Forces

Warm Up: What is Wind? 9/27/17

1. Explain how does a difference in temperature cause convection currents in gases.
2. Using what you know about convection currents, explain why large amounts of air move to become wind.

Windmills Spinning

https://www.youtube.com/watch?v=Gu3EyzOYpGY

Ziggy

- https://www.youtube.com/watch?v=Yydv7unoTtk

Pool Tricks

- https://www.youtube.com/watch?v=pvVGRfN7DxQ

Sledding

- https://www.ngssphenomena.com/#/sleddinginertia/

What should we figure out

How does wind turn the blades of a windmill?

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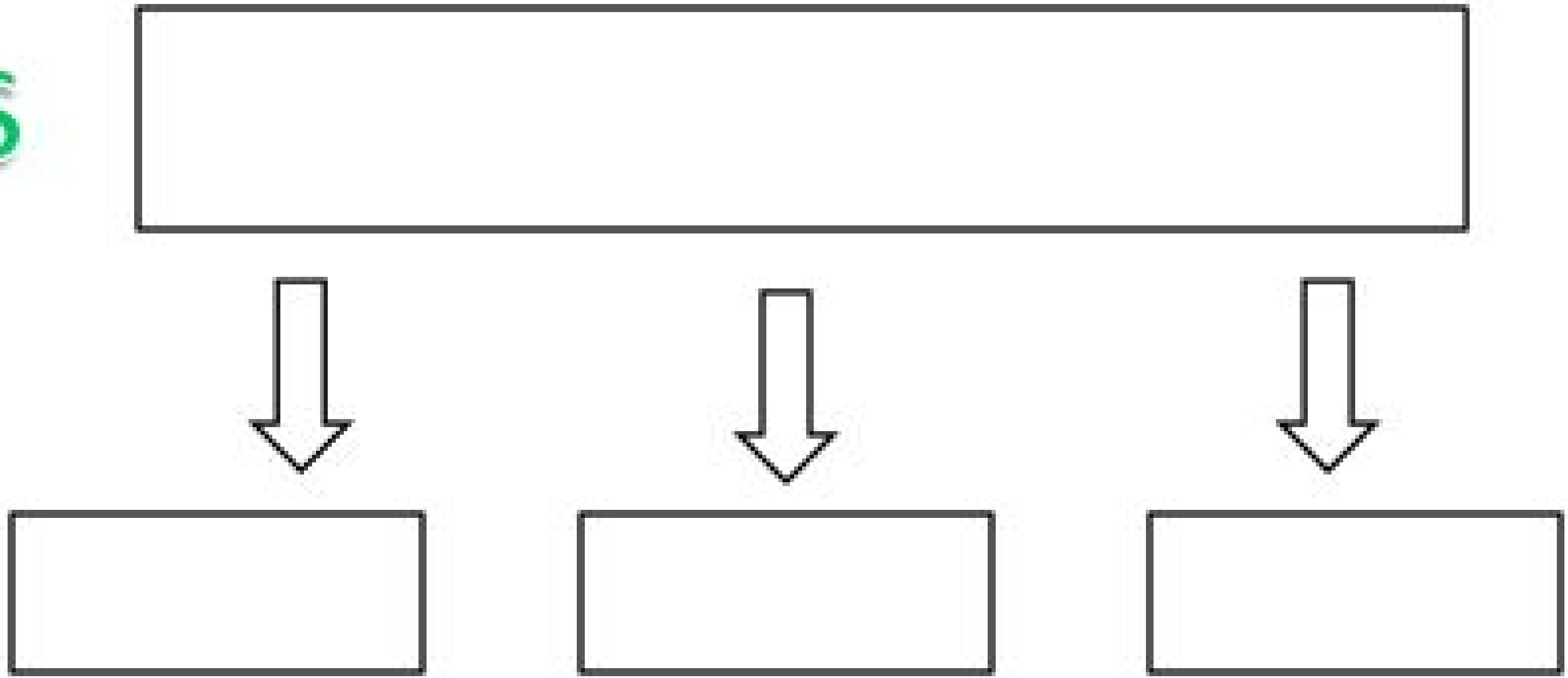
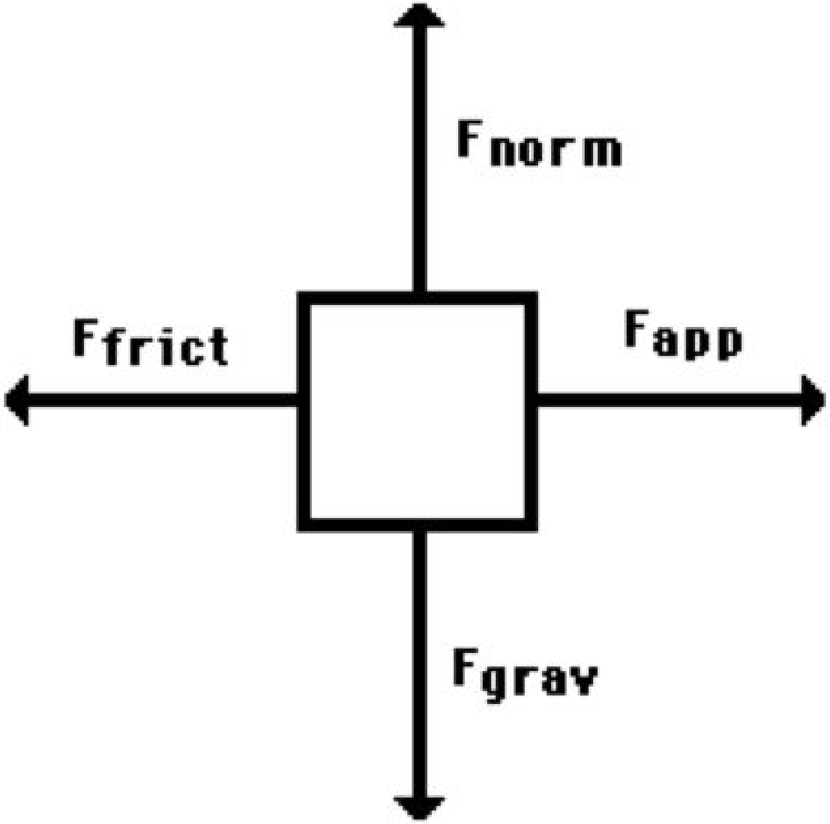


