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Kirchhoff's Current Law



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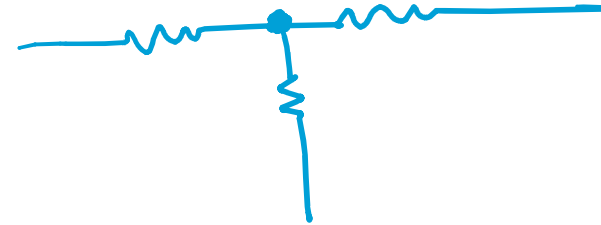
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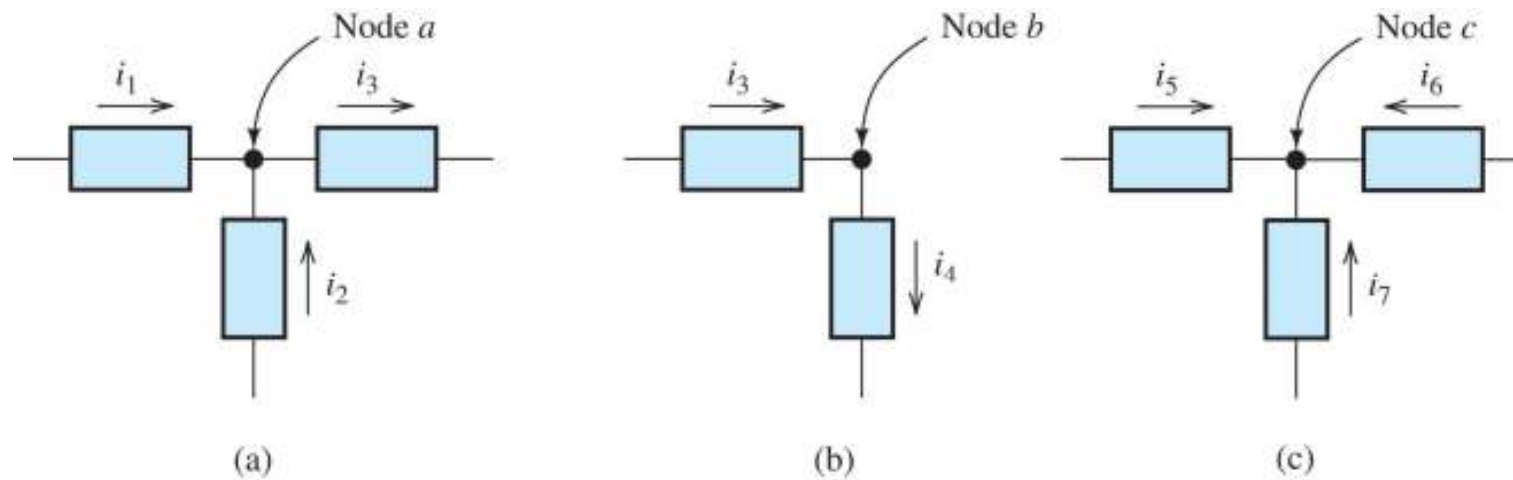
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Kirchhoff's Current Law (KCL)



- *The net currents entering a node is zero.*
- *Alternatively, the sum of the currents entering a node equals the sum of the currents leaving a node.*

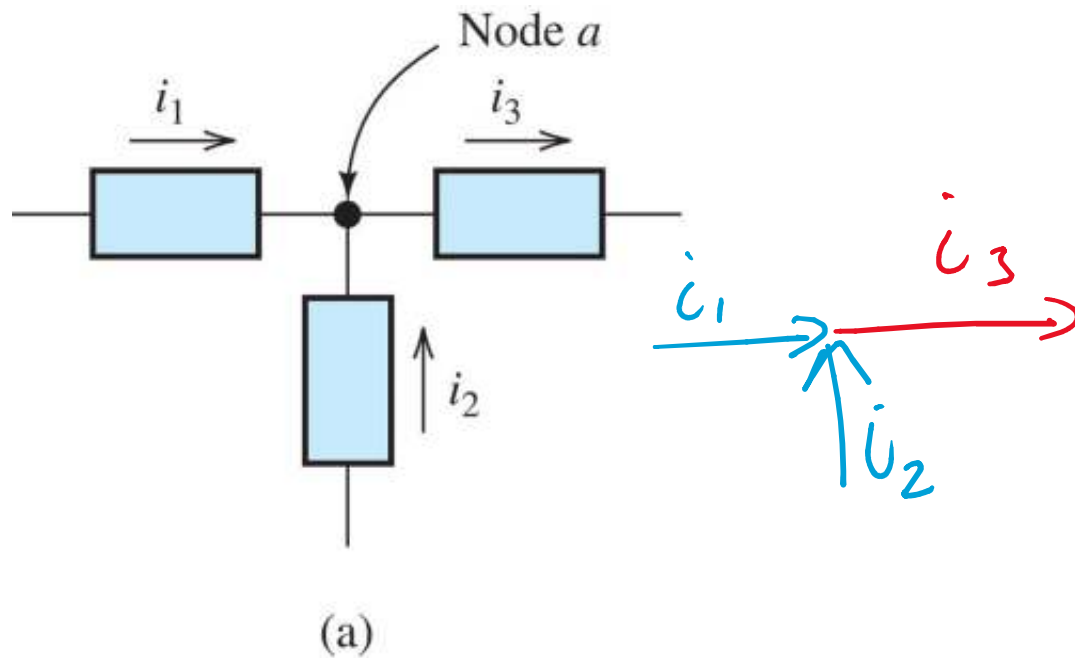
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Figure 1.18 Partial circuits showing one node each to illustrate Kirchhoff's current law.

