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Name: _____

Date: ____ / ____ / ____ Class Hour: ____

What's the Cheapest Watt?

Student Lesson & Response Guide

Introduction:

Try to make a list of everything you plug in, turn on, or that turns on for you and you'll be busy for a while. You'll probably miss a few things too, since we use most of our electric appliances without thinking. Yet each electrical appliance contributes to an electric bill that someone has to pay. At home, that someone is probably your parents. But some day that someone will be you!

Not only does electricity cost money, generating it costs resources to produce the electricity to run an electric appliance. In addition, there is usually a cost to our environment in the form of air emissions or some other form of environmental pollution. These consequences usually go completely unnoticed at the place and time the appliance is used.

The use of every watt of electricity has consequences of cost, resources, and emissions. As you know, these can be subjects of discussion on a scale that ranges from dinnertime conversation to international politics.

So, ***what's the cheapest watt***—the one that costs the least, uses the fewest resources, and causes the least pollution? That will be really valuable to learn, and it's time to find out—starting with factual data you measure and evaluate.

In this activity you'll measure electrical data coming from a common plug-in appliance you use. To do this you will use a device called a Kill-A-Watt®. The Kill-A-Watt enables you to record electrical use information from any device that uses a standard 120 Volt electrical plug. Your teacher will train you to use this simple device.

Materials:

Kill-A-Watt®

Electrical appliances

Internet-accessible device

With this electrical information you and your classmates will evaluate and compare the use of a variety of electrical appliances. In the end you will be able to answer the question—***What's the cheapest watt?***

0. What are common electrical appliances used by you and your classmates?

0- 1. *** Answer**

0- 2. *** Answer**

0- 3. *** Answer**

0- 4. *** Answer**

0- 5. *** Answer**

0- 6. *** Answer**

0- 7. *** Answer**

0- 8. *** Answer**

0- 9. *** Answer**

0-10. *** Answer**

0-11. *** Answer**

0-12. *** Answer**

0-13. *** Answer**

0-14. *** Answer**

0-15. *** Answer**

0-16. *** Answer**

0-17. *** Answer**

0-18. *** Answer**

0-19. *** Answer**

0-20. *** Answer**

0-21. *** Answer**

0-22. *** Answer**

0-23. *** Answer**

0-24. *** Answer**

My Appliance Assignment:

From the class list in the Introduction, you will select or be assigned an appliance to survey. Your teacher will describe your procedure and the timeline you will use to perform this activity and record necessary data. In addition, your teacher will train you in how to use the Kill-A-Watt® meter. Good questions any time throughout this activity will help you to understand what you are doing. Ask questions!

1. What is the electrical appliance you have been assigned to survey? Enter it below, and after instruction 5.

*** Answer**

Following are terms expressing electrical concepts you'll use while completing the activity. Write good definitions for each

2a. Define the term *electrical power* or *electrical demand*:

*** Answer**

2b. Define the term *electrical energy* or *electrical use*:

*** Answer**

2c. Define the term *phantom load*:

*** Answer**

3. Develop a specific and complete "game plan" for your appliance. How will you determine the average amount of electricity you use per year in your home with this appliance?

*** Answer**

4. Have the plan you developed approved by your teacher.

Steps To Take Before Killing Your Kill-A-Watt

- If you haven't already, take a good photo of your appliance plugged into the Kill-A-Watt meter. Your photo should help you to tell the story behind what you write about in the questions for this lesson. Place your photo into the box after instruction 6.

- Press the grey "Volt" button on the far left. Record your Volts. It should be a number close to 120, which is your household's electrical voltage.

Volts: * Answer

- Press the grey "Watt" button in the middle. Press again. Note the change from Watts to VA (or from VA to Watts). Press again if, necessary, to get the Watts screen. Record the Watts of power your appliance demands when it's on. If it is not on and you can't turn it on, your Watts may be zero or a very small number.

Watts: * Answer

- Press the Pink button. It has two settings, KWH and hours, and you need to record both. By pressing the button, you switch from one setting to the other.

KWH: * Answer

Hours: * Answer

If for example, you've been plugged in for 1 week, your "Hours" number should be close to 168. [7 ~~days~~ X 24 hours/~~day~~ = 168 hours]

- Now you can unplug and set everything back to normal.
    - Thank your parents for indulging you during this activity.
    - Take a picture of the paper on which you recorded your results right away.
    - Don't lose the paper or your cell phone. You need your pictures and data to do a great job completing **What's the Cheapest Watt?**

My Appliance Information and Estimates:

5. My appliance: *** Answer**

6. Digitally copy and paste a good photo of your appliance plugged into the Kill-A-Watt meter. The photo should help you to tell the story behind what you write about in the questions that follow.

7. Describe the appliance, what it does, and how it is used. In the description of your appliance, include:

- Is it plugged in all the time, or plugged in only when it is being used?
- Does it draw a "phantom load" while plugged in?
- Does it run on its own when plugged in, or does it have to be turned on and off?
- Does it run continuously when plugged in or turned on, or does it cycle on an off?

