_____'s Whysheet for

Your name

Why don't you float away when you jump?

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

Whybricks

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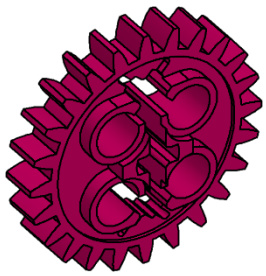
Part 1: What goes up...



For the first part of this investigation, you will need a 24-tooth gear.

Make a prediction and run a test (twice)

This is a two-in-one set of tests using the 24-tooth gear. Read what the test is, write down your prediction and then run the test.

To run the first test, stand still and hold your arm straight out in front of you, palm down, holding the gear in your closed fist. Count to three and then open your hand.

What do you think the gear 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 now wondering about? Write your questions on your Wonder sheet.

The next test is similar, but this time, you are going to gently toss the gear up into the air.

What do you think the gear will do?

Safety first!

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

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 now wondering about? Write your questions on your Wonder sheet.

What is going on?

Were you surprised by what the gear did? Probably not. But what is causing the gear to behave the way it did?

Grab this resource!

The **What is gravity?** WOW sheet.

Investigate **gravity** and **gravitational acceleration** on Earth.

Explain why the Earth doesn't move up when you toss the gear into the air, even though the gear is pulling up on the Earth:

Part 2: The sky is falling?

Look at your 24-tooth gear again. Can you see how it looks a little bit like a snowflake?

In terms of weather, the word **precipitation** means any kind of weather condition where something is falling from the sky. That includes snow, rain, sleet and hail.

I wonder... How does gravity affect precipitation?

For the next part of this investigation, you will need the 'snowflake' (the 24-tooth gear) and another form of precipitation: a hailstone.

Build it!

First, build the hailstone out of Whybricks.

Grab this resource!

The **Hailstone** build guide.

You may notice that this hailstone doesn't look like hailstones in the real world. That's okay. This is just a model that you can use to investigate how gravitational acceleration affects objects that fall on Earth.

Make a prediction, then run a test

For this test you will need your hailstone and your snowflake. Read what the test is, write down your prediction and then run the test.

To run the test, hold the snowflake and the hailstone at the same exact height. The bottom of the snowflake should be even with the bottom of the hailstone. Count to three and drop both the snowflake and the hailstone at the same time.

Which object, the snowflake or the hailstone, do you think will hit the ground first? Why do you think that?

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 now wondering about? Write your questions on your Wonder sheet.

What is going on?

Near the surface of the Earth, the local **gravitational acceleration** is 9.8 meters per second squared ($9.8\frac{m}{s^2}$). In other words, everything on Earth is being accelerated towards the centre of the Earth at a rate of $9.8\frac{m}{s^2}$.

That means that all objects, no matter how much **mass** they have, accelerate at the same rate.

Does that seem correct to you?

When hailstones fall, they sometimes cause damage to things, like cars. But when a snowflake falls on a car, the car is fine. If both the snowflake and the hailstone fall at the same rate, why does hail damage cars, but snowflakes don't?

Tinker and experiment

Try dropping the snowflake and hailstone again. What can you tell about the **force** they are hitting the ground with?

Try listening to the sounds each object makes when it hits. You might try dropping the objects one at a time. Is one louder than the other? Why is that?

I notice...

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

Newton's second law tells us that **F**orce = *m*ass × ***a***cceleration (**F**=*m****a***). If the ***a***cceleration is the same, what must be true of the **F**orce that falling objects with different *m*asses have when they hit the ground?

There is a special name for the force of gravity exerted on an object. This force is called **weight**. Investigate weight.

Grab this resource!

The **What is weight?** WOW sheet.

Explain why a hailstone can damage a car but a snowflake does not:

I wonder... is weight the only thing that matters?

Have you ever seen snow falling? What about a hailstone? Do they look like they are moving in the same way?

Other forces can influence how objects fall. When it comes to precipitation, **air resistance** is particularly important.

Grab this resource!

The **What is air resistance?** WOW sheet.

Investigate air resistance.

Explain how **weight** and **air resistance** together account for why a hailstone can damage a car but a snowflake does not:

Part 3: Slow down your hailstone

This is an engineering design challenge. Your goal is to engineer a solution to get your hailstone to fall more slowly based on what you've learned about air resistance.

Step 1: Brainstorm

What could you do to make your hailstone fall more slowly?

Write and draw your ideas.

Idea #1

Idea #2

Idea #3

Idea #4

Idea #5

Idea #6

Idea #7

Idea #8

Step 2: Design your test

How will you know whether or not your design is successful? You need to design a test that you can run with each hailstone design you try to determine whether or not your idea is successful.

