Grades 4–9: Sports Challenge!

The Life of a ball in pictures (Pre) Activity #1

Students will be able to view and analyze a scientific photograph, begin to discuss and hypothesize about the physics of sports, discuss their ideas about what they notice with class, learn about the life and work of Scientist/Inventor and Photographer Harold "Doc" Edgerton and write and summarize their thoughts and ideas about how balls move.

Materials

- Five high-resolution Harold "Doc" Edgerton photos.

Pre-setup

- Display the five photos museum style depending on your classroom geography.
- For resource information, materials and assistance see appendix...

Procedure

1. Establish cooperative viewing groups.
2. Have cooperative groups rotate through a viewing schedule.
3. Provide students with post-it notes and have them write down comments and post near photos.
4. Bring class together as a group and have students discuss each photo separately.
5. Use Visual Thinking Strategies to generate student lead observations and discussions on each photo. Use opening questions such as "What do notice in this photograph"
6. Teacher or student should chart/record student comments.
7. Teacher may add information as needed to enhance conversation.
8. Teacher can ask additional questions that probe students to think deeper about the science of the photos.
9. Hand out short bio of Harold "Doc" Edgerton and his techniques for taking these photos. Lead short discussion.
10. After the discussions have students respond in a journal entry about their ideas about how balls move and what happens when the ball comes in contact with another object (bat, floor, racket.)
11. Keep photos with comments and record of conversation for use during virtual visit.

Grades 4–9: Sports Challenge!

Do Balls Change Shape? (Pre) Activity #2

Students will be able to build on previous observations and discussions, conduct experiment to test ideas and observations previously generated, explore gravity and kinetic energy's role in sports, observe physical properties, and begin learning about molecular changes in matter.

Background Information

A ball drops to the ground because of gravity. Since the ball is in constant motion it is gaining energy. When the ball hits the floor and stops, that energy goes into deforming the ball from its original round shape to a squashed shape. When the ball deforms, its molecules are stretched apart in some places while being squeezed together in other places. At this time the molecules inside the ball collide with and rub across each other. Depending on what the ball is made of the molecules that are being stretched and squeezed return to its natural state. Most of the energy that was gained on the balls downward decent becomes upward motion as the ball returns to its original shape and bounces into the air.

Materials

- Baby Powder
- Large Cardboard Pieces for each group
- Chalk
- Rubber ball

Pre-setup

- Arrange space to accommodate five cooperative groups.
- Establish five group work areas with the baby powder, cardboard piece, chalk and rubber ball.
- Keep photos, brainstorming charts and other material created from pre-activity one displayed and accessible.

Procedure

1. Establish five collaborative groups.
2. Place collaborative groups at pre-established work areas.
3. Quickly lead student driven summary of previous activities observations.
4. Ask for student predictions about what will happen when you demonstrate bouncing the rubber ball off the floor.
5. Bounce the ball and ask for observations. did the ball remain the same shape? What part of the ball hits the floor?
6. Each group should mark off the area on the rubber ball that they believe will make contact with the floor, by drawing a circle with chalk around the possible area of impact.
7. Each group should lay the cardboard down on the floor.
8. Each group should sprinkle the baby powder on the cardboard.
9. Each group should at a medium force bounce the ball onto the chalk covered cardboard piece and catch after the first bounce.
10. The students should compare the ring of baby powder dust to the originally marked circle of impact.
11. Each group should do it again with a harder force, with the same side pointing down. Does the chalk circle get larger?
12. Allow each group to try different variations of the experiment.

13. Lead concluding conversations asking questions such as: What is the difference between the drawn line on the ball and the baby powder line? Why do you think the baby powder covers as mush as it does on the ball? Did the amount of force used to throw the ball change the powder covering?

Bouncing Balls (Pre) Activity #3

Students will be able to analyze the physical components of various balls used in sports explore gravity and kinetic energy's role in sports experiment and record some of the properties of various balls used in sports, and summarize in writing their observations and ideas based on this lesson.

Materials

Five sets of:

- Baseballs
- Golf Balls
- Soccer Balls
- Basketballs
- Tennis balls
- Tape measure

Each individual needs:

- Science notebook/Journal/Scrap paper
- Pencil

Pre-setup

- Make five sets of balls and one tape measure for each group.
- Arrange space to accommodate five cooperative groups.
- Keep photos, brainstorming charts and other material created from pre-activity one displayed and accessible.

