Classical Mechanics
Lecture 5

Today's Concepts:

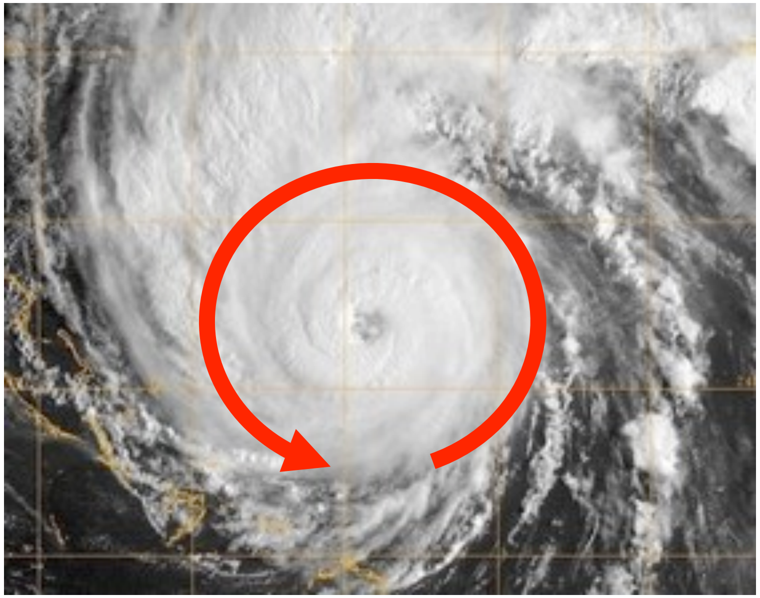
a) Free Body Diagrams
b) Force due to strings
c) Force due to springs
d) Force due to gravity

Stuff you asked about:

- Could you go over Newton's 3rd law more? I don't understand how if I push on a box, the box pushes equally back. If so wouldn't the net horizontal force be 0, meaning the box shouldn't move horizontally?
- A problem like the elevator problem, but in two dimensions or even 3 dimensions. So maybe the elevator is from Willy Wonka's factory, and can move in 3 dimensions
- elevators are pretty messed up~!
- show derivation of Law of Universal Gravitation please
- I'd like to get more of an explanation on force tension in situations with objects like hanging masses on a string.
- Why gravitational force is so small compared to the other major forces?
- I did not find any of these concepts difficult as for me this was a quick refresher on physics 11 and 12.
- We should discuss "exactly" what will be covered in the upcoming midterm on friday! Maybe give us some hints on the type of questions as well.

Hurricane explanation

We observe that hurricanes rotate CCW in the northern hemisphere, CW in southern hemisphere.



