Name:_____Binder Number:_____

Home Energy Use Labs

Name:_____Binder Number:_____

Class Activity

A DAY IN MY LIFE:
ENERGY USE & TRANSFORMATIONS

NAME:_____DATE:_____

Think about your average day. Begin with waking up to go to school. Check all the energy transforming devices you use. Give their energy transformations. Fill in the Relative Energy Points using the chart provided.

DEVICE	USED	ENERGY TRANSFORMATIONS	RELATIVE ENERGY POINTS USED
Waking up/Making Breakfast			
Alarm Clock or Radio			
Toaster			
Stove/oven			
Microwave			
Refrigerator			
Other			
Energy Used to Get Ready for School:			
AC/Heating			
Space Heater			
Shower/bath			
iPod/Radio/CD			
Hairdryer			
Curling iron			
Electric curlers			
Hair Straightener			
Electric Toothbrush			
Iron			
TV/Monitor			
Other			
Rooms With Lights On This Morning:			
Bedroom			
Bathroom			
Kitchen			
Family Room			
Hallway			
Basement			
Garage			
Dining Room			
Living Room			
Other			

DEVICE	USED	ENERGY TRANSFORMATIONS	RELATIVE ENERGY POINTS USED
Energy Used To Get To School			
Walk			
Bicycle			
School Bus			
Carpool			
Family Vehicle			
Other			
Energy Used After School & In The Evening:			
AC/Heating			
Lights			
iPod/Radio/CD			
TV/VCR/DVD Player			
Video Game System			
Computer			
Printer/scanner/fax			
Cell phone/charger			
Telephone			
Snack preparation			
Travel in vehicle			
Stove/oven			
Refrigerator			
Freezer/Ice Maker			
Microwave			
Toaster oven			
Grill			
Shower/bath			
Hairdryer			
Washer/dryer			
Swimming pool			
Water Pump			
Other			
		TOTAL	

How does your energy use compare to your classmates?

What could you do to reduce your use of energy?

A DAY IN MY LIFE:
RELATIVE ENERGY POINTS USED

DEVICE OR ACTIVITY	ENERGY POINTS USED
Air Conditioning	10
Heating	10
Alarm Clock	2
Bath	3
Bicycle	0
Carpool	2
CD Player/Stereo	2
Cell Phone Charger	1
Camera	1
Computer	3
Curling Iron	3
Electric Curlers	3
Family Vehicle	4
Fan	2
Freezer/Ice Maker	3
Grill	2
Hair Dryer	3
iPod/MP3 Player	2
Iron	3
Lights (each)	2

DEVICE OR ACTIVITY	ENERGY POINTS USED
Microwave Oven	2
Printer/Scanner/Fax	1
Radio	1
Refrigerator	3
School Bus	1
Shower	2
Snack Preparation	2
Space Heater	5
Straightener	3
Stove/Oven	5
Swimming Pool	3
Telephone	1
Toaster	3
Toaster Oven	3
Toothbrush (Elec)	1
TV/VCR/DVD	3
Video Game System	3
Walk	0
Washer/Dryer	5
Water Pump	2

MY HOME ENERGY AUDIT

NAME: _____ DATE: _____

*Your first home energy activity is to perform a general audit or inspection of the energy your family uses at home. Begin by sharing the **ENERGY SAVERS booklet** with your parents. Together, read **pages 4-6.***

This can be found online at:
http://energy.gov/sites/prod/files/2014/05/f16/Energy_Saver_Guide_Phase1_Final.pdf

Next, complete the audit below with your family. Bring the audit back to school to discuss the results in class.

1) How many incandescent light bulbs are in your home? _____

2) How many compact fluorescent light bulbs are in your home? _____

3) What is the normal thermostat setting for your furnace/AC?

