Anglophone School District - North

Grade 6 Science - Unit Lesson Guide

Electricity

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The Aim of Science Education - Scientific Literacy

The aim of science education in the Atlantic Provinces is to develop scientific literacy.

Scientific Literacy is an evolving combination of the science-related attitudes, skills, and knowledge students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them. To develop scientific literacy, students require diverse learning experiences that provide opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment.

The Three Processes of Scientific Literacy

An individual can be considered Scientifically Literate when he/she is familiar with, and able to engage in, three processes: Inquiry, problem solving, and decision making.

Inquiry

Scientific inquiry involves posing questions and developing explanation for phenomena. While there is a general agreement that there is no such sing as the scientific method, students require certain skills to participate in the activities of science. Skills such as questioning, observing, inferring, predicting, measuring, hypothesizing, classifying, designing experiments, collecting data, analysing data, and interpreting data are fundamental to engaging science. These activities provide students with opportunities to understand and practise the process of theory development in science and the nature of science.

Problem Solving

The process of problem solving involves seeking solutions to human problems. It consists of proposing, creating, and testing prototypes, products, and techniques to determine the best solution to a given problem.

Decision Making

The process of decision making involves determining what we, as citizens, should do in a particular context or in response to a given situation. Decision-making situations are important to their own right, and they also provide a relevant context for engaging in scientific inquiry and/or problem solving.

Science Assessment Overview

Science is a hybrid term that houses different disciplines such as: Physics, Chemistry, Biology, Environmental Studies, Engineering, Math, etc. Given this broad spectrum, it is not realistic that we can paint science assessment with a single brush in terms of probes that work for every science activity. However, regardless of school subject, let alone science, the frequency of assessment should be unbalanced with formative assessment occupying 80% of practise and summative with the remaining 20%.

80% Formative - 20% Summative

Formative Assessment
Formative assessment is a range of formal and informal assessment procedures employed by teachers during their learning process in order to modify teaching and learning activities to improve student attainment. It typically involves qualitative feedback (rather than scores) for both students and teacher that focuses on the detail of content and performance. Feedback is the central function of formative assessment. It typically involves a focus on the detailed content of what is being learnt.

Science Formative Assessment falls into 2 distinct categories, and they are divided about how feedback is given. Please be aware that an activity could be informal or formal, it is the purpose of the task that determines purpose.

Informal Formative
Informal Formative Science Assessment acts as a monitoring probe and is distinct because it is not graded.

Formal Formative
Formal Formative Science Assessment provides specific feedback to students, the teachers corresponds via anecdotal feedback, rubrics, and written responses to offer progress to student attainment.

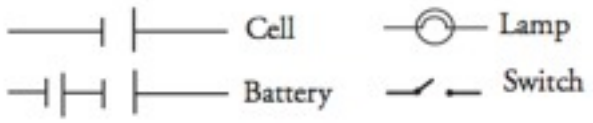
Summative Assessment
Summative assessment seeks to monitor educational outcomes, often for the purposes of external accountability. Usually occurring at the end of a learning unit and determines if the content being taught was retained.

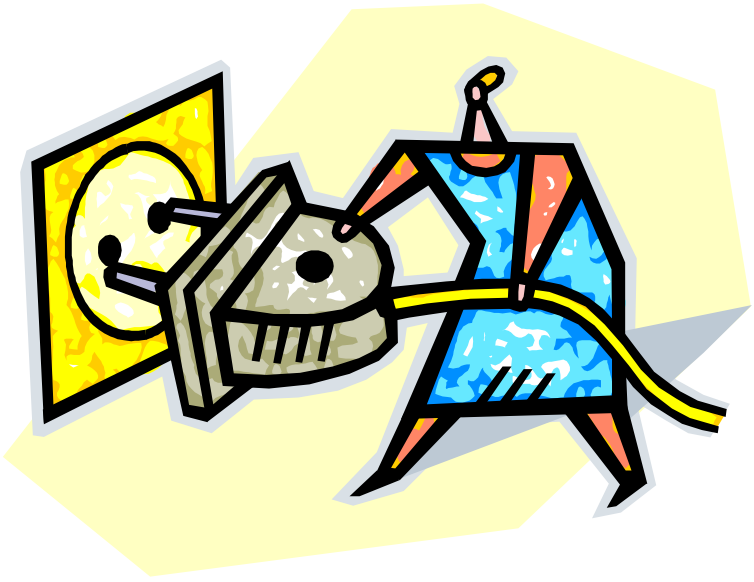
Electricity

Focus and Context

There is a dual focus in this unit, inquiry and problem solving. Students should be encouraged to investigate which materials conduct electricity, and compare a variety of circuit pathways. From this, they should be able to design solutions to electrical problems by completing various circuit pathways.

The context for this topic should be on electrical systems, Our society's reliance on electricity is pervasive; on need only think about the implications of an extended blackout to realize the extent to which our society depends on electricity. Electrical appliances, houses, small town, and large cities use and depend on electricity to function.





Unit Instructional Overview

Electrical Safety	Safety Checklist		Understanding Electrical Safety		Electrical Safety Simulator	
Investigating Static Electricity	Investigating Static Electricity					
Circuit Pathways	Access Prior Knowledge	Cycle 1 - Light up the Bulbs Activity	Cycle 2 - What is a Switch Activity	Cycle 3 - Series and Parallel Circuits Activity	Cycle 4 - Switches Activity (in parallel circuits)	Testing Conductivity - Spark
Electro-magnets and Their Applications	Investigating Electromagnets			Electromagnets in Everyday Life		
Uses for Electricity	Build Your Own Circuit			Our Life with Electricity...or Without it!		
Sources of Electricity	Understanding Electrical Generators			How is Energy Converted?		
Electrical Energy Composition and Conservation	Quantifying Personal Electrical Use					

* - EECD Grade 6 Inquiry package - available at
https://portal.nbed.nb.ca/tr/lr/k-8Science/Pages/default.aspx

Electricity - Curriculum Outcomes

Electrical Safety	205-9 use tools and apparatus such as batteries, bulbs, and wires in a manner that ensures personal safety and the safety of others	303-31 identify and explain the dangers of electricity at work or at play	106-4 describe examples of how knowledge of the hazards of electrical shock has led to the development of electrical safety features
Investigating Static Electricity	205-7 record observations while exploring and solving static electricity challenges	104-5, 206-3 suggest possible explanations for variations in the results of investigations involving static electricity	204-4 use the terms attraction, repulsion, electron, positive charge and negative charge in meaningful contexts while exploring static electricity
Circuit Pathways	303-23, 207-2 Compare a variety of electrical pathways by constructing simple circuits, and illustrate the electrical circuits with drawings and appropriate symbols	205-3, 300-20 follow instructions for testing the conductivity of different solids and liquids, and draw conclusions as to which materials tested were insulators or conductors	303-24, 204-8 describe the role of switches in electrical circuits, and identify materials that can be used to make a switch
	303-25 compare characteristics of series and parallel circuits	303-22 compare the characteristics of static and current electricity	
Electro-magnets and Their Applications	303-27 describe the relationship between electricity and magnetism when using an electromagnet	204-1, 204-3, 205-1 propose questions about the factors that affect the strength of electromagnets, state predictions and hypothesis related to these factors, and carry out a fair test of these factors	106-3 describe how knowledge of electromagnets has led to the development of many electrical devices that use them
Uses for Electricity	303-26 demonstrate how electricity in circuits can produce light, heat, sound, motion, and magnetic effects	204-1, 204-7 propose electrical circuitry problems to investigate, and plan a set of steps to solve them	107-9, 106-4 describe how knowledge of electricity has led to many new inventions that have changed the way we live, and describe ways in which we have become increasingly dependent on electricity over the years
Sources of Electricity	106-4 describe how knowledge that magnets can produce electric current led to the invention of electrical generators	303-28, 105-3, 108-8 identify and investigate various methods of generating electricity (past, present and future), and describe some ways in which these methods affect the environment	
Electrical Energy Composition and Conservation	303-29 identify and explain sources of electricity as renewable or nonrenewable		

Keeping an Electrical Use Journal

Outcomes:
108-5, 303-30 identify and explain different factors that could lead to a decrease in electrical energy consumption in the home and at school, and how this will help protect the environment

Lesson Activity Overview
Students should see the effects of their effort to conserve energy by collecting data about the consumption before and after they try to reduce electrical usage

Students should keep an “Electrical use” journal, noting various electrical devices/ systems they encounter over the course of this unit.

