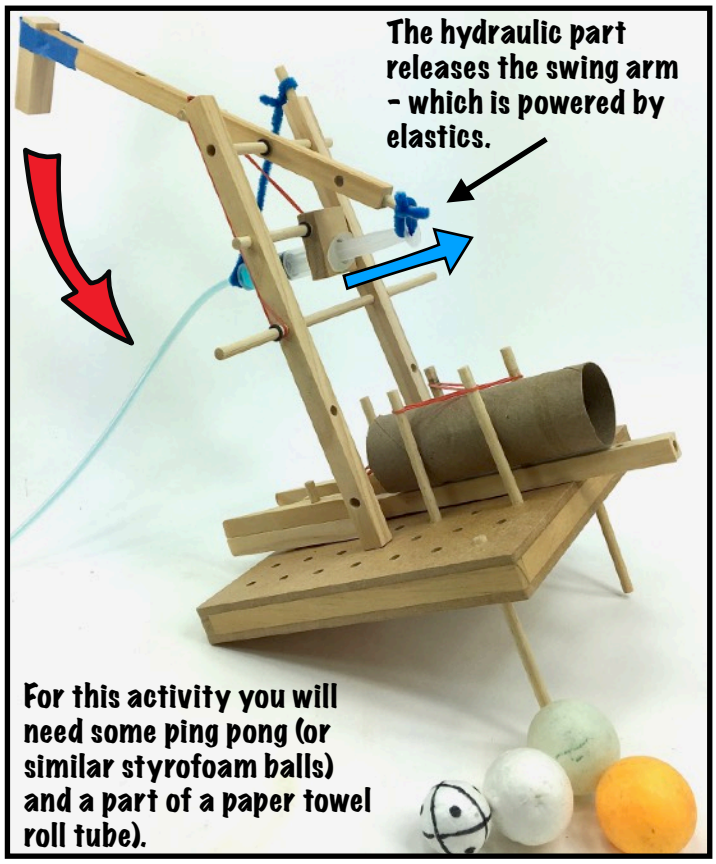
PATHFINDERS STEM
HYDRAULICS MAKER SET

PING PONG BALL LAUNCHER

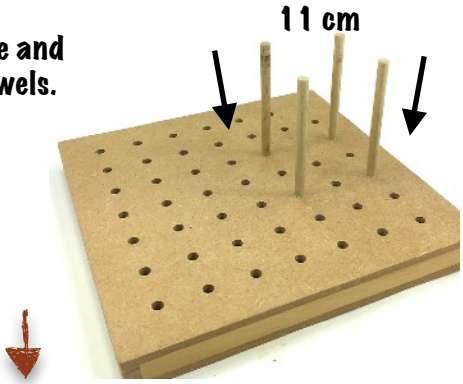
PATHFINDERS

We love making up games with the Maker Set, and while launching balls is fun, just, well, cause it is, there is a scientific element where you can test the best angles to launch a ball for maximum distance.

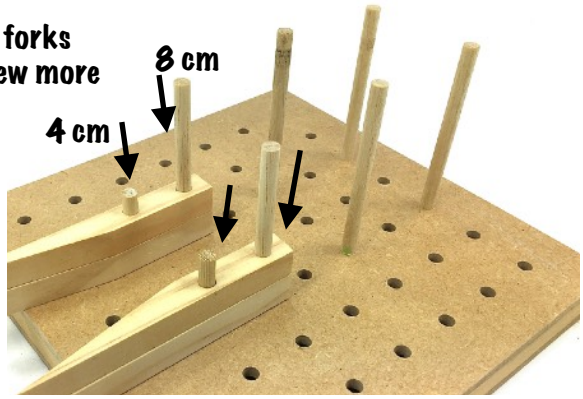


We have a few instructions for launching things, but this one is different in that you can change the angle of launch, and as the power of the release is the same every time, theories of trajectory and distance can be tested - cool!

Start with a base and four - 11 cm dowels.