The goal is: to get the engineered hailstone to fall more slowly than the original hailstone.

Things I need to know to run my test:

How I will set up and run my test (including the materials and equipment I will use and my procedure):

How I will measure the outcome:

Step 3: Build, test, learn, repeat

You are now ready to start **iterating**. Iterating is the process of taking one of your ideas and trying it out. You will try to build your idea and then test it out. Somethings will work and somethings won't. You then take what you learnt and apply it to a new iteration. That is to say, you apply the learning to a new version and try again!

For each iteration there are three steps:

1. Build. Describe and draw your build for your records.
2. Run your test and record your results.
3. Record your ideas for how to improve your next iteration.

If at any point things don't work how you thought they would, record what happened and what you did to solve the problem. You will need this for your next iteration!

Iteration #1

Describe and draw your build:

Run your test and record your results:

Record your ideas for how to improve your next iteration:

Iteration #2

Describe and draw your build:

Run your test and record your results:

Record your ideas for how to improve your next iteration:

Iteration #3

Describe and draw your build:

Run your test and record your results:

Record your ideas for how to improve your next iteration:

Iteration #4

Describe and draw your build:

Run your test and record your results:

Record your ideas for how to improve your next iteration:

Iteration #5

Describe and draw your build:

Run your test and record your results:

Record your ideas for how to improve your next iteration:

Wrap-up

Describe your most successful design. Draw and label your design and explain why you believe it was the most successful:

So... why don't you float away?

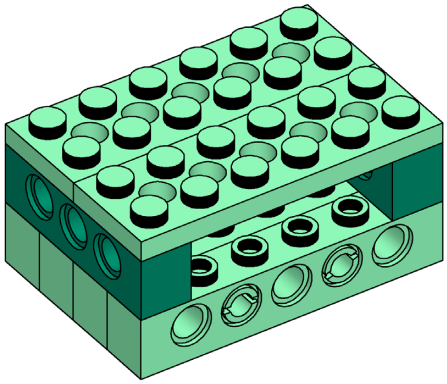
Now that you've completed this investigation, what do you think about your original answer? Can you add any new information to your original explanation?

And... what are you wondering about now?

Now I wonder...

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

Hailstone



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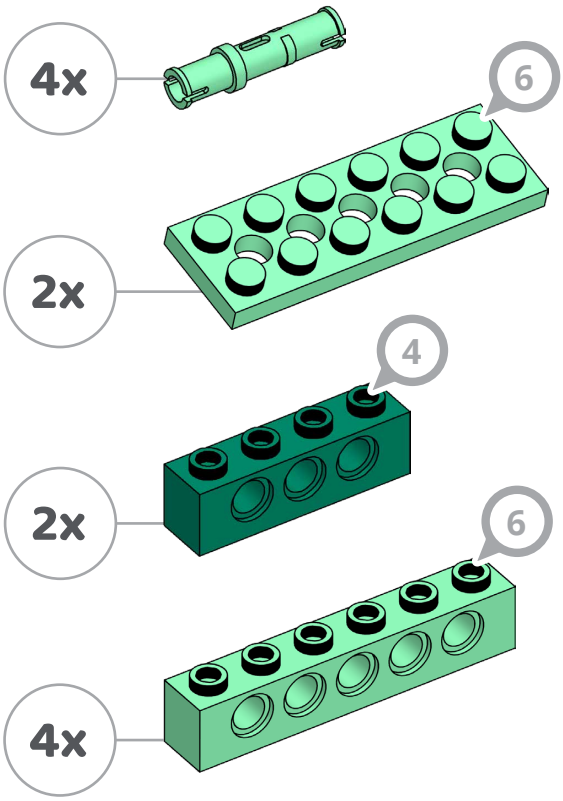
Parts



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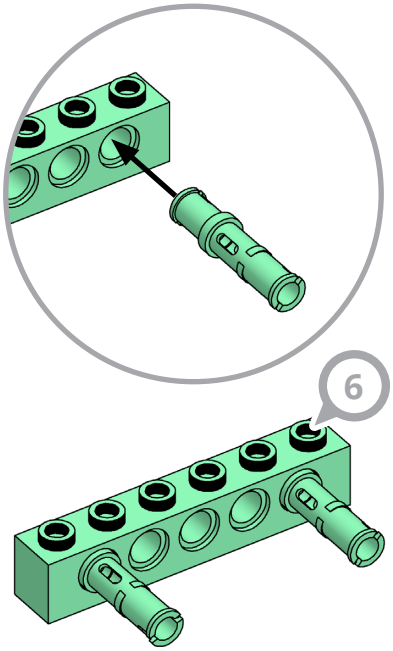

