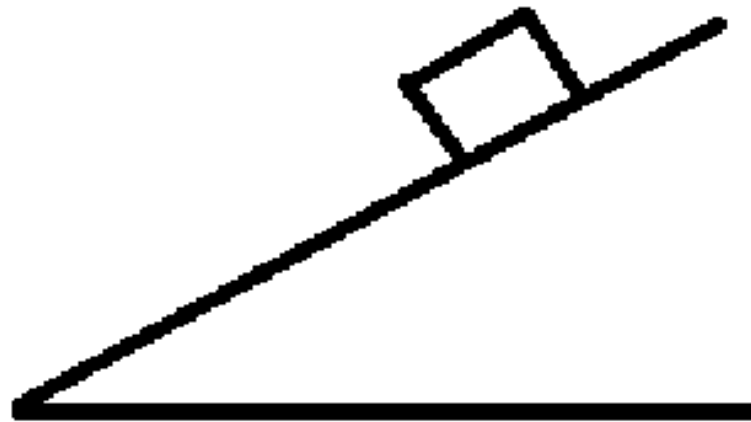
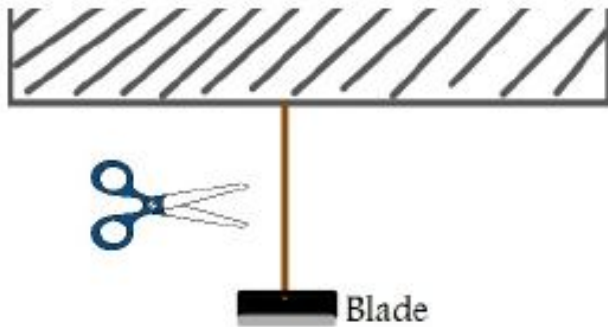


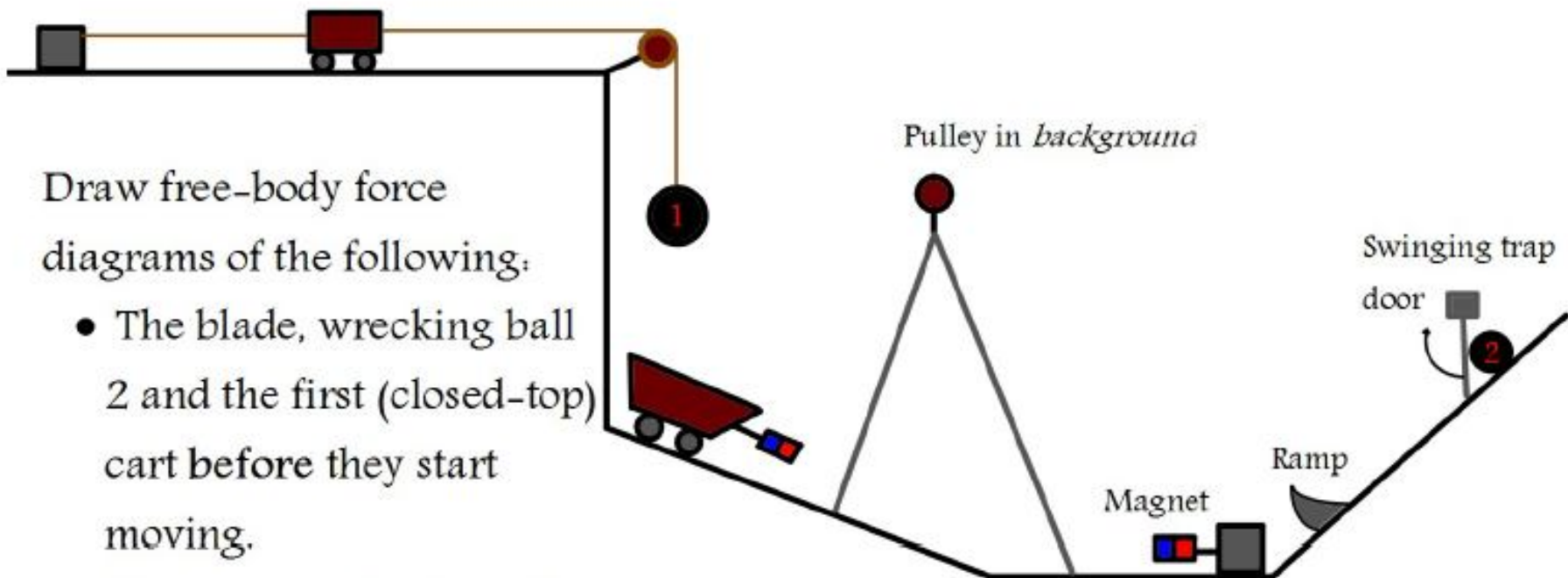
# WARM UP

A block is held at rest on a ramp by friction. Draw a free body force diagram of this situation.