*** Answer**

8. Check the appliance rating. This may be provided on a tag (usually on the cord), printed or imprinted behind or under the appliance, or in the instruction manual (which may be found online). How many watts of electric power does it demand when it is in use?

*** Answer**

9. Is it an Energy Star rated appliance? If so, why? If not, why not?

*** Answer**

10. How many watts of power did your appliance actually demand when it was in use? How does this compare with its appliance rating (#4)?

*** Answer**

To answer questions 8-10, carefully, completely, and legibly show Your supporting math work. Then highlight your final answer.

11. How many KWH of electrical energy do you estimate your appliance used per year?

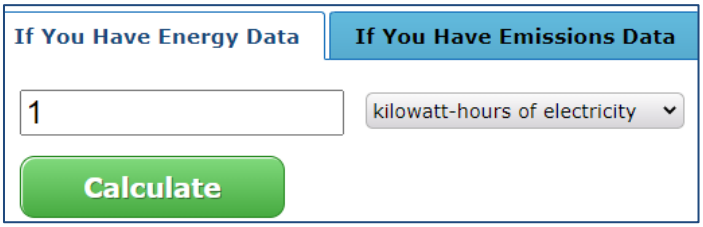
*** Answer**

12. Based on your estimated use, what does it cost/year to use this electrical appliance? (Use a cost of electricity: **$ 0.13 /KWH** or a cost your teacher gives to you.)

*** Answer**

13. Before answering this question, you'll need to get information from United States Environmental Protection Agency Greenhouse Gas Equivalency Calculator. Navigate to get this important information in its most accurate and current form with this hyperlink: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Once there, enter your data into the equivalency calculator as indicated in the illustration that follows. Then click Calculate.



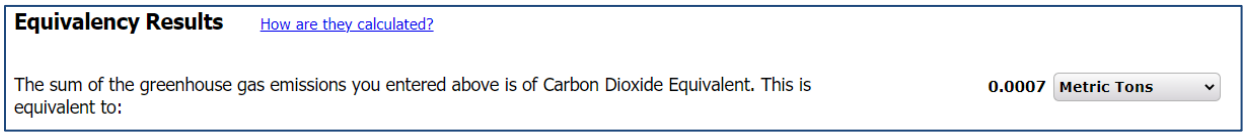
Locate the graphic that says **Pounds of coal burned**. The number in the graphic is the average mass of coal—and only coal—that would have to be burned to produce 1 kilowatt-hour of electricity. Copy this number. [**_____ lbs. coal / KWH**]

Do not close out of the Equivalency Calculator.

Based on your estimated use, how many lbs. of coal are burned/year to use the appliance you surveyed? (Use the **lbs. coal / KWH** you just researched in your math calculation.)

*** Answer**

14. Locate the area that says Equivalency Results. To the right, change Metric Tons to Pounds, as indicated in the illustration that follows. Once you make the change, a new number will immediately appear.



That number is the **Pounds of Carbon Dioxide Equivalent**. It defines the mass of CO_2 that would have the same warming potential as the mixture of emissions released to produce 1 kilowatt-hour of electricity. Copy this number. [**_____ lbs. CO_2 / KWH**]

Based on your estimated use, how many lbs. of CO_2 are released to the air each year to use the appliance you surveyed? (Use the **lbs. CO_2 / KWH** you just researched in your math calculation.)

*** Answer**

Lesson Summary Questions:

15. How can you save energy in using the appliance you surveyed?

*** Answer**

16. Provide a list of those appliances surveyed by all members of your class and the data acquired and calculated from them. You may word process the list or copy and paste a digital copy of the list if provided by your teacher. You may also take a picture and of the list and place it here.

*** Answer**

17. Among those surveyed by the class, which appliances were estimated to use the most electricity over the course of a year?

17-1) *** Answer** (most electricity)

17-2) *** Answer** (second most electricity)

17-3) *** Answer** (third most electricity)

18. Consider the appliances surveyed by the class and yourself only. What are the best things you can do to decrease the amount of electrical energy used in your home?

18-1)

*** Answer**

18-2)

*** Answer**

18-3)

*** Answer**

19. Electricity is considered a *secondary* source of energy because a *primary* energy resource is used to produce it. Once the energy from the primary source is put into the form of energy we call electricity, it can then be used by consumers.

Make a two column table. In it, list the primary energy resources used to produce electricity, along with the percent of electricity they produce in our region. To get this information, go to the USEPA Power Profiler at:

- https://www.epa.gov/energy/power-profiler

Once there, enter our zip code. Then click on View Report. Hover over the Fuel Mix Comparison for our region to get the primary energy resources used to produce our electricity and the percent of the overall fuel mix for each.

*** Answer**

20. When you conserve energy, you save money. What else do you save?

*** Answer**

21 What's the cheapest watt—the watt that costs the least, uses the fewest resources, and causes the least pollution?

*** Answer**

22. You have $10,000 to spend on your home. You may spend it on energy conservation measures, or you may spend it on a good rooftop solar PV array. Which comes first, energy conservation or the solar array? Explain why you made your choice in convincing detail.

*** Answer**