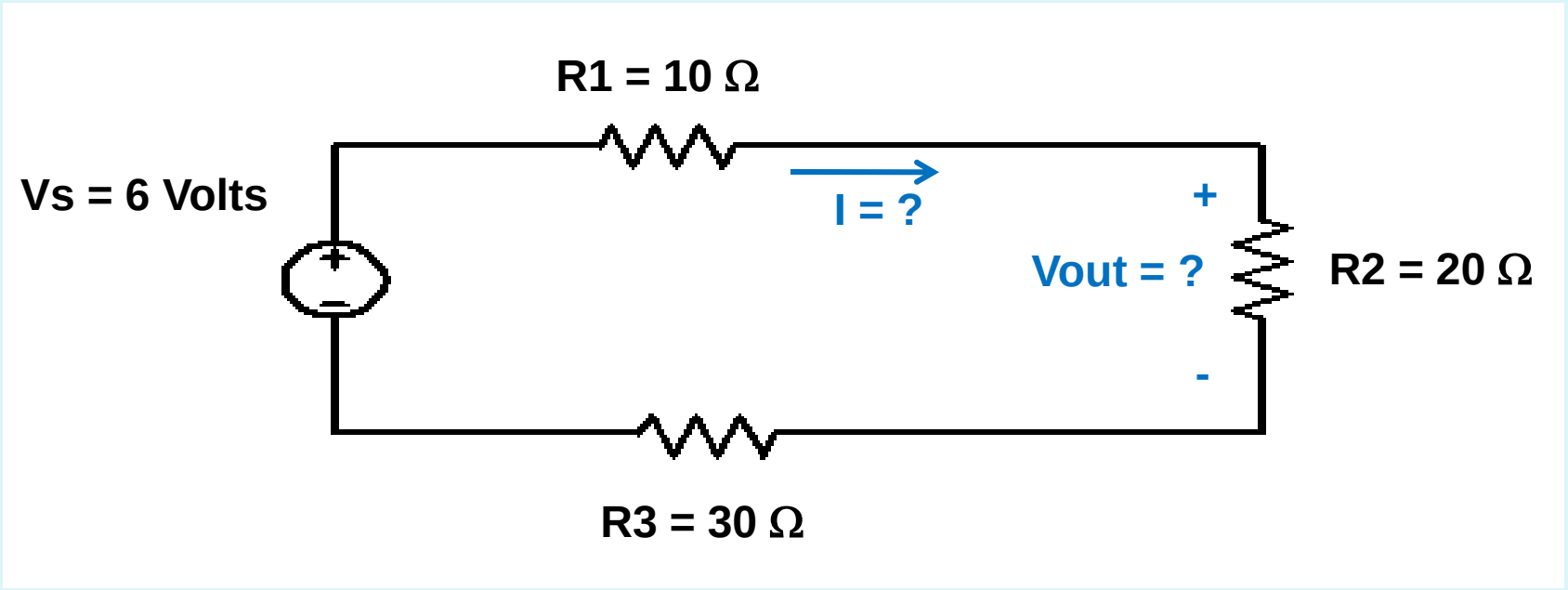


3. State any assumptions



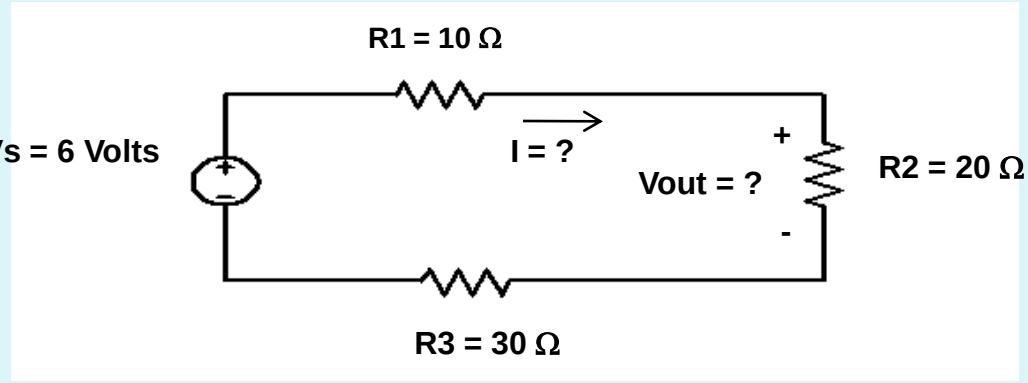
Assume there are no power losses in the wires

