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Energy Curriculum Map

Building on their present knowledge base, students will have the opportunity to learn about various types of energy using the five-step investigative method.

In each section you will find:

- Teacher Notes: ideas and suggestions for conducting experiments and completing activities.
- Materials List: items needed to carry out experiments and activities.
- Pre-assessment Quiz: a quick overview of what students already know about the topic.
- Activities and Experiments: simply laid out instructions and worksheets.
- What Have You Learned?: A quick review of concepts covered and a check for student understanding.

Contents Include:

- At A Glance – Skill List
- Teacher Rubric
- Student Rubric
- Introduction

Activities and Experiments

Light and Sound Energy

- Teacher Notes
- Materials List
- Answer Key
- Pre-assessment Quiz
- Student Activities and Experiments
- What Have You Learned?

LIGHT:

1. Natural and Artificial Light:

- Meaning of natural and artificial light
- Identify sources of each type of light
- Distinguish between objects giving off light and heat, and those that give off light but no heat

2. Behavior and Characteristics of Light

- How light travels
- Meaning of emission and reflection
- Identify objects that emit or reflect light

- Recognize the importance of light reflectors in daily safety
- Meaning and relationship of reflection and refraction
- Identify objects that are related to light

3. Uses of Light

4. The Meaning of the Spectrum

5. Invisible Light

SOUND:

1. Sound waves

- How sound is produced
- How sound travels
- Measuring sound

2. Information from Sound and Uses of Sound

3. Characteristics of sound

4. The Human Ear: how it hears sound

5. Making a Musical Instrument

Conservation of Energy

- Teacher Notes
- Materials List
- Answer Key
- Pre-assessment Quiz
- Student Activities and Experiments
- What Have You Learned?

1. Characteristics of Energy:

- suppliers and types of energy
- kinetic and potential energy
- friction
- input and output

2. Sources

- features of different energy sources
- renewable and non-renewable
- energy pyramid

3. Applications

- storage of energy for later use
- transference

4. The future of energy

- human use of energy
- conservation practises and plans
- alternative sources

5. Research a topic and present results.

Electrical Energy

- Teacher Notes
- Materials List
- Answer Key
- Pre-assessment Quiz
- Student Activities and Experiments
- What Have You Learned?

1. Characteristics of Electricity:

- identify presence in daily life
- current and static electricity

2. Investigate:

- transformation of electrical energy into other forms
- the relationship between electricity and magnetism in an electromagnetic device
- electromagnetic energy
- materials that conduct electricity
- different types of switches that are used to control electrical devices

3. The future of electricity:

- human use
- standby power
- conservation practises and plans

4. Research a topic and present results.

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Activities and Experiments

Conservation of Energy

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Answer Key is after the Teacher Notes pages i to iii





Introduction

Teacher Notes

The activities in this book have two intentions:

- To teach concepts related to energy.
- To provide students with the opportunity to apply necessary skills needed for the mastery of science and technology curricula.

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

1. Consider a question to investigate.

It is important to choose a question that is clear and that the students are capable of answering.

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 sound will travel through wood.” 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 can be recorded in written, table (chart) or picture form.

5. Draw a conclusion.

Do the results support the hypothesis? Encourage the students to share their conclusions with their classmates.

The experiments and activities in this book fall under three categories:

Light and Sound Energy, Conservation of Energy, and Electrical Energy.

In each section you will find:

- **Teacher Notes:** ideas and suggestions for conducting experiments and completing activities.
- **Materials List:** items needed to carry out experiments and activities.
- **Pre-assessment Quiz:** a quick overview of what students already know about the topic.
- **Activities and Experiments:** simply laid out instructions and worksheets.
- **What Have You Learned?:** A quick review of concepts covered and a check for student understanding.





