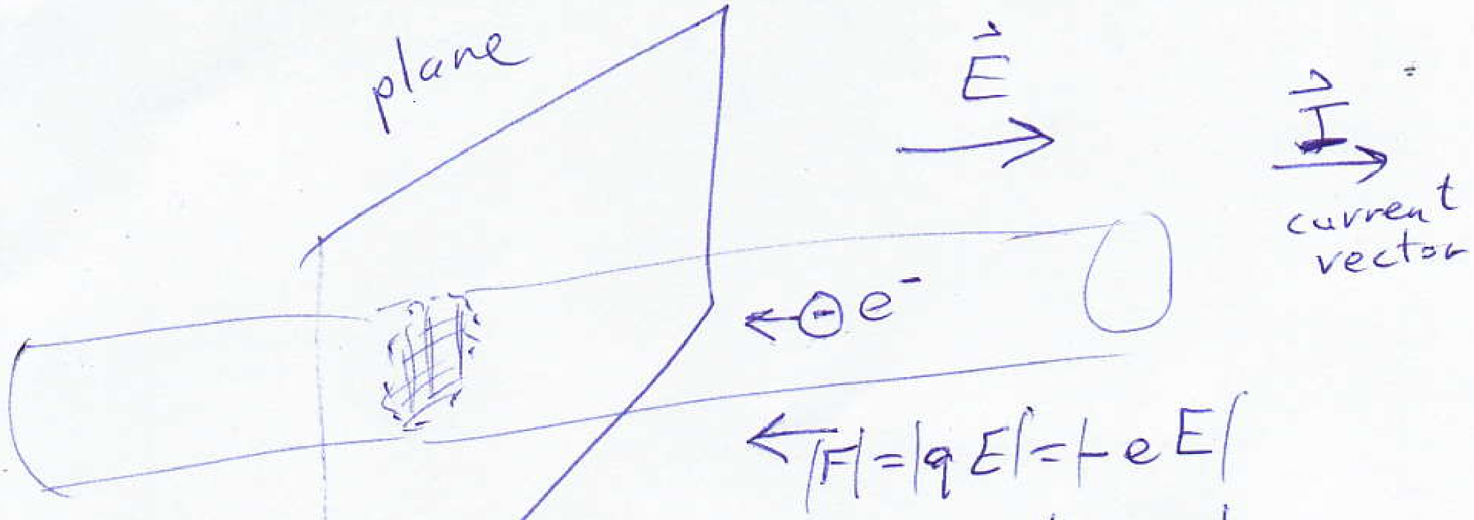


[How much charge crosses the ~~wire~~ dividing plane each second? Count one direction (e.g. left to right) → as positive, the other as negative.

current [net flow rate of charge]

$1A = \frac{1C}{1s}$

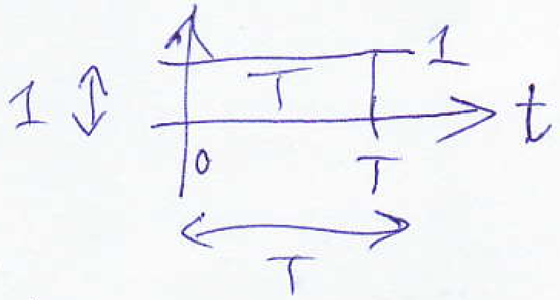
$$1W = \frac{1J}{1s} = \frac{1V \cdot 1C}{1s} = 1V \cdot 1A$$

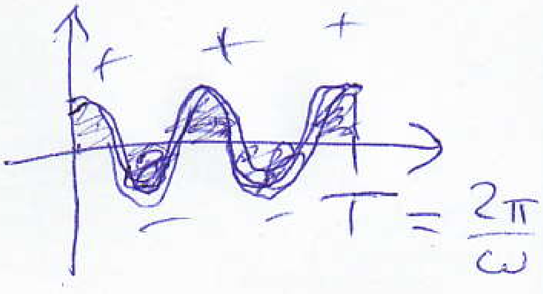
For many metallic materials, current I is proportional to voltage V: $I = \frac{1}{R}V$

$V = IR$. R just depends on the wire.

Ohm's Law.

$$I_{rms} = \frac{I_0}{\sqrt{T}\sqrt{2}}\sqrt{\int_0^T \left(1 - \cos(2\omega t + 2\phi)\right) dt}$$





$$I_{rms} = \frac{I_0}{\sqrt{T}\sqrt{2}}\sqrt{T}$$

E.g. $\int_0^{2\pi} \cos(2t)\, dt$ → 0

$$I_{rms} = \frac{I_0}{\sqrt{2}}$$

rms current

I_0 = peak current

For alternating current,

$P = I_{rms} V_{rms}$, not

$P = I_0 V_0$.

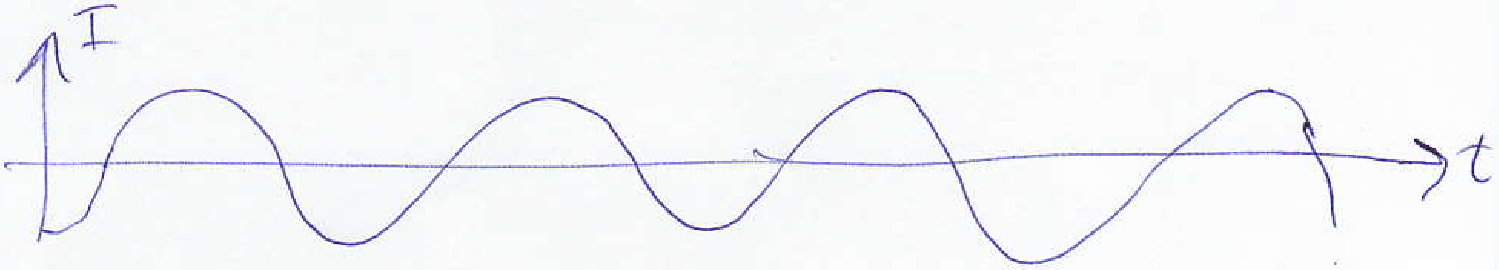
$$V_{rms} = \sqrt{\left(\int_0^T V^2 \, dt / T\right)} \qquad T = \frac{2\pi}{\omega}$$