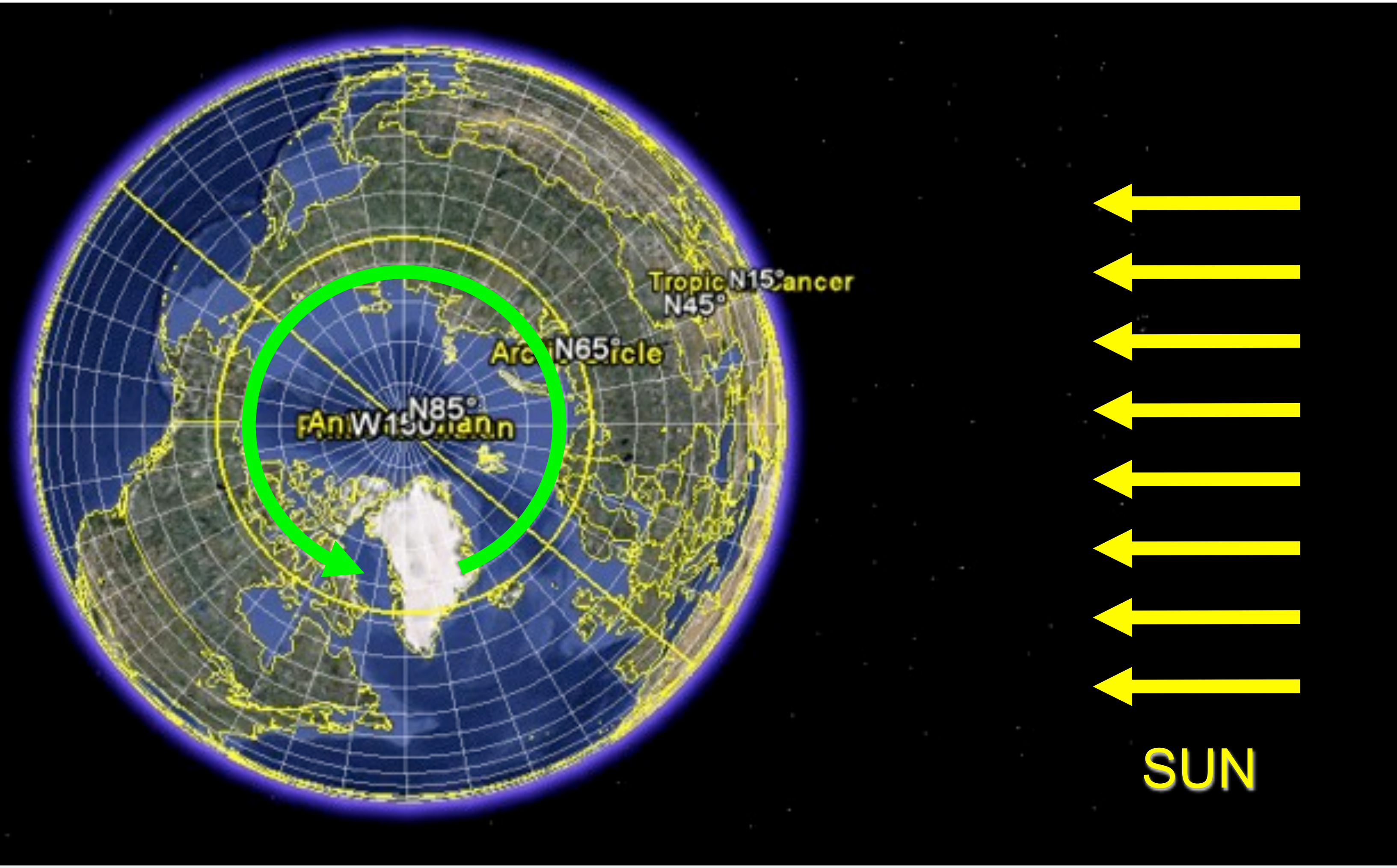
Hurricane explanation

1) If you are on some object rotating clockwise then objects moving in a straight line relative to someone who is not rotating appear to be turning LEFT relative to you.

2) If you are on some object rotating counter clockwise then objects moving in a straight line relative to someone who is not rotating appear to be turning RIGHT relative to you.

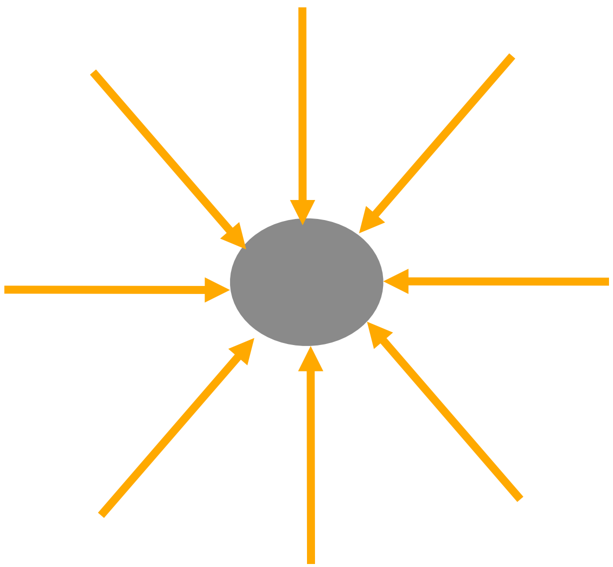
Hurricane explanation

3) Viewed from above the North Pole, the earth is rotating counter clockwise. This means if you are in the northern hemisphere, things will always appear to be turning right.



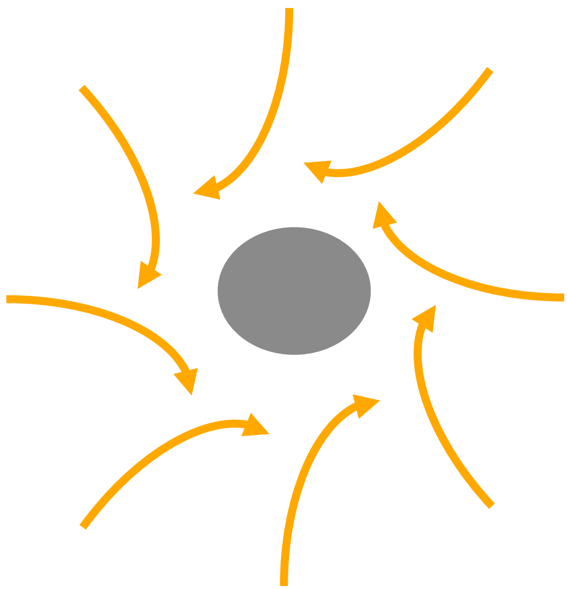
Hurricane explanation

4) The atmospheric pressure at the center of a hurricane is much lower than the atmospheric pressure in the air surrounding it. This means that air tries to move from the outside to the inside.

