

STEM

gems



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FROZEN BASEBALLS



CURVEBALLS, FASTBALLS, SLIDERS, AND CHANGE UPS.

In baseball pitchers use aerodynamics to try and make the ball move unexpectedly in an attempt to lure the batter into a swing and a miss. Occasionally teams have even tried to gain the upper hand by doctoring their baseballs to change their physics. Connie Mack, a player turned manager, who managed the Philadelphia Athletics from 1901 to 1950, was rumored to employ some very out of the box thinking. To give his team the edge he was said to have kept a box of frozen baseballs handy for occasions when the other team had leapt ahead in the score. How would freezing a baseball help his team?







THE SCIENCE OF BOUNCE

Everything in the universe from baseballs to elephants is made from tiny particles joined together. These particles are called molecules. In hard objects, the molecules are joined tightly together and cannot move very much. In softer objects, the molecules are less tight and can move a little. Balls bounce because they are made from molecules that have fluidity and impact recovery. When a ball hits the floor it compresses before quickly springing back to its original shape and bouncing upward. The more a ball compresses, and the faster it springs back, the higher it will bounce. Baseballs are made from cork and several types of rubber covered in leather. When dropped the rubber compresses and springs back to provide the bounce. When a baseball is frozen, the molecules it is made from slow down and tighten up. They lose their flexibility and are not as free to move and do not bounce as well.

WHAT IS A FAIR TEST?

One of the most important components of a good science experiment is conducting fair tests. In a fair test, only one variable is changed in an experiment at a time. All the other conditions are kept the same. In an experiment if more than one variable is changed, it is difficult to know which of the changes affected the results. Fair tests also help scientists reproduce their results, another important component of a good science experiment.



-  **What kinds of things bounce?** *Balls, rubber, etc.*
-  **How could you test how well something bounces?** *You could test how well something bounces by dropping it onto a hard, flat surface and using a ruler to measure how high it bounced.*
-  **What happens to objects when you freeze them?** *They get hard and cold. They may change color.*
-  **Would a ball bounce more or less if it was frozen?** *Open choice.*



FLUIDITY

The ability of a substance to flow and to be reshaped.

FREEZE

To become hard or stiffened because of a loss of heat.

IMPACT RECOVERY

How quickly something returns to its original state after being altered or changed in some way.

MOLECULE








A unit of matter; two or more atoms chemically bound together to form a substance.

VARIABLE

Something that can be changed from one experiment to the next.



YOU WILL NEED & before YOU BEGIN

-  **2 Baseballs**
-  **2 Tennis Balls**
-  **2 Racket Balls**
-  **Large Ziploc Baggie**
-  **Other Balls to Test**
-  **A Piece of Chalk or a Role of Tape**
-  **Access to a Freezer**

- Take one of each type of ball you are going to experiment with and place them in a baggie. Then place them in a freezer or if cold enough, outside overnight.



EXPLORE & EXPERIMENT

- 1** Tell the kids that they are going to investigate what bounces better; a warm or a frozen ball.
- 2** Challenge the kids to design an experiment to test the amount of bounce a ball has. Discuss the concept of variables and a fair test. The only thing that should change in this experiment is whether the ball is frozen or not. The height the ball is dropped from, the surface it is dropped on and how it is observed should all stay the same.
- 3** When ready find a hard flat surface next to a wall to bounce the balls on. Use chalk or tape to make a line high up on the wall. Working with helpers take the unfrozen balls and one at a time drop them from your mark. Mark a spot for an observer to stand and view how high each bounces. Mark on the wall the highest points they bounce to.
- 4** Next retrieve the frozen balls and repeat the experiment. Is there a difference between how high the frozen balls bounced compared to the regular balls?

Provide paper and pencils and have your young people record the results of their bounce tests as a graph. Younger children can create a simple bar graph showing one measurement for each type of ball. Older youth can record the results of three or more bounce trials for each ball by marking points for each ball type.



make THE CONNECTION

LOTS OF SPORTS EQUIPMENT IS MADE TO HAVE FLUIDITY AND IMPACT RECOVERY.

ATHLETIC SHOES ARE MADE FROM MATERIALS THAT PUT A BOUNCE IN YOUR STEP AS YOU PLAY.

HELMETS HELP PROTECT ATHLETES FROM HEAD INJURIES. Most helmets contain two types of foam. One is stiff and designed to collapse, which protects heads from sharp edges and corners, and the other is soft and squishy to cushion the head during an impact.

Have the kids think of different sports and how the fluidity and impact recovery of the materials used affects how the sport works.



EXTEND & EVALUATE

Provide paper and pencils and have the kids draw out how their favorite sports could be played on a deeply frozen planet. Have them explain how the equipment used or rules of the game would not to change in response to the decreased fluidity and impact recovery.