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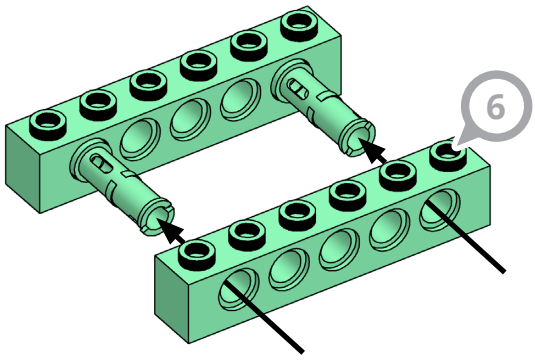

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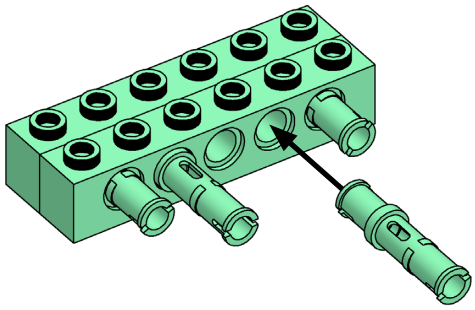

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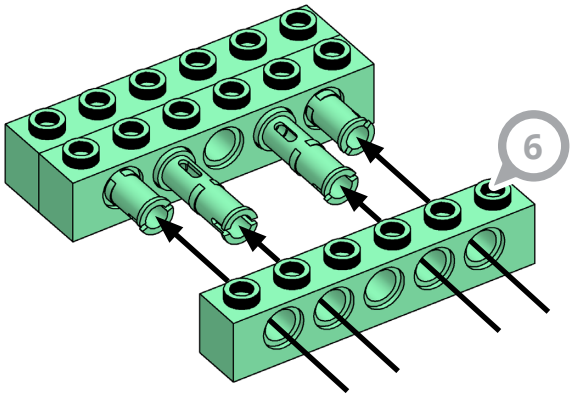

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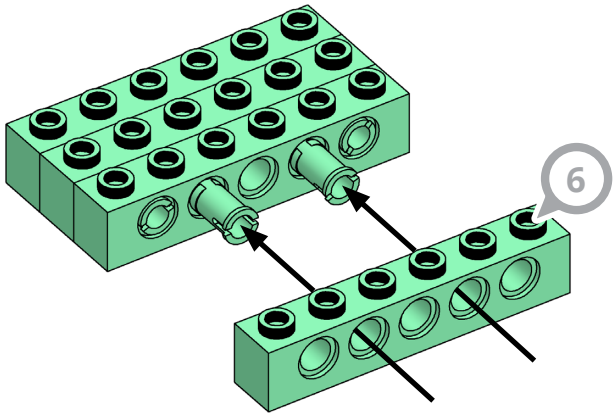

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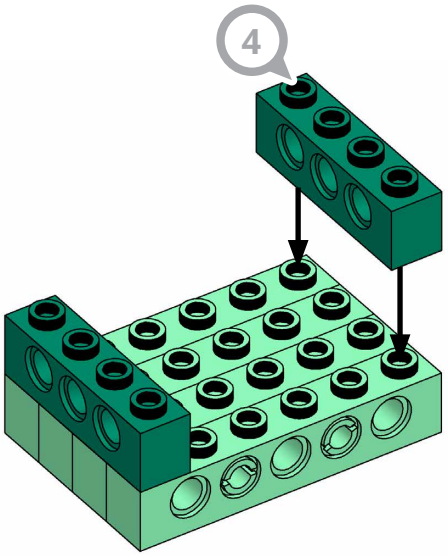

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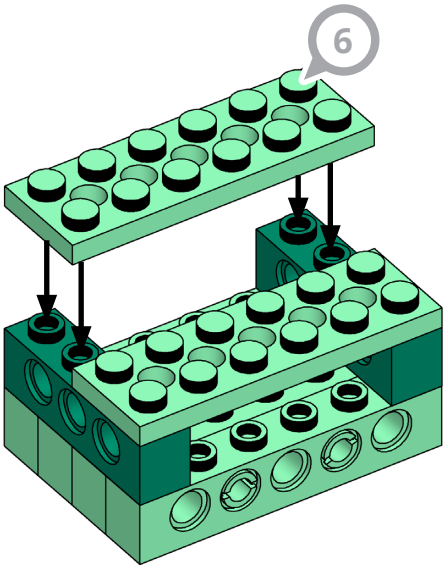

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