

End of Unit Assessment | Science | Year 5 | Forces

All	Most	Some
<p>Identify forces as pushes and pulls, explain gravity as a force that pulls objects down, identify Isaac Newton's discoveries, explain the effects of friction, including air and water resistance, on moving objects, identify different mechanisms, recognise that there are different variables in an investigation, predict what will happen in an investigation and make observations.</p>	<p>Identify and explain the different forces acting on objects, explain Newton's role in discovering gravity, accurately measure an object's weight and mass, explain how to increase the effects of air resistance, explain Galileo's 'Tower of Pisa' experiment into gravity and air resistance, identify streamlined shapes, explain how friction is used in brake pads, investigate the effects of friction, explain how different mechanisms work, design their own mechanism to achieve a given purpose, identify the variables in an investigation make observations and conclusions and be able to answer questions based on their learning.</p>	<p>Identify and explain forces, explain the difference between weight and mass, explain the link between the weight and mass of an object, make generalisations about how to increase the effects of air resistance, explain the conclusions and implications of Galileo's 'Tower of Pisa' experiment, explain how to minimise the effects of water resistance make generalisations about the properties of materials that create the most friction, explain how a mechanism they have designed alters force and motion to achieve a purpose, discuss how variables can be controlled when investigating, set up reliable and accurate investigations, make and explain predictions, make and record accurate observations, use scientific language to explain their findings, use their results to make generalisations and further predictions and be able to ask and answer questions based on their learning using scientific language.</p>
33%	33%	33%
<p>Name Name Name Name</p>	<p>Name Name Name Name</p>	<p>Name Name Name Name</p>



NC Aims Covered in Forces

To recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

To identify the effects of water resistance.

To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.

To identify the effects of air resistance, water resistance and friction.

To identify the effects of friction.
















To identify the effects of air resistance.

Forces: Gravity

<p>Aim: To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object by measuring the force of gravity pulling on objects.</p> <p>To explore the effect that gravity has on objects and how the first theory of gravity was developed.</p>	<p>Success Criteria: I can explain the effect of gravity on unsupported objects.</p> <p>I can explain Isaac Newton's role in developing a theory of gravity.</p> <p>I can accurately measure the force of gravity pulling on objects.</p>	<p>Resources: Lesson Pack</p> <p>Newton meters</p> <p>Weighing scales</p> <p>Objects to be measured</p> <p>Clear bags with handles</p>
	<p>Key/New Words: Gravity, force, Isaac Newton, newton, newton meter, weight, mass.</p>	<p>Preparation: Newton and Gravity Fact Sheet - one per child</p> <p>Differentiated Newton and Gravity Activity Sheet - one per child</p> <p>Differentiated Measuring Gravity Activity Sheet - one per child</p>

Prior Learning: The children will have learnt about gravity as a pulling force in Lesson 1.

Learning Sequence

	<p>Falling Down: Drop a bouncy ball and ask children to discuss their ideas about gravity using the prompts on the Lesson Presentation. Explain the force of gravity using the information on the Lesson Presentation. <i>Can children explain the effect of gravity on unsupported objects?</i></p>	
	<p>Discovering Gravity: Children discuss any existing knowledge they have of Isaac Newton and discuss briefly how Isaac Newton developed his theory of gravity.. Children use the Newton and Gravity Fact Sheet to answer the comprehension questions on the differentiated Newton and Gravity Activity Sheet. <i>Can children explain Isaac Newton's role in developing a theory of gravity?</i></p> <p> Children answer simpler, literal questions based on the Newton and Gravity Fact Sheet.</p> <p> Children answer more difficult questions, including some inferential questions, based on the Newton and Gravity Fact Sheet.</p>	
	<p>Weight and Mass: Explain the difference between weight and mass, and how to measure them, using the information on the Lesson Presentation.</p>	
	<p>Measure the Force of Gravity: Explain how children will measure the weight and mass of different objects using the Lesson Presentation. Children complete the differentiated Measuring Gravity Activity Sheet with their prediction, results and conclusion, and conduct the investigation in pairs. <i>Can children measure the weight of objects? Can children explain that the weight of an object is caused by gravity pulling it down?</i></p> <p> Children use prompts to make their prediction. They use key words to fill in gaps in the explanation of gravity, weight and mass.</p> <p> Children fill in gaps in the explanation of gravity, weight and mass.</p> <p> Children complete the blank labels on the diagrams.</p>	
	<p>Fin the</p> <p>discuss their results and try to spot a link between weight and mass. Explain the link using</p>	