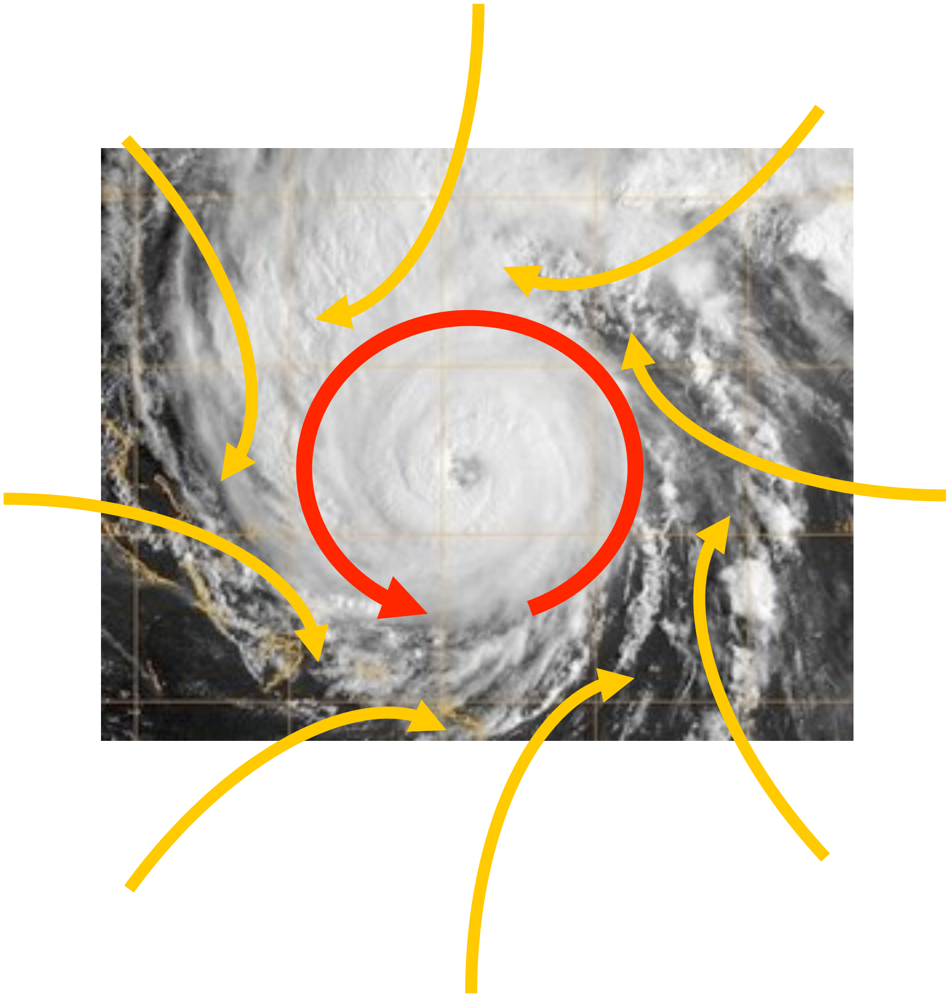


Hurricane explanation

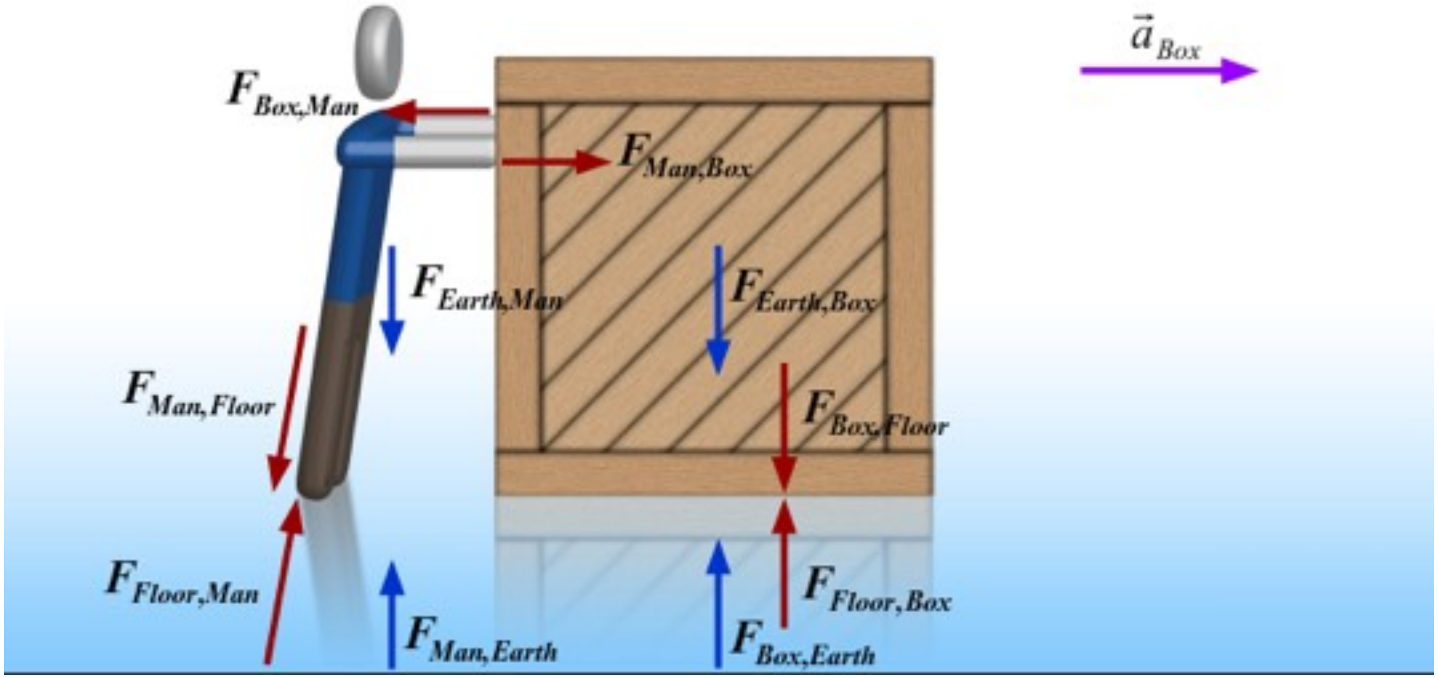
5) Since the earth is rotating, all of these lines will turn to the right as they move toward the center.



6) All of these "right turns" make the hurricane rotate CCW.

