PHYS 202 Practice for final KEY

Coulomb's law $F = k\frac{|Q_1||Q_2|}{r^2}$ Coulomb's constant = k = 9 x 10^9 (SI)

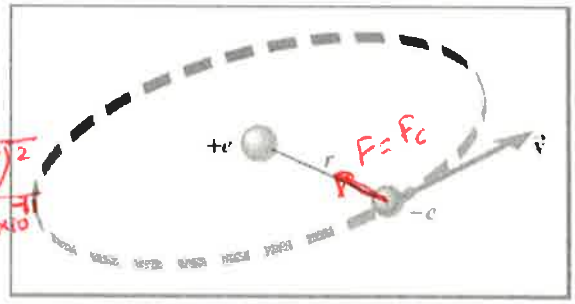
1. In the Bohr model of the hydrogen atom, the electron is in a circular orbit about the nuclear proton at a radius of 5.29 x 10^{-11} m as shown below. The mass of the electron is 9.11 x 10^{-31} kg. Determine the speed of the electron. [Centripetal Force = $F_C = \frac{mv^2}{r}$]

$\frac{mv^2}{r} = \frac{ke^2}{r^2}$

$mv^2 = \frac{ke^2}{r} \rightarrow v^2 = \frac{ke^2}{mr}$

$v = \sqrt{\frac{ke^2}{mr}} = \sqrt{\frac{9\times10^9 \times (1.6\times10^{-19})^2}{9.11\times10^{-31} \times 5.29\times10^{-11}}}$

$V = 2.19\times10^6$ m/s

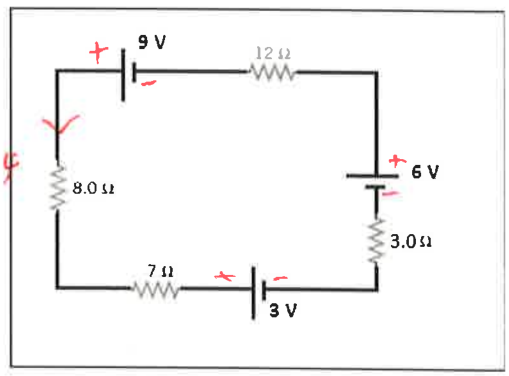


Ohm's Law V = IR

2a. What is the direction of current for the circuit shown?

a. Clockwise b. Counter clockwise

$I = \frac{\Sigma V}{\Sigma R} = \frac{9+6-3}{30} = 0.4$



2b. Determine the magnitude of the current for the circuit shown?

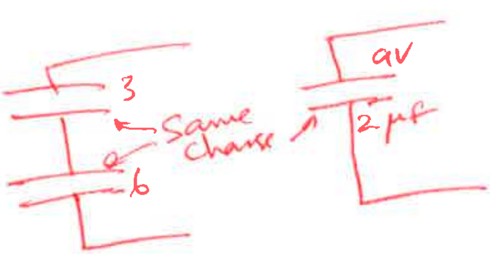
a. 0.38 A b. 0.40A c. 0.50 A d. 0.60 A e. 0.20 A

2c. What is the voltage across the 12 ohm resistor?