Taskit

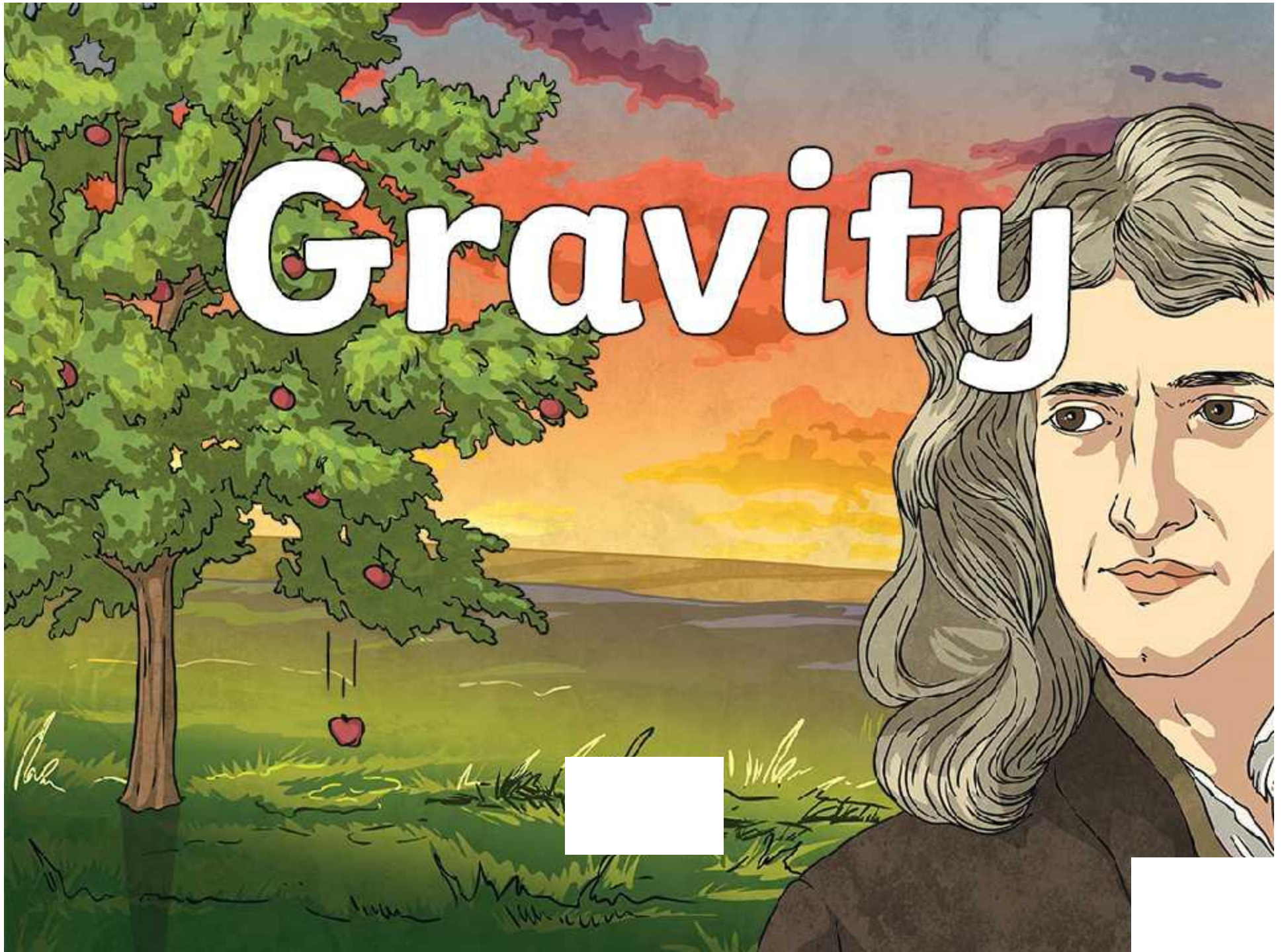
- Writeit:** Why not make a book all about gravity? Include pages on what gravity is, how Isaac Newton developed his theory about it, how it differs on different planets and how it gives objects their weight. Add pictures to make your book even more interesting.
- Makeit:** Make a poster to explain the force of gravity and its effects.