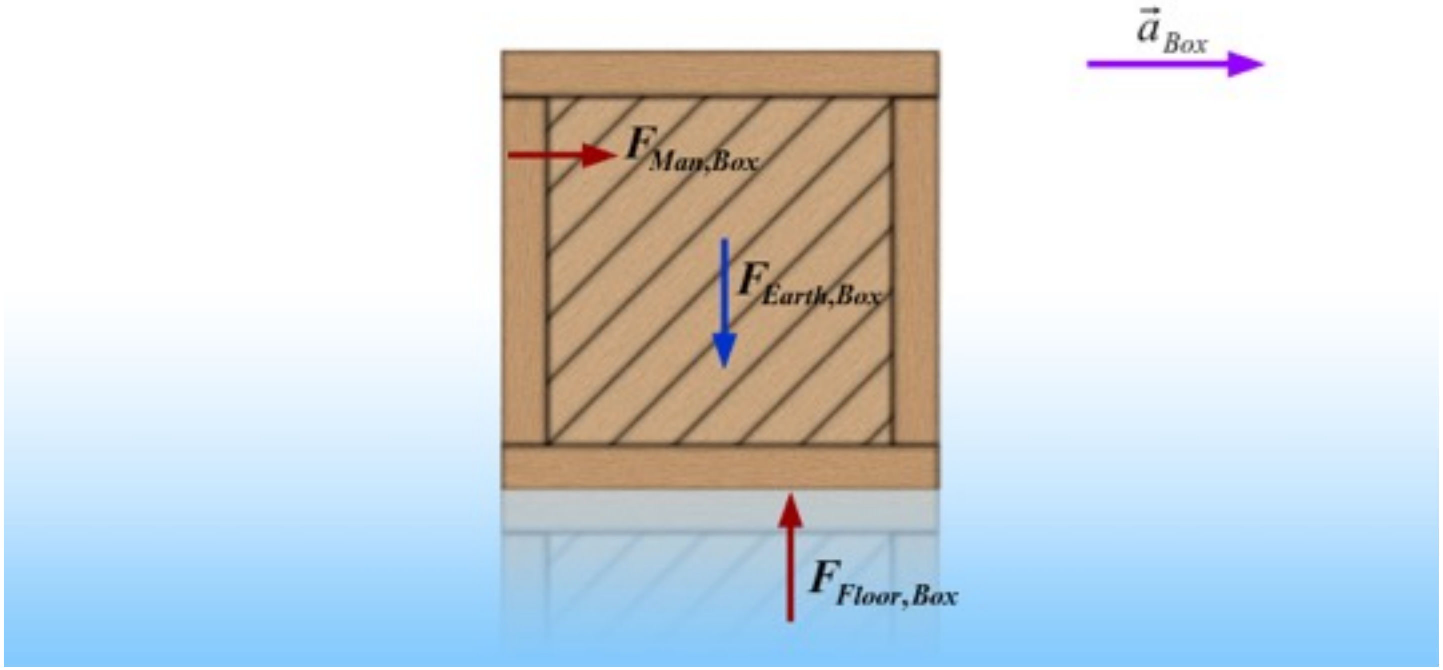


How to determine the box's acceleration...



How to determine the box's acceleration...

1. Identify the forces acting only on the box

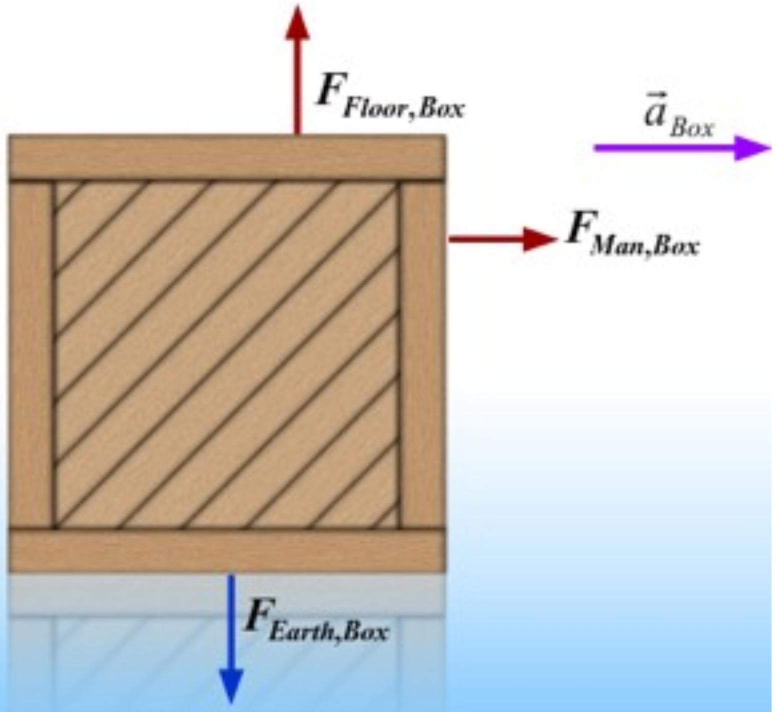


How to determine the box's acceleration...