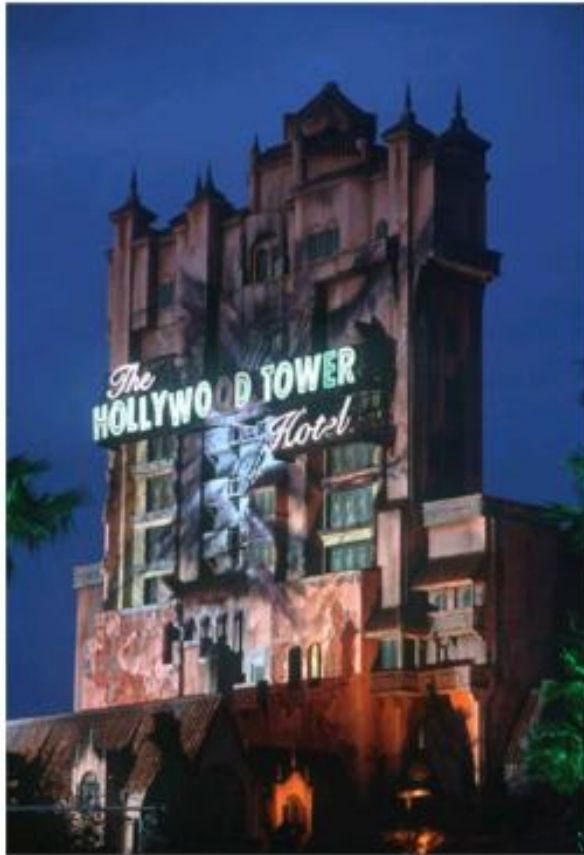


Evil geniuses have to start somewhere. Some of them start by building physics contraptions. In this particular contraption, cutting the rope will set off a series of events that will lead to wrecking balls 1 and 2 being collected in the open-top cart.



Draw free-body force diagrams of the following:

- The blade, wrecking ball 2 and the first (closed-top) cart before they start moving.
- Wrecking ball 1, 2 and the open-top cart after they start moving.



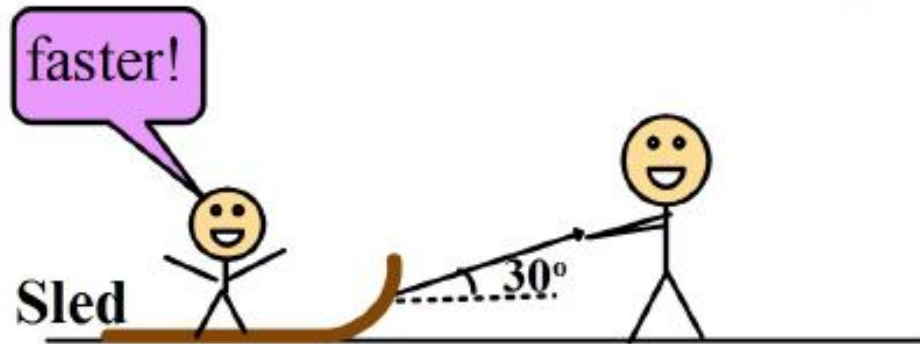
You are standing in the Tower of Terror elevator when it drops at an acceleration of  $12 \text{ m/s}^2$ .

1) What is the net force acting on you during the drop? Be sure to include a force diagram in your answer.

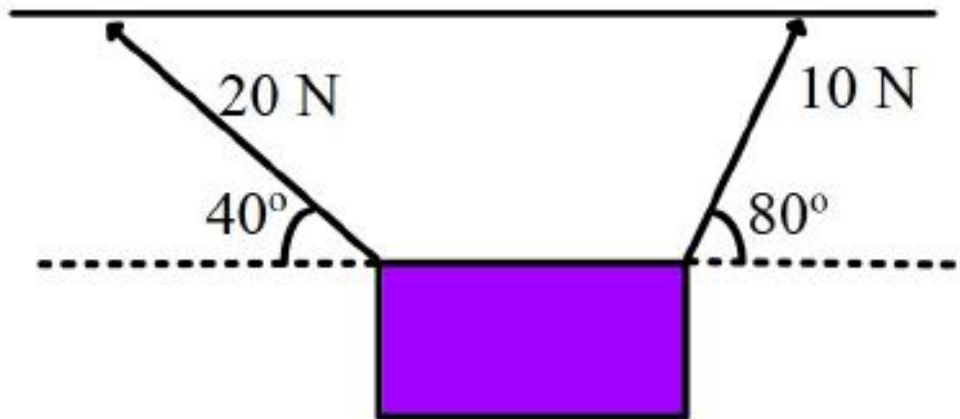
Hint: You can use your own weight in kg (1 pound = 0.45 kg). Or just use 55kg if you'd prefer.