Science

Forces

Science | Year 5 | Forces | Gravity | Lesson 2



Aim

- To explore the effect that gravity has on objects and how the first theory of gravity was developed.

Success Criteria

- I can explain the effect of gravity on unsupported objects.
- I can explain Isaac Newton's role in developing a theory of gravity.
- I can accurately measure the force of gravity pulling on objects.

Falling Down



Watch your teacher let go of a bouncy ball. What does it do?

These children are discussing why the bouncy ball falls down rather than falling up, sideways or staying still.

Which child or children do you agree with?

There is no air resistance acting on the ball, so it can go straight down.

The ball falls downwards because gravity is pulling it down.

The ground exerts a force on the ball so the ball is magnetically attracted to the ground.

The bouncy ball falls downwards because it is heavy. If it were lighter, it would float away.



Falling Down

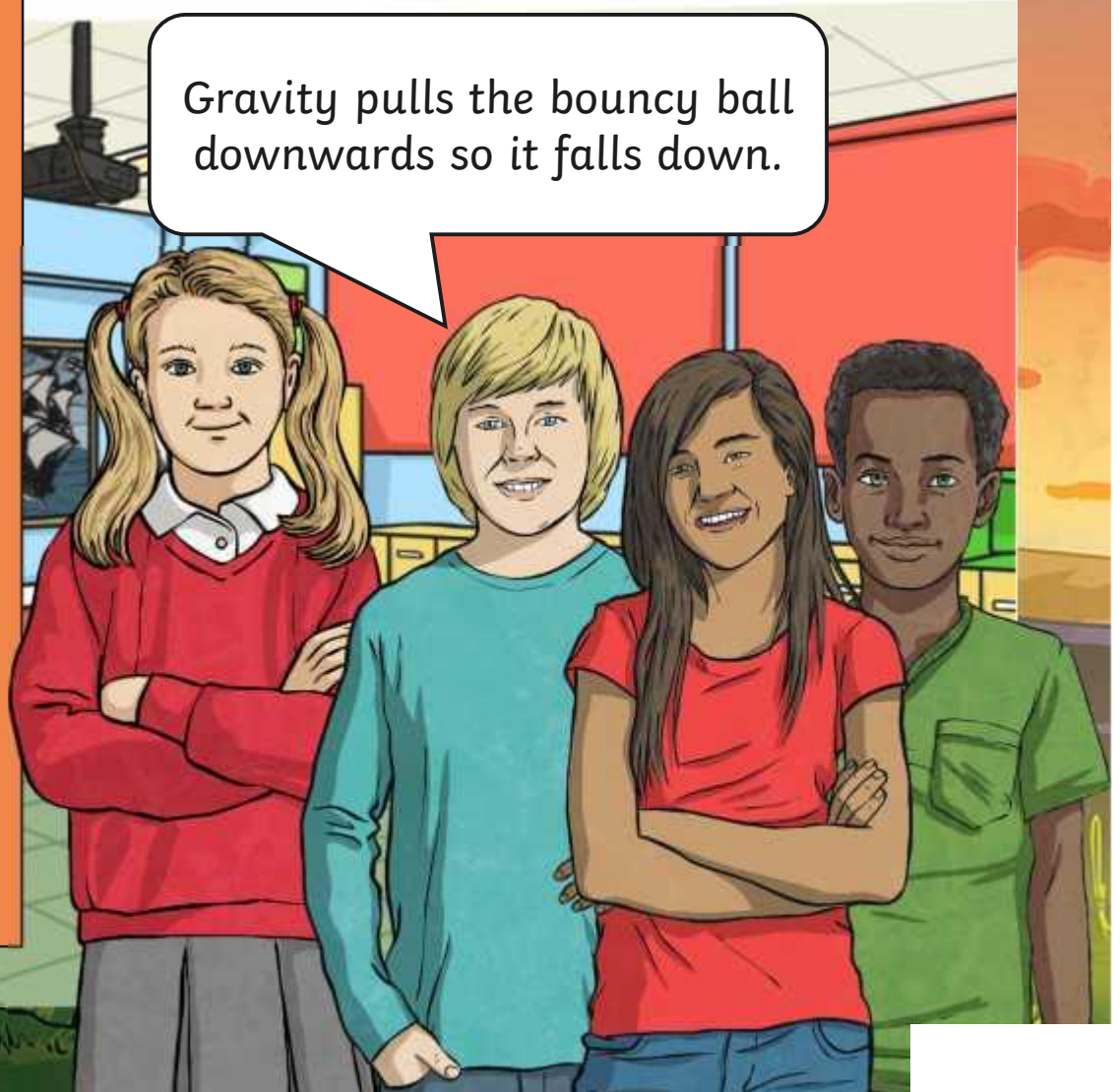


Did you agree with this boy?
Gravity is the force that means that objects are pulled towards the centre of the Earth.

All objects exert a **gravitational pull**. However, the strength of an object's gravitational pull depends on its **mass**. The Earth is a huge object with an extremely high mass, so its gravitational pull is very strong.

The force of gravity keeps us on the ground. Gravity also causes objects to fall down if they are dropped.

Gravity pulls the bouncy ball downwards so it falls down.



Discovering Gravity



This is Isaac Newton.
Do you have any idea
why he is pictured next
to an apple tree?



Discovering Gravity



Isaac Newton famously developed his theory of gravity when he saw an apple fall to the ground from an apple tree.

Read your **Newton and Gravity Fact Sheet** about his life and his theory. Then answer the questions on the **Newton and Gravity Activity Sheet**.

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 of these discoveries was the law of gravity.

Newton was born in 1643 in Woolsthorpe, Lincolnshire. He went to school in Cambridge and later became a professor at Cambridge. He was also a brilliant inventor and scientist. He designed the first reflecting telescope.