1. Identify the forces acting only on the box
   (Draw a free-body diagram for the box)

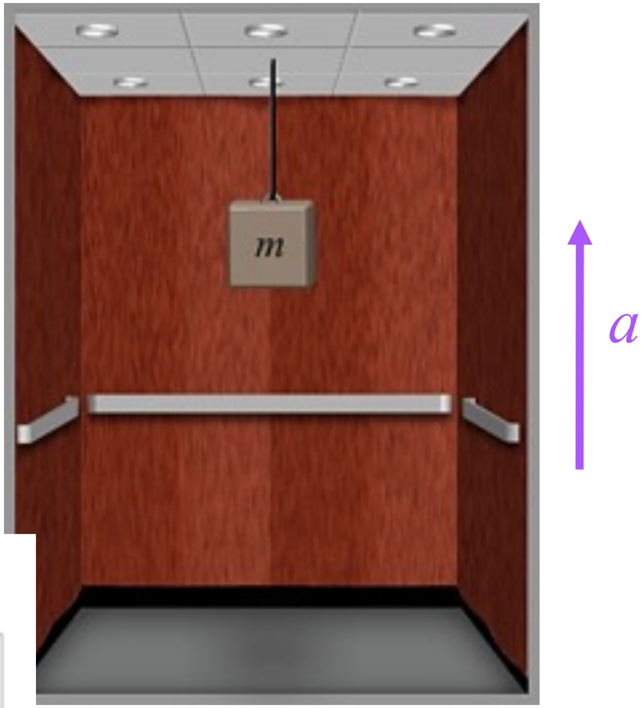
2. Apply Newton's 2nd Law

Newton's 2nd Law



CheckPoint

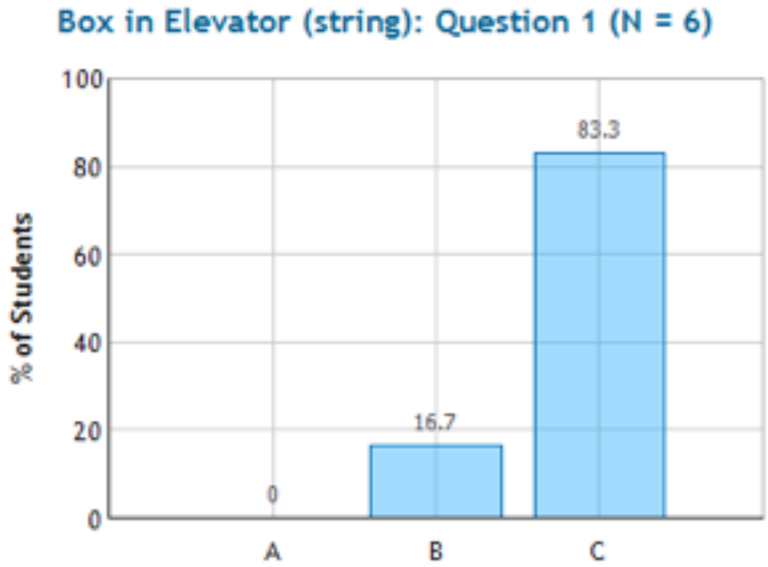
A box of mass m is hung with a string from the ceiling of an elevator that is accelerating upward. Which of the following best describes the tension T in the string:



A) $T < mg$

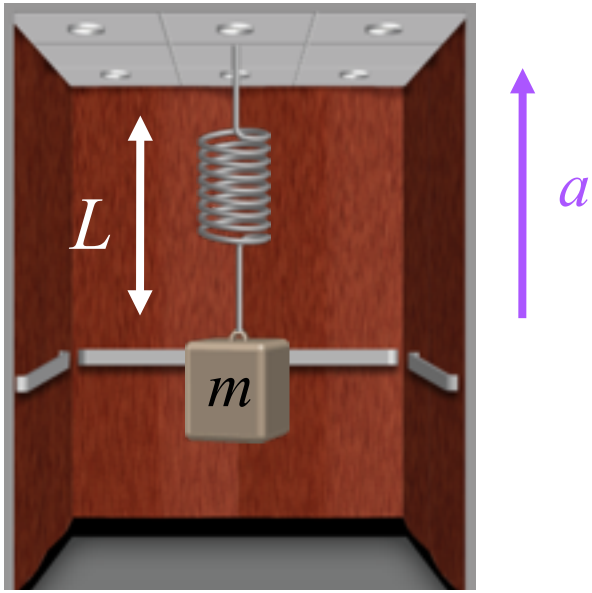
B) $T = mg$

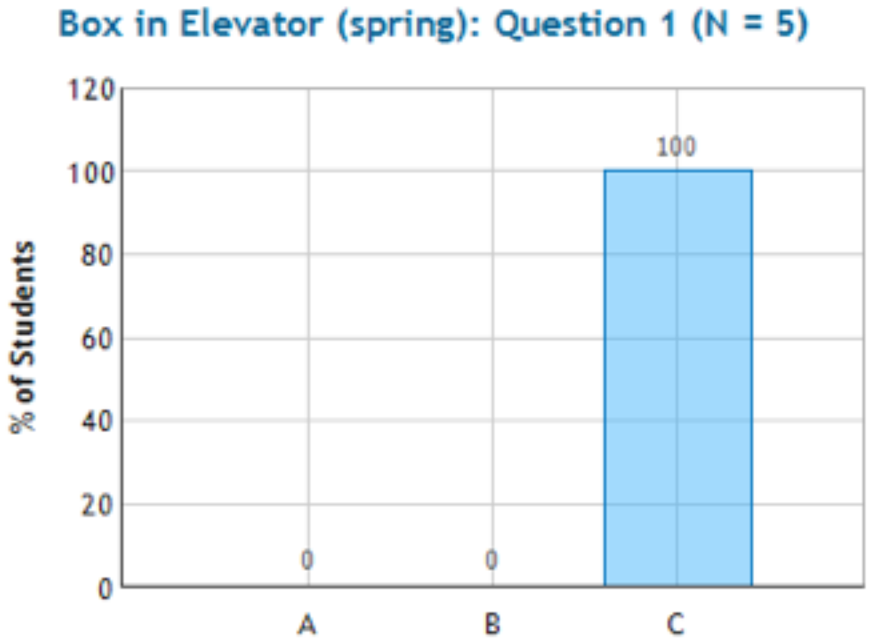
C) $T > mg$



CheckPoint

A box of mass m is hung by a spring from the ceiling of an elevator. When the elevator is at rest the length of the spring is $L = 1$ m. If the elevator accelerates upward the length of the spring wil' '





