

ASSESSMENT

Vocabulary List and Test Questions/Answers

1. Pulley

A mechanism with a grooved wheel for carrying a rope to do lifting

2. Fixed pulley

Pulley is attached to a mechanism and does not move.

3. Moveable pulley

Pulley rides up and down the rope as the rope is manipulated

4. Simple Machine

An item which is created to accomplish a task, which uses few parts.

5. Mechanical advantage

Measures whether or not it is easier to accomplish the lifting (work) with a pulley and by how much. Measured in Newtons by dividing the force out by the force in.

6. Support ropes

The number of ropes used in a pulley to accomplish the work. Usually this is equal to the mechanical advantage.

7. Force in

Force applied by the machine, powered by hand in this case, by pulling the rope.

8. Force out

Force acting on the load, as a result of the force in.

9. Newton

Unit of force, creating an acceleration of one meter per second per second on a mass of one kilogram.

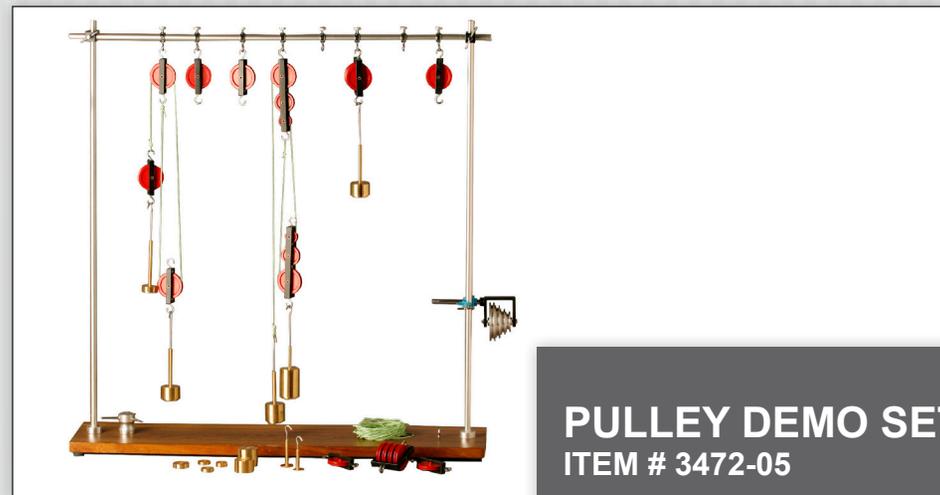
10. Work

When a force moves something. Calculated by $W = F \times D$ (Work = Force times Distance)

1. What is the purpose of a pulley? - To accomplish work with less personal force required, or in the space given by changing direction of the force.
2. What does a flagpole, a sail on a boat, mini-blinds, and a construction crane have in common? - They each use a pulley system
3. What is the formula for Mechanical Advantage? - Force out divided by force in
4. How can knowing this formula help you to construct an effective simple machine? (Effective would mean that it fixes your problem with as little effort as possible, and within your circumstances.) - You could decide how best to create a system that will help your specific circumstance, rather than by guessing. Saves time and gets job done better.
5. What is a downside of a pulley which reduces the required force? - Takes more length of rope, more pulling> (But that pulling is easier)
6. In what unit is the force in and force out measured? - Newton
7. What is one downside to a moveable pulley? - It requires much more pulling.



T E A C H E R S G U I D E



MECHANICS - DEMONSTRATION DEVICES

What does a flagpole, a sail on a boat, mini-blinds, and a construction crane have in common?

How can I move a riding lawn mower to a platform that is taller than I am?

Utilize multiple pulley configurations, fixed, moveable, single or multiple, to accomplish relevant tasks. Students can measure mechanical advantage to choose the best pulley. Rectangular wooden base approximately 20x82cm supports two threaded rods in metal flanges and fitted with capstan and a screw eye. A cross rod approximately 12.5mm x 81cm is held by right-angle clamps, and holds up to 8 clamps to suspend pulleys. Ships with the following pulleys and clamps made of plated metal or polished aluminum, and with weights and hangers made of brass.