Conservation of Energy

Teacher Notes

Using their present and prior knowledge base, students will begin to examine and explore the forms of energy that they encounter daily, their sources, and reflect on how we can conserve energy in our society. Through a variety of experiments and activities, students will have the opportunity to learn the following:

1. Characteristics of Energy:

- suppliers and types of energy
- kinetic and potential energy
- friction
- input and output

2. Sources

- features of different energy sources
- renewable and non-renewable
- energy pyramid

3. Applications

- storage of energy for later use
- transference

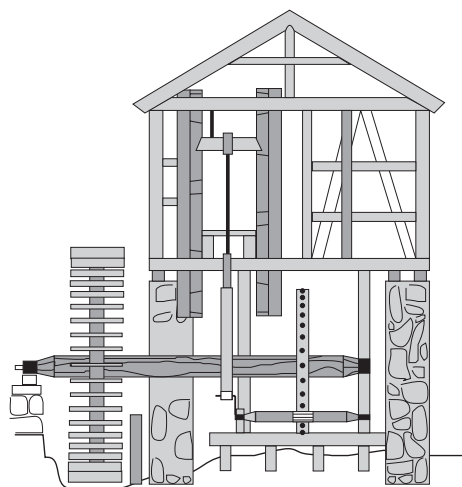
4. The future of energy

- human use of energy
- conservation practises and plans
- alternative sources

5. Research a topic and present results.

6. WHAT HAVE YOU LEARNED?

An activity to assess student understanding of the qualities of energy and of conservation and terms used in relation to this topic.





Materials List for Conservation of Energy Experiments and Activities

Teacher Notes

Suggestions:

- Review the scientific method
- Try any experiments in advance before students attempt them.
- Collect all materials required before beginning an activity or experiment.
- Plan for modification for individual student needs.
- Discuss and practice safety rules and procedures.
- Student can perform experiments individually, in pairs or in teams.

Experiment or Activity	Page #	For each child/pair or team, you will need
Friction: What is It? Experiment #1	53 - 54	• a pair of woolen mitts • a sample piece of carpet • a small rubber or plastic ball
Friction and Heat Experiment #2	55 - 56	• a brick • a piece of concrete or a rough rock • a long nail
Future Uses and Alternate Sources Activity #9	62	• access to computer lab • art supplies for poster making





What Do You Know about Conservation of Energy?

Name: _____

Pre-assessment Quiz

You are going to be learning about characteristics of energy and some ideas for conservation by doing all kinds of experiments and activities. However, you probably already know a few things about energy and its conservation. Think about what you know, then complete the questions below.

A. TRUE or FALSE?

Read the statement then circle **True** or **False**

All energy comes from the sun.	True	False
We will always have endless supplies of oil and gas.	True	False
All energy sources renew themselves.	True	False
Wind power would be the best source of inexpensive energy.	True	False
We use all sources of energy equally in our country.	True	False
Even a small effort at energy conservation makes a difference.	True	False
Friction is useful in our everyday life.	True	False
Even when we are not working, we have stored energy.	True	False

B. What are some things you would like to learn about energy and its use in our world?





Energy Suppliers

Name: _____

Activity I

Energy is what makes things “go”. Everything that changes or moves has some form of energy.

We are using energy all the time each day. Whether we are walking, talking, running, or even sleeping, we are using energy. Machines use energy. Actions in nature require energy.

Here are some suppliers of energy:

batteries

food

gasoline

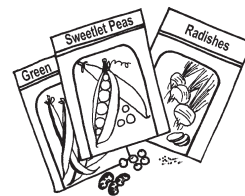
sun

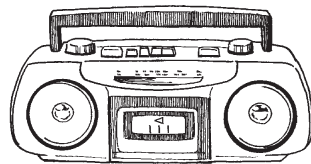
wind

wood

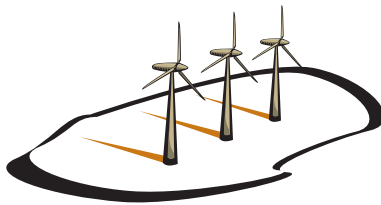
Write the name of the energy supplier under each of these pictures.

