

Gr. 4 – Understanding Structures & Mechanisms

Pulleys and Gears

The Pulley/What Gears Do

Specific Expectations:

- 1.1 Assess the impact of pulley systems and gear systems on daily life.
- 2.1 Follow established safety procedures for working with machinery.
- 2.2 Use scientific inquiry/experimentation skills to investigate changes in force, distance, speed, and direction in pulley and gear systems.
- 2.3 Use technological problem-solving skills to design, build, and test a pulley or gear system that performs a specific task.
- 3.1 Describe the purposes of pulley systems and gear systems.
- 3.3 Describe how one type of motion can be transferred into another type of motion using pulleys or gears.
- 3.5 Distinguish between pulley systems and gear systems that increase force and those that increase speed.
- 3.6 Identify pulley systems and gear systems that are used in daily life, and explain the purpose and basic operation of each.

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

Multiple Intelligence:

- Verbal/Linguistic
- Logical/Mathematical
- Visual/Spatial
- Bodily/Kinesthetic

Gr. 4 – Understanding Structures & Mechanisms

Pulleys and Gears

- Synthesis
 Evaluation

- Naturalist
 Musical/Rhythmic
 Interpersonal
 Intrapersonal

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"/>	<p>Teacher can do a demonstration to introduce the usefulness of simple machines, specifically that of a compound pulley:</p> <ul style="list-style-type: none"> -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 <p>Ask students about the forces that are occurring in the system:</p> <ul style="list-style-type: none"> -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>) -How does motion change in this exercise? (<i>Answer: The motion of pulling the rope changes direction with each turn in the system, and overall the brooms will move together.</i>) 	Broom handles Long thread
Action: 20 mins	W <input checked="" type="checkbox"/>	S <input checked="" type="checkbox"/>	I <input checked="" type="checkbox"/>	<p>Have students build their own pulleys and gears according to the instructions on the handout.</p> <p>Teacher can circulate and ask questions of the</p>	The Pulley & What Gears Do Handout

Gr. 4 – Understanding Structures & Mechanisms

Pulleys and Gears

				<p>different groups:</p> <p>-How many turns does your pulley have? <i>(Answer: 1.)</i></p> <p>-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 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>	(Materials listed)
Consolidate: 10 mins	W <input checked="" type="checkbox"/>	S <input checked="" type="checkbox"/>	I <input type="checkbox"/>	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. Talk about the changes of motion in each of these situations as well.	