Creating Catapults

Supplies Needed:

- Two aluminium cans
- Frog tape (or masking tape)
- Two long pencils
- Paper
- Wooden ruler
- Piece of cardboard

Setting Up:

In this workshop we are making a super simple torsion trebuchet. There are many other types and methods you could make, and thus there are many ways you could alter this lab and challenge each other.

Tape a can down to the piece of cardboard. Then, using a pencil to space the second can, tape it down as well. Take a small strip of paper and make it into a tube and slide it over one pencil.

This pencil you'll tape to the top of the cans. The second pencil you'll tape to the front or back of the cans as a brace just to keep the cans in place and even in case the tape holding them down moves.

Tape the ruler to the tube of paper on the pencil with about two inches on one side. This is the side you'll be using as a launch method.

At the beginning I mentioned that this lab can be altered. This altering is half the fun and challenge. The best way to do this is to practice the foundation of engineering and business: staying within a budget.

Tool	Price	Total
Foundation	1×1	1
Tin cans	5×2	10
Ruler	10×1	10
Braces	2×1	2
Frog tape	5×9	54
Scotch tape	1×1.5	1.5
Pieces of paper	1×2	2
		70.5

Budget:

To the left is an example of the budget we use at Insanitek using the supplies listed here. However, if you have a choice of plastic cups or cans, you might value the lighter cups at 3 points, while the heavier cans would be at 5.

If you don't have strong tape, you might value Scotch tape at 1 point versus Duct tape (even stronger than Frog tape) at 7 points.

When we did this at a library, we even used coloured gaming chips to cash in to buy parts that teams used to assemble their designs.

Challenge Set Up:

Fold a small, half sheet of paper into a catch boat. Or, use another empty cup on a stand. This is what you'll aim to land the projectile (crumbled up ball of paper) in.

Creating Catapults

This challenge gives you the opportunity to explore some interesting topics in physics and engineering. Rather than explaining each of these topics in detail, this background section will give you a brief overview of each one, and then you can do more research using the links in the bibliography. If you are doing this project for a science fair, do not worry about learning about all of these topics. Choose one or two to learn about in more detail.

First, this is a great opportunity to learn about simple machines, like the lever or the inclined plane. You can also investigate more complex machines, like catapults, trebuchets, or slingshots, that are used to launch projectiles. Think about how you could incorporate different aspects of these machines into your design.

You can also use this project to learn about projectile motion. How do the initial velocity (starting speed) and launch angle (angle at which an object leaves the launcher) of a projectile affect its range (distance it travels)? What trajectory (path through the air) will make it easier to catch the ball? A high, steep trajectory or a low, shallow trajectory?

You can also use this project to learn about energy. The ball needs kinetic energy, the energy of motion, in order to fly through the air. Where will that energy come from? It could come from elastic potential energy, the energy stored in a stretched material, like a rubber band. It could come from gravitational potential energy, the energy stored in an object that is raised up off the ground. Or, the energy could come from work that you do with your hand by exerting a force. How could your machine convert one form of energy to another?

Finally, you can use this project to demonstrate the engineering design process. You will probably not think of an idea for a machine, sit down and build it, and have it work perfectly on the first try. You might need to come up with multiple designs, test more than one of them, and modify the designs to improve them. This is OK "real engineers rarely get things right on the first try!

Terms to Explore

* Simple machine
* Lever
* Inclined plane
* Complex machines
* Catapult
* Trebuchet
* Slingshot
* Projectile motion
* Initial velocity
* Launch angle
* Range
* Trajectory
* Energy
* Kinetic energy
* Elastic potential energy
* Gravitational potential energy
* Work
* Force
*

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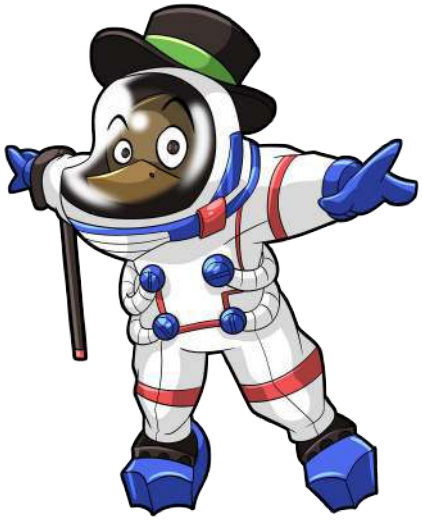

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