4. Label the unknowns



Assume there are no power losses in the wires

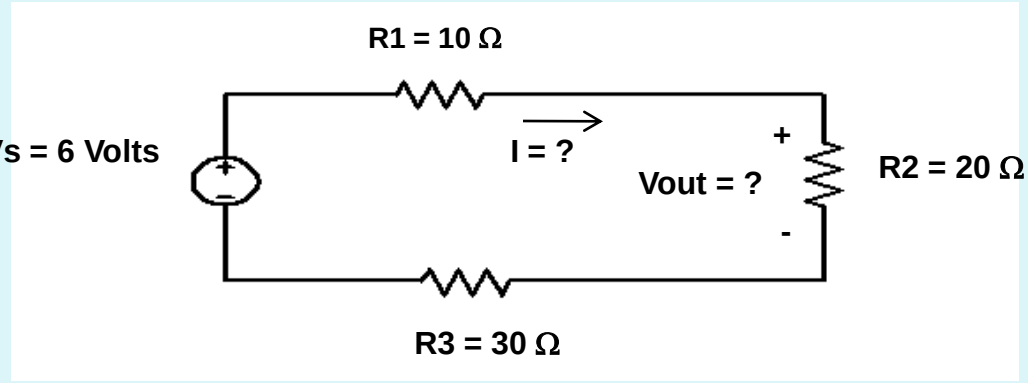
5. Write the main equation



Assume there are no loses in the wires

$$v = iR$$

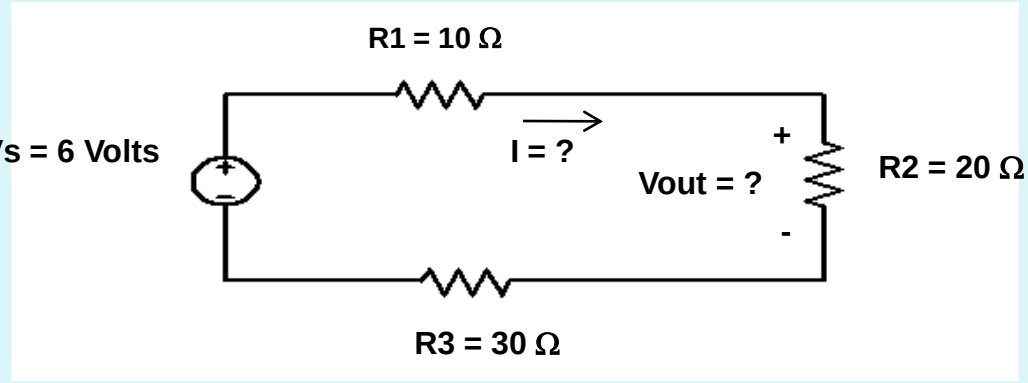
6. Isolate the unknown



Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R}$$

7. Write subordinate equations

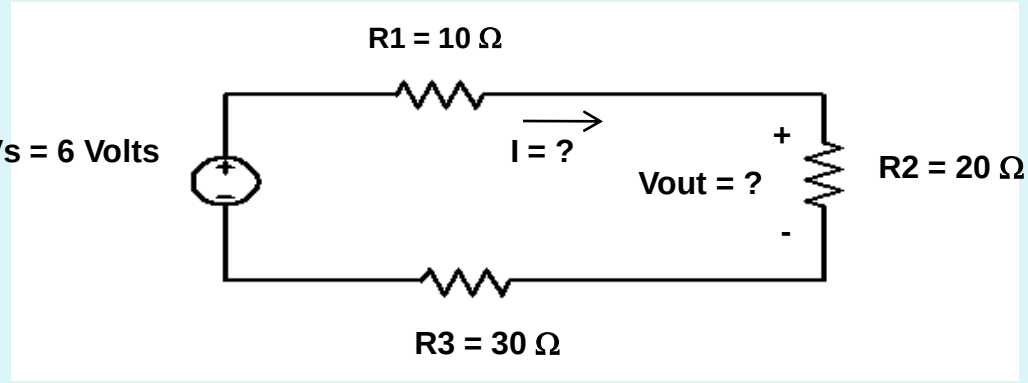


Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R}$$

