

# Investigating Friction

You have been asked to design a new brake pad for a tricycle or scooter. You will find out which material creates the most friction and stops the wheels the quickest.

Which materials will you test?

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Which material do you predict will be the best choice for the new brake pad?

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Can you explain why?

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Material being tested	Time taken for the wheel to stop (in seconds) First test	Time taken for the wheel to stop (in seconds) Second test

Did your repeat readings match up to your first readings? If not, why do you think this was?

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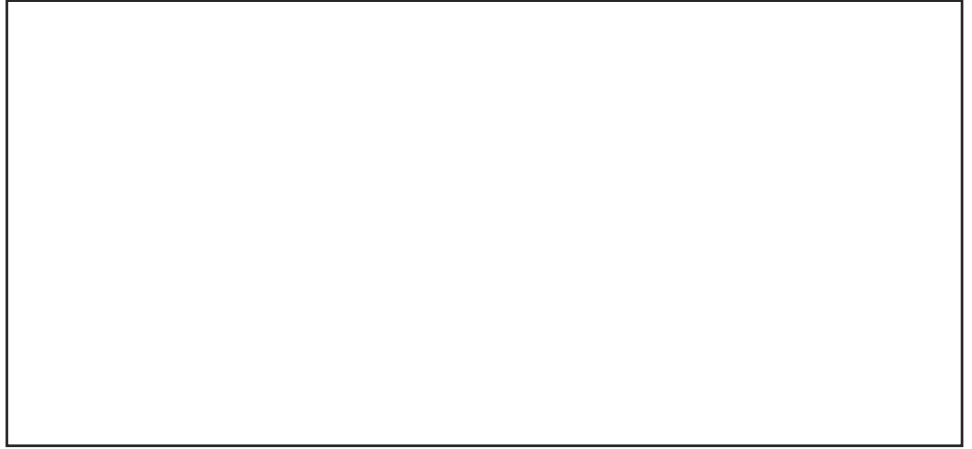
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Why is it useful to take repeat readings?

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(Remember that the material that stops the wheel in the shortest time has most friction.)

The company would like to see a demonstration of the best material in action. Stick a photo or draw a picture of your demonstration of the best choice for the new brake pad in the box.



(Remember that the material that stops the wheel in the shortest time has most friction.)

The company would like to see a demonstration of the best material in action. Stick a photo or draw a picture of your demonstration of the best choice for the new brake pad in the box.

Can you explain why this material is the best choice for the new brake pad?

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**Use these words in your explanation**

friction	brake	slow	stop	wheel	speed
rough	smooth	surface	force	push	back

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If this material is not available, what properties should the company look for in another material?

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# Measuring Gravity

Measure the weight and mass of different objects. Do you think there will be a link between the weight and mass of each object? (Think about whether the mass of each object will be the same as its weight. Or will the mass be higher than the weight? Or will it be lower? Or maybe you think there will be no link at all!)

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Record the mass and weight of each object in the table below.

Object	Mass (kg)	Weight (N)

Did you notice a link between the weight and mass of each object?

Describe what you found out below.

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Fill in the key words below to explain how gravity gives objects their weight.

All objects are made of \_\_\_\_\_, or stuff. The amount of matter they are made of is called their mass. This is measured in \_\_\_\_\_.

\_\_\_\_\_ pulls all objects down towards the \_\_\_\_\_ of the Earth. It pulls objects with a larger mass down with a stronger \_\_\_\_\_. The pulling force of gravity on an object is its weight. It is measured in \_\_\_\_\_.

<b>Key words:</b>	newtons	gravity	force	matter	centre	kilograms
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Explain how gravity gives objects their weight. Refer to the difference between weight and mass, and the units of measurement for both weight and mass.

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# Measuring Gravity Answers

Do you think there will be a link between the weight and mass of each object?

**Accept appropriately justified predictions.**

Did you notice a link between the weight and mass of each object?

Example answer: *My results show that the weight in newtons is about ten times bigger than the mass in kg. 1kg weighs around 10 newtons on Earth.*



Fill in the key words below to explain how gravity gives objects their weight.