The context and content of the journal entries should be agreed upon by the class.

Classes can have several option to report. First, students can produce daily anecdotal reports of what they have used and the time frame in which they consumed electricity. Also, students could choose to set up a checklist that will be reported daily that offers more quantitative data.

This data, whether quantitative or qualitative, will be used at the in the least lesson to formulate answer as to how to reduce and conserve electrical energy.

Assessment:Informal Formative
Ensure that students, on a agreed upon timeframe, report their findings to the teacher. 303-30

Electricity

Strand - Electrical Safety

General Curriculum Outcomes	Specific Curriculum Outcomes
205-9 use tools and apparatus in a manner that ensures personal safety and the safety of others	205-9 use tools and apparatus such as batteries, bulbs, and wires in a manner then ensures personal safety and the safety of others
303-31 identify and explain the dangers of electricity at work or at play	303-31 identify and explain the dangers of electricity at work or at play
106-4 describe instances where scientific ideas and discoveries have led to new inventions and applications	106-4 describe examples of how our knowledge of the hazards of electrical shock has led to the development of electrical safety features

Safety Checklist

Outcomes:
205-9 use tools and apparatus such as batteries, bulbs, and wires in a manner that ensures personal safety and the safety of others

Lesson Activity Overview
Suggested checklist and anecdotal record: As students work through the activities in this unit, the teacher can observe to ensure safety is paramount. Any concerns about safety should be addressed. (205-9)

Investigating Static Electricity

_____ 205-7 record observations while exploring and solving static electricity challenges

Circuit Pathways

_____ 303-23, 207-2 compare a variety of electrical pathways by constructing simple circuits, and illustrate the electrical circuits with drawings and appropriate symbols

_____ 205-3, 300-20 follow instructions for testing the conductivity of different solids and liquids, and draw conclusions as to which materials tested were insulators or conductors

_____ 303-24, 204-8 describe the role of switches in electrical circuits, and identify materials that can be used to make a switch

_____ 303-25 compare characteristics of series and parallel circuits

_____ 303-22 compare the characteristics of static and current electricity

Electromagnets and their Applications

_____ 303-27 describe the relationship between electricity and magnetism when using an electromagnet

_____ 204-1, 204-3, 205-1 propose questions about the factors that affect the strength of electromagnets, state predictions and hypotheses related to these factors, and carry out a fair test of these factors

Uses for Electricity

_____ 303-26 demonstrate how electricity in circuits can produce light, heat, sound, motion, and magnetic effects

_____ 204-1, 204-7 propose electrical circuitry problems to investigate, and plan a set of steps to solve them

Sources of Electricity

_____ 303-29 identify and explain source of electricity as renewable or nonrenewable

Understanding Electrical Safety

Outcomes:
303-31 identify and explain the dangers of electricity at work or at play
106-4 describe examples of how our knowledge of the hazards of electrical shock has led to the development of electrical safety features

Lesson Activity Overview
Before students begin with the unit, there should be focus put on being safe. In addition to the checklist used to assess 205-9 above, students should have an overview of what is expected of them. In addition, qualified people (electrician, power utility representative, etc.) should be used to make students aware of electrical dangers like:
• taking electrical devices like radios into the bathroom or near the bath fallen power lines
• climbing transmission towers and climbing trees or flying kites near power lines
• frayed or exposed wires
• pulling out plugs by the cord
• taking apart electrical appliances (some contain capacitors which store electrical charge even if unplugged)

Focus should also be placed on understanding safety features that have been developed, such as three prong plug, circuit breakers, grounding wires and fuses.

Activity
Students could be sorted into three large groups and have each group complete one of the following:
1. Create a poster (web page), including illustrations, labels, and captions to: (106-4, 303-31)
    a. identify electrical dangers at work and play
    b. identify electrical safety devices/procedures which protect us from these dangers.

2. Make a public service advertisement which provides safety information about electricity. (106-4, 303-31)

Assessment:Informal Formative
Ensure that students have been engaged in conversations about electrical safety at work or at play. 303-31

Assessment:Formal Formative
Ensure that students have completed one of the three activities. 106-4, 303-31)

Electrical Safety Simulator

Outcomes:
303-31 identify and explain the dangers of electricity at work or at play
106-4 describe examples of how our knowledge of the hazards of electrical shock has led to the development of electrical safety features

Lesson Activity Overview
NB Power has developed an web based electrical safety simulator to specifically educate children on the safety needed around power lines. This simulator is more than just a video about how to be safe, it allows the user to interact in different situations and based on their response to a situation a specific result occurs.

http://www.3dinternet.com/NBPower/ElectricalSafetySimulator/

School	Username	Password
Blackville	D1602	623498
EWG	D1606	588257
Dr. Losier	D1605	552557
Miramichi Rural	D1614	229685
Nelson Rural	D1617	235982
NSEE	D1618	845672
Millerton	D1613	967863
Harkins Middle	D1610	345753
Tabusintac	D1623	924236
Superior	D1514	897493
Jacquet River	D1508	943432
CMS	D1504	368283
DMS	D1506	545624

Assessment:Formal Formative
Ensure that students have completed the simulator. 106-4, 303-31

Electricity

Strand - Investigating Static Electricity

General Curriculum Outcomes	Specific Curriculum Outcomes
205-7 recored observations using a single word, notes in point form, sentences, and simple diagrams and charts	205-7 record observations while exploring and solving static electricity challenges
104-5 describe how results of similar and repeated investigations may vary and suggest possible explanations for variations	104-5, 206-3 suggest possible explanations for variations in the results of investigations involving static electricity
206-3 identify and suggest explanations for patterns and discrepancies in data	
204-4 define objects and event in their investigations	204-4 use the terms attraction, repulsion, electrons, positive charge and negative charge in meaningful contexts while exploring static electricity

Investigating Static Electricity

Outcomes:
205-7 record observations while exploring and solving static electricity challenges
104-5, 206-3 suggest possible explanations for variations in the results of investigations involving static electricity
204-4 use the terms attraction, repulsion, electrons, positive charge and negative charge in meaningful contexts while exploring static electricity

Lesson Activity Overview
Students have previous understanding of static electricity form invisible forces from grade 3. Students should begin by brainstorming their current understanding of static electricity. From discussions that arise, students should begin an investigation that reinforces static electricity.
Inside of these discussion, highlight uses and references to the terms: **attraction, repulsion, electrons, positive charge and negative charge**. By the end of the lesson , students should be showing evidence of the understanding of these terms. 204-4

Investigation
The easiest set up is for students to rub a balloon against a surface (your hair) and see how many pieces of confetti will be picked up. Use the worksheet below for this task 205-7. This design can be extended if the conversations lead to greater understanding.

