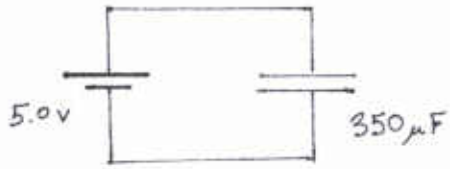
Name_____ Units? Units?

Phys 2020, Section 1
Quiz #2 — Spring 2002

1. A potential of 5.0 V is applied across the plates of a 350 μF capacitor.



a) What is the charge stored in the capacitor?

Charge stored is

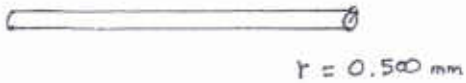
$$Q = CV = (350\times10^{-6}\,F)(5.0\,V) = 1.75\times10^{-3}\,C$$

b) What is the electrical energy stored in the capacitor?

Energy stored in capacitor is

$$E_{energy} = \tfrac{1}{2}CV^2 = \tfrac{1}{2}(350\times10^{-6}\,F)(5.0\,v)^2 = 4.4\times10^{-3}\,J$$

2. A piece of copper wire has circular cross-section with a radius of 0.500 mm.



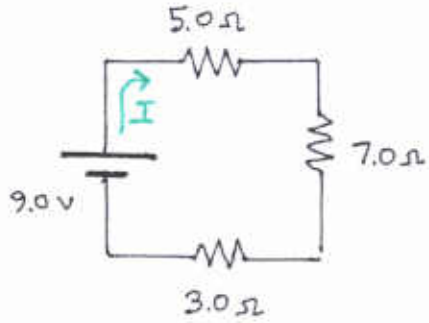
a) What is the cross-sectional area of the wire in units of m^2?

$$A = \pi r^2 = \pi(0.500\times10^{-3}\,m)^2 = 7.85\times10^{-7}\,m^2$$

b) If the resistance of the wire is $1.00\times10^{-2}\,\Omega$, what is the length of the wire? The resistivity of copper is $1.72\times10^{-8}\,\Omega\cdot m$.

From $R = \rho\frac{L}{A}$, solve for L:

$$L = \frac{RA}{\rho} = \frac{(1.00\times10^{-2}\,\Omega)(7.85\times10^{-7}\,m^2)}{(1.72\times10^{-8}\,\Omega\cdot m)} = 0.457\,m$$



3. In the circuit shown at the right, three resistors are connected in series to a 9.0 V battery. Resistances are as given.

a) What is the current in the circuit?

Equivalent resistance of resistors is $R_{eq} = 5.0\Omega + 7.0\Omega + 3.0\Omega = 15.0\Omega$

Then current in circuit is

$$I = \frac{V}{R_{eq}} = \frac{(9.0\,V)}{(15.0\,\Omega)} = \boxed{0.60\,A}$$

b) What is the potential drop (voltage) across the 5.0 Ω resistor?

Current in the 5.0Ω resistor is 0.60 A, so voltage drop across it is

$$V_{5.0\Omega} = IR = (0.60\,A)(5.0\,\Omega) = \boxed{3.0\,V}$$

c) What is the power dissipated in the 7.0 Ω resistor?

Current in the 7.0Ω resistor is also 0.60 A, so power dissipated is

$$P_{7.0\Omega} = I^2R = (0.60A)^2(7.0\,\Omega) = \boxed{2.5\,W}$$

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

$$k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9\ \tfrac{\mathrm{N\cdot m^2}}{\mathrm{C^2}} \qquad \epsilon_0 = 8.85 \times 10^{-12}\ \tfrac{\mathrm{C^2}}{\mathrm{N\cdot m^2}} \qquad e = 1.602 \times 10^{-19}\ \mathrm{C}$$

$$A_{\mathrm{circ}} = \pi R^2 \qquad Q = CV \qquad E = \tfrac{1}{2}CV^2 \qquad C_{\mathrm{p-plates}} = \epsilon_0\frac{A}{d}$$

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

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