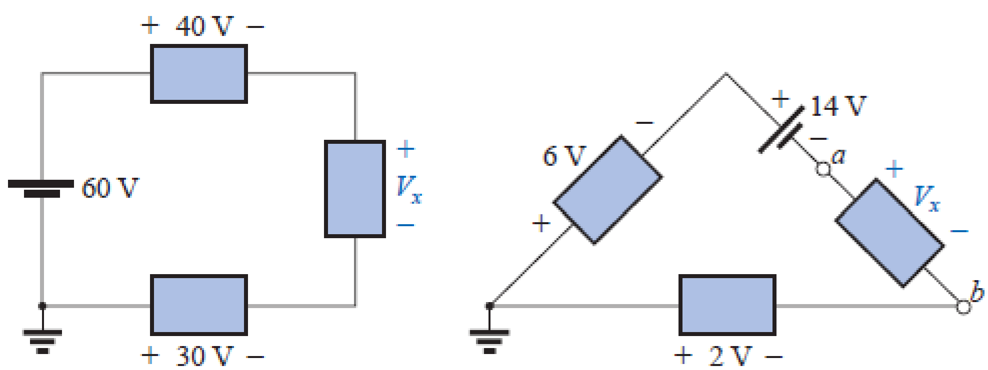
Chapter 2
Series and parallel resistance

2.7 KIRCHHOFF'S VOLTAGE LAW

Kirchhoff's voltage law ***(KVL) states that the algebraic sum of the potential rises and drops around a closed loop (or path) is zero.*** A **closed loop** is any continuous path that leaves a point in one direction and returns to that same point from another direction without leaving the circuit.

Example 2.9 Using Kirchhoff's voltage law, determine the unknown voltages for the network of Fig. below .



(a) (b)

Solution:

For Fig a

$$60\text{ V} - 40\text{ V} - V_x + 30\text{ V} = 0$$

and
$$V_x = 60\text{ V} + 30\text{ V} - 40\text{ V} = 90\text{ V} - 40\text{ V} = \mathbf{50\text{ V}}$$

For Fig b

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$$-6\text{ V} - 14\text{ V} - V_x + 2\text{ V} = 0$$

and

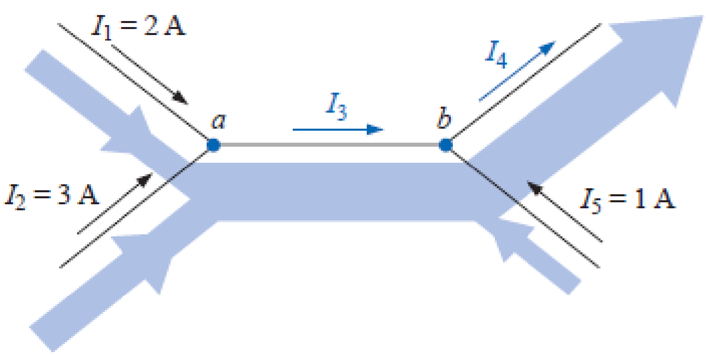
$$V_x = -20\text{ V} + 2\text{ V}$$
$$= \mathbf{-18\text{ V}}$$

2.8 KIRCHHOFF'S CURRENT LAW

the sum of the currents entering an area, system, or junction must equal the sum of the currents leaving the area, system, or junction.

$$\Sigma I_{\text{entering}} = \Sigma I_{\text{leaving}} \quad \textbf{(2.14)}$$

Example 2.10 Determine the currents I_3 and I_4 of Fig. below using Kirchhoff's current law ??



Solution:

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At *a*:

$$\Sigma I_{\text{entering}} = \Sigma I_{\text{leaving}}$$
$$I_1 + I_2 = I_3$$
$$2\text{ A} + 3\text{ A} = I_3$$
$$I_3 = \mathbf{5\ A}$$

At *b*:

$$\Sigma I_{\text{entering}} = \Sigma I_{\text{leaving}}$$
$$I_3 + I_5 = I_4$$
$$5\text{ A} + 1\text{ A} = I_4$$
$$I_4 = \mathbf{6\ A}$$