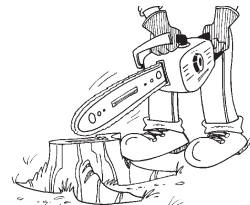


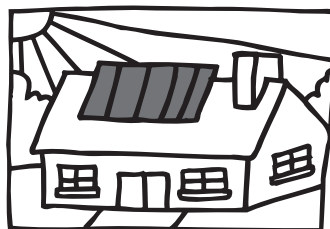


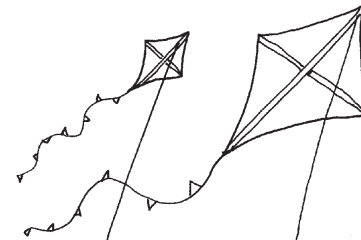
















Forms of Energy

Name: _____

Activity 2

Energy comes in many forms and serves many purposes in our lives.

1. Solve the puzzle by matching words in the Words Box to the clues.

Write your answers on the puzzle grid.

chemical electrical gravitational heat light sound wind

1.														
2.														
3.														
4.														
5.														
6.														
7.														

1. Hot objects have more of this energy than cold objects.
2. This energy is found in moving air.
3. This energy allows us to see the things around us.
4. This energy is produced by a vibrating object.
5. This energy is produced by a chemical reaction.
6. This energy is used by our toasters, grills and coffee makers.
7. This energy is found in an object that is above the surface of the earth.

2. Give an example for your home of each of these forms of energy:

a) electrical _____

b) sound _____





States of Energy

Name: _____

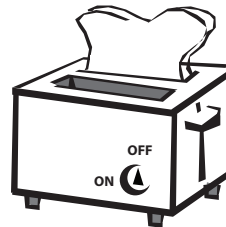
Activity 3

There are two main states of energy:

- **Potential** energy is **stored energy** that an object has when it is not moving. It gives the object the ability to do work. Potential energy is hard to see, but it is there.
- **Kinetic** energy is **energy in action**. We see it when an object is moving or doing work.

1. Look at each of these examples and decide on the state of energy.

Write **potential** or **kinetic** on the line under the picture.



2. Look at the examples below. Think about the form of energy shown.

Then draw a picture to show what the other state of energy would look like.

Potential Energy	Kinetic Energy





Friction: What is It?

Name: _____

Experiment I



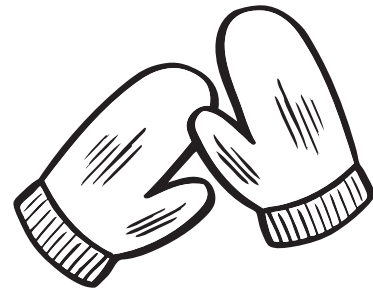
- a pair of woolen mitts
- a sample piece of carpet
- a small rubber or plastic ball

Moving objects have energy. Also, it takes energy to make things move. In this experiment, you will see how movement is affected.

Write your ideas for these questions.



What do you think is meant by the word "friction?"



1. Set the piece of carpet on your desk.
2. Put on your woolen mitts.
3. Place your hand on top of the ball.
4. Roll the ball as far as you can by keeping your hand on top of it.
5. Record your observations on the chart. Repeat the action, but with a couple of changes.
6. Place your hand (keep on those mitts!) flat on the surface of one end of the carpet.
7. Try to push your hand down onto the carpet and try to move forward to the other end.
8. Record your observations on the chart.





Name: _____

Friction: What is It?

Experiment I



Draw a diagram to show what you did for each of these attempts to move your hand on the carpet.

Moving my hand down the carpet with my hand on a ball.	Moving my hand down the carpet with my hand flat on the carpet.

Record your observations:

	Moving my hand down the carpet with my hand on a ball.	Moving my hand down the carpet with my hand flat on the carpet.
Describe how your hand was able to move.		
Would you say that moving your hand was easy or hard?		
What might have made moving your hand easier?		



When we try to move one object along another, we create **friction**.

From your experiment results, what do you think is the meaning of **friction**?

Why was it easier to move your hand when it was on top of the ball?

Why was it harder to move your hand when it was flat on the carpet?





