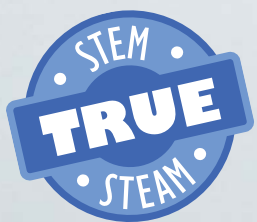




# Projectile Launcher Basic Build Guide



Start by building the example launcher, then turn it into **your own** unique design.



↓ You Are Here

GO

Build Guide

Lab Activity  
Optional

Launching & Graphing Sheet

Design & Engineering Challenge

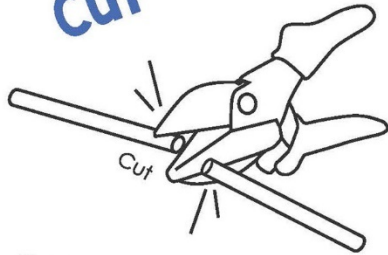
Download documents at [teachergeek.com/learn](https://teachergeek.com/learn)

For use with TeacherGeek [Projectile Launcher Activity](#), or [Maker Cart](#) available at [teachergeek.com](https://teachergeek.com).

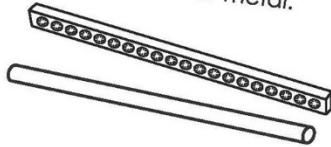


# Projectile Launcher Basic Build Guide

## Cut



**Multi-Cutters** cut wood & plastic (like **dowels** and **connector strips**). They do not cut metal.

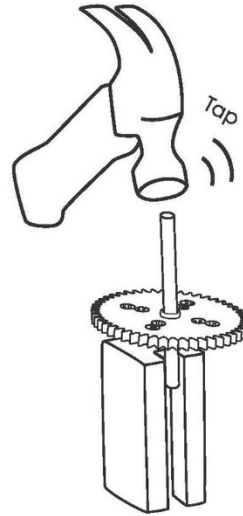


## Push, Wiggle,

Push, wiggle or tap **dowels** into holes.



## Tap



Use a **hammer** and **slider block** to tap **dowels** farther through holes.

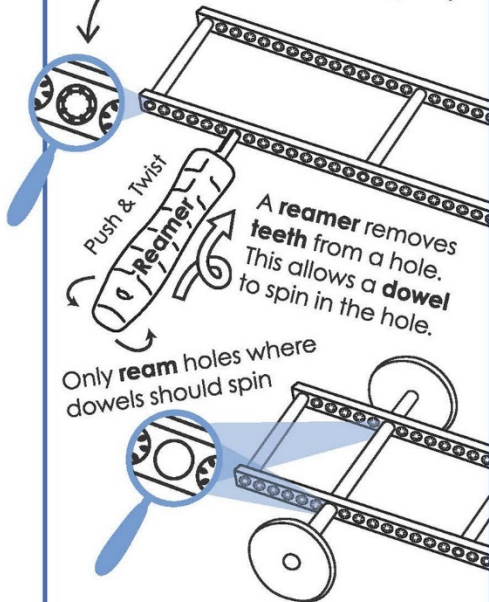
## Quick Tip!



Use a **crayon**, or **soap** on the end of a **dowel** to make building easier.

## Ream

Most parts have holes with **teeth**. The **teeth** hold **dowels** (keep dowels from falling out).



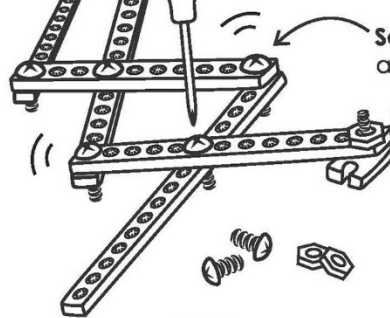
A **reamer** removes **teeth** from a hole. This allows a **dowel** to spin in the hole.

Only **ream** holes where dowels should spin

Never **ream** pulleys, gears, wheels, or any hole a **dowel** stays stuck into.

## Screws & Nuts

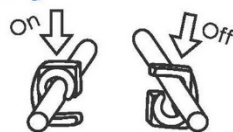
Do not **ream** holes you will put **screws** into.



**Screws (without nuts)** can connect parts, and allow them to rotate.

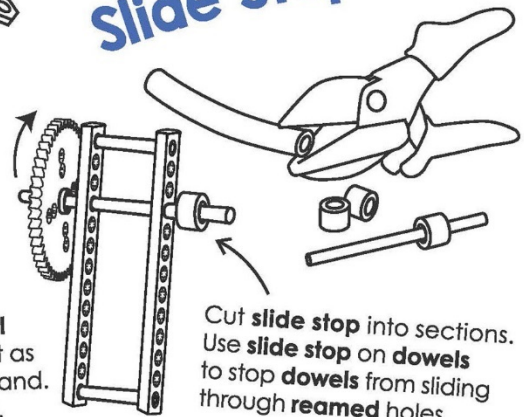
**Screws (with a nut)** can connect parts, and keep them from rotating.

