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Lesson Focus

Lesson focuses on simple machines and how they can be found in many everyday items. Students explore the different types of simple machines, how they work, and how they are integrated into many items. Students explore common kitchen machines and identify how many simple machine types are incorporated into each item.

Lesson Synopsis

The Simple Kitchen Machines activity is designed to introduce simple machine concepts to younger children allowing them to work in teams to determine whether simple machines are incorporated in the design of everyday kitchen items. Students evaluate the different machines, complete an evaluation sheet, and present their reflections to the class.



Age Levels

8-11.

Objectives

- ✦ Learn about different types of simple machines.
 - ✦ Learn about engineering design.
 - ✦ Be able to identify simple machines as part of daily life.
 - ✦ Learn about teamwork and working in groups.
-

Anticipated Learner Outcomes

As a result of this activity, students should develop an understanding of:

- ✦ simple machines
 - ✦ engineering design
 - ✦ problem solving
 - ✦ societal impact of engineering
 - ✦ teamwork
-

Lesson Activities

Students learn about different types of simple machines, and working in teams, evaluate several simple kitchen machines to determine how many simple machines are incorporated in each. Students complete a worksheet and present their findings to the class.

Resources/Materials

- ✦ Teacher Resource Documents (attached)
- ✦ Student Worksheets (attached)
- ✦ Student Resource Sheets (attached)

Alignment to Curriculum Frameworks

See attached curriculum alignment sheet.

Internet Connections

- ✦ TryEngineering (www.tryengineering.org)
- ✦ ITEA Standards for Technological Literacy: Content for the Study of Technology (www.iteaconnect.org/TAA)
- ✦ National Science Education Standards (www.nsta.org/publications/nses.aspx)

Recommended Reading

- ✦ Simple Machines (Starting With Science) by Adrienne Mason, Deborah Hodge, the Ontario Science Centre (Publisher: Kids Can Press; (March 2000) ISBN: 1550743996
- ✦ Science Experiments With Simple Machines (Science Experiments) by Sally Nankivell-Aston, Dorothy Jackson (Publisher: Franklin Watts, Incorporated; (September 2000) ISBN: 0531154459

Optional Writing Activity

- ✦ Write an essay or a paragraph describing three simple machines you can find in an office or classroom.

Simple Kitchen Machines



For Teachers: Teacher Resources

◆ Lesson Goal

The Simple Kitchen Machines activity is designed to introduce simple machine concepts to younger children allowing them to work in teams to determine whether simple machines are incorporated in the design of everyday kitchen items. Students evaluate the different machines, complete an evaluation sheet, and present their reflections to the class.

◆ Lesson Objectives

- ✦ Learn about different types of simple machines.
- ✦ Learn about engineering design.
- ✦ Be able to identify simple machines as part of daily life.
- ✦ Learn about teamwork and working in groups.

◆ Materials

- ✦ Student Resource Sheets and Worksheet
- ✦ Optional Extension: Allow students to explore a variety of simple kitchen machines in the classroom. This will depend on the age of your students. If you use actual kitchen machines, use caution with sharp parts with young children.

◆ Procedure

1. Show students the various Student Reference Sheets. These may be read in class, or provided as reading material for the prior night's homework.
2. Divide students into groups of 2-3 students.
3. Explain that students are investigating engineers and need to determine whether a series of simple kitchen machines include simple machines. The examples may include none, or multiple simple machines in each device (the can opener for example.)
4. Students also evaluate different designs of can openers and work as a team to determine what the engineering goals were that resulted in the variances.
5. Student teams complete worksheets with their findings.
6. Student teams present their observations to the class.