In your own words, explain to your partner what you think a force is

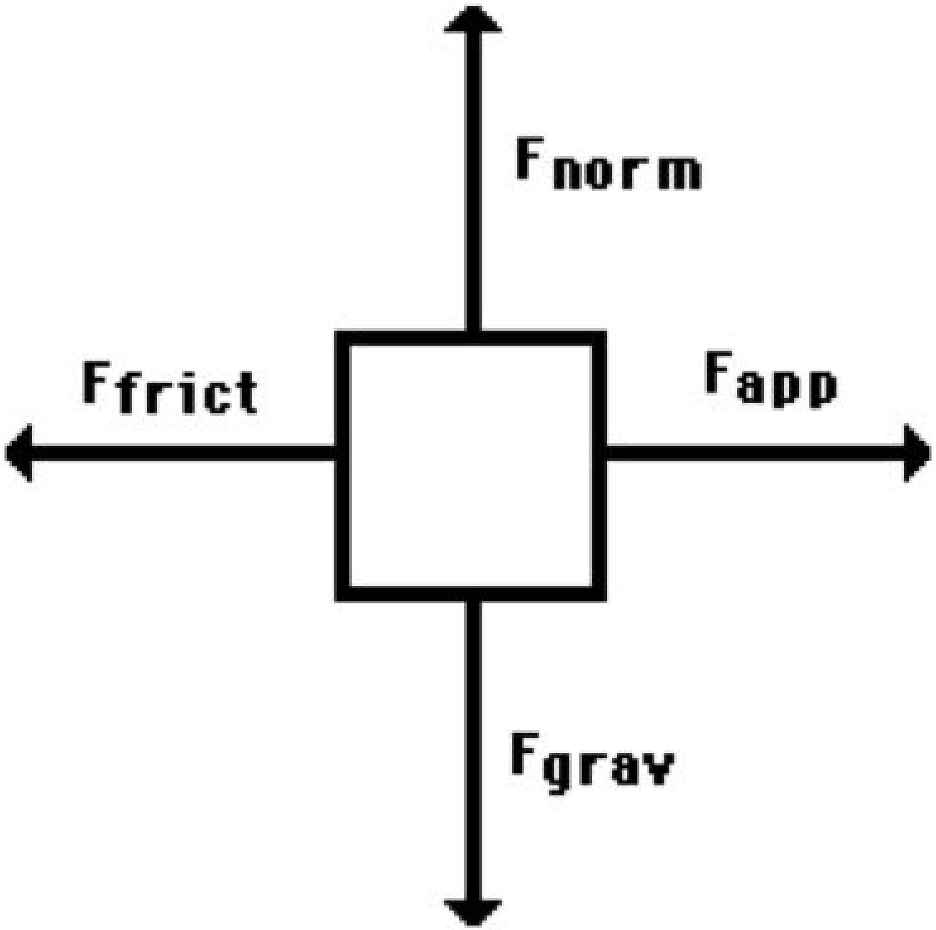
Notes: Free-body Diagrams 9/27/17

Free-body diagrams are pictures that show the ***size*** and ***direction*** of each force that acts on an object.



The square represents the object.

This diagram shows four forces acting on an object. There aren’t always four forces like the picture. There might be one, two, or three forces.



Common Forces

The ***force of gravity*** is shown by F_G and it usually pulls *down*.

The ***normal force***, F_N , pushes against objects. For example, the normal force for a book lying on a table would point straight up.

The ***force of air resistance***, F_{air} , pushes against gravity for falling objects. The direction of this force is usually opposite of gravity.

The ***applied force***, F_{app} , is the force of pushing an object.

The ***force of friction***, F_{frict} , pushes against the direction of movement.

Common Forces

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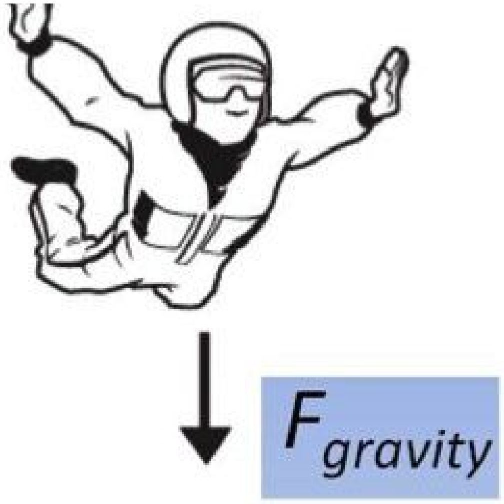

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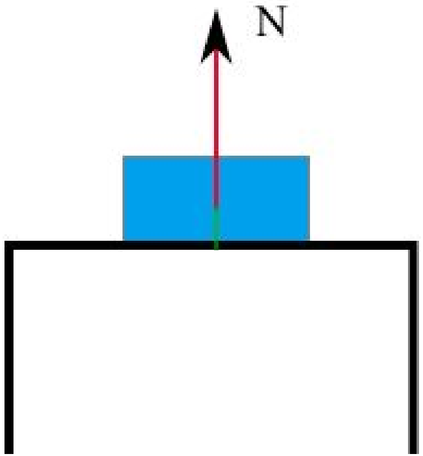