## Stop Clip



Press a **stop clip** onto a **dowel** to keep it from sliding or use it as a hook for a string / rubber band. It takes little force to get it on.

## Slide Stop



Cut **slide stop** into sections. Use **slide stop** on **dowels** to stop **dowels** from sliding through **reamed** holes.





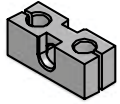
# Projectile Launcher Basic Build Guide



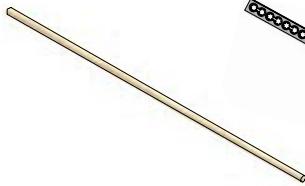
## TeacherGeek Components

For One  
Launcher

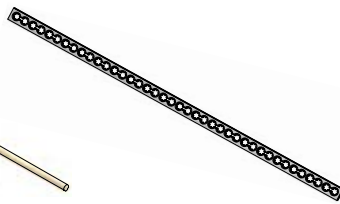
Here are TeacherGeek components to make the example projectile launcher, and then turn it into your own unique design.



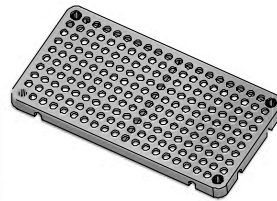
10 - Blocks



5 - Dowels  
30cm (12")



2 - Connector  
Strips



1 - Hole Plate



1 - Ping Pong  
Ball



2 - Nuts  
#10



2 - Lock Nuts  
#10



1 - 38mm  
Screw  
38mm (1½") #10



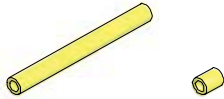
1 - 25mm  
Screw  
(1") #10



10 - Rubber  
Bands



2 - Stop Clips



1 - Slide Stop  
76mm (3")



1 - Steel Wire  
7.5cm (3")



1 - Plastic  
Coated Wire  
8cm (3¼")



You might  
need to cut this  
from a wire roll.

► Components available in the TeacherGeek [Ping Pong Launcher Activity](#),  
TeacherGeek [Maker Cart](#), or at [teachergeek.com](http://teachergeek.com)



# Projectile Launcher Basic Build Guide



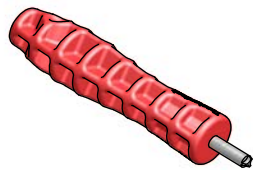
## TeacherGeek Tools You'll Need

Easy to Share  
in Groups

This isn't a kit. You're going to really build (cut, ream, screw) your launcher. Here are the tools you'll need.



**Multi-Cutter**  
[SKU 1823-81](#)



**Reamer**  
[SKU 1823-87](#)



**Screwdriver**  
[SKU 1823-90](#)



**Pliers**  
[SKU 1823-86](#)

Tools available at [teachergeek.com](http://teachergeek.com)

## Materials You Supply

You will need these non-TeacherGeek supplies:



**Tape**  
Masking, Painter's, Duct;  
Any kind of tape will work.



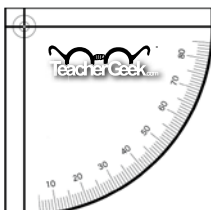
**Safety Goggles**  
Should be worn during  
the activity.



**Recycling  
Materials**  
Add to your design



**Scissors**  
For cutting out the  
protractor and  
recycling materials.



### TeacherGeek Protractor

Print on cardstock or thicker paper for a sturdier protractor.

Printable Protractor Download:

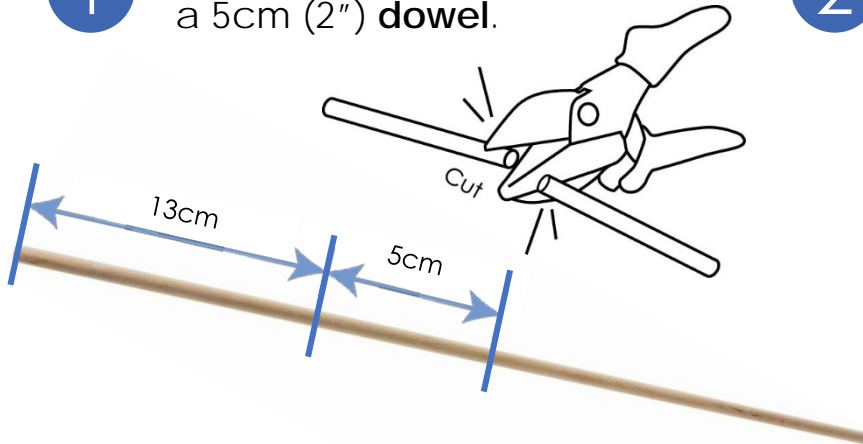
[http://teachergeek.org/protractor-angle\\_finder.pdf](http://teachergeek.org/protractor-angle_finder.pdf)



