

# 8. Mechanical Advantage

**Subject:** Mechanics

**Objective:** To introduce students to a form of simple machine (the pulley) and to learn the practical use of pulleys to solve a problem.

**Logistics:** Classroom demonstration with students participating

**Materials:**

*2-3 sheave pulleys*

*rope*

*1000 gram weight*

*pulley stand*

*scale and data sheet (see illustration)*

---

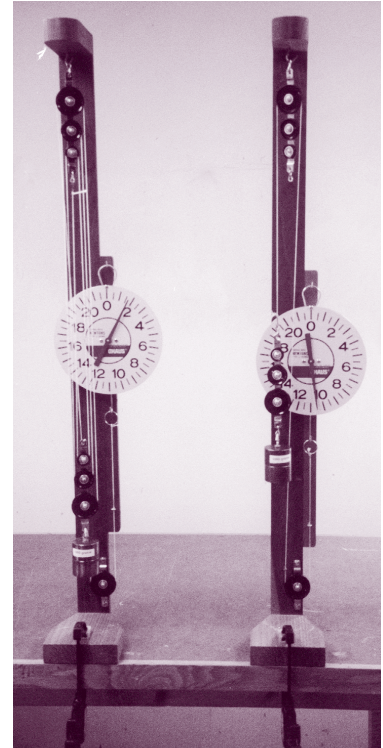
**Procedure:**

**Step 1:** Set problem for students: Can a 100-pound 5th grader raise a five hundred pound piano to the second floor using a rope and a pulley? Answer is: no. How can you raise the piano? Five 5th graders? No. Find the answer by experiment.

**Step 2:** 1000 gram weight plus pulley block of 50 grams equals total weight of 1050 grams. Each student pulls on end of rope for a feel of weight and weight is read on the scale as equal to 1050 grams.

**Step 3:** Second setup is two ropes and students note ease of exertion needed. Scale reads 525 grams. Weight 1050, divided by the pulling force (reading on scale—525 grams) equals the mechanical advantage (MA) of 2. So a 500-pound piano would require 250 pounds pulling force with a mechanical advantage of 2.

**Step 4:** Second setup uses five ropes. Each student pulls on rope end and notes ease of exertion. Scale now reads 210 grams. With mechanical advantage of 5 a 500 pound piano would require 100 pounds to raise it. Actually need 6 ropes so that 100-pound 5th grader can raise the piano.



---

**Vocabulary:** *data sheet, pulley, mechanical advantage, gram*

**What they Learn:** Students see how to use an experiment to solve a problem, and discover how a pulley works.