

LAUNCH LAB!

**AIM, LAUNCH & DISCOVER THE
SCIENCE OF FLYING THINGS**



WHAT WILL YOU LEARN?

In this kit you will find out:

- How bending and stretching can store energy
- How a lever and its fulcrum fling things
- How launch direction changes a flight
- How to run a fair test and use your data to win

YOUR ACTIVITIES AT A GLANCE

YOU WILL EXPLORE ...



#1: FLING THE CATAPULT

Build a catapult and test its stack



#2: PULL BACK & SLING

Build a slingshot and test your pull



HISTORY - LAUNCHERS THROUGH HISTORY

Same problem, different machines!



#3: ANGLE TEST

Find out what tilting your catapult does



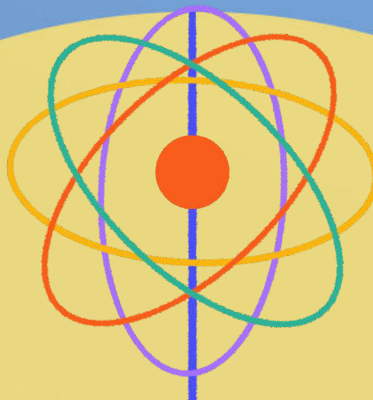
SCIENCE SPOTLIGHT - STORED ENERGY

The science behind your launches!



CHALLENGE - SIEGE THE FORT

Use your data to win two launch events!



[QR-LL-MASTER]

SCAN FOR THIS KIT'S VIDEOS!

SAFE LAUNCH CHECKLIST

READ THIS BEFORE YOUR FIRST LAUNCH



SAFE LAUNCH CHECKLIST

Real engineers test their machines safely — and so do you. Read this list with your grown-up before your first launch. Follow it every single time.



NEVER AIM AT PEOPLE, PETS, OR FACES. Point your launcher away from anything that can get hurt — or broken.



KEEP YOUR HEAD OUT OF THE LAUNCH PATH. Never lean over your launcher when firing!



FELT BALLS ONLY! Never launch coins, rocks, building bricks, or anything hard or sharp.



CLEAR THE LAUNCH ZONE. Before you fire, make sure no one is walking through.



PICK UP YOUR FELT BALLS BETWEEN ROUNDS. That way they don't get lost — and no one slips on them.



WATCH YOUR STEP AROUND THE FORT. Bricks scatter when a fort topples. Pick them up before someone's foot finds them first!



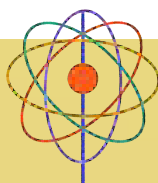
SHOW A GROWN-UP YOUR FINISHED LAUNCHER before your very first launch.



KEY WORDS AHEAD

elastic · lever · fulcrum ·
projectile · trajectory ·
elastic potential energy

WATCH FOR THE WORD WATCH BOXES!



MEET YOUR KIT

Get ready to launch! You will build two launchers. You will test them like a real engineer. Then you'll use your own data to topple a brick fort! Along the way, you'll see how a bent stick stores energy. A stretched rubber band stores it too! Then all that energy sends a ball flying. Everything you need is right here in the box.

MEET BOLT, YOUR BUILD BUDDY!

Hi there! I'm Bolt the Bear, your build buddy for this adventure! I love building things, testing them, and watching them FLY. Every time you launch, I'll be nearby. I'll have tips, questions, and a surprise or two. When your

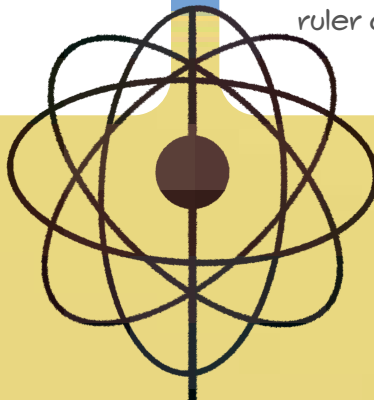
launchers are ready, we'll aim your best one at a brick fort. Helmet on — let's launch!



WHAT'S IN YOUR KIT?

- Craft sticks — for your catapult's frame and stick stack
- Rubber bands — they hold your builds together
- Plastic spoon — your catapult's launch arm
- 2 cardboard tubes — a smaller tube (with three rings marked on it) and a larger tube (with slots already cut) — your slingshot
- Pencil — the slingshot's handle
- 5 felt balls in different colors — the only things you'll ever launch
- Bullseye target — something to aim at!
- Building bricks + target design cards — for the Grand Challenge

You will also need a few things from home — a ruler or tape measure, 6 thin books, and paper towels.



ACTIVITY 1

FLING THE CATAPULT - THE STICK STACK TEST

WHAT IS THIS ACTIVITY ABOUT? Time to build your first launcher: a catapult! Your catapult uses a stick that bends and springs back. When you push down, the stick bends. When you let go — FLING! — the stick springs back and sends the ball flying. Where does all that power come from? Build one and find out.

MY LEARNING GOAL

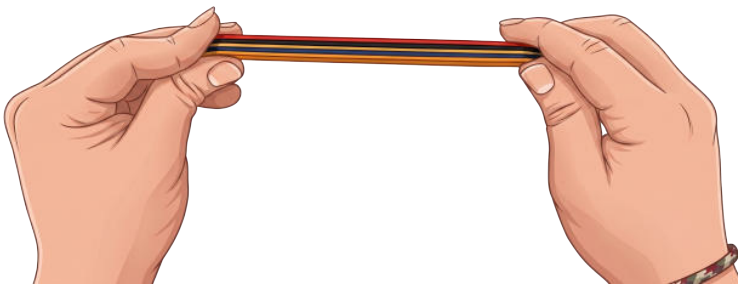
I will find out how the height of my stick stack changes how far my catapult can fling.

WHAT YOU NEED

- 13 craft sticks (9 for your stack + 4 for the arm)
- 7 rubber bands
- Plastic spoon
- 1 felt ball
- Ruler or tape measure
- This workbook + a pencil

BUILD IT!

STEP 1. Count out 5 craft sticks and stack them into one even pile.



WORD WATCH

ELASTIC — Something that springs back to its shape after being bent or stretched. A wooden stick is elastic when it bends a little. A rubber band is elastic when it stretches.

TRY IT: Gently bend one craft stick just a tiny bit — can you feel it spring back?

