

Gr. 5 – Understanding Structures & Mechanisms

Forces Acting on Structures and Mechanisms

The Pulley/What Gears Do

Specific Expectations:

- 2.1 Follow established safety procedures for working with tools and materials.
- 2.2 Measure and compare, quantitatively and/or qualitatively, the force required to move a load using different mechanical systems, and describe the relationship between the force required and the distance over which the force moves.
- 2.4 Use technological problem-solving skills to design, build, and test a frame structure that will withstand the application of an external force or a mechanical system that performs a specific function.
- 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.

Big Idea (for lesson):

Students will build and explore properties of pulley and gear mechanisms, testing for differences in speed and force. Students will also be introduced to some pulley and gear systems used in everyday life.

Accommodations:

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

Differentiated Instruction:

- Content: Use demo to show the content as you offer verbal descriptions.
- Process: Have students work in pairs and support each other if physical impediments exist.
- Product: Students may show their final product in pairs, and communicate their findings either verbally, visually, or through written means.
- Other: _____

Bloom's Taxonomy:

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

Multiple Intelligence:

- Verbal/Linguistic
- Logical/Mathematical
- Visual/Spatial
- Bodily/Kinesthetic
- Naturalist
- Musical/Rhythmic
- Interpersonal
- Intrapersonal

Gr. 5 – Understanding Structures & Mechanisms

Forces Acting on Structures and Mechanisms

Delivering The Lesson:

Portion & Timing	Grouping:			Introduction:	Materials
Minds On: 10 mins	W <input checked="" type="checkbox"/>	S <input type="checkbox"/>	I <input type="checkbox"/>	Teacher can do a demonstration to introduce the usefulness of simple machines, specifically that of a compound pulley: -Have two students hold the broom handles, and tie the end of the string to one of them. -Bring the string over and around the other broom handle, and continue to wrap around both of them several times. Be sure to keep about 1-2 feet between the two broom handles. -Have the two students try to keep the broom handles apart while a third students pulls the thread. -For more detail, see: http://www.flinnsci.com/documents/demopdfs/physicalsci/ps10409.pdf Ask students about the forces that are occurring in the system: -Would the tension (force in the rope) be the same if it were less wrapped? (<i>Answer: No, it would be less.</i>) -Why do you think it's easier to pull the two broom handles together when there are more "wrap-arounds"? (<i>Answer: the more "wrap-arounds" imitate having more ropes acting to lift the object.</i>)	Broom handles Long thread
Action: 20 mins	W <input checked="" type="checkbox"/>	S <input checked="" type="checkbox"/>	I <input checked="" type="checkbox"/>	Have students build their own pulleys and gears according to the instructions on the handout. Teacher can circulate and ask questions of the different groups: -How many turns does your pulley have? (<i>Answer: 1.</i>) -Does your pulley make it easier to lift something? What advantage does it have? (<i>Answer: it doesn't make it easier since it's just a simple pulley, however it does give the advantage of being able to lift something from a distance and by pulling from a</i>	The Pulley & What Gears Do Handout (Materials listed)

Gr. 5 – Understanding Structures & Mechanisms

Forces Acting on Structures and Mechanisms

				<p><i>different direction.)</i></p> <p>-Is the force on a pulley a push or a pull? How about for gears? (<i>Answer: for a pulley it's a pull, but for a gear, it's a push.</i>)</p> <p>-What's the advantage of using gears? (<i>Answer: You can change the direction of a force, and also create very compact or very large systems.</i>)</p>	
<p>Consolidate: 10 mins</p>	<p>W <input checked="" type="checkbox"/></p>	<p>S <input checked="" type="checkbox"/></p>	<p>I <input type="checkbox"/></p>	<p>Go through the list of simple machines, and discuss whether or not you would use a push or a pull to operate the machine. Discuss different types of these machines and the specific forces acting on and in them.</p>	