



Electrical Energy Audit

Suggested Time: 1.2 Hours

What's important in this lesson:

- use personally collected data to understand how you use electricity and how much it costs
- communicate your findings in graphs and tables

Complete these steps:

1. Complete the Diagnostic/Introductory Activity. Get this checked as being completed on your Course Checklist.
2. Get a textbook, either *Science 9* or *Science 9 Concepts and Connections* and get started on the student handout. If you are having difficulty with a section, note this in the section below: Questions for teacher and move on to the next activity in your student handout.
3. Once the student handout is complete check your answers or your teacher will with the Answer Key. Get this checked as being completed on your Course Checklist.
4. You'll need at least 10 -15 minutes to complete the quiz on the material you've reviewed today. If you've got at least that much time, ask your teacher for the quiz and hand the quiz in when you are done. If you don't have enough time move on to the Reflective Activity and try the quiz next day.
5. Complete the Reflective Activity. Get this checked as being completed on your Course Checklist.

Hand-in the following to your teacher:

1. The bar graph of your appliance monthly costs
2. The lesson quiz

Questions for the teacher:

Diagnostic/Introductory Activity: Unit 3 Lesson 3



Identify at least 8 electrical appliances in the puzzle below. When you are finished, select the appliance that you think is the most expensive to operate and indicate why.

L F K L Z A V X K N G D K Z M
R Y R Y E Y B P O U A V P C Y
X A P I G U E I E K M D R W F
X M O C M Q S J H C E F B Z J
C L R O T I N O M R C Q A T E
Y L K M V P C Z X L U L Q V O
Q N O E O R Z R U D B C O R C
E Y L C O B U Y O L E T H O C
M E W F K E Y E G W S S M Q S
T H A I R D R Y E R A P Z V X
L A M P S L H E U T U V C O F
N G U U B B F I T T M V E I Y
D Y X M K Z N T E S I C W D U
K R S S I Y E R W P J S L A U
D H W A F E F K E J V C O R W

CLOCK
COMPUTER
DVD
GAMECUBE
HAIRDRYER
LAMPS
MICROWAVE
MONITOR
RADIO
STEREO
STOVE
TELEVISION



Electrical Energy Audit

Electrical Energy Metering

Many of your homes will have an electrical meter outside. This measures the amount of energy your house has been using. Your household electrical bill is based on the change in reading from month to month. The meter measures the energy consumed in kilowatt hours (kWh). One kilowatt hour of energy is approximately equal to the energy consumed by a toaster operating for one hour. You can read the meter by using the pointer in each dial. If the pointer is between two numbers always use the lower number. For instance in the meter shown in Figure 2 below you would read 85001 kWh.