Friction Makes Heat

Name: _____

Experiment 2



- a brick, a piece of concrete or a rough rock
- a long nail

You have shown that friction is the rubbing together of surfaces that slows down and stops movement. In this experiment, you will learn more about friction.



What will happen when you rub the tip of the nail quickly backwards and forwards across the brick, concrete or rock?



1. Feel the tip of the long nail. How does it feel?
2. Rub the nail quickly backwards and forwards across the brick, concrete or rock.
3. Feel the tip again.
4. Draw a diagram to show what you did.
5. Record your observations.

Diagram: Remember to label each object.





Friction Makes Heat

Name: _____

Experiment 2



Record your observations on the chart.

Compare	What the tip of the nail felt like before I rubbed it on the brick, concrete or rock.	What the tip of the nail felt like after I rubbed it on the brick, concrete or rock.
Sharpness of tip		
Temperature		



What was the effect of friction on:

1. the sharpness of the nail _____

2. the temperature of the nail _____

Friction can either help or hinder us in everyday life.

Think of some situations where friction is useful and those when it is not useful.
Record your answers on the chart.

Friction is useful in everyday life.	Friction is not so useful in everyday life.
Example: The brakes on a car grip the road and make the car stop.	Example: moving heavy objects that are sitting flat on a surface.





Name: _____

Energy Input and Output

Activity 4

Scientists confirmed some time ago that energy cannot be made or destroyed. We can only change one kind of energy into another form.

Think about the energy that is put into these objects. This is **energy input**.

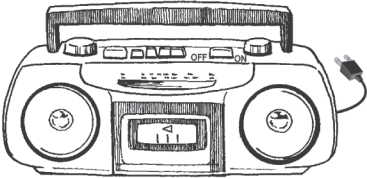
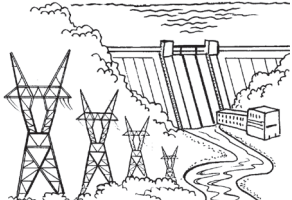
Think about the energy that **comes out** of these objects. This is **energy output**.

Look at the names of the types of energy input and energy output.

Energy Input	Energy Output
chemical electrical gravitational	electrical heat light and heat sound

Choose the correct type of energy for each object.

Write your answers under the correct heading on the chart.

Energy Input	Object	Energy Output
		
		
		
		





Where Do We Get Our Energy?

Name: _____

Activity 5

We need energy to grow, to do work, and to have fun. Draw the missing link in this human energy chain.



Food stores potential energy for us to use at a later time. Draw the missing link in this animal energy chain.



Energy Pyramid

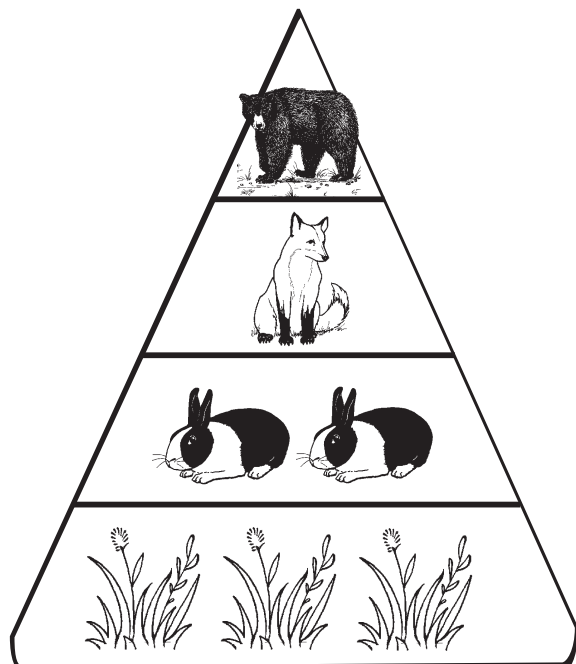
The food chain works in a pyramid shape because the farther up the food chain you go, the less food (and the less energy) there is available. Complete this Energy Pyramid by writing three examples for each category at each level.

