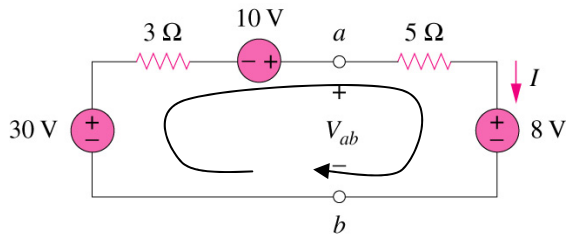


Problem 1: Find I and V_{ab} in the circuit below



Following the direction of the central arrow, adding in voltages as we go...

$$-30 + 3(I) - 10 + 5(I) + 8 = 0$$

$$3(I) + 5(I) = 30 + 10 - 8$$

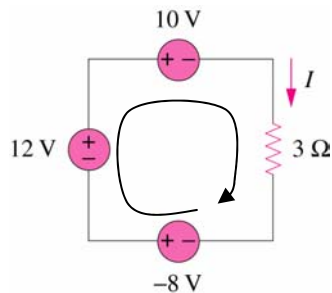
$$8I = 32$$

$$I = 4 \text{ amps}$$

The voltage from a to b is equal to the voltage drop across the 5Ω resistor plus the $8V$ source:

$$V_{ab} = V_{5\Omega} + 8V = 5(I) + 8 = 28 \text{ volts}$$

Problem 2: Find I in the circuit below



$$-V_1 - V_2 + V_3 + 3(I) = 0$$

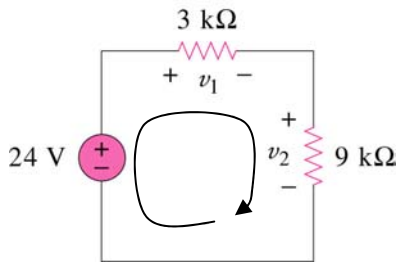
$$-(-8) - 12 + 10 + 3(I) = 0$$

$$3I = -6$$

$$I = -2 \text{ amps}$$

** This simply means that the current is flowing in the direction opposite to what we initially assumed: It is flowing counter-clockwise)

Problem 3: Find v_1 and v_2 in the circuit below



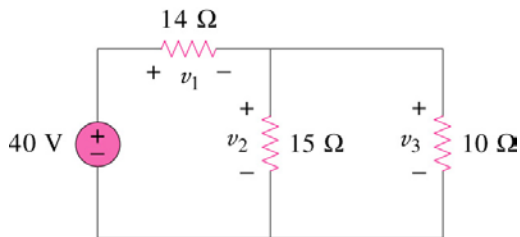
First find the total current flowing around the circuit using Ohm's law

$$\begin{aligned}
 -24 + 3000(I) + 9000(I) &= 0 \\
 12000(I) &= 24 \\
 I &= 2 \text{ milliamps} = 2\text{mA}
 \end{aligned}$$

Now find v_1 and v_2 also using Ohm's law

$$\begin{aligned}
 v_1 &= IR = 2\text{m} (3\text{k}) = \boxed{6 \text{ Volts}} \\
 v_2 &= IR = 2\text{m} (9\text{k}) = \boxed{18 \text{ Volts}}
 \end{aligned}$$

Problem 4: Find v_1 , v_2 and v_3 in the circuit below



First we can combine the 15Ω and 10Ω resistors into an equivalent resistance

$$R_{\text{eq}} = 15 \parallel 10 = (15)(10)/(15 + 10) = 6\Omega$$

Now use Ohm's law to find the total current

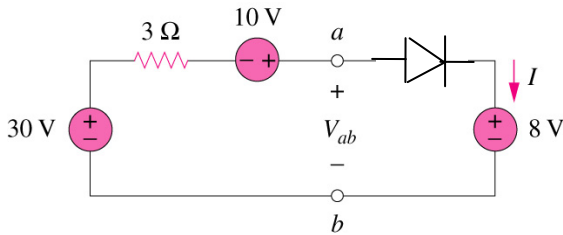
$$\begin{aligned}
 -40 + 14(I) + 6(I) &= 0 \\
 20I &= 40 \quad \text{so} \\
 I &= 2 \text{ A}
 \end{aligned}$$