A class form should be shared among all trials (SMART Board file) This way students get to see the variations in the results. 104-6, 206-3

Journal
Static electricity can be tricky. Explain why the results of every trial by different groups gave different results 104-6, 206-3

Assessment:Informal Formative
Ensure that students have recorded results from their static electricity investigation 205-7.

Ensure that students have been involved in conversations that and have used the terms attraction, repulsion, electrons, positive charge and negative charge in an appropriate context 204-4

Assessment:Formal Formative
Ensure that students have created a journal entry that outlines why repeat trials of the same activity will vary and ensure responses are appropriate 104-5, 206-3

Investigating Static Electricity

Set the Control: _____ rubs of the balloon against your hair or other surface(same for all groups)
Before each trial, you must restart by using the same number of rubs

Trial 1	Trial 2	Trial 3
Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon

Trial 4	Trial 5	Trial 6
Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon

Trial 7	Trial 8	Trial 9
Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon

Trial 10	Trial 11	Trial 12
Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon	Number of Confetti that were Picked up by the balloon

Electricity

Strand - Circuit Pathways

General Curriculum Outcomes	Specific Curriculum Outcomes
303-23 compare a variety of electrical pathways by constructing simple circuits	303-23, 207-2 Compare a variety of electrical pathways by constructing simple circuits, and illustrate the electrical circuits with drawings and appropriate symbols
207-2 communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language	
205-3 follow a given set of procedures	205-3, 300-20 follow instructions for testing the conductivity of different solids and liquids, and draw conclusions as to which materials tested were insulators or conductors
300-20 compare the conductivity of a variety of solids and liquids	
303-24 describe the role of switches in electrical circuits	303-24, 204-8 describe the role of switches in electrical circuits, and identify materials that can be used to make a switch
204-8 identify appropriate tools, instruments, and materials to complete their investigations	
303-25 compare characteristics of series and parallel circuits	303-25 compare characteristics of series and parallel circuits
303-22 compare the characteristics of static and current electricity	303-22 compare the characteristics of static and current electricity

New Nouveau Brunswick
Be...in this place • Être...ici on le peut

Science Resource Package: Grade 6

Electricity:

Circuit Pathways

New Brunswick Department of Education

September 2009

Instructional Plan

✪ Curriculum Outcomes

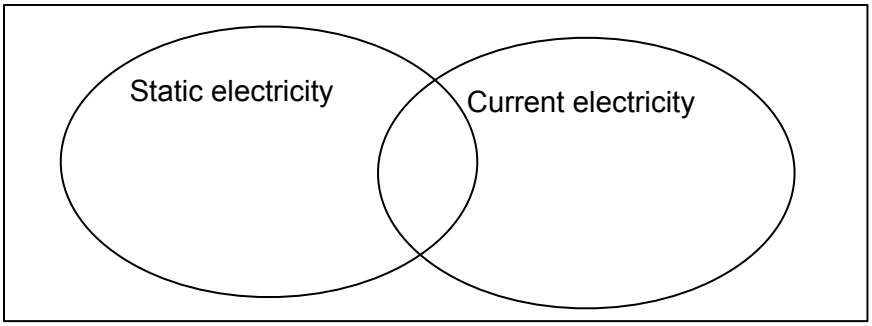
303-22: Compare the characteristics of static and current electricity.

Access Prior Knowledge

Activity

Students have been exploring static electricity. How is current electricity the same and different from static electricity?

- Do with an “I think, we think, we all think” method. First have students write down what they think. Second, students discuss with a partner or small group and make a list of ideas. Third, these are shared with the whole class.
- As students share in the whole class, put their points into a large Venn diagram discussing the placement. The discussion tips on pages 16-17 may be helpful. Create the Venn diagram in a form that may be revisited. For example: on chart paper or on a bulletin board.



Note: Students may have difficulty with current electricity and may only come up with basic ideas such as “needs a plug or outlet”, dangerous, provides power to items like a toaster, hair dryer, etc.

✓ Assessment:

Note the concepts and misconceptions students are expressing. You will need to know these to plan effective questions for subsequent activities and discussions so that students will examine and adjust their alternate conceptions.

Post student versions of curricular outcomes on chart paper (see page 19).

Inform students that these outcomes will be addressed over the next portion of the unit. Point out to students which outcomes are being addressed in each activity.

1st Cycle

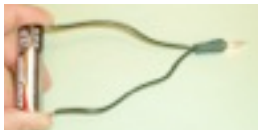
✪ Curriculum Outcomes

205-1: Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables.
205-9: Use tools and apparatus in a manner that ensures personal safety and the safety of others.
207-2: Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language.
303-23: Compare a variety of electrical pathways by constructing simple circuits.

Light up the Bulbs Activity

Materials:

1 Christmas tree (non-LED) mini-light
Extra wire
1 D battery



- Put students into small groups. It is helpful to assign roles or have managers.
- Give each group: 1 light bulb, extra wire and a battery.
- Ask students to connect the light bulb/wires to the battery in a variety of positions. The light bulb will light when a complete circuit is made.
- Tell students to draw each successful and unsuccessful attempt. Label each as a circuit or incomplete circuit (the bulb did not light).
- Have them try as many arrangements as possible.

On large paper or overhead transparencies (so that they may be shared with the whole class), ask several groups to draw one of their “non-functional” circuit diagrams and the other groups to draw one of their functioning circuits.

✓ **Assessment:**
During student activity, make notes on outcomes (or parts of outcomes) you observe being addressed. Process skill outcomes are part of the curriculum and should be assessed. Using the observation chart or the checklist (on pages 25-28) on a clipboard may be helpful to you. Develop your own code for quick notes.

A suggested code:
√ observed and appropriate,
WD with difficulty,
RTT refused to try,
A absent.

This chart may be used on multiple days, using a different coloured pen or pencil each day and putting the date in the corner. You may not have a symbol or note for every child every day. Some teachers like to focus on a group or two each time. However you choose to make note of your observations, you will always have a sense of who you need to take more notice of and who might need extra support. The information will also help you when it is reporting time.

Reflection: Class Discussion

- First, look at the drawings to talk about how the diagrams are different from each other. Discuss how the students represented the battery and light bulbs or how much time the diagrams took to draw.
  - Introduce standard symbols for the light bulb, wires and battery in drawings (schematic) to use next time. Symbols can be found in the "Turn It On!" resource on page 21.
- Next, look at the diagrams to talk about what made a functional circuit and what didn't work. Ask: *Why do some work and some not? What conditions are necessary to have a complete circuit?* The supporting class discussion tips on pages 16-17 may be helpful.
- Review the ideas in the Venn diagram from the Accessing Prior Knowledge activity on page 5. *Do we need to revise, add to or change any of these? Is there other information we could add?*
- In small groups, discuss and make a list of rules necessary for circuits.

Think like a scientist

Asking good questions is an important skill in science. Initially students will need support. Model the skill with the whole class and students will begin to have the confidence to contribute. After some practice, students will be able to generate questions successfully individually.

Present students with a situation and ask them to generate questions that could be investigated scientifically. (These situations and questions do not have to be limited to those that can be done in a classroom.)

Situation:

A newspaper reports that a PEI farmer was devastated by the sight of five dead cows in his pasture. He knew it was lightning because one thin tree had a massive split down the middle and a nearby tree had a smaller split. A current appears to have run the length of the trees, striking down the five cows that were in the field. The farmer found them dead in a straight line that stretched about 10 metres from the tree.