Cooling Season: Day _____ Night _____

Heating Season: Day _____ Night _____

4) How many times does your family run the dishwasher each week? _____

5) What percentage of times is the Energy Saving feature used on the dishwasher? _____

6) How many loads of laundry are washed in your home each week? _____

7) What percentage of loads of laundry are washed in cold water? _____

8) How many baths are taken by all your family members in total each week? _____

9) How many showers are taken by all your family members in total each week? _____

10) What is the average length of each shower in your household (in minutes)? _____

11) How many times today was a light left on in an unused room? _____

12) How many times today was a TV/computer/video game/radio/stereo/CD or other device left on with no one using it? _____

13) How many times today was reading, a board game, or an outside activity chosen instead of a TV/video game/computer activity? _____

14) How many times today was water allowed to run needlessly? _____
(for example, while brushing teeth or doing dishes)

15) How many times today was the refrigerator door left open needlessly? _____

16) How many times today was door or window left open needlessly while the heat/AC was on? _____

17) How many times today was a microwave oven used instead of a stove/oven/toaster oven? _____

18) Does your family have or use any LED holiday lights or LED light bulbs? _____

19) Do you turn off your TV or computer monitor if you know you will return at a later time? _____

20) Do you leave your cell phone or iPod charger plugged in when not in use? _____

JOURNAL ENTRY #1 – INTRODUCTION TO ENERGY

NAME: _____ DATE: _____

1. After completing the **"Day in My Life – Energy Use & Transformations"** table and the "**Home Energy Audit"**, choose 5 things you could give up to save energy:

2. Write a paragraph explaining what you would miss most if you had no electricity.

3. Do you believe it is a good idea to require consumers to save energy, or should it be optional? Write a paragraph defending your answer:

Name:_____Binder Number:_____

Station 1

LIGHT BULB OR HEAT BULB - EXPERIMENT

NAME:_____DATE:_____

PART I:

Purpose: to compare an incandescent light bulb to a compact fluorescent light bulb

Materials:

1 incandescent light bulb (IL)	2 thermometers
1 compact fluorescent light bulb (CFL)	light bulb packaging for IL and CFL
2 radiometers	1 timer
2 lamp bases or clamp lights	1 calculator

Hypothesis: Which light bulb do you think will be hotter? _____

Which light bulb do you think will use more electricity? _____

Procedure:

1) Assign roles for your group:

CFL thermometer reader _____

IL thermometer reader _____

Timer _____

Recorder _____

2) Observe each light bulb. Sketch and record their physical characteristics. Be very careful with the bulbs. Do not shake the bulbs.

Observations (Physical Characteristics):

Compact Fluorescent Light bulb (CFL)	Incandescent Light bulb (IL)

3) Record your starting temperature before you turn on each light bulb. Turn on the compact fluorescent light bulb (CFL) in the lamp base or the clamp light. BE CAREFUL NOT TO TOUCH THE BULB. Place the radiometer under or next to the CFL and observe the speed of the blades. Record your observations. Turn off the CFL.

4) Turn on the incandescent light bulb (IL) in the lamp base or the clamp light. BE CAREFUL NOT TO TOUCH THE BULB. Place the radiometer next to the IL at the same distance as before and observe the speed of the blades. Record your observations. Turn off the IL.

Observations (Radiometer Activity):

Compact Fluorescent Light bulb (CFL)	Incandescent Light bulb (IL)

5) Put a compact fluorescent light bulb (CFL) in the lamp base or clamp light. Hold or place the thermometer 5-10 cm from the bulb and take the temperature. Take the temperature every minute for 10 minutes and record it in the data table.

5) Put an incandescent light bulb (IL) in the lamp base. Hold or place the thermometer 5-10 cm from the bulb and take the temperature. (Make sure the thermometer is at the same distance from the bulb as before.) Take the temperature every minute for 10 minutes and record it in the data table. BE CAREFUL NOT TO TOUCH THE BULB.