A) $L < 1$ m

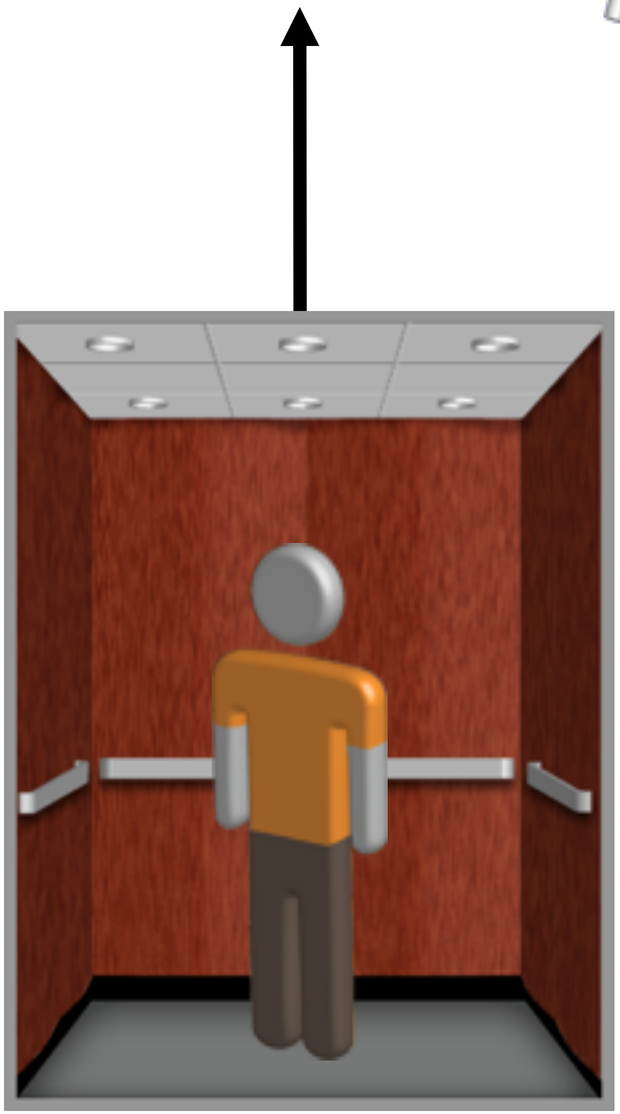
B) $L = 1$ m

C) $L > 1$ m

I don't like elevators. They are either hot, smelly, and icky or really cold. They give you motion sickness if they go to fast, but if they don't they take forever. And they have to stop at like every other floor. They are usually always cramped and enclosed. You can die in there or get trapped in there, or both. If you move up, you get squished, but if you move down you fly. Talk about elevators please.

Clicker Question

You are traveling on an elevator up the Willis tower. As you near the top floor and are slowing down, your acceleration



A) is upward

B) is downward

C) is zero

Clicker Question

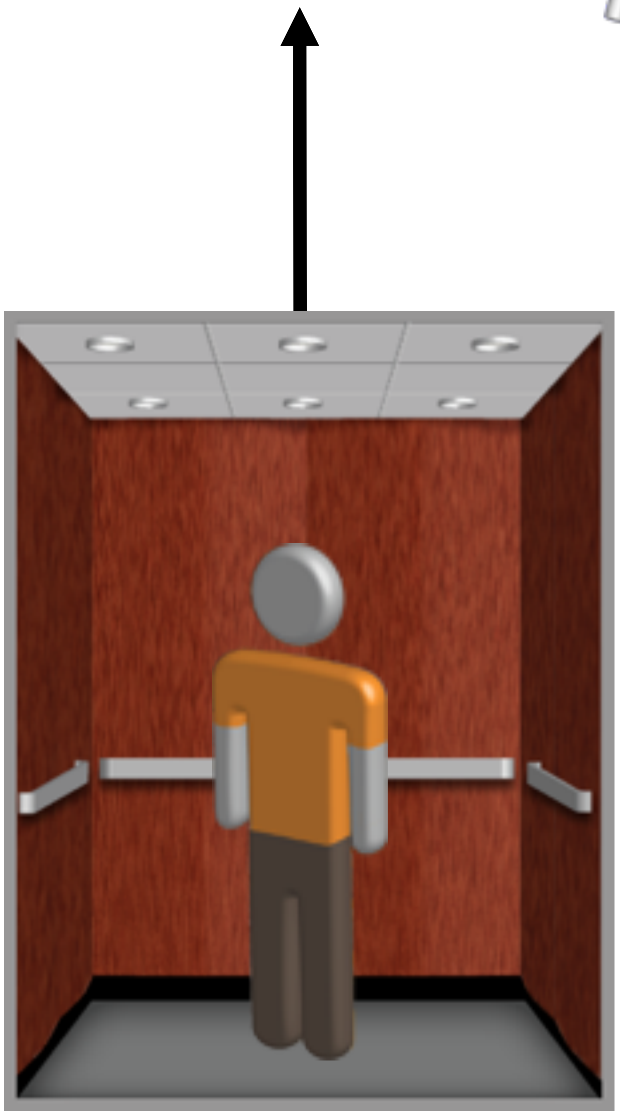
You are traveling on an elevator up the Willis tower, and you are standing on a bathroom scale.

