

**APES Energy Problems**

(for this practice, you may use your calculator)

**The Basics:**

**Energy:** The basic unit of energy is a Joule (J).  
Other units are kilojoule, calorie, British Thermal Unit (BTU), and therm.

**Power:** Power is the rate at which energy is used. **Power (watts) =  $\frac{\text{Energy (joules)}}{\text{time (secs)}}$**

$$1 \text{ kJ} = 1000\text{J}$$

$$1\text{W} = 1\text{J/s} \text{ (1Watt = 1 Joule per second)}$$

$$1\text{kW} = 1000 \text{ J/sec (1kJ/sec)}$$

these are measurements of the rate of energy usage

$$1\text{kWh} = 3600 \text{ KJ (3.6 x 10}^6 \text{ J)} \rightarrow$$

this is the measurement of the total amount of energy used in one hour

1. The “old-style” 100 Watt incandescent light bulb uses 100 J/sec of electrical energy. If it is 5% efficient, then the bulb converts 5% of the electrical energy into light and 95% is wasted by being transformed into heat.  
(Ever felt a hot light bulb?)

a. How is the First Law of Thermodynamics referenced above?

b. How is the Second Law of Thermodynamics referenced above?

**Practice Problems:**

2. How much energy, in kJ, does a 75 watt light bulb use then it is turned on for 25 minutes?  
(Hint to get started: Using the power equation above, 1 watt = 1 J/sec, therefore 75 watts = 75 J/sec.  
You are allowed to immediately indicate that and then proceed with dimensional analysis.)

$$75 \text{ watts} = \frac{75 \text{ J}}{\text{sec}}$$

continue from here →

3. The kilowatt-hour, or kWh, is the measure of your total energy use.
  - a. Assume your electric bill showed you used 1355 kWh over a 30-day period. Find the energy used, in kJ, for the 30 day period.
  - b. Find the energy used in J/day.
  - c. At the NY rate of \$0.21/kWh, what will your electric bill be for this month?
4. Remember: a 100-Watt incandescent light bulb is 5% efficient.
  - a.) How much energy (in Joules) does it use in 12 hours of operation?
  - b.) Convert total energy use to kWh
  - c.) How much energy does the bulb convert to light during 12 hours?
5. An electric clothes dryer has a power rating of 4000 W. Assume a family does 5 loads of laundry each week for 4 weeks. Assume each dryer load takes 1 hour.
  - a. Find the energy used in J.
  - b. Find the energy used in kWh.
  - c. Find the operating cost for 4 weeks. Assume cost is \$0.21/kWh