

Inclined Plane

4th or 5th Grade

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Benchmark:

(4th) SLC 10: Students will identify and explain how simple machines help mechanical devices operate (e.g., bicycles, pencil sharpener, fishing rod, etc.) by describing the work a machine can do (e.g., change the size of the force, change the direction of force, and/or change the distance a force moves something)

(5th) SLC 6: Students will identify the differences between work and force as they relate to each of the 6 simple machines.

An inclined plane consists of a straight sloped surface with no moving parts. Inclined planes are used to reduce the force needed to move an object to a certain height.

Materials:

For each group:

- Clay
- Toothpicks
- Desk
- 1 long board
- 1 heavy book
- String
- Spring scales
- Rulers

Initial Demonstration:

Give each student a hunk of clay and a toothpick. Have them shape the clay into a “mountain” upon which they are going to embark on a journey. Each student must make a road up the mountain that is the shortest in distance. Have them measure the length of their road. Next tell them to make a road that is the longest in distance (without backtracking down the mountain!). Have them measure the length of this road. Now ask them which one they would rather climb up and why. Discuss how it would take a lot more work to get to the top using the short road, and it would be a lot easier to take the longer road. Why is this? Tell them that this is the same concept behind a simple machine called an inclined plane. Get set up to do the next activity.

Target Model:

-It is easier to travel up a hill slowly and gradually than taking the steepest path.

Procedure:

The class will be split up into groups to work on this next activity. The setup is to have an board leaning against a desk act as an incline plane. The students will be testing to see when it is easiest to carry a book up to the top the desk using the incline plane at 3

different angles. The students will record in a data table the horizontal distance from the desk to the end of the board, the length of the board that the book travels up (not the whole board, only the part from the floor to the desk), the height of the desk that they are using, and the amount of force needed to move the book slowly and at constant speed. For comparison, the students should also record the amount of force needed to lift the book straight up from the ground to the surface of the desk.

Height of Desk (cm)	Distance from Desk to Board (cm)	Distance the book has to travel (cm)	Amount of Force needed to move Book (N)
LIFT BOOK STRAIGHT UP	0		

Each group should share their data with the other groups and compare. What is the same in each case? Do they notice any patterns? How is this similar to other simple machines? Can they name some real life examples where this is used? Do the findings agree with our initial model?

Target Model:

- It is easier to travel up a hill slowly and gradually than taking the steepest path.
- Longer incline planes reduce the amount of force needed to move an object up the incline plane. The absence of an incline plane requires the most amount of force.*