◆ Time Needed

One 45 minute session







Simple Kitchen Machines



Teacher Worksheet

Student Worksheet: Are These Machines? (sample answers)

Work in teams and examine the drawings below to determine whether these are simple machines. Some of these simple kitchen machines have more than one type of simple machine included in the design. See how many you can identify!

| | |
|---|--|
|  | <p>Notes:</p> <p>A knife is a wedge.</p> |
|  | <p>Notes:</p> <p>Scissors incorporate both a wedge and a screw.</p> |
|  | <p>Notes:</p> <p>The blind is controlled by a pulley.</p> |
|  | <p>Notes:</p> <p>A cheese grater is a wedge.</p> |
|  | <p>Notes:</p> <p>This pizza cutter contains a wedge, a wheel, and an axle.</p> |
|  | <p>Notes:</p> <p>A can opener contains four simple machines...a screw, a lever, a wedge, and a wheel and axle.</p> |






Simple Kitchen Machines



Teacher Worksheet

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| | |
|---|---|
|  | <p>Notes:</p> <p>These spoons are levers.</p> |
|  | <p>Notes:</p> <p>A spoon is a lever.</p> |
|  | <p>Notes:</p> <p>This cheese slicer is a wedge.</p> |
|  | <p>Notes:</p> <p>A bottle opener is an example of a lever.</p> |
|  | <p>Notes:</p> <p>A fork is a lever and can also serve as a wedge.</p> |

Simple Kitchen Machines



Student Resource Kitchen Simple Machines

◆ What are Simple Machines?

A simple machine is any device that only requires the application of a single force to work. Work is done when a force is applied and results in movement over a set distance. The work done is the product of the force and the distance. The amount of work required to achieve a set objective is constant, however the force required can be reduced provided the lesser force is applied over a longer distance. Increasing the distance reduces the force. The ratio between the two is the mechanical advantage. The traditional list of simple machines is: inclined plane, wheel and axle, lever, pulley, wedge, and the screw.

| SIMPLE MACHINES | WHAT IT IS | HOW IT HELPS US WORK | EXAMPLES |
|-----------------------|--|--|--|
| LEVER | A stiff bar that rests on a support called a fulcrum | Lifts or moves loads | Nail clipper, shovel, nutcracker, seesaw, crow-bar, elbow, tweezers, bottle opener |
| INCLINED PLANE | A slanting surface connecting a lower level to a higher level | Things move up or down it | Slide, stairs, ramp, escalator, slope |
| WHEEL AND AXLE | A wheel with a rod, called an axle, through its center: both parts move together | Lifts or moves loads | Doorknob, pencil sharpener, bike |
| PULLEY | A grooved wheel with a rope or cable around it | Moves things up, down, or across | Curtain rod, tow truck, mini-blind, flag pole, crane |
| WEDGE | A portable double inclined plane, used to separate two portions of objects, through the application of force | Split objects or portions of objects | Axe, nails, teeth, scissors |
| SCREW | A helical inclined plane | Converts a rotational force (torque) to a linear force | Automated garage door, Archimedes' screws, worm gears, and simple screw |

Some machines contain multiple simple machines. A can opener contains four simple machines...a screw, a lever, a wedge, and a wheel and axle. The wedge is found on the cutter, the lever is the handle, and the screw is the device that holds the can-opener together. The wheel and axle attaches the cutter to the opener. They all work together to make opening a can much easier!



Simple Kitchen Machines

Simple Kitchen Machines



Student Worksheet: Are These Machines?

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| | |
|---|--------|
|  | Notes: |
|  | Notes: |
|  | Notes: |
|  | Notes: |
|  | Notes: |
|  | Notes: |

Simple Kitchen Machines



Student Worksheet: Are These Machines?

