Name _____ Date _____ Class _____

Power Meter: Demonstration Guide

A. Background Information

1. **What is a watt?**
   A watt is a measure of the instantaneous energy usage (power).

2. **What is a kilowatt-hour?**
   This is a measure of energy, which is the amount of power used (Watts) over a given amount of time (an hour).

3. **Where does our power for electricity come from?**
   It depends, (trick question) in California the majority is derived from power plants fueled by natural gas. Other parts of the country depend on burning coal to create power. It is important for students to understand that power is created by different sources and when fossil fuels such as natural gas and coal are burned they emit greenhouse gases. Wind and solar are also used to produce energy, but they don't emit greenhouse gases.

4. **Why is it import to be energy efficient?**
   The less energy we consume, the less greenhouse gas emissions are released into the atmosphere. Reducing energy also saves money.

5. **Calculation Example:** A light bulb uses 50W of power. If the light bulb is turned on for 1 hour, determine a) the amount of energy (in units of kWh), b) the emissions of CO_2 (in units of lbs. of CO_2) and c) the amount of money this will cost for the electricity (in units of US dollars).

   a) Energy=Power × Time, so a 50W light bulb turned on for 1 hour produces 50W×1h = 50Wh of energy. It's more convenient and common to use the units of kWh or 1000 Wh. We can convert Wh to kWh by dividing by 1000. Therefore, 50Wh = 0.050kWh.
   b) In California, for every kWh of energy used, 0.5 lbs. of CO_2 are emitted. So, emissions of CO_2=kWh of energy × lbs. CO_2 emitted 0.050kWh × 0.5 lbs. = 0.025 lbs. of CO_2.
   c) In California, every kWh of energy costs about $0.16. So the costs of using a 50W light bulb for 1 hour is 0.050kWh × $0.16/1000Wh = $0.008 or less than a penny.

B. Introduction to Power Meter activity using the scientific method.

Fill out the different sections of the scientific method below.

1. **Question** *(What is the question that needs to be answered or problem that needs to be solved?)*:

Is there a difference in energy use between two different types of light bulbs? An incandescent bulb (regular light bulb) and a LED light?

2. **Hypothesis** *(Answer the question and state which light bulb you think will use less energy.):*

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3. **Method**: Use the power meter to measure and quantify how much power (in Watts) each light bulb will use. *Note: Do not perform this experiment without the supervision of an adult.*
    a. Plug your power meter into a wall outlet.
    b. Plug the lamp into the power meter, put in a light bulb and turn it on.
    c. Press the middle button to display Watts.
    d. Read the power used by the light bulb in Watts (W) and record your data in the table below. Repeat and compare with the other light bulb or any other electrical device.

Item name	Power (in Watts)
Incandescent Light Bulb:	
LED Light Bulb:	
Other:	
Other:	

4. **Result**: Calculate the Energy, in kWh, the CO_2 emissions (in lbs. of CO_2) and the cost for the bulb and energy for the two types of bulbs. Complete the table using the example in the demonstration guide as a reference.

	
Incandescent bulb **60 W** **1,000 hours** **$0.75** **800 lumens**	**LED Bulb** **9.5 W (60 W equivalent)** **25,000 hours** **$10.00** **800 lumens**

Lighting for 25,000 hours	Incandescent	LED
Energy (kWh)		
CO_2 (lbs.)		
Cost of Energy ($)		
Total Cost [Energy+Bulb(s)] ($)		

Calculations:

Energy (kWh)

Incandescent: (_____W × _____ hours)/1,000 = _____ kWh

LED: (_____W × _____ hours)/1,000 = _____ kWh

CO_2 (lbs.)

Incandescent: _____ kWh × _____ lbs. CO_2/kWh =_____ lbs. CO_2

LED: _____ kWh × _____ lbs. CO_2/kWh =_____ lbs. CO_2

Cost of Energy ($)

Incandescent: _____ kWh × $_____/kWh = $_____

LED: _____ kWh × $_____/kWh = $_____

Total Cost [Energy+Bulb(s)] ($)
Incandescent: $_____ + $ _____ = $_____

LED: $_____ + $ _____ = $_____

5. Conclusion

a. State whether your prediction or hypothesis was correct or not.

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