[QR-LLV1]

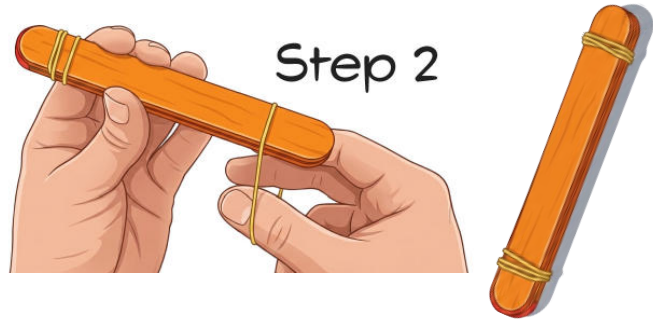


● ACTIVITY 1

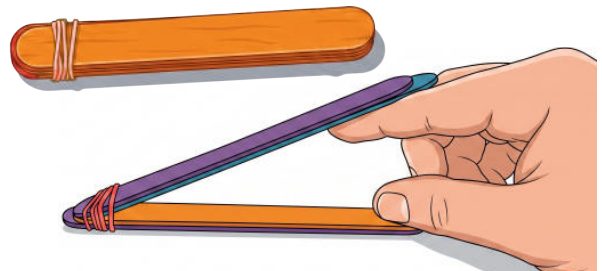
FLING THE CATAPULT - THE STICK STACK TEST

BUILD IT! (CONTINUED)

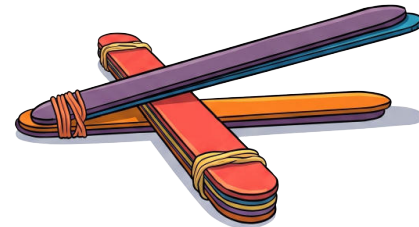
STEP 2. Wrap a rubber band tightly around one end of the stack. Wrap another around the other end. This is your stick stack.



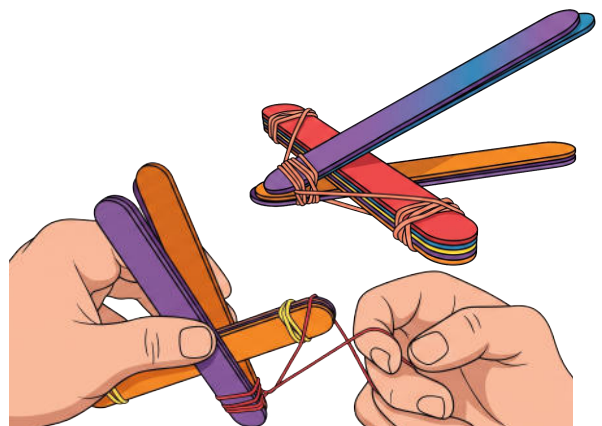
STEP 3. Take 4 more sticks. Band them together at one end with two rubber bands. Open one end like an alligator's mouth.



STEP 4. Open the alligator's mouth — two sticks up and two sticks down. Slide your stick stack inside, close to the banded end.



STEP 5. Loop two rubber bands around the banded end of the alligator's mouth. Stretch each one over the ends of the stick stack — the stack's own bands act as blockers that hold everything in place.



WORD WATCH

LEVER — A stiff bar that tips on a resting point to lift or fling something. Your top stick and spoon make a lever.

TRY IT: Push the spoon end down and watch the whole arm tip



● ACTIVITY 1

FLING THE CATAPULT - THE STICK STACK TEST



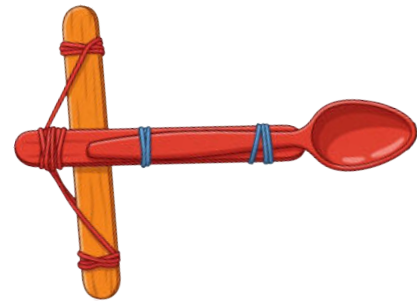
WORD WATCH

FULCRUM — The resting point a lever tips on. Your stick stack is the fulcrum — and you're about to change it with your own hands!

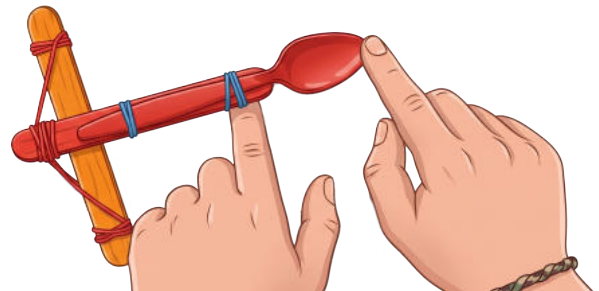
TRY IT: Find the spot where your lever rests on the stack. That's your fulcrum!

BUILD IT! (CONTINUED)

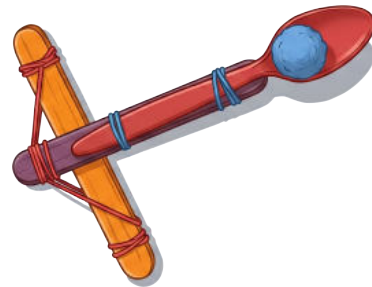
STEP 6. Use a rubber band to bind the spoon onto the top sticks, with the spoon's bowl at the free end.



STEP 7. Give the spoon a gentle push down. Does it spring back up? If it flops, tighten your bands.



STEP 8. Load a felt ball into the spoon. Your catapult is ready for the launch pad!



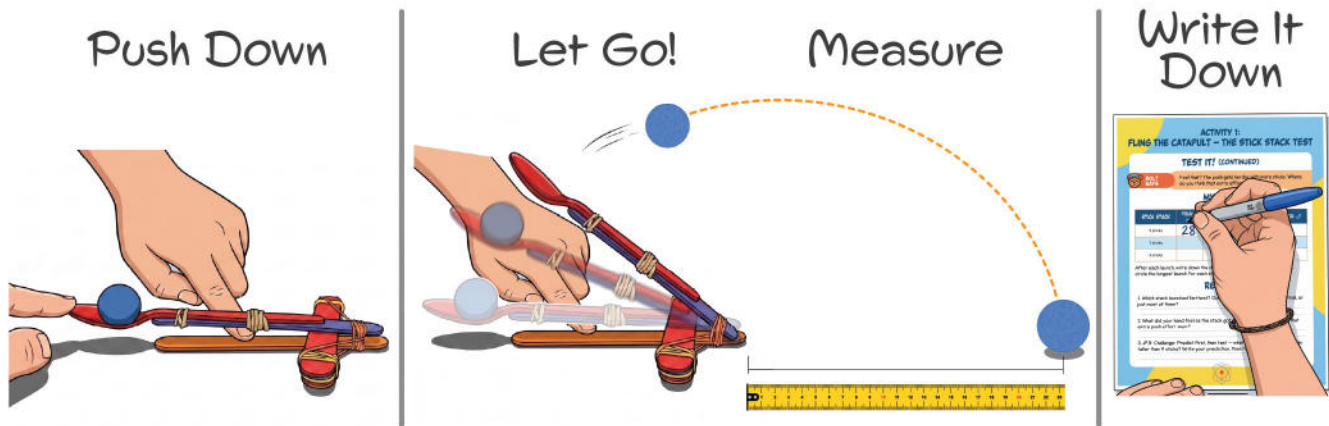
FUN FACT

The fulcrum doesn't have to sit in the middle! Engineers slide it along the lever to change what it can do. Slide it one way, and a small push can lift something heavy. Slide it the other way, and a big push can fling something fast and far. Try sliding your stick stack and see what changes.



