Pueblo Science

BALLOON CAR

INSTRUCTORS:
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INTRODUCTION!

* Emerson
* Senior Research Associate @ University of Toronto. MASc in Aerospace Engineering
* Fun Fact: 25+ satellites I've worked on are in space!

* Evan
* Year Ten High School Student
* Fun Fact: I like photography

YOUR TASK

Today, you are going to be working with household materials to build a car that uses a balloon to propel itself forward!

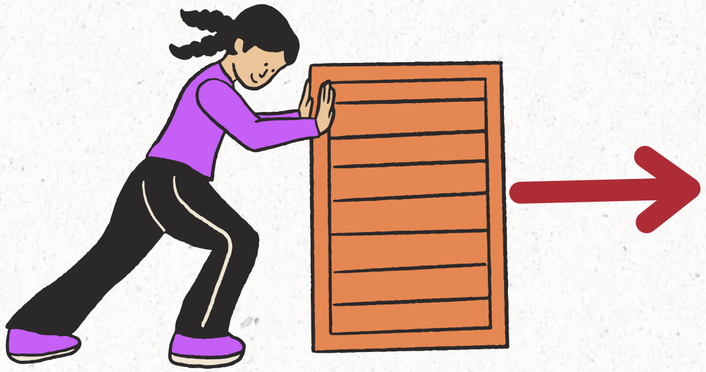
Before building your balloon-powered car, we will do an investigation into the science behind it to find out exactly how it works and why we may see certain results.

01 INVESTIGATION

~ Let's take a look into the science, and find out how exactly the Balloon Car will work!

FORCE

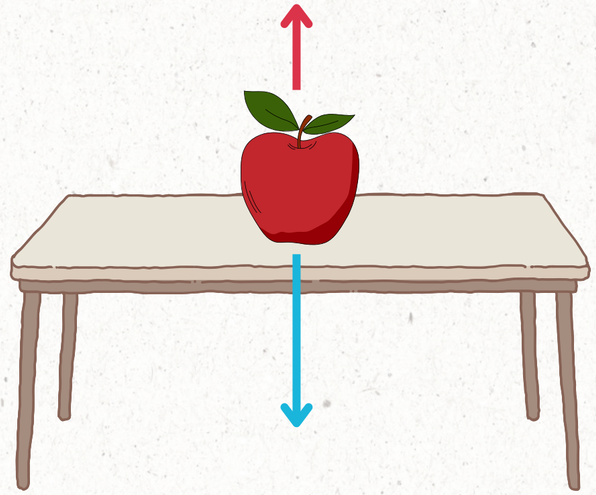
The Pushing or Pulling motion caused by objects interacting



