Cat-a-Pult Launch

Description: In this activity, students will launch an object (cat) using the cat-a-pult. They are to try and hit a target by adjusting the tension and trajectory knobs.

Age Group: Upper elementary.

Time Required: 15-20 minutes.

Science Skills: Observation, inquiry, prediction and experimentation.

Key Question: How does changing the tension or trajectory improve accuracy of the catapult?

Content Expectations Addressed: Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.

Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.

Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science through history and within society.

A force is either a push or a pull. The motion of objects can be changed by forces. The size of the change is related to the weight of the object on which the force is being exerted. When an object does not move in response to a force, it is because another force is being applied by the environment.

An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far.

Forces have a magnitude and direction. Forces can be added. The net force on an object is the sum of all of the forces acting on the object. The speed and/or direction of motion of an object changes when a non-zero net force is applied to it. A balanced force on an object does not change the motion of the object.

Motion can be described by a change in position relative to a point of reference. The motion of an object can be described by its speed and the direction it is moving. The position and speed of an object can be measured and graphed as a function of time.

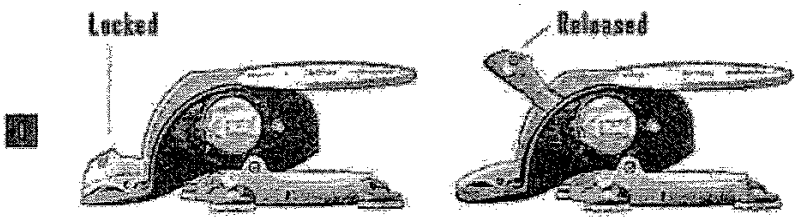
Objects and substances in motion have kinetic energy. Objects and substances may have potential energy due to their relative position in a system. Gravitational, elastic, and chemical energy are all forms of potential energy.

Teacher Background: Humans have been using catapults to fling things for thousands of years. The catapult is a mechanism used to throw missiles in ancient and medieval warfare. At first, catapults were specifically designed to shoot spears or other missiles at a low trajectory. They were used to attack or defend fortifications. Catapults were widely employed in siege warfare, but with the introduction of artillery they passed from use. hi the 20th century catapults using hydraulic pressure were reintroduced to launch aircraft from warships. (Gende, 2006)

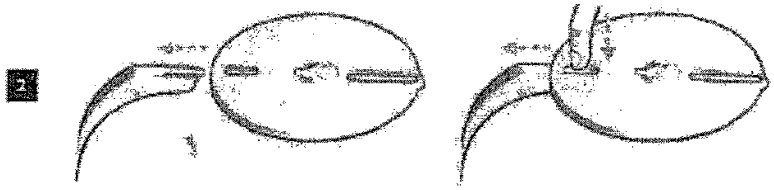
Materials: cat-a-pult, 2 soft foam cats (the launch cat and trigger cat), target, laminated catapult parts handout, student handout.

Teacher catapult set up:

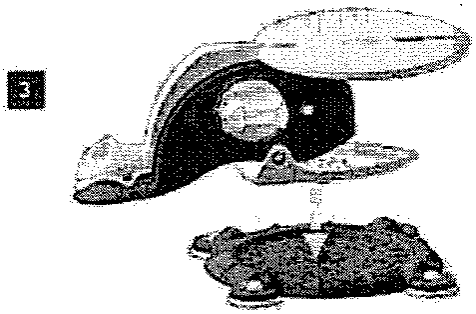
1. Please make sure the cat-a-pult is properly assembled. With the launch-arm in the release (up) position, figure 1.



2. The trigger plate needs to be correctly attached by sliding the small notch over the latch near the top of the trigger arm, figure 2. When the latch is partially inserted, press down with your finger so that the latch goes under the lip on the trigger plate. Slide the plate until it locks. Don't force it. When the pieces are lined up correctly, the will easily snap together. **Green arrow dial (on sides) means force and orange arrow dial (on opposite side) is trajectory.**



3. Secure the cat-a-pult body to the base, pressing firmly on the pivot at the bottom of the body and snapping it into the hole at the center of the base, figure 3. Once it snaps together, it is ready for use.



4. The consistency of each launch is sometime improved by setting the spring tension at the maximum 5 position and releasing 10 times. This helps align components properly.

Materials: (6 sets) 1 catapult, 2 cats, student help hint card.

Teacher Activity Prep Notes and Safety Tips:

1. Event logistics:

• Have 2 to 3 adults (or reliable student helpers) to help run event makes if much easier.

• Consider setting this event up in a corner to help control launched objects and students.

• Wait until target area is clear of adult/student helper retrieving launched objects before allowing students to launch objects. (wait to make sure no one is hit by flying object.)

2. Each numbered Launch site should have corresponding: Helpful Hints laminated card, a catapult and two numbered cats.

3. Demonstrate how to drop the trigger cat so that students see how easily it launches cat.

• Students should only trigger the cat-a-pult by dropping the cats or lightly tapping on the trigger plate. Remind them to NOT hit, step on or use force on the trigger plate to launch the cat. It does not improve distance it will only break the cat-a-pult.

(cat-a-pults can be found at Educational Innovations, Inc. teachersource.com)

• Never aim the cat-a-pult at others and keep students out of launch area so that they will not be hit by flying objects.

4. Remind the students that due to time, they only have 8 tries to hit the target and its okay if they don't hit the target.

5. The launch distance is where the cat first hits the ground.

Resources:

http://www.apphysicsb.homestead.com/catapult.html, Delores Gende, AP Physics Catapult Project, June 2006 http://www.tasigh.ora/ingenium!yhysics.html, Kevin A. Geiselman, Jngenium: Ingenious Machines, May 2002.