ACTIVITY 1 FLING THE CATAPULT - THE STICK STACK TEST

TEST IT: STICK STACK SHOWDOWN



TEST 1

STEP 1.

Your stack has 5 sticks — that's for your first test. Load a felt ball.

Follow the Fair-Launch Rule: hold the base down, push the arm down until the sticks touch — and let go!

STEP 2. Measure from the front of your catapult to where the ball first lands, in centimeters (cm). Write it in your MY DATA table.

STEP 3. Launch 3 times with the 5 stick stack.

THE FAIR-LAUNCH RULE

- ☐ HOLD THE BASE DOWN WITH ONE HAND.
- ☐ PUSH THE ARM DOWN UNTIL THE STICKS TOUCH.
- ☐ THEN LET GO — SAME PUSH EVERY TIME!
- ☐ ONLY THE STICK STACK CHANGES — NOTHING ELSE.



ACTIVITY 1

FLING THE CATAPULT - THE STICK STACK TEST

TEST IT: STICK STACK SHOWDOWN (CONTINUED)

TEST 2

STEP 4.

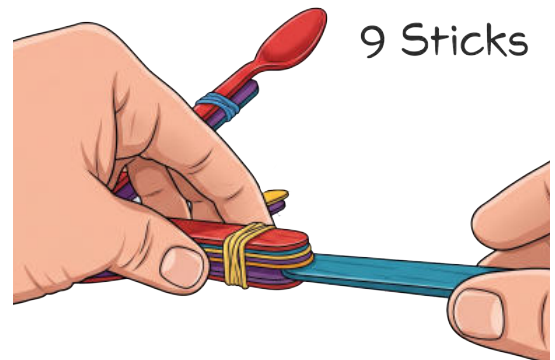
Add 2 sticks to the stick stack — slide them into the middle of your stack (now 7).
Launch 3 more times. Measure. Write it down.



TEST 3

STEP 5.

Add 2 more sticks the same way (now 9).
Launch 3 more times. Add sticks — never take them away!



NOTICE ANYTHING?

A taller stack holds the spoon higher. But the rule says: push down until the sticks touch. So the top stick has to bend farther. More bend means more stored energy. And more stored energy means... check your data!



**BOLT
SAYS**

Feel that? The push gets harder with more sticks. Where do you think that extra effort goes?



● ACTIVITY 1

FLING THE CATAPULT - THE STICK STACK TEST

MY DATA

STICK STACK	TRIAL 1 (CM)	TRIAL 2 (CM)	TRIAL 3 (CM)	BEST LAUNCH 🏹
5 sticks				
7 sticks				
9 sticks				

After each launch, write down the distance. When all your trials are done, circle the longest launch for each stack — that's your Best Launch 🏹.

REFLECT

1. Which stack launched farthest? Does your data show that in every trial, or just most of them?
2. What did your hand feel as the stack got taller? Where do you think that extra push effort went?
3. ✎🔮 Challenge: Predict first, then test — what happens with a stack even taller than 9 sticks? Write your prediction, then try it!



2 **ACTIVITY 2**

PULL BACK & SLING - THE PULL-BACK TEST

WHAT IS THIS ACTIVITY ABOUT? Launcher number two is a slingshot. It stores energy a whole different way! Your catapult stored energy in a bending stick. Your slingshot stores energy in stretching rubber bands. Pull the plunger back, and the bands stretch. Let go — TWANG! — the bands snap back and send your felt ball zooming out of the tube. How far back should you pull? That's exactly what you'll test.

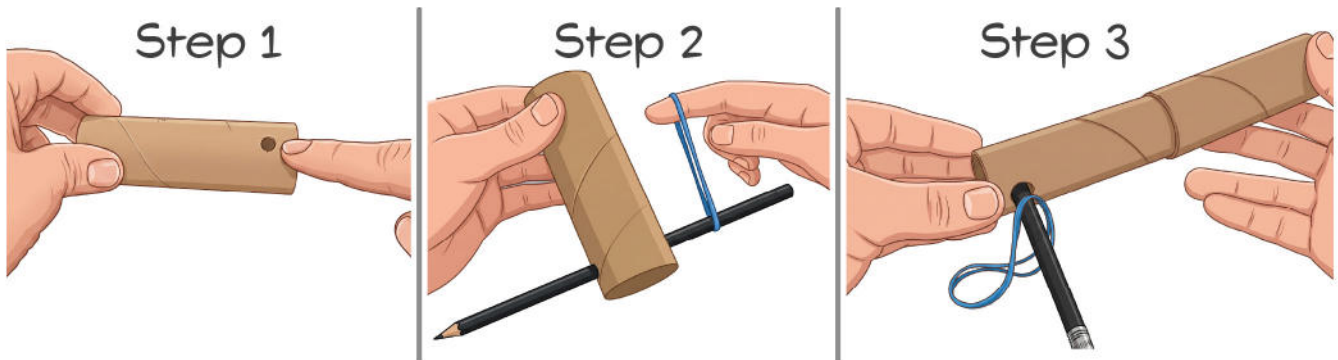
MY LEARNING GOAL

I will find out how far my slingshot flings when I change how far I pull back.

WHAT YOU NEED

- Smaller tube (with holes) and larger tube (slots already cut)
- Pencil (the handle)
- 4 rubber bands
- 1 felt ball
- Ruler or tape measure — for measuring your launches
- This workbook + a pencil

BUILD IT!



STEP 1. Slide the pencil through the two holes near the back end of the smaller tube. This is your plunger — the pencil is its handle.

STEP 2. Loop two rubber bands over each end of the pencil.

STEP 3. Slide the smaller tube into the larger tube, front end first, so the pencil sticks out the back.

[QR-LLV2]

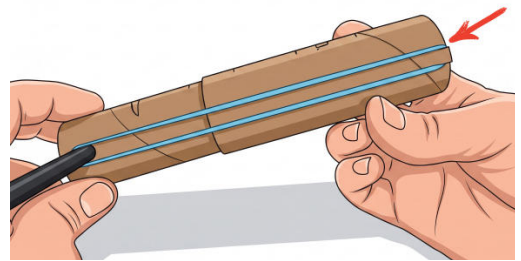
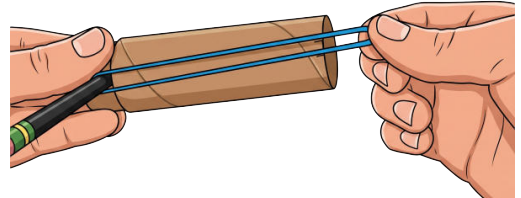


ACTIVITY 2

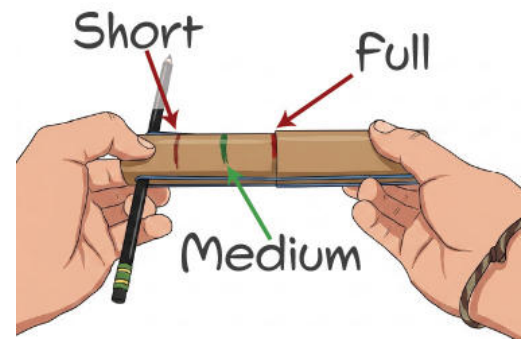
PULL BACK & SLING - THE PULL-BACK TEST

BUILD IT! (CONTINUED)

STEP 4. Stretch the bands forward. Hook both bands on each side into the pre-cut slot on that side of the larger tube.



