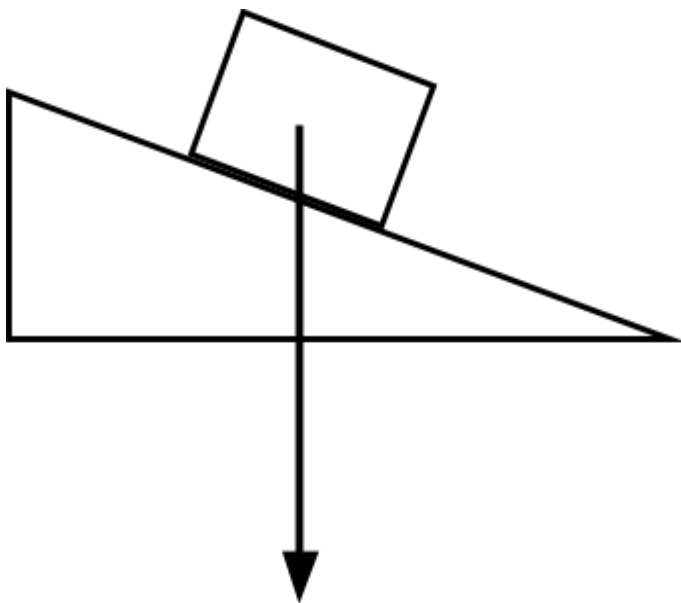


**Inclined Planes – Free Body Diagrams****Pre - Class Questions****[Video Instruction](#)**

1. The weight force on the block below acts **ON** the ramp and **DOWN** the ramp.

The force the box exerts **ON** the ramp is a component called:

$F_{\text{perpendicular}}$  OR  $F_{\text{parallel}}$ ? (Circle the correct answer)



2. What ramp angle would cause the box's force on the ramp to be:

a) the greatest? \_\_\_\_\_ degrees      b) the smallest? \_\_\_\_\_ degrees

3. What ramp angle would cause the force that the box exerts **ON** the ramp to be equal to the force that the box exerts down the ramp to be equal?

a) \_\_\_\_\_ degrees

4. What ramp angle would the Normal Force of the ramp equal the weight force of the box? \_\_\_\_\_

Normal Force - upward \_\_\_\_\_

5. The larger the ramp angle the **SMALLER** or **LARGER** the Normal Force (circle)

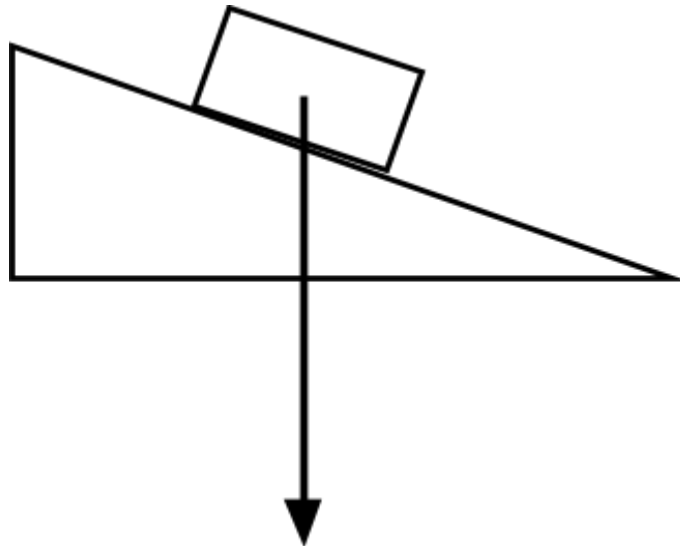
### Frictionless Ramp / Trig and Weight Components

**Ex 1)** A 5.0 kg box slides on a 20. degree frictionless ramp (see drawing below)

1. Label all the angles on the ramp
2. Label the weight force on the box below  $F_g = \underline{\hspace{2cm}}$  N
3. IN PENCIL - Find parallel and perpendicular components of the weight force
4. Draw the rest of the force(s) acting on the box below.