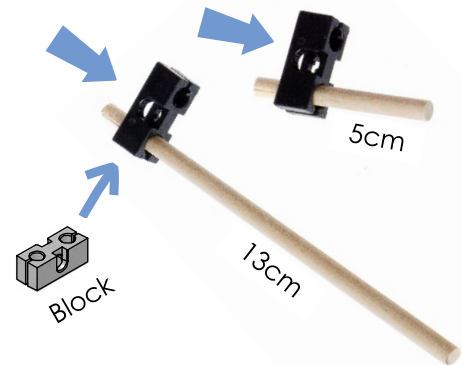
# Projectile Launcher Basic Build Guide

## Make the Launch Pad

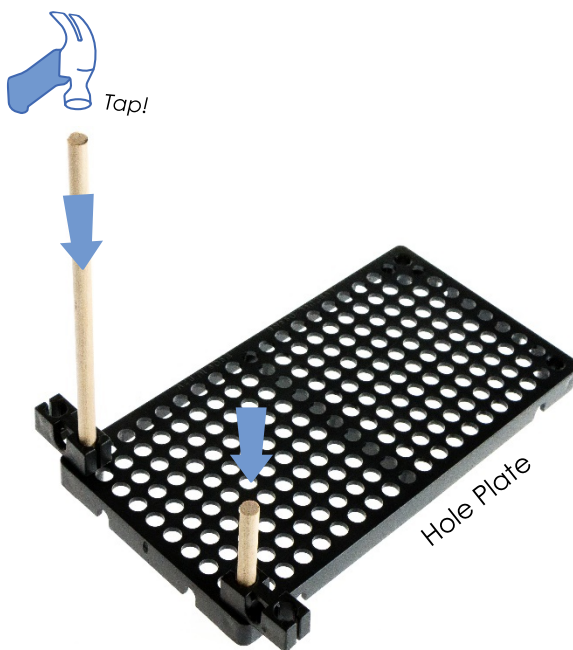
- 1** Cut a 13cm (5") **dowel**, and a 5cm (2") **dowel**.



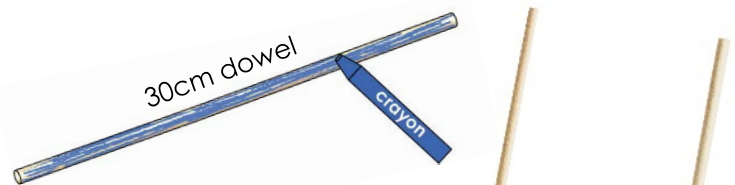
- 2** Push, or tap, each **dowel** from Step 1 into a **block** as shown. The dowels should stick out a little.



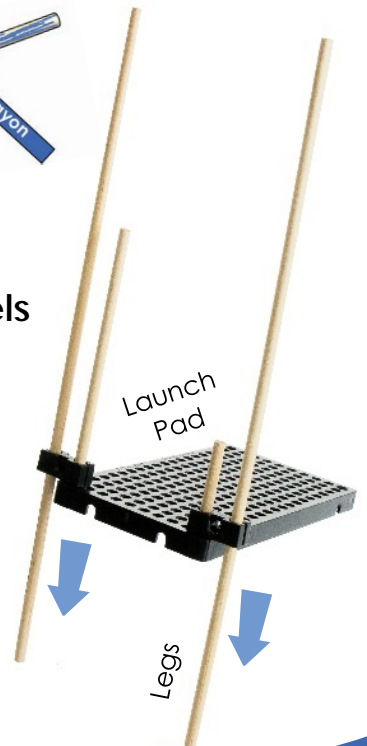
- 3** Push or tap the **dowels** from Step 2 into the **hole plate**, as shown.



- 4** Rub a crayon, wax, or bar of soap, on two **full** (30cm) **dowels**. This helps the dowels slide.



- 5** Slide the **dowels** from Step 4 through the **blocks** from Step 3. These will be the **legs**.