Finally, note that $v_2 = v_3$ since both share the same (+) and (-) terminals

$$\begin{aligned}
 v_1 &= IR = 2(14) = \boxed{28 \text{ V}} \\
 v_2 &= v_3 = IR_{\text{eq}} = 2(6) = \boxed{12 \text{ V}}
 \end{aligned}$$

Double check – note that $28\text{V} + 12\text{V} = 40\text{V}$, which is the source voltage

Problem 5: Find I and V_{ab} in the circuit below



Here, the diode passes the current, and acts like a short circuit (*i.e.*, a simple piece of wire)

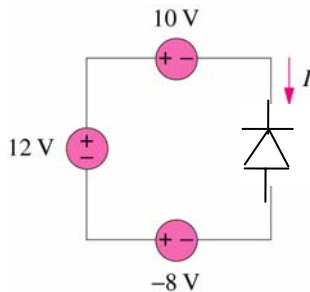
$$-30 + 3(I) - 10 + 8 = 0$$

$$3I = 32$$

$$I = 10.67 \text{ A}$$

$$V_{ab} = 8\text{V}$$
 since there is no voltage drop across the (ideal) diode

Problem 6: Find I in the circuit below



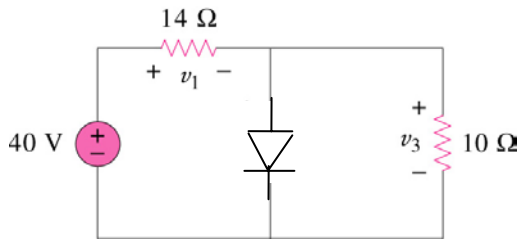
This problem is not intended to be tricky, but has a few more twists than the others. For the purposes of this class you can answer it in **either way** discussed below

1) The diode is in the blocking direction, given the direction of current drawn, so the current is 0 amps

OR

2) The actual current flows in the direction opposite to the arrow shown, given the sum of the voltage sources (see problem 2). Using Ohm's law then $V = IR$ or $I = V/R$. Here R is equal to zero, so the current is infinite. For an actual voltage source, the current would be limited, but would be the maximum that it could produce.

Problem 7: Find v_1 and v_3 in the circuit below



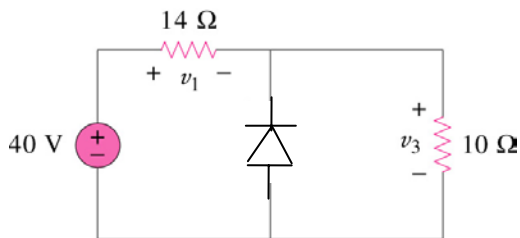
Here the diode is in the passing direction, providing a short circuit such that no current (bothers to) pass through the 10Ω resistor. Thus

$$I = 40\text{V} / 14\Omega = 2.86 \text{ A}$$

$v_1 = IR = (2.86)(14) = \boxed{40 \text{ V}}$ – We did not need to calculate this – we can observe that v_1 is equal to the source voltage. Since the diode shorts out the v_3 branch, that voltage is equal to zero.

$\boxed{v_3 = 0\text{V}}$ since the diode act to short out this branch

Problem 8: Find v_1 and v_3 in the circuit below



Here the diode is in the blocking direction, so all the current **MUST** flow through the 10Ω resistor

$$I = 40\text{V} / (14\Omega + 10\Omega) = 1.67 \text{ A}$$

$$v_1 = 1.67\text{A} (14\Omega) = \boxed{23.3 \text{ V}}$$

$$v_3 = 1.67\text{A} (10\Omega) = \boxed{16.7 \text{ V}}$$

Double check that these two voltages add up to the source voltage: $23.3 + 16.7 = 40\text{V}$