MiSP SIMPLE MACHINES / INCLINED PLANE
Teacher Guide, L1 – L3

Introduction

The Simple Machines / Inclined Plane MiSP five-day unit may be included as part of a physical science energy and motion unit, or as a separate motion unit. It should be incorporated into the regular simple machines curriculum and would work nicely as a set of culminating activities.

This is one of two Simple Machines MiSP units. The other focuses on levers. Teachers in the MiSP program may choose to do neither of these units, one, or both.

Lessons in the unit utilize activities from the AIMS Education Foundation's *Machine Shop*. By purchasing this book, a school may duplicate the activities (a maximum of 200 copies may be made; unlimited rights are available at a small cost).
(For the book, see: http://wwws.aimsedu.org/aims_store/Machine-Shop-p-886.html.
For information on duplication rights, see: http://www.aimsedu.org/documents/duprights.html.)

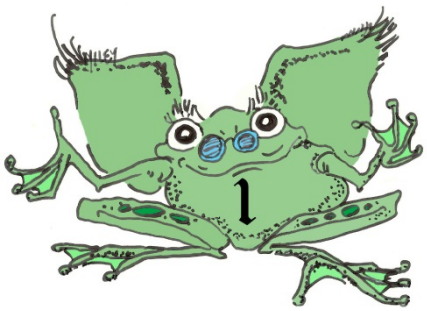
The AIMS activities for this unit are focused on the inclined plane and the wedge, so MiSP instructors may consider doing laboratory activities involving simple machines other than the plane and the wedge. Many of the AIMS activities in *Machine Shop* are worth doing. Instructors may want to plan their entire Simple Machines unit using that resource.

Standards

ILS Core Curriculum — Major Understandings:
Standard 4 Physical Setting 5.2c, 5.2f, and 5.2g

Lesson Objectives: After completing this unit *and regular simple machines instruction*, students will be able to:

- Define *simple machines* as devices that are used to move things
- Explain that simple machines may increase or decrease force required, change the direction of applied force, or increase or decrease the speed of the object moved
- List (at least) these types of simple machines: lever, pulley, wheel and axle, and inclined plane
- Describe everyday examples of simple machines
- Define and give examples of complex machines
- Collect and graph data from simple machines experiments
- State the relationships shown in simple machines graphs
- Interpolate and extrapolate from simple machines graphs



- Calculate unit rate of change (slope) (L2) and correlate that number with the graphed trends
- Determine the equation of a line on a simple machines graph and use the equation to calculate *x* and *y* measurements.

Day 1 — Lessons on Simple Machines

Depending on the instruction that has occurred previously, students should review/learn the types of simple machines. (The ILST Core Curriculum lists four: lever, pulley, wheel and axle, and inclined plane; the wedge is a form of inclined plane.) Some textbooks or instructors may include others.) Important to conceptualizing simple machines is knowing how frequently we utilize simple machines in our daily lives.

You may want to consider these online resources for instruction prior to the MiSP unit or for day 1:

http://edtech.kennesaw.edu/web/simmach.html

http://www.science-class.net/Physics/simple_machines.htm

http://www.uark.edu/depts/aeedhp/agscience/simpmach.htm

Part of day 1 should be used to introduce or even begin the day 2 activity: Wedge-Ease.

Question of the Day:

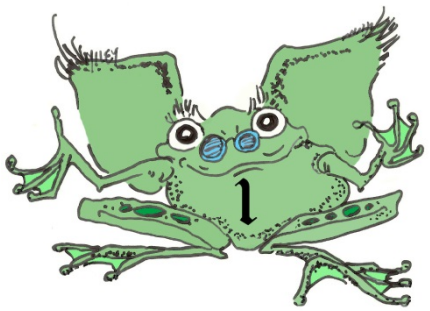
We most often think of simple machines as making a job easier: less effort is needed to move a resistance or load. Yet simple machines often do not change the effort needed; in fact, more effort may be needed to move the resistance or load with a simple machine than without it. When and why do we use simple machines when the effort force is equal to or greater than the resistance force?

Day 2 — Wedge-Ease: *Machine Shop*, pages 206-215

Because of the five-day MiSP unit length, this activity will be carried out as a teacher demonstration. Students should be called on to assist with the various steps.

Introduction, materials list, background information, and information on how to set up and run the activity are on pages 206-207. Optional student materials are pages 208-215. Students will utilize Worksheet #1.

The Management notes in *Machine Shop* suggest that this activity should occur after experiments with inclined planes. But in this unit, students do an inclined activity after the wedge activity. Changing the order should not be a problem.



The three wedges (with backups) should be constructed ahead of time. Any type of cardboard may be used but pressed (non-corrugated) is preferred. The external surface of the wedges should be smooth. Manila folder or index stock can be used but the construction must be done precisely or the wedges will not hold up. The advantage of index stock is that the patterns may be photocopied directly onto the sheets.

Question of the Day:

The edge of a kitchen knife—not the whole blade—is a wedge. In this demonstration we saw that longer wedges were better than shorter wedges for splitting the books apart. So why not make the wedge part of a kitchen knife blade wider?

Days 3 and 4 — Making the Grade (Inclined Plane Activity): *Machine Shop,* pages 187-194

Introduction, materials list, background information, and instructions on how to set up and run the activity are on pages 187-189.

It is suggested that spring scales (even if they measure mass rather than force) be used, if possible, instead of rubber bands, to measure force. Students should do procedures 1-10. Data may be recorded on copies of pages 191-192 and the graph on page 193 if you do not use spring scales. Levels 1, 2, and 3, questions and calculations will be done on Worksheet #2a. If you use spring scales, Worksheet #2b has places to record and graph data, and it includes the Levels 1, 2, and 3 questions and calculations. Discussion questions are found on pages 195-196 and are included on the worksheets.

Critical to the success of this experiment is having smooth cups or tubs and a smooth ramp to minimize friction. Although the AIMS recommendation to use a meterstick is OK, a wider, smoother board is recommended. A meterstick, however, is needed to adjust the length of the ramp if a board is used as the ramp.

Procedures 11-13 are optional.

Day 5

Administer the appropriate level assessment.