

Inclined Plane

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CHAPTER

1

Inclined Plane

- Describe an inclined plane.
- Explain how an inclined plane changes force to make work easier.
- Identify the mechanical advantage of an inclined plane.



The highway above switches back and forth as it climbs up the steep hillside. The much gentler slope of the road makes it easier for vehicles to reach the top of the mountain. The highway is an example of an inclined plane.

What Is an Inclined Plane?

An **inclined plane** is a simple machine that consists of a sloping surface connecting a lower elevation to a higher elevation. An inclined plane is one of six types of simple machines, and it is one of the oldest and most basic. In fact, two other simple machines, the wedge and the screw, are variations of the inclined plane.

A ramp like the one in the **Figure 1.1** is another example of an inclined plane. Inclined planes make it easier to move objects to a higher elevation. The sloping surface of the inclined plane supports part of the weight of the object as it moves up the slope. As a result, it takes less force to move the object uphill. The trade-off is that the object must be moved over a greater distance than if it were moved straight up to the higher elevation. You can see several other examples of inclined planes at this URL:

<http://www.mikids.com/SMachinesInclinedPlanes.htm>

Mechanical Advantage of an Inclined Plane

The mechanical advantage of a simple machine is the factor by which it multiplies the force applied to the machine. It is the ratio of output force (the force put out by the machine) to input force (the force put into the machine). For an inclined plane, less force is put into moving an object up the slope than if the object were lifted straight up, so the mechanical advantage is greater than 1. The more gradual the slope of the inclined plane, the less input force is needed and the greater the mechanical advantage.



FIGURE 1.1

Q: Which inclined plane pictured in the **Figure 1.2** has a greater mechanical advantage?

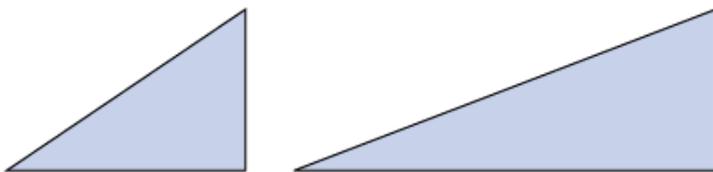


FIGURE 1.2

A: The inclined plane on the right has a more gradual slope, so it has a greater mechanical advantage. Less force is needed to move objects up the gentler slope, yet the objects attain the same elevation as they would if more force were used to push them up the steeper slope.

Summary

- An inclined plane is a simple machine that consists of a sloping surface connecting a lower elevation to a higher elevation. It is used to move objects more easily to the higher elevation.
- Less force is needed to move an object uphill with an inclined plane, but the force must be applied over a greater distance.
- The mechanical advantage of an inclined plane is always greater than 1, because the machine puts out more force than the user puts into it.

Explore More

At the following URL, click on the inclined plane and go through the animation. Then answer the questions below.

<http://dev.cosi.org/files/Flash/simpMach/sm1.html>

1. In the animation, how is the mechanical advantage of an inclined plane calculated?
2. Use this method to find the mechanical advantage of the inclined plane in the **Figure 1.3**.

Review

1. What is an inclined plane?
2. How does an inclined plane make work easier? How does it change the force that is applied to the inclined plane?

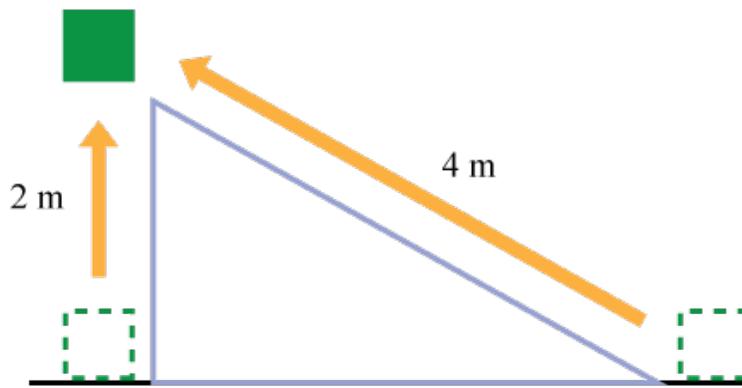


FIGURE 1.3

3. Why is the mechanical advantage of an inclined plane greater than 1?
4. What is an example of an inclined plane that wasn't mentioned in the article?

References

1. Image copyright Christina Richards, 2013. [Object being moved up ramp](#) . Used under license from Shutterstock.com
2. Zachary Wilson. [Inclined planes with different mechanical advantages](#) . CC BY-NC 3.0
3. Zachary Wilson. [Finding mechanical advantage practice](#) . CC BY-NC 3.0