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Kirchhoff's Voltage Law

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The algebraic sum of the voltages equals zero for any closed path (loop) in an electrical circuit.

Kirchhoff's Voltage Law

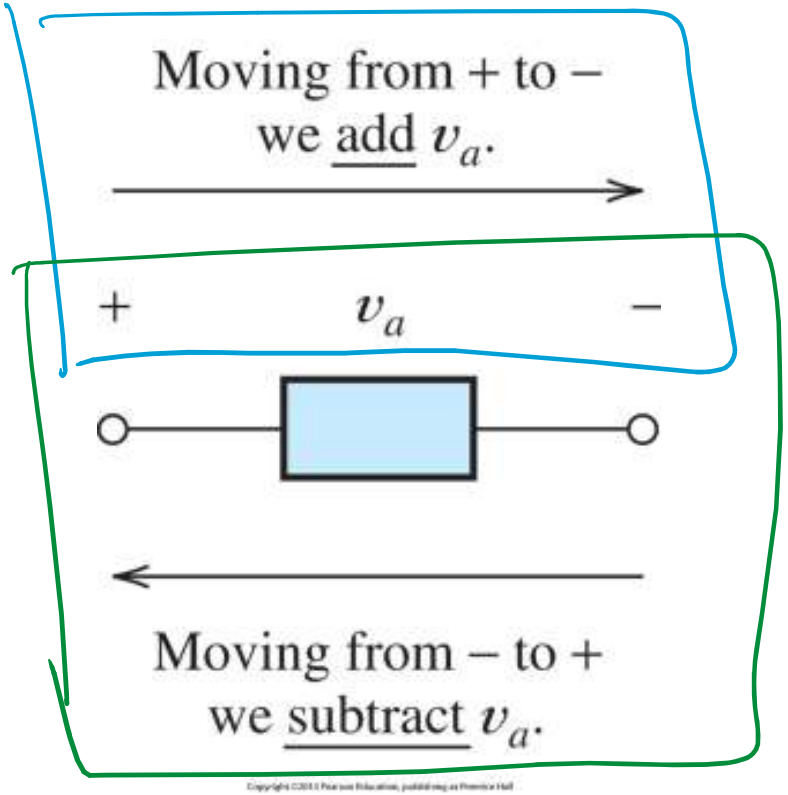


Figure 1.23 In applying KVL to a loop, voltages are added or subtracted depending on their reference polarities relative to the direction of travel around the loop.

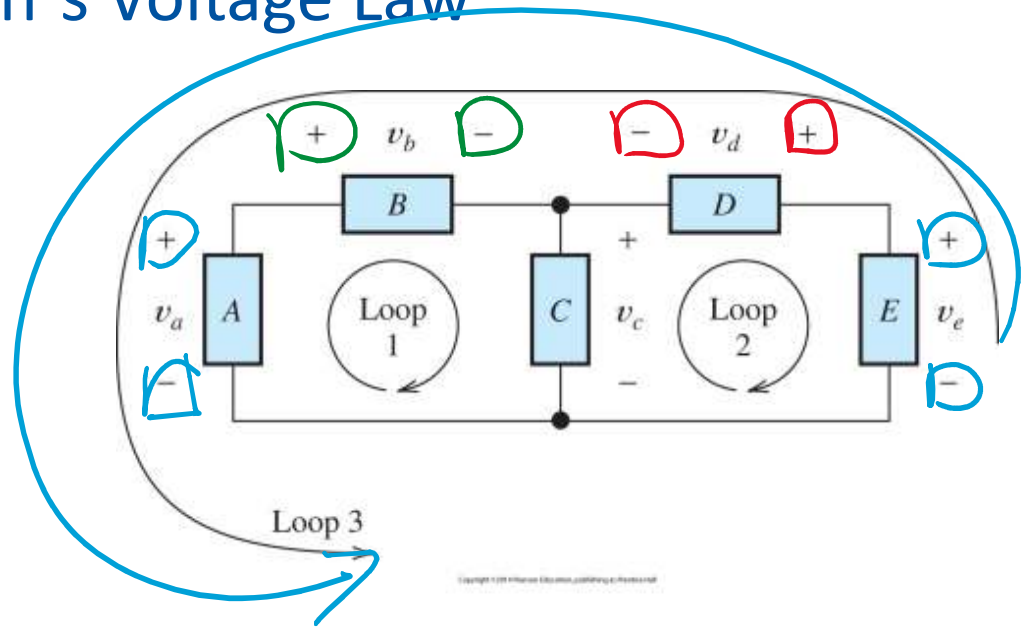


Figure 1.24 Circuit used for illustration of Kirchhoff's voltage law.

