Homework # 1: Chapter 1
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Homework Problems

Charge and Current

1. 1.2 a & b in Text
2. 1.6 in Text
3. 1.7 in Text

Voltage, Power, and Energy

4. 1.11 in Text

Comprehensive Problems

5. 1.31 in Text, and use the information from the example at the bottom of this assignment to calculate the size of a piece of coal needed to generate the energy for the computer and lightbulb for the entire year.

6. 1.34 in Text, and use the information from the example at the bottom of this assignment to calculate the size of a piece of coal needed to generate the energy for the household for a day and for an entire year, assuming the household uses this power profile everyday. List a common object that would be the volume of coal used in a day and in a year.
Coal Conversion Information for 1.31 and 1.34

Power is the rate of energy change over time.

\[ \text{Power} (\text{Watts}) = \frac{\text{Energy} (\text{Joules})}{\text{Time} (\text{Seconds})} \]  

(1)

However Joules are not used very often when discussing energy. Usually energy is given in terms of Watt*Hours.

\[ \text{Power} (\text{Watts}) \times \text{Time} (\text{Hours}) = \text{Energy} (\text{Watt} \times \text{Hours}) \]  

(2)

For example, a 60 Watt light bulb that is on for 180 minutes uses 180 Watt*Hours of energy.

\[ 60 \text{ Watts} \times 180 \text{ minutes} \times \frac{1 \text{ hour}}{60 \text{ minutes}} = 180 \text{ WattHours} \]  

(3)

Watt Hours aren’t intuitive, so let’s convert them to the equivalent amount of coal needed to generate that energy. The ratio of 1.09 pounds of coal per KiloWattHour is used for this conversion\(^1\).

\[ 180 \text{ WattHours} \times \frac{1 \text{ KiloWattHour}}{1000 \text{ WattHours}} \times \frac{1.09 \text{ pounds coal}}{1 \text{ KiloWattHour}} = 196 \text{ pounds coal} \]  

(4)

.2 pounds is getting better, but let’s change it to a volume so it can be visualized. The density of solid anthracite coal, used in power production, is 94.02 pounds per cubic foot\(^2\).

\[ 0.196 \text{ pounds coal} \times \frac{ft^3 \text{ coal}}{94.02 \text{ pounds coal}} = 0.0021 ft^3 \text{ coal} \times (\frac{12 \text{ in}}{1 \text{ ft}})^3 = 3.6 \text{ in}^3 \text{ coal} \]  

(5)

For reference, the Galaxy S III has a plastic chassis measuring 5.38 in long, 2.78 in wide, and 0.34 in thick is about 5 in\(^3\) of volume\(^3\).

\(^1\)http://www.eia.gov/tools/faqs/  
\(^2\)http://www.aqua-calc.com/calculate/volume-to-weight  
\(^3\)http://en.wikipedia.org/wiki/