STEM Outreach Presents:

STEM Every Day Keeps the Boredom Away

Balloons Edition

SQUEALING BALLOON

DIFFICULTY LEVEL: NOVICE

PURPOSE

To explore the relationships between vibrations and sound.

MATERIALS

1 Balloon
1 Hex Nut

INSTRUCTIONS

1. Insert a hex nut into the “mouth” of the balloon.
2. Inflate the balloon and tie it off.
3. Spin the balloon around while holding it by the neck.
4. Listen. What do you hear? What happens if you spin it faster or slower? What happens when you stop?

VOCABULARY

Matter: Everything that makes up the universe
Sound Waves: Vibrations that we can hear
Volume (amplitude): How loud or quiet a sound is
Pitch (frequency): How high or low a sound is
Noise: Any kind of sound that is unwanted or harmful

CONCEPT #1

Sound

Sound waves are created when matter vibrates. Sound waves can move though solids, liquids and gases. When a sound wave enters your ears, the bones in your ear vibrate and you can hear the sound.

CONCEPT #2

Pitch

When you spin the balloon, the hex nut rubbing against the inside of the balloon causes friction. The six sides of the hex nut rub the balloon and cause a vibration. The air vibration makes a sound wave. The speed of the vibration controls the pitch of the sound.

What do you notice when you spin it faster? What happens when you spin it slower?

⚠ **WARNING**: **CHOKING HAZARD**- this activity contains a hex nut. Not for children under 3 years old.

⚠ **WARNING**: **CHOKING HAZARD**- Children under 8 years old can **choke** or suffocate on uninflated or broken balloons.

CONCEPT #3

Noise

Noise is often generated by community activities, such as cars on the road. Too much noise can hurt people and animals' ears, or make it hard to communicate. Scientists and engineers make sure that people and animals are not affected by the noise from technology and industry.

https://www.thinglink.com/en-us/scene/530450745720307713

http://www.brimfulcuriosities.com/2010/09/screaming-balloon-ghosts-for-halloween.html

PARENT'S GUIDE

Helpful tip: students who struggle to make a sound may need to hold the base of the balloon.

EXTENSIONS

What happens if you use a penny instead of a hex nut? Try using different sized balloons and other materials to create different sounds. Which combination makes the loudest sound?

REFERENCES

Adapted from: www.usna.edu/stem

*https://rmpbs.pbslearningmedia.org/resource/lsps07.sci.phys.energy.dfdecibel/extreme-sounds/

**https://cheshirelibraryscience.wordpress.com/category/forces/

Balloon Brain

DIFFICULTY LEVEL: INTERMEDIATE

PURPOSE

To explore how a helmet protects a brain. Participants will build their own device to protect a water balloon.

MATERIALS

Balloons
Water
Household materials: cotton balls, bubble wrap, tape, egg cartons, newspaper, etc.*

INSTRUCTIONS

1. Find a place to build and test where it is okay for the area to get wet.
2. Fill the balloon with water.
3. Build a device, using household materials, to protect the balloon from a fall. Your device should not be more than two inches thick.
4. Test out the device by dropping your device from a height. What is the greatest height from which is can survive a drop?
5. Repeat until you are happy with your design. Which design was best at protecting the balloon.

VOCABULARY

Skull: the bone surrounding the brain, also called the "cranium"
Force: a push or a pull
Acceleration: is a change in speed
Distribute: to spread along a greater area

CONCEPT #1

Human Skull

The human brain is protected by the skull, also called the *cranium*. The cranium is hard and rigid to protect the brain from damage. This is why a fall or a bump on the head rarely causes long-term damage.

However, the skull doesn't always provide enough protection. Wearing a helmet can protect the head and brain from injuries. It is especially important to wear a helmet when doing a high-speed activity or sport, like biking or skating.

*Get permission from a trusted adult before using materials you find around the house.

⚠ **WARNING**: **CHOKING HAZARD**- Children under 8 years old can **choke** or suffocate on uninflated or broken balloons.