STEP 5. Find the three rings marked on your smaller tube. The ring closest to the back rim is Short. The middle ring is Medium. The farthest ring is Full.



STEP 6. (NOT SHOWN) Fit test: drop a felt ball into the tube. It should slide smoothly but not rattle. If it sticks, gently squeeze the tube to make it a little wider.

Your firing rule: pull the plunger back until the ring you want just peeks past the back rim — then let go. The rings make every pull the same.



WORD WATCH

PROJECTILE — Anything that is thrown or launched through the air. Your felt ball is the projectile.

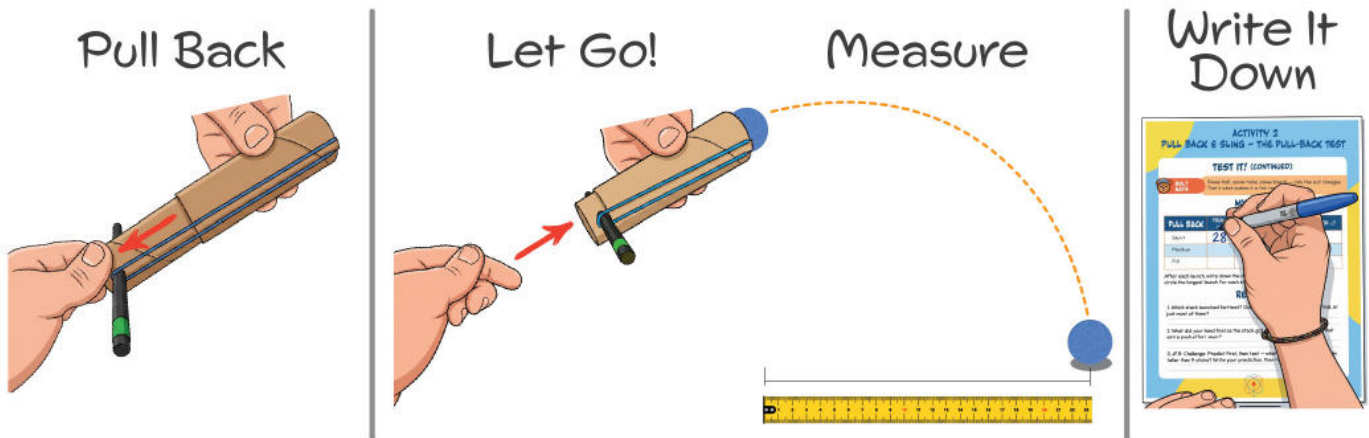
TRY IT: Gently toss a felt ball into the launch zone — congratulations, you just launched a projectile!



● ACTIVITY 2

PULL BACK & SLING - THE PULL-BACK TEST

TEST IT!

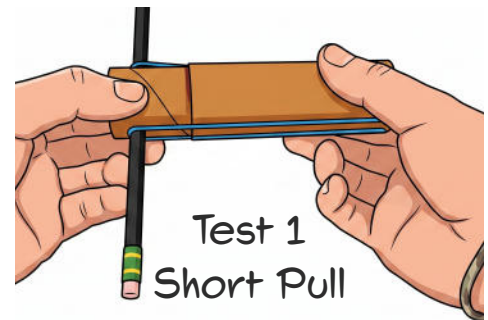


TEST 1

STEP 1. Load a felt ball into the tube. Pull the plunger back to the Short ring — just until it peeks past the rim.

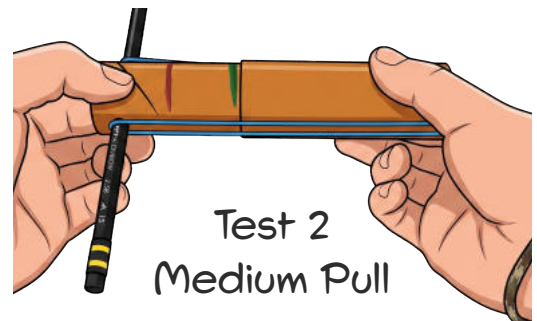
STEP 2. Let go! Measure from the front of your slingshot to where the ball first lands, in centimeters (cm). Write it down.

STEP 3. Launch 3 times at Short.



TEST 2

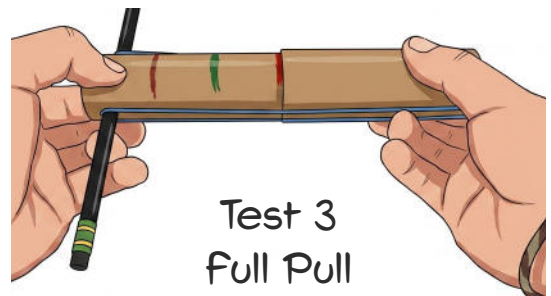
STEP 4. Pull to the Medium ring — 3 launches.



TEST 3

STEP 5. Pull to the Full ring — 3 launches.

Feel what's happening: a farther pull means a bigger stretch. A bigger stretch means more stored energy in the bands. And more stored energy means... watch those distances!



● ACTIVITY 2

PULL BACK & SLING - THE PULL-BACK TEST

MY DATA

PULL-BACK	TRIAL 1 (CM)	TRIAL 2 (CM)	TRIAL 3 (CM)	BEST LAUNCH 🏆
Short				
Medium				
Full				

After each launch, write down the distance. When all your trials are done, circle the longest launch for each pull — that's your Best Launch 🏆.



**BOLT
SAYS**

Same ball, same tube, same bands — only the pull changes. That's what makes it a fair test!

REFLECT

1. Did Full always beat Short? Check every single trial.
2. Which launcher was easier to aim — your catapult or your slingshot? Why do you think so?
3. ✎🌟 Challenge: Take one rubber band off each side — then launch with the same full pull. How much closer does it land? Keep the pull exactly the same — or it isn't a fair test! Put the bands back when you're done.



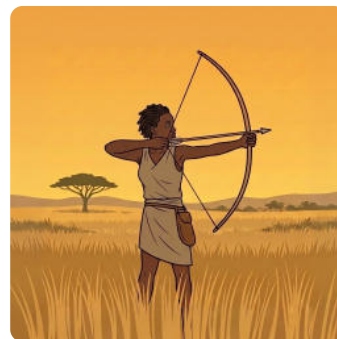


LAUNCHERS THROUGH HISTORY

Long ago, there were no engines & no electricity. But people had tricky puzzles: how do you send something far away — or lift something heavy that's nearby? Their answer was the same as yours. Store some energy first. Then let it go!

