Inclined Plane
What is Inclined Plane?

The inclined plane is simply a flat surface raised at an angle, like a ramp. Inclined Plane is a simple machine. Lifting a load vertically straight up takes considerable effort. But by moving that load across a gentle slope, instead of lifting it straight up, less effort (force) is needed. The angle (the steepness of the inclined plane) determines how much effort is needed to raise the weight. The steeper the ramp, the more effort is required.

Why is Inclined Plane important?

We see examples of inclined plane in our every day life. We see mountain roads wind around instead of going straight up. We use ramps to transport heavy things into a truck. It is less tiring to walk up a gentle hill compared to a walk up a steep hill. The picture shows that it is more difficult to push the box up a steep ramp compared to a gentle ramp.
**Goal of experiment**

To measure force required to pull a load across inclined planes with different angles.

- Students will learn a ramp is a simple machine, the inclined plane.
- Students will become familiar with how an angle of an inclined plane(ramp) affects the force needed to move objects up the plane(ramp).
- Students will experiment to find how the use of an inclined plane(ramp) makes work easier.

**Items needed for the experiment**

A small bag filled with books,

A stack of textbooks,

A long smooth wooden board with a line marked off for stopping point about 4" from one end.

A spring scale is a weighing scale used to measure force, such as the force required to lift an object. This force is commonly measured in newtons, for which one newton corresponds to the weight of about a tenth of a kilogram of mass.
Instructions for the demonstration

1. Stack 2 textbooks on top of each other. Place the wooden board against the books on an angle, with the marked end up by the books.

2. Show children the bag filled with books and spring scale. Explain that they are going to use the ramp, bag of books and spring scale to measure the force it takes for the bag of books to be pulled up the inclined plane they made.

3. Attach the bag of books to the spring scale. Pull the bag up the inclined plane by the spring scale. Keep pulling the bag until the bag reaches the marked line. Explain to the children this line is used so the results will be constant. Look at the measurement of force on the spring scale. Record this number on the experiment worksheet.

4. Repeat procedures # 1-3, using 4, 6, and 8 textbooks. Record the measurements for each experiment. Ask them if they notice anything about the measurements as the number of books increases and the ramp gets steeper.

5. Have children take turns doing different parts of the experiment for each of the different stacks of books.

6. Then have a child use the spring scale to pull the car up the top of the 8 stacked books without using the inclined plane. Have them record the results. Ask the children why they think the numbers are different.

Conclusions

1. Conclude with a review. It takes more force to move an object up a steep inclined plane than an inclined plane that is not as steep. Also, it takes more force to move an object to a higher level when you are not using an inclined plane.

Applications

We use ramps to transport heavy things into a truck.

Worksheet

Teacher Worksheet to use in classroom (provided on next page).
Measure the force using a spring scale while pulling across different surfaces and up an inclined plane.

Decide the unit of measure for the force ie. Newtons or Grams.

<table>
<thead>
<tr>
<th>ACTION</th>
<th>CIRCLE ONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring Scale Reading in:</td>
</tr>
<tr>
<td></td>
<td>Newtons (N) or Grams (g)</td>
</tr>
<tr>
<td></td>
<td>First Try</td>
</tr>
<tr>
<td>Pulling the bag of books up an inclined plane created with 2 books</td>
<td></td>
</tr>
<tr>
<td>Pulling the bag of books up an inclined plane created with 4 books</td>
<td></td>
</tr>
<tr>
<td>Pulling the bag of books up an inclined plane created with 6 books</td>
<td></td>
</tr>
<tr>
<td>Pulling the bag of books up an inclined plane created with 8 books</td>
<td></td>
</tr>
<tr>
<td>Lifting the bag of books straight up the height of 8 books</td>
<td></td>
</tr>
</tbody>
</table>

Which action required the least amount of work?
This inclined plane activity offers a great way to interest youngsters in physics at an early age.

NYS Standard 4: The Physical Setting

Key Idea 5: Energy and matter interact through forces that result in changes in motion.

P.I. – 5.1 Describe the effects of common forces (pushes and pulls) of objects, such as those caused by gravity, magnetism, and mechanical forces.

5.1a
5.1b
5.1c
5.1d
5.1f

P.I. – 5.2 Describe how forces can operate across distances.

5.2a

NYS Standard 6: Interconnectedness: Common Themes

Key Idea 2: Models are simplified representations of objects, structures or systems, used in analysis, explanation, or design.

Key Idea 5: Identifying patterns of change is necessary for making predictions about future behavior and conditions.