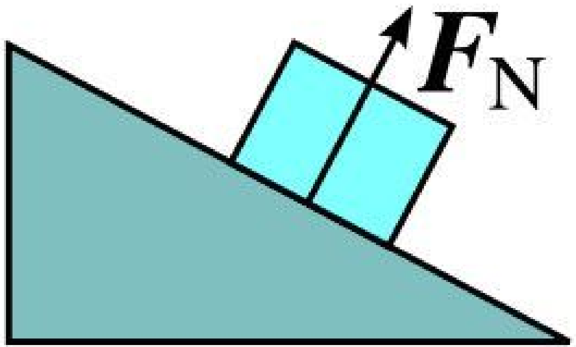

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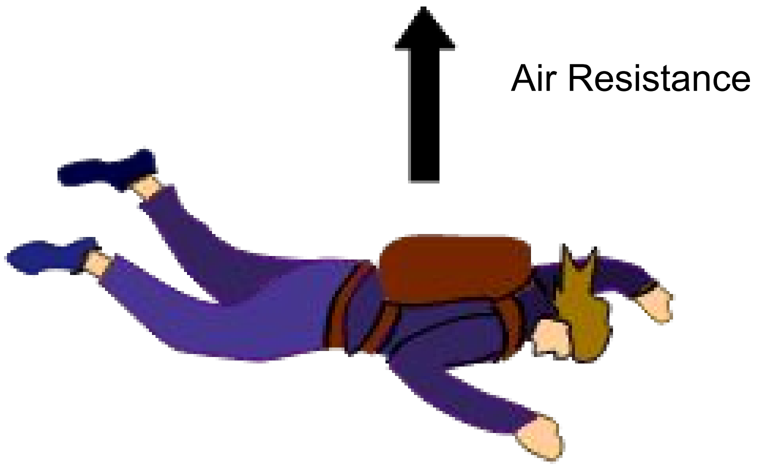
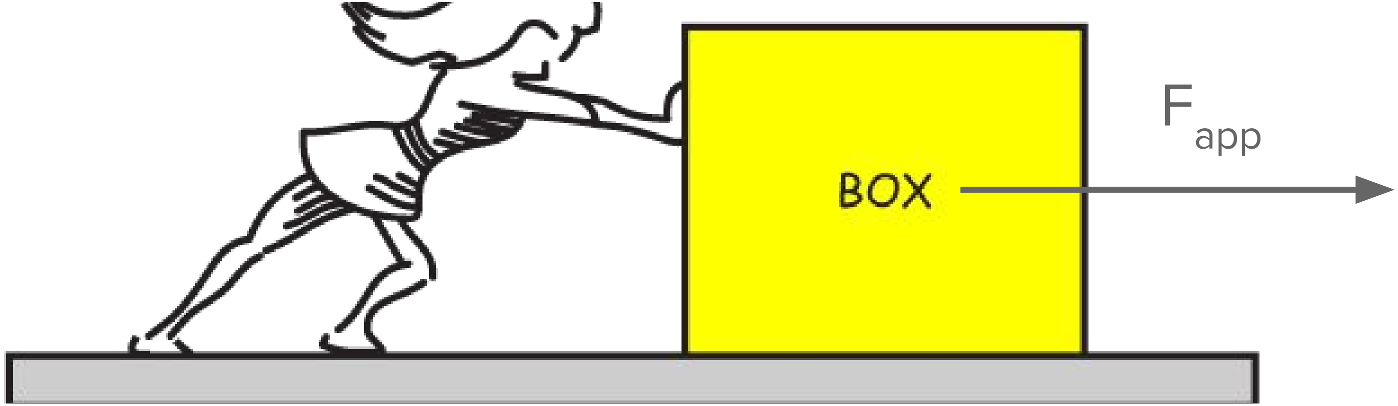


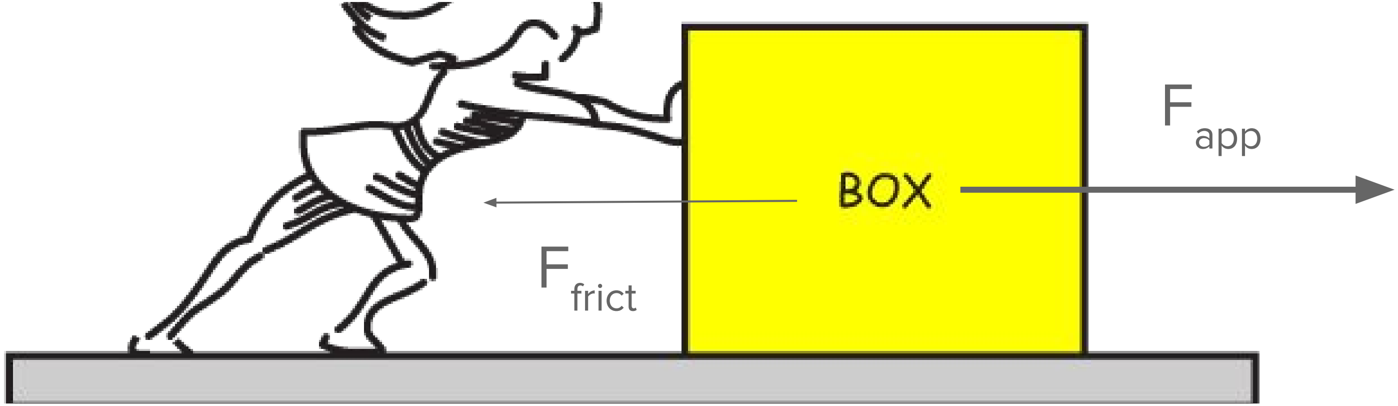
Common Forces

The ***applied force***, F_{app} , is the force of pushing an object.



Common Forces

The ***force of friction***, F_{frict} , pushes against the direction of movement.