All objects are made of *matter*, or stuff. The amount of matter they are made of is called their mass. This is measured in *kilograms*.

*Gravity* pulls all objects down towards the *centre* of the Earth. It pulls objects with a larger mass down with a stronger *force*. The pulling force of gravity on an object is its weight. It is measured in *newtons*.



Explain how gravity gives objects their weight. Refer to the difference between weight and mass, and the units of measurement for both weight and mass.

**Look for understanding of the concepts explained in the answer above.**

# Newton and Gravity

1. When was Isaac Newton born?

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2. Why did Newton move from Cambridge to Woolsthorpe Manor?

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3. What fruit did Newton see falling from a tree?

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4. In which direction does gravity pull objects?

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5. Why does the Moon stay in orbit around the Earth?

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6. What are forces measured in?

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7. What did Albert Einstein think of Isaac Newton?

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8. What can still be seen from Isaac Newton's old bedroom window?

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# Newton and Gravity Answers

1. When was Isaac Newton born?

*Isaac Newton was born in 1643.*

2. Why did Newton move from Cambridge to Woolsthorpe Manor?

*Newton moved to Woolsthorpe Manor because plague broke out.*

3. What fruit did Newton see falling from a tree?

*Newton saw an apple falling from a tree.*

4. In which direction does gravity pull objects?

*Gravity pulls objects down towards the centre of the Earth.*

5. Why does the Moon stay in orbit around the Earth?

*The Moon stays in orbit around the Earth because gravity pulls it towards the Earth.*

6. What are forces measured in?

*Forces are measured in newtons (N).*

7. What did Albert Einstein think of Isaac Newton?

*Albert Einstein thought that Isaac Newton had one of the most brilliant minds of anyone who had ever lived and that he was a 'shining spirit'.*

8. What can still be seen from Isaac Newton's old bedroom window?

*The apple tree that inspired Newton's ideas about gravity can still be seen from his old bedroom window.*

# Newton and Gravity

1. When was Isaac Newton born?

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2. Why do you think the outbreak of plague forced Newton to move from Cambridge back to Woolsthorpe Manor?

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3. What inspired Newton to explore the force of gravity?

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4. How did Newton describe the way gravity pulls objects?

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5. What did Newton discover about the way gravity affects the Moon?

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6. Why do you think forces are measured in newtons with a newton metre?

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7. Look at this phrase: *Even Albert Einstein, writing in 1927, 200 years after Newton's death, described Newton as a 'shining spirit'.* What does the word 'Even' make you think about Albert Einstein?

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8. Why do you think the National Trust have kept and looked after the apple tree in the gardens of Woolsthorpe Manor?

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# Newton and Gravity Answers

1. When was Isaac Newton born?

*Isaac Newton was born in 1643.*

2. Why do you think the outbreak of plague forced Newton to move from Cambridge back to Woolsthorpe Manor?

*He was forced to move away from the city when Plague broke out because he would be less likely to catch the infectious disease in the country.*

3. What inspired Newton to explore the force of gravity?

*The sight of an apple falling from a tree inspired Newton to explore the force of gravity.*

4. How did Newton describe the way gravity pulls objects?

*He described gravity as being like a 'drawing power' from the centre of the Earth.*

5. What did Newton discover about the way gravity affects the Moon?

*He discovered that the Earth exerts its gravitational force on the moon and this causes it to stay in orbit.*

6. Why do you think forces are measured in newtons with a newton metre?

*Newtons and the newton meter are named after Isaac Newton because of the discoveries he made to do with forces.*

7. Look at this phrase: *Even Albert Einstein, writing in 1927, 200 years after Newton's death, described Newton as a 'shining spirit'.* What does the word 'Even' make you think about Albert Einstein?