CONTACT FORCES

NORMAL FORCE

The force that keeps an object in place

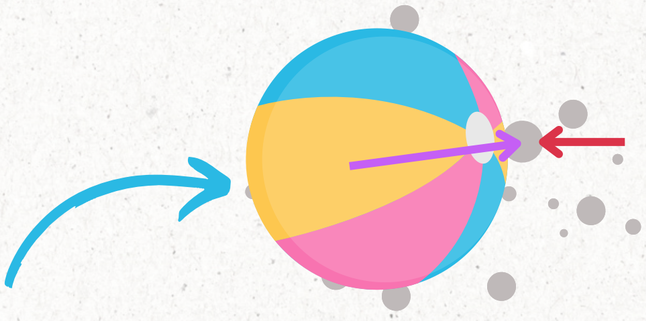


FRICTION

The force pushing back against the motion of an object, on a surface

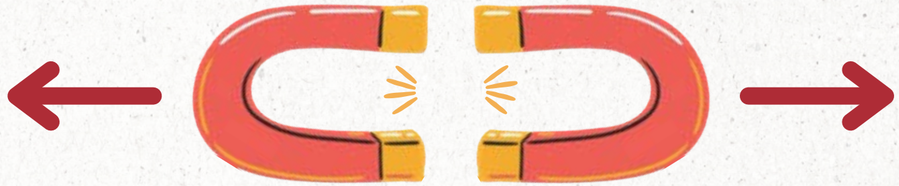
AIR RESISTANCE

The force pushing back against the motion of an object, in the air

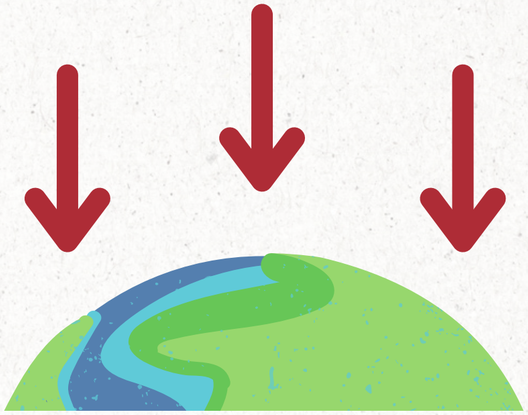


NON-CONTACT FORCES

A force that occurs when objects aren't touching one another



Gravity is a non-contact force that draws objects toward the ground



WHY IS AIR RESISTANCE NOT A NON-CONTACT FORCE?

ANSWER:

In Air Resistance, air particles hit the object, pushing against it and slowing it down

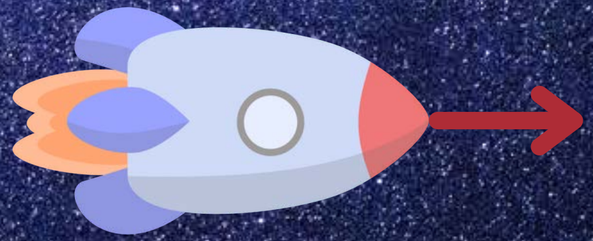
FORCE

HOW CAN FORCES EXERTED ON AN OBJECT IMPACT VELOCITY?

- Forces exerted on an object can change its speed, shape and/or direction.
- If a force acts in the **same direction** an object is moving, it will **increase** the speed of an object.
- If a force acts in the **opposite direction** an object is moving, it will **decrease** its speed.
- For example, when your balloon car starts moving Air Resistance & Friction will act on it, slightly pushing it back and slowing the speed.

FUN FACT

SPACE IS A VACUUM AND SO THERE IS NO AIR OR FRICTION TO SLOW YOU DOWN. THAT MEANS YOU CAN CONTINUE MOVING AT THE SAME SPEED FOREVER OR CONTINUE ACCELERATING GOING FASTER AND FASTER SINCE THERE IS NOTHING TO SLOW YOU DOWN, AS LONG AS YOU DON`T COLLIDE INTO ANYTHING OR GET PULLED INTO A GRAVITATIONAL FIELD.



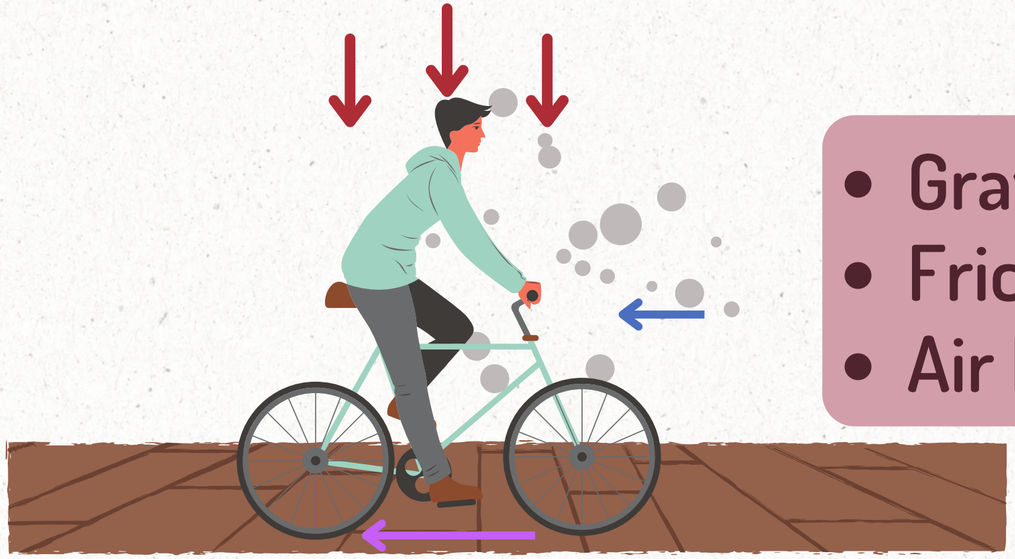
CAN MORE THAN 1 FORCE AT A TIME ACT ON AN OBJECT?

