

LESSON PLAN

Financial Literacy in Grade 9 Science

Science (SNC1P)

Connections to Financial Literacy

Students will conduct an energy audit of their homes. They calculate the cost of lighting their homes, considering the use of Compact Fluorescent Lights (CFLs) and incandescent light bulbs. Working in groups, students will develop tips to reduce their electricity costs in their homes.

Curriculum Expectations

A. Scientific Investigation Skills and Career Exploration

A1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communication)

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.13 express the results of any calculations involving data accurately and precisely

E. Physics: Electrical Applications

E1. assess the major social, economic and environmental costs and benefits of using electrical energy, distinguishing between renewable and non-renewable sources, and propose a plan of action to reduce energy costs

E1.2 propose a plan of action to decrease household energy costs by applying their knowledge of the energy consumption of different types of appliances [PR, AI, C]

Sample question: Which appliances in the home consume the greatest amount of energy? What are some options for reducing the amount of energy they consume? How cost-efficient is it to purchase a new energy-efficient appliance when a less efficient appliance is still in good working condition?

E2. investigate, through inquiry, the properties of static and current electricity and the cost of consumption of electrical energy

E2.7 calculate the costs of running common household electrical devices, and compare their efficiency (e.g., using EnerGuide information) [AI, C]

Learning Goals

By the end of this lesson, students will be able to:

- gather data on energy use in their homes by auditing the number of light bulbs.
- accurately calculate the cost of using incandescent and CFL light bulbs in their homes.
- explain how to save money and energy through energy efficiency and energy conservation.

Sample Success Criterion

for explaining how to save money and energy

- I can provide creative suggestions for how to save money and energy by using energy efficiently and conserving energy in my own home.

Instructional Components and Context

Readiness

Students will have completed a home energy audit prior to class.

Terminology

- Compact Florescent Light bulbs (CFLs)
- Incandescent Light bulbs
- Energy Efficiency
- Energy Conservation

Materials and Resources

- Handout: **Lighting Calculations** (copied for each student in the class)
- Calculators

Financial Literacy in Grade 9 Science

Science (SNC1P)

Minds On

Whole Class → Discussion

- Lead a brief discussion about the connections between the understanding of sustainable ecosystems and electricity consumption (include concepts of energy efficiency and energy conservation).
- Students share data collected from their home energy audits on an interactive white board. (An overhead projector, chart paper or chalk board can also be used to share the collected data.)

Demonstration*: Cost savings through choice of light bulb

Here is the formula to calculate the cost of lighting a home:

$$\# \text{ of light bulbs} \times \text{number of watts} \times \text{hours used} \div 1000 \times \text{price per kWh} \\ = \text{cost of electricity}$$

All students take 1 minute to count the number of light bulbs in their homes. Ask one student to share his/her estimate. Using that estimated number of light bulbs, show how savings of using CFLs rather than incandescent light bulbs can add up.

For example, 20 light bulbs in a home @ 75 watts per light bulb per 4 hours per day @ \$0.16 per kilowatt hour. For one month that would cost **\$28.80** if all of those bulbs were incandescent bulbs. Note that CFLs use 25% of the electricity that incandescent bulbs use. If all of those bulbs were compact florescent bulbs instead, the cost would be about **\$7.20**.

Connections

Guiding Questions

- Why is it important to be aware of our energy consumption and to reduce our consumption as much as possible? What are the financial benefits? What are the environmental benefits?

AOL Assessment for Learning

- Observation of students' abilities to use scientific investigation skills and accurately record data and make calculations.
- [This demonstration can be done on an interactive white board using a calculator. An online energy calculator can also be used with an interactive white board. An overhead projector, chart paper or chalk board can also be used.]

Tip

This activity could be connected to a discussion about the properties of electricity where students discuss conservation of electricity and the properties that lead to the loss of electricity. Students could consider how incandescent bulbs work from a properties of electricity point of view.

Action!

Individual/Pairs → Calculating Lighting Costs

- Students take their individual data from their personal home audits and calculate the total cost of lighting their homes for one year. They can use the **Lighting Calculations** sheet to guide their calculations.
- Students then work in pairs to check each others' calculations.



Differentiated Instruction

- Use online energy calculators as an alternative to doing calculations by hand. Make calculators available for students who need them. Strategically pair students in order to allow them to support each other with the calculations.

Note: A variety of web-based tools are available. One sample online calculator can be found at: <http://www.enmax.com/Energy/Res/Greenmax/Conservation/Light+Bulb+Calculator.htm> Encourage students to investigate additional tools available online such as energy audit tools and new appliance energy calculators from their local utility companies and provincial and federal sources.