Kirchhoff's Current Law



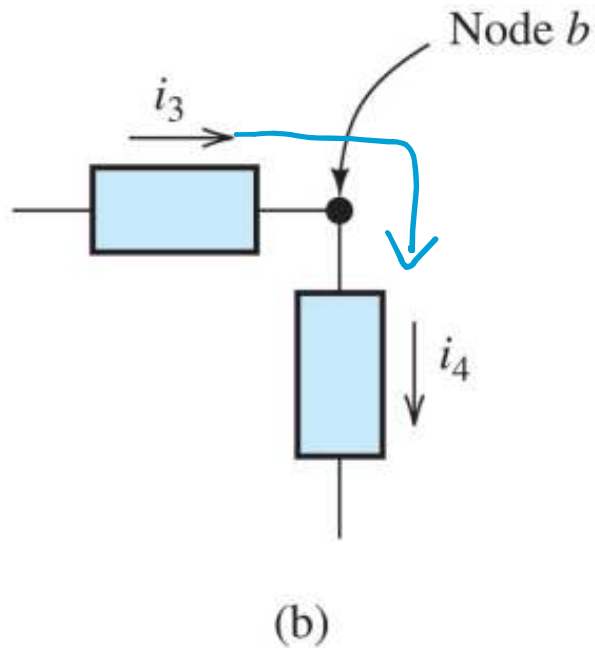
Node a;
 $i_1 + i_2 = i_3$

$i_3 = i_1 + i_2$

or

Node a;
 $-i_1 - i_2 + i_3 = 0$

Kirchhoff's Current Law



Node a;

$$\underline{i_3 = i_4}$$

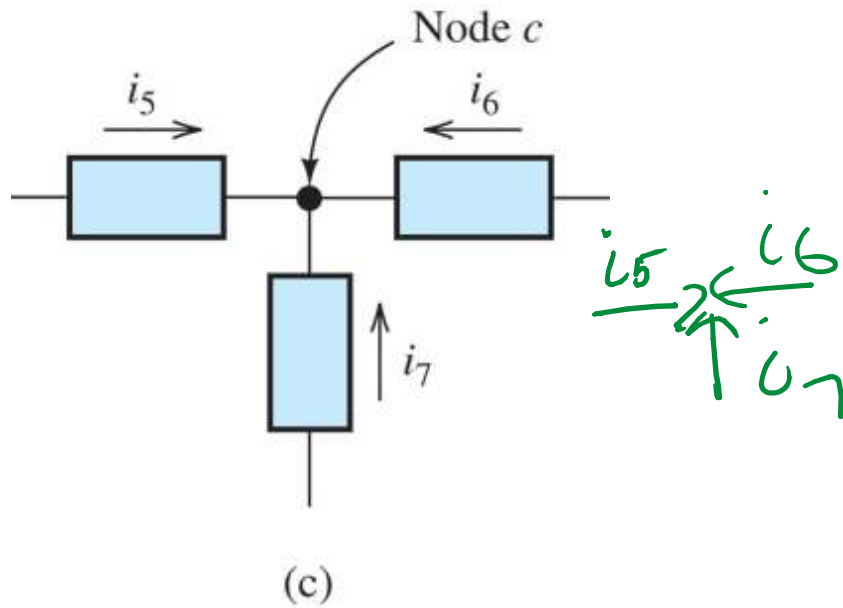
or

Node b;

