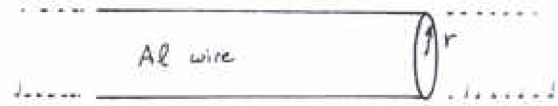
Name______________________________

**Phys 122 — Section 4**

**Quiz #2**




1. An conductor made of aluminum has a circular cross-section with radius 3.2 mm.

$r = 3.2$ mm

**a)** What is the cross-sectional area of the conductor?

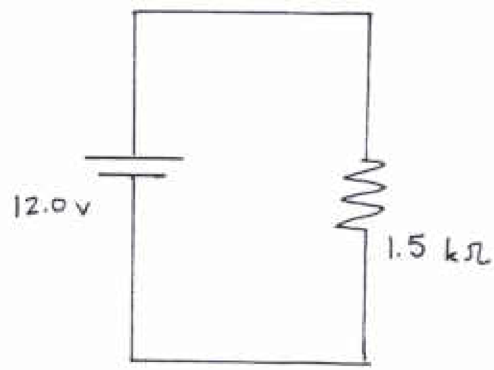
$$A = \pi r^2 = \pi (3.2 \times 10^{-3} m)^2 = \boxed{3.2 \times 10^{-5}\ m^2}$$

**b)** What length of the conductor has a resistance of $1.0\,\Omega$? (The resistivity of Aluminum is $2.82 \times 10^{-8}\,\Omega \cdot \mathrm{m}$.)

Use $R = \rho \frac{\ell}{A}$, find $\ell$:

$$\ell = \frac{AR}{\rho} = \frac{(3.2 \times 10^{-5} m^2)(1.0\,\Omega)}{(2.82 \times 10^{-8}\,\Omega \cdot m)} = 1.1 \times 10^{3}\ m = \boxed{1.1\ km}$$

2. A $1.5\,\mathrm{k}\Omega$ resistor is connected to a 12.0 V battery.




**a)** What current flows through the resistor?

Ohm's Law:

$$I = \frac{V}{R} = \frac{12.0 V}{1.5 \times 10^{3}\,\Omega}$$

$$= \boxed{8.0 \times 10^{-3} A} = 8.0\ mA$$

**b)** How much energy is dissipated in the resistor in 1.0 hour?

Power dissipated in resistor is

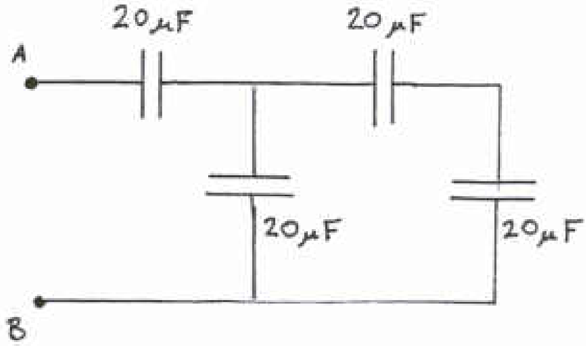
$$P = I^2 R = (8.0 \times 10^{-3} A)^2 (1.5 \times 10^{3}\,\Omega) = 9.6 \times 10^{-2}\ W.$$

In one hour = 3600 s, the energy dissipated is

$$\text{Energy} = Pt = (9.6 \times 10^{-2} W)(3600 s) = \boxed{346\ J}$$

*Phys 122, Sec 4 Quiz #2*

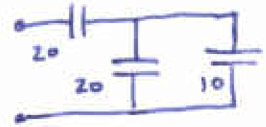
**3.** Find the equivalent capacitance (i.e. the capacitance between points A and B) for the combination shown here.




The farthest two capacitors :

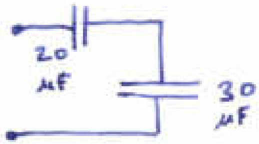

are in series ; they reduce to : $\frac{1}{C_{ser}} = \frac{1}{20\mu F} + \frac{1}{20\mu F}$

$\rightarrow$ $C_{ser} = 10\mu F$ . The combination is now :




(in μF)

for the 10μF and 20μF cap's are in parallel, giving :




. Finally, combine the series 20μF and 30μF cap's to get :

$\frac{1}{C_{eq}} = \frac{1}{20\mu F} + \frac{1}{30\mu F}$ $\rightarrow$ $\boxed{12\mu F}$

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**You must show all your work!**

$$I = \frac{q}{t} \qquad V = IR \qquad R = \rho\frac{\ell}{A} \qquad P = VI = I^2R = \frac{V^2}{R} \qquad q = CV \qquad \text{Energy} = Pt$$

$$R_{ser} = R_1 + R_2 + \cdots \qquad \frac{1}{R_{par}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots \qquad \frac{1}{C_{par}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots \qquad C_{par} = C_1 + C_2 + \cdots$$

$$\text{Circle: } C = 2\pi R \quad A = \pi R^2 \qquad \text{Sphere: } A = 4\pi R^2 \quad V = \tfrac{4}{3}\pi R^3$$

$$V_{rms} = \frac{V_0}{\sqrt{2}} \qquad I_{rms} = \frac{I_0}{\sqrt{2}}$$

Some EM units: Coulomb, Volt, Farad, Ampere, Watt, Ohm
Sum of currents going into junction equals sum of currents coming out of junction; around ant closed loop, the sum of potential gains equals the sum of potential drops.