

Subject: Science		Year Group: 5			Unit: Gravity and other forces - Ancient Greeks	
First- hand experience: Use of Newton meters. Holding apples (one apple = 1 Newton). Sliding objects across different surfaces. Air resistance practical with folding paper (how does the surface area of paper affect the speed of descent). Observation of different shaped objects (pastry? Play doh?) falling in water. Children should have experience of how gears, pulleys and levers work.						
NC Objectives to be addressed:				Prior Learning required:		
<ul style="list-style-type: none"> explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object identify the effects of air resistance, water resistance and friction, that act between moving surfaces recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect <p>Below are to be discussed but not taught in detail as this teaching happens in year 5 term 6</p> <ul style="list-style-type: none"> describe the movement of the Earth, and other planets, relative to the Sun in the solar system describe the movement of the Moon relative to the Earth describe the Sun, Earth and Moon as approximately spherical bodies use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky. 				<p>Forces and magnets unit – Year 3 Stone age to the Iron age and Saxons and Vikings</p> <ul style="list-style-type: none"> compare how things move on different surfaces notice that some forces need contact between two objects, but magnetic forces can act at a distance observe how magnets attract or repel each other and attract some materials and not others compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials describe magnets as having two poles predict whether two magnets will attract or repel each other, depending on which poles are facing. <p>Seasons -Year 1 throughout</p> <ul style="list-style-type: none"> observe changes across the four seasons observe and describe weather associated with the seasons and how day length varies. 		
Biology		Chemistry		Physics		
Working scientifically					Where next?	
Comparative and fair testing	Pattern seeking	Observing over time	Secondary sources	Classifying and grouping	<p>Year 5 Earth and Space Recapped in year 6 WW2</p> <p>All studied again at KS3 Physics. Really important the key language of accelerate and decelerate is used to help prepare.</p>	

Key Vocabulary:			
Force	A push or a pull. Either provided by an object touching another one, or by gravity or magnetism. Causes objects to speed up or slow down	Gears	See https://www.youtube.com/watch?v=Ml9Ojbl2uaw
gravity	A non-contact Force caused by big objects like planets or stars	Accelerate	When an object speeds up or gets faster
Earth	The planet on which we live	Decelerate	When an object slows down or gets slower
air resistance	The contact force caused by air particles. It can make objects accelerate or decelerate		
water resistance	The contact force caused by water. It can make objects accelerate or decelerate		
friction	The contact force caused by solids. It can make objects accelerate or decelerate.		
mechanisms	A system of parts working together		
simple machines	Uses a single applied force to do work		
levers	A device that provides a mechanical advantage by applying a turning force at a large distance from where the object is being turned <div style="text-align: center;"> <p><i>How Does a Lever Work?</i></p> </div>		
pulleys	A device that applies a mechanical advantage (See https://www.youtube.com/watch?v=DH2tmYQICJs)		

Sequence of learning:
<p>Lessons 1 and 2:</p> <p>Forces are pushes and pulls. Forces make objects accelerate or decelerate (NOT make them move) (Forces are measured in newtons (N), named after Sir Isaac Newton)</p> <p>It is believed that Isaac Newton came up with his theory of gravity after observing apples fall from a tree in his garden</p> <p>Newton discovered that gravity was the force that held the moon to earth, and that held the earth to the sun (he did not discover gravity, Aristotle knew about that!)</p>

(The ancient Greek philosopher Aristotle said that objects fall because each of the four elements (earth, air, fire, and water) had their natural place, and these elements had a tendency to move back toward their natural place. Thus, objects that were made of earth wanted to return to Earth, whereas fire, for example, rose toward heaven.

We now know Aristotle is wrong because all objects with mass are pulled towards earth. The only reason some objects “rise” is because they are less dense (compacted) than the air around us, and so float on it (like boats floating on water))

Magnetism is also a non-contact force (y3 revision)

Gravity is an invisible non-contact force that pulls objects down to the ground (makes them fall).

Weight is created by the force of gravity pulling down on the mass of an object It is the gravitational pull of the Sun that keeps the Earth and the other planets in orbit around it orbit gravity.

The Earth’s gravity also keeps the Moon in orbit around the Earth. It is constantly falling, but missing because of its motion Weight can be measured using a force meter (also called a newton meter).

