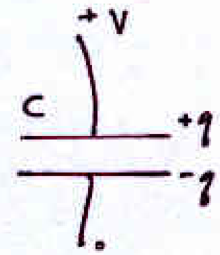
Units? Units?

Name____________________

Feb. 16, 2004

Phys 2020
Quiz #2 — Spring 2004



1. A 12.0 V potential difference is applied across the plates of a 6.00 μF capacitor.

a) What is charge stored on the capacitor?

Use $q = CV$, then:

$q = CV = (6.00\times10^{-6}\,F)(12.0\,V)$

$= \boxed{7.20\times10^{-5}\,C} = 72.0\,\mu C$

b) How much energy is stored in the capacitor?

Energy stored in capacitor is $E = \frac{1}{2}CV^2$, so:

Energy $= \frac{1}{2}CV^2 = \frac{1}{2}(6.00\times10^{-6}\,F)(12.0\,v)^2 = \boxed{4.32\times10^{-4}\,J}$

2. What is the resistance of a 1.00 km length of aluminun wire which has a circular cross-section with a radius of 1.00 mm?

The resistivity of aluminum is $2.75\times10^{-8}\,\Omega\cdot m$.

Use $R = \rho L/A$. Since cross-sectional area is

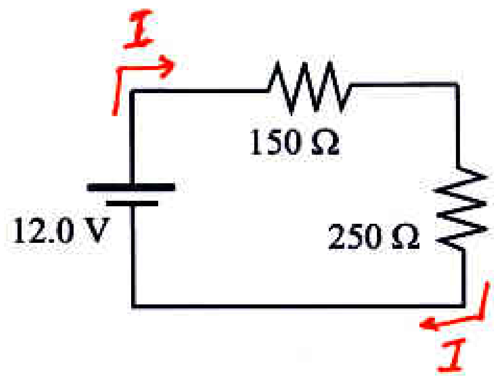
$A = \pi r^2 = \pi(1.00\times10^{-3}\,m)^2 = 3.14\times10^{-6}\,m^2$

then the resistance is

$R = \rho \frac{L}{A} = (2.75\times10^{-8}\,\Omega\cdot m)\frac{(1.00\times10^{3}\,m)}{(3.14\times10^{-6}\,m^2)}$

$= \boxed{8.75\,\Omega}$

3. An electric circuit, shown at the right, consists of a 12.0 V battery connected to two resistors ($150\,\Omega$ and $250\,\Omega$) connected in series.



a) Find the current in the circuit.

Equivalent resistance is

$R_{eq} = R_1 + R_2 = 150\,\Omega + 250\,\Omega = 400\,\Omega$

Then from $V = IR_{eq}$, we have

$I = V/R_{eq} = 12.0\,V / 400\,\Omega = \boxed{3.00 \times 10^{-2}\,A} = 30.0\,mA$

b) What is the potential difference (drop) across the $250\,\Omega$ resistor?

Current in that resistor is $3.00 \times 10^{-2}\,A$ so from Ohm's law,

$V = IR = (3.00 \times 10^{-2}\,A)(250\,\Omega) = \boxed{7.50\,V}$

c) At what rate is energy dissipated in the $150\,\Omega$ resistor?

Rate of energy dissipation is $P = I^2R$. Current in $150\,\Omega$ resistor is also $3.00 \times 10^{-2}\,A$, so

$P = I^2R = (3.00 \times 10^{-2}\,A)^2(150\,\Omega) = \boxed{0.135\,W}$

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

$$k = \frac{1}{4\pi\epsilon_0} \qquad \epsilon_0 = 8.85 \times 10^{-12}\,\frac{C^2}{N\cdot m^2} \qquad m_{elec} = 9.1094 \times 10^{-31}\,\text{kg} \qquad e = 1.602 \times 10^{-19}\,\text{C}$$

$$\Delta\text{EPE} = q_0\Delta V \qquad V_{pt-ch} = k\frac{q}{r} \qquad E_x = -\frac{\Delta V}{\Delta x} \qquad 1\,\text{eV} = 1.602 \times 10^{-19}\,\text{J}$$

$$A = \pi R^2 \qquad q = CV \qquad C_{air} = \frac{\epsilon_0 A}{d} \qquad C_{diel} = \kappa C_{air} \qquad \text{Energy} = \frac{q^2}{2C} = \tfrac{1}{2}CV^2$$

$$V = IR \qquad R = \rho\frac{L}{A} \qquad R_{ser} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{par}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$P = VI = I^2R = \frac{V^2}{R} \qquad \text{Energy} = Pt \qquad 1\,\text{eV} = 1.602 \times 10^{-19}\,\text{J}$$