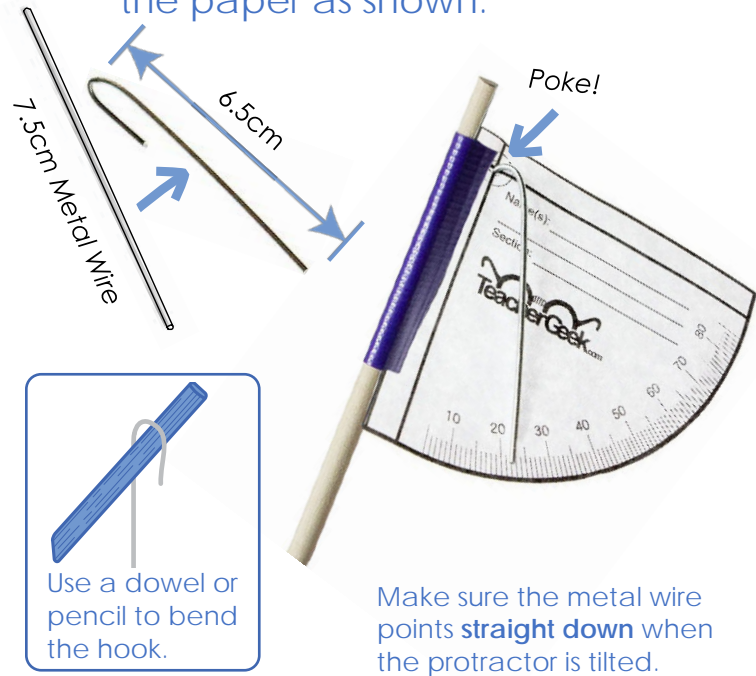
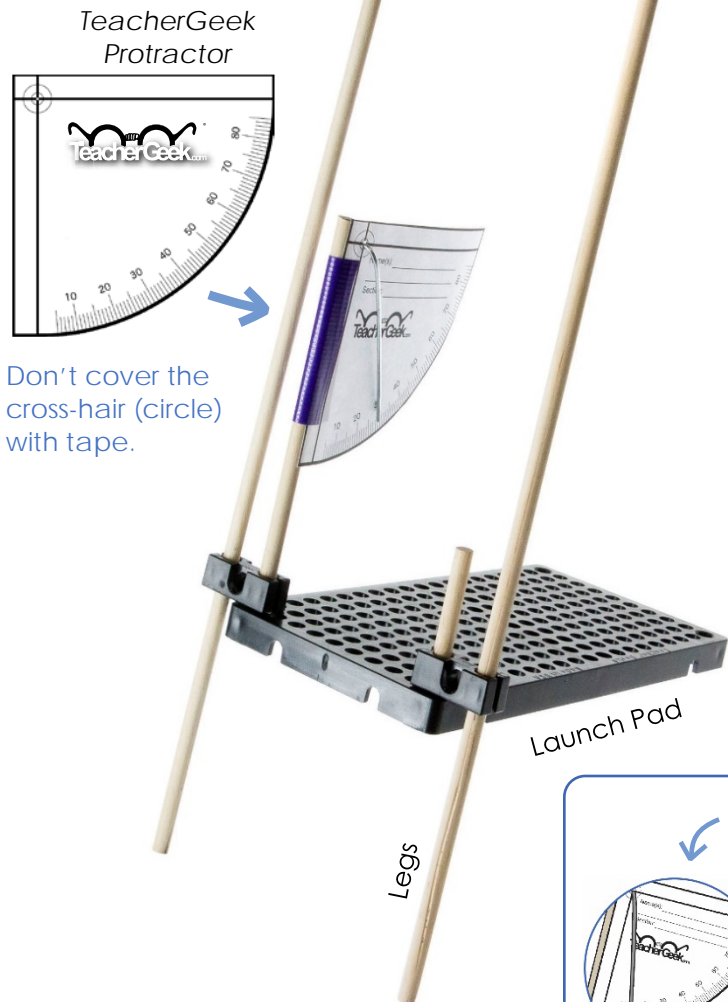