A Newton meter is used like this:



The force of gravity is not as strong on the Moon because it is smaller than the Earth No matter where you are on the Earth, or in the sky above it, gravity will be pulling you down towards the centre of the Earth

Lesson 3

There are 3 contact forces: Friction, air resistance, and water resistance

Air resistance is caused by air particles slowing an object down

Friction is caused by rough objects rubbing against each other

Water resistance is caused by water particles exerting a force on objects

If a hammer and feather were dropped at the same time on the moon, or on the earth if there was no air around, they would reach the ground at the same time, because gravity makes all massive objects accelerate at the same rate. It is just the air resistance which makes it seem like feathers would fall slower

Lesson 4

The Ancient Greeks thought that the stars were put there by the gods to serve as lessons, and that the stars could be used to predict events on Earth – Astrology. Also, the Greeks believed that the Earth was the centre of the Universe, was round (because of Earth's shadow), and that the planets and stars revolve around it. They, and many ancient societies, used the sun to tell the time, and the stars to mark key parts of the year (Winter and Summer Solstices)

Now we know that the sun is just one star, out of billions, and that all stars are balls of hot gases that are a very long way away. That the Sun is the centre of our Solar system, and why we now believe that (Jupiter's moons, ships sailing into the horizon)

Galileo observing Jupiter's moons provided evidence for the sun being the centre of the universe

Newton discovered that gravity was the force that held the moon to earth, and that held the earth to the sun (he did not discover gravity, Aristotle knew about that!)

How seasons are caused by the tilt of the earth.

Discuss in this lesson how Scientific ideas change, and why. Why did Scientists decide that Astrology is not correct? Why did Aristotle have good ideas, and how did modern Scientists views change them?

Lesson 5, 6 and 7 (opportunities for extended practical work)

Friction is a force between two surfaces when they slide or move across each other. Friction works in the opposite direction to motion. It also generates heat. Friction either decelerates objects, or makes them accelerate (think tyres on a car, the need to have friction to make them work)

You can feel air resistance if you run whilst holding a large piece of card or if you carefully put your hand out of the window of a moving car

Air resistance occurs between the surface of a falling/moving object and the air particles that surround it. As a friction force, it works to decelerate the object as it falls/moves, or it can be used to accelerate an object (think of birds pushing air back with their wings to propel themselves)

The greater the surface area of an object, the greater the air resistance will be. This is because the air particles have further to travel to get around the object, creating greater resistance

Water resistance is another type of friction that can decelerate items, or accelerate them. Because water particles are closer together (denser) than air particles, the resistance created is greater in water than in air

Fish, and submarines, are shaped the way they are so they are streamlines, and so there is less water resistance.



Newton meters are used to measure forces and can be used like

Forces are measured in Newtons

1N = 1 apple

Stopwatches are used to measure time and can be used like <https://www.youtube.com/watch?v=jJMdpXIVq7I>

A hypothesis is made by using any scientific ideas the children already have to make a prediction as to what they think will happen. It encourages the scientist to consider as much science that could be relevant as possible

A detailed plan is the exact instructions on how an experiment was carried out. It is completed to ensure that if another scientist wanted to carry out the experiment, they could do it exactly

In an experiment the variables are controlled so that we can see the impact of only one variable on the results

We include a labelled diagram to make sure another scientist can easily repeat the experiment

We record results in a results table so it is clear what data has been recorded. We include units in table headings so that readers can know what units the quantities are measured in

In an experiment, we repeat results in order to check to see if there are any results that are clearly wrong (outliers) and so that we can work out the average (mean)

Conclusions tell us what we have found out from the Science experiment

At the end of an experiment, we work out which controls were controlled well, and which could have been controlled better, and therefore determine what improvements could be made to the science investigation.

Lesson 8 onwards (opportunities for extended practical work)

How Gears, levers and pulleys work. Examples of the temples, and other structures, the Greeks built using them. Practical examples will be used.

A lever is a simple mechanism that assists the lifting of heavy items using less force (see https://www.youtube.com/watch?v=E8RA9Kw_laE)

A pulley system can reduce the force required to lift a load by changing the speed and direction of a movement

(<https://www.youtube.com/watch?v=DH2tmYQICJs>)how

Gears are different sized toothed wheels that lock together and turn each other. Turning each gear combination will mean that there is a different amount of wheel turns for every pedal turn. (See <https://www.youtube.com/watch?v=Ml9Ojbl2uaw>)

The Ancient Greeks invented the pulley, and the Greeks then used often to build temples

The Ancient Greeks didn't invent the lever, but they did continue to use them

The Ancient Greeks didn't invent gears, but developed them further to help predict, for example, the phases of the moon

Resources and teacher subject knowledge: