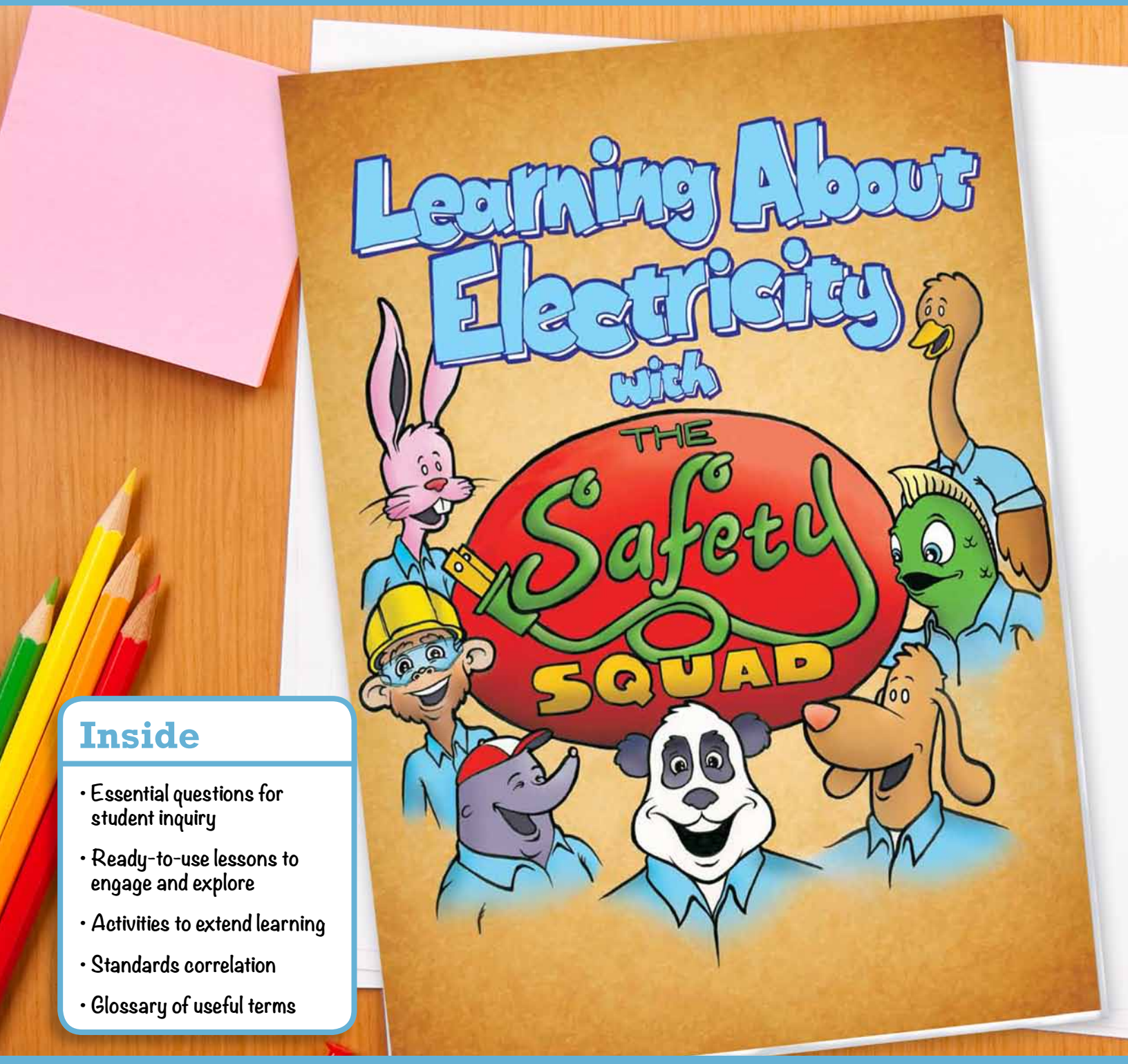
The Educator's Guide to:

Learning about Electricity with the Safety Squad



Inside

- Essential questions for student inquiry
- Ready-to-use lessons to engage and explore
- Activities to extend learning
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Introduction

Electricity is an important resource we use every day. It has awesome power, but that same power can make it very dangerous. This guide, a supplement to the kids' book *Learning about Electricity with the Safety Squad*, provides educators and parents with essential background information, practical lessons, and hands-on investigations for educating children about electricity and energy safety. Large group activities ideal for the classroom and small group activities suitable for the home are designed to enhance student learning. Essential questions and lesson plans are linked to curriculum requirements and explore themes within topics such as science as inquiry, and science in personal and social perspectives. The guide's activities aim to help children acquire skills that are significant in their developmental process—to collect, organize, and communicate ideas.

Essential Questions

Where does electricity come from?

The electricity we use comes from a variety of sources: some comes from fuels like **coal**, **oil**, and **natural gas**; and some comes from the sun.

How does electricity get to our homes, schools, and businesses?

Electricity is created at **power plants** from energy sources such as coal, sunlight, or wind. The electricity is then carried from power plants to homes, schools, and businesses through wires, called **power lines**, that are strung overhead on utility poles or through pipes underground.

How is electricity measured in our homes?

When we use electricity in our homes, it first passes through an electric meter. The meter tells our electric company how much energy we use. Electricity costs money, and the more we use the more we have to pay! The meter measures electricity usage in kilowatt-hours (kWh), or the amount of energy used over a length of time.

What can you do to stay safe around electricity?

- Never stick things into electrical sockets.
- Don't go near downed power lines. If you see one, tell an adult right away!
- Remember, water and electricity don't mix! Electricity can travel through water right to your body.
- Never leave a hair dryer plugged in near the sink.
- Don't touch a kitchen **appliance** if it's wet! And wait until your hands are dry before using the toaster.
- Frayed power cords can be dangerous. Tell an adult if you see damaged plugs and cords.
- Don't drag anything by its cord.
- Don't plug too many cords into an outlet.
- Keep things that are **flammable** away from space heaters and other appliances that get hot. They could start a fire.
- Never swim during a storm! If you hear thunder or see lightning, get out of the water right away.
- Don't climb on utility poles or on trees that are close to power lines.
- Never fly a kite or play ball near power lines.
- Don't climb fences near power stations.
- If you think something might be dangerous, always ask an adult for help.

Lessons to Engage and Explore!

1. Outlet Overload Game!

Introduction

Remember the Safety Squad's tip, "Don't plug too many cords into an outlet"? Too many appliances plugged into an outlet could cause a fire. Different electric sockets can handle different amounts of wattage. The maximum for a standard household single socket is about 3,000 watts, or 3 kilowatts. Use the facts below to determine whether your household outlet is overloaded.

Appliance List

2. Cell phone charger: 10 watts
3. Radio: 30 watts
4. Laptop computer: 50 watts
5. Video game console: 80 watts
6. TV: 100 watts
7. Washing machine: 750 watts
8. Vacuum cleaner: 800 watts
9. Toaster oven: 1,200 watts
10. Microwave: 1,500 watts
11. Hair dryer: 1,800 watts
12. Air conditioner: 2,000 watts

Objectives and Learning Goals

Students will have fun while learning an important electricity safety tip.

Time and Groups

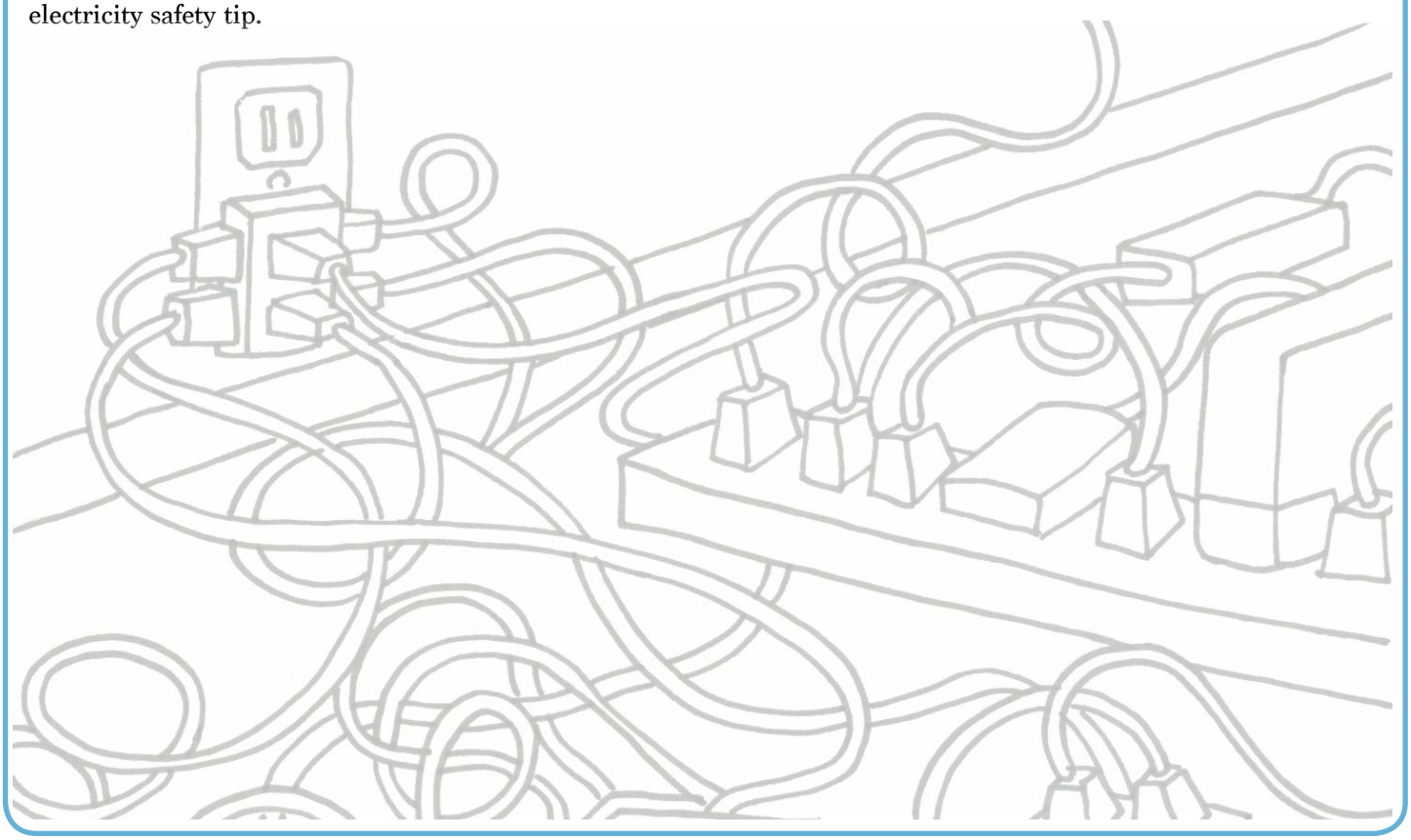
30 minutes; three students per group

Materials

2 dice per group, pencils, paper

Activity Procedure

- Ask each group of students to sit in a circle with the list of appliances in the middle.
- Have students take turns rolling both dice. The two numbers that land face up are added together, and that number is looked up on the appliance list.
- The appliance that each student rolls and the number of watts it uses is recorded. For example, if Timmy rolls a 5, he writes down "Video game console: 80 watts." After the next two students roll the dice and record their appliances and wattage, the group adds up the total wattage used. If the total of the three appliances is more than 3,000 watts, the group will yell "Overloaded!" If the total is less than 3,000 watts, the outlet is not overloaded and is safe!
- Play again as time permits.



2. Electricity Distribution System—Make a Map!

Introduction

How does electricity get to our homes, schools, and businesses? There are many steps in the process. Electricity is generated in power plants using an energy source like coal, oil, or natural gas. Power lines then carry it to buildings, where the amount used is measured by electric meters.

The Journey of Electricity!

1. Power plant: A large building where energy sources are used to make electricity.

2. Transmission lines: Wires in which high-voltage electricity travels long distances from power plants to substations.

3. Substation: A place where high-voltage electricity is reduced to a lower voltage so it can be transported through distribution lines.

4. Distribution lines: Wires (also called power lines) that carry the lower-voltage electricity to local communities.

5. Pole mount transformer: Small devices on power line poles that lower the voltage even further before the electricity enters a home or other building.

6. Electric meter: A measurement tool that keeps track of electricity usage, located in the service box where electricity enters a home or other building.

Objectives and Learning Goals

Students will understand how electricity travels to homes, schools, and businesses.

Time and Groups

45 minutes; small groups of 2–3 students

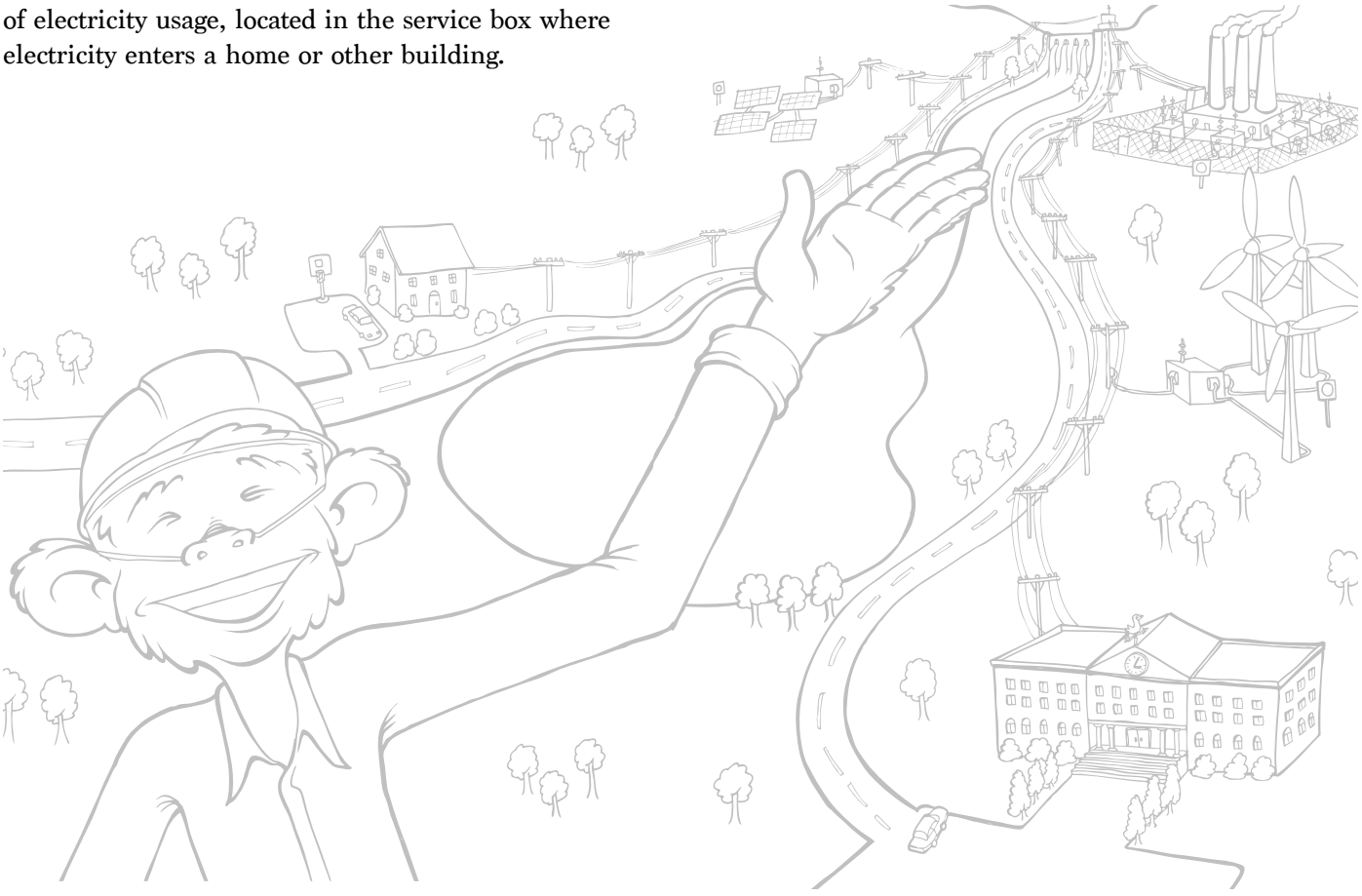
Materials

Poster paper, markers, colored pencils, and/or crayons

Activity Procedure

Before starting the activity, talk with the whole class about each step that electricity goes through in its journey to their homes. Write the name of each step and a short definition beside it to guide the students in their map making.

► Ask the students to use the information provided to map out (step-by-step) the journey electricity takes from the power plant to their homes. Remind them to draw and label all the steps.



3. Spreading Electricity Safety Awareness!

Introduction
Now that you know how to be safe around electricity, spread the word!

Objective and Learning Goals
Students will learn to communicate electricity safety ideas to their school community.

