

Fairy Tale Engineering with Simple Machines

Time Frame: 5 Lessons (Allow 1-2, 40 Minute Periods for Each Lesson)

Quick Links:

- [Wedge - Gingerbread Man](#)
- [Inclined Plane - Rapunzel](#)
- [Wheel & Axle - 3 Billy Goats Gruff](#)
- [Pulleys - Jack & Jill \(or Little Red Hen\)](#)
- [Levers - Little Red Riding Hood](#)

Stage 1 - Desired Results

Big Idea(s)

1. Simple Machines help people work and move loads. Examples include wedges, pulleys, inclined planes, and levers.
2. Simple machines are used in everyday life to make everyday tasks easier by moving objects across distances.
3. Critical thinking can help me solve problems by using given materials to create simple machines to complete tasks that are assigned to my group. Through trial and error and evaluating what works and doesn't work, we can complete the task.
4. The Engineering and Design Process consists of multiple stages/steps to create a product to accomplish a task. When I follow the steps, I can organize my thinking and go back and make changes where necessary.

PA Core Standards / Next Generation Science Standards

T & E Education	Science Education	Mathematics Education	Computer Science	CEW
	<p>3.2.4.D GRADE 4 - Recognize and use the technological design process to solve problems.</p> <ul style="list-style-type: none"> • Recognize and explain basic problems. • Identify possible solutions and their course of action. • Try a solution. • Describe the solution, identify its impacts and modify if necessary. • Show the steps taken and the results. 			<p>*The corresponding 5th Grade CEW Standards can also apply.</p> <p>13.2.3.A - GRADE 3 -Identify appropriate speaking and listening techniques used in Conversation.</p> <p>13.3.3.B - GRADE 3 -Identify how to cooperate at both home and school.</p>

Essential Questions

- What are simple machines?
- How do I use simple machines in my daily life?
- How can I think critically to solve problems with simple machines?
- How can the design process help me create a simple machine to complete a task?

Students Will Know

Students Will Be Doing

1. Simple Machines include lever, inclined planes, wedges, pulleys, and wheel and axles. They help people work and move loads.
2. Using simple machines makes it easier to get from place to place (wheel and axle-car), cutting (lever - scissors), going from floor to floor (stairs - inclined plane) etc.
3. When building a simple machine, it will not always work the way you expect it to the first time. It is a series of testing, improving, and retesting the design.
4. The design process is a series of steps to come up with a solution. The steps include the problem, imagine a solution, come up with a plan, create your solution using your plan, testing your project, and then improving your project.

1. Identifying simple machines and what each simple machine does.
2. Explain how simple machines make everyday tasks easier
3. Evaluating what did and did not work when designing my simple machine and going back to make small changes to improve the design
4. Designing a simple machine using the Design process that completes the assigned task

VOCABULARY STUDENT/STAFF WILL KNOW AND USE

Engineering/Design Process - a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.

Simple Machine- any of the basic mechanical devices for applying a force

Inclined Plane - any slanting surface that is higher on one end; It connects a lower level to a higher level

Lever - a board or bar that rests on a support called a fulcrum; helps lift or move objects called loads

Fulcrum - the support for a lever

Pulley - a wheel and a rope with a load attached to one end of the rope; pulleys let you move a load up or down and to and from hard to reach places

Wheel and Axle - a wheel with a rod through its center; axle lets the wheel turn making the making it easy to move things from place to place

Wedge - an object with at least one slanted side ending in a sharp edge; used to push 2 objects apart; used to keep an object from moving

Critical Thinking - using what you know and new information to find a new way to solve a problem

Communication - a way to share ideas and ask questions

Collaboration - working with someone or a team to produce something

Creativity - using the imagination or original ideas to produce something

Effective - successful in producing desired results

Stage 2 - Evidence of Understanding

Assessments (Formative and Summative):

- Teacher Observation of STEM behaviors (4CS, EDP)
- Class Discussion of how to use simple machines
- Optional: Student digital portfolios with self-reflection (i.e. Seesaw, Screencastify/Google Drive)

Performance Task(s)

- Student Demonstrations of Working Simple Machines
- Student Demonstrations of Creating Solutions that utilize simple machines

Stage 3 - Lesson Learning Targets

Learning Activities:

Learning Target: I can or Today we will..... (What are students learning?)

- I can explain how simple machines work.
- I can demonstrate how simple machines are used to complete a task.

Performance of Understanding: I will show my learning by.... (What are students doing?)

- I will show my learning by explaining and demonstrating to my teacher or peers how simple machines work.
- I will show my learning by creating an item that uses a simple machine to help a fairy tale character.

Success: I will know that I can do this when I can... (What is a successful product, process?)

- I will know that I can do this when I can use communication with my group to describe and plan a successful simple machine.
- I will know that I can do this when I have a complete and functional simple machine in my project.

RESOURCES / LINKS

Activities

Lesson 1: Wedge | Gingerbread Man

FOCUS: A wedge is a simple machine that can cut and separate items. A boat is a wedge that cuts water to move across.