Materials

Included in Pulley Set:

- 8 single pulleys
- 2 triple tandem pulleys
- 2 quadruple pulleys
- 1 wheel and axle
- 7 weight hangers (5 of 50g and 1 each of 10g and 20g)
- 15 slotted weights (2 each of 10g, 20g, and 50g, 4 each of 100g and 200g, and 1 500g)
- 3 right-angle clamps
- 1 spool of cord
- 1 tommy bar to tighten the vertical rods
- Instruction manual

Equipment used for Lesson:

- Vocabulary list
- pulley demo set
- pictures or videos of a flagpole being used/a sail being hoisted/mini-blinds being raised/a construction crane working
- Presentation Guide Sheet
- Test

Goals & Objectives

Students will:

- explore simple machines.
- demonstrate ability to solve tasks with desired outcomes via pulley systems.
- calculate the benefit of their solutions by finding the mechanical advantage.
- identify the purpose of a pulley.

ASSESSMENT

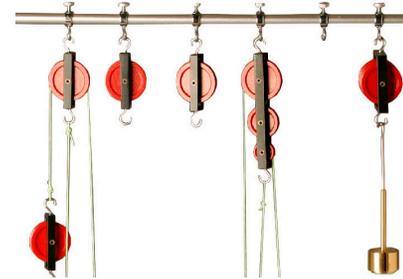
Participation, Vocabulary list, Presentation, and Test.
(Use attached Vocabulary Sheet, Test and Presentation Guide Sheet)

ACTIVITIES

- 1 View the pictures or video. They can guess what mechanism allows these items to function.
- 2 Distribute the vocabulary list, and use internet, science text and class participation to define as a class. (Alternatively, teachers could demonstrate the use of one pulley for the class and see if students could suggest definitions from that.)
- 5 Group students into groups of 4.
- 6 Assign a situation to each group and have them design a pulley system to achieve solve the situation. (They can manipulate the pulleys on the demonstrator set to inspire ideas and to create a working model to show the class.)

To conclude their presentation of the solution, they should express whether their system reduced force, (support this by using the calculation for mechanical advantage), required a change of direction, or both.

Use the Presentation Guide Sheet



- 3 Set up a single fixed pulley, a multiple pulley, and a compound pulley (both fixed and moveable), each with the same amount of load.
- 4 Allow students to work each pulley, noting the amount of heft needed to lift the load in each one.
 - Which one is easiest? (compound)
 - Which one gets the most lift for amount of rope used? (Single fixed)
- 7 For struggling students, teachers could show one situation and demonstrate 2 pulley options, discuss/let students manipulate each until students can see which choice would be best.

Note

It is always best to **DO** an experiment ahead of time to be able to best present it to the class.



S T U D E N T
H A N D O U T

Student Name: _____

Pulley Test

- 1 What is the purpose of a pulley?
- 2 What does a flagpole, a sail on a boat, mini-blinds, and a construction crane have in common?
- 3 What is the formula for Mechanical Advantage?
- 4 How can knowing this formula help you to construct an effective simple machine? (Effective would mean that it fixes your problem with as little effort as possible, and within your circumstances.)
- 5 What is a downside of a pulley which reduces the required force?
- 6 In what unit is the force in and force out measured?
- 7 What is one downside to a moveable pulley?



1 Pulley

6 Support ropes

2 Fixed pulley

7 Force in

3 Moveable pulley

8 Force out

4 Simple Machine

9 Newton

5 Mechanical advantage

10 Work



HANDOUTS

Student Name: _____

Presentation Guide

- 1 What was your situation?
- 2 Sketch your suggested solution.
(pulley model)
- 3 Does your system reduced force?
(Support this by using the calculation for mechanical advantage).
- 4 Does your system use a change of direction?
Why or why not?