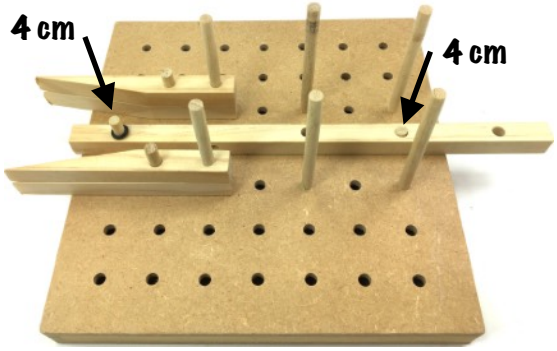


Add the forks with a few more dowels.

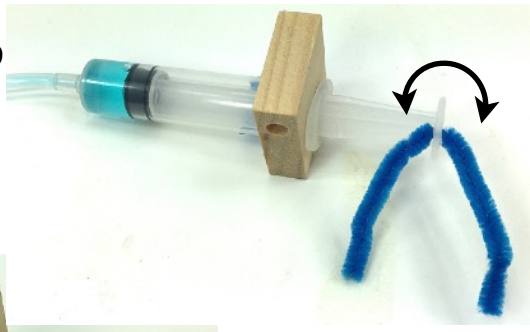


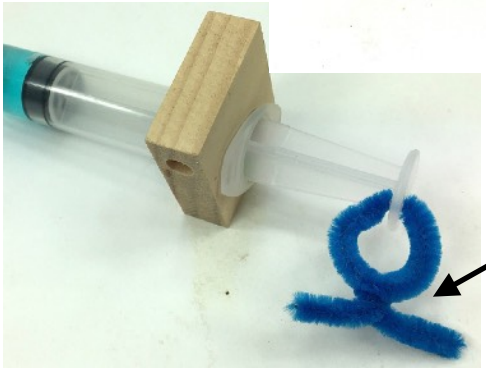
You can also use smaller rubber or wooden balls to compare the launching distance of those kind too!

Add a long beam down the middle.



Add a twist tie to the plunger...

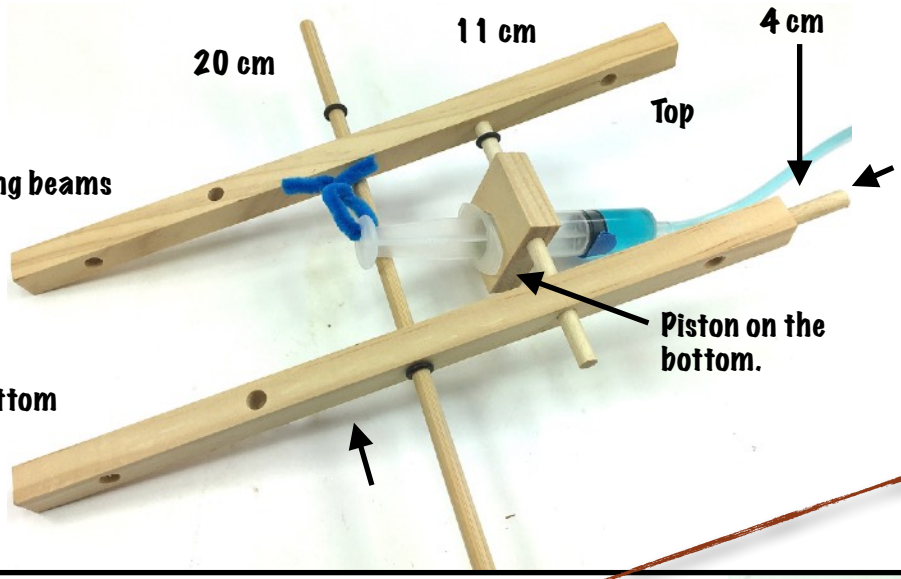


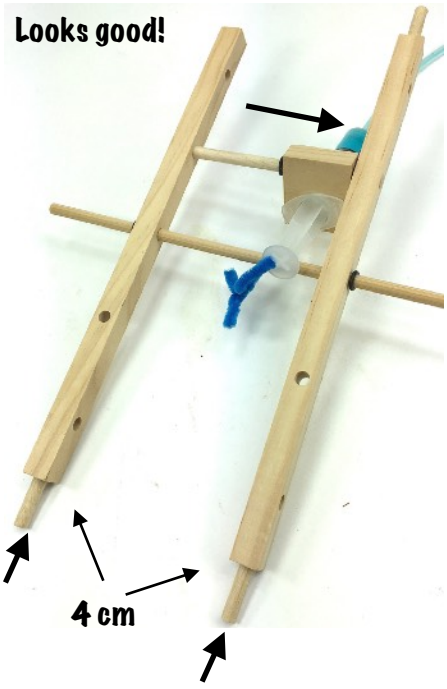


Make a loop that is about 3 cm long.