As you near the top floor and are slowing down, the scale reads

A) More than your usual weight

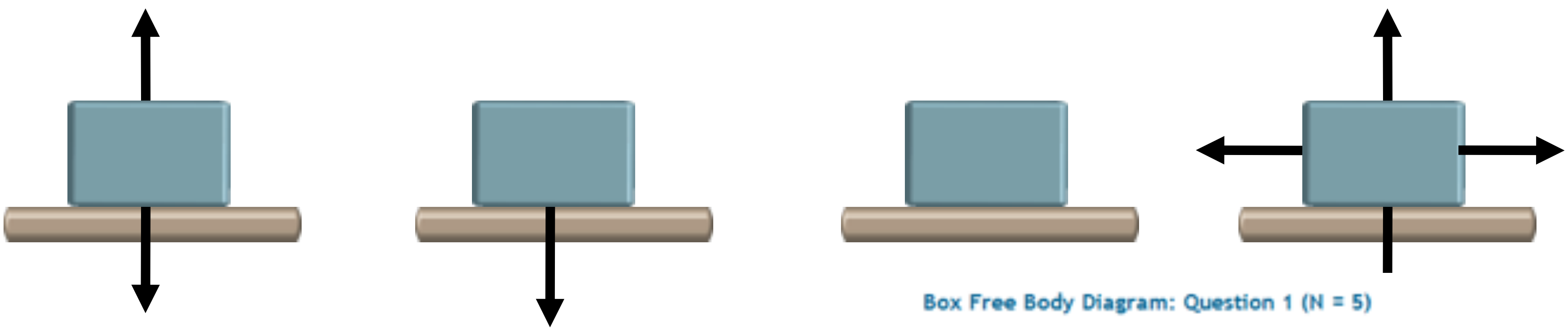
B) Less than your usual weight

C) Your usual weight

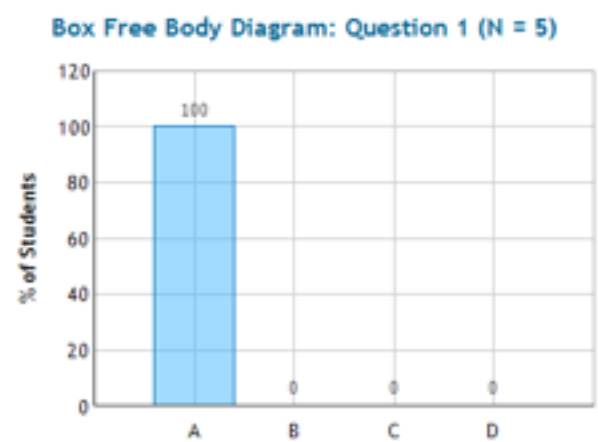


CheckPoint

A block sits at rest on a horizontal frictionless surface. Which of the following sketches most closely resembles the correct free body diagram for all forces acting on the block? Each arrow represents a force.

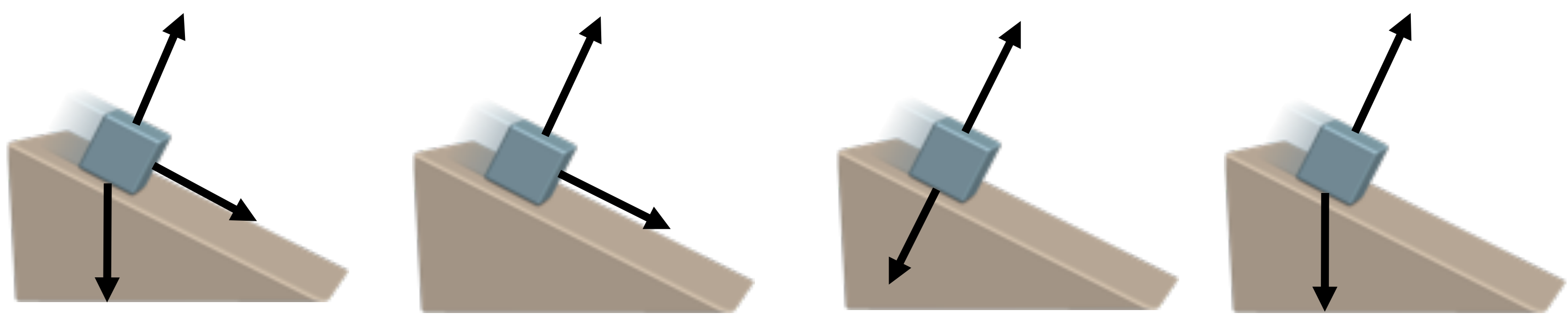


The only forces acting on the box are gravity (acting downward) and normal force (acting upward).