While Newton was in the garden at Woolsthorpe, he was sitting under an apple tree. One day, an apple fell from the tree and hit him on the head. This was a very important moment for Newton. He thought about the apple falling and how it got to the ground. He realized that the apple was pulled down by a force. He called this force gravity.



Newton spent a lot of time thinking about the way of gravity. He realized that all objects on Earth are pulled down by gravity. He also realized that the force of gravity is stronger on objects that are closer to the ground. He called this force of gravity the force of attraction.



Newton's theory of gravity was very important. It helped scientists understand the way the world works. It also helped them understand the way the universe works.

Newton died in 1727. He was one of the greatest scientists of all time. His theory of gravity is still used today. It has helped us understand the way the world works and the way the universe works.

Today, the theory of gravity is still used. It has helped us understand the way the world works and the way the universe works. It has also helped us understand the way the Earth works and the way the Sun works.

Weight and Mass

People often use the words weight and mass to mean the same thing.

Mass is a measure of the amount of 'stuff' inside an object, and is measured in **kilograms** (kg).

Weight is actually a measure of the strength of gravity acting on an object. It is measured in **newtons** (N).

The **weight** of an object is caused by **gravity** pulling it down. Objects with more **mass** have a greater weight, as the force of gravity pulls them down more strongly.



Weight and Mass

An object's mass will stay the same even if it is in a place with weaker gravity, like the Moon.


However, an object's **weight** can **change**! If the object were on the Moon, although it would have the same mass, it would weigh much less as the gravity would not be pulling it down as strongly. The Moon's gravity is much weaker than the Earth's.