True or False?

ANSWER: TRUE!

Awesome job!

When many forces are acting on an object, the forces combine into a net force, which is the combination of all forces acting on the object.

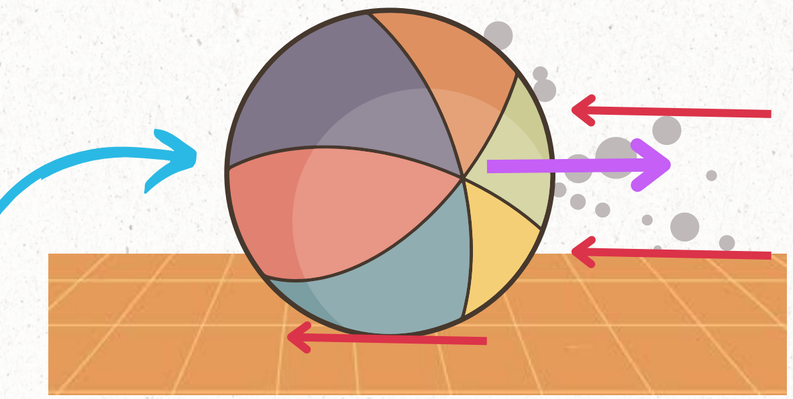


- Gravity
- Friction
- Air Resistance

NEWTON`S LAWS OF MOTION

FIRST LAW

An object will stay at rest or continue moving unless an external force acts on it



SECOND LAW

Force is equal to mass multiplied by acceleration

THIRD LAW

For every action, there is an equal and opposite reaction.

ANY QUESTIONS?

Any questions? Don't hesitate to ask us anything! :-)

02 PROCEDURE

~ It's time to apply what we have just learned and build an awesome car that will propel itself using air!

- 1, Cut 2 straws so they are slightly longer than the width of the bottle.
  - 2, Then, Tape the straws to the bottle. Make sure they are parallel.

Your Balloon Car's base should look like this after the first two steps!

  - 3, Cut the skewers so they are slightly longer than the straws.

  - 4, Use an Exacto knife to make small holes in the centre of all four bottle caps **(with teacher's assistance)**

- 5, Push a skewer through one of the holes. [2]
  - 6, Thread the skewer through one of the straws, pointy end first. [2]

Your Balloon Car's base should look like this after steps 5-8!

  - 7, Push a bottle cap onto the other end of the skewer. This makes an axle with two wheels. [2]

- 8, You need to repeat steps 5-7 once more!

  - 9, Make sure your axles spin freely. Put the car down and make sure it rolls smoothly. It might get stuck if the wheels wobble or the axles are not parallel. Adjust them if needed.

This is what steps 10-11 should look like

- 10, Slide the short end of the third straw into the neck of the balloon.
    - 11, Tightly wrap a rubber band around the neck of the balloon.

    - 12, Blow the balloon up through the straw to make sure there are no leaks.

    - 13, Cut a small hole (big enough for the straw) in the top of the car **(with teacher's assistance)**

This is what it should look like after step 15

- 14, Press the free end of the straw through the small hole and out the mouth of the bottle.
    - 15, Tape the straw so it points backwards, not down.

    - 16, Inflate your balloon; then put the car down and release! Cover the tip of the straw with your fingertip to keep the air in the balloon until you put it down.

Awesome Job! You have completed the Balloon Car!!

COMMON ISSUES

- If your car does not move at all, or moves very slowly, inflate the balloon more and try again.

- If your car still does not move, double check your axles to make sure they spin freely. If the wheels and axles are not aligned, the balloon might not be strong enough to push the car forward.

ADDITIONAL ACTIVITIES

FRICTION CHALLENGE

Try using your balloon car on different surfaces! See how the speed might change as you change the surfaces.

WEIGHT CHALLENGE

Fill the car with small, heavy objects, like rocks! See how the additional weight might impact speed in different situations!

RACING CHALLENGE

Race your Balloon Car with your friends, and see who wins! Good Luck! You can also try mixing the weight challenge/friction challenge with the Racing Challenge.

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THANK YOU!

Any questions? Don't hesitate to
ask for our help!