Steps to Diagram Forces:

1. Draw a box to represent the object.
2. Identify all forces acting on the object.
3. Draw arrows to represent those forces.

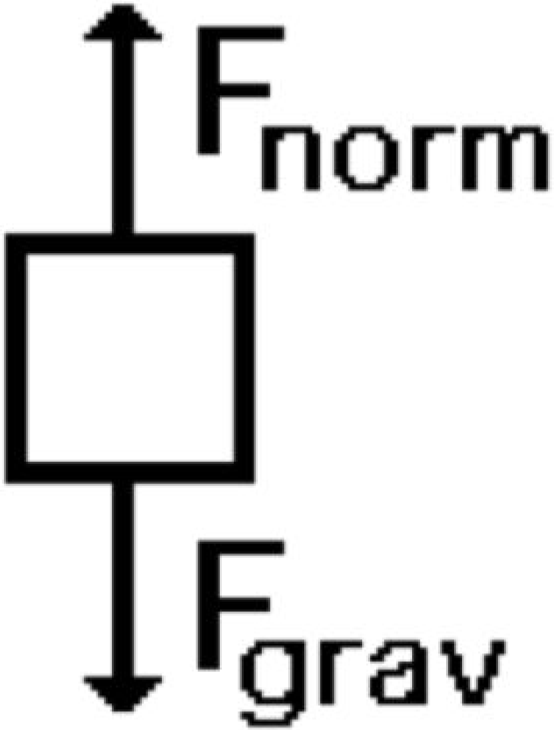
Example 1

A book is at rest on a table. Diagram the forces acting on the book.

- Force of gravity
- Normal force

Example 1

A book is at rest on a table. Diagram the forces acting on the book.

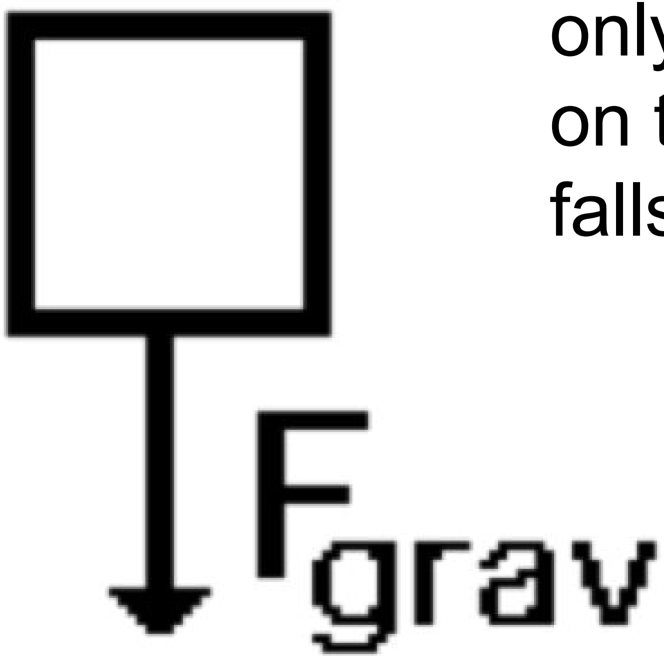


In this diagram:

- The force of gravity is pulling the object down
- The normal force is pushing against gravity.

Example 2

An egg is falling from a nest in a tree. Ignore air resistance.



Gravity is the only force acting on the egg as it falls.

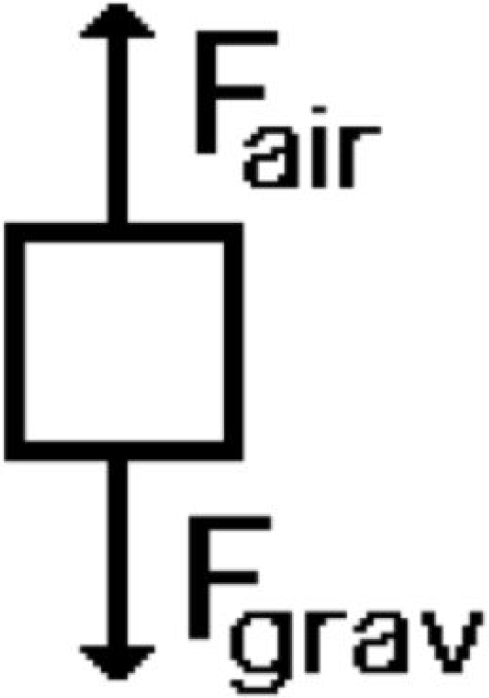
Pull out a half sheet of paper

Notebook Quiz 4 9/28/17

1. Write your answer to question 1 from Warm Up: What is Wind on 9/27/17.
2. Write your answer to question 2 from Warm Up: What is Wind on 9/27/17.