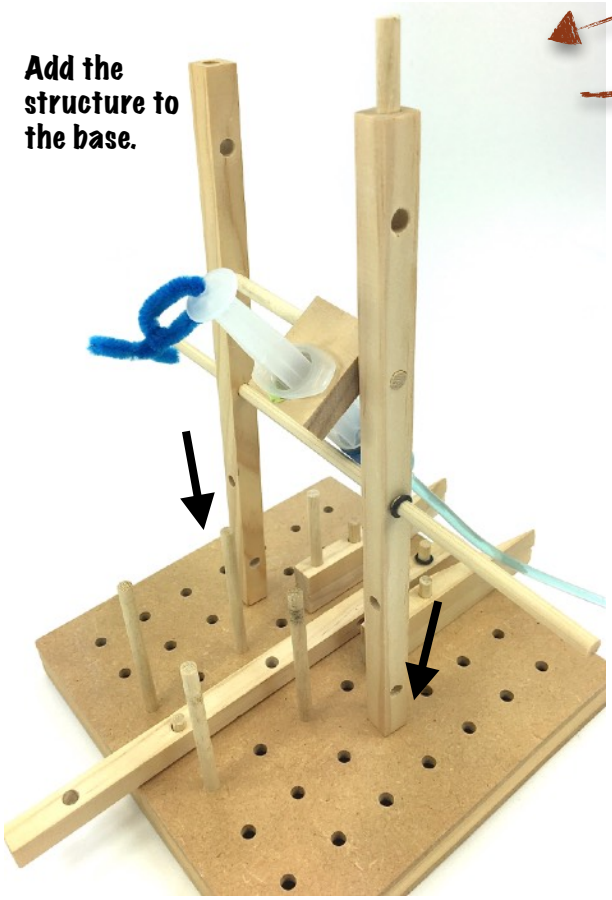
BALL LAUNCHER!

Add the piston to an 11 cm dowel.
You can add O-rings to the inside to hold it in place.
Add a long dowel and use O-rings to hold it in place.



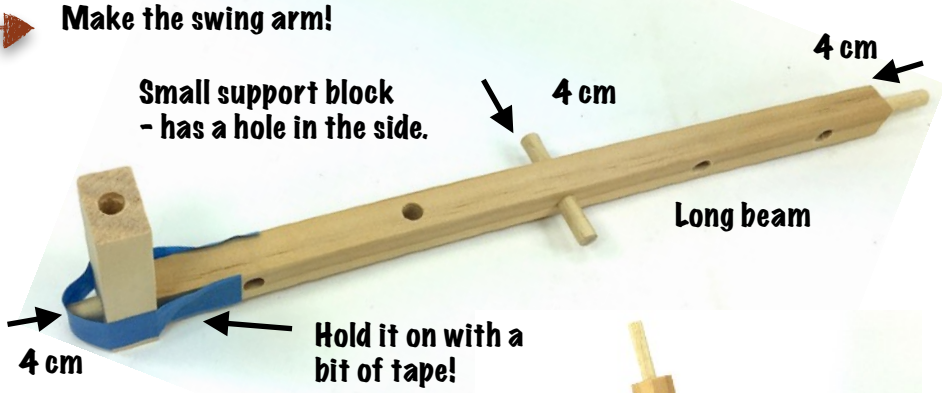


Add the structure to the base.

