

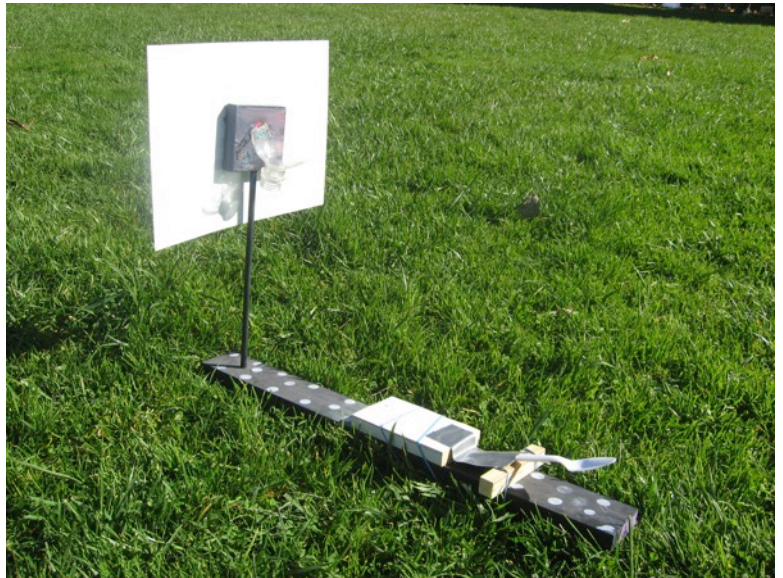
Parabola Basketball

Category: Physics: Force & Motion

Type: Make & Take

Rough Parts List:

1	Plastic bottle
1	Spoon
1	Baseboard, 18" x 1" x 1/2"
1	Dowel
1	Wood for backboard, 2" x 2" square
1	Wood, 4" x 1/2" x 1/4"
1	Wood, any size, to attach to spoon
3	Rubber bands
1-3	Pompoms
	Paper for backboard
	Duct Tape
	Hot glue gun



Video: <http://youtu.be/keBmvTpAf0g>

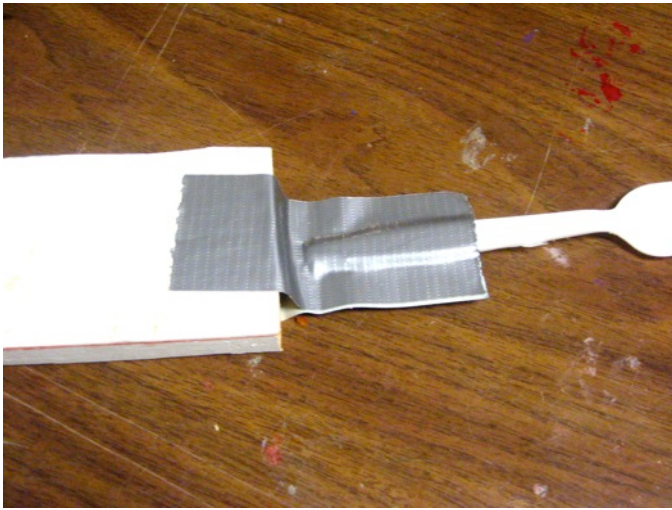
How To:



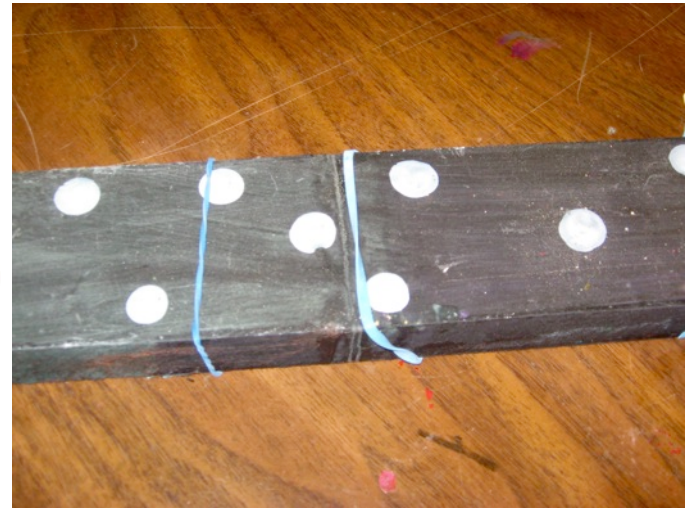
Build a backboard using the neck of a plastic bottle, wood, and paper. Drill a hole and hammer a dowel into the bottom of the backboard.



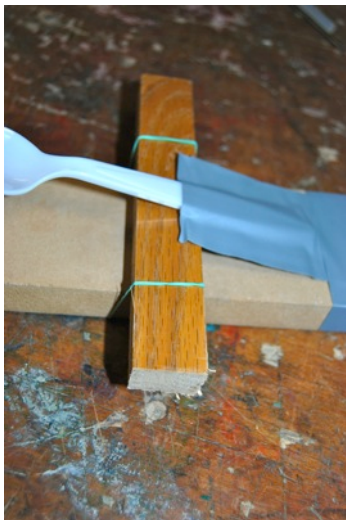
Place a spoon onto the sticky side of a piece of tape.