Weight and Mass

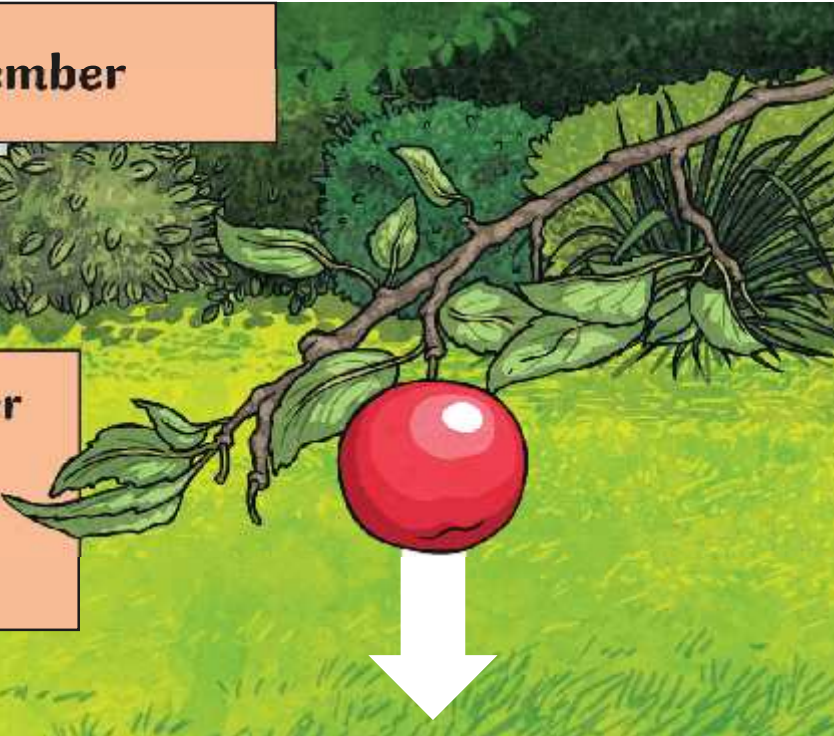
Jupiter is a much bigger planet than Earth so it has a stronger gravitational pull. Although an object would have the same **mass** on Jupiter as anywhere else, it would **weigh** much more due to the gravity pulling it more strongly.

Weight and Mass

Remember



Mass is how much **matter** (or 'stuff') is inside an object. It is measured in **kilograms (kg)**.



Weight is how strongly **gravity** is pulling an object down. It is measured in **newtons (N)**.