$$Loop1: -v_a + v_b + v_c = 0$$

$$Loop2: -v_c - v_d + v_e = 0$$

$$Loop3: v_a - v_b + v_d - v_e = 0$$

Kirchhoff's Voltage Law Related to Conservation of Energy

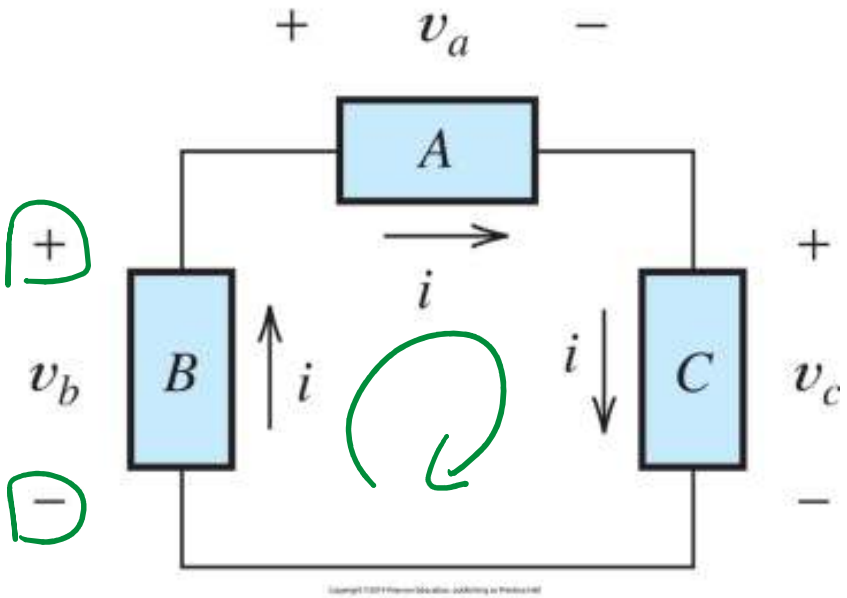


Figure 1.25 In this circuit, conservation of energy requires that $v_b = v_a + v_c$.