$$\underline{-i_3 + i_4 = 0}$$

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$$\text{Node } c;$$
$$\underline{i_5 + i_6 + i_7 = 0}$$

or

$$\text{Node } c;$$
$$\underline{-i_5 - i_6 - i_7 = 0}$$

Kirchhoff's Current Law

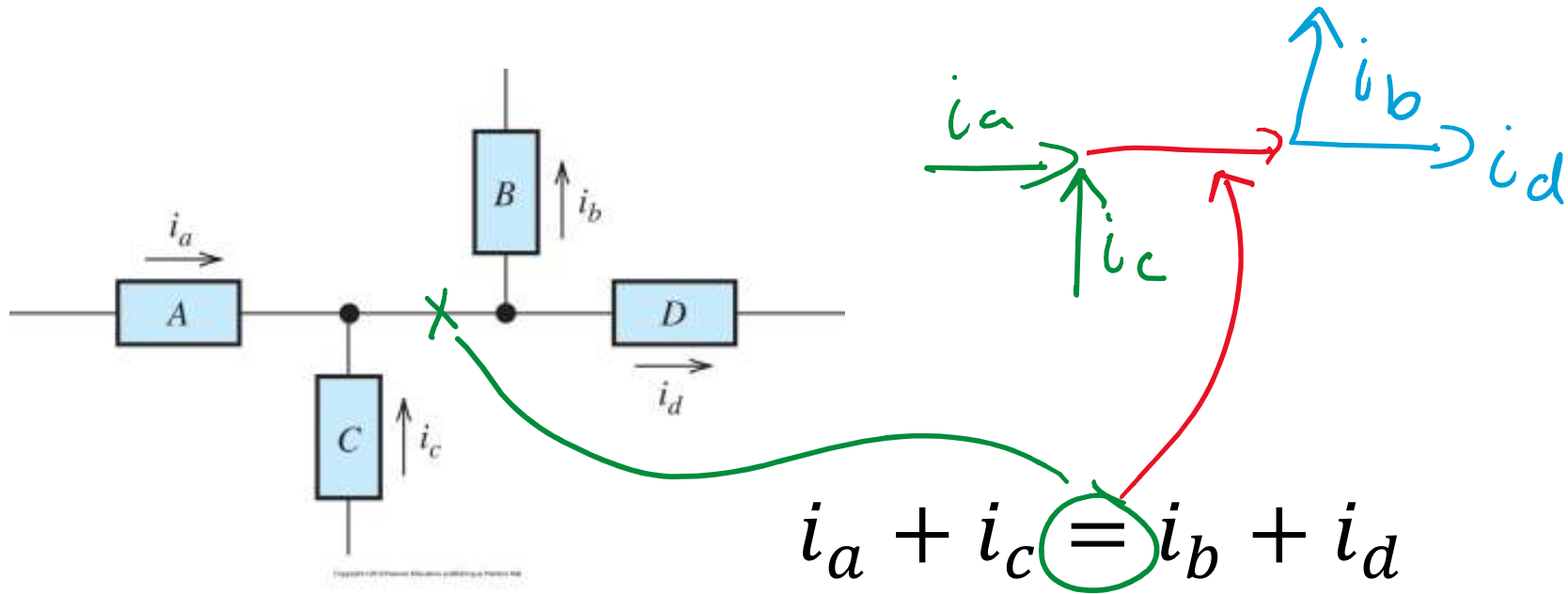
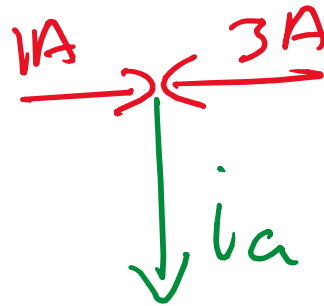
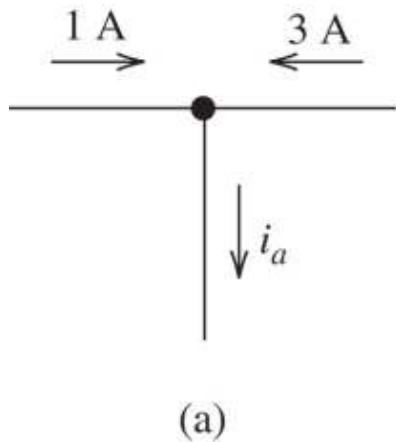


