

KETTLE EFFICIENCY ACTIVITY WORKSHEET



To understand the importance of energy efficiency we are going to complete a math problem.

In this activity we use the example of an electric kettle that is used every day to boil water. When full, the kettle uses 3 kWh to boil 1.75 liters of water in 6 minutes which is the same as 0.1 hour. First, we will calculate the energy consumption for a year of boiling a full kettle. You will need to know that the price of electricity in Nova Scotia per kilowatt hour is \$0.15 (15 cents)/kWh.

Then we will look at an energy efficient option. We don't need to boil a full kettle if we only need 2-3 cups of hot water. So, we assume that if we don't boil a full kettle, the energy used will decrease. If we fill the kettle to 70% full, we only require 70% of the electricity.

1. Calculate the annual cost to use a full kettle.

$$3 \text{ kWh} \times 0.1\text{h/day (6 minutes)} \times 365 \text{ days/year} = \underline{\hspace{2cm}} \text{ kWh/year}$$

$$\underline{\hspace{2cm}} \text{ kWh} \times \$0.15/\text{kWh} = \$ \underline{\hspace{2cm}} / \text{annual cost to boil a full kettle}$$

2. Calculate the annual cost to use a kettle that is only 70% full. An energy efficient option would be to only boil the water that is needed. We don't need to boil a full kettle for just 2-3 cups of hot water. So, we can assume that if we don't use a full kettle, it will decrease the energy used. If we fill the kettle to 70% full, we only require 70% of the electricity.

$$\underline{\hspace{2cm}} \text{ kWh/year used to boil full kettle} \times 0.7 \text{ (70\% full kettle)} = \underline{\hspace{2cm}} \text{ kWh/year}$$

$$\underline{\hspace{2cm}} \text{ kWh/year} \times \$0.15/\text{kWh} = \$ \underline{\hspace{2cm}} / \text{year (cost of efficient use)}$$

3. Calculate the energy savings!

$$\$ \underline{\hspace{2cm}} \text{ (annual cost to boil full kettle)} - \$ \underline{\hspace{2cm}} \text{ (efficient use cost)} = \$ \underline{\hspace{2cm}} / \text{year saved}$$

If you are more energy efficient when using your kettle by boiling 30% less water over the course of a year, you will save about \$ that year just on that one appliance!

4. What are other ways we can adjust our behaviour to reduce energy waste?

CURRICULUM LINKS

Mathematics 4

Numbers

N06 Students will be expected to demonstrate an understanding of multiplication (one-, two-, or three-digit by one-digit numerals) to solve problems by

- using personal strategies for multiplication, with and without concrete materials;
- using arrays to represent multiplication;
- connecting concrete representations to symbolic representations;
- estimating products;
- applying the distributive property [C, CN, ME, PS, R, V].

N07 Students will be expected to demonstrate an understanding of division (one-digit divisor and up to two-digit dividend) to solve problems by

- using personal strategies for dividing, with and without concrete materials;
- estimating quotients;
- relating division to multiplication [C, CN, ME, PS, R, V].

Mathematics 5

Numbers

N05 Students will be expected to demonstrate, with and without concrete materials, an understanding of multiplication (two-digit by two-digit) to solve problems. [C, CN, PS, V]

N06 Students will be expected to demonstrate, with and without concrete materials, an understanding of division (three-digit by one-digit), and interpret remainders to solve problems. [C, CN, PS]

Mathematics 6

Numbers

N02 Students will be expected to solve problems involving whole numbers and decimal numbers. [ME, PS, T]

N08 Students will be expected to demonstrate an understanding of multiplication and division of decimals (one-digit whole number multipliers and one-digit natural number divisors). [C, CN, ME, PS, R, V]

Mathematics 7

B4 determine and use the most appropriate computational method in problem situations involving whole numbers and/or decimals [C, CN, ME, PS, R, V]

B14 solve and pose problems that utilize addition, subtraction, multiplication, and division of integers

D1 identify, use, and convert among the SI units to measure, estimate, and solve problems that relate to length, area, volume, mass, and capacity

D3 develop and use rate as a tool for solving indirect measurement problems in a variety of contexts