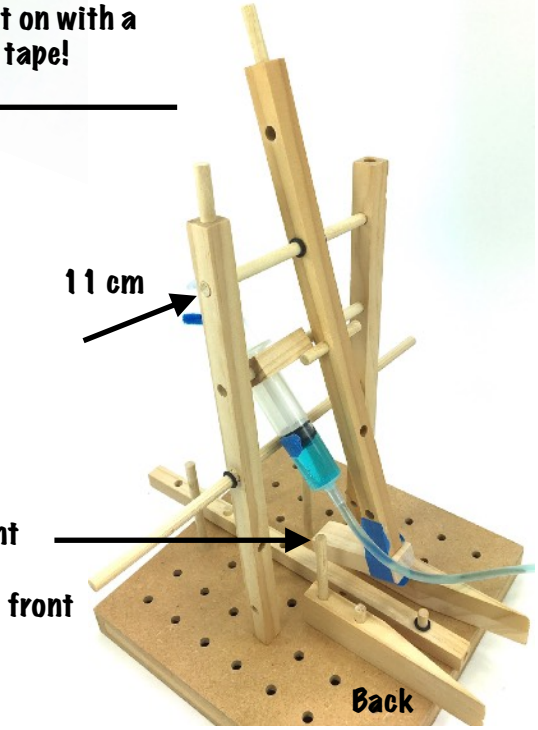


Long beams

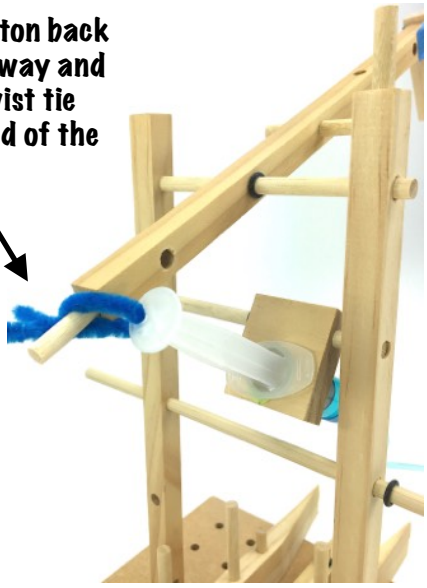
Make the swing arm!



Add the swing arm.
Use an 11 cm dowel.



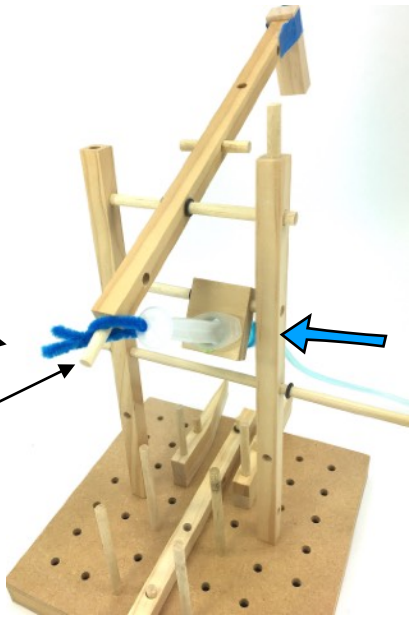
Pull the piston back about 1/2 way and loop the twist tie over the end of the dowel.



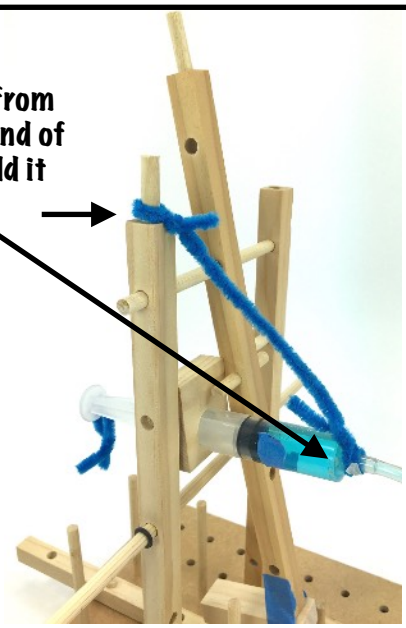
Looks good, adjust the piston in the holder, or the length of the loop if you need to.

When you push the piston it should unhook from the dowel.

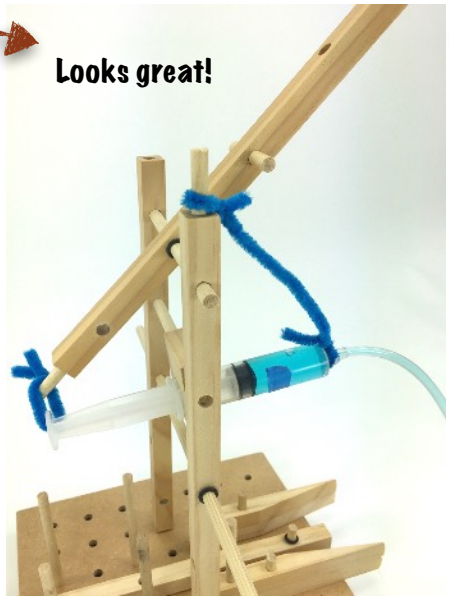
If the dowel comes off - just add a bit of tape for a friction fit!



