Physical Science

Grade 6

Written by Tracy Bellaire

About this Book

The experiments in this book fall under thirteen topics that relate to three aspects of physical science: **Air and Aerodynamics, Characteristics of Flight, and Electricity and Electrical Devices.** In each section you will find teacher notes designed to provide you guidance with the learning intention, the success criteria, materials needed, a lesson outline, as well as provide some insight on what results to expect when the experiments are conducted. Suggestions for differentiation are also included so that all students can be successful in the learning environment.

About the Author:

Tracy Bellaire is an experienced teacher who continues to be involved in various levels of education in her role as Differentiated Learning Resource Teacher in an elementary school in Ontario. She enjoys creating educational materials for all types of learners, and providing tools for teachers to further develop their skill set in the classroom. She hopes that these lessons help all to discover their love of science!

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At A Glance

Learning Intentions	Properties of Air-Part 1	Properties of Air-Part 2	Properties of Air-Part 3	Forces of Flight	Parts of a Plane	Birds in Flight	Aircraft vs. Spacecraft	Electrical Usage	Circuitry	Electrical Current	Static Electricity	Electromagnetism	Energy Sources
Knowledge and Understanding Content													
• recognize that air takes up space and that it has mass, identifying these as properties of air	•												
• recognize that air expands and that it can exert a force when it is compressed, identifying these as properties of air		•											
• recognize that hot air rises and that it has insulating properties, identifying these as properties of air			•										
• describe the four forces of flight and explain the relationship between the forces				•	•								
• identify the main parts of a plane and investigate how a plane uses unbalanced forces to control flight				•	•								
• identify characteristics and adaptations that enable birds to fly; make comparisons between birds and airplanes in flight						•							
• describe differences in aircraft and spacecraft design, identify reasons for the design differences							•						
• describe how electricity usage is registered and assess opportunities for reducing their own consumption								•					
• design, construct, and test simple electrical circuits that use batteries, bulbs, wires, buzzers, and switches									•	•		•	
• distinguish electrical conductors from insulators; and describe how chemical energy is transformed into electricity										•			
• distinguish electrical conductors from insulators											•		
• demonstrate that electricity can be used to create a magnet												•	
• describe how various forms of energy can be transformed into electrical energy													•
Thinking Skills and Investigation Process													
• make predictions, formulate questions, and plan an investigation	•	•	•				•	•	•	•	•	•	
• gather and record observations and findings using drawings, tables, written descriptions	•	•	•	•	•	•	•	•	•	•	•	•	•
• recognize and apply safety procedures in the classroom	•	•	•	•	•	•	•	•	•	•	•	•	•
Communication													
• communicate the procedure and conclusions of investigations using demonstrations, drawings, and oral or written descriptions, with use of science and technology vocabulary	•	•	•	•	•	•	•	•	•	•	•	•	•
Application of Knowledge and Skills to Society and the Environment													
• assess the benefits and costs of aviation technology to society and the environment					•								
• assess opportunities for reducing electrical consumption in order to reduce the impact of electricity generation on the environment								•					
• assess ways that electricity is generated, and the effects they have on natural resources and our environment													•

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Student's Name: _____ Date: _____

Teacher Assessment Rubric

Success Criteria	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding Content				
Demonstrate an understanding of the concepts, ideas, terminology definitions, procedures and the safe use of equipment and materials	Demonstrates limited knowledge and understanding of the content	Demonstrates some knowledge and understanding of the content	Demonstrates considerable knowledge and understanding of the content	Demonstrates thorough knowledge and understanding of the content
Thinking Skills and Investigation Process				
Develop hypothesis, formulate questions, select strategies, plan an investigation	Uses planning and critical thinking skills with limited effectiveness	Uses planning and critical thinking skills with some effectiveness	Uses planning and critical thinking skills with considerable effectiveness	Uses planning and critical thinking skills with a high degree of effectiveness
Gather and record data, and make observations, using safety equipment	Uses investigative processing skills with limited effectiveness	Uses investigative processing skills with some effectiveness	Uses investigative processing skills with considerable effectiveness	Uses investigative processing skills with a high degree of effectiveness
Communication				
Organize and communicate ideas and information in oral, visual, and/or written forms	Organizes and communicates ideas and information with limited effectiveness	Organizes and communicates ideas and information with some effectiveness	Organizes and communicates ideas and information with considerable effectiveness	Organizes and communicates ideas and information with a high degree of effectiveness
Use science and technology vocabulary in the communication of ideas and information	Uses vocabulary and terminology with limited effectiveness	Uses vocabulary and terminology with some effectiveness	Uses vocabulary and terminology with considerable effectiveness	Uses vocabulary and terminology with a high degree of effectiveness
Application of Knowledge and Skills to Society and Environment				
Apply knowledge and skills to make connections between science and technology to society and the environment	Makes connections with limited effectiveness	Makes connections with some effectiveness	Makes connections with considerable effectiveness	Makes connections with a high degree of effectiveness
Propose action plans to address problems relating to science and technology, society, and environment	Proposes action plans with limited effectiveness	Proposes action plans with some effectiveness	Proposes action plans with considerable effectiveness	Proposes action plans with a high degree of effectiveness

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Name: _____ Date: _____

Student Self-Assessment Rubric

Put a check mark (✓) in the box that best describes you:

	Always	Frequently	Sometimes	Seldom
• I listened to instructions.				
• I was focused and stayed on task.				
• I worked safely.				
• My answers show thought, planning, and good effort.				
• I reported the results of my experiment.				
• I discussed the results of my experiment.				
• I used science and technology vocabulary in my communication.				
• I connected the material to my own life and the real world.				
• I know what I need to improve.				

1. I liked _____

_____

2. I learned _____

_____

3. I want to learn more about _____

_____

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Introduction

The activities in this book have two intentions: to teach concepts related to physical science and to provide students the opportunity to apply necessary skills needed for mastery of science and technology curriculum objectives.

Throughout the experiments, the scientific method is used. The scientific method is an investigative process which follows five steps to guide students to discover if evidence supports a hypothesis.

1. **Consider a question to investigate.**
   For each experiment, a question is provided for students to consider. For example, "Does air take up space?"

2. **Predict what you think will happen.**
   A hypothesis is an educated guess about the answer to the question being investigated. For example, "I believe that air does take up space". A group discussion is ideal at this point.

3. **Create a plan or procedure to investigate the hypothesis.**
   The plan will include a list of materials and a list of steps to follow. It forms the "experiment".

4. **Record all the observations of the investigation.**
   Results may be recorded in written, table, or picture form.

5. **Draw a conclusion.**
   Do the results support the hypothesis? Encourage students to share their conclusions with their classmates, or in a large group discussion format.

The experiments in this book fall under thirteen topics that relate to three aspects of physical science: **Air and Aerodynamics, Characteristics of Flight, and Electricity and Electrical Devices.** In each section you will find teacher notes designed to provide you guidance with the learning intention, the success criteria, materials needed, a lesson outline, as well as provide some insight on what results to expect when the experiments are conducted. Suggestions for differentiation are also included so that all students can be successful in the learning environment.

Assessment and Evaluation:

Students can complete the Student Self-Assessment Rubric in order to determine their own strengths and areas for improvement. Assessment can be determined by observation of student participation in the investigation process. The classroom teacher can refer to the Teacher Assessment Rubric and complete it for each student to determine if the success criteria outlined in the lesson plan has been achieved. Determining an overall level of success for evaluation purposes can be done by viewing each student's rubric to see what level of achievement predominantly appears throughout the rubric.

Properties of Air – Part One

Learning Intention:

Students will learn that air takes up space and that it has mass, identifying these as properties of air.

Success Criteria:

- conduct experiments to determine the properties of air
- make observations and record results using diagrams and written descriptions
- make conclusions about the properties of air
- make connections to our environment by identifying common applications of the properties of air in real life situations

Materials Needed:

- a copy of "Properties of Air – Experiment #1" worksheet 1 and 2 for each student
- a copy of "Properties of Air – Experiment #2" worksheet 3 and 4 for each student
- a clear glass or jar, a sheet of paper, a pail of water (a set for each group of students)
- a balance scale, two basketballs, a pump pin (a set for each group of students)
- pencils, pencil crayons, markers, chart paper

Procedure:

1. Have a brainstorming/discussion session with students to find out what they know about air. Record student responses on chart paper. Next, explain to students that they are going to conduct a couple of experiments to find out more about air and its characteristics, or properties. Divide students into small groups, and give them the materials to conduct the experiment on worksheets 1 and 2. Upon completion of the experiment, students are to understand that the paper remained dry because air took up space and prevented water from entering the glass.
2. Continuing to work in their groups, students will investigate if air has mass. Give them the materials to conduct the experiment on worksheets 3 and 4. Upon completion of this experiment, students are to understand that the inflated ball weighs more than the deflated ball because air has mass.

***Discussion options:**

An option at this point is to come back together as a large group to discuss real life applications of these properties of air. When would it be useful to know that air takes up space? When would it be useful to know that air has mass? Can you think of other real life situations in which these properties have been displayed? How do you think flying devices make use of these properties of air?

Differentiation:

Slower learners may benefit by working together in a small group with teacher direction to conduct the experiments, this would allow opportunity for extra scaffolding of information. Further small group discussion about real life applications of these properties may be a necessary follow up to the large group discussion of this topic.

For enrichment, faster learners could draw pictures or diagrams to depict real life applications of these properties of air (indicating situations in which these properties have been displayed).

Worksheet 1

Name: _____

Properties of Air

EXPERIMENT #1

Question:

Does air take up space?

Materials needed:

- a clear glass or jar
- a sheet of paper
- a pail
- water

What To Do:

1. Make a prediction about the answer to the question then record it on worksheet 2.
2. Fill the pail with water, so that it is about 2/3 full.
3. Crumple the sheet of paper and place it in the bottom of the glass.
4. Turn the glass upside down and submerge it in the water. Make sure that the entire glass is under the water.
5. Lift the glass out of the water, making sure not to turn the glass upright.
6. Remove the paper from the glass.
7. Draw diagrams to show your observations and results.
8. Make a conclusion about what you have observed.

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Worksheet 2

Name: _____

Let's Predict

Does air take up space? Explain your thinking.

_____

_____

Let's Investigate

Make observations about the paper when the glass is under water and when it is pulled out of the water.

Diagram of glass submerged under water	Diagram of glass pulled out of the water
Condition of paper: _____ _____	Condition of paper: _____ _____

Let's Conclude

Were your predictions correct? Explain the results. _____

_____

_____

_____

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Energy Sources

Learning Intention:

Students will learn how various forms of energy can be transformed into electrical energy.

Success Criteria:

- identify and describe different sources of energy that produce electricity
- determine which sources of energy are renewable or non-renewable
- research and record the advantages and disadvantages of the production of electricity using different energy sources

Materials Needed:

- a copy of "Generating Electricity" worksheets 1, 2, 3, 4 for each student
- a copy of "Renewable and Non-Renewable Sources" worksheet 5 for each student
- a copy of "Energy Sources" worksheet 6 for each student
- a copy of "Sourcing It Out!" worksheet 7 for each student
- access to internet, or library materials
- chart paper, markers
- pencils

Procedure:

1. Give students worksheets 1, 2, 3, 4. Read and discuss the information to ensure students' understanding of the concept of each energy sources ability in producing electricity. An option at this point is to have students engage in a "Turn and Talk" activity where they turn to a partner and talk about the different energy sources and how exactly they provide electrical power. This activity will help to substantiate their understanding of the concepts and give them the opportunity to retell what they know.
2. Give students worksheet 5. Read and discuss the information. Students will then identify different energy sources by matching a label to a picture, then determine if the energy source is renewable or non-renewable.
3. Give students worksheet 6. They will research the different energy sources, then determine and record their advantages and disadvantages in producing electrical power. An option at this point is to have students assigned to a 'power group' where they work together to record the advantages and disadvantages of their resource in electrical production. Each group could record responses on chart paper and then present it to the larger group.

Differentiation:

Slower learners may benefit by working together in a small group with teacher direction to do the "Turn and Talk" activity. This would allow opportunity to scaffold the information for the students in order for them to grasp the concepts.

For enrichment, faster learners could research about an electricity generating plant that supplies electricity to their community. Some guiding questions:

- what are some environmental effects of its generating method to your community?
- how does it compare with another method used in another part of the country?

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Worksheet 1

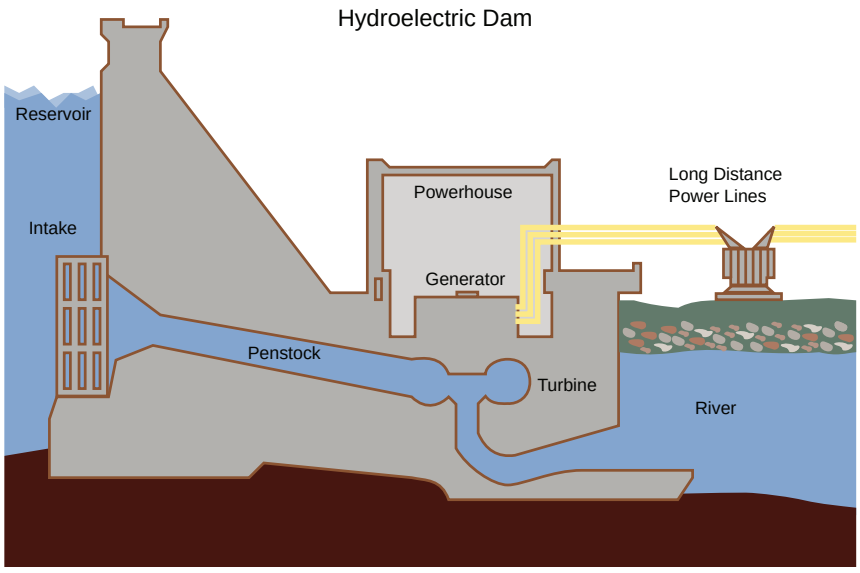
Name: _____

Generating Electricity

The world's need for electricity grows every year. Our electrical needs are taken care of by huge power plants that have giant generators. The generator at a power plant is really just a large electromagnet. Energy is needed at these power plants to turn the generator. These huge generators are driven by steam engines that are fueled by coal, oil, gas, water pressure, or the energy from nuclear reactions.

