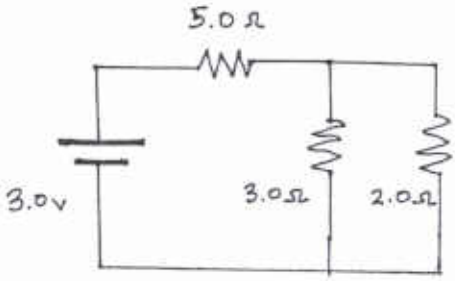
Name_____ Units? Units?

Phys 2020, Section 2
Quiz #2 — Spring 2002



1. In the circuit diagrammed at the right, a 3.0 V battery is connected across a combination of resistors, connected as shown.

a) What is the equivalent resistance of the resistors?

R_{eq} of 3.0Ω - 2.0Ω parallel comb is

$\frac{1}{R_{eq}} = \frac{1}{3.0\Omega} + \frac{1}{2.0\Omega} = 0.833\,\Omega^{-1} \rightarrow R_{eq} = 1.2\,\Omega$

This comb is in series with the 5.0Ω resistor so R_{eq} of all resistors is

$R_{eq} = 5.0\Omega + 1.2\Omega = \boxed{6.2\,\Omega}$

b) What is the current in the 5.0 Ω resistor?

Current in the 5.0Ω resistor is the total current in the circuit, so:

$I_{5.0\Omega} = \frac{V}{R_{eq}} = \frac{3.0\,V}{6.2\,\Omega} = \boxed{0.48\,A}$

c) What is the voltage drop across the 5.0 Ω resistor?

Using answer of (b) Ohm's law for 5.0Ω resistor gives

$V_{5.0\Omega} = I_{5.0\Omega} R = (0.48\,A)(5.0\,\Omega) = \boxed{2.42\,V}$

d) What is the voltage across the 3.0 Ω resistor? (The Kirchhoff Loop Rule may be of use here.)

Consider the loop with the battery, 5.0Ω resistor and 3.0Ω resistor. Kirchhoff Rule gives: $+3.0\,V - 2.42\,V - V_{3.0\Omega} = 0$ $\quad V_{3.0\Omega} = \boxed{0.58\,V}$

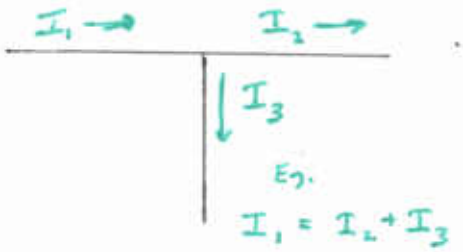
e) What is the current in the 3.0 Ω resistor?

Using answer from (d) Ohm's Law for 3.0Ω resistor gives

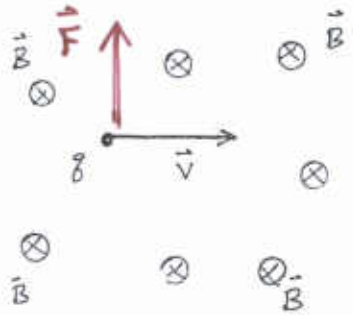
$I_{3.0\Omega} = \frac{V_{3.0\Omega}}{R} = \frac{0.58\,V}{3.0\,\Omega} = \boxed{0.19\,A}$

2. State the Kirchhoff Rule for junctions, i.e. what is the condition that holds at a junction of wires in a circuit?

At any junction of wires in an electric circuit the sum of the currents going into the junction equals the sum of the currents leaving the junction.



3. A particle with a charge of $+3.2 \times 10^{-19}$ C moves to the right with speed $5.6 \times 10^5 \frac{\text{m}}{\text{s}}$ in a uniform magnetic field of magnitude 0.500 T which points into the page, as indicated at the right.



a) Indicate the direction of the magnetic force on the particle.

By RHR-1 force points "up" (as shown).

(From: Thumb = $\vec{v}$, Fingers = $\vec{B}$ (into page) Palm = force = up

b) Find the magnitude of the magnetic force on the particle.

$$F = qvB\sin 90^\circ = (3.2\times10^{-19}\text{C})\left(5.6\times10^{5}\tfrac{\text{m}}{\text{s}}\right)(0.500\text{T})\cdot 1$$

$$= 9.0\times10^{-14}\ \text{N}$$

You must show all your work and include the right units with your answers!

$$k = \frac{1}{4\pi\epsilon_0} = 8.99\times10^{9}\ \tfrac{\text{N}\cdot\text{m}^2}{\text{C}^2} \qquad \epsilon_0 = 8.85\times10^{-12}\ \tfrac{\text{C}^2}{\text{N}\cdot\text{m}^2} \qquad e = 1.602\times10^{-19}\ \text{C}$$

$$Q = CV \qquad E = \tfrac{1}{2}CV^2 \qquad C_{\text{p-plates}} = \epsilon_0\frac{A}{d}$$

$$V = IR \qquad R = \rho\frac{L}{A} \qquad P = IV = I^2R \qquad R_{\text{ser}} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{\text{par}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$F = qvB\sin\theta, \quad \text{w/ RHR–1}$$