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| | |
|---|--------|
|  | Notes: |
|  | Notes: |
|  | Notes: |
|  | Notes: |
|  | Notes: |

Simple Kitchen Machines



Student Worksheet: Engineering Design

Engineers are continually looking to improve products and systems that are already in place. Take a look at each of the following different types of can openers and reflect on what you think the engineering team was hoping to achieve through the unique design. Some versions might be lighter weight, easier to use, nicer to look at, easier to hold...you decide what you think the goals of the engineers might have been!

| | |
|---|--------------------|
|  | Engineering Goals: |
|  | Engineering Goals: |
|  | Engineering Goals: |
|  | Engineering Goals: |

Simple Kitchen Machines



For Teachers: Alignment to Curriculum Frameworks

Note: Lesson plans in this series are aligned to one or more of the following sets of standards:

- U.S. Science Education Standards (http://www.nap.edu/catalog.php?record_id=4962)
- U.S. Next Generation Science Standards (<http://www.nextgenscience.org/>)
- International Technology Education Association's Standards for Technological Literacy (<http://www.iteea.org/TAA/PDFs/xstnd.pdf>)
- U.S. National Council of Teachers of Mathematics' Principles and Standards for School Mathematics (<http://www.nctm.org/standards/content.aspx?id=16909>)
- U.S. Common Core State Standards for Mathematics (<http://www.corestandards.org/Math>)
- Computer Science Teachers Association K-12 Computer Science Standards (<http://csta.acm.org/Curriculum/sub/K12Standards.html>)

◆ National Science Education Standards Grades K-4 (ages 4 - 9)

CONTENT STANDARD A: Science as Inquiry

As a result of activities, all students should develop

- ✦ Abilities necessary to do scientific inquiry
- ✦ Understanding about scientific inquiry

CONTENT STANDARD B: Physical Science

As a result of the activities, all students should develop an understanding of

- ✦ Properties of objects and materials
- ✦ Position and motion of objects

CONTENT STANDARD E: Science and Technology

As a result of activities, all students should develop

- ✦ Abilities of technological design
- ✦ Understanding about science and technology

CONTENT STANDARD F: Science in Personal and Social Perspectives

As a result of activities, all students should develop understanding of

- ✦ Personal health
- ✦ Science and technology in local challenges

CONTENT STANDARD G: History and Nature of Science

As a result of activities, all students should develop understanding of

- ✦ Science as a human endeavor

◆ National Science Education Standards Grades 5-8 (ages 10 - 14)

CONTENT STANDARD A: Science as Inquiry

As a result of activities, all students should develop

- ✦ Abilities necessary to do scientific inquiry
- ✦ Understandings about scientific inquiry

CONTENT STANDARD B: Physical Science

As a result of their activities, all students should develop an understanding of

- ✦ Motions and forces
- ✦ Transfer of energy

CONTENT STANDARD E: Science and Technology

As a result of activities in grades 5-8, all students should develop

- ✦ Abilities of technological design
- ✦ Understandings about science and technology

CONTENT STANDARD F: Science in Personal and Social Perspectives

As a result of activities, all students should develop understanding of

- ✦ Science and technology in society

Simple Kitchen Machines

For Teachers: Alignment to Curriculum Frameworks (continued)

◆ National Science Education Standards Grades 5-8 (ages 10 - 14)

CONTENT STANDARD G: History and Nature of Science

As a result of activities, all students should develop understanding of

- ✦ Science as a human endeavor

◆ Next Generation Science Standards Grades 2-5 (Ages 7-11)

Matter and its Interactions

Students who demonstrate understanding can:

- ✦ 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

- ✦ 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

◆ Standards for Technological Literacy - All Ages

The Nature of Technology

- ✦ Standard 1: Students will develop an understanding of the characteristics and scope of technology.
- ✦ Standard 2: Students will develop an understanding of the core concepts of technology.
- ✦ Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

- ✦ Standard 6: Students will develop an understanding of the role of society in the development and use of technology.
- ✦ Standard 7: Students will develop an understanding of the influence of technology on history.

Design

- ✦ Standard 8: Students will develop an understanding of the attributes of design.
- ✦ Standard 9: Students will develop an understanding of engineering design.
- ✦ Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World

- ✦ Standard 13: Students will develop abilities to assess the impact of products and systems.