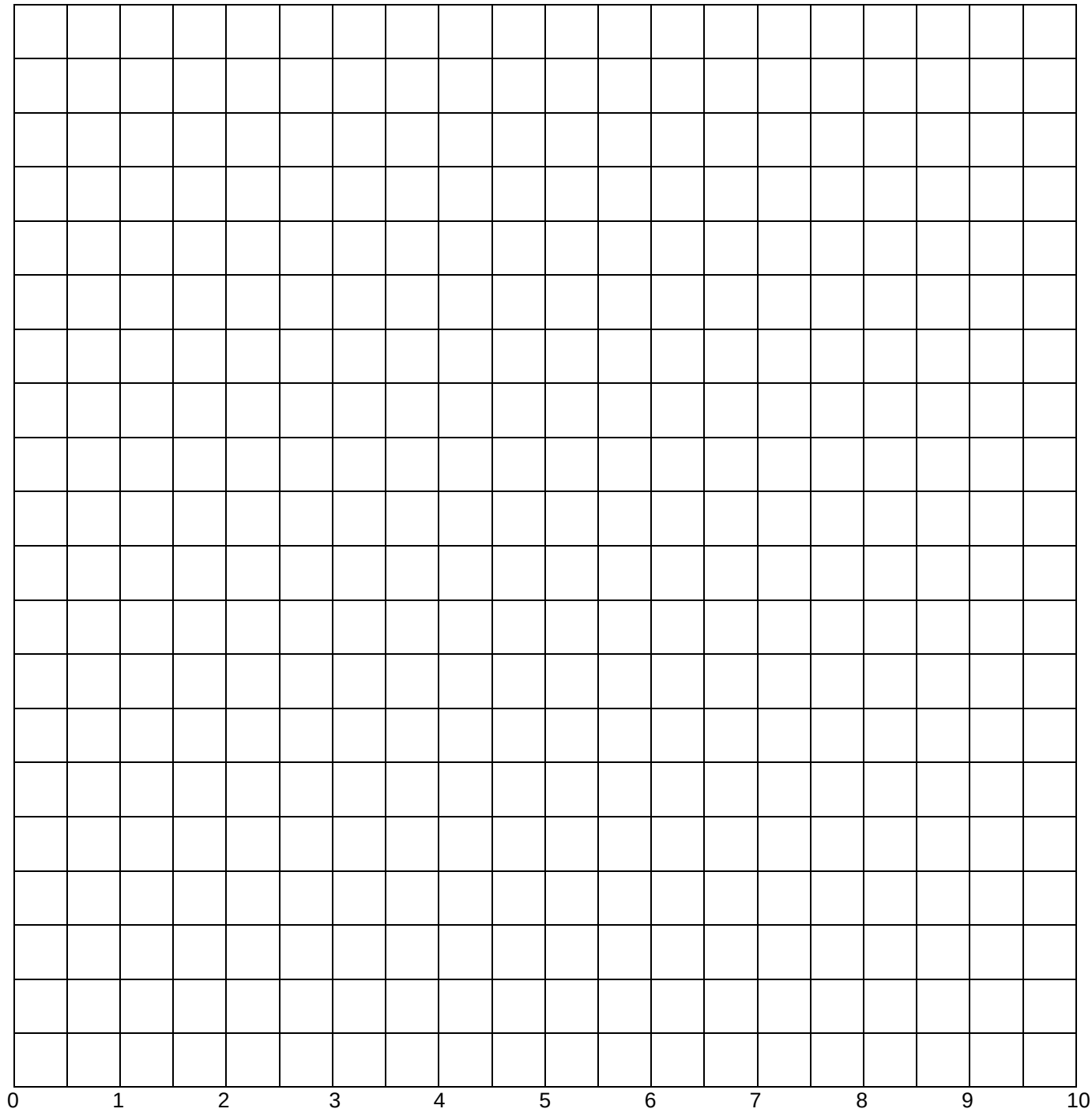
6) Calculate the change in temperature for each bulb.

7) Graph the results of your temperature experiment. Use one color for the compact fluorescent light bulb and one color for the incandescent light bulb. Make a key showing which bulb each color represents. Label each axis and give the graph a title.

