

Testing your Catapult!

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Let's test the catapult to see what it can do!

You have a few variables that will make a difference in the distance the projectile will go.

1. **You can change the size (weight) of the ball** – a larger plasticene ball will have an effect on how far it travels.
2. **You can change the type of the ball as an experiment.** You have a puff ball and a Styrofoam ball in the kit, compare the distance each of them travels! You can also go to a craft store and get a variety of sizes of Styrofoam balls for some interesting discoveries.
3. **You can turn the tensioner and the twist the rope tighter**, but not too tightly, or the line will break– so be careful!
4. **You can change the number of pads at the crossbar.** Adding wood to make the swing arm hit the crossbar sooner will change the trajectory (angle of the projectile) as it leaves the swing arm.

Remember to change only **one** variable at a time, and to test it about 10 times, measuring the distance each time. Record your results on a table, then make a line graph to see if there is a pattern. Be sure to write your steps down on the worksheet.

Activity 1 – Use the worksheet to write up what you did.

Test how the weight of the ball affects the distance.

First, on your worksheet, make a prediction about what you think will happen as the weight changes.

1. Take the plasticene and roll it into three small balls, each one a little larger than the other. If you have a scale you can weigh them – one ball two grams, the next one four grams, the next one six grams and so on (and more if you have time!).
 2. Start with the smallest ball. Put some tape on the floor so you can place the catapult in the same place each time. Roll out a tape measure in front of the catapult, and fire off the catapult. The lightest will go pretty far and fast so you may have to practice your skills in seeing where it lands.
 3. Measure where it **lands**, not where it rolls to, in case the floor is uneven (plus the plasticene dents when it hits the ground, so it doesn't roll evenly). If your tape measure isn't long enough, then get a rough idea where the ball lands, measure out to that point and put down the tape measure there, adding in the distance to what you measure on the tape.
 4. Take ten shots and record each distance on a table.
 5. Use the next larger ball and do the same thing. Ditto with another heavier ball.
- Remember that in medieval times the attackers had to use a heavy projectile, or it wouldn't do any damage to the castle walls, but if they were too close then they could be hit with arrows from the castle! Some catapults had wooden screens in front to protect the attackers from arrows shot from the castles.

Once you have recorded ten shots of each weight then add up all the distances and divide by the number of shots you made (ten). This will give you an **average** distance for each weight. Then with these numbers you can make a graph.

Plot your graph with two axis. Along the bottom could be the distance the ball traveled, and along the side would be the weight of the ball.

As you can see you need to start at zero and make sure your distances between the marks are equal!

Now comes the fun part, draw a line between the marks you made and see what shape the line is. Is it straight, curved? Can you extend the line in the same direction, what might it look like?

Well now that you have an idea about how far the ball goes with the two pads on, now you can try it with only one pad, or none.

Try using the twist of the rope as a variable, how much farther does the projectile go with each quarter turn? But be careful!

You have different types of balls in your kit. Find a few others (nothing hard!) and do an experiment with them, comparing the distance and the way they fly through the air.

Make a prediction about which will go farther, and fire away! You might predict that the lighter the ball the farther it will go, this may be so for some balls, but for all? What other factors affect the distance of the projectile? This is an open ended activity leading to some interesting results!

Ye Olde Catapult Worksheet

This will really impress the lord of the castle!

Use the back side to write your test results and make a graph.

Description of your experiment (what are you trying to test?)

Hypothesis (what do you think will happen).

Method (how did you do the experiment?)

Results (well, what happened?)

Helpful tools for testing your siege engine! A table for results and a graph to plot them!

Record your results.

Variable _____

WEIGHT	WEIGHT	WEIGHT	WEIGHT

Effect of changing the weight of the projectile on a catapult

Weight
of
ball
—

Distance in _____