

Levers

2nd or 3rd Grade

Bret Underwood

Benchmarks:

(2nd) SLC 10: Students will describe simple instruments found in the environment as applications of simple machines (e.g., pulley on flag pole; hammer as a lever, nail as wedge, etc.).

(3rd) SLC 10: A. Students will compare how the 6 simple machines work and provide a written description of how they are used. (S03-2.10A) B. Students will identify and explain, in writing, how simple machines help mechanical instruments operate (e.g., bicycles, scissors, pencil sharpener).

Objective:

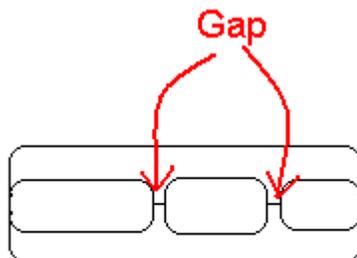
Students should come away from this lesson with some familiarity of the incline plane and how it helps us do work. In addition, students will be able to compare incline planes to decide which one will require less force (in the form of the number of paperclips needed to pull an object up).

Materials:

- Paint Stirrers for lever arms
- Fulcrum – triangular prism object, or large pencil
- Paper cups
- Foil pot pie pans
- Something to lift (like a Lego person)
- Paper clips
- Marbles

Initial Demonstration:

Set up: tape together 2 paint stirrers side by side to create a wide lever arm. Support the lever arm by gluing/taping paint stirrers on the bottom of the arm, leaving a gap in certain places (such as the middle and near the end) for the fulcrum to sit (see Fig. 1). Affix a paper cup on one end of the lever and a foil pan on the other. Do this for enough levers for each group.



Underside view of Lever-arm

Fig. 1

Demonstrator should set up one of the levers in front of the class with a Lego Person in the foil pan and the fulcrum set in the middle. Demonstrator should initiate discussion into the parts of a lever (fulcrum, arm) and why we would use levers. Demonstrator should have a student come up and put paperclips into the cup until the other end of the lever (with the Lego Person) lifts up.

Target Observations:

- The Lego Person went up
- The Cup went down
- It took 30 paperclips to get the Lego Person to go up

Target Model:

-One side of the lever can be used to lift things up when paperclips are put on the other side.

Procedure:

Demonstrator should ask students if they think that any lever (with the fulcrum in the middle) will use the same amount of paperclips. Regardless of what they say, ask them to prove it. Break the class up into groups of 4-5 students, and give each group a *Levers Data Sheet* as well as a lever, Lego Person, fulcrum, and some paperclips. Ask the students to prove what they think by taking data and then comparing what they found with the rest of the groups.

Discussion:

Did all the groups agree? Why not? What does this mean about science experiments? Will any experiment ever be exactly the same? Now that we've seen that the difference between the levers give small differences, what are some things we could change about the lever to make a large difference? (i.e position of the fulcrum)

Procedure:

Ask students to prove you wrong that changing the position of the fulcrum does not change the number of paperclips needed by working in their groups. Groups should move the fulcrum closer to the Lego person and carry out the experiment, marking the number of paperclips needed on their *Data Sheet*.

Discussion:

Did moving the fulcrum change the number of paperclips needed? More or less? Did all the groups agree? Why do you think this was so? What can we change about our description of levers? Can we understand the quote, "Give me a lever long enough and I'll move the world" by Archimedes by what we learned today?

Target Revised Model:

-One side of the lever can be used to lift things up when paperclips are put on the other side; if the fulcrum is placed closer to the thing we want to lift it is easier to lift.

Optional Extension:

Procedure:

What would happen if we moved the fulcrum the other way, i.e. towards the paper cup? Would it make the Lego person easier to lift or harder to lift? How can you prove it?

Demonstrator should have the students find out what happens when the fulcrum is moved from the middle to the side closest to the paper cup by working in their groups. Students should record their data on the *Optional* data sheet.

Students should quickly find out that the use of paperclips will not work – it would require too many paperclips. Demonstrator should ask the students what they think they should do. After some discussion about different weighted objects to use, give each group about 15 marbles each to use.