Element *A*: $p_a = v_a i$

Element *B*: $p_b = -v_b i$

Element *C*: $p_c = v_c i$

$p_a + p_b + p_c = 0$

$v_a i - v_b i + v_c i = 0$

$v_a - v_b + v_c = 0$

Kirchhoff's Voltage Law – Parallel Circuits

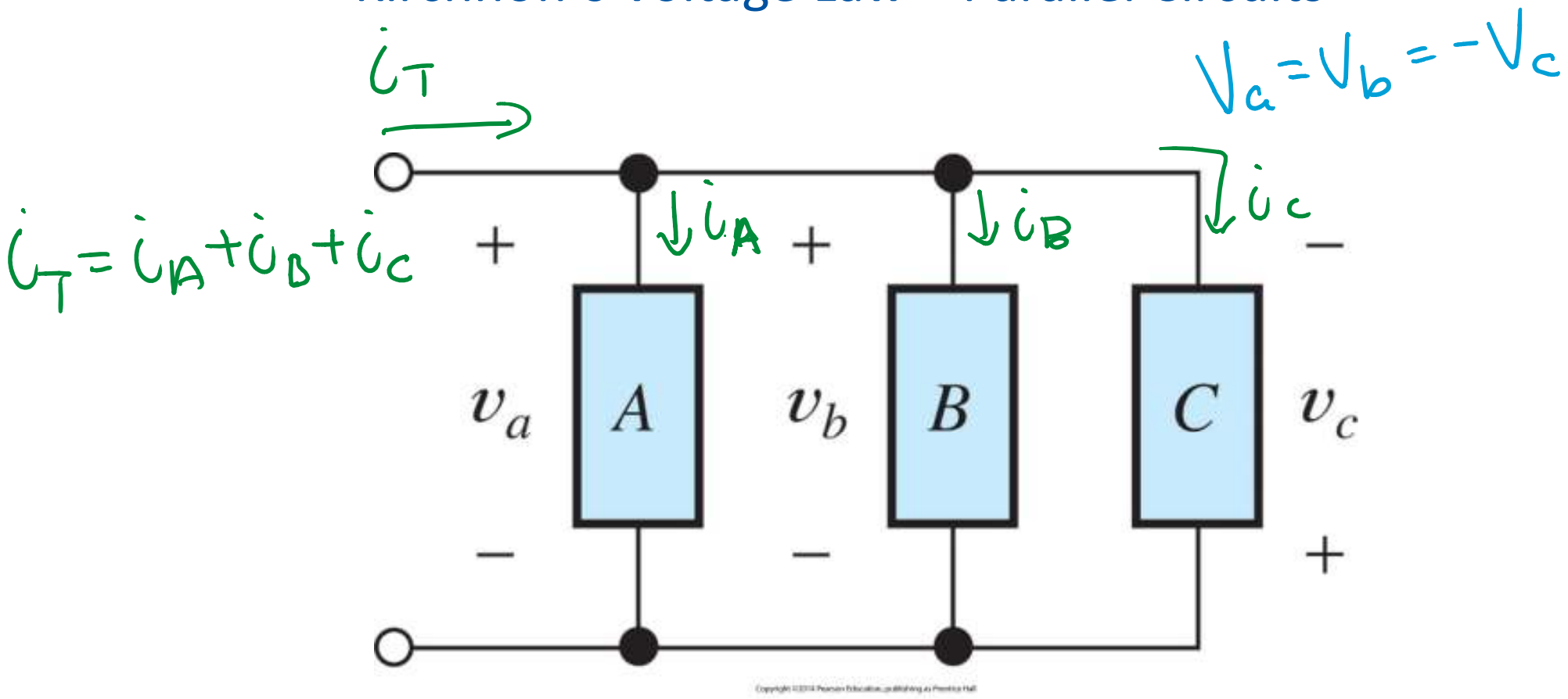


Figure 1.27 For this circuit, we can show that $v_a = v_b = -v_c$.
Thus, the magnitudes and actual polarities of all three voltages are the same.

Kirchhoff's Voltage Law - Example

Use repeated application of KVL to find the values of v_c and v_e for the circuit of figure 1.29.

