



Science of Sports Teacher Packet

GRADE LEVELS:

Grades K – 6th

OBJECTIVES:

Participants will become more aware of the forces that are used in sports and will use various measurement tools to record data.

ACADEMIC CONTENT STANDARDS:

- Life Sciences 1.3
- Physical Sciences: 1.6, 3.3-4. 4.1, 4.5, 5.2, 6.1, 6.3
- Scientific Inquiry: K.1, 1.1, 2.4-8, 2.10, 3.2-3, 3.5, 5.3-4
- Scientific Ways of Knowing: K.1-2, 1.1-2

VOCABULARY WORDS:

Center of Mass - Is a point in an object where all the mass is evenly distributed around the point.

Gravity - Is the natural force pulling all objects on Earth downwards towards the center of the Earth.

Force - Energy exerted onto an object, usually in a push or pull motion.

Mass - Is the amount of stuff in an object.

Kinetic Energy - The energy of motion.

Potential Energy - Stored energy.

Energy - The capacity or ability to do work.

EXTENSIONS AT COSI:

Life Exhibition Area

ADDITIONAL RESOURCES:

www.cosi.org



Science of Sports Pre Visit Activities

Roaring Good Times

Primary Audience: All Ages

Description:

Students will pick a sport and then think about what animal would be suited to play this sport. They'll then create a short story or story board detailing both the sport and animal.

Keywords:

- Animals

Materials:

- Pencil and Paper

Instructions:

Ask the students about different sports that they play or know. Ask them what equipment they use, what body parts, and also about team names. Now ask them "What if the Cincinnati Bengals really were Bengal tigers? Why would a tiger make a good or bad football player?"

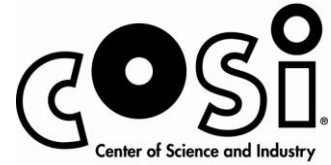
Next, have each student pick an animal and a sport. Have the students create a story about playing a sports team composed of actual animals. Once the students have completed their stories, have them share with each other their stories. Encourage them to ask other questions like, "Would kangaroos have a difficult time dribbling the ball?" or "If an elephant used its trunk during a soccer game, would that be considered a foul?"

Further Exploration:

Using the animals the students picked, have them do an in-depth research paper on that animal. Have the students report to the class about the animal's habitat, adaptations, characteristics, food, and features. Using this deeper knowledge, have the students rewrite or modify their original stories. Ask the students to explain what changes they made and why they made them.

Relevant Ohio Science Content Standards:

- Life Sciences 1.3
- Scientific Ways of Knowing: K.1-2, 1.1-2



Bouncing Around

Primary Audience: 2-6

Description:

Participants will bounce a ball from various heights to see the effects of gravity.

Keywords:

- Gravity
- Units of Measurement
- Bounce

Materials:

- Ruler
- Bouncy ball
- Pencil and Paper

Instructions:

1. Divide the class into pairs. Each pair will be divided into a “Dropper” and a “Spotter”.
2. The Dropper will hold the ruler on the table and drop the bouncy ball from a height of one inch.
3. Have the Spotter eye the ball to see how high up it bounces. Record the measurement from the bottom of the ball. It’s important to always measure from the bottom of the ball.
4. Next the Dropper will drop the ball at the height of two inches, and the Spotter will watch and record the measurement.
5. Repeat these actions until you get to 12 inches. The Dropper and Spotter can switch roles midway if you like.
6. Share results with class.

Possible Interactive Questions:

- What forces are acting on the ball?
- Why does the ball bounce more the higher it is dropped?
- Do second, third, or even fourth bounces get to the same height as the first?

What’s Going On?

The higher the ball is dropped, the more time gravity has to act upon it, creating more force, thus bouncing the ball higher. There is a limit to how much force gravity imparts to an object and this is called terminal velocity. Other factors like air resistance are also in play, but they are limited in their scope.

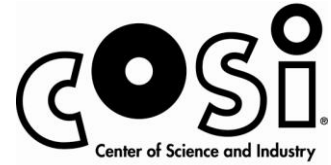
Further Exploration:

Feel free to use different balls to see how different materials bounce. If using a basketball use a yardstick, or you could even create a larger tape measure by placing masking tape on the wall.

This experiment is really easy to graph. Have the students make a chart either in their pairs or as a larger group. It is also possible to have different pairs use different materials, and then to chart the differences between them.

Relevant Ohio Science Content Standards:

- Physical Sciences: 3.3
- Scientific Inquiry: 2.6-8, 2.10, 3.2-3, 3.5, 5.3,



Boing!

Primary Audience: All Ages

Description:

Students will explore potential and kinetic energy and energy conservation by dropping two balls on top of each other.

