Simple Machines: *Catapult*

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Related Standards:

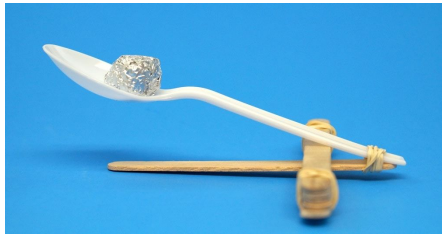
K-2-ETS1 K-PS2-2
3-5-ETS1 3-PS2-1
MS-ETS1 MS-PS2-1
HS-ETS1

Try It!

What happens if you change the size and weight of the load?

Materials:

- ❑ 6 popsicle sticks
- ❑ 1 plastic spoon
- ❑ 3 rubber bands



Instructions:

1. Stack 5 of your popsicle sticks on top of each other.
2. Take one of your rubber bands, and tie it around one of the ends of your popsicle stick stack.
3. Now that your stack is half assembled, take your 6th popsicle stick and slide it in between the last two popsicle sticks of your stack perpendicularly so that it makes it a “t” shape.
4. Tie your second rubber band around the opposite end of the popsicle stick stack. (Be sure that both rubber bands are tied tightly around both ends of the stack.)
5. Take your plastic spoon and place it on the very top of the entire stack facing the same direction as the 6th popsicle stick you added.
6. Using your last rubber band, tie the handle end of the plastic spoon to the top part of the 6th popsicle stick making a “v” shape with the 6th popsicle stick and the plastic spoon.
7. Put a small object into the scoop side of the spoon, pinch, and release the load. Try different objects for best results.

What’s the science behind it?

Catapults behaves as a lever. It involves moving a load, a steel ball or aluminium foil roll, around a fulcrum or a pivot. The pivoting action is provided by the point where the spoon and popsicle sticks are tied with the last rubber band. The force required for the triggering action is provided by your hand pulling back on the spoon. Catapults also apply the principle of conservation of energy. Potential energy gets stored in the rubber bands every time they are stretched. Even the flexing and bending of the wooden levers cause the catapult to gain potential energy. When the spoon is released, that potential energy is converted into kinetic energy (motion).

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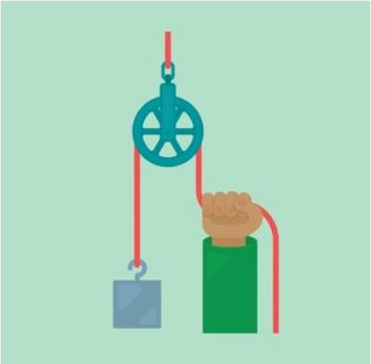
Try It!

Use objects with a variety of different weights for best results!



Simple Machines: *Toy Pulley*

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Materials:

- ❑ A hanger
- ❑ Card stock or toilet paper roll
- ❑ 1 7ft piece of string or yarn
- ❑ Two paper cups
- ❑ Heavy items to place in the cup (like hex nuts)
- ❑ 2 1 ft piece of string or yarn

Instructions:

1. If you have card stock, cut a 5.5” by 5.5” square out.
2. Place the bottom part of the hanger (not the part with the handle) in the middle of the square.
3. Wrap the ends of the square around the bottom part of the hanger so that they meet and make a cylinder. Tape the ends together to secure them place.
4. If you have a toilet paper roll, cut down the middle of the toilet paper roll from one end to the other.
5. Put the bottom of the hanger through the slit that you cut in the toilet paper roll.
6. Poke two holes in each of the paper cups. The holes need to be on opposite sides of each other.
7. Take the 1ft yarn/string and thread it through one hole and then the other. Tie knots around each hole to secure them in place. Do this for both cups.
8. Take the 7 ft yarn/string and tie one end around the yarn/string in one of the cups.
9. Thread the other end of the yarn/string through your toilet paper roll/cardstock and then tie that end to the other yarn/string on the other cup.
10. Place items in cups so that they can raise and lower.

What’s the science behind it?

Engineering: A pulley is a wheel that you loop a rope over. The key point of pulleys is that they redirect force. For example, instead of PUSHING a load up, you can attach it to a rope and pulley above you and PULL DOWN. All pulley systems redirect force. Some pulley systems make work easier, allowing a worker to use less force to move the object. Many window blinds and tow trucks use pulleys to make the work easier.