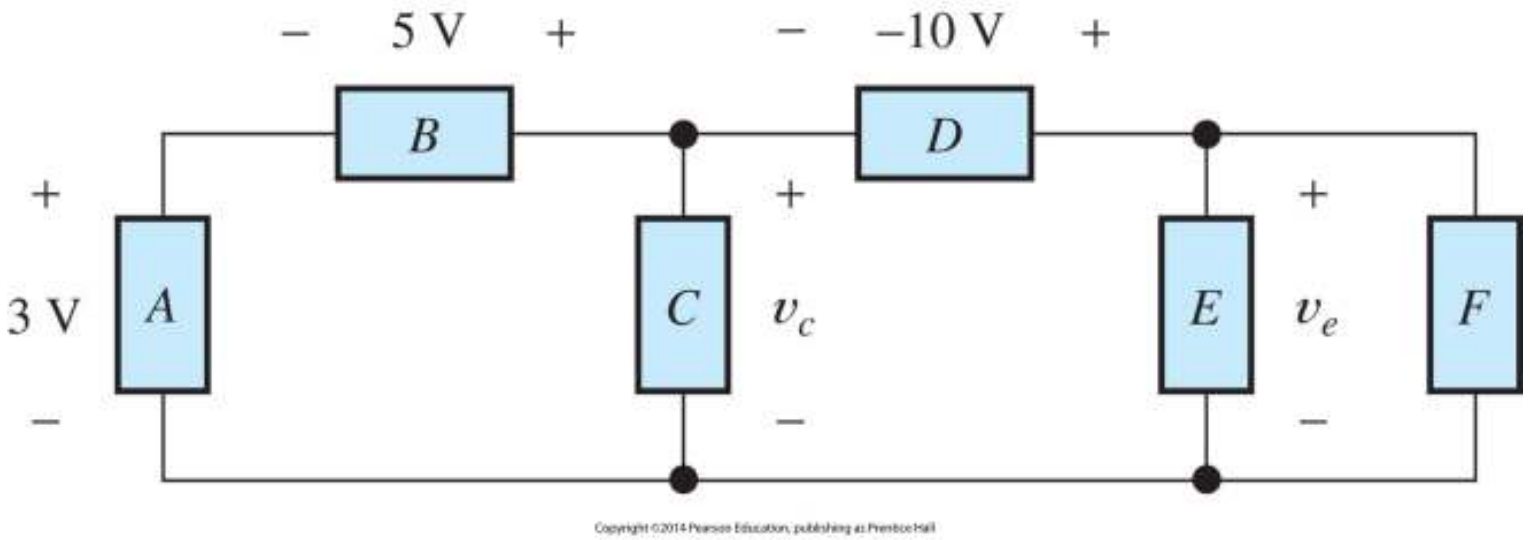


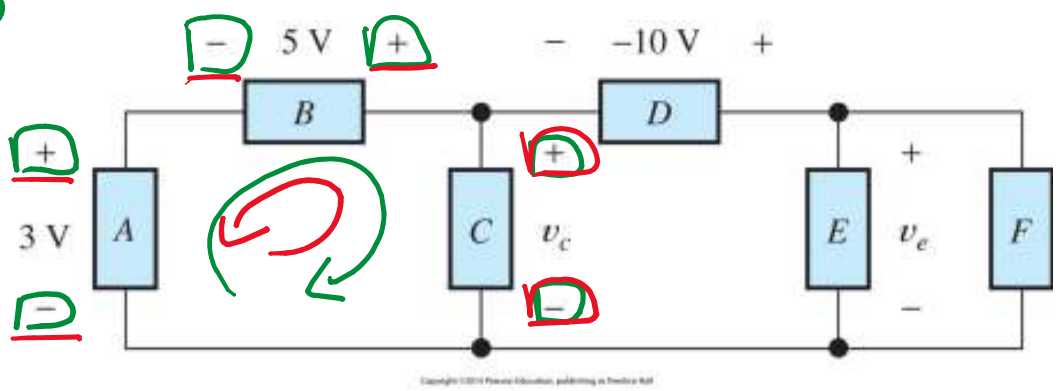
Figure 1.29 Circuit for Exercises 1.9

Kirchhoff's Voltage Law - Example

Find the values of v_c

$-3V-5V+V_c=0$

$V_c=8V$

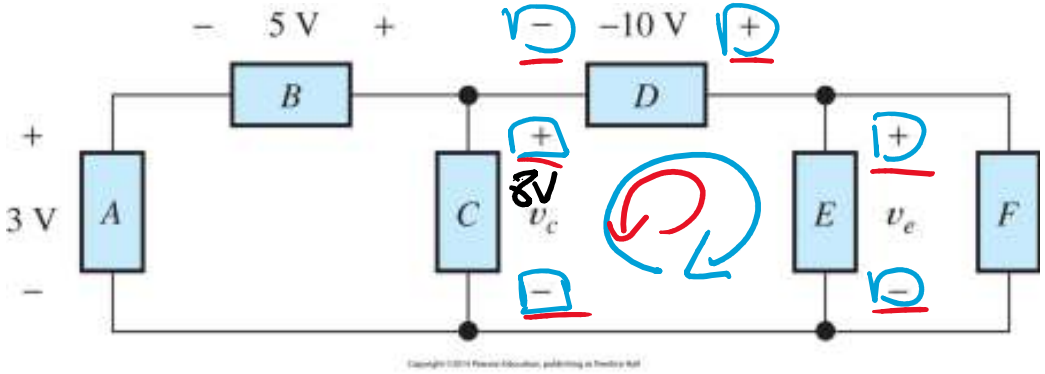


$-V_c+5V+3V=0$

$V_c=8V$

Kirchhoff's Voltage Law - Example

Find the values of v_e. Where v_c is given as 8V



$-V_c-(-10)+Ve=0$

$-8V+10V+Ve=0$

$Ve=-2V$

$-Ve+(-10V)+8V=0$

$Ve=-2V$

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THANK YOU