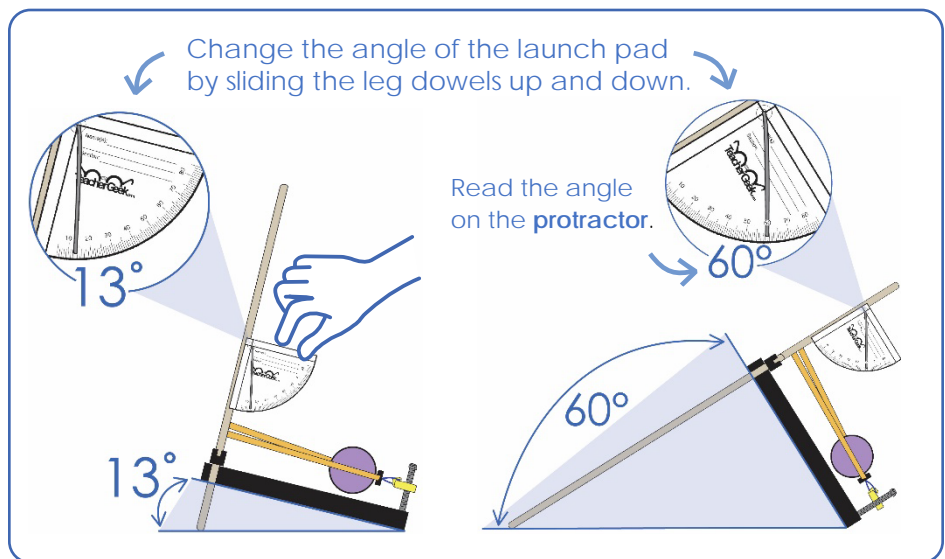
# Projectile Launcher Basic Build Guide

- 6** Print, cut, and tape a **protractor** to the launcher, as shown.

- 7** **Bend** a 1.5cm hook at the end of a 7.5cm **Steel wire** (Not the plastic coated wire). **Poke** it through the **protractor** at the . **Hang it on** the paper as shown.



► **Congratulations!**  
Your Launch Pad is finished!  
Now, it's time to create  
the Launching Mechanism.



Printable Protractor Available at:  
[http://teachergeek.org/protractor-angle\\_finder.pdf](http://teachergeek.org/protractor-angle_finder.pdf)



# Projectile Launcher Basic Build Guide

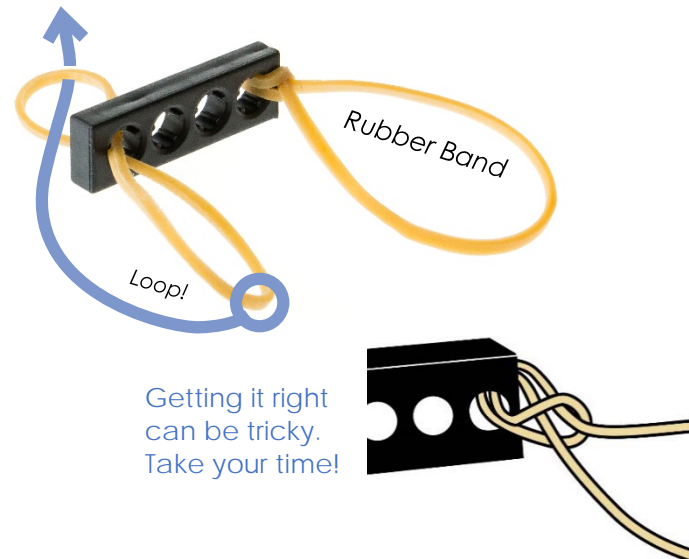


## Launch Mechanism

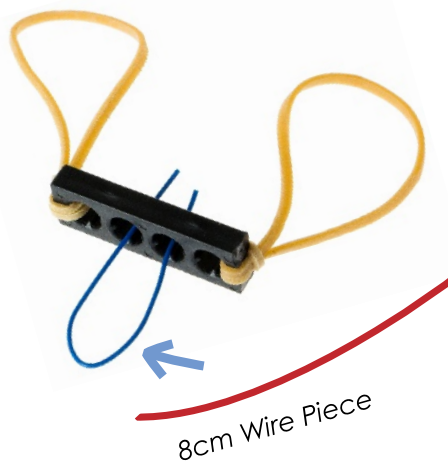
- 8 Cut a piece of **connector strip**, four **holes** long.



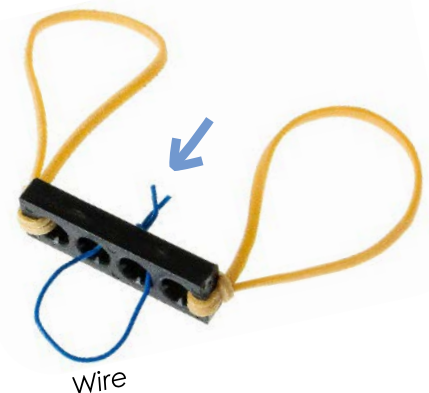
- 9 Connect two **rubber bands** to the cut **connector strip**, as shown.



- 10 Cut, or find, a 8cm (3") piece of plastic coated **wire**. Fold it in half and place each end through a **connector strip** hole.



- 11 Twist **wire** ends together to create a strong **loop**. This will be the launch mechanism.