Data Table:

Time (min)	Temperature of Compact Fluorescent Light Bulb (°C)	Temperature of Incandescent Light Bulb (°C)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Change in Temperature ΔT		

Graph:



Color Key:

CFL ☐

IL ☐

Name:_____Binder Number:_____

Station 2

INSULATION EXPERIMENT

NAME: _____ DATE: _____

PURPOSE: to test the thermal energy insulating properties of various materials

Insulation means _____

_____

MATERIALS:

2 Beakers or cups
2 Thermometers
Stopwatch or clock with second hand
Rubber bands
Cardboard or plastic wrap
6 Different insulating materials

HYPOTHESIS: Examine the various materials available. Rank the materials in the order you predict from "most effective" to "least effective".

My Prediction:

Most effective: _____

Second most: _____

Third most: _____

Fourth most: _____

Fifth most: _____

Least effective: _____

PROCEDURE:

1) Assign group roles for data collection.

Timer: _____

Recorder: _____

Thermometer 1 Reader _____

Thermometer 2 Reader _____

2) Wrap insulation around the sides of one beaker. Secure it with rubber bands. Set up the beakers. You may want to use cardboard to make covers for both beakers. If this is done, make the covers the same for both beakers. One thermometer will go into the water in the insulated beaker and one thermometer will go into the water in the non-insulated beaker. Fill or ask your teacher to fill each beaker with exactly the same amount of hot water.

3) Take the starting temperature of the water in each beaker. Record the temperature in the data table. Take the temperature each minute after that for 20 minutes total. For best results, keep the thermometer in the beaker.

4) Remove the thermometers and place them safely away.

5) Graph the results of your experiment. Use one color for the insulated beaker and one color for the non-insulated beaker. Make a key showing which beaker each color represents. Label each axis and give your graph a title.

6) Calculate the change in temperature for each beaker. Record this number on your data table and on the class data table.

DATA TABLE:

TIME (min.)	TEMPERATURE Insulated Beaker (^{0}C)	TEMPERATURE Non-insulated Beaker (^{0}C)
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Change in Temp. ΔT		

Name:_____Binder Number:_____

Station 3

TESTING THE ENERGY USED BY ELECTRIC APPLIANCES Experiment

NAME:_____DATE:_____

PURPOSE: to compare the electricity used by different electric appliances

MATERIALS:

Common appliances
Calculator
Wattmeter
Power strips / extension cords (optional)

VOCABULARY:

Watt -

Kilowatt -

Kilowatt-hour -

Wattmeter -

HYPOTHESIS: Which appliances do you think will use the most electricity? Why? Which appliances do you think will use the least electricity? Why?

Most - _____ Why? _____

_____

Least - _____ Why? _____

_____

PROCEDURE:

1) Review with your teacher how to use a **wattmeter**.

2) Use the appliances provided to select five appliances your family uses weekly to test. For each appliance, use the meter to measure the number of watts used when in operation. Record the type of appliance, and the wattage (w) in the data table.

3) Divide by 1000 to calculate the kilowatts (kw). Record this number in the data table.

4) Estimate the number of hours the appliance is used per week in your home. Record.

5) Multiply the kilowatts by the number of hours per week to determine the kilowatt-hours used per week. Note: Remember that kilowatt-hour (kwh) is the unit used to purchase electric energy. Record your answer in the data table.

6) Multiple the kilowatt-hours per week by 52 weeks in a year to determine the kilowatt-hours per year. Record.

7) The average cost per kilowatt-hour in a home in Ohio is $0.12. Multiply the kilowatt-hours (kwh) per year by the cost per kilowatt-hour to determine the cost per year. Record in the data table.

DATA TABLE: Testing Appliances

APPLIANCE	Watts	Kilowatts	Hours per Week	Kwh per Week	Kwh per Year	Cost per Kwh ($)	Cost per Year ($)
Ex: computer monitor	80	0.080	40	3.2	166.4	0.12	19.97
						0.12	
						0.12	
						0.12	
						0.12	
						0.12	
						0.12	
						0.12	
						0.12	

QUESTIONS:

1) Do your results support your hypothesis? Explain.

2) What appliances used the most energy? Do they have anything in common?

3) What appliances used the least energy? Do they have anything in common?

4) Were any of the appliances you tested Energy Star® rated? If so, how did they compare?

5) Some appliances state the wattage on the back. This number may not match the meter reading from your experiment. Why do you think this may happen?