Write a question concerning the movement of electricity suggested by this report that could be investigated scientifically.

🗨 Reflection: Journaling

What is an electrical circuit? Explain using words and drawings.

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Read journal entries to determine which students understand the characteristics of a complete circuit (a complete path with no breaks and a power source).

- BrainPop video : “Electric Circuits”

http://www.brainpop.com/science/energy/electriccircuits/preview.weml

The BrainPop site requires a paid subscription though it is possible to sign up for a five day free trial.

- Other possible videos can be found at http://learning.aliant.net/. You need to register to use the videos on the Aliant site. Registration is free. If you try to watch a video without logging in, you are prompted to do so.

Type electricity into the search box: “Getting to Know Electricity” (save the series and parallel circuits for later) and “Bill Nye – Electrical Current” (up to Nifty Home Experiment at this time) may be useful. Note that a table of contents opens beside the video so that you may select only certain sections for viewing. There is also an option to watch the video full screen.

2nd Cycle

✪ Curriculum Outcomes

204-3: State a prediction and a hypothesis based on an observed pattern of events.
204-7: Plan a set of steps to solve a practical problem and to carry out a fair test of a science-related idea.
204-8: identify appropriate tools, instruments, and materials to complete their investigations.
205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables.
205-9: Use tools and apparatus in a manner that ensures personal safety and the safety of others.
207-2: Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings and oral language.
303-24:Describe the role of switches in electrical circuits.

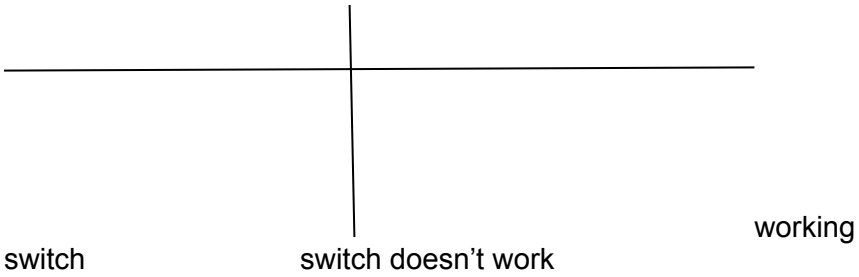
What is a Switch Activity

- Ask the class for a few examples of items that use batteries.
  Ask*: How long do the batteries last? Wow, ___ weeks! How can that be?*
  Get students to the idea that switches are useful. If the switch is off, there is no current flowing from the battery.
- Introduce the symbol for a switch. The switch symbol is shown in the “Turn It On!” resource on page 22.

Materials:

D-battery
1 light bulb
Extra wire
Possible materials to try for switches: paper clip, rubber band, penny, nickel, pop can tab and a Popsicle stick

- Have students make predictions about what sorts of materials and shapes would make a good switch and explain their choices.
- Ask students to create a circuit that works.
- Have them add a switch so it is possible to turn the light bulbs on and off.
- Have them draw the circuit with the switch.
- How many different switches can they make? Have them make a T chart of working switches and non-working switches (see next page). Students will start talking about conductors. (You may need to introduce term insulator.)



✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill outcomes.

Reflection: Class Discussion

- Have the class discuss what a switch is, what it does, and how it is represented in electrical diagrams (schematics).
- Ask: *Why is it important to know about conductors and insulators when making switches?*
- As a class, revisit ideas on static and current electricity in the Venn diagram activity on page 5. *Do we need to revise, add to or change any of these? Is there other information we could add?*

Other examples of switches: circuit breakers in a house, bathroom/kitchen GFCI switches, surge protectors on a power bar

Reflection: Journaling

What are the characteristics of a working switch? Explain.

and/or

What is the best material for a switch? What material is easiest to use? Explain.

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

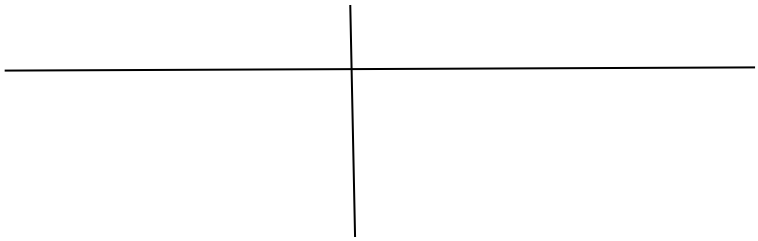
Note which students understand the concept of a switch completing and breaking the circuit.

What is a Switch? (cycle 2)

Materials:

- 1 battery
- 1 light bulb
- Extra wire
- Various materials to try for switches

1. Make predictions about which materials will make a good switch and which will not. Record your predictions in your notebook.
2. Using 1 battery and 1 light bulb make a working circuit.
3. Add a switch so it is possible to turn the light bulb on and off.
4. Draw the circuit with the switch in your notebook.



5. How many different materials can be used as a switch? Test materials and record them in a T chart.

working switch	switch doesn't work

6. Did you find any surprises? What sorts of materials make a good switch?

3rd Cycle

✪ Curriculum Outcomes

204-3: State a prediction and a hypothesis based on an observed pattern of events.
204-7: Plan a set of steps to solve a practical problem and to carry out a fair test of a science-related idea.
205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables.
205-9: Use tools and apparatus in a manner that ensures personal safety and the safety of others.
207-2: Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings and oral language.
303-25: Compare characteristics of series and parallel circuits.

Series and Parallel Circuits Activity

Materials:

2 light bulbs
Extra wire
D battery

Task 1

- Ask students to find a way to make 2 bulbs light at the same time then predict what will happen if you take one bulb out of its holder.
- Have them test their predictions and record their observations.

Task 2

- Ask students to create a circuit so that one bulb stays lighted when the second is missing.
- Have them draw the circuit.

✓ **Assessment:**

On observation chart (or other record), note how students are performing on the skill outcomes.

Were students able to predict what would happen when one bulb was removed? Were they able to create a circuit with one bulb lit when the other was removed?

Reflection: Class Discussion

- Ask one or two groups to share their diagrams with the class. Can students explain that when two bulbs are in series and one bulb is removed, the circuit it broken and no longer works? And when the bulbs are connected to the battery in parallel, a bulb can be removed but the other is still receiving current from the battery.
- Use circuit diagrams such as those on pages 23-24 to elicit differences between series and parallel circuits. Or make your own using the SMART board (the symbols are in the gallery).
    - One way is to sort them into series and parallel circuits without telling students and have students notice what characteristics each group has.
    - Or if they have a good idea of the differences in circuit types, have the students sort them and explain their reasoning.
- Another idea is to have circuit diagrams on the floor. Have students be an electron and walk the circuit. If they have a choice of path, it is a parallel circuit.

ⓘ Teacher note: To help students visualize the difference between series and parallel, two things can be done

1) Ask the students to use a finger to trace from the battery to the light bulbs back to the battery. If they can trace the entire circuit without lifting their fingers or having to choose a direction, that is series. If there is a branch in the pathway and they have to choose a direction, it is a parallel circuit.
2) Show students a map of a race track and a city. A series circuit is like the Indy 500 race – cars go in circles over and over again. A parallel circuit is like driving through a busy city where multiple streets can be used to get to the same location.

- Ask if anyone noticed any differences in how bright the light bulbs were.

ⓘ Teacher note: Brightness changes with the number of bulbs. Some students may notice that having 2 light bulbs connected in a row (in series), they are dimmer than with just one bulb. However, when 2 bulbs connected in parallel (each bulb attached to the battery) the bulbs are brighter than the bulbs in the series circuit.