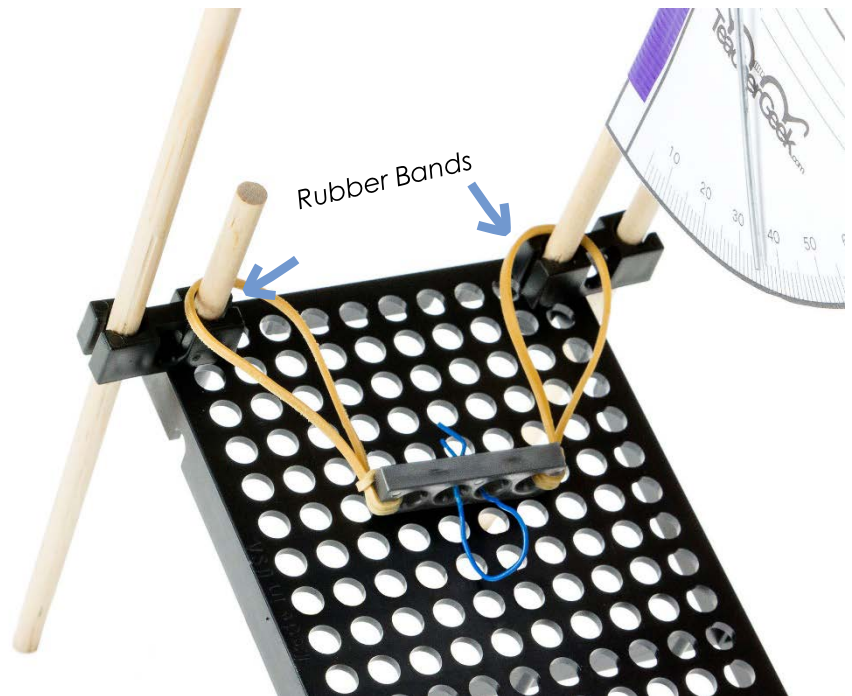
# Projectile Launcher Basic Build Guide

- 12** Slide the launch mechanism **rubber bands** over the Launch Pad **dowels** shown.

► **Give it a try...**

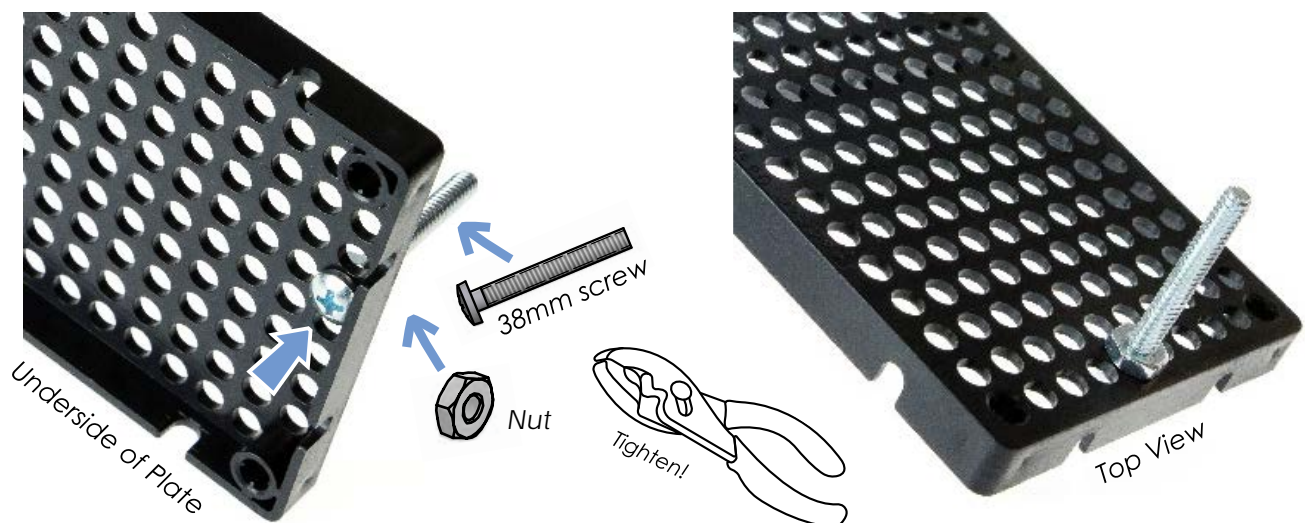
Pull it back, place a ping-pong ball in the launch mechanism, let go and watch it fly.

Can you get it to hit the same spot twice? Probably not...  
Try building a trigger to help out.



## Trigger Build

- 13** Place a **38mm (1 ½") screw** through the bottom of the **hole plate**, as shown. **Fasten** it with a **nut**.