Students create a boat as a wedge that cuts through the water, to get away from the fox.

Materials

- Trough
- Upcycle Supplies: i.e. Plastic bottles, Aluminum Foil etc.
- Water
- Gingerbread Man Story
- Paper/Pencil
- Optional: Student Tablets/devices

Procedures

1. Pre-assessment:
 - a. Find out what students already know about simple machines. Ask:
 - i. What is a wedge?
 - ii. How is a wedge used?
 - b. Discuss how wedges are used and explain them
2. Read the story the Gingerbread man to the students
3. Whole class brainstorm how could the gingerbread man have used a wedge to escape
 - a. Explain how a boat is a wedge
4. Students review materials to use, and build a boat that is a wedge.
5. Test the builds/creations. Improve as necessary.
6. At the end of class pull class back together to discuss success/failures, share boats and review wedges.
7. *If using digital portfolios, students could post their project to a digital portfolio such as seesaw and reflect on the design process.

Lesson 2: Inclined Planes | Rapunzel

Focus: Inclined plane help raise and lower a load. The ladder is a practical inclined plane

Students create a way for Rapunzel to get down from the tower, if she had short hair.

Materials:

- Upcycle Building supplies (will vary in each elementary school)
 - Popsicle Sticks
 - Tape
 - Pipe Cleaners
 - Straws
- Rapunzel Story
- Paper/Pencil
- Optional: Student Tablets/devices

Procedures:

1. *Set up a tower or multiple towers with rapunzel trapped at the top.
2. Read the story to the students.
3. Discuss what an inclined plane is and how it works.
4. Whole class brainstorm how could Rapunzel use an inclined plane to get out of the tower
5. Students review materials to use, and build an inclined plane that will save rapunzel.
6. Test the builds/creations. Improve as necessary.
7. At the end of class pull class back together to discuss success/failures, share inclined planes and review inclined planes.
8. *If using digital portfolios, students could post their project to a digital portfolio such as seesaw and reflect on the design process.

Lesson 3: Wheels and Axles | 3 Billy Goats Gruff

Focus: Wheels and Axles help transport an object across a distance

Students create a car/cart to transport the goats across the bridge that use a wheel and axle.

Materials:

- LEGOs, DUPLOs, K'nexs or Other building supplies
- Paper/Pencil
- Optional: Student Tablets/devices
- 3 Billy Goats Gruff Story

Procedures:

1. **Teacher Prep: Build a "bridge" where students can test their cars/carts.
2. Read the story to the students.
 - a. 3 Billy Goats Gruff
3. Discuss what a wheel & axle is and how it works.
4. Whole class brainstorm on how the goats could have used a car/cart to get across the bridge without the trolls hearing them.
5. Students review materials to use, and build a car/cart with a wheel and axle.
6. Test the builds/creations. Improve as necessary.
7. At the end of class pull class back together to discuss success/failures, share cars/carts and review wheels & axles.
8. *If using digital portfolios, students could post their project to a digital portfolio such as seesaw and reflect on the design process.

Lesson 4: Pulleys | Jack & Jill (or Little Red Hen)

Focus: Pulleys move materials from one location to another using less effort

Students create a pulley to move materials out of a well or from one location to another.

Materials:

- Book: Jack & Jill OR Little Red Hen
- Pencil/Paper
- Upcycle Supplies:
 - Straws
 - TP Tubes
 - String
 - Cups with holes pre punched (or cups and separate scissors/hole punchers etc.)
- Optional: Student Tablet/Device

Procedures:

1. Read the story to the students.
 - a. Jack and Jill or Little Red Hen
2. Discuss what a pulley is and how it works.
3. Whole class brainstorm on how to build a pulley system to fetch a pail of water OR to send materials from one location to another.
4. Students review materials to use, and build a well & pulley or pulley system to transfer materials.
5. Test the builds/creations. Improve as necessary.
6. At the end of class pull class back together to discuss success/failures, share wells/pulleys and review pulleys.
7. *If using digital portfolios, students could post their project to a digital portfolio such as seesaw and reflect on the design process.

Lesson 5: Levers | Little Red Riding Hood

Focus: Levers can move materials from one place to another using force.

Students construct a lever using provided materials in order to deliver cookies to Grandma's house.

Materials:

- Book: Little Red Riding Hood
- Upcycle Supplies: Spoons, Rubber Bands, Popsicle Sticks, Cardboard, Cups etc.
- Optional: Student Devices/Tablets
- Small Cookies - i.e. Teddy Grahams or Cookie Crisp Cereal

Procedures:

1. Read the story to the students.
 - a. Little Red Riding Hood
2. Discuss what a lever is and how it works.
3. Whole class brainstorm on how to use what we know about levers to build a cookie catapult.
4. Students review materials to use, and build a cookie catapult that will transfer the cookies to Grandma's house without having to cross paths with the wolf.
5. Test the builds/creations. Improve as necessary.
6. At the end of class pull class back together to discuss success/failures, share catapults and review levers.
7. *If using digital portfolios, students could post their project to a digital portfolio such as seesaw and reflect on the design process.