Using an analogy of drinking straws and water:

- series is like drinking through straws taped straws together in a single line/row
- parallel is where the straws would be taped together in a bundle to drink.

You will get more water using the bundle of straws than a line of straws – the lights will be brighter in a parallel circuit than in series.

- As a class, revisit ideas on static and current electricity in the Venn diagram activity on page 5. *Do we need to revise, add to or change any of these? Is there other information we could add?*

Reflection: Journaling

In their journals, have students compare series and parallel circuits.

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.
Note if students can distinguish between a series and parallel circuit.

Series and Parallel Circuits (Cycle 3)

Materials:

1 battery
extra wire
2 light bulbs

Task 1

- Find a way to make 2 bulbs light at the same time.Do you notice anything about the brightness of the lights compared to when you used just one light bulb?
- What will happen if you take one bulb out of its holder?
- Test your predictions and record your observations.

Caution:
Do not stick objects into the empty bulb holder!

Task 2

- Create a circuit with 2 light bulbs so that one bulb stays lit when the other is missing. (It can be done!)
- Draw the circuit.
- What is happening?

4th Cycle

✪ Curriculum Outcomes

204-3: State a prediction and a hypothesis based on an observed pattern of events.
204-7: Plan a set of steps to solve a practical problem and to carry out a fair test of a science-related idea.
205-1 Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables.
205-9: Use tools and apparatus in a manner that ensures personal safety and the safety of others.
206-3 Identify and suggest explanations for patterns and discrepancies in data.
207-2: Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings and oral language.
303-24:Describe the role of switches in electrical circuits.
303-25: Compare characteristics of series and parallel circuits.

Switches Activity (in parallel circuits)

Materials:

D battery
wires
2 separate light bulbs
The student's best switch

Task 1:
Have students draw a parallel circuit with a switch to turn off only one light bulb.

Task 2:
Have students draw a parallel circuit with a switch that will turn off both light bulbs.

Have students construct and test their diagrammed circuits. They may adjust their diagrams if necessary.

✓ **Assessment:**
On observation chart (or other record), note how students are performing on the skill

Students should hand in their two labelled diagrams.

✓ **Assessment:**
Were students able to successfully complete both of the drawings and test the circuits?

Reflection: Class Discussion

Discuss adding a switch to a parallel circuit. *What was easy or difficult about these tasks? Why?*

How does this compare to adding a switch to a series circuit? (revisiting cycle 2 investigation on page 9)

As a class, revisit ideas on static and current electricity in the Venn diagram activity on page 5. *Do we need to revise, add to or change any of these? Is there other information we could add?*

Reflection: Journaling

What material did you choose for your switch? Why?

✓ **Assessment:**
Journal entries should not receive a score or mark. A positive comment followed by a question to refocus attention or suggest the next step in learning is very effective.

Note if students are able to explain their switch material choice in terms of conductors and ease of use.

Switches in Series and Parallel Circuits (cycle 4)

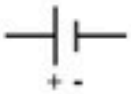
Materials:

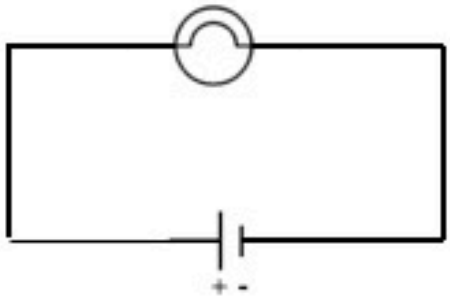
D battery
wires
2 separate light bulbs
your best switch

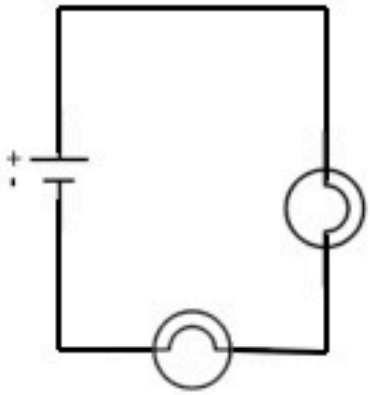
1. Draw a parallel circuit with a switch to turn off only one light bulb.
2. Draw a parallel circuit with a switch that will turn off both light bulbs.
3. Test these.
4. Adjust your diagrams if necessary and re-test.

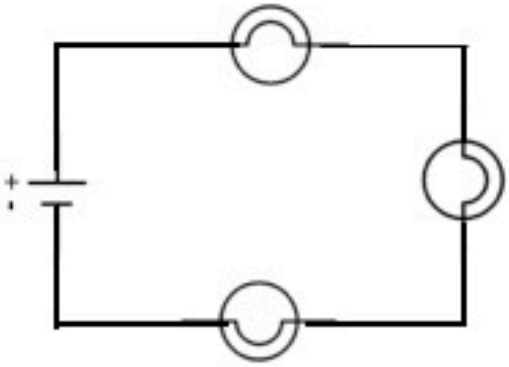
What material did you choose for your switch? Why?

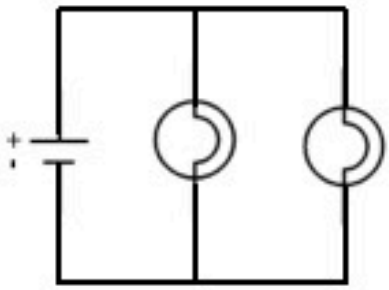
Series and Parallel Circuits

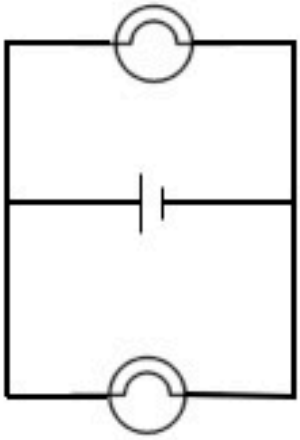


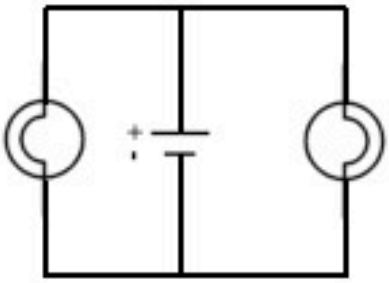


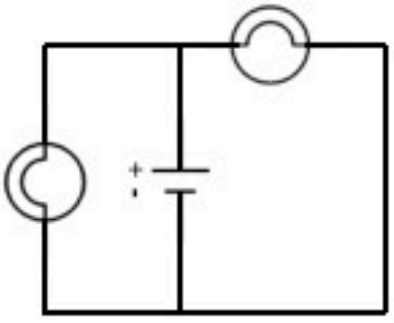


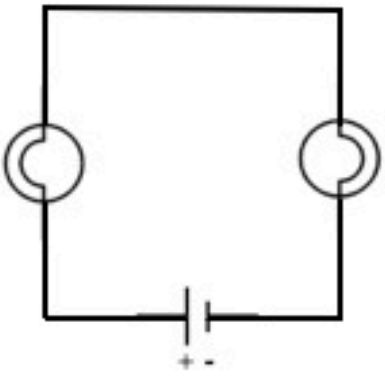












Testing Conductivity - Spark

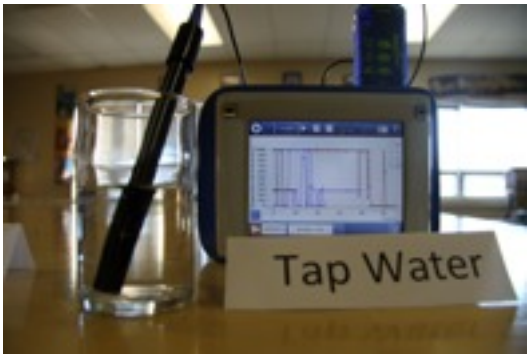
Outcomes
300-20 compare the conductivity of a variety of solids and liquids
104-5 describe how results of similar and repeated investigations may vary and suggest possible explanations for variations
207-2 communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language
205-7 record observations using a single word, notes in point form, sentences, and simple diagrams and charts
205-3 follow a given set of procedures
205-1 carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables
204-3 state a prediction and a hypothesis based on an observed pattern of events

