




STEAM Engineering Lesson:

Catapult Challenge - Grades 6-8

Students will experiment with inertia and force as they build, test, and make changes to a homemade catapult. This lesson is designed for grades 6-8, but can be adapted for younger grade levels as well.

 Teacher Led	 Requires Computer OR Mobile Device	 Requires Spaces
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Spaces Prep

Create your Activity in Spaces before the lesson. Not sure how to create an Activity? Check out this [short video tutorial](#) on assigning and managing activities.

Learning Goals

1. Students will **understand** Newton's three laws of motion.
2. Students will **design, build, and test** a catapult.
3. Students will **reflect on** their catapult design through the lens of Newton's three laws of motion.

Materials

 Student Handouts	<ul style="list-style-type: none"> ● Handout [A] - Catapult Design for each student, partnership, or small group (page 4) ● Handout [B] - Catapult Reflection for each student, partnership, or small group (page 5-6)
 Technology Requirements	<ul style="list-style-type: none"> ● Mobile device, tablet, or laptop ● Projector or Smartboard
 Video/Audio Clips/Images	<ul style="list-style-type: none"> ● Medieval Catapult Images ● Newton's Laws - Catapult Style video from Discovery Science ● Newton's Laws of Motion from NASA
 Additional Materials	<p>Have enough for each partnership or group:</p> <ul style="list-style-type: none"> ● Large and small craft sticks ● Rubber bands ● Plastic spoons ● Binder clips ● Paper or plastic cups ● Clothespins ● Tape ● String ● Straws ● Cardboard ● Ping pong balls or other small objects to launch ● Other materials around the classroom or brought in from home

Instructions

Before the lesson

1. Engage students by showing them (or making available on their own devices) the [Medieval Catapult Images](#) gallery.
2. Once students have observed pictures of ancient catapults, ask them how they think catapults connect to science/engineering.
 - Solicit student ideas, recording them on a whiteboard if desired.
 - Possible student ideas may have to do with simple machines, building/designing, etc.
3. If it didn't come up in student discussion, explain that catapults are also a great way to understand Newton's three laws of motion.
 - Show [Newton's Laws - Catapult Style](#) video from Discovery Science.

During the lesson

1. Tell students that today, they will experiment with Newton's three laws of motion by designing, building, and testing a catapult.
2. If desired, you can have students look up pictures of homemade catapults, OR have them simply use their own imaginations and creativity to design their catapult.
3. Have students work independently, in partnerships, or in small groups, and give each student or team an equal amount of available materials (except ping pong balls or other launch objects— do not hand these out until catapults are fully built).
4. Before students start building, they should plan out and draw a rough design of their catapult on **Handout [A] - Catapult Design** (page 4).
5. Once designs are approved, allow students time to build their catapult.
6. Once all teams are finished, have students do a gallery walk of each other's plan/design and catapult.

After the lesson

1. Now, it's time for the experiment! Have students launch a ping pong ball or other small, light object using their catapult.
 - You may want to make a "target" using tape on the floor or on a long table for an extra challenge for students to try to hit.
 - Have students record their catapult launch distance on **Handout [B] - Catapult Reflection** (page 5).
 - If time, you can have students make adjustments and re-test their catapults, or simply have them re-test their catapults without making changes to see if they get a consistent launch distance.
2. Once the experiment is done, have each student, partnership, or group complete **Handout [B] - Catapult Reflection** (page 5-6).
 - Allow students to view/read [Newton's Laws of Motion](#) from NASA as they complete their reflection.

Worksheet

HANDOUT [A]: Catapult Design

Name(s) _____

<u>Material</u>	<u>Quantity</u>	<u>Purpose</u>

Below, draw a rough design of the catapult you plan to build:

Worksheet

HANDOUT [B]: Catapult Reflection

Name(s) _____

<u>Catapult Launch</u> <u>(1, 2, 3)</u>	<u>Distance</u>	<u>Notes</u>

Documenting in Spaces

Teacher Tip! The instructions for this lesson involve adding to the Class or Individual Space in Spaces. You can adapt the instructions if you'd prefer to make this an Activity.

1. Students will document their learning in Spaces by following these guidelines:
 - a. Click **+ Create** > Choose **Camera** > Take a photo of the completed handouts [A] & [B]
 - b. Add a **Title**
 - c. Post a Description > Have students answer the following prompts:
 - How did your catapult demonstrate Newton's First Law of Motion? (An object at rest remains at rest, and an object in motion remains in motion at constant speed and in a straight line unless acted on by an unbalanced force.)

- How did your catapult demonstrate Newton's Second Law of Motion? (The acceleration of an object depends on the mass of the object and the amount of force applied.)
- How did your catapult demonstrate Newton's Third Law of Motion? (Whenever one object exerts a force on another object, the second object exerts an equal and opposite on the first.)
- If you were to re-design and re-build your catapult, what would you change to improve the outcome? How do you think those changes would improve your launch distance? Explain at least three changes you would make. Try to include as many details as possible.

d. Click ✓ **Next**

e. Choose the **Class Space** or **Individual Space**

Click ✓ **Post**