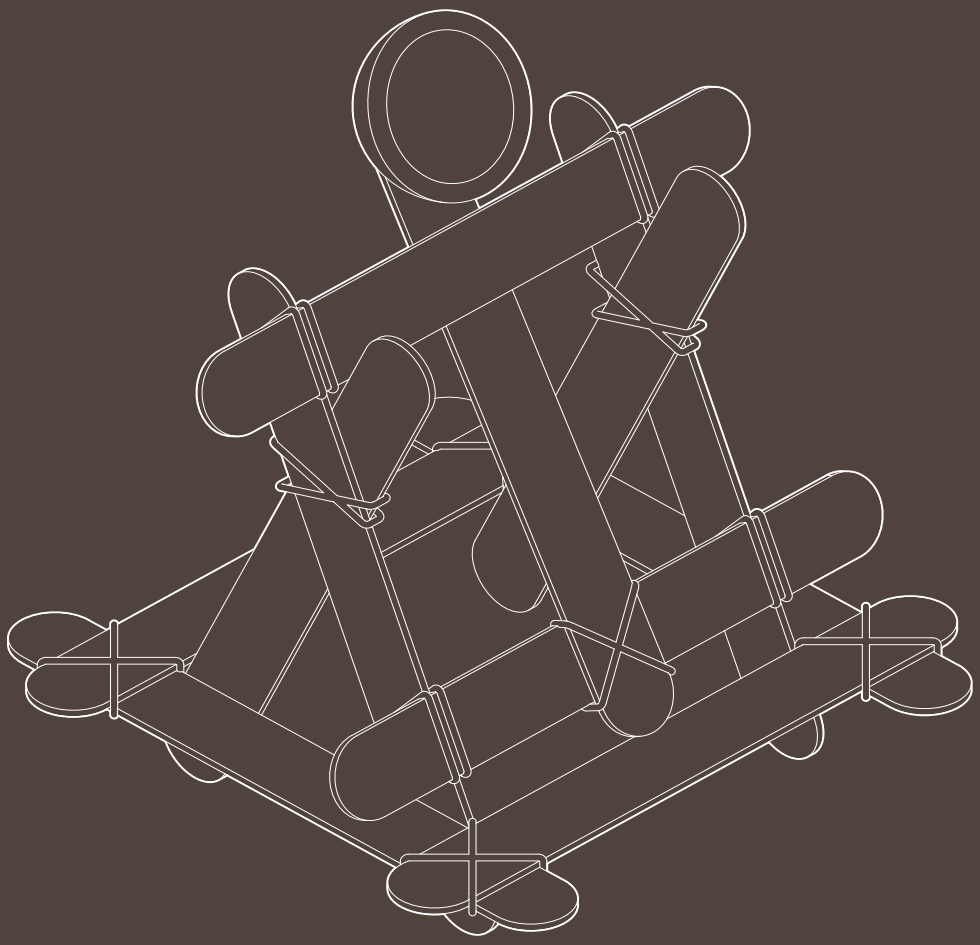
CHALLENGE 3

CATAPULT

In this challenge, teams will work together to create a catapult powered only by elastic bands.



TEACHING NOTES

SUMMARY

The Catapult session challenges students to design and build a catapult, which uses a lever and fulcrum to launch a pom-pom or ping-pong ball across the room.

Students will work in teams using lollipop sticks, elastic bands, pegs, bulldog clips and white tac to create their own medieval catapults, which will be put to the test in a final showdown.

The students will learn about force, accuracy, precision and angles. The catapults will be assessed by both accuracy and distance, with a winner for each category.

LESSON PLAN

ACTIVITY	DESCRIPTION	TIMING
Introduction	Introduce the goal of the session and hand out the student resource sheet. Divide students into teams of 4 students, providing a set of materials to each.	5-10m
Warm-up Activity A	Introduce the catapult energy exercise and ensure students have the required materials to complete it.	5-10m
Warm-up Activity B	Introduce the catapult vocabulary exercise and ensure students have the required materials to complete it. Provide feedback to the students after the activity.	10-15m
Main Challenge	Explain to students that their catapult must be stable enough to fire at least six projectiles; three will be measured on accuracy and three on distance.	30-40m
Measuring Up	When the teams are finished building, they need to test their catapult's capabilities. Accuracy and distance are the two key measurements.	10-15m
Extension Activities	If any of your teams finish their build early, get them to try one of the extension activities.	5-15m
Extra Content	Additional educational content for those with enquiring minds.	10-15m
Quiz	Ask your students to complete this quick quiz to test their knowledge.	10-15m
Wrapping Up	Cover the discussion points with the students to close the session.	10-15m

LEARNING OUTCOMES

Students will learn:

- How force affects the motion of a projectile
- Optimum angles for launching a projectile the farthest
- The importance of accuracy and precision in the design phase
- The effects of potential and kinetic energy on the final design

CURRICULUM

KS1 Design and Technology

- Design purposeful, functional, appealing products for themselves and other users based on design criteria
- Evaluate their ideas and products against design criteria
- Build structures, exploring how they can be made stronger, stiffer and more stable
- Explore and use mechanisms [for example, levers, sliders, wheels and axles], in their products

KS2 Design and Technology

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups
- Understand how key events and individuals in design and technology have helped shape the world
- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures
- Understand and use mechanical systems in their products (for example, gears, pulleys, cams, levers and linkages)
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work

TOP TIP

Set up a designated testing zone for students with enough room for at least two teams to test at a time.

You can also give each team an allotted time to test their catapults.

DOWNLOAD

Download and print student worksheets from imeche.org/stemtoolkit

WRAPPING UP

MEASURING UP

10-15m

In this challenge there will be two winning titles to work towards: The team who manage to launch their projectile the farthest and the team with the most accurate landing. To test the catapults, pull back on the pivot arm, load the basket with the projectile and release. It may be possible for one team to win both titles with an inventive and well-built design.

You have the option of using pom-poms or ping-pong balls as your projectiles. Experiment which would be better for distance and which, for accuracy?

EXTENSION ACTIVITIES

There are plenty of extra considerations that engineers need to take into account when designing a catapult. Here are a couple of ideas for extension activities if a team finishes early:

A

10-15m

Ask students to alter their design to increase the amount of kinetic energy released.

B

5-10m

Ask the students to make a target from a piece of paper and practice trying to aim for it in preparation for the measuring up process.

DISCUSSION POINTS

10-15m

To close the session, hold a class discussion and cover the following points:

- Did the teams succeed in creating a stable catapult that was able to launch a projectile?
- If not, why did it fail?
- Was each team's catapult accurate and how far did their projectiles go?
- What do the students like about designs from other teams?
- Do the teams think it would have been easier to work alone? Why?
- What would the teams change if they were to attempt the task again?
- What additional materials would the teams need to improve their design?

REMEMBER

Provide a recap or short summary to the class highlighting the key engineering skills and what has been learnt during this activity.