1. Give the meter readings for the diagram below.

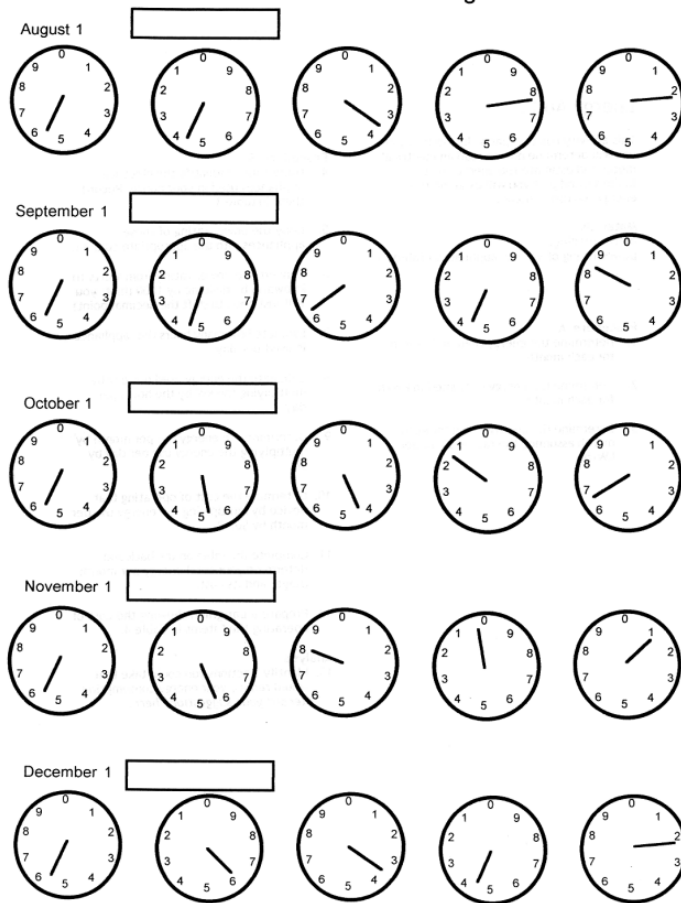


Figure 1 Meter Reading

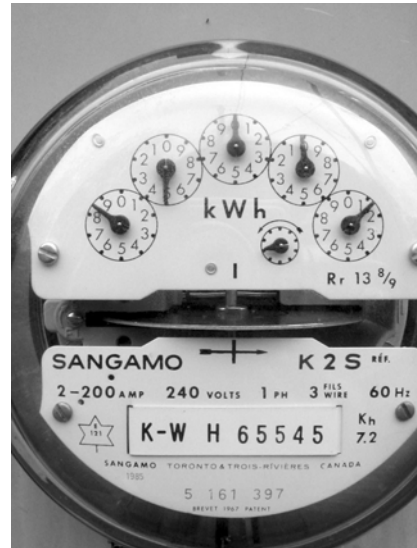


Figure 2 Household Electrical Meter

Different appliances in your house use electricity at different rates. For instance a TV that has a rating of 120 W uses electrical energy at 10 times the rate the portable stereo (12 W) in Figure 3 uses electrical energy. As a result a TV is ten times as expensive to operate as a stereo. The more electrical energy you use the greater your monthly electrical utility bill.

Student Handout: Unit 3 Lesson 3



Figure 3 Portable Stereo

Listed below are some typical household appliances, their potential difference (voltage), current, power and hourly cost of operation.

Table 1 Operational Costs of Some Appliances

Appliance	Power (watts)	Voltage (volts)	Current (amperes)	Hourly Cost (\$/hour)
Game cube	40	12	3.3	0.005
TV	200	120	1.7	0.024
Light bulb (incandescent)	60	120	0.5	0.007
Light bulb (energy efficient)	14	120	0.1	0.002
DVD player	20	120	0.2	0.003
toaster	900	120	7.5	0.108
microwave	900	120	7.5	0.108
hair drier	1200	120	10.0	0.144
clothes drier	2400	240	10.0	0.288
refrigerator		120		0.010
water heater		240		0.020
stereo	12	120	0.1	0.002
computer	120	120	1.0	0.014
monitor	60	120	0.5	0.007
printer	60	120	0.5	0.007
phone	2	9	0.2	negligible
coffee maker	1200	120	10.0	0.144
air conditioner	1000	120	8.3	0.120
ceiling fan	40	120	0.3	0.005

Student Handout: Unit 3 Lesson 3



Monthly Energy Usage

In Figure 1 you determined the meter reading on the first of each month. By finding the difference in the meter reading for two months in a row you can calculate the amount of electricity used in that one month period. For instance on August 1 the reading was 54372 kWh and on September 1 it was 54658 kWh. By subtracting these two (54658 kWh - 54372 kWh) you find that 276 kWh of electrical energy was used in the month of August.

- Repeat this calculation to find the energy consumed each month in the table below

Table 2 Monthly Energy Usage

Month	Electrical Energy Used (kWh)
August	276
September	
October	
November	

- Examine Table 1 Operational Costs of Some Appliances. What do the high cost items tend to have in common?

Monthly Cost of Some Appliances

- Choose any 10 electrical appliances in Table 1 and list them as well as their hourly cost in the table below.
- Estimate the amount of time in one month the appliance is used. For example if a DVD player is used on Friday and Saturday nights for 2.5 hours, then in one month it would be used for 20 hours ($2 \times 2.5 \times 4$).
- Calculate the cost of using each appliance. For example our DVD player has an hourly cost of $0.003\$/h \times 20 h = 0.06\%$

Assessment and Evaluation: Unit 3 Lesson 3



Modified True/False

Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

- _____ 1. Summer months tend to have higher electrical usage than in the fall months.
- _____ 2. Devices that convert electrical energy into sound use electrical energy at the highest rate.

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- _____ 4. The amount of electricity your house uses is measured in
- | | |
|----------|-------------------|
| a. volts | c. amperes |
| b. watts | d. kilowatt hours |
- _____ 5. The appliance that has the highest hourly electrical usage is
- | | |
|----------|------------------|
| a. phone | c. toaster |
| b. TV | d. clothes drier |
6. Look at a few of the appliances that have high monthly operating costs in your bar graph. Can you suggest some alternatives that could reduce your monthly costs?

Assessment and Evaluation: Unit 3 Lesson 3



7. An incandescent bulb costs 0.007\$/h to operate and the energy efficient bulb costs 0.002\$/h to operate. Calculate the savings in one year if the bulbs are on for 6 h per day.



Figure 1 Incandescent and Fluorescent Bulbs

8. The Energuide label on appliances is used to tell consumers how much electrical energy the device uses in one year.

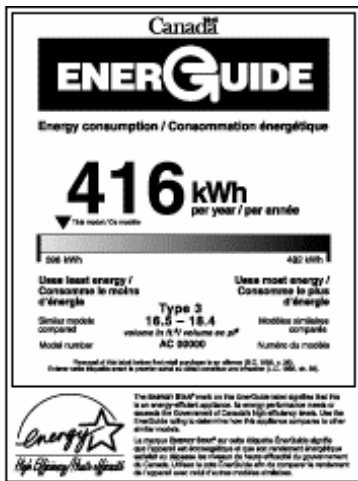


Figure 2 Energuide Label

(a) How much energy does this device use in one year? Include a unit in your answer.

(b) If you are comparing two appliances that cost nearly the same amount, would you want the appliance with the higher or lower Energuide number? Explain.

Reflection Activity: Unit 3 Lesson 3



Suggest three actions you could take to reduce your electrical energy needs.