Keywords:

- Kinetic Energy
- Potential Energy
- Conservation of Energy
- Gravity
- Mass

Materials:

- Two types of balls of different mass (ex: ping pong and golf ball)
- Large space

Instructions:

- In small groups, each student will be given the opportunity to drop the two balls.
- The balls should be placed with the lighter one on top of the heavier one.
- When dropped at the same time in this fashion, it should allow the lighter ball to jump up and bounce higher than the height it was originally dropped from.
- Using a large space for this activity is recommended as the balls have a tendency to bounce around the room.
- You can have the students record results.

Further Exploration:

- Try using different balls like basketballs and tennis balls or bouncy balls. You could ask the gym teacher for supplies.
- Try changing the position of the lighter ball from the top to the bottom.
- If possible, try dropping three balls at the same time and see what happens.

Possible Interactive Questions:

- What forces are acting on the balls?
- How could you get the ball to bounce higher? How can you get it to not bounce?

What's Going On?

The important part of this experiment is the differing masses. As long as the ball with more mass is on the bottom, the lighter mass ball will bounce higher. When the first ball hits the ground it will bounce up hitting the second ball, transferring the energy so the second ball will go higher. Technically the momentum is transferred in both directions but the lighter mass ball is overwhelmed by the greater mass creating the bouncing effect.

Relevant Ohio Science Content Standards:

- Physical Sciences: 1.6, 3.3, 6.1
- Scientific Inquiry: K.1, 1.1, 2.5, 5.4



Science of Sports Post Visit Activities

Graph it Out!

Primary Audience: 2-6

Description:

Students will explore data recorded during the session and create charts.

Materials:

- Data from long jump activity
- Graphing paper
- Pencil

Instructions:

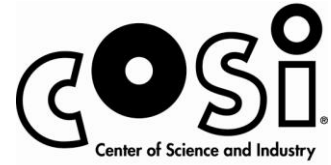
Using graph paper and the measurements taken during the long jump activity, have the students compile a scatter plot graph. Have the students find their group's average distance and create a bar graph with this information. Share results amongst the class. It is even possible to graph the entire class' results.

Further Exploration:

Using the same data, create charts based on gender, age, or even height. Have other classes try the experiment and record their data as well. Do research and figure out how far a kangaroo, cheetah, and Olympic athletes can jump. Compare this new research with the students' results.

Science Content Standards:

- Physical Sciences: 3.3
- Scientific Inquiry: 2.6-8, 2.10, 3.2-3, 3.5, 5.3,



Bouncing Around: Heat Edition

Primary Audience: 2-6

Description:

Participants will bounce a hockey puck from various heights to see the effects of gravity and heat.

Keywords:

- Gravity
- Units of Measurement
- Bounce
- Temperature

Materials:

- Ruler
- Hockey Puck
- Pencil and Paper
- Freezer or ice
- Microwave or heat source

Instructions:

1. Divide the class into groups of three and each group will be divided into a "Dropper," "Spotter," and "Material Handler."
2. When ready for the experiment the Material Handler will get the hot puck, hand it to the Dropper, and the Dropper will drop the puck from a height of 12 inches.
3. Have the Spotter eye the puck to see how high it bounces. The Material Handler should record the measurement from the bottom of the puck.
4. Quickly repeat experiment while the puck remains hot. The more trials the better, but try to aim for 3-5 trials.
5. After trials are run, the Material Handler will get the cold puck. Repeat steps 2-5 with the cold puck.
6. After running the cold trials, try dropping a room temperature puck for a control.
7. Share results with class.

Possible Interactive Questions:

- What forces are acting on the pucks?
- Why would the temperature of the puck make a difference in its bounce?
- Would hockey players like a cold or hot puck better?
- Do second, third, or even fourth bounces get to the same height as the first?

What's Going On?

The higher the puck is dropped, the more time gravity has to act upon it, creating more force, thus bouncing the puck higher. There is a limit to how much force gravity imparts to an object and this is called terminal velocity. Other factors like air resistance are also in play, but they are limited in their scope.

The temperature also plays a role in the amount of friction caused by the puck. A cold puck will have a lot less friction, which when playing hockey will let the puck travel further and faster. It also allows the puck to bounce.

Further Exploration:

Try testing other sports equipment to see how heat affects their performance. (Hint: Any ball with air will have a change in air pressure causing different effects).

Relevant Ohio Science Content Standards:

- Physical Sciences: 3.3-4. 4.1, 4.5, 5.2, 6.3
- Scientific Inquiry: 2.4, 2.6-8, 2.10, 3.2-3, 3.5, 5.3,