Materials:
• Conductivity probe
• Various liquids (ex: pepsi, water, salt water, Gatorade, etc.)
• Glasses
• Spark Unit
• Salt

Lesson Activity Overview

Cycle 1
• Have students fill glasses with different liquids they would like to test for conductivity
• Have students predict which liquids will have the greatest conductivity and why they think this is
• Use probe to test the various liquids
• Have students record their observations
• Students should analyze the data and come up with some reasons for why the differences might exist

Assessment
- Could be conducted through the use of an exit card where student has written why they think the different liquids recorded different results for conductivity



Cycle 2

•Ask students to come up with their own experiment and testable question to test the conductivity of liquids (ex: Does the fat content in milk affect conductivity?, Does the temperature of the liquid affect conductivity?, does the amount of liquid affect conductivity?, Does the container the liquid is in affect conductivity?, etc.)

Assessment

•could be conducted through a journaling activity where students should create their own testable question, come up with a hypothesis, write their procedure (ensuring a fair test), and record their observations using charts, graphs, drawings, etc.

Electricity

Strand - Electromagnets and their Applications

General Curriculum Outcomes	Specific Curriculum Outcomes
303-27 describe the relationship between electricity and magnetism when using an electromagnet	303-27 describe the relationship between electricity and magnetism when using an electromagnet
204-1 propose questions to investigate and practical problems to solve	204-1, 204-3, 205-1 propose questions about the factors that affect the strength of electromagnets, state predictions and hypotheses related to these factors, and carry out a fair test of these factors
204-3 state a predictions and a hypothesis based on an observed pattern of events	
205-1 carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables	
106-3 describe examples of improvements to the tools and techniques of scientific investigation that have led to new discoveries	106-3 describe how knowledge of electromagnets has led to the development of many electrical devices that use them

Investigating Electromagnets

Outcomes:
303-27 describe the relationship between electricity and magnetism when using an electromagnet
204-1, 204-3, 205-1 propose questions about the factors that affect the strength of electromagnets, state predictions and hypotheses related to these factors, and carry out a fair test of these factors

Lesson Activity Overview
Students should begin this lesson by having a discussion of what is an Electromagnet. If students have misconceptions, then it must be identified before they begin to explore using electromagnets.

Provide students with the materials to make an electromagnet. Electromagnets use a length of insulated wire, battery, and a long iron nail or spike to wrap the wire around, and a compass or paper clips, staples or other small magnetic objects to detect the magnetism.

Once students make an electromagnet, they can experiment, with ways to increase its strength. They can then state their thoughts in the form of a testable question, and compose a hypothesis and predictions. Some factors that they might like to try are: the voltage of the batteries (see caution below), the number of wraps of wire around the nail, the type of nail, the size of the nail, and the type of wire. They can test the electromagnet by seeing how much a compass needle deflects, or by counting the number of staples or paper clips the electromagnet attracts. In groups, they can plan their strategies, brainstorm possibilities, make predictions, and test their hypotheses.
204-1, 204-3, 205-1, 303-27
Teacher Note: (Variables could include the size, shape and type of the core. Another variable is the type, size and length of wire wrapped around the core.)

<u>Journal</u>
• What did you learn about electromagnets? What else would you like to know? (204-1, 204-3, 204-7)

• What is an electromagnet? What do you need to make an electromagnet? What makes an electromagnet stronger? (204-1, 204-3, 204-7)

Assessment:Informal Formative
Ensure that students have participated in discussions related to electromagnets 303-27

Ensure that students have recorded observations from their investigation of the strength of an electromagnet

Assessment:Formal Formative
Ensure that students have completed an initial investigation to construct an electromagnet 303-27

Ensure that students have created a testable questions to test the strength of an electromagnet 204-1

Ensure that students have created a prediction with justifications from personal experiences related to testing the strength of an electromagnet 204-3

Ensure that students have identified one variable to manipulate in an investigation of an electromagnet 205-1

Ensure that students have identified all the variables that need to controlled in an investigation of an electromagnet 205-1

Ensure that students have designed the parameters of an investigation that ensures the fair test of an electromagnet 205-1

Ensure that students have described the relationship between electricity and magnetism from their investigation of an electromagnet 303-27

Ensure that students have created a journal entry related to electromagnets 204-1, 204-3, 204-7

Experimenting with Electromagnet Strength

204-1	Propose questions about the factors that affect the strength of electromagnets

204-3	State a Prediction and hypothesis about the factors that affect the strength of electromagnets

205-1	Carry out procedures to explore a given problem and to ensure a fair test of a proposed idea, controlling major variables
Manipulated Variable:	Design Procedures to ensure a fair test
Variables To Control:	

Observations	Record Observations of an Electromagnet

303-27	Describe the relationship between electricity and magnetism when using an electromagnet

Electromagnets in Everyday Life

Outcomes:
106-3 describe how knowledge of electromagnets has led to the development of many electrical devices that use them

Lesson Activity Overview
Begin with a discussion about the everyday devices that use electromagnets to function. Based on the previous understanding of students proceed accordingly.

If understanding is low, you may choose to show many devices that use electromagnets (telephones, televisions, radios, and microphones) in the classroom or on SMART Board.
If there is a solid baseline understanding then, pictures of heavy objects that are being lifted using electromagnets can be used to illustrate the power that they have.

Have students investigate simple devices, like doorbells, to see how the electromagnets cause the bell to work. These activities will encourage students to appreciate the role and contribution of technology in their understanding of the world. 106-3. Please use a common device (that uses an electromagnet) that you have access to. A door bell work well, but you can choose to dissect any devices that you have access to.

<u>Journal</u>
Collect or draw pictures of a device that uses electromagnets. State the role of the electromagnet in the device. (106-3)

Assessment:Informal Formative
Ensure that students have participated in discussions about the everyday uses of electromagnets

Ensure that students have physically manipulated a device that operates via electromagnet

Assessment:Formal Formative
Ensure that students have created a journal entry in which they have identified a device, collected or drawn a pictures and stated the role of the electromagnets in the device 106-3

Electricity

Strand - Uses for Electricity

General Curriculum Outcomes	Specific Curriculum Outcomes
303-26 demonstrate how electricity in circuits can produce light, heat, sound, motion, and magnetic effects	303-26 demonstrate how electricity in circuits can produce light, heat, sound, motion, and magnetic effects
204-1 propose questions to investigate and practical problems to solve	204-1, 204-7 propose electrical circuitry problems to investigate, and plan a set of steps to solve them
204-7 plan a set of steps to solve a practical problem and to carry out a fair test of a science-related idea	
107-9 compare past and current needs, and describe some ways in which science and technology have changed the way people work, live, and interact with the environment	107-9, 106-4 describe how knowledge of electricity has led to many new inventions that have changed the way we live, and describe ways in which we have become increasingly dependent on electricity over the years
106-4 describe instances where scientific ideas and discoveries have led to new inventions and applications	

Build Your Own Circuit

Outcomes:
303-26 demonstrate how electricity in circuits can produce light, heat, sound, motion, and magnetic effects
204-1, 204-7 propose electrical circuitry problems to investigate, and plan a set of steps to solve them

Lesson Activity Overview
This lesson should be broken down into two distinct sections

Part 1. Students should be given the chance to to test all kinds of buzzers, lights, solar cells, motors, and electromagnets can be used. Heat can be demonstrated by feeling the light bulb warm up, or by displaying electrical devices that convert electrical energy into heat (toasters, curling irons, kettles). *Caution: Check the voltage rating on the gadget—some of them need a power supply with greater than three volts.* You must make sure the minimum voltage required for the device is between one–three volts, or else you will be using too many batteries to get it to work. Students can make circuits using these devices to see how they work.