Clicker Question

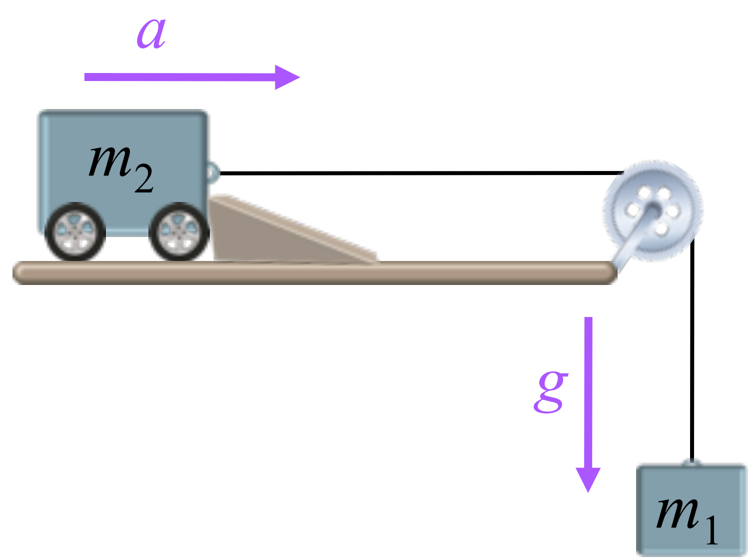
A block slides down a frictionless inclined plane. Which of the following sketches most closely resembles the correct free body diagram for all forces acting on the block? Each arrow represents a force.



A B C D

Clicker Question

A cart with mass m_2 is connected to a mass m_1 using a string that passes over a frictionless pulley, as shown below. The cart is held motionless.



The tension in the string is

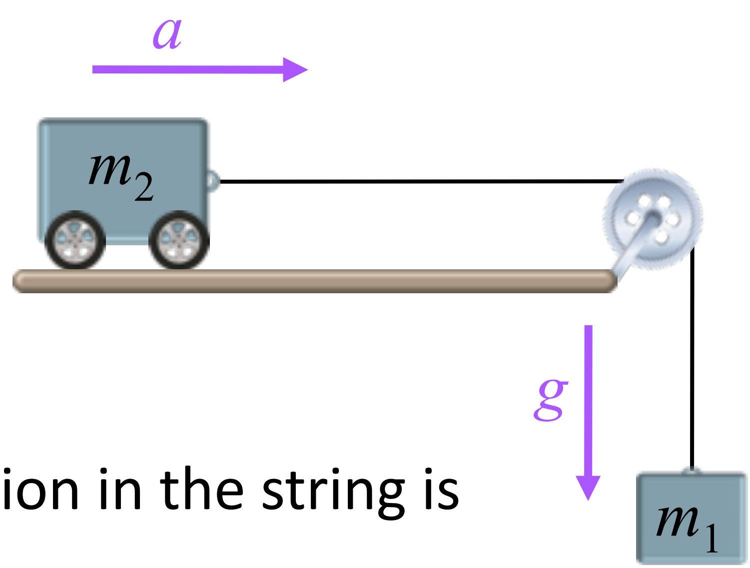
A) $m_1 g$

B) $m_2 g$

C) 0

Clicker Question

A cart with mass m_2 is connected to a mass m_1 using a string that passes over a frictionless pulley, as shown below. Initially, the cart is held motionless, but is then released and starts to accelerate.

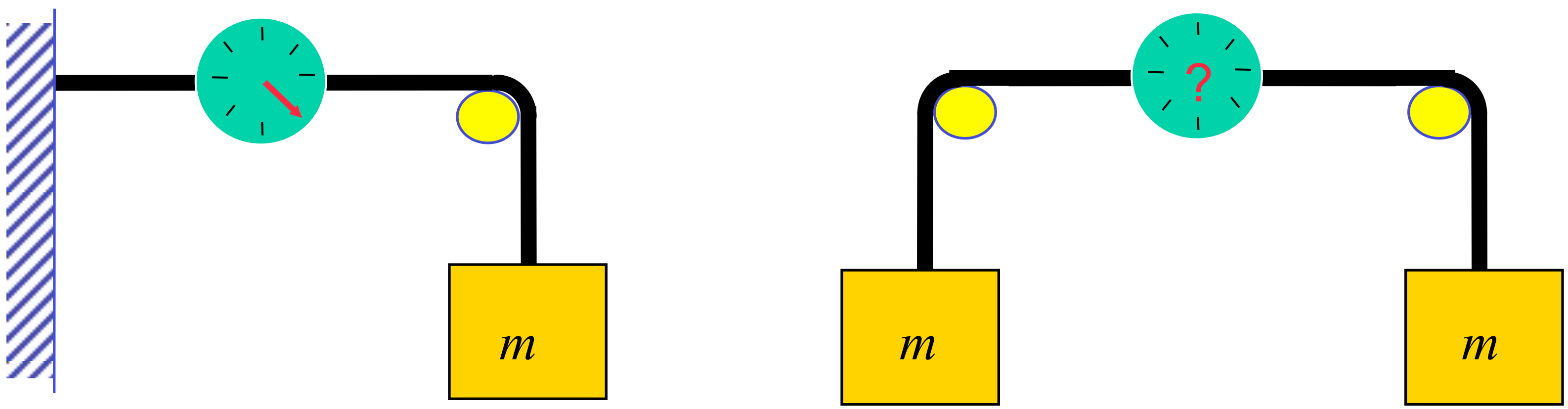


After the cart is released, the tension in the string is

A) $= m_1 g$
B) $> m_1 g$
C) $< m_1 g$

Clicker Question

A block weighing 4 N is hung from a rope attached to a scale. The scale is then attached to a wall and reads 4 N. What will the scale read when it is instead attached to another block weighing 4 N?



A) 0 N.

B) 4 N.

C) 8 N.