Moving upwards in Science (Or Incline Planes)
2nd or 3rd Grade

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Benchmarks:

SLC 10: Explain the operation of a simple mechanical device.

Purpose:

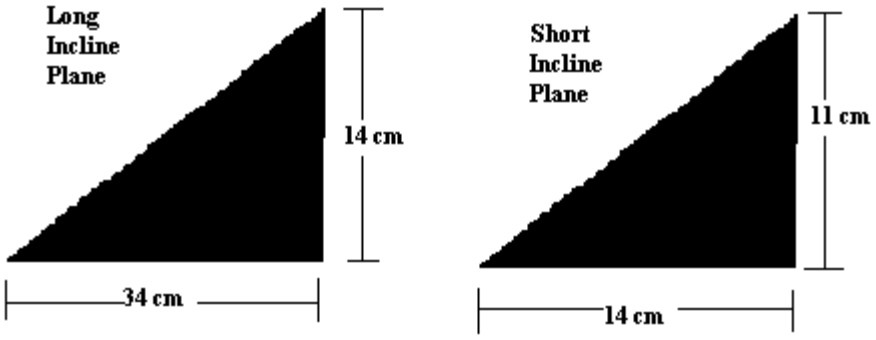
Students should come away from this lesson with some familiarity of the incline plane and how it helps us do work. In addition, students will be able to compare incline planes to decide which one will require less force (in the form of the number of paperclips needed to pull an object up).

Materials:

- Long wooden plank (2' x 4')
- Toy Cars – enough for each group (Matchbox cars work good)
- Pulleys with clamps – '' ''
- Materials for Incline Planes (see below)
- String
- Paper or Plastic cups
- Paper clip

Materials for Incline Planes:

The incline planes can be made several different ways. One way is to cut out wood triangles ~3 cm thick with the length and height that you want. However, if one wishes to conserve wood, the wood can be cut to a smaller triangle and thin piece of wood or a pair of paint stirrers glued to the hypotenuse to make a ramp. For someone who does not have access to the wood or the facilities to cut it, paint stirrers glued together in threes (two together and one underneath to support) can be propped on books to make workable incline planes. Some suggested sizes for the incline planes are given below:



Initial Demonstration:

Set Up: Demonstrator should set up a big incline plane using the long wooden plank, perhaps using a chair to prop it up. One of the pulleys should be affixed to the top of the plank. Attach a long string (~3 ft.) to a plastic cup on one end, thread the string through the pulley, and attach the other end of the string to a matchbox car.

Demonstrator should ask a student to come up and help with the demonstration. Student will put paperclips in the cup until the car starts to roll up the incline plane. Student and class should help count the number of paperclips put in the cup.

Target Observations:

- The car rolled up the plank
- The cup went down
- The pulley was moving
- It took 50 paperclips to get the car to move

Target Model:

-Incline planes make things go up a hill if paperclips are put on the other end of the string.

Procedure:

Demonstrator should show the class two different sized incline planes, one short and the other long. Demonstrator should ask students if they think it is true that it will always take the same amount of paperclips to pull the car up. Regardless of what they say, ask them to prove it by doing some experiments. Break the class up into groups of about 4-5 students per group. Give each group one of the incline planes, a pulley with clamp, and a car-string-cup already together. It may help to have the units pre-assembled. Give each group one of the *Moving Upwards* worksheets and ask them to "prove you (or themselves) wrong" and see if two different incline planes require different amounts of paperclips. To help the students prioritize, the demonstrator should give the groups only one incline plane to start with, and then when they have finished they can "trade" for the other incline plane.

It may help to break the groups up into the following roles: a *Leader* will bring the completed first half of the sheet and incline plane to the demonstrator and collect the other incline plane, as well as make sure the group is running smoothly; a *Writer* will write down any data and observations that the group collects; the rest of the students can be *Experimenters*, who will be the first students in the group to carry out the experiment. Every group member should be given a chance to carry out the experiment, but this division may help the groups work a little smoother if they are having problems.

Discussion:

What did the groups find? Did they prove you, or themselves, wrong? How? Which incline plane took the most paperclips? Does the class agree? Why do they think so? How should we change our description of incline planes? What are some examples of incline planes around us? How could they be changed so that they are easier to use (i.e. lengthening)?

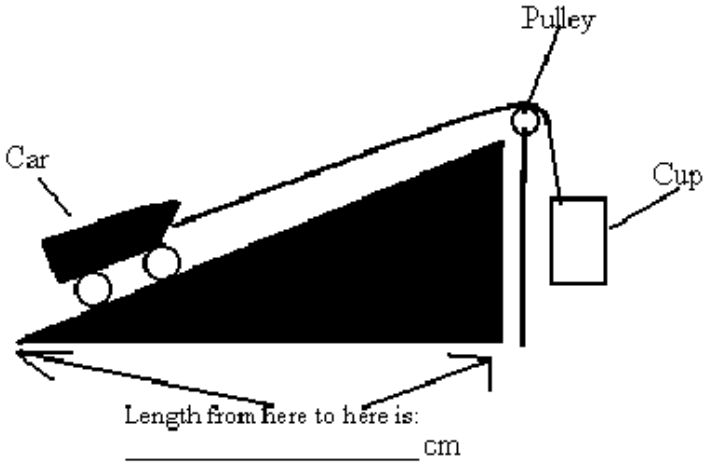
Target Revised Model:

-Incline planes make things go up a hill if paperclips are put on the other end of the string; *short incline planes need more paperclips than long incline planes.*

Prove me wrong: The number of paperclips is the same for every incline plane.

Incline Planes!!

Part 1: Measure the length and weight for your LONG incline plane and write it in.



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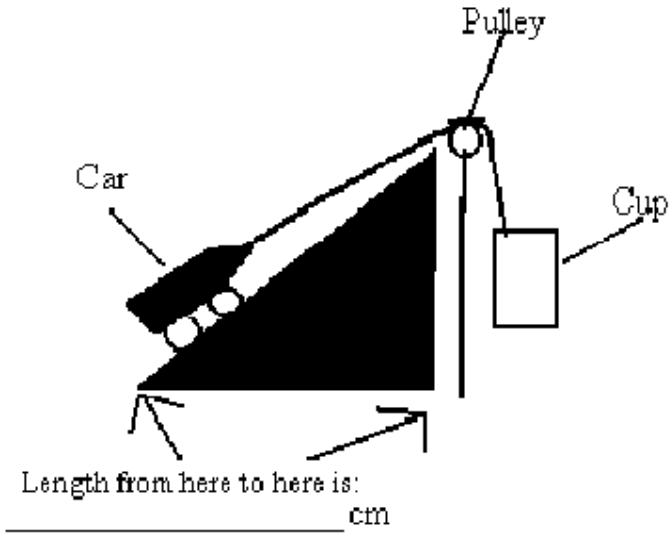
# of paper clips	_____	_____	_____

Part 2: Measure the length and weight for your SHORT incline plane and write it in.



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# of paper clips	_____	_____	_____