Device	Heat	Motion	Sound	Magnetic	Light
Buzzer					
Speaker					

Part 2. Students should design a circuit. Challenge students to think of an electrical task. For example, design circuits that won't shut off if one light bulb is removed, or one that will; design a circuit with switches that activate the circuit on contact, or one with switches that turn off the circuit on contact; circuits that have two places to turn off or on a circuit; or circuits with buzzers that are activated by touching something. Give them a wide variety of electrical apparatus (such as wires, buzzers, light bulbs) to try to design solutions.

Assessment:Informal Formative
Ensure that students have participated in manipulating devices to identifying what they produce 303-26

Ensure that students have recorded observations from the design of a circuit

Assessment:Formal Formative
Ensure that students have have completed a table from results of different devices and the effect they produce 303-26

Ensure that students have created a questions to test in the design of a circuit 204-1

Ensure that students have designed a set of steps to test the design of a circuit 204-7

Designing Your Own Circuit

204-1	Propose electrical circuitry problems to investigate

204-7	Plan a set of steps to solve an electrical circuitry problem

Observations	Record Observations of an electrical circuitry problem

Our Life with Electricity...or Without!

Outcomes:
107-9, 106-4 describe how knowledge of electricity has led to many new inventions that have changed the way we live, and describe ways in which we have become increasingly dependent on electricity over the years

Lesson Activity Overview
Select from the following activities, it is not recommended that all tasks be accomplished. Teachers can choose to make this a UDL, where students choose a task to accomplish. Another way to accomplish this is to assign groups to accomplish each task and present the results to the class.
Tasks
Write a diary of your day of technology use. Compare with grandparents. Students could interview parents, grandparents, or older people in the community about electrical devices that have been developed in their lifetimes, and how these devices have changed their lives. This connects with the English Language Arts Curriculum Outcome students will be expected to use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imagination.

No Technology Day: Students experience a day at school, in your classroom/whole school (adaptable), without the use of lighting (if possible), SMARTBoards, Computers, and other tools. They should bring a lunch that does require boiled water or microwave. Be creative! Prior: Students track their own technology use for one day. Post: Students reflect on the challenges/happenings of No Technology Day.

In 1989 a powerful solar storm caused the power to go out in Quebec for 9 hours. In 1859 there was a superstorm that was many times more intense than the one in that impacted Quebec in 1989. We are currently in another period of extreme solar activity which has been damaging satellites and causing problems with power grids, cell phones, and satellite t.v. around the world.

Pretend the power were to go out for a period of 20 days due to a solar storm. Write a diary entry describing how the power outage is impacting your life for the following days: Day 1, Day 4, Day 10, Day 15, Day 20.
What's your EQ?

Did you ever wonder how much energy your house uses each year? Now you can calculate your EQ (or energy quotient) and determine how many kilowatt-hours your house uses annually! http://omsi.info/teachers/psd/2002/eq/

Assessment:Formal Formative
Ensure that students have participated in a task and have appropriately accomplished the expectations

Electricity

Strand - Sources of Electricity

General Curriculum Outcomes	Specific Curriculum Outcomes
106-4 describe instances where scientific ideas and discoveries have led to new inventions and applications	106-4 describe how knowledge that magnets can produce electric current led to the invention of electrical generators
303-28 identify various methods by which electricity can be generated	303-28, 105-3, 108-8 identify and investigate various methods of generating electricity (past, present and future), and describe some ways in which these methods affect the environment
105-3 describe examples of scientific questions and technological problems that have been addressed differently at different times	
108-8 describe the potential impact of the use by humans of regional natural resources	
303-29 identify and explain sources of electricity as renewable or nonrenewable	303-29 identify and explain sources of electricity as renewable or nonrenewable

Understanding Electrical Generators

Outcomes:
106-4 describe how knowledge that magnets can produce electric current led to the invention of electrical generators

Lesson Activity Overview
Students should understand that the production of electricity by passing a magnet by wire has lead to the invention of electrical generators. Students have already investigated how electricity can generate magnetism (electromagnets).

A good way to lead into this section is to investigate the reverse of this (generating electricity from magnets). Students will need a fairly sensitive way to detect electricity (galvanometer, compass).
1. Using a wire coiled around a tube and connected to a galvanometer, students can move a magnet in various directions around the coil and watch the way the needle on the galvanometer deflects.
2. If they insert the bar magnet in and out of the tube, they should also detect a current in the wire.
3. Alternatively, generators can be purchased from science supplies catalogues. Students could look carefully at these to see the components (coils of wire, rotating magnet) of the generator. By turning the crank at sufficient speed, students can get light bulbs and buzzers to work.

Journal
1. Compare and contrast electromagnets and generators in terms of: (106-4, 303-27)
• what they are made from
• their source of energy
• what they do

2. What invention came from the discovery that magnets can produce an electric current? How is this invention useful to us? (106-4)

Assessment:Informal Formative
Ensure that students have participated in an investigation of generating electricity from magnets 106-4

Assessment:Formal Formative
Ensure that students have recorded appropriate observations from their investigation of generating electricity from magnets 106-4

Ensure that students have completed journal entries that measure students understanding of the relationship of electromagnets and electrical generators 106-4

Generating Electricity from Magnets

Using a wire coiled around a tube and connected to a galvanometer, students can move a magnet in various directions around the coil and watch the way the needle on the galvanometer deflects.
Record Observations:

If they insert the bar magnet in and out of the tube, they should also detect a current in the wire.
Record Observations:

***If Available** **Alternatively, generators can be purchased from science supplies catalogues. Students could look carefully at these to see the components (coils of wire, rotating magnet) of the generator. By turning the crank at sufficient speed, students can get light bulbs and buzzers to work.**
Record Observations:

How is Energy Converted?

Outcomes:
303-28, 105-3, 108-8 identify and investigate various methods of generating electricity (past, present and future), and describe some ways in which these methods affect the environment
303-29 identify and explain sources of electricity as renewable or nonrenewable

Lesson Activity Overview
Brainstorm with students and record their ideas on how electricity is produced.

Students should identify chemical (batteries), mechanical (wind, falling water, steam) and solar energy as forms of energy that can be converted into electrical energy.

Energy can be converted from chemical, mechanical, solar and nuclear to electrical energy. Some forms of chemical energy would be batteries and fossil fuel combustion.

