

## Understanding Structures and Mechanisms

### Simple Machine: Inclined Planes

#### Specific Expectations

**Grade 2 – Movement:** **1.1** assess the impact on society and the environment of simple machines that allow movement; **2.2** investigate and describe different kinds of movement; **2.3** investigate the structure and function of simple machines; **2.4** use technological problem-solving skills (see page 16), and knowledge and skills acquired from previous investigations, to design, build, and test a mechanism that includes one or more simple machines; **3.1** describe different ways in which objects move (*e.g., turning, spinning, swinging, bouncing, vibrating, rolling*); **3.2** identify ways in which the position of an object can be changed (*e.g., by pushing, by pulling, by dropping*); **3.3** identify the six basic types of simple machines – lever; inclined plane; pulley; wheel and axle, including gear; screw; and wedge – and give examples of ways in which each is used in daily life to make tasks easier; **3.4** describe how each type of simple machine allows humans to move objects with less force than otherwise would be needed; **3.5** identify simple machines used in devices that move people

**Grade 3 – Strong and Stable Structures:** **2.3** investigate, through experimentation, the effects of pushing, pulling, and other forces on the shape and stability of simple structures; **3.1** define a structure as a supporting framework, with a definite size, shape, and purpose, that holds a load

#### Potential Specific Expectations with minor extensions to the lesson:

**Grade 5 – Forces Acting on Structures and Mechanisms:** **2.2** measure and compare, quantitatively and/or qualitatively, the force required to move a load (*e.g., to lift a book, to open a drawer*) using different mechanical systems (*e.g., different pulley systems, a lever, a gear system*), and describe the relationship between the force required and the distance over which the force moves; **2.5** use appropriate science and technology vocabulary, including *tension, compression, torque, system, and load*, in oral and written communication; **3.3** explain the advantages and disadvantages of different types of mechanical systems

**Grade 8 – Systems in Action:** **2.2** investigate the work done in a variety of everyday activities and record the findings quantitatively; **2.3** use scientific inquiry/experimentation skills (see page 12) to investigate mechanical advantage in a variety of mechanisms and simple machines; **2.6** use appropriate science and technology vocabulary, including *mechanical advantage, input, output, friction, gravity, forces, and efficiency*, in oral and written communication; **3.2** Identify the purpose, inputs, and outputs of various systems; **3.3** Identify the various processes and components of a system that allow it to perform its function efficiently and safely; **3.5** understand and use the formula work = force × distance ( $W = F \times d$ ) to establish the relationship between work, force, and distance moved parallel to the force in simple systems; **3.6** calculate the mechanical advantage ( $MA = \text{force needed without a simple machine} \div \text{force needed with a simple machine}$ ) of various mechanical systems

#### Big Ideas (for lesson):

Students will understand why people create and use simple machines to make tasks easier to perform (*mechanical advantage*)

Students will learn how inclined planes function and how they are used to move heavy objects

Students will see how inclined planes are used effectively in everyday life

#### Accommodations:

- Increase time
- Visual Aids
- Manipulatives
- Chunking
- Step-by-Step
- Scaffolding
- Copy of Notes
- Student Grouping

#### Differentiated Instruction:

- Content: Use demonstrations throughout verbal instruction to help visual learners.
- Process: Students will work in pairs or groups to support each other if limitations or impediments exist.
- Product: Students may demonstrate their learning verbally, visually, or by written means.
- Other: \_\_\_\_\_

#### Multiple Intelligence:

<b>Bloom's Taxonomy:</b>	
<input checked="" type="checkbox"/> Knowledge	<input checked="" type="checkbox"/> Verbal/Linguistic
<input checked="" type="checkbox"/> Comprehension	<input checked="" type="checkbox"/> Logical/Mathematical
<input checked="" type="checkbox"/> Application	<input checked="" type="checkbox"/> Visual/Spatial
<input checked="" type="checkbox"/> Analysis	<input checked="" type="checkbox"/> Bodily/Kinesthetic
<input checked="" type="checkbox"/> Synthesis	<input type="checkbox"/> Naturalist
<input checked="" type="checkbox"/> Evaluation	<input type="checkbox"/> Musical/Rhythmic
	<input checked="" type="checkbox"/> Interpersonal
	<input checked="" type="checkbox"/> Intrapersonal