THE BOW AND ARROW – TENS OF THOUSANDS OF YEARS AGO

The oldest launcher of all. Pull the string, and the bow bends. That bend stores energy — just like the stick in your catapult. Let go, and the arrow flies! People in Africa made the first bows tens of thousands of years ago. Then people everywhere used them to hunt for food. Today, archery is an Olympic sport.

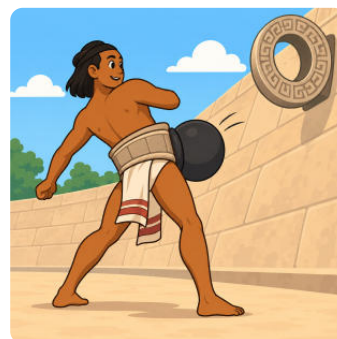


THE SHADUF – ABOUT 4,000 YEARS AGO

A long pole on a pivot: a bucket on one end, a heavy weight on the other. Farmers in Mesopotamia and Egypt pulled the bucket down into the river. That lifted the weight — and stored energy. Let go, and the weight lifted the water up for them! Some farmers still use a shaduf today.

THE RUBBER BALL – ABOUT 3,600 YEARS AGO

The Olmec people of Mexico were the first to make things from rubber. Their favorite? A solid rubber ball for a fast team game. The ball squished when it hit the ground, stored the energy, and sprang right back. That's elastic! It was the world's first bouncy ball.



NALUKATAQ – HUNDREDS OF YEARS AGO, AND STILL TODAY

In northern Alaska, the Iñupiat celebrate a good whale hunt with a festival. Dozens of people hold the edges of a big blanket made of seal or walrus skins. It stretches like a trampoline. They call it nalukataq. One jumper stands in the middle — and the crowd launches them high into the air! Stretched skin stores energy, just like your slingshot's bands.

[QR-LLV6]



LAUNCHERS THROUGH HISTORY

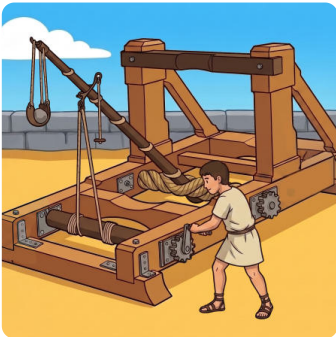
WAR MACHINES

Many of the first big launchers were weapons. Armies found two more ways to store energy: twisting ropes and lifting weights. Their machines were huge and clever — and each one made a different trade.



THE BELLY-BOW – GREECE, ABOUT 2,400 YEARS AGO

Greek engineers wanted a bow too big for any arm to pull. So they built the belly-bow: a giant bow on a long wooden stock with a slider. To load it, you pressed the back end against your belly and pushed with your whole body. That bent the bow far more than an arm could — and stored far more energy. Let go, and a heavy dart flew straight and true. It was the ancestor of every catapult.



THE ONAGER – ROME, ABOUT 1,700 YEARS AGO

Roman armies built a launcher with one big arm. Its power came from a thick bundle of twisted ropes. Soldiers cranked the arm down, and the ropes twisted tighter and tighter. All that twist stored energy. Let go — and the arm kicked a heavy stone at castle walls! The kick was so hard that soldiers named it after a wild donkey. The onager was strong, but hard to aim.



THE TREBUCHET – ABOUT 900 YEARS AGO

Hundreds of years later came the mightiest launcher of its time. Here's the surprise — a trebuchet is not elastic at all! It stores energy by lifting a huge box of rocks high into the air. Drop the box, and the long arm whips around and hurls a stone bigger than you. It could knock down a castle wall from far away. Same job as your catapult — a whole different way to store energy.

Engineers had to choose: power, or better aim? You will face the very same choice in your Grand Challenge!



● LAUNCHERS THROUGH HISTORY

LAUNCHERS TODAY – AND IN NATURE



FUN FACT

Plants launch things too! The touch-me-not grows in damp woods in Maine. Its seed pods are wound up like tiny springs. Touch a ripe pod — POP! — it bursts and flings its seeds a meter away. Find one in late summer and try it!

Launchers never went away. They're in your kitchen, at the park — and inside living things!



THE TOASTER

Push the lever down, and you squish a spring. The timer lets go — POP! — your toast launches. A catapult in your kitchen!



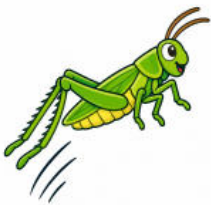
THE TRAMPOLINE

Springs and mat stretch, store your energy, and throw you back up. Two gymnasts invented it in 1936 after watching circus nets.



THE MANTIS SHRIMP

This little sea creature locks its club arm against a springy latch. Then — SNAP! — it punches faster than you can blink. It can crack a snail's shell!



THE GRASSHOPPER

It slowly bends a springy part of its knee to store energy. Then it lets go all at once — and jumps 20 times its own length. A catapult with legs!



BOLT SAYS

Bend it, lift it, squish it, stretch it, twist it — every launcher stores energy first. Which one would YOU build?



3 ACTIVITY 3

ANGLE TEST - SAME PUSH, NEW DIRECTION

WHAT IS THIS ACTIVITY ABOUT? Your catapult is back — but this time, you won't change the machine at all. Same catapult. Same push. Same everything... except the direction of the launch. You will tilt your catapult up, a little at a time. What does a new launch angle do to a flight? (Why the catapult and not the slingshot? The spoon holds the ball snugly, even when it tips.)

MY LEARNING GOAL

I will find out how the launch angle changes how far my catapult flings.

WHAT YOU NEED

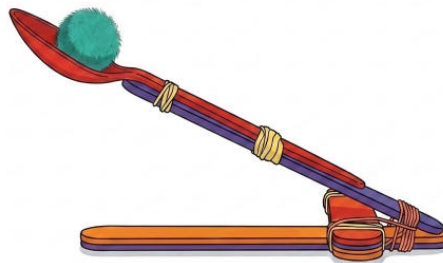
- Your catapult from Activity 1 — set your stack to 7 sticks
- 1 felt ball
- Your bullseye target — for the Challenge
- 6 thin books from home — each about as thick as this workbook
- Ruler or tape measure
- This workbook + a pencil

TEST IT!

SET IT UP

STEP 1. Set your stack to 7 sticks — and keep it there for every single launch. Today, only the angle changes.

STEP 2. Flat: set your catapult flat on the floor. That's your first launch angle.



[QR-LLV3]



ACTIVITY 3

ANGLE TEST - SAME PUSH, NEW DIRECTION

TEST IT! (CONTINUED)

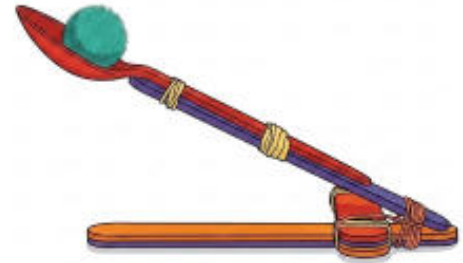
TEST 1

STEP 1. Start flat. Load a felt ball.