Time and Groups
45–60 minutes; small groups of 2–3 students

Materials
Poster paper and colored pencils or markers

Activity Procedure
► Divide students into small groups.

► Ask students to create posters to hang up around the school to spread their electricity safety ideas.

At Home Activities to Extend Learning!

1. Electricity at Home

Overview
Families use electricity in many ways at home. How does your family use electricity?

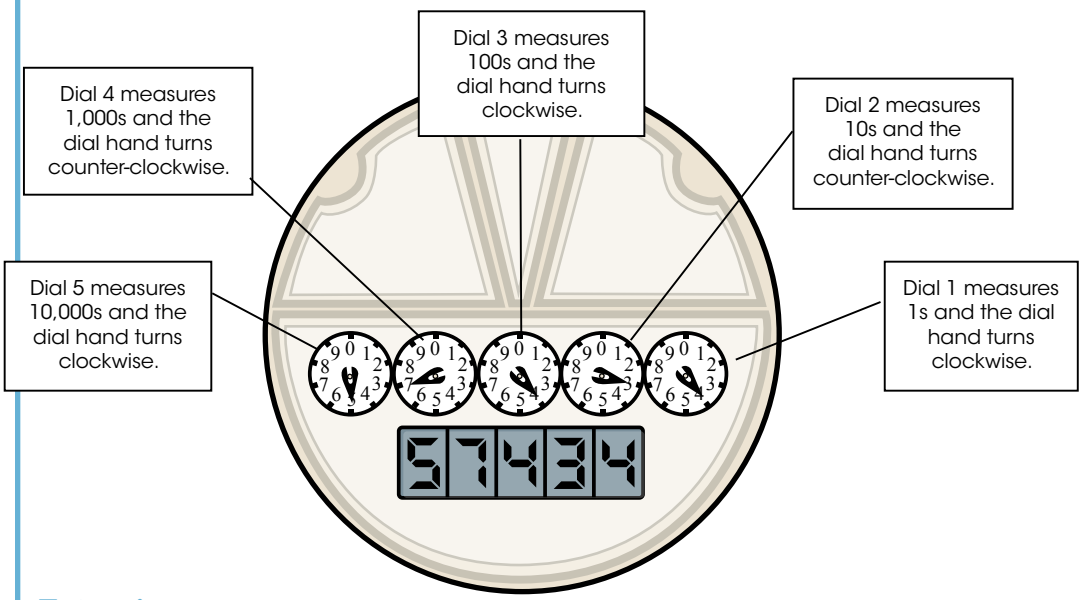
Exploration
With an adult helper, list (or draw) how you use electricity around the house.

Extension
Be an electricity saver detective! How can you save energy in your home? How can you use less?

2. Meter Reader

Overview
When you use electricity in your home, it first passes through an electric meter. The meter tells your electricity company how much energy you use. Electricity costs money, and the more you use the bigger the bill! The meter measures electricity usage in kilowatt-hours (kWh), or the amount of energy used over a length of time. The average cost for power is $0.10 per kilowatt-hour. An electric meter may look complicated, but once you learn about the different parts you will be able to read your home's meter and help your family keep track of their electricity usage.

Exploration
Can you read your electric meter? Remember to ask an adult for help. The electric meter may be read from right to left—the opposite of how you read a book. If the dial is in between two numbers, record the smaller number.



An Electric meter can look complicated, but its easy once you learn how!

Here's an example: This meter reads 57,434 kWh.

Extension
How many kilowatt-hours (kWh) did your family use this month? How much would your monthly bill be if the average cost is $0.10 per kilowatt-hour?

_____ _____ _____

(monthly kilowatt-hours) × (average cost) = monthly bill

3. Safety at Home

Overview
If you keep the Safety Squad's electricity safety tips in mind, you can enjoy and use electricity in your home without worry.

Exploration
Make an electricity safety list for your home. Include safety tips and emergency phone numbers.

Extension
Hold a family meeting and make sure everyone in your house knows what to do to be safe around electricity.

Glossary of Useful Terms

Appliance A home device such as an oven, refrigerator, or washing machine.

Coal A blackish rock that forms over millions of years from organic materials; it is extracted from the earth and used to make a large portion of the electricity we use every day.

Flammable Materials that can easily catch fire.

Power Line Wires that carry electricity to homes, schools, and businesses.