$$i = \frac{v}{R_1 + R_2 + R_3}$$

8. Insert numerical values

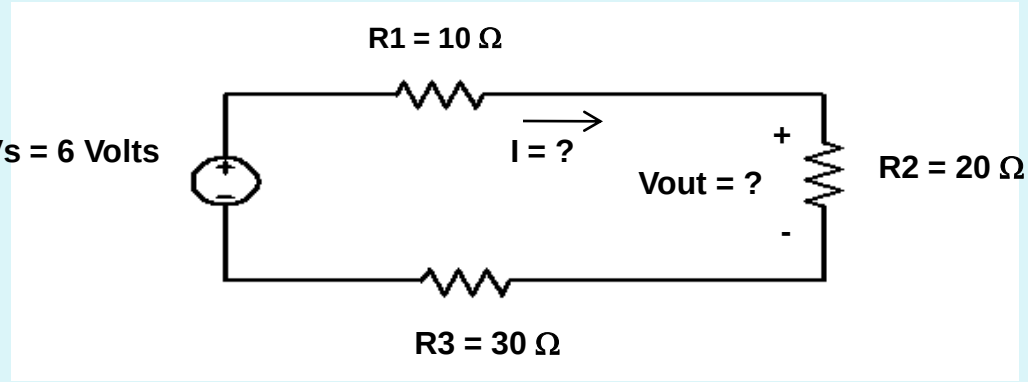


Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R}$$

$$i = \frac{v}{R_1 + R_2 + R_3} \Rightarrow i = \frac{6V}{10\Omega + 20\Omega + 30\Omega}$$

9. Insure that units are correct



Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R}$$

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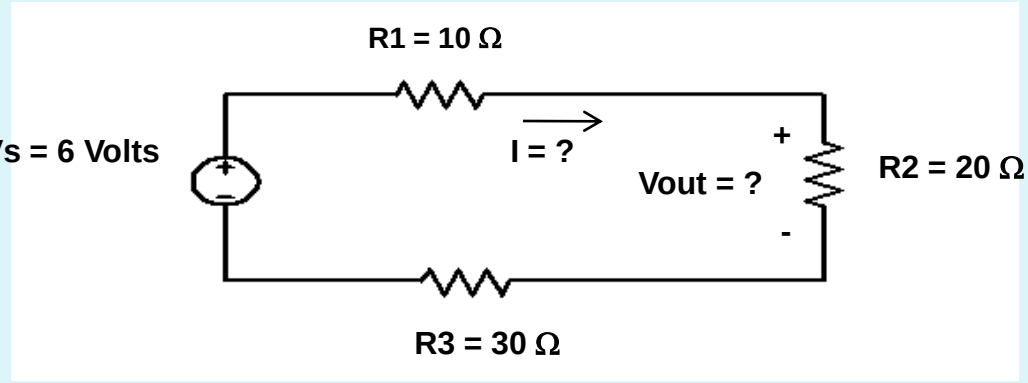
10. Compute the final answer