The box's force on the ramp equals the ramp's force \_\_\_\_\_

The ramp's upward force on the box is called the \_\_\_\_\_ force

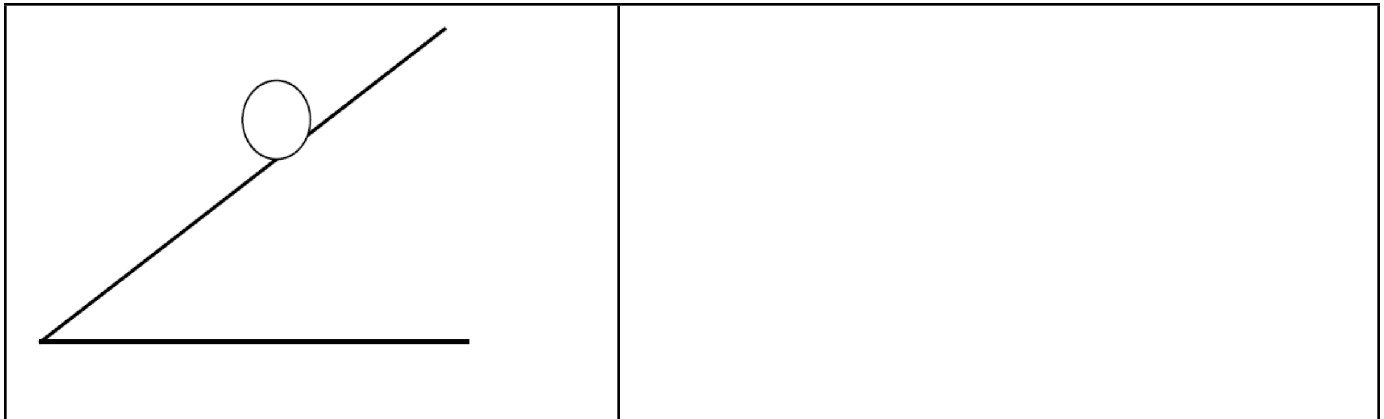


$F_{\text{box on-ramp}} =$  \_\_\_\_\_

$F_{\text{box}}$  parallel to ramp = \_\_\_\_\_

**Ex 2) a) Sketch** the weight force and the ball below

**Let the mass of the ball = 5.0 kg and angle = 45 degrees.**



**F parallel =** \_\_\_\_\_

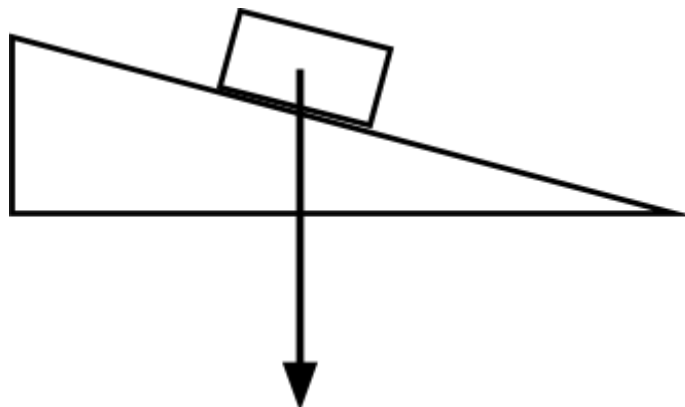
**F perp. =** \_\_\_\_\_

**Ex 3) Mass is 5.0 kg and ramp angle = 15 degrees (label all ramp angles)**

**a) F parallel =** \_\_\_\_\_

**b) F perp. =** \_\_\_\_\_

**c) Sketch** the normal force on the box

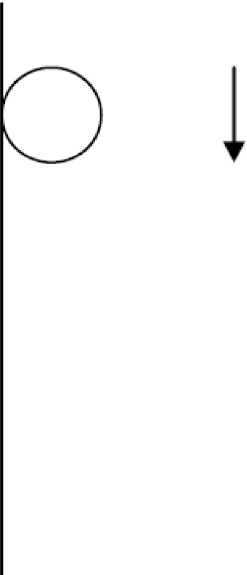


**Ex 4)** Mass is 5.0 kg and ramp angle = 70 degrees

**F parallel =** \_\_\_\_\_

**F perp. =** \_\_\_\_\_

**Ex 5)** Mass is 5.0 kg and ramp angle = \_\_\_\_\_ degrees



**F parallel =** \_\_\_\_\_

**F perp. =** \_\_\_\_\_

**Ex 6)** Mass is 5.0 kg and ramp angle = \_\_\_\_\_ degrees



**F parallel =** \_\_\_\_\_

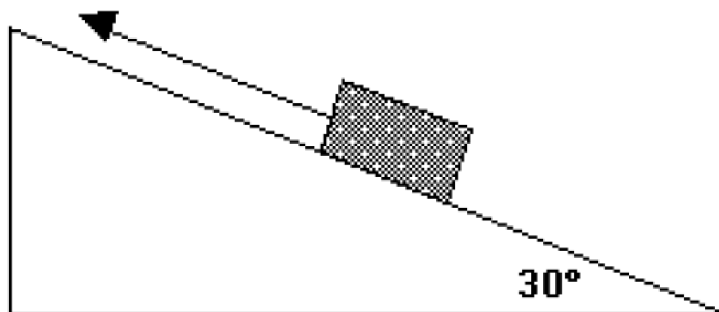
**F perp. =** \_\_\_\_\_

Name \_\_\_\_\_

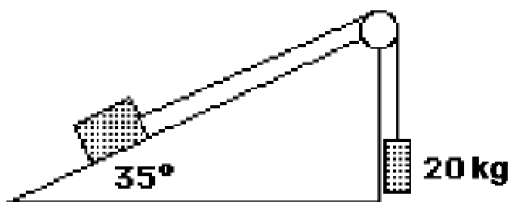
AP Physics 1

### Worksheet: Incline Plane Problems

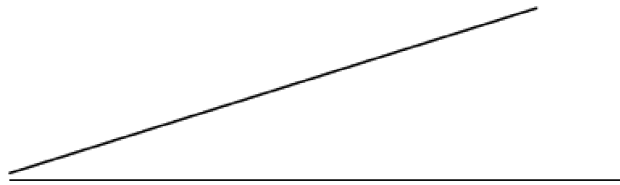
1. The box on a *frictionless* ramp is held at rest by the tension force. The mass of the box is 20. kg. a) Draw a force diagram for the mass. B) Determine the value of the tension force.