Discussion:

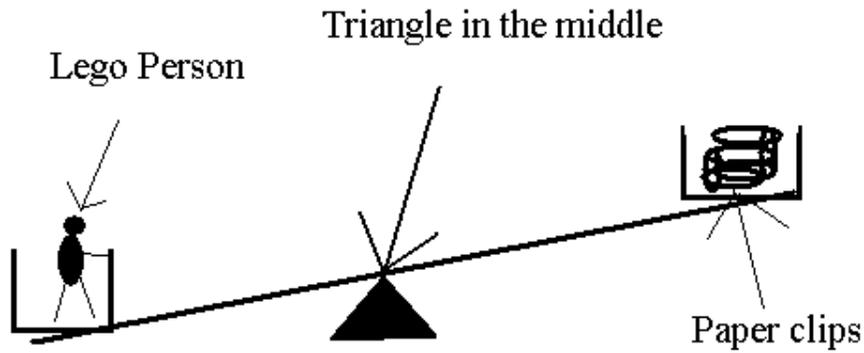
Why did the paperclips not work? Can we compare paperclips and marbles? If so, how? (hint: measure them) How many paperclips is the number of marbles equivalent to? What can we add to our description of levers?

Target Revised Model:

-One side of the lever can be used to lift things up when paperclips are put on the other side; if the fulcrum is placed closer to the thing we want to lift it is easier to lift, *but if the fulcrum is placed further from the thing we want to lift it is harder to lift.*

Levers worksheet

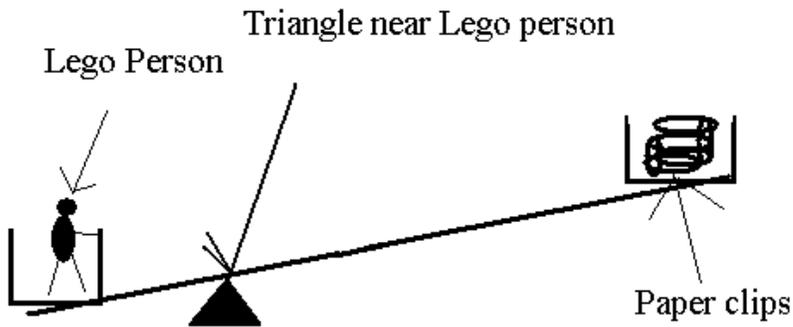
Part one: First measure the number of paper clips needed to lift the Lego person up, with the triangle in the middle:



	Trial 1	Trial 2	Trial 3
# of paper clips	_____	_____	_____

Names:

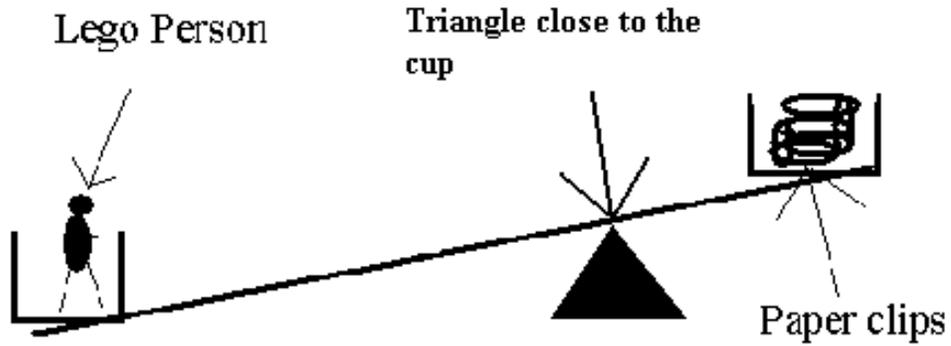
Part two: Measure the number of paper clips needed to lift the Lego person up, with the triangle closer to the Lego person.



	Trial 1	Trial 2	Trial 3
# of paper clips	_____	_____	_____

Extended Data Sheet

Part 3: Measure the number of paper clips needed to lift the Lego person up, with the triangle further from the Lego person.



	Trial 1	Trial 2	Trial 3
# of paper clips	_____	_____	_____