_____'s Whysheet for

Your name

Why do rubber bands snap back?

Yeah, why? Write (or draw) your answer:

Whybricks

Giving physical science form

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Part 1: The catapult

For the first part of this investigation, you will need the catapult.

Build it!

First, build the catapult out of Whybricks.

Grab this resource!

The **Catapult** build guide.

Once the catapult is built, test it out. Place your catapult on a flat surface like your desk, table, or floor. Tinker and experiment with the catapult to see how it works.

There are a few different parts of your catapult you might want to explore.

First, there's the catapult's base.

Next there's the launch arm. This is attached to the base by supports in the middle of the arm. One end of the launch arm is also connected to the base with a Whybricks rubber band. The other end of the launch arm has the bucket.

Behind and below the bucket there are two vertical beams with a bar running between them. This is the guidepost. You can change where the guidepost is by moving it up or down to a different level.

Try pulling the catapult bucket back towards the guidepost, then letting it go. What happens?

I notice...

What do you notice about this phenomenon?

Write your observations on your Notice sheet.

Make a prediction, then run a test

For this test you will need your catapult, a projectile, and a flat surface, like a desk, table, or the floor. Read what the test is, write down your prediction, and then run the test.

Before you run the test, make sure you can launch the catapult consistently.

For example, you might try using something, like your hand, to hold down the base of the catapult and keep it steady while you launch. Test different ways of pulling the catapult bucket back toward the guidepost. Once you find a way to launch the catapult consistently, practice it a few times while the catapult is empty. You will then be ready to use the same launch method when you load your projectile.

To run the test, place your catapult on a flat surface, like a table or desk. Using the launch method you have practiced, pull the bucket back into the launch position and load in your projectile.

Safety first!

Before you begin, make sure you won't hit anyone (or anything) with the projectile.

Holding your catapult steady, release the bucket and observe what happens.

What do you think will happen to the projectile?

Write down your prediction:

Now, run the test. If you want, you can run it more than once.

I notice...

What do you notice about this phenomenon? Write your observations on your Notice sheet.

I wonder...

What are you wondering about? Write your questions on your Wonder sheet.

What is going on?

Your catapult takes advantage of something called **elastic potential energy** to get a projectile to fly.

Think back to the main 'why' question of this investigation:

Why do rubber bands snap back?

Why does a rubber band go flying if you let it go after stretching it out? Why do slingshots and bungee trampolines use stretchy materials? Why does it hurt to get snapped with a hair tie?

Investigate **potential and kinetic energy** and **Newton's second law** to help you form some ideas to help answer some of these questions.

Grab this resource!

The **Potential and kinetic energy** WOW sheet.

Grab this resource!

The **Newton's second law** WOW sheet.

What factors do you think affect how far the projectile travels after being launched by your catapult?

Write down your ideas about what factors affect the distance the projectile travels:

Part 2: Your experiment

You are going to design and run an experiment to discover more about one of the factors you think affects how a projectile travels after being launched by your catapult.

Step 1: Available equipment

Look at the materials and equipment available for you in your experiment.

List all the available materials and equipment:

Tinker and experiment with the materials and equipment that you have available to explore how everything works.

I notice...

What do you notice about this phenomenon? Write your observations on your Notice sheet.

I wonder...

What are you now wondering about? Write your questions on your Wonder sheet.

Step 2: Determine variables

What are the **independent variables** you could test? (An **independent variable** is a variable that is manipulated or changed by the experimenter. Think of things you could control.)

Your list of independent variables:

What are the **dependent variables** you could measure? (A **dependent variable** is a variable that responds to what else is happening. These variables can be measured and/or calculated with the available equipment.)

Your list of dependent variables:

Step 3: Determine your question

You need to create a testable question that you will be able to answer by making a claim based on evidence from your scientific experiment.

One format you can use is to select one independent variable and one dependent variable and ask 'How will changing *the independent variable* affect *the dependent variable*?'

You will need to choose one independent variable you will change in your experiment and one dependent variable you will measure.

Independent variable selected for testing:

Dependent variable selected for measuring:

Write out your question:

How will changing_____

affect _____?

This is the question your experiment will help you answer.

Step 4: Hypotheses

Once you have run your experiment, you will be able to make a claim about how your independent variable affects your dependent variable. You will be able to support this claim with the data you collect. It's important to consider every possible claim you might be able to make once you have collected your data.

1. **Direct relationship:** increasing *the independent variable* will increase *the dependent variable.*

Increasing _____

will **increase** _____.

2. **Indirect relationship:** increasing *the independent variable* will decrease *the dependent variable.*

Increasing _____

will **decrease** _____.

3. **No relationship:** increasing *the independent variable* will not change *the dependent variable.*

Increasing _____

will **not change** _____.

Step 5: Designing the experiment

You need to design your experiment to test how your independent variable affects your dependent variable.

Draw and label your experimental setup

Materials and equipment list

List of the materials and equipment I need for my experiment:

Experimental procedure

You need to write your procedure with enough detail so that it can be repeated exactly. Be sure to include how you collect your data.

Control variables

All independent variables that you have NOT selected for testing must be controlled in your experiment. For example, you need to give each one a set value and keep it that way for the whole experiment. Be sure to explicitly note your controlled settings in your procedure.

My experimental procedure:

Step 6: Run your experiment and record your data

It's time to run your experiment! Use the data table below to record your results.

Add your independent and dependent variables into the correct spots and write what units you will be using for that variable. (An example of units might be 'centimetres' or 'inches' if you are measuring height or distance.)

Remember you are only going to change the setting for your independent variable. List each setting you will use. For each setting you try with your independent variable, you should run five trials with that setting. Then average the results for the setting in the last column.

_____ Independent variable name (units)	_____ Dependent variable name (units)					
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average

Step 7: Present your results

You can now present your findings and answer your question using the CER (**C**laim, **E**vidence, **R**easoning) method.

Claim – This is the answer to your investigation question. It should either be one of the hypotheses from step 4 or a new claim you hadn't considered.

My claim is:

Evidence – Cite data from your experiment to support your claim.

My evidence is:

Reasoning – Explain how your evidence supports your claim by connecting your evidence to your claim using scientific principles and rules.

My reasoning is:

So... why do rubber bands snap back?

Now that you've completed this investigation, what do you think about your original answer? Can you add any new information to your original explanation?

And... what are you wondering about now?

Now I wonder...

Now that you have completed the investigation, what new questions do you have?