Hydroelectric Energy

A hydroelectric dam uses water pressure to produce energy to spin the generator. A dam is built to hold back large quantities of water which are then allowed to travel through pipes to a turbine. The turbine has blades which spin as the water hits them. The turbine is connected to the generator arm that holds the magnet. When the turbine spins, it turns the drive shaft of the generator causing the magnet to twirl inside the coil of wire.



Located in Niagara Falls, Canada, Sir Adam Beck I was the first large hydroelectric generation plant in the world. It first produced power in 1922. It contains 10 generators. Sir Adam Beck II first produced power in 1954. It contains 16 generators.

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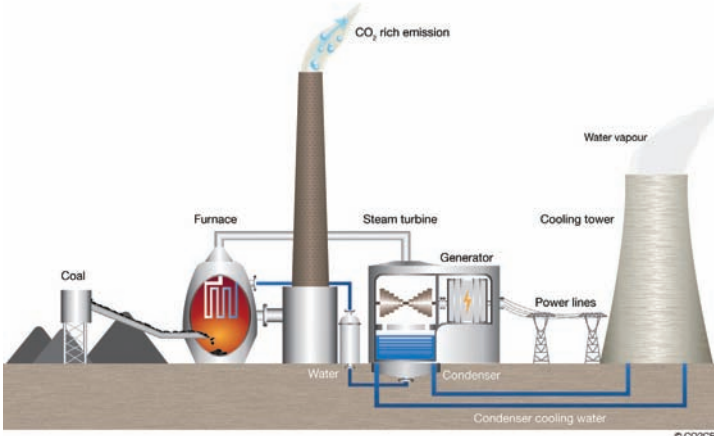
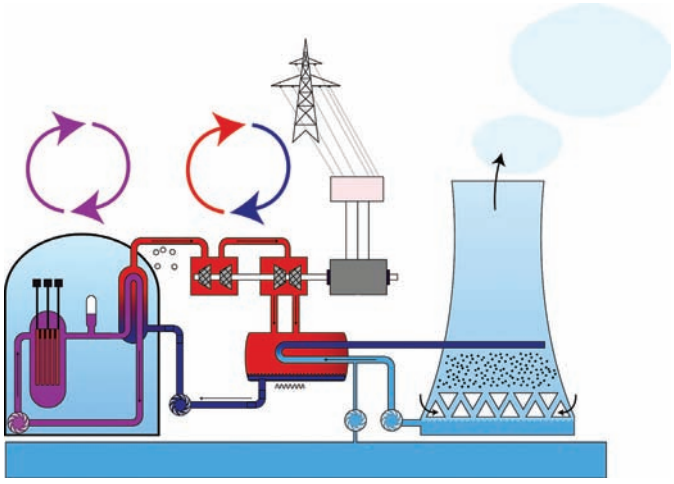
Name: _____

Energy from Fossil Fuels



Some of the world's power is generated by fossil fuel plants such as gas, coal, and oil. Fossil fuels were formed from the remains of prehistoric plants and animals. These remains have been trapped underground for millions of years and eventually turn to coal, gas, and oil. The fossil fuels are burned in large furnaces that heat the water and change it to steam. This powerful steam is used to turn blades of the turbine. After the steam goes through the turbine, it passes to the condenser where it changes back to water and is used again.

Nuclear Energy



Nuclear power plants operate the same way, except steam is produced using a different form of energy. Instead of water or fossil fuels, heat is created by using pellets of uranium. The uranium pellets are placed in long hollow rods which are placed into the nuclear core of the power plant. A process called fission then takes place which causes atoms of uranium to split. When the atoms split, they give off a lot of heat energy. This energy is used to make steam the same way as the fossil fuel plants do.

Pickering Nuclear Power Plant
outside of Toronto, Ontario

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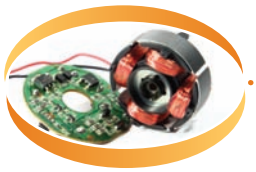

Worksheet 7

Name: _____

Sourcing It Out!

You have learned a lot about electricity and the energy sources that provide electricity for our usage in our daily lives.

Get on Task!

Your task now is to research the energy sources in the chart below and list the advantages and disadvantages of each source in producing electricity.

Energy Source	Advantages	Disadvantages
Hydroelectric		
Nuclear		
Fossil Fuels		
Wind Power		
Solar Power		

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