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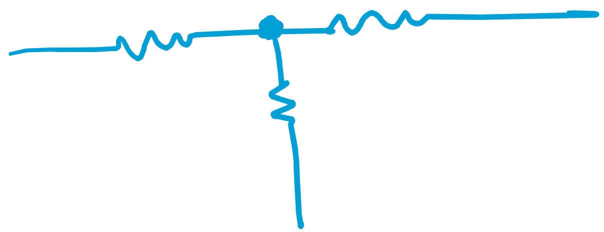
Kirchhoff’s Current Law

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.*

Kirchhoff's Current Law

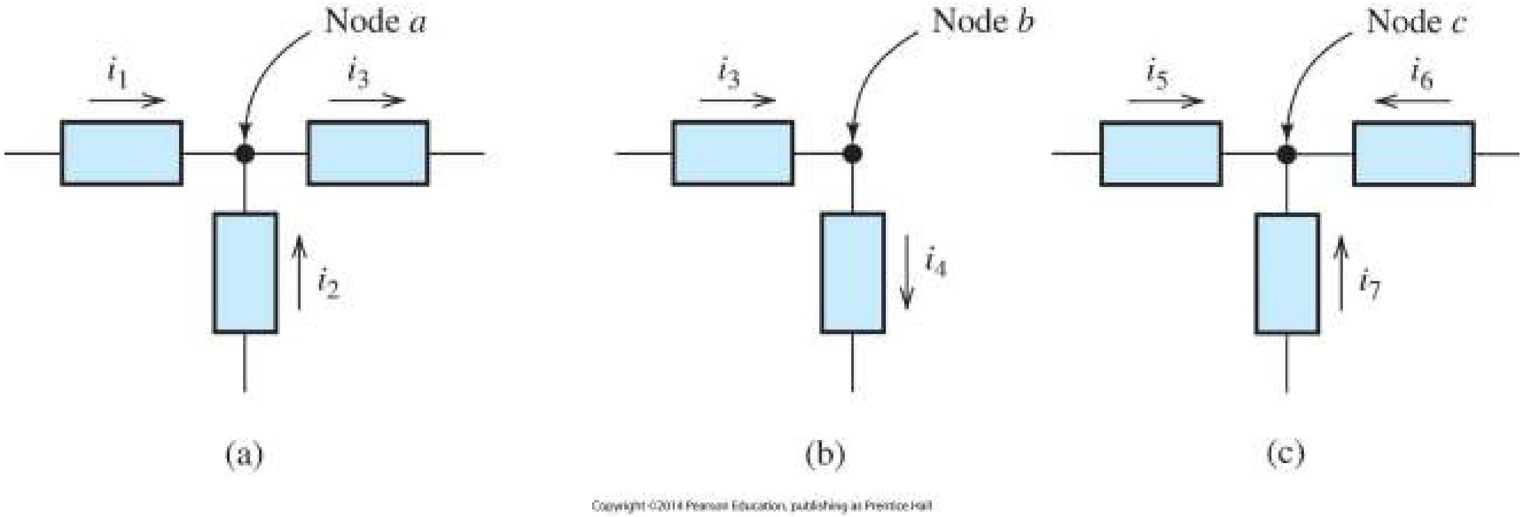
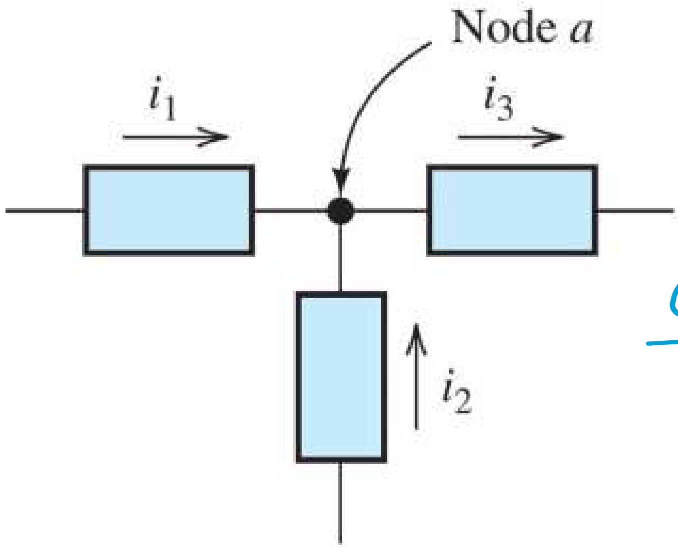
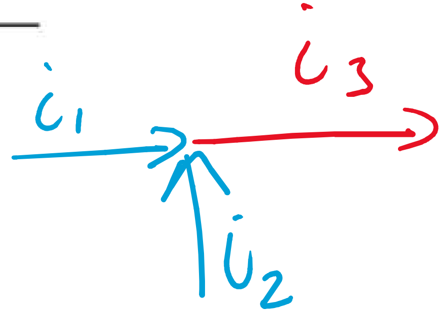