Procedure

1. Establish five collaborative groups.
2. Each collaborative group should receive a set of the balls and a yardstick.
3. Introduce all of the balls to the students. Ask the students if they know what sport they come from? Why do you think that all these sports use different balls? What is the difference between these balls? At this point the instructor will be eliciting answers that will be in the form of descriptive adjectives that differentiate the different balls.
4. The students should make predictions on which ball will bounce the highest and which ball is going to bounce the lowest. On a scale of 1-5, 1 being the least bouncy and 5 being the most bouncy. Hint: You cannot use a number more than once.
5. Each group should bounce theirs balls next to the tape measure and record on their paper how high the balls bounced.
6. The students should retest the bouncing to be sure they have gotten an accurate measurement.
7. Have wrap-up discussion asking these questions: Which ball bounced the highest? Which ball bounced the lowest? Why do you think this happened? What is each of these balls made out of? Is it their composition or size that makes for their bounce?
8. Have each student write a paragraph in their science notebooks/journals answering for them selves: Were my groups predictions accurate? Why or Why not? What factors in a ball help determine their bounce? What are my observations and new understandings about the properties of various balls used for sports after these three activities?

Grades 4–9: Sports Challenge!

Background Information (Bouncing Balls)
When a ball is dropped from a distance, it falls to the floor due to gravity. Since the ball is in constant motion it gains energy, called Kinetic Energy. Kinetic Energy is energy that a moving object has due to its motion; energy of motion. So when the ball hits the floor, the energy is still there and has to go somewhere. Since the ball has all of this energy, and depending on what the ball is made of (a flexible material), and the surface is hard the ball will bounce back up in the air. A ball is an elastic object, so when it hits the ground there is a slight deformation as it strikes the hard surface, which is called Elastic Potential Energy. Elastic potential energy is potential energy that is stored as a result of deformation of a ball.

Post-Activity Project: Create your own Sport

Students will be able to, identify and explain what science concepts affect the way sports are played, make scientific links to different sports, and develop their own sport eliminating science principles that affect the sports we play today.

Materials

- Blank sheets of paper
- Pen and Pencil
- Drawing paper
- Markers/Crayons/Colored Pencils

Procedure

1. Initiate this activity by having the class begin a KWL chart (K=What I know, W=What I want to know, L= What I Learned) about the science of sports drawing from their experience with the Virtual Visit. Keep chart posted.
2. Create cooperative groups or keep existing groups. The group size can be in a range of 2-5 students depending on the make-up of your class.
3. Have cooperative groups work on developing a sport where gravity seizes to exist. (Students can also eliminate other scientific concepts in addition to gravity)
4. Make sure cooperative groups keep in mind that they have to create and write down:
    a. A name for their sport and league (ex: Basketball=sport NBA=league).
    b. Rules to the sport (The minimum amount is 4 rules).
    c. A name for their state team (ex: Los Angeles Spartans).
5. In each cooperative groups essay answering the above criteria they must also write down how gravity would affect their sport if played in a gravity environment? If students decided eliminate other science concepts in addition to gravity than have them write down how that concept has affected their sport.
6. The cooperative group must then artistically create:
    a. The design of their teams uniforms both Home and Away.
    b. A team mascot.
    c. **Optional:** design of the team stadium, their sports' star player (ex: Michael Jordan to basketball), a logo for the sport/league.

Grades 4–9: Sports Challenge!

Natonal Standards

Middle School 5-8

NS.5-8.1 SCIENCE AS INQUIRY
As a result of activities in grades 5-8, all students should develop
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

NS.5-8.2 PHYSICAL SCIENCE
As a result of their activities in grades 5-8, all students should develop understanding of
- Properties and changes of properties in matter
- Motions and forces
- Transfer of energy

NS.5-8.6 PERSONAL AND SOCIAL PERSPECTIVES
As a result of their activities in grades 5-8, all students should develop an understanding of
- Personal health
- Risks and benefits
- Science and technology in society

NS.9-12.7 HISTORY AND NATURE OF SCIENCE
As a result of activities in grades 5-8, all students should develop understanding of
- Science as a human endeavor