Measure the Force of Gravity

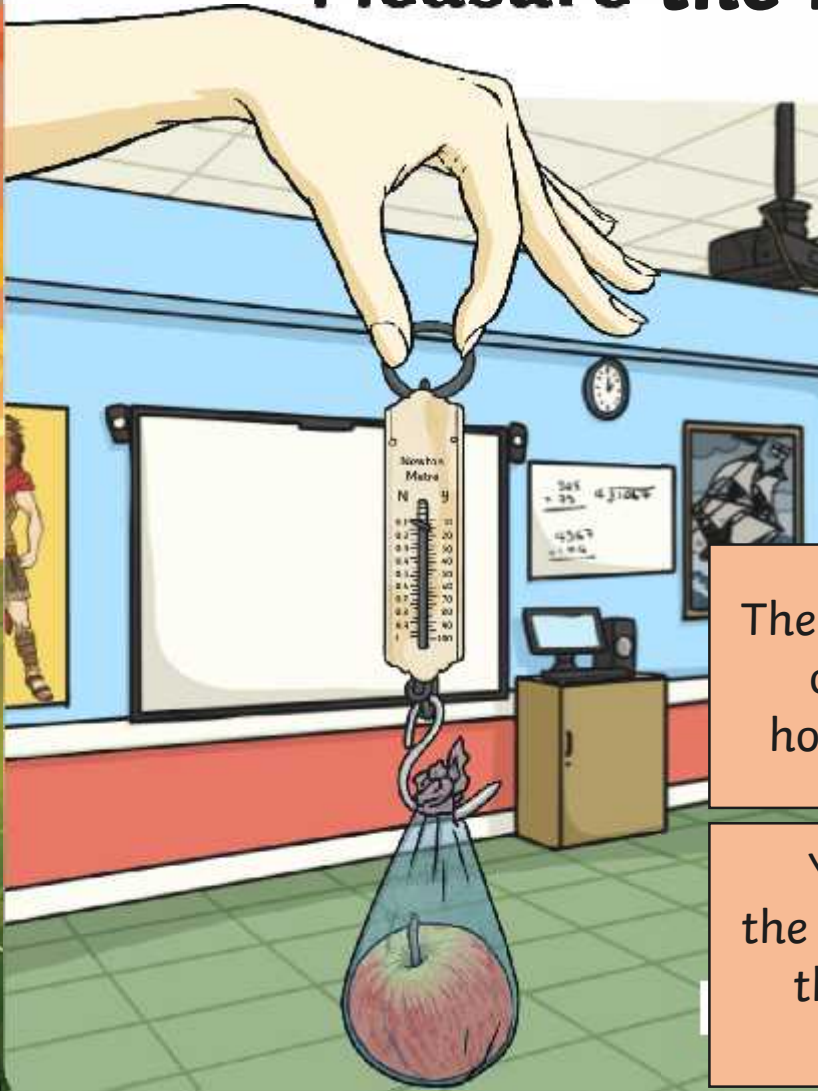


You are going to measure the **weight** and **mass** of different objects.

The weight of an object is measured using a **newton meter**. Remember, weight is a measure of how strongly gravity is pulling on the object.

The mass of an object is measured using a set of **scales**. Remember, mass is a measure of how much matter (or 'stuff') is in the object.

You can find an object's weight by placing the object in a bag and hanging the bag from the newton meter to measure how strongly gravity is acting on the object.



Measure the Force of Gravity



Do you think that there will be a link between an object's

Did you measure the weight and mass of each object accurately?

Was it easy or hard to get an accurate measurement?

your results. Then use your results to form a conclusion.

★

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

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.

Fill in the key words below.
All objects are made of _____ called their mass. This is a _____ pulls all of _____ with a larger mass down _____ object is their weight. It is _____

Key words: mass, weight

★★

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

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.

Fill in the key words below.
All objects are made of _____ called their mass. This is a _____ pulls all of _____ with a larger mass down _____ object is their weight. It is _____

★★★

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

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.

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.

Finding a Link



Did you notice a link between each object's **weight** and its **mass**?

Talk to a partner about the link you spotted.

Did they see a similar link?

Can you explain any results that don't follow this link?



Finding a Link



You should have discovered that gravity pulls objects down with a force of approximately 1N for every 100g.

So if an object weighs 200g, gravity will pull it down with a force of 2N.

If an object weighs 1kg, gravity will pull it down with a force of 10N.

Have another look at your results. Do they follow this pattern?