Oil A dark-colored liquid used to make fuels such as gasoline, jet fuel, and diesel fuel. It's most commonly formed over millions of years from organic material that lived in marine environments.

Power Plant The facility where electricity is made.

Natural Gas A gas used in many homes for heating and cooking. Natural gas is also a product of millions of years of plant and animal decay; it is extracted from pockets deep within the earth.

Correlation to Standards

This educator's guide can be correlated to the standards listed below for students in grades K–5. The activities provided in this guide allow children to use appropriate techniques to collect, organize, communicate, and visualize data. Selected lessons also enable the use of mathematics to ask questions and form conclusions.

National Science Education Standards K-4

Content Standard A: Science as Inquiry, A1. Abilities necessary to do scientific inquiry, A2. Understanding about scientific inquiry
Content Standard B: Physical Science, B3. Light, heat, electricity, and magnetism
Content Standard E: Science and Technology, E2. Understanding about science and technology
Content Standard F: Science in Personal and Social Perspectives, F3. Types of Resources, F5. Science and technology in local challenges

Next Generation Science Standards

Scientific and Engineering Practices: Asking questions and defining problems; Planning and carrying out investigations; Analyzing and interpreting data; Obtaining, evaluating, and communicating information
Disciplinary Core Ideas: ESS3.A Natural resources; ESS3.C Human impacts on Earth systems; PS3.A Definitions of energy
Crosscutting Concepts: Structure and Function

Common Core Standards

English Language Arts & Literacy in History/ Social Studies, Science, and Technical Subjects K-5

Reading: Informational Text
Key Ideas and Details: CCSS.ELA-LITERACY.RI.K.1, 1.1, 1.2, 1.3, 1.4, 1.5; CCSS.ELA-LITERACY.RI.K.2, 1.2, 2.2, 3.2, 4.2, 5.2
Craft and Structure: CCSS.ELA-LITERACY.RI.K.4, 1.4, 2.4, 3.4, 4.4, 5.4
Integration of Knowledge and Ideas: CCSS.ELA-LITERACY.RI.K.8, 1.8, 2.8, 3.8, 4.8, 5.8
Range of Reading and Level of Text Complexity: CCSS.ELA-LITERACY.RI.K.10, 1.10, 2.10, 3.10, 4.10, 5.10

Writing
Text Types and Purposes: CCSS.ELA-LITERACY.W.K.1, 1.1, 2.1, 3.1, 3.1.A, 3.1.B, 4.1, 4.1.A, 4.1.B, 5.1, 5.1.A, 5.1.B
Production and Distribution of Writing: CCSS.ELA-LITERACY.W.K.5, 1.5, 2.5, 3.5, 4.5, 5.5
Research to Build and Present Knowledge: CCSS.ELA-LITERACY.W.K.8, 1.8, 2.8, 3.8, 4.8, 5.8

Speaking & Listening
Comprehension and Collaboration: CCSS.ELA-LITERACY.SL.K.1, K.1.A, K.2.B, 1.1, 1.1.A, 1.1.B, 1.1.C, 2.1, 2.1.A, 2.1.B, 2.1.C, 3.1, 3.1.A, 3.1.B, 3.1.C, 3.1.D, 4.1, 4.1.A, 4.1.B, 4.1.C, 4.1.D, 5.1, 5.1.A, 5.1.B, 5.1.C, 5.1.D
Presentation of Knowledge and Ideas: CCSS.ELA-LITERACY.SL.K.5, 1.5, 2.5, 3.5, 4.5, 5.5

Language
Vocabulary Acquisition and Use: CCSS.ELA-LITERACY.L.K.4, 1.4, 2.4, 3.4, 4.4, 5.4

Mathematics Standards K-5
Counting & Cardinality: CCSS.MATH.CONTENT.K.CC.B.4, B.4.A, B.4.B, B.4.C; CCSS.MATH.CONTENT.K.CC.C.6
Operations & Algebraic Thinking: CCSS.MATH.CONTENT.K.OA.A.1, 1.OA.A1, 2.OA.A1, 3.OA.A1, 4.OA.A1, 5.OA.A1
Measurement & Data: CCSS.MATH.CONTENT.K.MD.B.3; CCSS.MATH.CONTENT.1.MD.C.4

References

- Energy Star: www.energystar.gov
- Energy Quest: www.energyquest.ca.gov
- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). Common Core State Standards. Washington, DC: Authors.

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