_____'s Whysheet for

Your name

Why do swings swing?

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

Whybricks

Giving physical science form

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Part 1: The hammer

In this part of the investigation, you are going to create and test a hammer in stages.

Build it!

First of all, build a test cube. You will use this cube throughout this investigation.

Grab this resource!

The **Test cube** build guide.

You will also need to build the hammer head. The hammer head is the first part of the hammer you will test.

Grab this resource!

The **Hammer head** build guide.

Build both the test cube and the hammer head out of Whybricks.

Make a prediction, then run a test

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

To run the test, place your test cube on the flat surface. Grip your hammer head in your fingers. Hold the hammer head on the flat surface a few centimetres away from the test cube. Slide the hammer head along the flat surface until it collides with the test cube.

What do you think the test cube will do?

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.

The next stage to test is a hammer with a handle.

Build it!

Build the hammer by attaching a handle to the hammer head.

Grab this resource!

The **Hammer** build guide.

Make a prediction, then run a test

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

To run the test, place your test cube on the flat surface. Position the hammer so that the hammer head is a few centimetres away from the test cube. Try to use approximately the same distance you did for your test with just the hammer head.

Pick up your hammer by gripping the top of the handle. Hold the hammer so that it is just above the flat surface.

Swing the hammer until it collides with the test cube.

What do you think the test cube will do?

Write down your prediction:

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

Tinker and experiment with swinging the hammer into the test cube. You might try swinging the hammer a bit harder or a bit softer as well. Or try keeping the hammer on the flat surface and sliding it into the test cube.

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.

What is going on?

One of the main jobs people use hammers to do is to hit nails.

If you need to drive a nail into a wooden board, you could do that with any hard object, like a rock. So, why do people use a hammer instead? What makes a hammer better than a rock?

A hammer acts as a **third-class lever** when it is used to drive a nail into something.

Grab this resource!

The **Levers** WOW sheet.

The **fulcrum** is actually the wrist of the person using the hammer. The **effort** is applied through the hand holding the handle. The **load** is the resistance of the wood.

In your experiment with the test cube, the hammer is also acting as a third-class lever. Even though you didn't hold the hammer like you do when you drive a nail, your wrist is still the fulcrum.

Think about the two tests you ran, one with just the hammer head and the other with the hammer. Did you notice much of a difference? Was it easier to move the test cube with just the hammer head or with the hammer?

Is the hammer or the hammer head the better tool for moving the test cube? Why do you think that?

Part 2: A swinging hammer

For this part of the investigation, you will need the swinging hammer and the test cube.

Build it!

Build the swinging hammer out of Whybricks.

Tinker and experiment with the swinging hammer to see how it works.

Grab this resource!

The **Swinging hammer** build guide.

Try placing the test cube just in front of the hammer head. Pull back the hammer just a little bit, then release it. Reset the test cube and the hammer. Try again, but this time, pull the hammer back a bit further before you release it.

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.

Your swinging hammer is still a lever.

The fulcrum is now the point where the top of the handle connects to the bar. The hammer head hitting the test cube is still the load.

But what is going on with the effort?

Your swinging hammer is taking advantage of **gravitational potential energy**.

Investigate potential and kinetic energy.

Grab this resource!

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

Explain what the input force (effort) is in the swinging hammer in terms of potential and kinetic energy:

I wonder... is gravity the only factor the matters?

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

Why do swings swing?

Why can an adult get themselves to swing higher than a little kid? Why does swinging higher make you move faster? Why does it hurt to be hit by someone on a swing?

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

Grab this resource!

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

What factors do you think affect the movement of a swing or an object that is hit by the swing?

Write down your ideas about what affects the movement of a swing or an object hit by the swing:

Part 3: Your experiment

You are going to design and run an experiment to discover more about one of the factors you think affects the movement of a swing or an object hit by the swing.

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 swings swing?

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?