STEP 2. The Fair-Launch Rule still rules: hold the base down, push the arm down until the sticks touch — then let go. Same push every time.

STEP 3. Measure from the front of your catapult to where the ball first lands, in centimeters (cm). Write it down.

STEP 4. Launch 3 times flat.

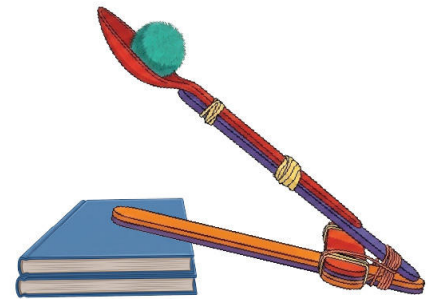


TEST 2

STEP 5. Prop your catapult on 2 books.

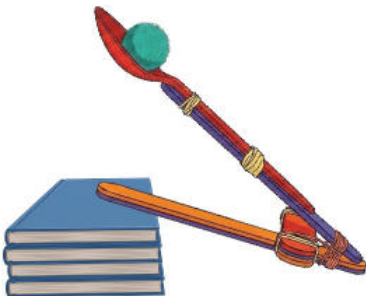
Do 3 launches. Measure. Write it down.

Use thin books. If the ball rolls out of the spoon before you launch, your tilt is too steep.



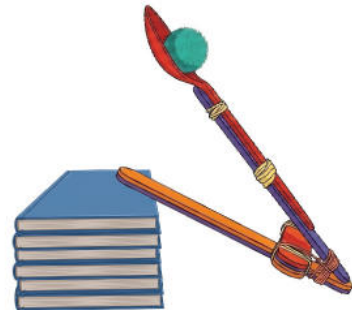
TEST 3

STEP 6. 4 books — 3 launches.



TEST 4

STEP 7. 6 books — 3 launches.



**WORD
WATCH**

TRAJECTORY — Imagine a basketball flying to the hoop. See its curved path through the air? That path is called a trajectory. Every launch has one.



● ACTIVITY 3

ANGLE TEST - SAME PUSH, NEW DIRECTION

MY DATA

LAUNCH angle	TRial 1 (CM)	TRial 2 (CM)	TRial 3 (CM)	BEST LAUNCH 🏆
Flat				
2 books				
4 books				
6 books				

After each launch, write down the distance. When your trials are done, circle the longest launch for each angle — that's your Best Launch 🏆.

**BOLT
SAYS**

Same push. Same bend. Same stored energy. Only the direction changed — and look how much farther it flew!

Want to tilt even higher?

Careful — at some point, the ball rolls right out of the spoon before you launch.

Every design has a limit. Finding your machine's limit is real engineering!



● ACTIVITY 3

ANGLE TEST - SAME PUSH, NEW DIRECTION

Try it: sketch two trajectories from your own launches — your flat launch and your 6-book launch. How are their paths different?

 SKETCH YOUR FLAT AND 6-BOOK TRAJECTORIES

REFLECT

1. Which launch angle sent your ball farthest?
How much did it beat flat by?
2. The stick bent the same amount every time — so what changed between launches?
3.   Challenge: Put your bullseye target past your best flat launch. Can you tilt your way to it? You'll want this trick for the Grand Challenge!





THE BIG IDEA: ELASTIC ENERGY

All through this book you've been saying two little words: stored energy. You stored it in a bent stick. You stored it in stretched rubber bands. Scientists have a special name for it — and you've earned it!

WORD WATCH

ELASTIC POTENTIAL ENERGY — The energy stored in something elastic when you bend it or stretch it. Bend a stick: elastic potential energy. Stretch a band: elastic potential energy. The name is big, but you've been making it all book long!

Here's the big idea: it doesn't matter whether you bend wood or stretch rubber. One kind of energy, two materials — your catapult and your slingshot are cousins.

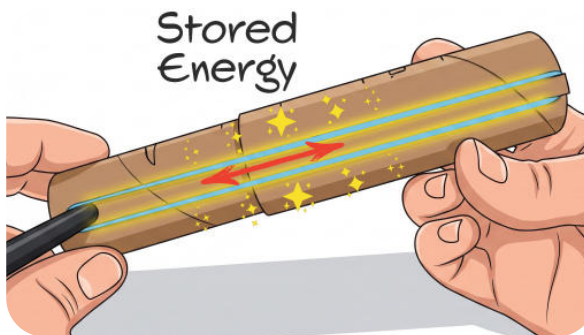


BEND IT

Push your catapult's arm down, and the top stick bends. That bent stick is loaded with elastic potential energy. Let go — it springs straight and flings the ball.

STRETCH IT

Pull your slingshot's plunger back, and the bands stretch. Stretched bands are loaded with elastic potential energy too. Let go — they snap back and the ball zooms out.



[QR-LLV5]





SCIENCE SPOTLIGHT

THE BIG CHANGE: STORED BECOMES MOVING

So how does stored energy become a flying felt ball? Watch closely. It happens in three beats.



1. **PULL BACK.** The bands stretch. The energy is stored, and everything is still.
2. **LET GO.** The bands snap back. The stored energy pours into the ball.
3. **FLY!** The ball is moving now — and moving things have their own kind of energy.



WORD WATCH

KINETIC ENERGY — The energy of motion. Anything that moves has it: a flying felt ball, a rolling car, you on a bike. The faster it goes, the more it has.

TRY IT: Toss a felt ball gently, then a little harder. Which toss gave the ball more kinetic energy?

Every launch in this kit tells the same story: elastic potential energy turns into kinetic energy. Stored energy becomes moving energy. That's the secret engine inside every launcher you built.

THE BIG TWIST: DIRECTION

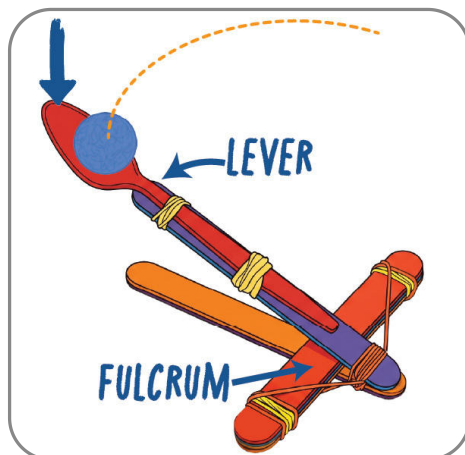
But energy is only half the story. Remember the Angle Test? The stick bent the same amount every time. The stored energy never changed — but the distances did! Why? Every launch has two ingredients.