*It makes me think that Albert Einstein must have had an impressive mind himself too.*

8. Why do you think the National Trust have kept and looked after the apple tree in the gardens of Woolsthorpe Manor?

*Example answer: I think the tree and gardens have been preserved because the discoveries that Newton made were significant and so the place where the ideas were first formed should be kept safe for people to see when they learn about Isaac Newton.*



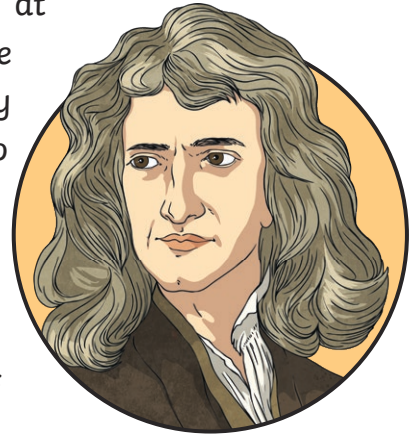
# Newton and Gravity Fact Sheet



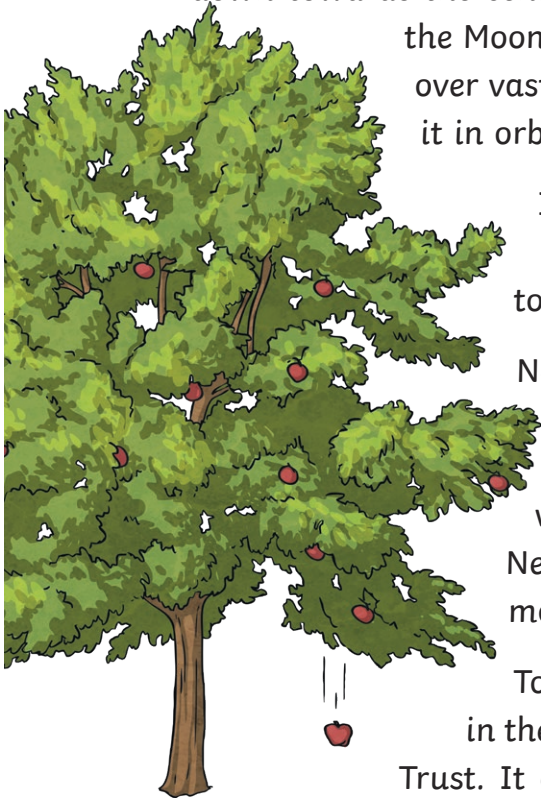
Isaac Newton was an English scientist and mathematician. He made many discoveries in his lifetime. One of the most important and influential discoveries that he made was the law of gravity.

Newton was born in 1643 at Woolsthorpe Manor in Lincolnshire. He worked hard at school, and was accepted to study at Cambridge University. He worked there for many years, but in 1665, the plague broke out and he was forced to move back to Woolsthorpe Manor.

While Newton was in the garden at Woolsthorpe Manor one day, he saw an apple fall from a tree. Some say it fell on his head but there is no evidence that this definitely happened. The sight of the apple falling down from the branch to the ground inspired Newton to think about the way it fell. Years later, he told his friend William Stukeley that he wondered why the apple fell down rather than sideways or upwards. He concluded there must be a 'drawing power' in the Earth and that 'the sum of the drawing power must be in the Earth's centre, not in any side of the Earth.'



Newton spent a lot of time thinking hard about the force of gravity, and how it pulls objects down towards the centre of the Earth. He was particularly interested in the way the Moon orbits the Earth, and he reasoned that gravity must extend over vast distances, pulling the Moon towards the Earth and keeping it in orbit.



In 1687, Newton published his discoveries about gravity in his famous book, *The Principia*. His findings are known today as Newton's Law of Universal Attraction.

Newton died in 1727, but his legacy lives on. All forces are measured in newtons (N), using a newton meter – both of which are named after Isaac Newton. Even Albert Einstein, writing in 1927, 200 years after Newton's death, described Newton as a 'shining spirit', and claimed he had one of the most brilliant minds of anybody who had ever lived.

Today, the apple tree that inspired Newton's ideas still grows in the gardens at Woolsthorpe Manor, now owned by the National Trust. It can be seen from the window of the room that was Isaac