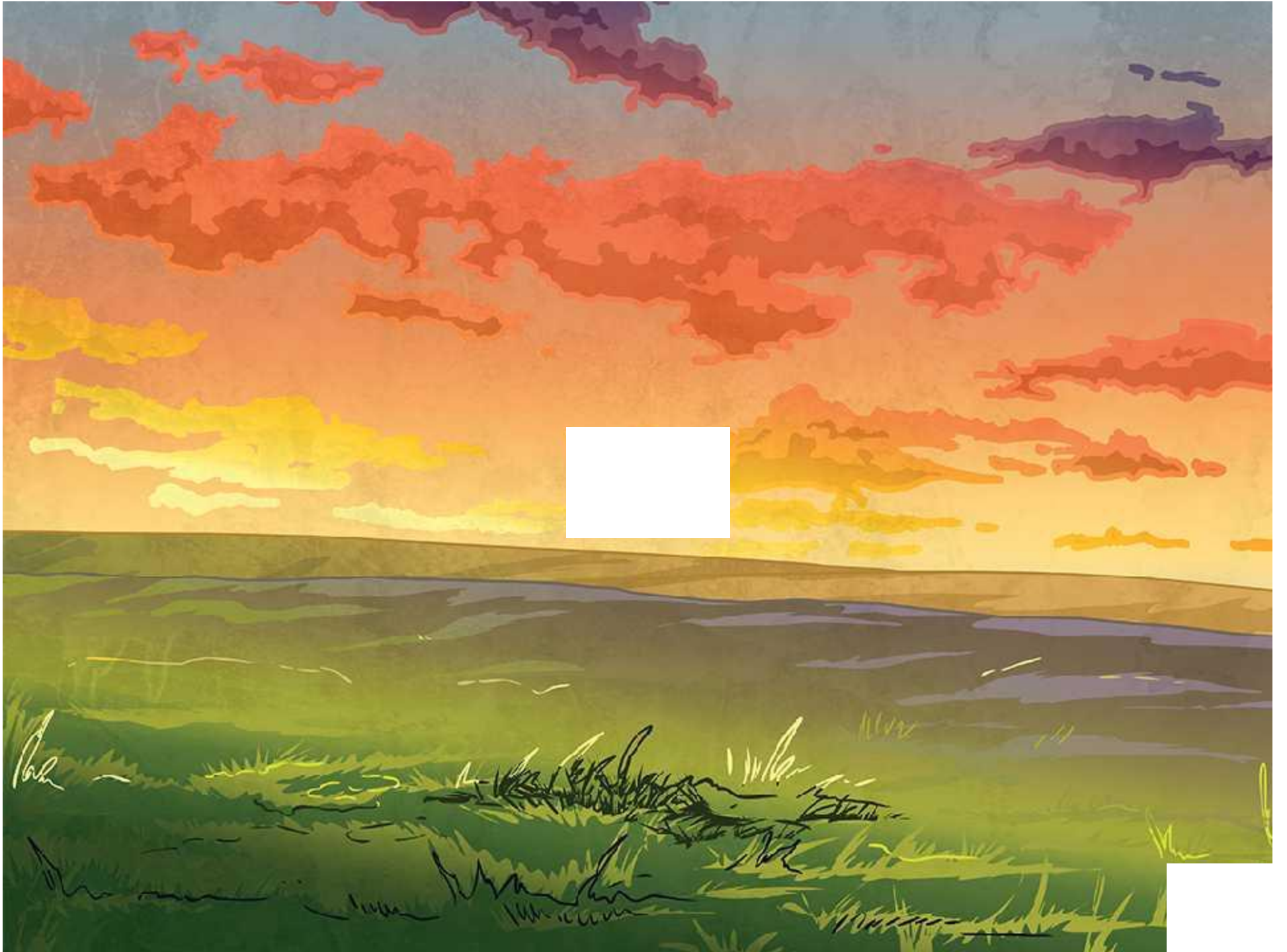
Aim



- To explore the effect that gravity has on objects and how the first theory of gravity was developed.

Success Criteria

- I can explain the effect of gravity on unsupported objects.
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				Delivered By:			Support:		
Success Criteria	Me	Friend	Teacher	T	PPA	S	I	AL	GP
I can explain the effect of gravity on unsupported objects.				Notes/Evidence					
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I can accurately measure the force of gravity pulling on objects.									
Next Steps									
) _____									
) _____									

T	Teacher	I	Independent
PPA	Planning, Preparation and Assessment	AL	Adult Led
S	Supply	GP	Guided Practice

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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!)

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.

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 _____.

Key words: newtons gravity force matter centre kilograms
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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?

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_____ 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 _____.



Measuring Gravity

Measure the weight and mass of different objects.

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Object	Mass (kg)	Weight (N)

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

Describe what you found out below.

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.

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?

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

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

4. In which direction does gravity pull objects?

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

6. What are forces measured in?

7. What did Albert Einstein think of Isaac Newton?

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



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?

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

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

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

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

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

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?

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



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 Newton's bedroom.

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