Example 3

A skydiver is falling from a plane.

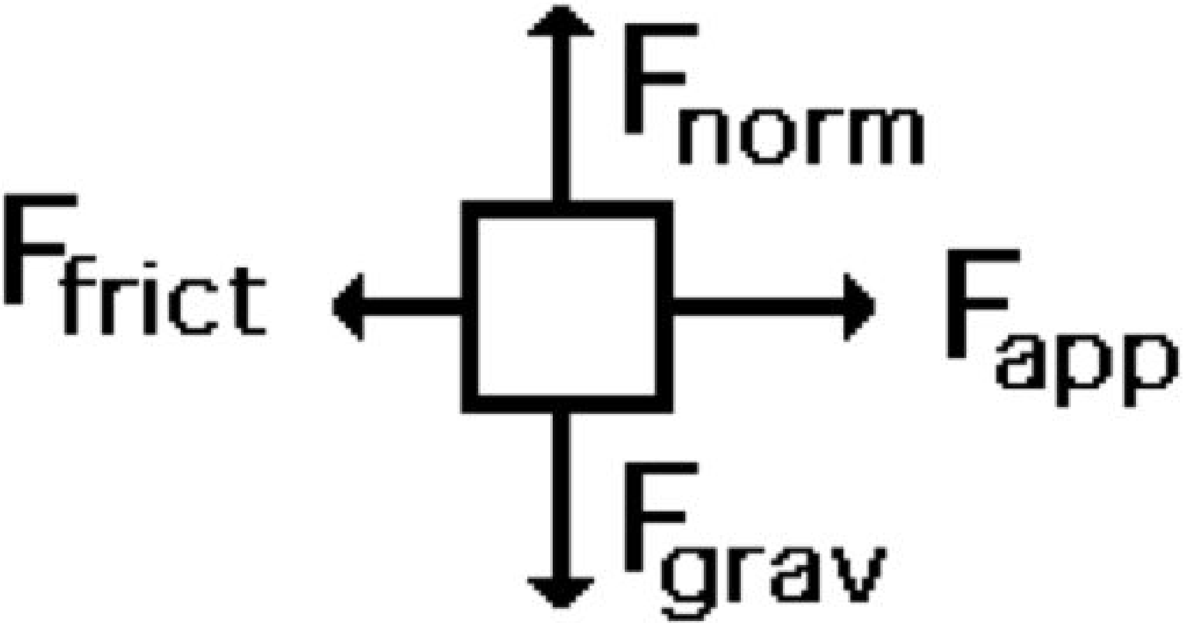


Gravity pulls down on the skydiver while air resistance pushes against gravity.

Example 4

You push a book across a table ***to the right.***

Example 4



Gravity pulls down on the book while the table (normal force) pushes against gravity.

The applied force points ***to the right*** while friction pushes in the opposite direction

Drawing Force Diagrams Worksheet

Velocity = speed

When finished:

- Work on homework, read, sleep. No phones.

Balanced/Unbalanced Forces

Balanced/Unbalanced Worksheet

Warm Up: Force Diagrams 9/29/17

Draw a force diagram for the **car** in each scenario below. Label the forces as balanced or unbalanced.

Hint: If the forces are unbalanced, make sure the arrows are different sizes.

1. You drive a car to the right at a constant speed of 65mph.
2. You drive a car to the right, push the gas harder, and speed up.
3. You drive a car to the right, take your foot off the gas pedal, and slow down.

Go Over Warm Up

10 minutes to complete worksheet

Activity 1: Penny and Card

1. Put card flat on top of cup
   a. If card is bent it will not work!
2. Put penny on card
3. Flick card
   a. Card should come out.

Activity 1: Penny and Card

1. Draw the force diagram for the **penny** before the card was flicked.
2. Draw the force diagram for the **penny** after the card was flicked. Ignore air resistance.
3. Draw the force diagram for the **card** as soon as it was flicked.

Penny and Card: Analysis

4. What happened to the penny when the card was quickly removed.
5. Why were you able to move the card without moving the penny?
6. Why did the penny drop into the cup when the card was moved? Why didn't it drop when the card was there?