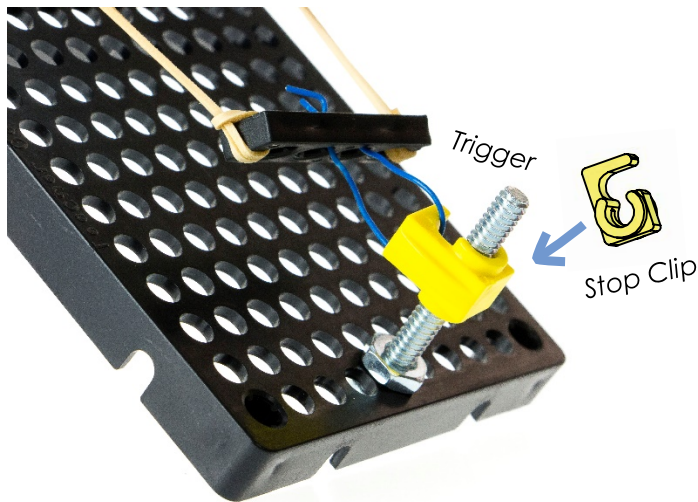




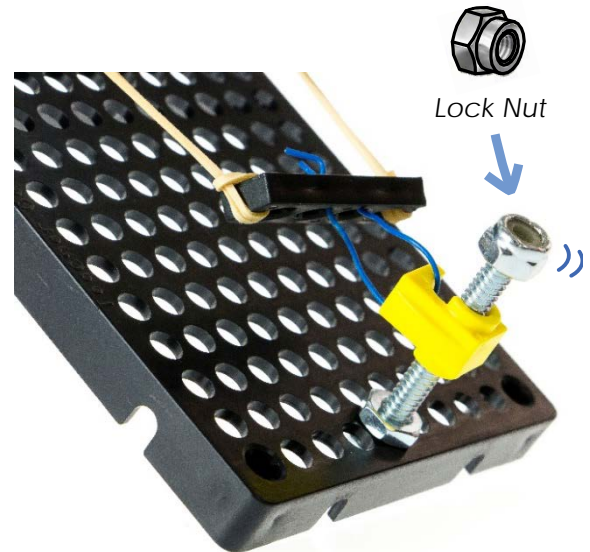


# Projectile Launcher Basic Build Guide

- 14** Place a **stop clip** on the **screw** to create a **trigger**.



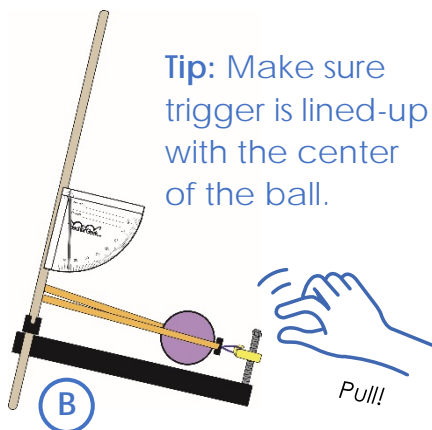
- 15** Place a **lock nut** on the **screw** to prevent the stop clip from sliding off.



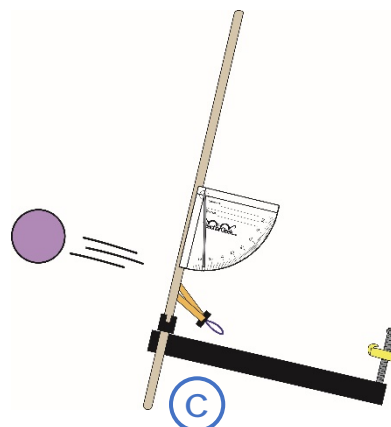
## Launching

Test Your Launcher Out!

- Pull back the launching mechanism and attach it to the trigger (stop clip).**
- Place a ping-pong ball into the launch mechanism.**
- Turn the trigger (stop clip) to fire!**



