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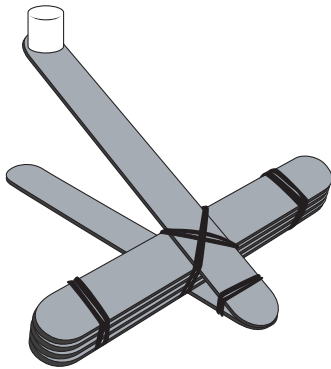


Popsicle Stick Catapults

Your resources are limited, your army decimated, but you must still take down the castle. Challenge yourself to use the elements of medieval technology to build a mini-catapult and blast castles ... with marshmallows! Experiment with making a catapult using popsicle sticks, rubber bands and everyday materials. Then face-off to see which contraption has the best combined accuracy, force and construction.

Materials You Will Need

- 9 popsicle sticks
- 5 rubber bands
- A (safe) projectile of your choice (eg. mini-marshmallows, cotton balls, etc.)



Procedure:

1. Stack four popsicle sticks. Using a rubber band at each end, squeeze the bundle tightly together.
2. Place the remaining two popsicle sticks together. Bundle only one end together using an additional rubber band.
3. Pry the unbundled end open enough to be able to slide the set of four sticks in between perpendicularly to form a cross. Slide the bundle of four sticks down as closely as you can get it to the rubber band that's holding the two sticks together.
4. Finish your catapult by securing the body to the wings (diagonally at the point where the popsicle sticks intersect) by crisscrossing a rubber band from the back of the right wing to the front of the left several times. Repeat with the final rubber band.
5. Place your projectile at the end of the popsicle stick that is highest in the air. Hold the set of four sticks with one hand, and push down on the angled stick just behind the projectile.
6. Release your projectile!

What's Going On?

A lever is a simple machine that uses a beam attached to a pivoting hinge, or fulcrum, to amplify the amount of force applied to one end. The lever provides mechanical advantage, or leverage, to make it easier to perform work on the other end.

Catapults were used in warfare for centuries, and are a great example of the power of a lever in action. By affixing a popsicle stick at a right angle (T-shape) to another, you are effectively using the bottom one as the fulcrum for the top. By adding force to change the shape of the bow or popsicle stick from its original resting position, you add stored (potential) energy to the wood. By stacking the popsicle sticks to increase the height of the fulcrum, then moving the end of the lever higher in the air (longer lever), you allow for more distance for the lever to build more potential energy as you pull it down. When you release your catapult, you're quickly transferring that stored potential energy into kinetic energy that sends your projectile flying.

DO try this at home!

Experiment with different materials and designs to create new catapult variations. To make a larger catapult, try using rulers instead of popsicle sticks. You can try out different designs by adjusting both the height of the fulcrum and its distance from the center of the catapult. By doing this, you can investigate the relationship between the position of the fulcrum and the launch angle of the projectile. You could even try attaching a spoon or bottle cap to the end to hold larger projectile loads. Let the target practice begin!



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New York Hall of Science

Who were the Vikings?

Who were the Vikings, and why do we still study them today? The Vikings came onto the world stage at the end of the 8th century. They were from modern-day Scandinavia (Sweden, Norway, and Denmark). Over the course of 300 years they made their mark by land and sea, conquering territories through innovative methods of seafaring and warfare. On inventive vessels such as the longship and with growing armies, they swept through large sections of the world, including parts of Western Europe, the Mediterranean, Russia and they even reached North America. Also known as "Norsemen," the Vikings left a big imprint on world history by the time their reign ended.

By studying their ships, stone and metal carvings and other objects, we can learn about the Viking age. The Vikings pushed the boundaries of technology, creating shipbuilding and navigational techniques which connected people in new ways. They had their own legal system, and a unique culture and worldview. The Vikings were also very destructive, plundering many of the communities they encountered. By studying their history, we can untangle myth from reality, and learn about how they shaped the world we live in today.

Some Famous Vikings:

Ragnar Lothbrok (also spelled Lodbrok)

Ragnar was a Viking chieftain known for his adventures and strong command of his army. Ragnar and his troops invaded Paris in 845 AD. The French King, Charles the Bald, was forced to pay Ragnar huge amounts of silver to regain the city.

Erik the Red

This chieftain from Norway established a settlement in Greenland around 985 AD after being exiled from Iceland. Though he later returned to Iceland, many Icelanders followed his route to Greenland and settled there.

Leif Eriksson (also known as Leif the Lucky)

The son of Erik the Red, Leif was a Viking explorer who sailed from Greenland to Norway. Many historians believe that Leif was among the Vikings that landed on the North American continent around 1000 AD (almost 500 years before Columbus!) Though their time in North America was short lived, the journey was a major seafaring breakthrough.

Viking Fast Facts:

There were three classes in Viking society: slaves (known as thralls), free men (known as karls), and nobles who were often leaders and local chieftains.

Vikings had assemblies known as The Thing where disputes were decided, punishments for crimes were determined, and where free man could give their opinions about important issues.

Women played important roles in Viking society. Many Viking women were free to choose their own husbands, and they often were left in charge of their homes and farms when their husbands were away on raids and expeditions.

Many of the words we use today stem from Viking history. For example, Thursday has its roots in the name Thor, named after the Viking god, as in Thor's Day



Vikings Word Search

N	I	G	E	O	L	O	M	V	E
T	H	S	S	M	D	P	O	H	E
U	K	C	U	W	K	I	H	D	Z
Z	D	A	N	T	O	C	N	Q	R
R	T	L	S	X	K	A	R	L	A
U	C	D	T	S	M	I	T	H	F
N	T	L	O	N	G	S	H	I	P
E	A	N	N	E	K	G	O	F	Z
S	T	O	E	Q	U	A	R	Q	G
K	E	E	L	N	U	P	U	J	T

Locate the Viking-era terms listed below and circle them in the puzzle above.

SCALD

(A Viking poet or writer of epics)

KARL

(A free man in Viking society; a karl could own land unlike thralls. They were farmers, warriors, craftsman, and other occupations.)

LONGSHIP

(An innovative Viking ship most commonly with many rowers and a rectangular sail)

KEEL

(The structure along the bottom of a vessel's hull on which the framework of the ship is built)

SMITH

(A Viking metalworker.)

RUNES

(Letters in the alphabet during the Viking era which were often carved in stone. These letters had symbolic meaning to Vikings.)

SUNSTONE

(A navigational tool used by the Vikings to determine direction by harnessing using sunlight, even on cloudy days.)

ODIN

(One of the most important Viking gods. Odin was known as the god of both war and wisdom.)

THOR

(Thor was a major Viking god who rules the sky and governs thunder and lightning, winds and storms.)

Learn more about the Vikings on History.com:

<http://www.history.com/topics/vikings-history>

Short video: Bet You Didn't Know: Vikings <http://www.history.com/topics/vikings-history/videos#bet-you-didnt-know-vikings>

View a Vikings photo gallery:

<http://www.history.com/topics/vikings-history/photos#viking-vessels-and-artifacts>

Vikings: North Atlantic Saga, from the Smithsonian Museum of Natural History:

<http://www.mnh.si.edu/vikings/>

The Viking Ship Museum:

<http://www.vikingseskibsmuseet.dk/en/>