Evidence - Explain

Evidence: Describe what the penny did before and after the card was flicked.

Explain: Explain why the penny fell down instead of move horizontally.

Exit Ticket

Draw the force diagram for the following scenario:

You drive a car to the left, push on the gas pedal, and speed up.

Warm Up: Force Diagrams 10/2/17

You throw a baseball up in the air. Draw a force diagram for each scenario below. Label the forces as balanced or unbalanced.

*Hint: If the forces are unbalanced, make sure the arrows are **different sizes.***

1. The baseball is leaving your hand.
2. The baseball is travelling up and slowing down.
3. The baseball is falling down and speeding up.

Activity 2: Washers

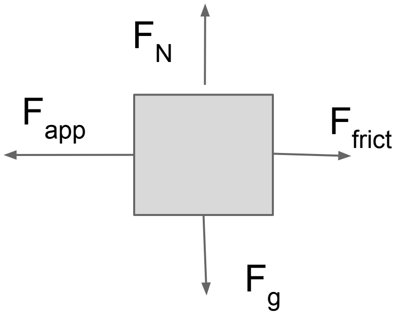
1. Stack 5 washers in one stack on the lab station.
2. Using the remaining washer, flick it at the bottom of the stack of washers.
3. Allow each person in the group to do this once or twice.

Washers Analysis

1. Draw the force diagram for the bottom washer when it was hit.
2. Draw the force diagram for the 5 remaining washers when the bottom washer was hit.

Washers Analysis Answers

1. D



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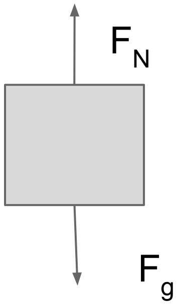


Washers: Analysis

3. Explain why the top washers didn’t move horizontally.
4. Explain why the bottom washer moved horizontally.

Washers: Analysis Answers

3. The top washers didn’t move because no horizontal force was applied to them.
4. The bottom washer moved horizontally because a force was applied to them horizontally.

Washers: Evidence-Explain

Evidence: Did the top washers move horizontally? Did the bottom washer move horizontally?

Explanation: Why?

Activity 3: Passenger Penny

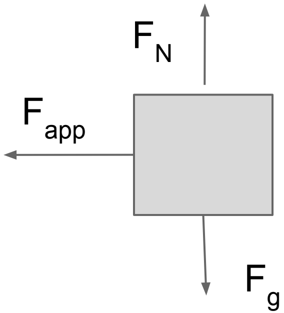
1. Place the penny on top of the car.
2. Slowly roll the car into your hand.
3. Notice where the penny goes.

Passenger Penny: Analysis

1. Draw the force diagram for the **car** the moment it hit your hand.
2. Draw the force diagram for the **penny** the moment the car hit your hand. *Ignore friction between the penny and car.*

Passenger Penny Analysis Answers

1.



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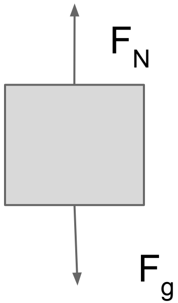


Passenger Penny: Analysis

3. Using forces, explain why the car stopped.
4. Using forces, explain why the penny continued to move.
5. Explain why seatbelts are important in car accidents.

Passenger Penny Analysis Questions

3. My hand applied a force to the car in the opposite direction of its movement. This applied force stopped the car.
4. Nothing applied a force to the penny so it did not stop moving.
5. When a car suddenly stops, bodies want to keep moving forward. The seatbelt applies a force in the opposite direction of movement and stops bodies from moving forward.

Passenger Penny: Evidence-Explain

Evidence: What did the car do when it hit your hand? What did the penny do when the car hit your hand.

Explanation: Why?

Pull out a half sheet of paper

Notebook Quiz 5 10/3/17

1. Write your answer to question 3 from Activity 2: Washers.
2. Write your answer to question 4 from Activity 2: Washers.

Activity 4: Eggs

1. Spin the hard boiled egg in the dish.
2. *Gently* tap the top of the hard boiled egg (this tap should last no more than a second).
3. Spin the raw egg in the dish.
4. *Gently* tap the top of the raw egg.

5 minute *Silent* work time

1. What state of matter is the inside of a raw egg? Solid or liquid?
2. What state of matter is the inside of a hard-boiled egg? Solid or liquid?
3. Why would the hard-boiled egg stop but the raw egg keep moving? Use numbers 1 and 2 to help.