SCIENCE SPOTLIGHT

THE BIG TWIST: DIRECTION (CONTINUED)



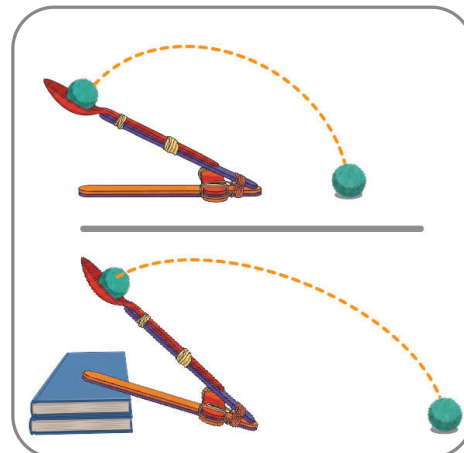
THE ENERGY TEAM

How much? A taller stick stack means a bigger bend — and more stored energy. That was Activity 1.



THE DIRECTION TEAM

Which way? Your books tilt the machine. That sets the launch angle, and the angle shapes the trajectory. That was Activity 3.



**BOLT
SAYS**

Engineers tune BOTH — how much energy, and which direction. That's why the Grand Challenge lets you pick!

CHECK YOUR UNDERSTANDING

- How does your catapult store energy?
 - By stretching its rubber bands
 - By bending its top stick
 - By spinning its spoon
 - By dropping a heavy weight
- In your Angle Test, what was the ONE thing that changed?
 - The stored energy
 - The felt ball
 - The stick stack
 - The launch direction
- Your felt ball is flying through the air. What kind of energy does it have now?
 - Heat energy
 - Elastic potential energy — still stored
 - Kinetic energy — the energy of motion
 - No energy — it left the launcher





GRAND CHALLENGE SIEGE THE FORT!

WHAT IS THIS ACTIVITY ABOUT? Two launch events to find one champion launcher. You built a catapult and a slingshot. You will test them head to head. How will you set up the best version of each? You ran three big tests. Your data tables are full of clues — time to use them!

MY LEARNING GOAL

I will use what I found out to pick and tune the best launcher for each event.

GET READY: TUNE YOUR LAUNCHERS

First, tune each launcher so it can reach 75 cm. Everything you tested is a tuning knob:

- Which launcher will be best for which event? Your Activity 2 Reflect has thoughts about aim.
- Stick stack height — your Activity 1 data knows which stack flings farthest.
- Launch angle — your Activity 3 data knows what tilting does.
- Pull-back — Short, Medium, or Full? Ask your Activity 2 data.
- Bands — the Activity 2 Challenge taught you: fewer bands, shorter flight. Keep both on for full power!

MAKE YOUR PREDICTION

Before your first shot, write it down:

"I predict the _____ will win the Box Shot
because _____.

I predict the _____ will
win Breach the Wall because
_____."

[QR-LLV4]



GRAND CHALLENGE **SIEGE THE FORT!**

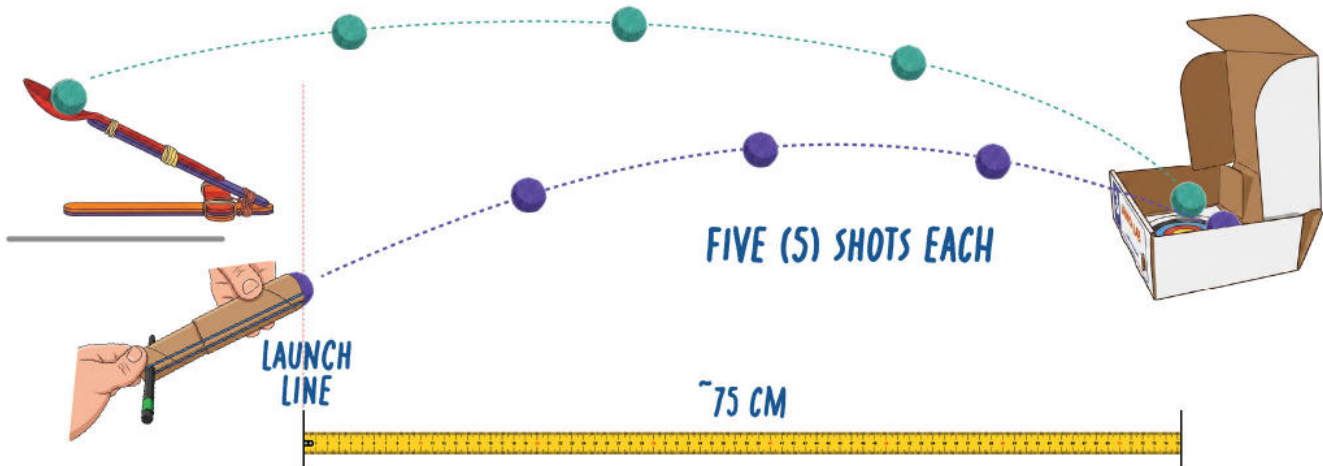
EVENT 1: BOX SHOT

SET UP

STEP 1. Place your bullseye target inside.

STEP 2. Pick a launch line. No launcher crosses the line!

STEP 3. Measure 75 cm from your launch line. Set your open kit box there, open top facing up.



LAUNCH

CATAPULT. Catapult first. Set your stack and your tilt. Load and fire just like Activity 1 — the Fair-Launch Rule still rules (see p 8). Take 5 shots, one at a time.

SLINGSHOT. Now the slingshot. Set your pull-back. Launch just like Activity 2 (see p 13). Take 5 shots. Which launcher has the best aim?

SCORING

1 point for every ball that lands in the box.

Catapult: _____ of 5 Slingshot: _____ of 5





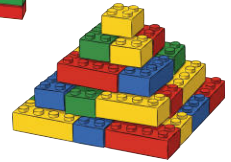
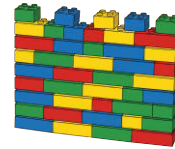
GRAND CHALLENGE SIEGE THE FORT!

EVENT 2: BREACH THE WALL

SET UP

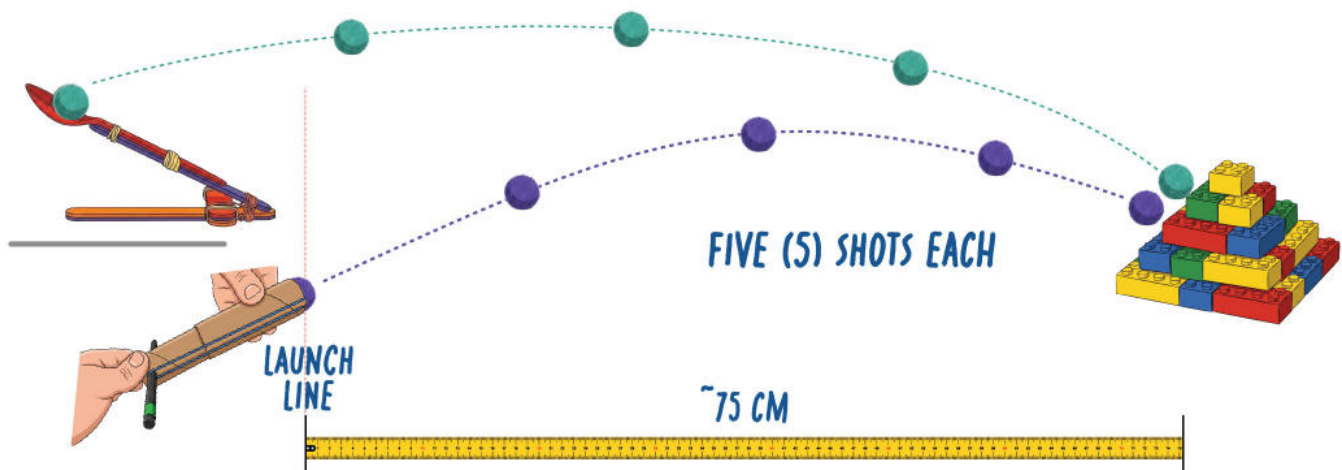
Move the box out of the way. Now build your brick target right at the 75 cm mark. Pick a design:

- the Wall (wide and stubborn),
- the Pyramid (the toughest to topple), or
- Design Your Own.