Large Carnivore

Small Carnivore

Herbivore

Plants





Energy Sources

Name: _____

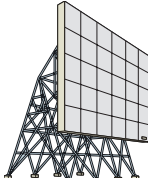
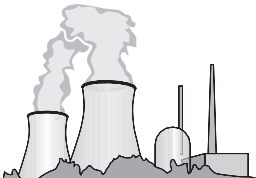
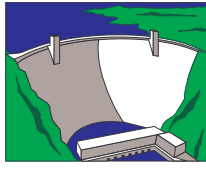
Activity 6

Almost all energy sources can be linked back to the sun. As our world population grows, we are using more and more of our present energy sources.

1. Match the name of the energy source with the clue. Write the number of the word in the box in front of the clue.

Name of Source	#	Description of Source: your clue
1. biomass		Power that is made by forcing water through narrow channels that will turn gigantic blades in a turbine and then create electricity.
2. chemical		Natural resources like coal, oil, and natural gas are burned in order to produce electricity.
3. fossil fuels		Uranium rock is heated so that the atoms are broken up. This creates an enormous amount of heat.
4. geothermal		Water that collects in cracks near a volcano will become hot. The hot water will then force its way up to the surface. The natural steam can be used to power the turbines.
5. hydroelectric		This is one of the oldest sources of energy. However, their generators can be noisy, take up a lot of room, and have to be located where their source is strongest.
6. nuclear		This is the best source of unlimited energy. It is clean and non-polluting. However, at the present time, it is not the most practical source.
7. solar		This energy is produced when garbage like paper, food scraps, and wood are burned. It can be burned in special power stations.
8. wind		When certain chemicals are combined with certain metals, electrical energy is produced.

2. Match the names of the energy sources with the pictures.





Renewable and Non-Renewable Sources

Name: _____

Activity 7

Read the following passages:

Renewable energy sources are those that will not run out. The sun will keep shining, the wind will keep blowing, and the rivers will keep flowing. These resources are constantly being renewed in the course of daily life in the natural world. The renewable sources include sun, wind, waves and tides, rivers and plant matter.

Renewable sources will be able to provide a great deal of energy while at the same time, doing far less environmental damage. They do not produce as much pollution and waste. They also do not contribute to major problems like greenhouse warming in the way that some other sources do.

Non-renewable energy sources do not last forever and can be used up. It takes thousands of years to replace some of these sources. Non-renewable sources include fossil fuels like coal, oil, and natural gas, and chemical energy.

Non-renewable sources are reliable to obtain and are cheaper to convert to energy. Most of the world continues to rely on these sources. However, they produce greater pollution and waste and are presently causing the greatest environmental damage.

Use the information in the passages (and your own knowledge) to complete the following.

- A. Tell whether each energy source is renewable or non-renewable. Write the name of the source under the correct heading.

biomass, chemical, fossil fuels, geothermal, hydroelectric, nuclear, solar, wind

Renewable Energy Sources	Non-Renewable Sources

- B. Compare the advantages and disadvantages of the following energy sources.

Energy Source	Advantages	Disadvantages
Geothermal energy		
Nuclear energy		
Wind power energy		





Name: _____

Use and Conservation of Energy

Activity 8

We know that human use of energy is far greater now than it was even 50 years ago. You have heard your parents and grandparents talk about what life was like then.

1. Think about some reasons for this great increase.

Write at least 5 reasons for greater use of energy.

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____

2. Contrast a household of 50 years ago to a modern day one as to how we use energy. Write your ideas about these points.

Household Situation	50 Years Ago	Modern Day
heating the house		
cooking meals		
doing the dishes		
doing the laundry		
doing your homework		
showers and baths		

3. Think about energy use in your own home and how you could work to conserve energy. Write down as many ways as you can that you could do to save energy resources. Include things you do outside your home as well. For example: walk to school (* Use the back of this sheet if you need more room for answers).

