**Electric Energy**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In this assignment, you will investigate electric energy and electric power. As you work on this assignment you will:

• identify the electric transformation systems in selected electric appliances;

• determine how utility companies bill customers for the electric energy used;

• investigate the efficiency of light bulbs; and

• one technology that could save you money by conserving electricity.

**What To Do**

1. If you are using a word processor, enter your answers electronically. Remember to save your work as you go.

**What Did You Discover?**

*1. Using Electrical Energy*

(a) What is an energy transformation system?

(b) Describe the energy transformation system in a light bulb.

(c) Describe the energy transformation system in a toaster.

(d) Describe the energy transformation system in a radio.

(e) Describe the energy transformation system in a fan.

*2. Generating Electrical Energy*

(a) Describe the energy transformation system in a generator.

(b) Write a statement that describes the relationship between the speed of the spinning wire and the amount of electric energy produced

*3. Electrical Power*

(a) Define the term “electrical power”.

(b) Write the chemical formula for calculating power.

(c) Identify the unit of power.

(d) Define one watt of power.

(e) How much power does a 100 watt light bulb use every second?

(f) How much power does a 40 watt light bulb use every second?

(g) How much power does a 20 watt compact fluorescent light bulb use every second?

(h) Complete the following chart.

|  |  |
| --- | --- |
| **Size of Light Bulb** | **Amount of Power Used in 1 hour (W)** |
| 100 watt incandescent  |  |
| 40 watt fluorescent |  |
| 20 watt compact fluorescent |  |

(i) Which of the light bulbs from (h) uses the most power in one hour?

*4. Electrical Energy*

(a) What two factors determine how much energy appliances use?

(b) What is the formula for calculating this energy?

(c) How much energy does a one watt electrical appliance use if it is left on for one hour?

(d) What units do utility companies use to calculate your electricity bill?

*5. Kilowatt Hours*

(a) Plug each light bulb in and determine how much it costs to operate it for 720 hours. Double the rate to see how increasing the cost of energy would affect you.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Light Bulb** | **Power Rating****(W)** | **Time****(h)** | **Energy Consumed (W•h)** | **Energy Consumed****(kW•h)** | **Cost at $0.061 per kW•h** | **Cost at****$0.12 per****kW•h** |
| 100 w |  |  |  |  |  |  |
| 40 w |  |  |  |  |  |  |
| 20 w |  |  |  |  |  |  |

(b) Which light bulb from (a) uses the most energy?

(c) What would happen to your utility bill if the power company doubled the amount it was charging per kilowatt•hour?

*6. Efficiency of Electrical Appliances*

(a) Why is no device is 100 percent efficient?

(b) Identify the undesirable form of energy produced by an incandescent light bulb.

(c) Consider an electrical device that is 75 percent efficient.

– How much energy is converted into a desirable form of energy?

– How much energy is converted into undesirable forms of energy?

*7. Measuring Efficiency*

A 100 watt incandescent light bulb and a 20 watt compact fluorescent light bulb each produce similar amounts of light energy.

(a) What is the temperature of the air just above the 100 watt incandescent light bulb after 10 minutes of use?

(b) What is the temperature of the air just above the 20 watt compact fluorescent light bulb after 10 minutes of use?

(c) Which light bulb converted more energy into thermal energy?

(d) Which light bulb is less efficient? Explain how you know.

(e) Read the Did You Know? What is the approximate efficiency of an incandescent light bulb?

(f) What is the estimated efficiency of a compact fluorescent light bulb?

*8. Cost of Efficiency*

(a) Complete the following chart.

|  |  |  |
| --- | --- | --- |
| **Comparison of Operating Costs** | **Annual Operating Cost for****Incandescent Bulb** | **Annual Operating Cost for Compact Fluorescent Bulb** |
| Energy used (2190 hours) |  |  |
| Energy cost at $0.11/kW•h |  |  |
| Initial cost of light bulb |  |  |
| Cost of replacement bulbs |  |  |
| **Total Cost** |  |  |

(b) Which light bulb uses the most energy during the 2190 hours?

(c) Which light bulb cost the most to operate during this time period?

(d) How much less does it cost to run a compact fluorescent light bulb for 2190 hours?

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