Name:_____Binder Number:_____

Station 4

MAKING A DRAFT METER

NAME: _____ DATE: _____

PURPOSE: to make an instrument sensitive to movements of air so it can detect drafts in the home

MATERIALS:

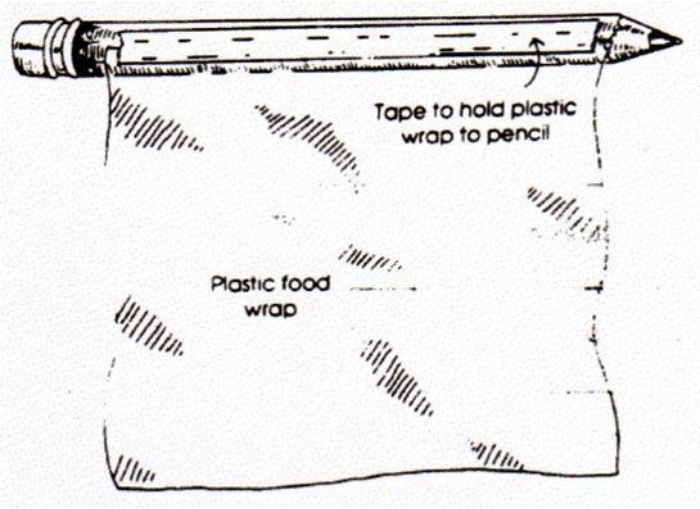
Plastic wrap or piece of plastic grocery bag
Tape
Pencil or pen

PROCEDURE:

1) Tear off a sheet of plastic wrap approximately 15 cm long.

2) Tape one end of the plastic wrap to the pencil. Let the plastic wrap hang freely from the pencil.

3) Blow gently on the plastic wrap to make sure it moves freely. Notice how easily the plastic moves. It is sensitive to air movement.



Questions:

1) What do drafts indicate about a building or room?

2) Why do drafts in a home or other building waste energy in the winter? In the summer?

3) List at least 5 places in your home that you could check for drafts:

HOME INSULATION AND AIR LEAKS
Activity

NAME: _____ DATE: _____

In this home energy activity, you will be investigating your home's insulation and sources of air leaks.

You will use your Draft Meter to check areas of your home for air leaks.

*Next, **WITH AN ADULT,** you will install the foam weather-stripping and self-stick door sweep (if available) where air leaks are found.*

PROCEDURE:

1) Begin by sharing the ***ENERGY SAVERS*** **Booklet** with your parents. Together, read aloud **pages 7-11 and pages 21-22**.

Online version (both English and Spanish) may be found at
http://energy.gov/sites/prod/files/2014/05/f16/Energy_Saver_Guide_PhaseI_Final.pdf

2) Open your outside doors and check the condition of the weather stripping between the doors and the door frames. Also check the condition of the door sweeps (if any) at the bottom of the doors. Rate your weather-stripping and door sweeps:

NONE _____ POOR _____ FAIR _____ GOOD _____

3) Examine the windows in your home and record your observations:

Number of windows: _____

Age of windows: _____

Type of windows: *(Check all that apply.)*

Single pane with no storm windows _____

Single pane with plastic sheeting _____

Single pane with storm windows _____

Double pane _____

Double pane with gas fill _____

Do your windows have… *(Check all that apply.)*

Special coating or window film? _____

Heavy blinds, curtains, or shades? _____

Caulking and weather-stripping? _____

Awnings over south or west facings? _____

4) Using the diagram on **page 7** in the ***ENERGY SAVERS Booklet***, select areas of your home to check for drafts. List the areas on your data table. Rate the draft as 1 (weak), 2 (medium), or 3 (strong). If there is no draft, check that on the data table. If you install the weather-stripping and/or self-stick door sweep, check the draft again after installation.

DATA TABLE – Draft Meter Home Experiment

Area of Home	0 No Draft	1 Weak Draft	2 Medium Draft	3 Strong Draft	Draft Rating after Installation

5) **WITH AN ADULT**, select a place to install the weather-stripping, if possible.

