

a WOW Lab

BLUEPRINT

Pulleys and Mechanical Advantage

Achievements and Competencies

Learning Outcomes

Grades 4-6
Materials and structures
Forces and simple machines
Initiating and planning

Achievements and Competencies are based on the Common Framework of Science Learning Outcomes (K-12) set by the Canadian Council of Ministers of Education (1997).

Specific Expectations

Grade 3

PHYSICAL SCIENCE

Materials and structures

101-9 Test the strength and stability of personally built structures, and identify ways of modifying a structure to increase its strength and stability (e.g., identify and evaluate ways to strengthen a model building, bridge, or other structure that supports a load. Increase the stability of a miniature tower or a model animal).

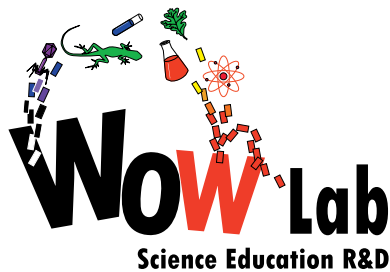
Students attempt to lift their teacher off the ground using a single pulley system. If the structure is modified by adding carabiners, this creates a new pulley system with an increase in mechanical advantage, allowing students to lift their teacher off the ground.

Grade 5

PHYSICAL SCIENCE

Forces and simple machines

107-8 Describe examples of technologies that have been developed to improve their living conditions (e.g., describe technologies such as wheelbarrows and conveyor belts that facilitate the carrying and transportation of products. Identify devices such as the pulley, which is used in a clothesline or in lifting the platforms used by window cleaners).



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Pulleys and Mechanical Advantage - Achievements and Competencies

Pulleys have been used for over two thousand years to achieve mechanical advantage. For example, a giant sailing ship full of cargo and passengers was pulled using only a pulley system. The students will investigate the ratio between the output and input forces in a simple and complex pulley system.

303-12 Investigate different kinds of forces used to move objects or hold them in place.

303-13 Observe and describe how various forces, such as magnetic, mechanical, wind and gravitational, can act directly or from a distance to cause objects to move.

The ratio between the input and output forces are investigated and altered to increase the mechanical advantage of the pulley system. The students will be able to investigate how a simple pulley system consists of equal input and output forces, which makes it difficult for them to lift their teacher. Making adjustments to create a compound pulley system leads to a gain in output force, which gives the students the ability to lift their teacher off the ground.

303-14 Demonstrate and describe the effect of increasing and decreasing the amount of force applied to an object.

The students will be able to describe the difference between trying to lift their classmates and their teacher. A greater force will be required from the students to lift their teacher versus their smaller and lighter classmates.

303-20 Compare the force needed to lift a load using a single pulley system with that needed to lift it using a multiple pulley system.

The students will begin by investigating the force required to lift a load using a simple pulley system. They will be able to determine that a large force is required to accomplish the required movement. Similarly, the students will investigate and compare the force that is required to lift the same load using a compound pulley system.

204-5 Identify and control major variables in their investigations (e.g., control variables such as the load, when testing and comparing simple machines).

Testing the simple and compound pulley systems allow students to identify and control different variables in their investigation.