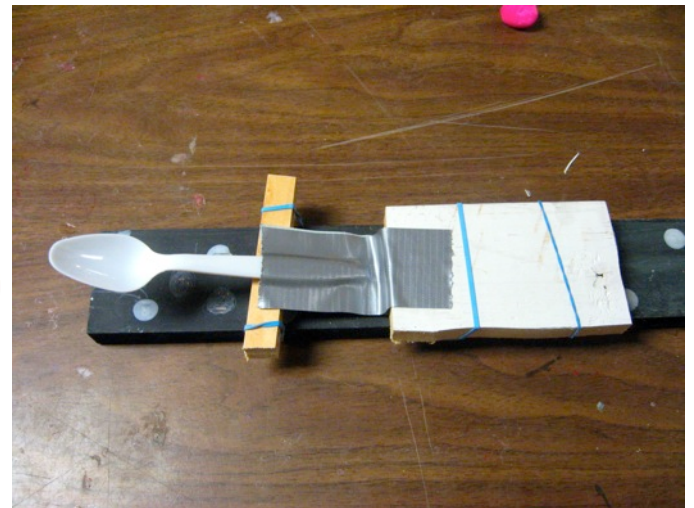
Place another piece of tape on top of the spoon and sticky tape and tape the spoon to a block of wood.



Loop two rubber bands around the baseboard. The block with a spoon will slip through the rubber bands.



Use a rubberband to attach the 4" x 1/2" x 1/4" wood to the baseboard.



Place a puff ball or other projectile on the spoon and shoot it into the basket. The trajectory of the shooting objects can be changed by sliding the blocks, rubber bands, and spoon along the baseboard.

Fine Points:

- If the path of the projectile either does not reach the basket or flies past it, adjust the position of the spoon and blocks.
- Often more than one position can result in a basket, because you can draw the spoon back different distances to give a different force to the projectile, which will result in a different parabola.
- Puffballs and paper balls will slow down as they fly due to large air resistance. Marbles and beads will not slow down much at all.

Concepts Involved:

- The force of gravity pulls everything down. When something is traveling under the influence of gravity, it follows a path called a parabola.
- Parabolas can be tall, short, skinny or fat, depending on the angle of the launch. If you launch something straight forward, it will follow one half of a parabola as it falls to the earth.
- If you want the pompom to go through the bottle neck, one end of the parabola has to be at the spoon, and the other end has to be in the bottle neck.

Focus Questions:

1. What would happen if you shot something bigger or heavier?
2. How could you make the project shoot higher or farther?
3. How could you make it easier to make a basket?
4. With what could you make a life-size version of this project that shoots a real basketball into a real hoop?

Elaboration:

Here on earth, the force of gravity pulls everything down. If you throw something forward, it goes both forward and down. It goes forward at a steady rate, but it accelerates downward. That means it goes down faster and faster. The result of these two motions creates a curve called a parabola.

Everything you throw or shoot on earth travels in a parabola. Heavy things like rocks and baseballs can be seen to travel in a parabolic curve because the air doesn't slow them down much. But sometimes the parabola gets messed up because of air resistance, such as when you throw a feather. It doesn't really go forward much, and doesn't really accelerate down because it is so hard for it to move through the air and there is such a small force of gravity on it. So it stops going forward and just floats downward at a steady speed. This is called terminal velocity. A feather's terminal velocity is very slow, but most things, including sky divers, will eventually reach terminal velocity if there is enough space for them to fall.

Parabolas of flight can be different shapes. If you launch something straight up, the parabola will be very skinny because there is very little forward motion. But if you stand on a cliff and throw a rock straight forward, it will go both forward and down until it hits something. This is one half a parabola, starting at its peak. So, the angle of launch will determine the exact shape of the parabola. In this project, you can change that angle and get different parabolas as you look for one that ends in the bottle neck.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:

1.0 Students make decisions about how to approach problems:

1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

1.2 Determine when and how to break a problem into simpler parts.

- 2.0 Students use strategies, skills, and concepts in finding solutions:
- 2.1 Use estimation to verify the reasonableness of calculated results.
 - 2.2 Apply strategies and results from simpler problems to more complex problems.
 - 2.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
 - 2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

- 3.0 Students move beyond a particular problem by generalizing to other situations:
- 3.1 Evaluate the reasonableness of the solution in the context of the original situation.
 - 3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
 - 3.3 Develop generalizations of the results obtained and apply them in other circumstances.

Grade 2 Standard Set 1. Physical Sciences:

The motion of objects can be observed and measured.

- 1.a Students know the position of an object can be described by locating it in relation to another object or
- 1.c Students know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of force, of the push or pull.
- 1.d Students know tools and machines are used to apply pushes and pulls (forces) to make things move.

Grade 3 Standard Set 1. Physical Sciences (Energy & Matter):

- 1.c Students know machines and living things convert stored energy to motion and heat.

Grade 8 Standard Set 2. Forces:

Unbalanced forces cause changes in velocity.

- 2.a Students know a force has both direction and magnitude.
- 2.e Students know that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).
- 2.f Students know the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.

Grade 9-12 Physics Standard Set 1. Motion & Forces

Newton's laws predict the motion of most objects.

- 1.b Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's First Law).