1. The inside of a raw egg is liquid.
2. The inside of a raw egg is solid.
3. The solid inside of the hard boiled egg is attached to the shell. When a force is applied to the shell, the shell AND solid inside stop. The liquid inside of the raw egg is not attached to the shell. When a force is applied to the raw egg shell, the liquid keeps moving because no force is applied to it.

Evidence-Explain

Force Model Map

What do the labs have in common?

Notes: Newton's First Law

Inertia describes how resistant an object is to change.

More inertia means more resistant to change.

Newton's First Law of Motion:

Particles at rest stay at rest and particles in motion stay in motion with the same speed and in the same direction unless acted on by an unbalanced force.

Particles tend to “keep doing what they’re doing.”

They resist changes in their state of motion.

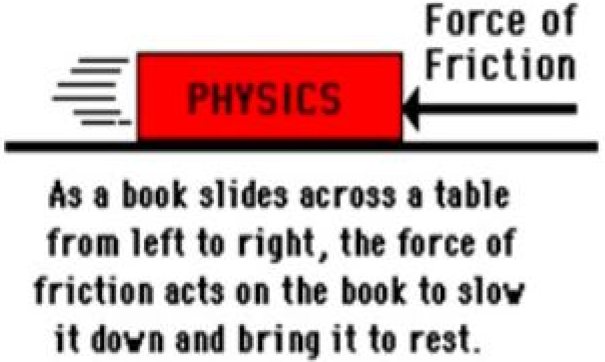
This resistance is called ***inertia***.

- **Mass** is how much “stuff” or matter an object has.
- The more mass, the more ***Inertia***

A force is ***NOT*** needed to keep an object moving.

We are used to seeing objects slow down and stop moving because ***friction*** is a force that slows down movement when objects rub against each other.

An object thrown in space, where there is no friction, would not stop moving.



Newton's First Law in Space

https://www.youtube.com/watch?v=Q0Wz5P0JdeU

Mechanical Universe: Inertia

Warm Up: Johnny's Claim 10/4/17

Johnny claims that:

"Objects with lots of mass produce big forces when they hit stuff. Objects with little mass produce small forces when they hit stuff."

- Write Johnny's claim.
- Do you agree or disagree with Johnny? Explain your reasoning.

Introduction/Purpose:

In complete sentences:

- What will your experiment try to prove or disprove?
- What two things does your experiment have to compare?

The experiment will prove or disprove ______________________
The experiment will compare ____________ and ____________.

Hypothesis

In a complete sentence:

What do you think the relationship between force and mass is?

I think objects with lots of mass produce
(a lot /a little) force compared to objects with little mass.

Procedure: With your group. About 15 minutes

Design an experiment using some or all of the following materials to support or refute Johnny's claim.

- Play Doh
- Toothpick
- Ruler
- Various masses
- Cup
- Balance (to measure mass if you need it)

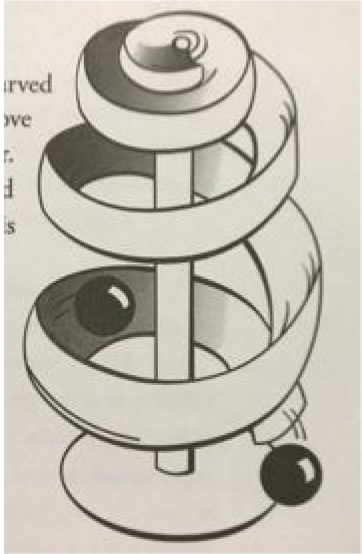
I will check procedures. Each group member must have a procedure by the end of class. When finished: work on homework, read, sleep.

Procedure

- Numbered
- Detailed
- Each sentence should start with a verb (*measure* 100mL of water, *pour* water into beaker, ...)

Pull out half sheet of paper

Exit Ticket: Marble Tower



Five friends built a marble tower. The marble had a curved track. The track was designed so that the marbles would move down the track in a circular path. The track ended on the floor. Each friend predicted how he or she thought the marble would move when it rolled of the end of the track onto the floor. This is what they said:

A: "I think it will curve for a bit and then straighten out."

B: "I think it will roll in one big curve."

C: "I think it will roll in a straight line."

Choose the answer you agree with most. Explain your reasoning using forces.