GRADE LEVELS: 3-5 (Modify by preassembling for K-2)

CATAPULT CHALLENGE: LAUNCH INTO DESIGN!

Project: Design and build the farthest-launching catapult!

Challenge: Students will follow the engineering design process:

1. **Design & Build:** Create a catapult using provided materials.
2. **Test & Analyze:** Launch a small object and observe its distance.
3. **Improve & Redesign:** Based on results, modify your catapult to launch farther.
4. **Relaunch & Compete:** Test your improved catapult and compete for the greatest distance!

Learning Objectives:

- Explore physics, engineering, potential energy, and projectile motion.
- Develop creative problem-solving skills in science and math.
- Understand the application of simple machines like catapults.

ENGAGE

Start a dialog with students about their experience with catapults. Undoubtedly you will learn that most have built a catapult. However, do they understand why?

- Explore student's understanding of catapults with detailed questions. Start with a show of hands, who has built a catapult? Then test students understanding. **Definition?** (*any device that throws an object*) **Purpose**? (move objects from one place to another); **Why?** (to understand the mechanics of simple machines, why we use them, how they work. i.e. Engineering)

Modern day examples of Simple Machines and their purpose:

1. **WHEEL AND AXLE** make it easy to move objects across distances, the wheel turns with the axle causing movement, i.e. skateboard, wagon.
2. **INCLINED PLANE** a flat surface that is inclined so it can help move objects across distances, (i.e. sliding board,)
3. **WEDGE** used to separate an object, i.e. axe.
4. **SCREW** used to hold things together.
5. **PULLEY** lift and lower heavy objects, i.e. water well buckets, rock climbing
6. **LEVER**, plank that rotates on a pivot, can be used to lift heavy things, i.e. seesaw, wheelbarrow, CATAPULT.

MATERIALS

KNT Catapult Kit:

- ✓ 2 Jumbo Craft Sticks
- ✓ 5 Small Craft Sticks
- ✓ 3 Rubber Bands
- ✓ 1 Cap
- ✓ 1 Double-sided tape
- ✓ 1 pom pom projectile

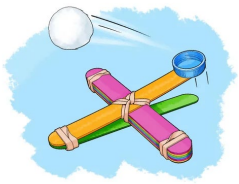
PRE-PLAN

- ✓ Read the full lesson plan.
- ✓ WATCH VIDEO
- ✓ Make a catapult
- ✓ Set-up goals or target distance

TECHNOLOGY REQUIRED

None, however a white board may be helpful.

PROJECT BUILD



Kids N Tech DESIGN PROCESS

- PROJECT/PROBLEM – Review project, read through instructions.
- PREPARE/ PLAN- Lay out all your materials that are required to make your project as listed in each step.
- BUILD IT – Follow instructions.
- TEST IT – Use your project for its intended use. Compare the

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PHYSICS: A catapult works because energy can be converted from one type to another and transferred from one object to another.

TWO TYPES OF ENERGY:

1. **Potential energy is** mechanical energy, stored energy, or energy caused by its position.
2. **Kinetic energy is** energy that is in motion.

BACKGROUND

When you prepare the catapult to launch, you add energy to it. This energy is stored in the launching device as ***potential or stored energy***. Catapults use potential energy stored in a wooden stick. As you bend it, then let it go, the stored energy is released, converted into ***kinetic energy*** of motion and transferred to the missile (the launched object), which then flies through the air.

Demonstrate

Show kids your sample catapult, demonstrate potential and kinetic energy.

Build – WATCH VIDEO

1. Distribute KNT Catapult Kits to each student.
2. Watch videos and follow building instructions.
3. Make Catapults

Launch!!!

SUGGESTION: Line groups up along the floor to test multiple catapults at once.

- Place a projectile on the spoon/bottle cap.
- Hold the catapult with one hand and use your other hand to pull down on the spoon/Popsicle stick. Release to watch the projectile launch! Did you make a goal OR make the target distance?
- Record your observations on your WDYD sheet.

appearance of your project to the sample. Does it look the same? Similar? Better? Or lacking the same appeal?

- TWEAK IT – Change the project in the areas that should be improved.

NOTES TO NOTE:

Longer Arm- increase the firing range.
Crossbar Position- Raise it or lower it. The purpose of this is to change the angle at which the swinging arm releases the object. This will affect the firing range of the catapult. Adjust the position of the crossbar until you achieve the best firing range.
Ammunition Choice-Finding the right ammunition for a catapult is about finding a balance. You need to balance the wind resistance of the object with density and weight. You want to have a small, dense object that won't get stopped by the resistance of the air. But if the object is too heavy, it will limit its own range. And, if you are trying to knock objects over, you will need the ammunition to be heavy enough to do this.

Observations and Reflections

1. Which projectile seemed to launch the furthest? What do you think made it go further?

2. What type of energy did the catapult use?

3. What would happen if I use a heavier object to launch?

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