#### Teachers Notes:

- This lesson is accompanied by a supplementary PowerPoint, "*Inclined Planes (powerpoint)*", and a worksheet, "*Inclined Planes (worksheet)*"
- The use of simple machine kits can be found throughout the lesson – it is recommended that these manipulatives be used to increase the experience and understanding of the students
  - your school might have access to a set of inclined planes you can use for this lesson
  - if this is not available, you can purchase simple machines sets here:
    - [http://www.pitsco.com/Grades\\_3-5/Kits/Simple\\_Machines\\_Set](http://www.pitsco.com/Grades_3-5/Kits/Simple_Machines_Set)
    - <http://www.learningresources.com/product/simple+machines+set.do>
  - if this is still not an option, you can build your own simple machines
  - see below for examples:
    - [http://www.ehow.com/info\\_7969543\\_homemade-simple-machines-kids.html](http://www.ehow.com/info_7969543_homemade-simple-machines-kids.html)
- Extensions to the lesson should be done if it is to be used at the grade 5 or 8 levels
  - The material covered by these lessons is strongly emphasized at the Grade 2 level – the more complex concepts that arise at later grade levels can be situated within the lesson
    - **i.e.** calculating force and mechanical advantage can be added into the lesson
- Resources for teaching and learning about simple machines can be found here:
  - Brainpop, <http://educators.brainpop.com/bp-jr-topic/simple-machines/>
  - Bill Nye The Science Guy: Simple Machines  
[https://www.youtube.com/watch?v=rRjCQGa\\_HCE](https://www.youtube.com/watch?v=rRjCQGa_HCE)
- The font used for the handout is called [Dyslexie](#). It is designed to help dyslexics read, but it is a very easy to comprehend font which will aid all readers.

## Delivering the Lesson

Portion & Timing	Grouping:			Introduction:	Materials
<b>Minds On: 5 minutes</b>	W <input checked="" type="checkbox"/>	S <input type="checkbox"/>	I <input type="checkbox"/>	Teacher introduces <b>inclined planes</b> to students - (ppt slides 1-3) Perform demonstration for class by moving various weights; <a href="#">Gizmos</a> simulation can be used as well - Discuss the <a href="#">Mocomi</a> video	- Inclined plane set to provide example to students - projector technology
<b>Action: 30 minutes</b>	W <input checked="" type="checkbox"/>	S <input checked="" type="checkbox"/>	I <input checked="" type="checkbox"/>	Proceed through " <i>Inclined Planes (powerpoint)</i> " - " <i>Inclined Planes (worksheet)</i> " can be followed along and filled in by students - Answer questions about the simple machine as the lesson proceeds - Students should highlight/underline important vocabulary words Activity: - Separate students into groups or pairs - Allow students to build and operate different inclined plane systems (different slopes) - Have them record their observations by drawing and labelling diagrams of all the different inclined planes they can create - See which group can create the most efficient and effective inclined planes (can lift the most weight easily)	- Inclined plane sets to allow students to explore the use and function of inclined planes
<b>Consolidate: 5 minutes</b>	W <input checked="" type="checkbox"/>	S <input checked="" type="checkbox"/>	I <input type="checkbox"/>	Conclude lesson by taking up worksheet – ensure each student has filled in all the appropriate information - Answer any remaining questions on inclined planes	

### References:

Mocomi; <http://mocomi.com/>

Teach Engineering;

[https://www.teachengineering.org/view\\_lesson.php?url=collection/cub\\_/lessons/cub\\_simple/cub\\_simple\\_lesson01.xml](https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_simple/cub_simple_lesson01.xml)

ExploreLearning Gizmos;

<https://www.explorelarning.com/index.cfm?method=cResource.dspResourcesForCourse&CourseID=361>

Wikipedia; [https://en.wikipedia.org/?title=Simple\\_machine](https://en.wikipedia.org/?title=Simple_machine)

All images from Google image search, Educational websites, and stock photos

All videos found on YouTube for educational purposes