$$V = V_0 \cos(\omega t + \phi) \qquad V_{rms} = \frac{V_0}{\sqrt{2}}$$

$$1\,V = 1\,\frac{J}{C} = \frac{1\,N \cdot 1\,m}{1\,C} = \underbrace{\left(\frac{1\,N}{1\,C}\right)} \cdot 1\,m$$

$$\frac{1\,V}{1\,m} = \frac{1\,N}{1\,C} \longleftarrow \text{standard unit of } \vec{E}$$

Average alternating current is 0



$$I = I_0 \sin(\omega t + \phi)$$

More useful: $\sqrt{\text{average of } I^2}$

$$I_{rms} = \sqrt{\int_0^T \left(I_0 \sin(\omega t + \phi)\right)^2 dt / T}$$

$$T = \frac{2\pi}{\omega}$$

$$I_{rms} = \frac{I_0}{\sqrt{T}} \sqrt{\int_0^T \sin^2(\omega t + \phi)\, dt}$$

$$I_{rms} = \frac{I_0}{\sqrt{T}} \sqrt{\int_0^T \frac{1}{2}(1 - \cos(2\omega t + 2\phi)\, dt}$$

Ch. 25 #92

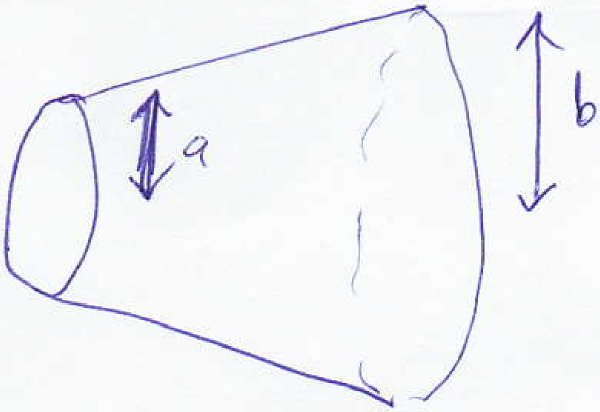
$j = \frac{I}{\text{area}}$

current density (j)

$a = 2.5\ mm$

$b = 4.0\ mm$

$I = 2.0\ A$



$\longrightarrow$ $I = 2.0A$ $\longrightarrow$ $I = 2.0A$

$j = \frac{I}{\pi a^2}$ $j = \frac{I}{\pi b^2}$

$j = 1.0\times10^{-1}\frac{A}{mm^2}$ $j = 4.0\times10^{-2}\frac{A}{mm^2}$

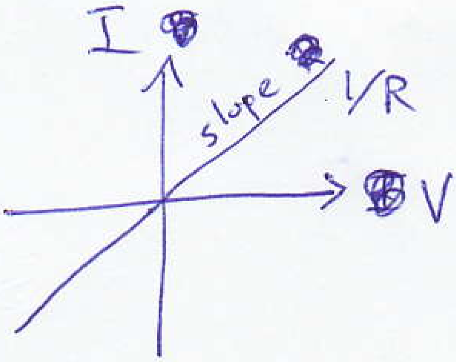
$j = 1.0\times10^{5}\frac{A}{m^2}$ $j = 4.0\times10^{4}\frac{A}{m^2}$

Consider a 295 hp car.

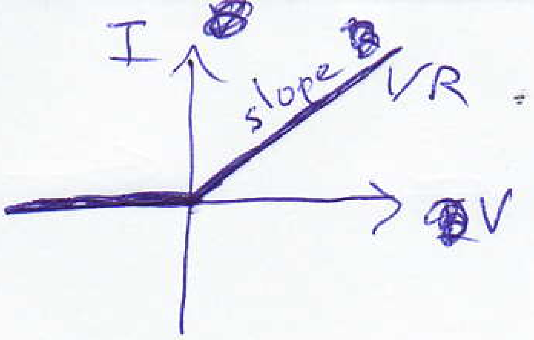
At 120V, how much current would provide 295 hp in power?

1 hp = 746 W "horsepower"

$I = \frac{P}{V} = \frac{(746\ W/hp)(295\ hp)}{120\ V} = 1.83\ kA$



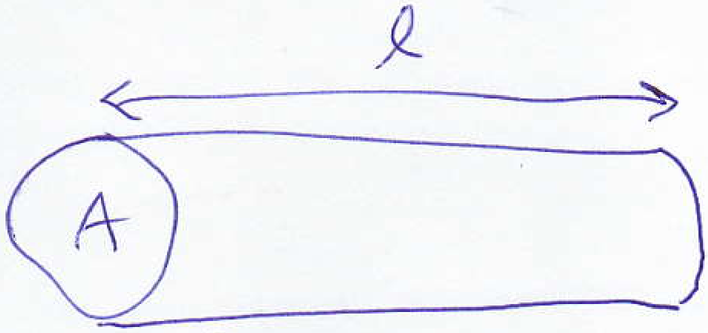
Ohm's Law



Diode's are "non-Ohmic."

$$R = \frac{\rho \ell}{A}$$

|| resistance



$$\rho = \text{resistivity} = \frac{AR}{\ell}$$

Ch. 26

series:

$$R = R_1 + R_2$$

parallel

$$1/R = 1/R_1 + 1/R_2$$