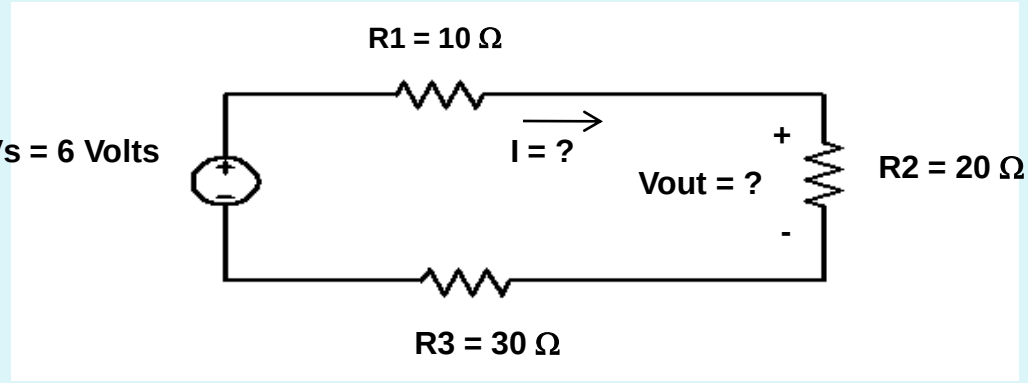
Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R}$$

$$i = \frac{v}{R_1 + R_2 + R_3} \Rightarrow i = \frac{6V}{10\Omega + 20\Omega + 30\Omega}$$

$$i = 0.1V/\Omega \Rightarrow i = 0.1A$$

11. Mark the answer



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$$v = iR \Rightarrow i = \frac{v}{R}$$

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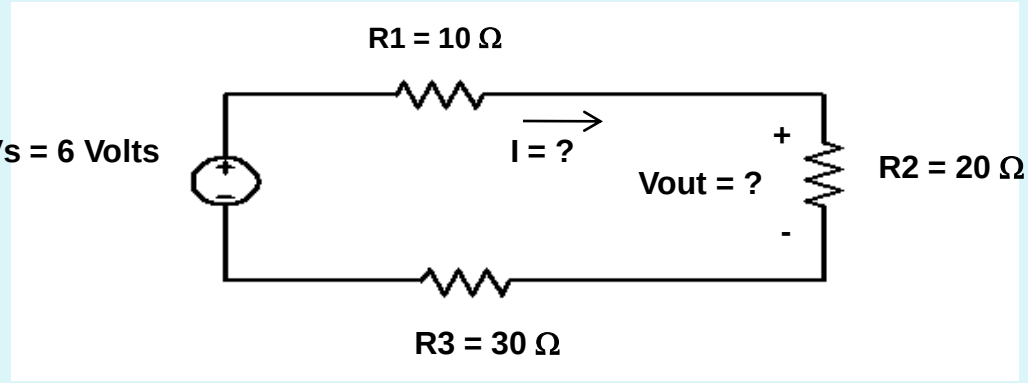
$$i = 0.1V/\Omega \Rightarrow \boxed{i = 0.1A}$$

12. Check that answer makes sense



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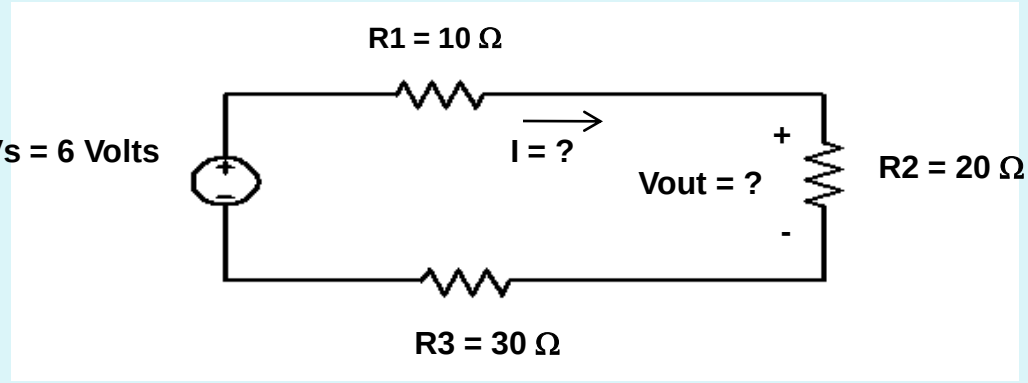
$$i = 0.1V/\Omega \Rightarrow \boxed{i = 0.1A}$$