Did you install the weather stripping? _____

Where? _____

6) **WITH AN ADULT**, select a door to install the door sweep, if available.

Did you install the self-stick door sweep? _____

Where? _____

Name:_____Binder Number:_____

Seat Work

Part II. Version 1

"LET'S COMPARE! 12,000 Hours of Light"

Purpose: to compare the costs or purchasing and operating IL and CFL bulbs

Materials: IL and CFL packaging, calculator

Hypothesis: Which light bulb do you think will cost the most to purchase? _____

Which light bulb do you think will cost the most to operate? _____

Which light bulb do you think will be most efficient? _____

Vocabulary:

Lumens-

Watts-

Kilowatt-

Kilowatt-hour-

Life Expectancy-

Background: The average cost of 1 kilowatt-hour is $0.12.

Procedure:

1) Use the "Let's Compare" worksheet. Look at the packaging of the light bulbs. Use the packaging or the sample packaging or the sample packaging to record the Light Output in lumens, the Power Used in watts, the Life Expectancy in hours, and the Cost per Bulb

2) Do the calculations comparing the cost of light bulbs and record the data in your table.

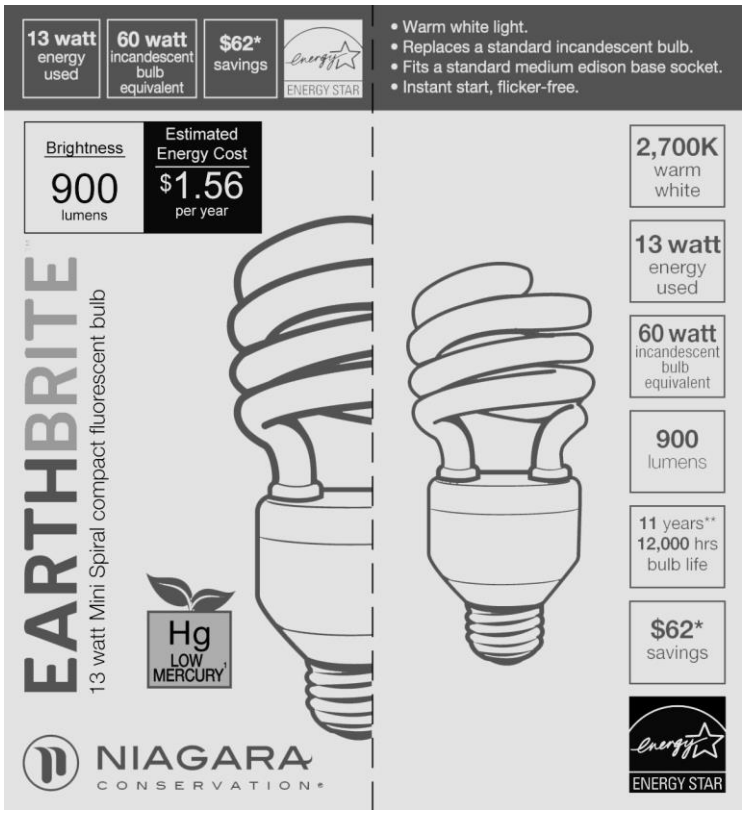
3) For the "**LET'S COMPARE! 12,000 Hours of Light"** data sheet**,** use the facts on the packaging and the current average cost per kilowatt-hour to calculate the numbers to complete the data.

4) Transfer your numbers to the **"CFL vs IL: The Big Picture"** sheet. Calculate the life cycle savings. Save this sheet to take home and share with your parents.

