

Lesson Plan for Simple Machines

Lesson Title: Teaching About Simple Machines

Length of Lesson: 3 hours

Target Audience: Elementary School Teachers



Lesson Objectives:

Upon conclusion of this session each participant will be able to:

- 1) Identify the six simple machines without error.
- 2) Differentiate between ideal and actual mechanical advantage.
- 3) Describe how simple machines work to create mechanical advantage of speed or distance.
- 4) Calculate ideal mechanical advantage for six simple machines.
- 5) Measure actual mechanical advantage for three simple machines.
- 6) Create simple machines for specific applications.
- 7) Design compound machines for specific applications.
- 8) Fabricate compound machines in accordance with design brief criteria distributed in class.
- 9) Appreciate the use of simple machines in our everyday lives.

Standards Addressed

Full participation in all aspects of this lesson will help the students to meet aspects of the following *Pennsylvania Academic Standards*.

Science & Technology Standard 3.2 *Inquiry & Design*

Science & Technology Standard 3.4 *Physical Science*

Science & Technology Standard 3.6 *Technology Education*

Science & Technology Standard 3.7 *Technological Devices*

Science & Technology Standard 3.8 *Science, Technology & Human Endeavors*

Mathematics Standard 2.1 *Numbers, Numbering Systems, Numerical Relationships*

Mathematics Standard 2.2 *Computation & Estimating*

Mathematics Standard 2.3 *Measurement and Estimation*

Mathematics Standard 2.4 *Mathematical Reasoning*

Mathematics Standard 2.5 *Mathematical Problem Solving*

Anticipatory Set

Transfer

Simple machines are used in countless ways to make our lives easier every day. From can openers to automobile transmissions simple machines are all around us. Participants will explore how simple machines are used in every day applications.

Motivation

Simple machines and mechanical advantage are fundamental to a greater understanding of physical science & technology. These concepts will be used in problem solving activities and are likely topics for statewide assessment in science & technology at the elementary school level.

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Tools & Materials Required

- One commercially available simple machines building kit for every two students
- Examples of simple machines
- Transparencies or Powerpoint to help describe concepts

Pre-test

All participants will complete an objective pre-test prior to receiving instruction (see attached).

Lesson Content Outline

- I. What is a Simple Machine?
 - A. How Simple Machines Work
 - B. Simple Machines in the History of Science & Technology

- II. Mechanical Advantage
 - A. Two Components to Power
 1. Effort
 2. Rate
 - B. Ideal Mechanical Advantage
 - C. Actual Mechanical Advantage

- III. Levers
 - 1st Class
 - 2nd Class
 - 3rd Class

- IV. Gears
 - A. Spur
 - B. Worm
 - C. Rack
 - D. Helical
 - E. Bevel
 - F. Crown
 - G. Idler
 - H. Series Gear Arrangements
 - I. Parallel Gear Arrangements

- V. Pulleys
 - A. Fixed
 - B. Moveable
 - C. Fixed & Moveable
 - D. Block & Tackle

- VI. Inclined Plane

- VII. Wedge

- VIII. Screw

- IX. Wheel & Axle

- X. Measuring Actual Mechanical Advantage

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XI. Designing & Creating Compound Machines

XII. Review

- a. If torque is increased in a gear-set then speed or distance is _____.
- b. Identify two components to power.
- c. Explain how a compound machine is created.
- d. Name six simple machines.

Accommodations for Special Needs Students

•Since the concepts of mechanical advantage must be proofed with math and measurement an aid may be required.

•If a student cannot perform the math calculations or measurements they may still be able to understand the concept of mechanical advantage by setting up a see-saw and showing them the relationship between weight and distance.

•Special needs students may also be able to complete the building portion of the activity.

Summary

Review: Review will take place at the end of the formal lesson. Several sample questions are included

Activity: At the conclusion of the lesson participants will construct a series of models to reinforce the concepts of mechanical advantage and the use of simple machines.

Modeling: Will occur through the activities

Conclusion: Summarize all key terms, concepts and calculations include effort, rate, torque, rpm, force, mechanical advantage, six simple machines, compound machines.

Post-test: Participants will complete both an objective quiz at the conclusion of the lesson. They will also be performance tested by providing a solution to a design brief as a means of authentic assessment. Both assessments are attached.