**Tip:** Make sure trigger is lined-up with the center of the ball.



**Caution:** Wear safety glasses.  
Never launch at another person.



# Projectile Launcher Basic Build Guide



## Experiment & Play

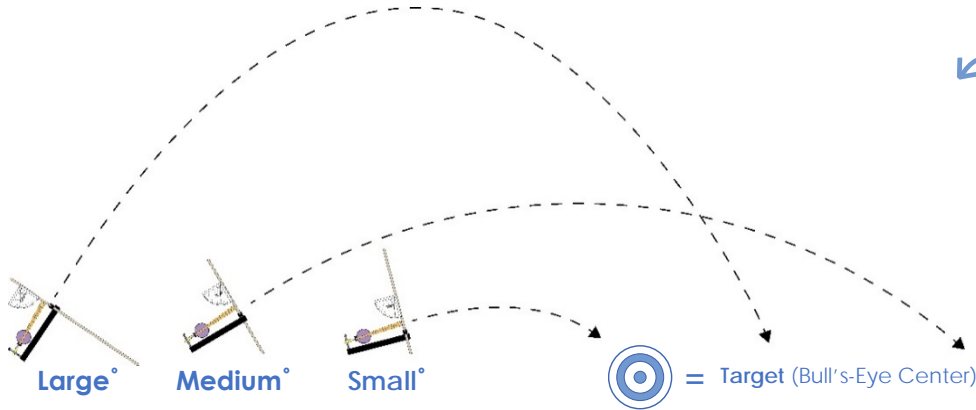


= Projectile

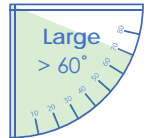
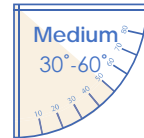
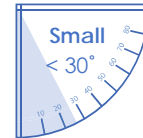


= Trajectory

The **angle** of launch affects the projectile's **trajectory** (how high + far it launches).



↪ **Try It Out:** Slide the legs to change the **angle** of the launcher? How does angle affect the projectile's trajectory?



= Target (Bull's-Eye Center)

## Redesigning Your Launcher

The example launcher is just...ok  
You can redesign it much better!



I'm a little wimpy -  
my launch mechanism  
needs more **accuracy**!

## ✓ Redesign Your Launcher to Be...



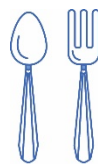
**Accurate** or how close you get to the **actual** (true) target or goal (bull's-eye).



**Precise** or how **constant** (repeatable) the results are (landing in the same spot).

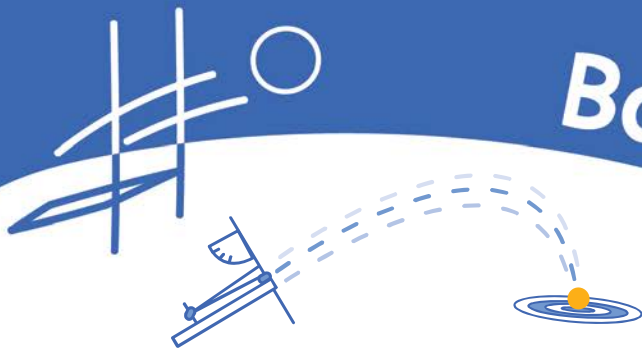


**Able to Launch Really, Incredibly Far**  
Power adds distance to your shots.  
Change how much power



Use recycling bin materials, Teachergeek components & 3D printing for your design!

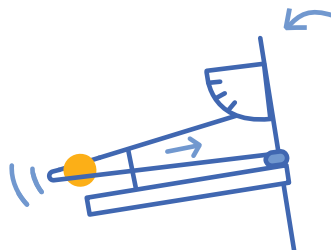
# Projectile Launcher Basic Build Guide



There are many ways to send a ball flying. Here are a few ideas...

## Sling It

Pull back and let it go! This is the most popular launch mechanism. The example launcher uses it. You can design your own "better" version.



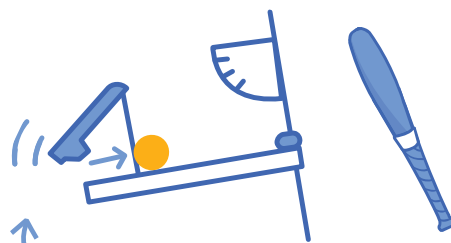
## Toss It

Toss it like a catapult, ballista or trebuchet. Note: It can be difficult to change only one independent variable (see below) with this launch mechanism.



## Hit It

Hit it like a golf ball or baseball. Get the launch mechanism moving before it contacts the ball.



## Control Your Variables

**Variables:** The things that change in an experiment (when you launch a projectile and measure where it goes).

*Design and test your launcher so that only the independent and dependent variables change.*

**Dependent Variable:** The variable being tested and measured.

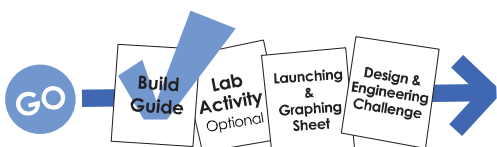
*Only have one dependent variable in your experiment, such as the **distance** projectile travels.*

**Independent Variable:** The thing you change in the experiment, to test how it effects the dependent variable.

*Only have one independent variable in your experiment, such as **launch angle**.*

## Get Going

What are you waiting for? It's time to start into a lab or engineering challenge. It's going to be a blast!



Visit [teachergeek.com/learn](http://teachergeek.com/learn) to download launcher lab and challenge documents.

