

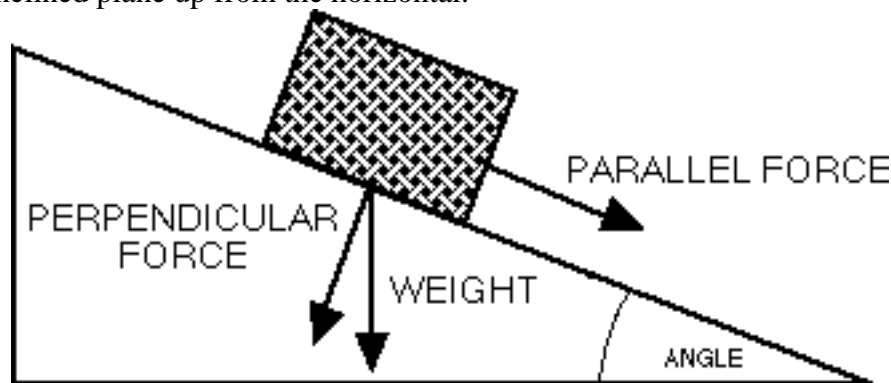
NOTES SHEET - INCLINED PLANES & FORCES

NOTES

In physics, things such as ramps and hills are referred to as **INCLINED PLANES**. Inclined planes provide an opportunity to study vector components of forces.

The weight of an object always acts vertically (or perpendicular to the surface of the earth). This is true whether the object is on an inclined plane or not. Objects on inclined planes follow a path down the incline when they are in motion. According to Newton's Second Law, the objects must move in the direction of the net force. Thus there must be a force acting downward and parallel to the surface of the inclined plane. This force is called the **PARALLEL FORCE**. It is counteracted by friction, which acts in the opposite direction. There is also another force, called the **PERPENDICULAR FORCE**, which acts at a right angle to the parallel force. This force is counteracted by the normal force since it is perpendicular to the surface of the plane. Together, the parallel force and the perpendicular force add up to the weight of the object. Keep in mind that these forces are vectors and have directions as well as magnitudes. The parallel force and the perpendicular force are the two components of the weight of the object.

For problem involving objects on inclined planes, use the object's weight as the hypotenuse of the right triangle formed by the parallel force (sine) and the perpendicular force (cosine). For reasons which you will learn in geometry, the angle you are working with is the angle of the inclined plane up from the horizontal.



REMEMBER:

Use the weight of the object as the hypotenuse and the angle of the plane as the angle you are working with. Use sine to find the parallel force and cosine to find the perpendicular force.

QUESTIONS:

1. In what direction does weight act?
2. What force acts down the plane?
3. What force acts against the parallel force?
4. In what direction does the perpendicular force act?
5. What force acts against the perpendicular force?

6. Which function is used to calculate the parallel force? (sine, cosine, or tangent)
7. Which function is used to find the normal force? (sine, cosine, or tangent)
8. What determines the size of the angle you will work with?
9. What is the hypotenuse of the vector triangle?
10. What is your favorite color?

PROBLEMS:

1. A 450 N trunk rests on a 30° inclined plane.
 - a. What is the force acting down the plane?

b. What is the force acting perpendicular to the plane?

2. A 54.7 kg box is resting on a 5° inclined plane.
 - a. What are the normal force?

b. What is the friction force holding the box?

3. What is the μ between a 59.3 kg crate and a wooden ramp with a 20° angle?

ANSWERS: Approximate and not in order

46.8 N 225 N 387 N 0.231 390 N 535 N 0.364

NAME: _____

DATE: _____

1. What is the force of friction holding a 225 kg box on a ramp that forms a 25° angle with the ground?

Sketch	Math	Answer

2. What is the μ of between a 520 kg wooden crate and the concrete ramp (15°) that it is sitting on?

Sketch	Math	Answer

3. A 125 kg box is sliding down a 27° ramp at a constant velocity of 1.12 m/s. What is the friction force acting on it?

Sketch	Math	Answer