Figure 1.18 Partial circuits showing one node each to illustrate Kirchhoff's current law.

Kirchhoff's Current Law



(a)



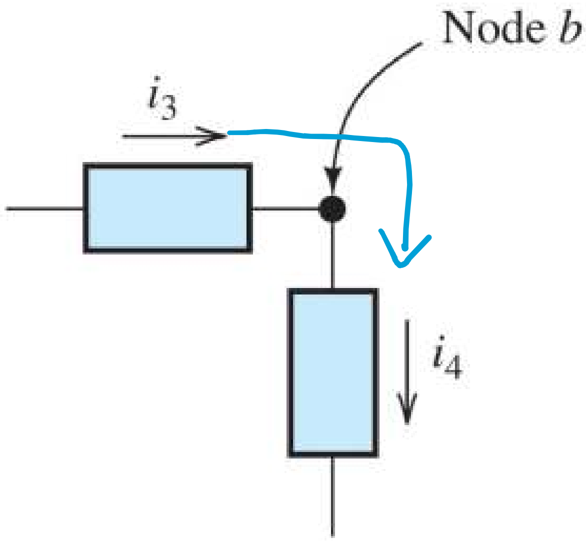
$i_3 = i_1 + i_2$

Node a;
$i_1 + i_2 = i_3$

or

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

Kirchhoff's Current Law



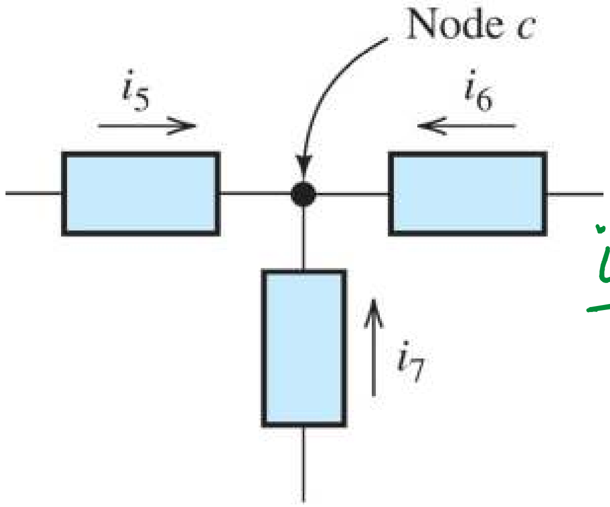
(b)

$Node\ a;$
$i_3 = i_4$

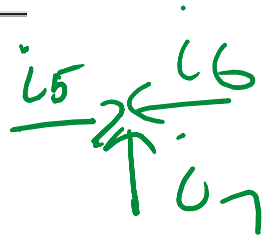
or

$Node\ b;$
$-i_3 + i_4 = 0$

Kirchhoff’s Current Law



(c)