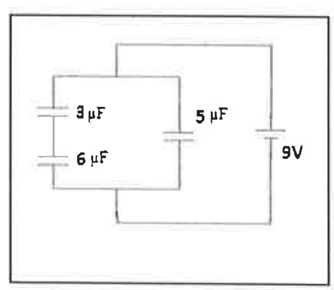
$V = IR = 0.4 \times 12 = 4.8$ Volt

Capacitance = C = Q/V

3. What is the charge in the 3 μF capacitor for the circuit shown below?

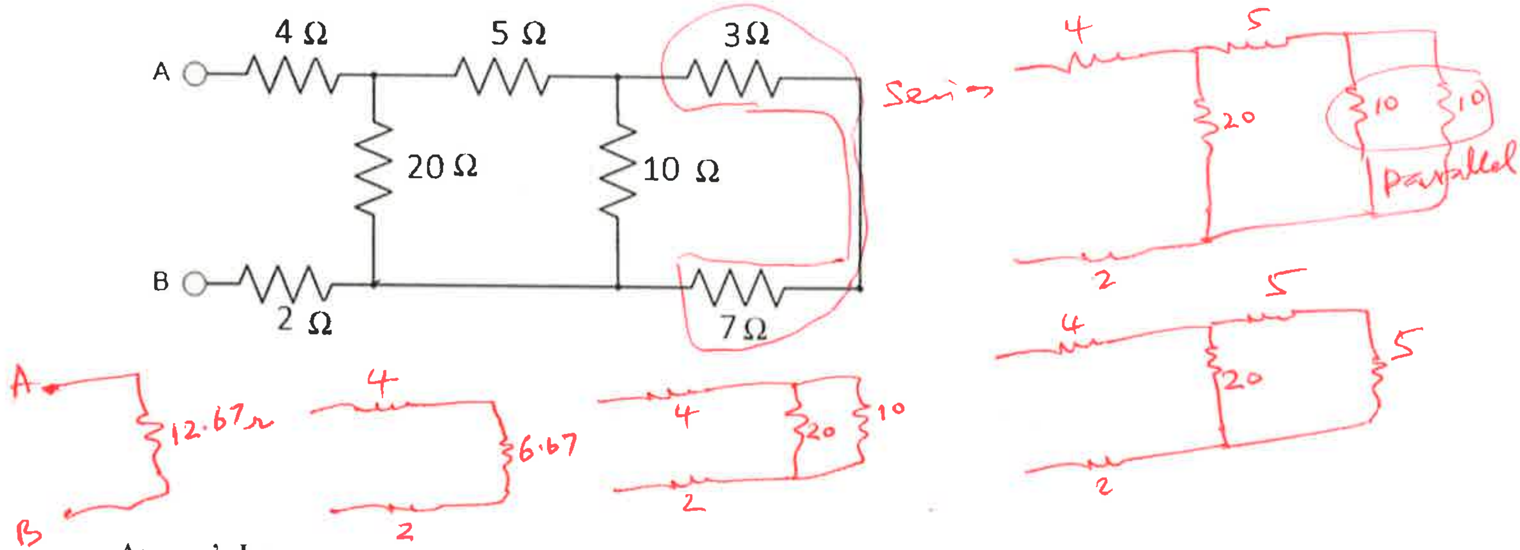


$Q = CV = 18\,\mu C$



III. Combine all the resistances into a single one, between A & B, for the circuit shown:

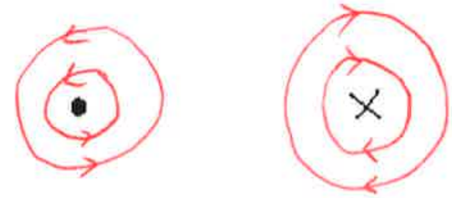
b. What is the voltage across the 4Ω resistor when a 6-v battery is connected between A and B.



Ampere's Law

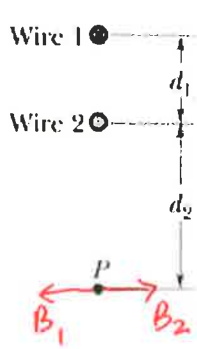
IV. The magnetic field due to a long straight wire, carrying a current I, at a distance r is given by; ($\mu_0 = 4\pi x10^{-7}$ T.m/A)

$$B = \frac{\mu_0 I}{2\pi r}$$



a. Show the magnetic field, circling the long-wire carrying current I (out of page and into page) using circles with directions, above.

b. In the figure below, two long straight wires are perpendicular to the page and separated by distance $d_1 = 0.75$ cm. Wire 1 carries 6.5 A into the page and wire 2 carries 4.5 A out of the page. What are the (a) magnitude and (b) direction of the net magnetic field due to the two currents at point *P*? ($d_2 = 1.50$ cm from wire 2)



$B_1 = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 6.5}{2\pi \times 2.25\times10^{-2}} = 5.78\times10^{-5}$ T

$B_2 = \frac{\mu_0 I}{2\pi r} = \frac{4\pi \times 10^{-7} \times 4.5}{2\pi \times 1.50\times10^{-2}} = 6\times10^{-5}$ T

$B_{net} = B_2 - B_1 = 6\times10^{-5} - 5.28\times10^{-5}$

$= 0.22\times10^{-5}$

$B_{net} = 2.2\times10^{-6}$ T