• Sources of energy would be wind, water, tidal, solar, and nuclear.303-28
• Renewable forms of energy would be wind, solar, water and tidal. 303-29
• Non renewable forms of energy are fossil fuels and nuclear energy.303-29

Task
1. Create a pictorial concept map showing energy conversions.
2. Choose either chemical, mechanical, or solar energy, and research:
    a.how electrical energy is produced from the source
    b.whether the source is renewable or non-renewable
    c.positive and negative impacts on the environment of using this source to create electricity
3.Report your findings (web page, report, oral presentation with visual aids). (303-28, 105-3, 108-8, 303-29)

Extension
Student can generate their own electricity from chemical energy by making some simple electrochemical cells using nails that are embedded in citrus fruit.
Connect a nail in one piece of fruit and another nail in another piece of fruit by a wire a wire that is hooked up to something that shows that electricity is flowing, like a bulb or a multi-meter. 303-29

Assessment:Informal Formative
Ensure that students can identify chemical, mechanical and solar energy as forms of energy that can be converted into electrical energy 303-28

Assessment:Formal Formative
Ensure that students have completed a pictorial concept map showing energy conversions 303-28

Ensure that students have show how electrical energy is produced based on their choice of either chemical, mechanical, or solar energy 303-28

Ensure that students have identified the source as renewable or non-renewable 303-29

Ensure that students have suggested positive and negative impacts on the environment of using this source to create electricity 108-8

Ensure that students have created a report (their choice of platform) of their findings (303-28, 105-3, 108-8, 303-29)

Extension Assessment:Informal Formative
Ensure that students have created a energy based on using citrus fruits, a wire and galvanized nails.

Electricity

Strand - Electrical Energy Consumption and Conservation

General Curriculum Outcomes	Specific Curriculum Outcomes
108-5 describe how personal actions help conserve natural resources and protect the environment in their region	108-5, 303-30 identify and explain different factors that could lead to a decrease in electrical energy consumption in the home and at school, and how this will help protect the environment
303-30 identify and explain different factors that could lead to a decrease in electrical consumption in the home and at school	

Quantifying Personal Electrical Use

Outcomes:
108-5, 303-30 identify and explain different factors that could lead to a decrease in electrical energy consumption in the home and at school, and how this will help protect the environment

Lesson Activity Overview
Students should see the effects of their effort to conserve energy by collecting data about the consumption before and after they try to reduce electrical usage

Students have kept an “Electrical use” journal, noting various electrical devices/systems they encounter over the course of this unit.

Students should sum up the total use (probably measured in time) per device they have used. For example, students most likely have categories like lights, electronic device, appliances. Totals should be summed up per electrical device they have. Use the “Personal Electrical use” worksheet.

Next, students should be introduced to the units of measurement used to quantify electrical energy, watts and kilowatt hour.

> **Watt** - is a unit of measuring how much electrical energy a device uses
> **Kilowatt hour** - is the amount of energy being consumed f the device is used for one hour

Students should understand that the more watts or kilowatt hours a device is rated for, then the more electrical energy is being used.
Students will have to be comfortable with converting units. Converting watts to kilowatts is the same conversion as Meters to Kilometers. These skills are used in Math.

<u>Using an Energy Consumption Meter</u>
1.Students could turn on electrical devices while connected to an Energy Consumption Meter and record the consumption.
2.Then turn off the device to see how this affects the meter.
3. Repeat this process with 5 different devices.
Students could categorize devices as high, medium. or low consumption devices
*ASD-N has one watts up?Pro Energy Consumption Meter for loan

<u>Journal</u>
Develop strategies to conserve energy in the school.

Students should share their strategies and students should have conversations to identify the best ideas. Present class findings, based on data to the administrator

Extension
Students should take the data generated from their personal use in term of time and calculate their actual use with a device. This can be done by taking the actual watt consumption while turned on and turned off and calculate the kilowatt of consumption for the course of the unit. Then students can determine the actual cost they have incurred by using the rate card.

How can you conserve electricity and what affect will this have on the home and family budget 108-5, 303-30

Assessment:Informal Formative
Ensure that students have been introduced to the terms Watts and Kilowatt hours 303-30

Ensure that students are able to convert a watt to a kilowatt 303-30

Ensure that students have participated in conversations that have led to a class consensus of strategies to present to the school administration 108-5

Assessment:Formal Formative
Ensure that students have kept an Electrical Use journal throughout the course of the unit. 303-30

Ensure that students have completed the Personal Electrical Use worksheet 303-30

Ensure that students have completed Using an Electrical Consumption Meter worksheet* 303-30

Ensure that students have created a journal entry in which they have identified strategies to reduce electrical use at school. 303-30

Extension Assessment:Formal Formative
Ensure that students have quantitatively calculated their actual cost 303-30

Ensure that students have created conclusions as to how they can conserve electricity at home. 303-30

Personal Electrical Use

Device:_____	**Units of Measurement:_____**
Show Quantitative Data to be Added	
Total:	

Device:_____	**Units of Measurement:_____**
Show Quantitative Data to be Added	
Total:	

Device:_____	**Units of Measurement:_____**
Show Quantitative Data to be Added	
Total:	

Using an Electrical Consumption Meter

Device: ______________________		
Watts Consumed while device is turned on	Watts Consumed while device is turned off	High Medium Low

Device: ______________________		
Watts Consumed while device is turned on	Watts Consumed while device is turned off	High Medium Low

Device: ______________________		
Watts Consumed while device is turned on	Watts Consumed while device is turned off	High Medium Low

Device: ______________________		
Watts Consumed while device is turned on	Watts Consumed while device is turned off	High Medium Low

Device: ______________________		
Watts Consumed while device is turned on	Watts Consumed while device is turned off	High Medium Low

Monthly Electricity Rates Effective October 1, 2013

Residential Service*	urban	rural/seasonal
Service charge	$20.08	$22.02
Energy Charge:		
All kilowatt hours	10.05¢/kWh	10.05¢/kWh

General Service I*	
Service charge	$21.35
First 20 kilowatts of demand	no charge
Additional kilowatts of demand	$9.85/kW
First 5000 kilowatt hours	12.31¢/kWh
Balance kilowatt hours	8.73¢/kWh

General Service II* (closed to new customers)	
Service charge	$21.35
First 20 kilowatts of demand	no charge
Additional kilowatts of demand:	
Lesser of	$6.05/kW
or	3.000¢/kWh
First 5000 kilowatt hours	12.31¢/kWh
Balance kilowatt hours	9.39¢/kWh

Small Industrial Service* (loads up to 750 kilowatts)	
Demand charge	$6.45/kW
First 100 kWh per kilowatt	12.50¢/kWh
Balance kilowatt hours	5.88¢/kWh

Water Heater Rental*	
22 Gallons/100 litres	$6.14
40 Gallons/180 litres	$6.14
60 Gallons/270 litres	$7.95
100 Gallons/455 litres	$15.98
100 Gallons/455litres (Commercial 208V)	$24.45
100 Gallons/455litres (Commercial 600V)	$30.97

Area Light Rental*	100 Watt	200 Watt
High pressure sodium		
Existing pole	$13.42	$21.10
Wood pole required	$17.56	$25.24

Floodlights - Improved efficiency metal halide (white light)*†	
250 Watts	$26.29
400 Watts	$32.55
1000 Watts	$56.33

Late Payment Charge

A charge of 19.56 percent per annum (1.5% per month) with a 50¢ monthly minimum is applied on the unpaid arrears at the date of billing. (Not subject to harmonized sales tax)

Other Services*	
Service call fee and reconnection fee	$43.79
New customer connection charge	$77.50
Reconnection charge for seasonals	$122.21

An after hours fee is charged in addition to the above charges for service calls requested outside normal working hours.

** Plus harmonized sales tax*

† Additional charge for pole rental may be required

For rates not listed, conditions of service and specific rate applications, please call

1 800 663-6272

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