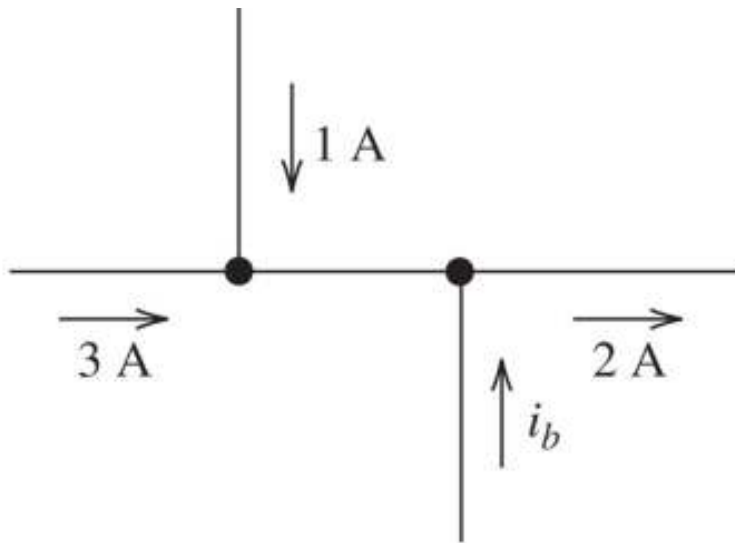
Figure 1.19 Elements A , B , C , and D can be considered to be connected to a common node, because all points in a circuit that are connected directly by conductors are electrically equivalent to a single point.

Kirchhoff's Current Law – Example 1



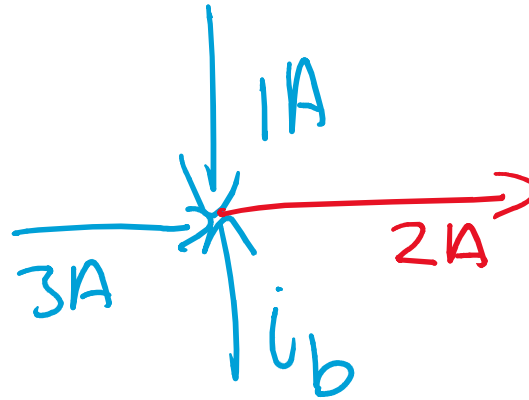
$$i_a = 1A + 3A \\ = 4A$$

Kirchhoff's Current Law – Example 2



(b)

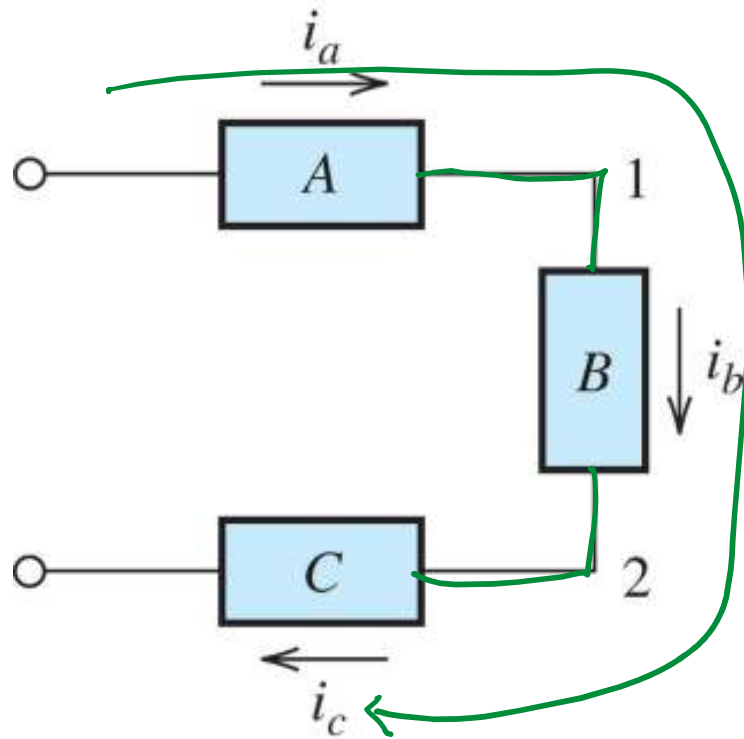
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$$3A + 1A + i_b = 2A$$

$$i_b = 2A - 3A - 1A$$
$$= -2A$$

Kirchhoff's Current Law – Series Circuit



Kirchhoff's current law at node 1 for the circuit of Figure 1.20, we have

$$\underline{i_a = i_b}$$

At node 2, we have

$$\underline{i_b = i_c}$$

Thus, we have

$$\underline{i_a = i_b = i_c}$$

Figure 1.20 Elements A , B , and C are connected in series.



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