0.1 Amperes is an appropriate value for the circuit

13. Ensure all answers are found



Assume there are no loses in the wires

$$v = iR \Rightarrow i = \frac{v}{R} \qquad i = \frac{v}{R_1 + R_2 + R_3} \Rightarrow i = \frac{6V}{10\Omega + 20\Omega + 30\Omega}$$

$$i = 0.1V/\Omega \Rightarrow \boxed{i = 0.1A}$$

0.1 Amperes is an appropriate value

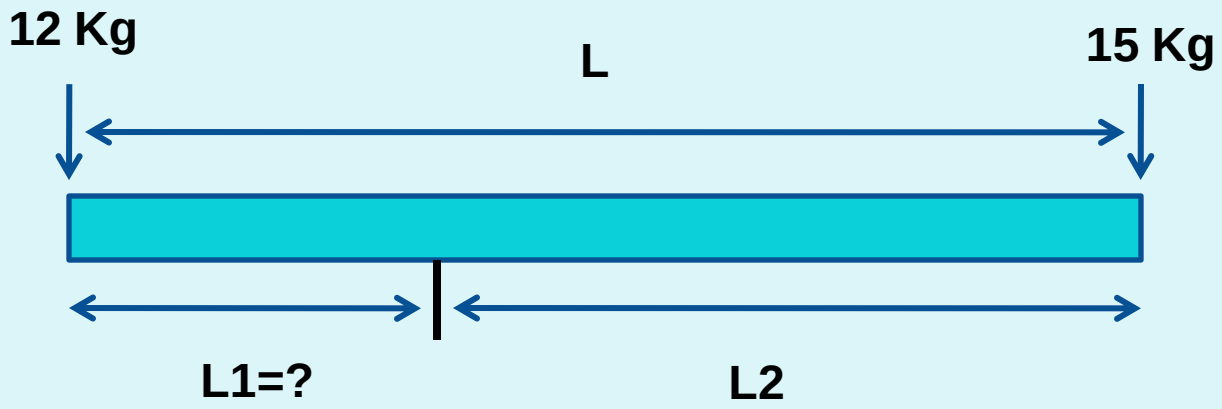
$$vout = iR_2$$

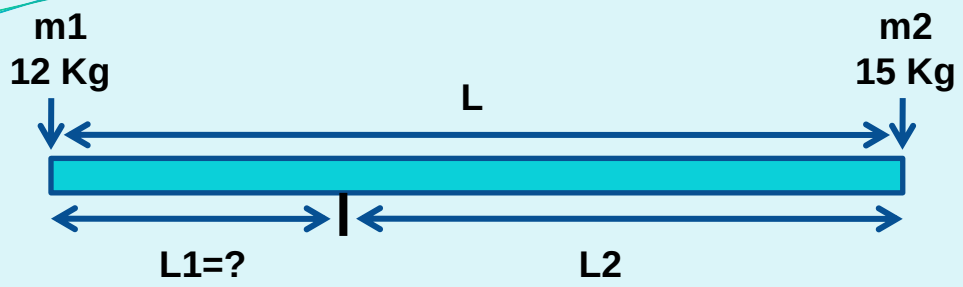
$$vout = (0.1A)(20\Omega) \Rightarrow \boxed{vout = 2Volts}$$

Done

Sample Problem 2

- A 12.0 Kg child and a 15.0 kg child sit on a 4.00 m long see-saw. Where should the pivot be placed so that the two children balance?





$$F_1 L_1 = F_2 L_2$$

$$m_1 g L_1 = m_2 g L_2 \quad \Rightarrow L_1 = \frac{m_2}{m_1} L_2$$

$$L_1 = \frac{m_2}{m_1}(L - L_1)$$

$$L_1 = \frac{15\cancel{Kg}}{12\cancel{Kg}}(4m - L_1) \quad \Rightarrow L_1 = 5m - 1.25L_1$$

$$L_1 = \frac{5m}{2.25} \Rightarrow \boxed{L_1 = 2.22m}$$

Conclusions

- In order to solve problems correctly, the solution must be carried out in a step-by-step procedure.

- A *problem solving* procedure that is composed of 13 steps was presented.