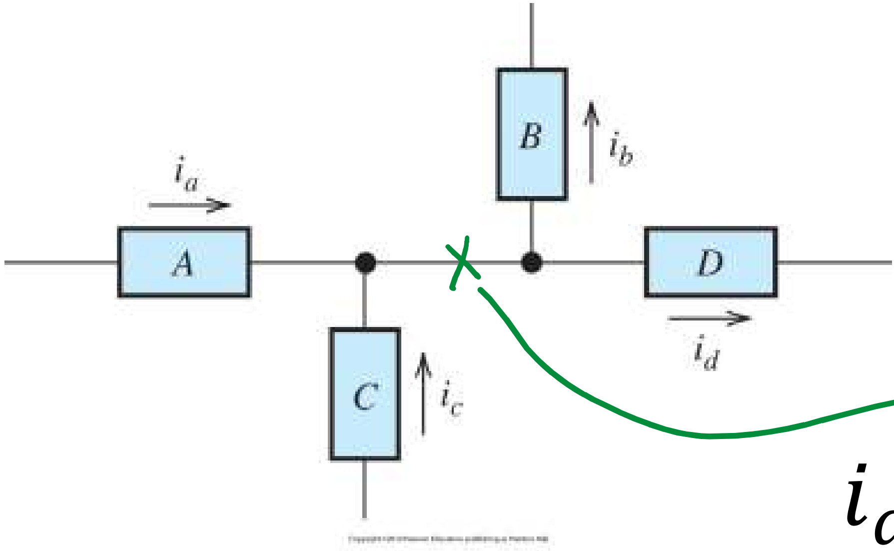


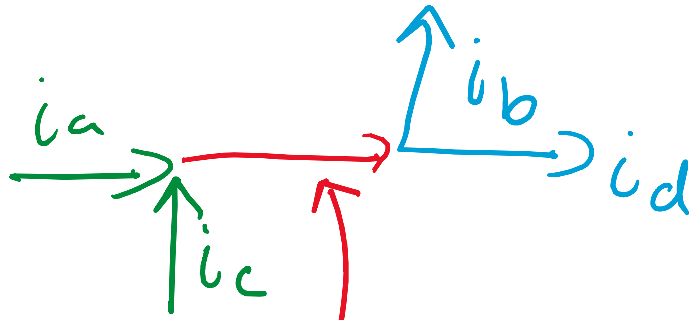
$$Node\ c;$$
$$i_5 + i_6 + i_7 = 0$$

or

$$Node\ c;$$
$$-i_5 - i_6 - i_7 = 0$$

Kirchhoff's Current Law

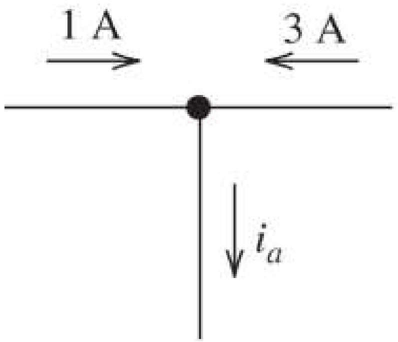




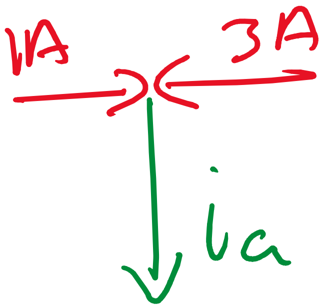
$$i_a + i_c = i_b + i_d$$

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

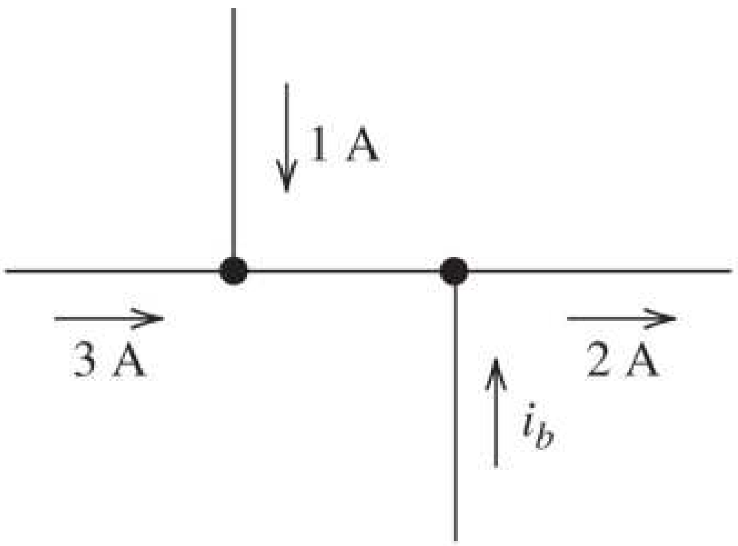


(a)

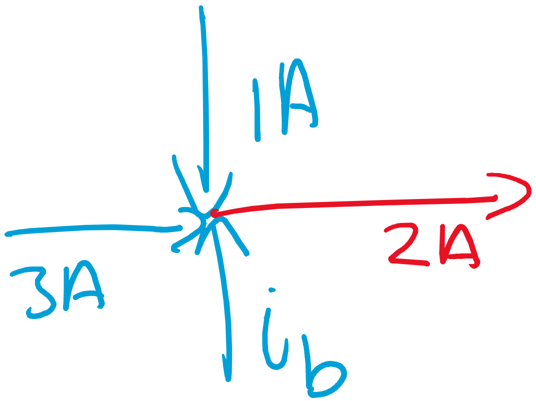


$$i_a = 1A + 3A$$
$$= 4A$$

