**Energy and Power for APES: The Basics**

ENERGY

* The basic unit of energy is the \_\_\_\_\_\_\_\_\_\_\_\_ ( )
* When talking about lots of energy we use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* 1000 J = \_\_\_\_\_\_\_\_\_\_\_\_\_.

POWER

* Power (P) is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Power x \_\_\_\_\_\_\_\_\_\_\_ = Energy (P x t = E)

Show how this can be rearranged to determine power:

EFFICIENCY

* The unit for power is the \_\_\_\_\_\_\_\_\_\_.
* 1W = 1 J/sec ( ).
* Therefore a 100 watt light bulb uses 100J/sec of electrical energy.
* If it is 20% efficient then the bulb converts 20% of the electrical energy into light and 80% is lost as waste heat.

PHYSICS LAWS

*First Law of Thermodynamics:*

*Second Law of Thermodynamics:*

ENERGY OF APPLIANCES

* Knowing the relationship between energy and power allows us to find the energy used when an appliance of known power (in watts) operates for a known amount of time (in seconds).

**Example:** How much energy (in KJ) does a 75 watt light bulb used when it is turned on for 25 minutes?

Equation :

Conversion: Power (in watts) 1 watt = 1J/sec

ANSWER:

IF THE WATTAGE IS NOT GIVEN

* To find the power (in watts) of any electrical appliance use this equation :

P =

V =

I =

KILOWATT HOUR: is a unit of ENERGY!

Kilowatt is a unit of \_\_\_\_\_\_\_\_\_\_\_\_ and hour is a unit of \_\_\_\_\_\_\_\_\_\_\_. Therefore E = P x t

* A kilowatt-hour is equal to 1 Kw (1000 watts) delivered continuously for one hour (3600 sec)
* 1 kwh = 1000 J/sec x 3600 sec = 3,600,000 J or 3600 kj

So…… 1kwh = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1 calorie (cal) =
* 1 BTU =
* 1 therm =

**Problem 1**

Dr. Clark’s power bill shows that his home used 1355 kwh over a 30 day period.

1. Find the energy used (in KJ) for the 30-day period.
2. Find the energy used in J/day.
3. At the rate of $.057/kwh, what is Dr. Clark’s power bill (without tax)?

**Problem 2**

A current through a toaster (110 V) is 8 A.

P = V x I

1. What is the power (in watts) of the toaster?
2. How much energy (in J) will the toaster use in 5 minutes of operation?

Power = Energy/ time therefore E = Power x Time

**Problem 3**

A 100 watt light bulb is 20% efficient. That means 20% of the energy used is converted to light while 80% of the energy used is lost as heat.

1. How much energy does it use in 12 hours of operation?
2. How much energy does the bulb convert into light over the 12-hour period?
3. How much energy does the bulb convert into heat over the 12-hour period?
4. Convert the total energy use into kwh.

**Problem 4**

An electric clothes dryer has a power rating of 4000W. Assume the family does five loads of laundry each week for 4 weeks. Further assume that each load takes one hour.

1 W = 1J/sec

1. Find the energy used in both J and kwh.
2. If the cost of electricity is $.075/kwh, find the cost of operating the dryer for a month (4 weeks).

**Problem 5**

Dr. Clark’s natural gas bill states that his household used 110 therms of energy over a 30-day period.

1. Covert 110 thems to kwh.
2. His charge for the energy was $ 88.78. Find the cost of this natural gas in $/kwh.
3. Using the information about electricity costs in the problems above, which form of energy (electricity or natural gas) is more expensive? How many times more expensive is it?