Add a twist tie from the top to the end of the piston to hold it level

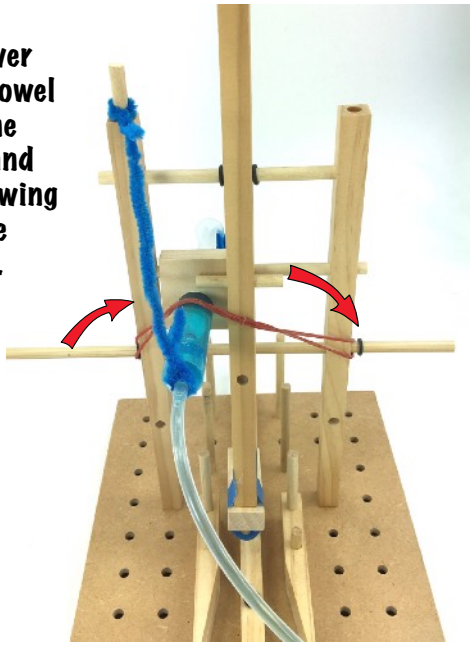


Looks great!

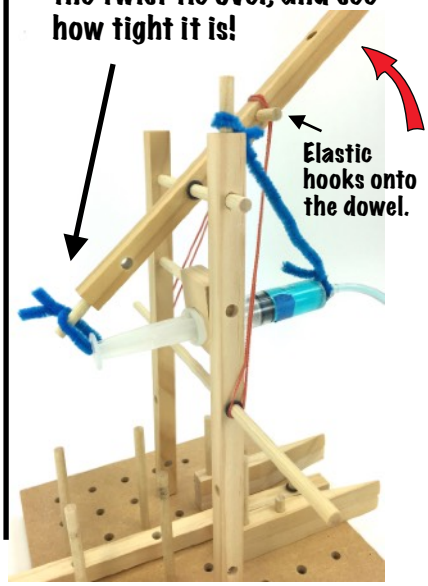


We used two long-ish elastics for the power. You might need three, depending on how thick they are. When they are added and stretched, they can swing the arm pretty fast! - so consider being careful so it doesn't break the pieces...

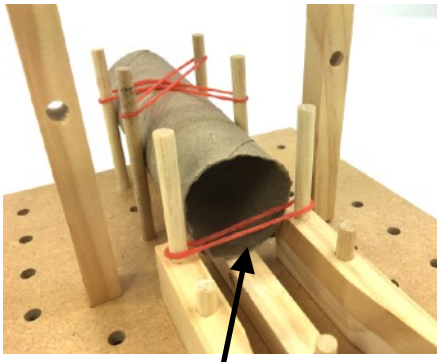
Slide the elastics over the long dowel - under the twist tie and over the swing arm to the other side.



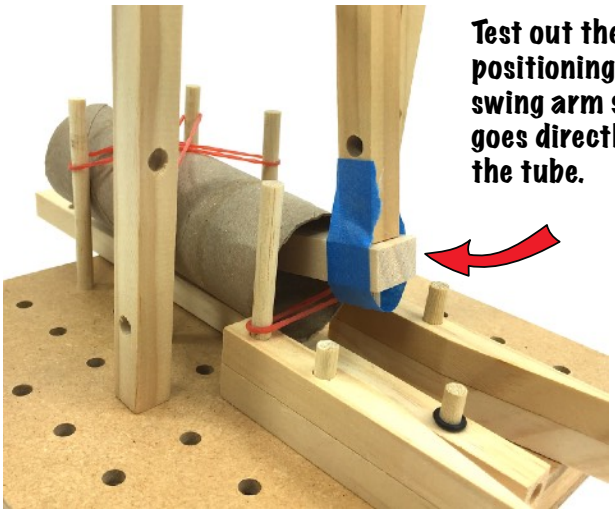
Push the arm down, slide the twist tie over, and see how tight it is!