- a) _____
- b) _____
- c) _____
- d) _____
- e) _____
- f) _____



Future Use and Alternate Sources

Name: _____

Activity 9

Energy is the driving force behind our daily life. As we use more and more resources to make our lives more comfortable, we will need to look at alternative sources of energy production. Scientists are currently working on the development of new ideas and their use in our world. As well, they are looking at ways to streamline some of the current sources --- like wind and solar power --- to make them more practical and affordable.

Some growing areas of energy development are:

- solar
- wind
- geothermal
- biomass
- fuel cells

In this activity, you will find out more about one of these energy options.

1. Select one choice from the five energy sources listed above.
2. Use research resources to find out more about your source. These internet sites provide some useful information:

www.alternate-energy-sources.com

www.ecokidsonline.com

www.eere.energy.gov/kids

www.eia.doe.gov/kids

www.alternative-energy-use.com/kids-corner

3. Write a short report to tell about your energy source.
Include:
 - a basic description of the source
 - how it is harnessed and used in today's world
 - advantages and disadvantages of this source
 - what you think is the future of this energy source in our lives.
4. Design a poster to promote your alternative energy source.
Include:
 - an attention getting caption
 - a colorful illustration showing your ideas about this source.
 - all of the information from your report (from # 3 above)
5. Share your poster with the class.





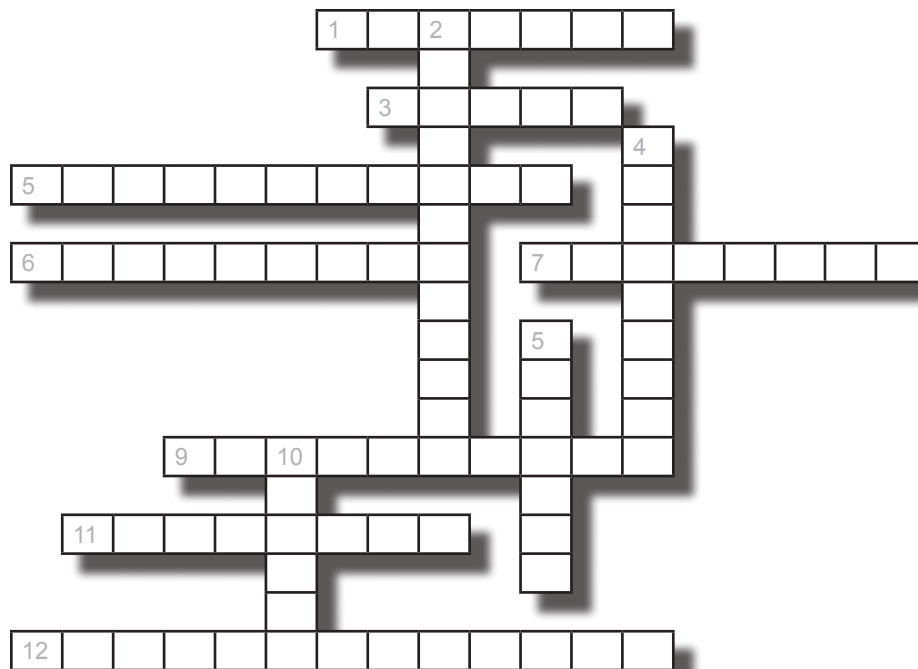
Name: _____

Conservation of Energy: What Have You Learned?

We have learned a number of new ideas and terms about the use and conservation of energy.

Complete the crossword puzzle using the words in the Word Box.

biomass	chemical	fossil fuels	friction	geothermal	gravitational
input	kinetic	non-renewable	output	potential	renewable



Across

1. energy in action
3. when energy goes into an object
5. natural resources like oil and coal
6. energy sources that will not run out
7. combination of chemicals and certain metals to produce electrical energy
9. hot water and steam power the turbines
11. a rubbing that slows down and stops movement
12. energy found in objects that are above the Earth's surface

Down

2. energy sources that do not last forever
4. energy that is stored for later use
5. producing energy by burning garbage like paper, food scraps, and wood
10. when energy comes out of an object