2. In the system below the pulley and ramp are *frictionless* and the block is in static equilibrium. First, draw a force diagram for the block on the ramp and hanging mass and then determine its **mass**.

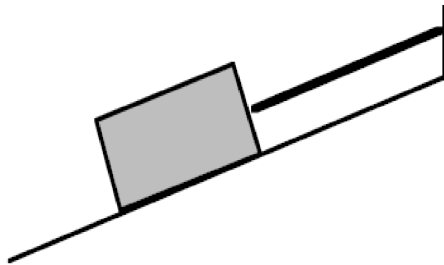


3. Ed is sledding down an ice-covered hill inclined at an angle of 15 degrees with the horizontal. If Ed and the sled have a combined mass of 54 kg, what is the force pulling them down the incline? (Ignore frictional effects here.)



4. A brick is held on a frictionless incline by a rope with a tension of  $T$ .

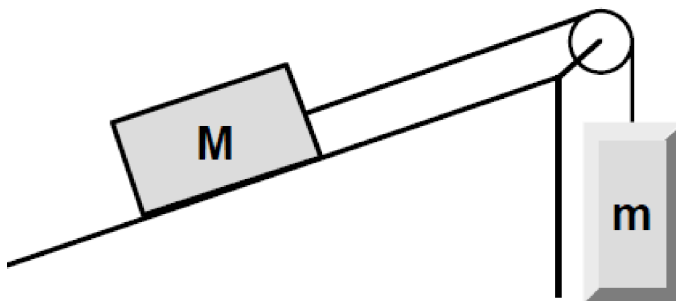
**a)** Draw the FBD **b)** Find the tension of the string  $T$  in terms of the mass  $m$



**Challenge:** A brick at rest on a smooth ramp attached to a hanging mass.

1. Draw the FBD for each body

Solve for  $M$  in terms of  $m$

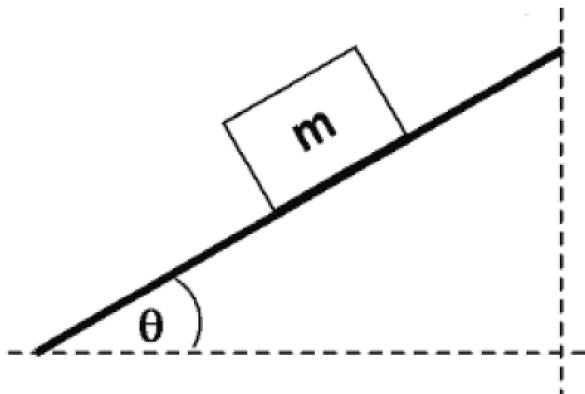


Name \_\_\_\_\_

AP Physics 1

**Forces on Inclined Planes: Additional Practice Problems**  
**(friction not zero)**

1. While being unloaded from a moving truck, a 10. kg box is placed on an incline plane angled at 37 degrees. When placed on the ramp, the box does not move. What is the coefficient of static friction, between the box and the ramp?



2. The coefficient of static friction between a box and an inclined plane is 0.25. What is the minimum angle required for the box to begin sliding down an incline?

