

Building a Catapult

Catapults have been used for centuries to throw objects great distances. According to Newton's third law of motion (whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first), when an object is launched, something must also happen to the catapult. In this activity, you will build a simple catapult that will allow you to observe the effects of Newton's third law of motion and the law of conservation of momentum.

WHAT YOU'LL DO

Construct a simple catapult.

Predict how Newton's third law of motion will affect a catapult and an object shot from the catapult.

WHAT YOU'LL NEED

- cardboard rectangles, 10 cm × 15 cm (3)
- glue
- marble
- meterstick
- pushpins (3)
- rubber band
- scale
- scissors
- straws, plastic (6)
- string

SAFETY



ASKING A QUESTION

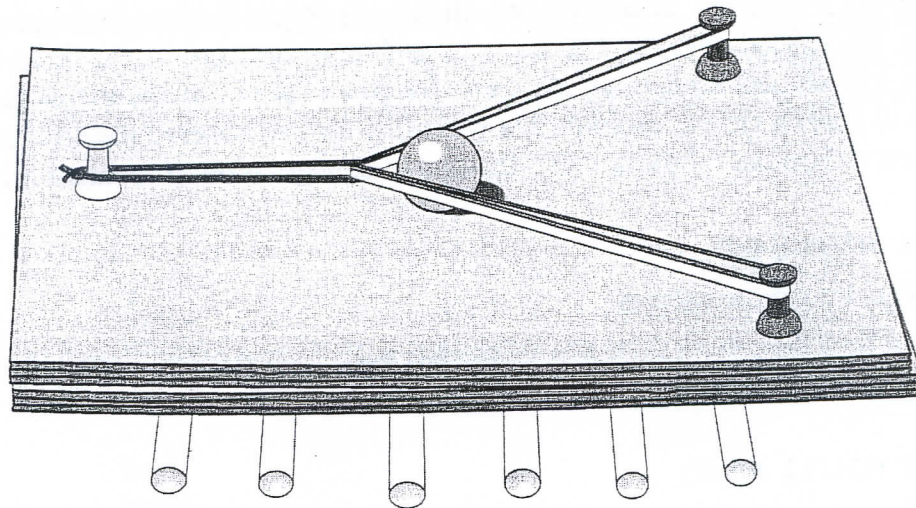
According to Newton's third law of motion, how will the motion of an object shot from a catapult compare with the motion of the catapult?

Building the Catapult

1. Glue the cardboard rectangles together to make a stack of three. Let the glue dry.
2. Push two of the pushpins into the cardboard stack near the corners at one end. These pushpins will be the anchors for the rubber band.
3. Make a small loop of string.
4. Put the rubber band through the loop of string, and then place the rubber band over the two pushpin anchors. The rubber band should be stretched between the two anchors with the string loop in the middle.

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5. Pull the string loop toward the end of the cardboard stack opposite the end with the anchors, and fasten the loop in place with the third pushpin.



FORMING AND TESTING A HYPOTHESIS

6. Determine the mass of the catapult and the marble. Consider Newton's third law of motion, and form a hypothesis about how the motion of a marble shot from the catapult will compare with the motion of the catapult.

Designing Your Experiment

7. With your lab partner(s), design an experiment to test your hypothesis.
8. Write the steps to the experiment in your lab report. Include diagrams if necessary.

Performing Your Experiment

9. Have your teacher approve your plan, and carry out your experiment.

ANALYSIS

1. **Identifying Relationships** Which has more mass, the marble or the catapult?

2. **Describing Events** In your experiment, what happened to the catapult when the marble was launched?

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3. **Describing Events** Describe the results of your experiment, comparing the type of movement and distance moved for both the marble and the catapult.

COMMUNICATING YOUR RESULTS

4. **Drawing Conclusions** Explain, in terms of Newton's third law, why the marble and the catapult moved as they did.

5. **Explaining Events** If the forces that made the marble and the catapult move apart are equal, why didn't the marble and the catapult move apart the same distance? Suggest two contributing factors.

6. **Applying Concepts** Using the law of conservation of momentum, explain why the marble and the catapult moved in opposite directions after the launch.

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EXTENSION

How would you modify the catapult if you wanted to keep it from moving backward as far as it did, while still having it rest on straws? Using items that you can find in the classroom, design a catapult that will move backward less than the one originally designed. Write a plan for your design, and include a drawing of the device.

	★ COK	ESC	VBS
Eric	3	2	2
Thompson	3	(3)	(3)
Contra	3	2	2
Dan	(2)	2	2