2) What is the value of the normal force acting on you?

**Connor is pulling his sister along the snow in the family sled. If he pulls her along at a constant speed with a force of 250 N at an angle of  $30^\circ$  with the horizontal, what is the frictional force between the sled and the snow?**



- Draw a free body force diagram
- Write an equation (no numbers, just variables)
- Solve the equation (with numbers)



A box is hanging from two ropes, one at 80 degrees to the horizontal, the other at 40 degrees to the horizontal. The ropes have tensions of 10N and 20N respectively. If the box is in static equilibrium, what is the mass of the box?



At a certain point on a water slide, you are sliding at an angle of 65 degrees to the horizontal. If you weigh 55 kg and accelerate at  $0.5 \text{ m/s}^2$  down the slide, what is the value of the frictional force?



(Assume that the water itself does not apply a significant force.)

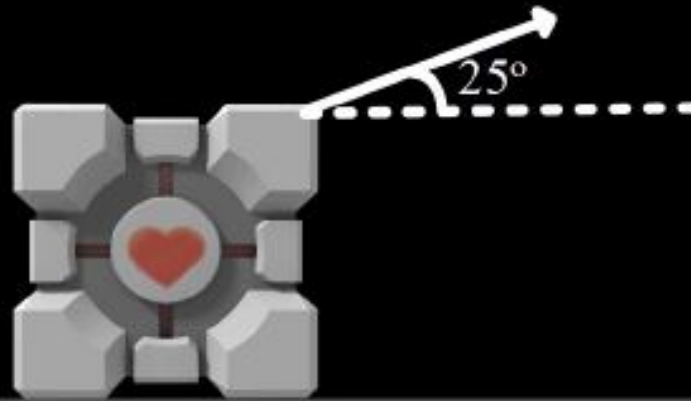


Grand pianos are wonderful until you have to move. To move this grand piano out of an apartment, it must be dragged along a hallway and then carried down a large staircase.

While carrying the piano down the stairs, it is accidentally dropped.



- a) Draw a free-body force diagram of the piano as it slides down the stairs.
- b) If the mass of the piano is 200 kg, the stairs are at an angle of 35 degrees and the value of the frictional force is 500 N, what is the acceleration of the piano down the stairs?



The (6 kg) weighted companion cube has a 50 N force applied to it at an angle of 25 degrees and accelerates in the x-direction at  $2 \text{ m/s}^2$ .

- Calculate the x and y-components of the 50 N force.
- Calculate the value of the frictional force.



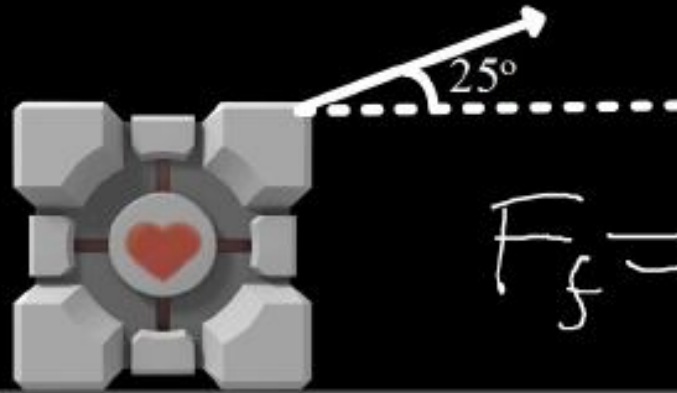
**COMPANION CUBE**

IT WILL NEVER LEAVE ME. IT HAS NO LEGS.



$$F_x = 45.3 \text{ N}$$

$$F_y = 21.1 \text{ N}$$



$$F_f = 33.3 \text{ N}$$

The (6 kg) weighted companion cube has a 50 N force applied to it at an angle of 25 degrees and accelerates in the x-direction at  $2 \text{ m/s}^2$ .

c) Calculate the value of the normal force.

d) Calculate the coefficient of friction between the companion cube and the floor.



**COMPANION CUBE**

IT WILL NEVER LEAVE ME. IT HAS NO LEGS.

## WARM UP

Two planets, A and B orbit a nearby star. Planet B has twice the mass of planet A and is three times the distance from the star. How does the gravitational force on planet A compare to the gravitational force on planet B?

## WARM UP

The International Space Station orbits 350 km above the Earth. What tangential speed must it be moving in order to maintain a stable orbit?

Mass of the Earth =  $5.97 \times 10^{24}$  kg  
Radius of the Earth = 6371 km  
 $G = 6.67 \times 10^{-11}$