Add the paper towel roll and use some elastics to hold it on - and one at the end.



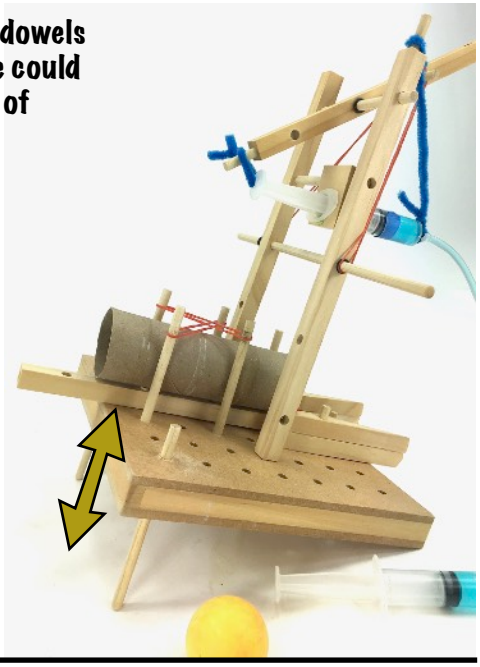
This elastic holds the ball in place.



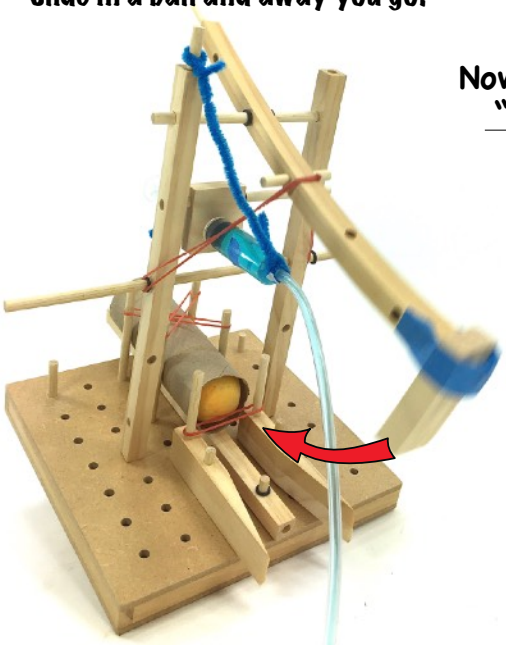
Test out the positioning of the swing arm so it goes directly into the tube.

We added 11 cm dowels to the front so we could change the angle of trajectory.

To make it angle higher - use the 20 cm dowels!



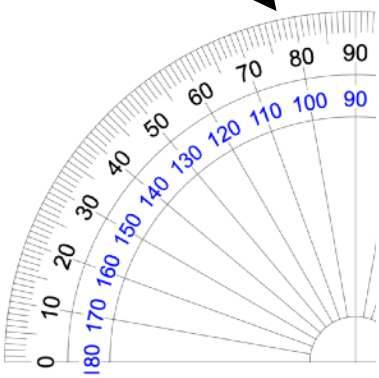
Slide in a ball and away you go!



Now gather a few different kinds of balls and begin - "HURLING FOR SCIENCE!" (yeah, thats a thing...)

You will need to make a graph to accurately record the results and consider things like the density and weight of the ball, as well as the trajectory angle.
Any good scientific experiment needs a hypothesis - your reasoned guess about which you think will happen*. So make a hypothesis about what type of ball you think will go farther, and which angle is the best for the longest shot. Then start launching! (this is how rocket scientists get their start).

This is too high...



* A hypothesis can be proven or disproven, either way you learn something!

Get a protractor to measure the trajectory angle! (or print this one?)

EXTEND YOUR DESIGNS!

These two machines launch balls - but the power comes from the push of the syringe, so it is hard to be accurate with the direction of the throw and the distance the ball flies.
Yours takes care of that problem with a a consistent swing arm speed from the elastics. Is it possible to make a launcher that is hand-pushed that is also consistent?

You can also work on accuracy with this launcher.
Make a target with a hole in it and see how well the launcher shoots balls into it. Are more dense balls more consistently accurate in their trajectory? (that would be my hypothesis).
It may give you some idea about the relationship of the weight of the projectile and the way the air friction affects the way it flies.