SAMPLE PACKAGING

CFL

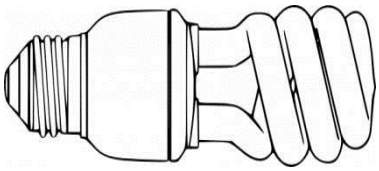
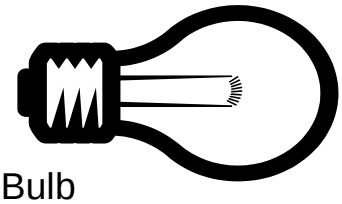
Sample cost of CFL = $2.00 per bulb



IL

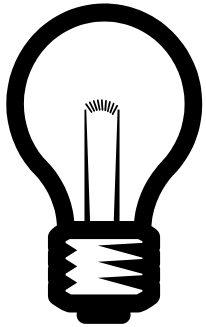
Sample cost of IL = $0.38 per bulb

LET'S COMPARE !
12,000 Hours of Light

CFL  Compact Fluorescent Light Bulb	**IL**  Incandescent Light Bulb
Amount of light = _____ lumens	**Amount of light = _____ lumens**
Power in watts = _____ watts	**Power in watts = _____ watts**
Lifespan = _____ hours	**Lifespan = _____ hours**
Bulbs needed for 12,000 hours? _____	**Bulbs needed for 12,000 hours? _____**
Cost per bulb = $_____	**Cost per bulb = $_____**
Total bulb cost for 12,000 hrs? $_____	**Total bulb cost for 12,000 hrs? $_____**
_____ watts X 12,000 hours = _____ watt-hours	**_____ watts X 12,000 hours = _____ watt-hours**
Kilowatt-hours (kWh)? _____	**Kilowatt-hours (kWh)? _____**
Cost per kWh = $ _____	**Cost per kWh = $ _____**
_____ kwh x $_____/kwh = $_____	**_____ kwh x $_____/kwh = $_____**
Cost of electricity for 12,000 hours $_____	**Cost of electricity for 12,000 hours $_____**
Total cost for 12,000 hours = $_____ + $_____ = $_____	**Total cost for 12,000 hours = $_____ + $_____ = $_____**

SAVINGS=$_____ - $_____ =$_____

CFL vs IL: THE BIG PICTURE!

INCANDESCENT 	○	+ ○	= □	
	COST OF INCANDESCENT BULBS	COST OF ELECTRICITY		INCANDESCENT LIFE CYCLE COST
FLUORESCENT 	○	+ ○	= □	
	COST OF FLUORESCENT BULBS	COST OF ELECTRICITY		CFL LIFE CYCLE COST
SAVINGS 	□	− □	= ⬡	
	INCANDESCENT LIFE CYCLE COST	CFL LIFE CYCLE COST		LIFE CYCLE SAVINGS

HOME ENERGY AUDIT: TAKE 2!

NAME: _____ DATE: _____

This home energy activity is to perform a second audit or inspection of the energy your family uses at home now that, together, you have completed this energy efficiency program. Complete the audit below with your family to see if you've made any changes. Bring the audit back to school to share the results.

1) How many incandescent light bulbs are in your home? _____

2) How many compact fluorescent light bulbs are in your home? _____

3) What is the normal thermostat setting for your furnace/AC?

Cooling Season: Day _____ Night _____

Heating Season: Day _____ Night _____

4) How many times does your family run the dishwasher each week? _____

5) What percentage of times is the Energy Saving feature used on the dishwasher? _____

6) How many loads of laundry are washed in your home each week? _____

7) What percentage of loads of laundry are washed in cold water? _____

8) How many baths are taken by all your family members in total each week? _____

9) How many showers are taken by all your family members in total each week? _____

10) What is the average length of each shower in your household (in minutes)? _____

11) How many times today was a light left on in an unused room? _____

12) How many times today was a TV/computer/video game/radio/stereo/CD or other device left on with no one using it? _____

13) How many times today was reading, a board game, or an outside activity chosen instead of a TV/video game/computer activity? _____

14) How many times today was water allowed to run needlessly? _____
(For example, while brushing teeth or doing dishes)

15) How many times today was the refrigerator door left open needlessly? _____

16) How many times today was door or window left open needlessly while the heat/AC was on? _____

17) How many times today was a microwave oven used instead of a stove/oven/toaster oven? _____

18) Does your family have or use any LED holiday lights or LED light bulbs? _____

19) Do you turn off your TV or computer monitor if you know you will return at a later time? _____

20) Do you leave your cell phone or iPod charger plugged in when not in use? _____

Learn more about how to conduct a comprehensive home audit on your utility's website.