Mathematics 8

B12 add, subtract, multiply, and divide positive and negative decimal numbers with and without the calculator

B13 solve and create problems involving addition, subtraction, multiplication, and division of positive and negative decimal numbers

B14 select and use appropriate strategies in problem situations

D2 solve measurement problems, using appropriate SI units

Mathematics 9

B1 model, solve, and create problems involving real numbers

B2 add, subtract, multiply, and divide rational numbers in fractional and decimal forms using the most appropriate methods

B14 select and use appropriate strategies in problem situations

D2 solve measurement problems involving conversion among SI units

Mathematics 10

M01 Students will be expected to solve problems that involve linear measurement, using SI and imperial units of measure, estimation strategies, and measurement strategies. [ME, PS, V]

M02 Students will be expected to apply proportional reasoning to problems that involve conversions between SI and imperial units of measure. [C, ME, PS]

Mathematics at Work 10

N01 Students will be expected to solve problems that involve unit pricing and currency exchange, using proportional reasoning [CN, ME, PS, R]

M01 Students will be expected to demonstrate an understanding of the International System of Units (SI) by:

- describing the relationships of the units for length, area, volume, capacity, mass, and temperature;
- applying strategies to convert SI units to imperial units [C, CN, ME, V].

Mathematics Essentials 10

A1 understand purchasing power

F4 make decisions regarding the purchase of costly items by identifying and ranking criteria for the comparison of possible choices

F5 make decisions regarding the payment options for purchases

F6 identify various incentives to make purchases

Mathematics at Work 11

M01 Students will be expected to solve problems that involve SI and imperial units in surface area measurements and verify the solutions

A01 Students will be expected to solve problems that require the manipulation and application of formulas related to:
- finance charges.

A03 Students will be expected to solve problems by applying proportional reasoning and unit analysis.

Mathematics Essentials 12

Module 1: Measurement

1.6 identify, use, and convert among and between SI units and imperial units to measure and solve measurement problems

Science 6

Physical Science: Electricity

- Learners will evaluate renewable and non-renewable sources of energy; Indicator: Compare renewable and non-renewable energy (CZ, COM, PCD, CT, TF); Investigate types of energy transformation (COM, CT, TF); Analyse impact of electrical energy consumption (CZ, COM, PCD, CT, TF)

Science 9

Electricity, Energy and the Environment

- relate electrical energy to domestic power consumption costs (308-18)

- make informed decisions and propose a course of action on science, technology, and social issues, including human and environmental needs for electricity and energy (113-9, 113-13)

Exploring Technology 10

Module 2: Green Technology

2.2 examine the consequences of technology in domestic use and consumption of energy

CROSS-CURRICULAR LINKS

Information and Communication Technology Integration 9

Social, Ethical, and Human Issues (SEHI)

SEHI 9.1 (relates to 6.1, 6.2, 6.3) demonstrate understanding of the nature of technology and its impacts on different societies and environments; using technology, in local and global contexts, with due regard for the legal and human rights of others

Productivity (PTS)

- The efficient selection and use of ITC to perform tasks such as:

- the exploration of ideas;
- data collection;
- data manipulation, including the discovery of patterns and relationships;
- problem solving;
- the representation of learning.

Research, Problem Solving, and Decision Making (RPSD)

RPSD 9.1 (relates to 6.2) select appropriate measuring and recording devices and/or software to collect data, discover patterns of change over time, solve problems and make logical decisions based on their investigations; with teacher assistance

Science 10

Sustainability of an Ecosystem

- predict and analyze the impact of external factors on the sustainability of an ecosystem, using a variety of formats (212-4, 214-3, 331-6)

Energy, Power, and Transportation Technology 11

Unit 6: Environmental Impact of Energy, Power, and Transportation

6.3 provide examples of methods used to save energy in the commercial and residential sectors of society, and identify the use of several energy-saving appliances

Mathematics at Work 12

A01 Students will be expected to demonstrate an understanding of linear relations by

- recognizing patterns and trends;
- graphing;
- creating tables of values;
- writing equations;
- interpolating and extrapolating;
- solving problems [CN, PS, R, T, V].