

## Quick View

Students demonstrate a basic understanding of how the trebuchet works by sketching a trebuchet with ideas on how to increase the distance the clay ball is thrown, without making the trebuchet larger.

## Standards Addressed

### NSTA 5-8

Students develop abilities necessary to do scientific inquiry.

- Students communicate scientific procedures and explanations.
- Students develop abilities for technological design.
- Students evaluate completed technological designs or products.
- Students develop an understanding of transfer of energy.

### ITEEA 6-9

Students develop an understanding of engineering design.

- Students develop abilities to apply the design process.
- Students learn to apply a design process to solve problems in and beyond the laboratory-classroom.
- Students learn to make a product or system and document the solution.
- Students develop abilities to assess the impact of products and systems.

### NCTM 6-8

Students represent, analyze, and generalize a variety of patterns with tables, graph, words, and, when possible, symbolic rules.

- Students understand measurable attributes of objects and the units, systems, and processes of measurement.

### NCTE K-12

Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

## Time Required

90-180 minutes (will vary with class size)

## Content Areas

Primary: Technology

Secondary: Math, science, language arts

## Vocabulary

- distance
- fulcrum
- mass
- potential energy
- trajectory
- trebuchet

# Materials

- Paper
- Pencil
- Modeling clay
- Completed trebuchet
- Materials and tools necessary to build a trebuchet
- Mass plates
- 10-meter tape measure
- Ruler
- Digital balance or digital scale



# Procedure

Have the students sketch out their ideas on a sheet of paper. Look for these and other ideas that students might incorporate in their sketches to achieve more distance:

- Add more mass plates.
- Change the fulcrum position on the lever arm.
- Raise the mass plates higher above the platform, increasing the potential energy.
- Decrease the mass of the ammunition.
- Shorten the string.
- Change the angle of the release hook.
- Change the location of the weight support.

**1** Start by sketching a trebuchet similar to the built trebuchet. Make sure to note on the drawing your ideas for how to increase the distance the clay balls are thrown.

**2** Now, look at the lever arm and write on your sketch how you would change the lever to throw farther. You can change the fulcrum, the weight support location, and the release angle.

**3** Now, consider the sling. You can change the string length, the pouch size, and the size of the ball.

**4** Make a new sketch that incorporates the changes you would make to the trebuchet to increase the distance the ammunition would travel.

**5** Construct your modified trebuchet or, if possible, make the modifications to an already completed trebuchet. Test the modified trebuchet. Did the modifications increase the distance the ammunition traveled?

*Students can use a completed trebuchet, or they can build one from raw materials you supply.*