CONCEPT #2

Force and Acceleration

When you bump against something, your body undergoes a sudden change in speed, from your original speed on impact to a complete stop. The *force* associated with such a sudden change in speed (*acceleration*), can cause an injury. The greater the force on our body, the greater the injury. A helmet slows the acceleration, which reduces the force on your head, and therefore reduces the chance of serious injury. A well-fitting helmet with a rigid shell also distributes the force across the rest of the helmet. This mean there is less force on each part of your head, which means less chance of injury.

https://www.pbslearningmedia.org/resource/phy03.sci.phys.matter.zballoon/columns-experimenting-with-balloons/

https://www.pbslearningmedia.org/resource/phy03.sci.phys.matter.zballoon/columns-experimenting-with-balloons/

PARENT'S GUIDE

Helpful tip: have participants look at a helmet to get inspiration for their design

EXTENSIONS

Try making a helmet that can be removed, consider a strap or a lid.

Draw a face on the balloon. When making the device, make sure the balloons eyes are uncovered.

REFERENCES

Adapted from:
https://rmpbs.pbslearningmedia.org/resource/phy03.sci.phys.matter.zhelmet/balloon-brain-designing-a-helmet/support-materials/

Balloon Delivery

DIFFICULTY LEVEL: ADVANCED

PURPOSE

Design and build something powered by a balloon that can carry a Ping-Pong ball.

MATERIALS

Balloons
String (fishing line or non-waxed dental floss are best)
Ping-Pong ball
Notebook paper and pen to record ideas
Household materials: cardboard, paper clips, scissors, small paper cups, tape*

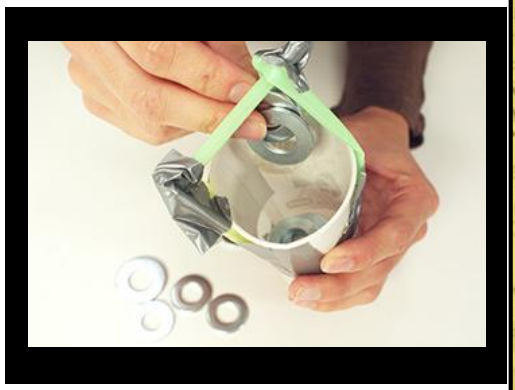
INSTRUCTIONS

1. Run a length of fishing line between two objects (at least four feet). Make sure the line is level or has a slight downward slope.
2. Look at your materials and think about the questions below. Then sketch your ideas on a piece of paper.
   - Using these materials, what can you design that can carry a Ping-Pong ball down the line?
   - How will the balloon power the carrier across the line?

CONCEPT #1

Engineering

Engineering is working with others to solve problems and improve our world. An engineer imagines creative and useful solutions to problems and works with others to design, build, and improve things we use every day.
Engineers are creative, work in teams, and change the world!



https://pbskids.org/designsquad/build/zip-line/

*Get permission from a trusted adult before using materials you find around the house.

⚠ **WARNING**: **CHOKING HAZARD**- Children under 8 years old can **choke** or suffocate on uninflated or broken balloons.

Balloon Delivery (cont.)

INSTRUCTIONS

3. Build your design using the materials
4. Test out the device and record the results on the same page you sketched out your designs. Use the questions below to guide your writing.
   - How far did your device travel?
   - Did the device stay intact throughout its journey?
   - How could you improve the design to go faster or farther?
5. Repeat until you are happy with your design. Which design was best?

VOCABULARY

Engineering Design Process: the series of steps engineers use to arrive at a solution

EXPLORING FURTHER

Research the following terms to explore how to further improve your design:

- Force
- Thrust
- Friction
- Center of Gravity
- Newton's Laws of Gravity

CONCEPT #2

Engineering Design Process

Engineers use the *Engineering Design Process* to develop and refine their solutions:

1. **Identify the need or challenge**
2. **Research and develop possible solutions**
3. **Draw a possible solution**
4. **Build and test the solution**
5. **Modify and retest the device**

EXTENSIONS

Challenge: Design the device to drop the ball onto a target.

Challenge: Design a device that uses multiple balloons at the same time

Challenge: Design a device that uses multiple balloons, one after the other.

REFERENCES

Adapted from:
https://pbskids.org/designsquad/build/zip-line/

More Balloon Activities

https://www.adabofgluewilldo.com/self-inflating-balloon-science-experiment/

https://littlebinsforlittlehands.com/lego-balloon-car-diy-lego-building-kit/

https://www.steampoweredfamily.com/activities/confetti-cannon-stem-challenge/

https://creeksidelearning.com/make-solar-system-model/

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Phys_p099/physics/balloon-powered-car-challenge

https://www.tinasdynamichomeschoolplus.com/homeschool-unit-study-human-body-2/

Balloons Edition