Connections

Guiding Questions

- Did any of your data surprise you? Explain.
- How did the audit help you discover areas where energy and cost savings may be possible?

AOL Assessment for Learning

Observation of students' abilities to accurately record data and make calculations.

AOL Assessment as Learning

Students peer assess each others' work when doing calculations.

Consolidation

Small Groups → Reducing Energy Consumption

- In groups of 2-3, students review their energy audit calculations and suggest at least 3 steps that can be taken to reduce energy consumption in the home.
- Students present their energy-saving tips to the class.

Extension Activity

If you were building a new home, what energy efficiency or design features would you consider to reduce the energy consumption in the house as much as possible? Create a rough sketch with your efficiencies/features.

Connections

Guiding Questions

- Should all energy-saving advice be followed? Give reasons.
- When might it be more wasteful to use an energy efficient appliance than a less efficient one (e.g., when you already have a functioning less-efficient appliance)?
- How could the elimination of "standby" electricity used by appliances in their sleep mode and its associated savings for the environment have an impact?

AOL Assessment of Learning Assess students' suggestions for reducing energy consumption in the home. Ensure that energy efficiency and energy conservation tips are addressed.

Lighting Calculations

Learning Goal

Students will conduct a home energy audit to identify ways to save energy and money in their home, either through Energy Efficiency or Energy Conservation.

Energy Conservation	Energy Efficiency
involves reducing or eliminating unnecessary energy use or loss (e.g., turning down your thermostat, turning off lights when not needed)	refers to products or systems that use less energy to do the same or better job than others. (e.g., compact fluorescent light bulbs vs. incandescent bulbs)

Energy Conservation or Energy Efficiency

Category	Yes	No	N/A	Energy Conservation or Energy Efficiency
Do most windows face south?				
Programmable Thermostat?				
Ceiling/Attic Insulated?				
Faucet off while brushing?				
5-minute or less showers?				
Laundry – cold water?				
Most CFL's vs. Incandescent				

Energy Calculator

Task #1 – Wish List

Think of one item that you would like to purchase. _____

Task #2 – Cost

Estimate the total cost of that item. _____

Task #3 – Change all lighting to CFLs

Calculate how much money you would save (or are saving) by using only CFLs throughout your home. Use an online energy calculator to calculate whether you would save (or are saving) enough to purchase the item that's on your wish list.

Point to Ponder

1. What are three things your household can do to conserve more energy?

Lighting Calculations

2. Count the number of lights in your home. How many of your lights use fluorescent bulbs and how many use incandescent bulbs. Incandescent bulbs glow brightly and get very hot. Fluorescent bulbs have a softer light, get less hot, and sometimes take a few minutes to warm up to full brightness. On average, fluorescent bulbs use about 25% of the electricity that incandescent bulbs do to deliver the same amount of light.

- In my home, there are about _____ incandescent bulbs and _____ fluorescent bulbs.

3. Make a best-guess estimate of the total number of hours per day you are burning light bulbs. Do this by adding together the number of hours per day EACH bulb is on. You will call this number "bulb-hours."

For example:

5 bulbs operating for 1 hour per day = 5-bulb-hours

3 bulbs operating for 2 hour per day = 6-bulb-hours

3 bulbs operating for 3 hour per day = 9-bulb-hours

6 bulbs operating for 5 hour per day = 30-bulb-hours

Total = 50 bulb-hours

If you have a lot of fluorescent bulbs in your home, you are saving energy and money. Fluorescent bulbs use about one-fourth as much electricity as incandescent bulbs. So, if about half of your bulbs are fluorescent, divide your bulb hours by two. If almost all of your bulbs are fluorescent, divide your bulb hours by four.

- Each day, all of the bulbs in my house added together are burning approximately _____ bulb-hours.

4. Calculate the cost of burning all the light bulbs over the course of one year.

a.) On average, a light bulb in my house is _____ watts.

b.) All together, they burn for about _____ bulb-hours per day.

_____ watts X _____ bulb-hours = _____ watt-hours per day

c.) _____ watt-hours ÷ 1,000 = _____ kilowatt-hours per day

d.) _____ kilowatt-hours per day X 365 = _____ kilowatt-hours per year

e.) _____ kilowatt-hours per year X \$.16 = \$_____ cost of electricity for lighting per year.

- Each year, my family spends approximately \$_____ on electricity for lighting.

5. Are there ways you could use fewer lights or use them for less time during the day? If so, how many hours per day of lighting could you save?

- My household could save _____ hours per day in lighting.

If you and your household saved that many hours of lighting, how much money would you save each year?

- My family would save \$_____ per year.

If the households of everyone in your class saved as much as they could on lighting each year, how much money would the whole class save?

- My entire class would save \$_____ each year.