Kirchhoff's Current Law – Example 2



(b)

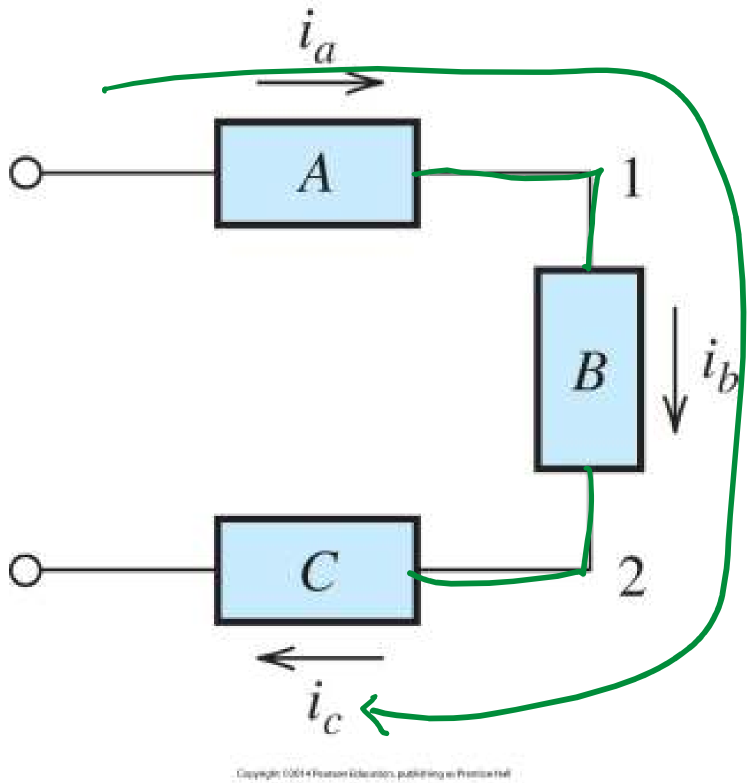


$$3A + 1A + i_b = 2A$$

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

$$= -2A$$

Kirchhoff’s Current Law – Series Circuit



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

$$i_a = i_b$$

At node 2, we have

$$i_b = i_c$$

Thus, we have

$$i_a = i_b = i_c$$

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

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THANK YOU