★ Stack your bricks — never snap them together. ★

If you have other bricks, you can build a larger wall.



LAUNCH

CATAPULT. Catapult first: 5 shots. Then rebuild the target just the way it was — the slingshot deserves a fair target!

SLINGSHOT. Now the slingshot: 5 shots.

SCORING

1 point for every shot that knocks bricks down.

Catapult: _____ of 5 Slingshot: _____ of 5



GRAND CHALLENGE **SIEGE THE FORT!**

ADD IT UP!

Copy each event's scores into the table. Then add across.

LAUNCHER	BOX SHOT (OF 5)	BREACH THE WALL (OF 5)	TOTAL (OF 10)
Catapult			
Slingshot			

★ Prediction Bonus: look back at your predictions. Give yourself a Prediction Point for each event you called right — smart thinking counts, win or lose!

WHY IT WORKED

Every point on that score table came from the same two ingredients you found:

Energy. Your stack height, pull-back, and bands set how much elastic potential energy each shot stored. That stored energy became the kinetic energy of your flying projectile.

Direction. Your launch angle set the trajectory — flat and fast, or high and floaty. Did you notice? A flat, fast shot punches walls. A high, floaty arc drops into boxes. Different trajectories win different events!



GRAND CHALLENGE **SIEGE THE FORT!**

REFLECT

1. Which launcher won each event? Did that match your predictions?
2. Look back at your data from Activities 1–3. What did you learn there that shaped your strategy today?
3.   Challenge: Rebuild your brick target to make it harder to topple — then test it. What changed, and why? Build, test, improve — that's the engineering design cycle. You just ran it like a real engineer!

**BOLT
SAYS**

You did it! You built two launchers, ran fair tests, collected data, and used it to win two events. That's not just playing — that's engineering!

OUTSTANDING WORK!

DID YOU DO SOMETHING EXTRAORDINARY TODAY? ASK YOUR FACILITATOR ABOUT EARNING AN OUTSTANDING WORK STICKER FOR EXCEPTIONAL EFFORT, CREATIVITY, OR SCIENTIFIC THINKING.

*"KEEP ASKING QUESTIONS — EVERY GREAT DISCOVERY STARTED WITH CURIOSITY!" — BOLT
THE BEAR*





GLOSSARY

HERE ARE ALL THE SCIENCE AND ENGINEERING WORDS YOU USED IN THIS WORKBOOK.
THESE ARE REAL WORDS THAT SCIENTISTS AND ENGINEERS USE EVERY DAY!

WORD	DEFINITION
DATA NOUN	Information you collect and write down, like your launch distances. Scientists use data to answer questions.
ELASTIC ADJECTIVE	Able to spring back to shape after being bent or stretched. A stick bends a little; a rubber band stretches.
ELASTIC POTENTIAL ENERGY NOUN PHRASE	Energy stored in something elastic that is bent or stretched, ready to become motion.
ENERGY NOUN	What it takes to make things move or change. Energy can be stored, and it can change from one form to another.
ENGINEER NOUN	A person who designs, builds, and tests things to solve problems — like launchers!
ENGINEERING DESIGN CYCLE NOUN PHRASE	The steps engineers repeat to make something better: plan, build, test, improve, and try again.
FAIR TEST NOUN PHRASE	A test where you change only one thing and keep everything else the same. That way you know what caused the difference.
FULCRUM NOUN	The resting point a lever tips on. Your stick stack is the fulcrum.
KINETIC ENERGY NOUN PHRASE	The energy of motion. A flying felt ball has kinetic energy.
LAUNCH ANGLE NOUN PHRASE	The direction of a launch — flat like a dart, high like a rainbow, or in between.
LEVER NOUN	A stiff bar that tips on a resting point to lift or fling something.
PREDICTION NOUN	Your best guess about what will happen, made before you test. Good predictions use what you already know.
PROJECTILE NOUN	Anything that is thrown or launched through the air.
SIMPLE MACHINE NOUN PHRASE	A tool with few or no moving parts that makes work easier — like a lever.



GLOSSARY

HERE ARE ALL THE SCIENCE AND ENGINEERING WORDS YOU USED IN THIS WORKBOOK.
THESE ARE REAL WORDS THAT SCIENTISTS AND ENGINEERS USE EVERY DAY!

WORD	DEFINITION
STORED ENERGY NOUN PHRASE	Energy that is saved up and ready to use, like the energy in a bent stick before you let go.
TRAJECTORY NOUN	The curved path something follows as it flies through the air.

This STEM kit was designed and tested by Randolph Kirchain, III, as part of earning the Eagle Scout rank at Troop 313 in Arlington, Massachusetts, Spirit of Adventure Council. The kits were assembled and distributed by the Scouts and community members of Troop 313.

Eagle Scout is the highest rank in Scouting America — and one of the most demanding achievements for youth anywhere. Fewer than 4% of Scouts go on to earn Eagle Scout. Those who do must demonstrate sustained leadership and plan and execute a significant community service project of their own design. This kit is the result of one of those projects. It was created for families at The Root Cellar, a refugee and immigrant transition center in Lewiston, Maine, with the hope that kits like these will find their way to similar programs and communities across the country.

For more than a century, Scouting America has prepared young people for lives of impact and purpose — building character, leadership, and personal fitness through hands-on adventure and real-world challenges. What is less widely known is that Scouting also cultivates curiosity about science, technology, engineering, and math. With merit badges spanning topics from astronomy to artificial intelligence and from robotics to environmental science, Scouts explore the world around them in ways far beyond the trailhead. Scouting America is open to all young people, boys and girls, from kindergarten through high school.

To learn more about Scouting or find a troop near you, visit www.scouting.org



THE MOST WORTHWHILE THING IS TO TRY TO PUT HAPPINESS INTO THE LIVES OF OTHERS - ROBERT BADEN POWELL (SCOUTING'S FOUNDER)





the
Shoebox Lab

LAUNCH LAB!

AIM, LAUNCH & DISCOVER THE SCIENCE OF FLYING THINGS
a the **Shoebox Lab** kit

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