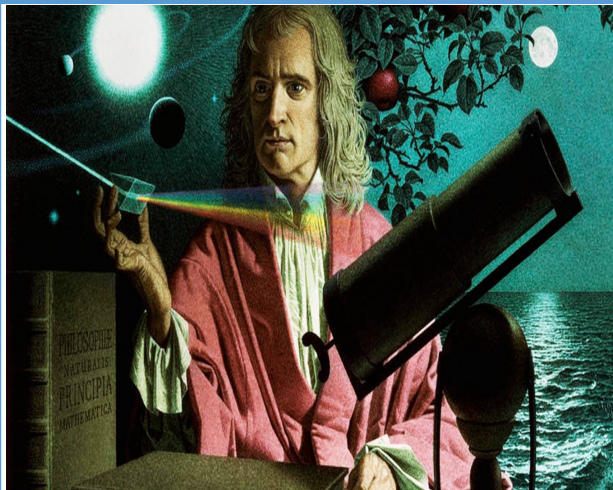




# Newton, an apple, and a world of forces!

## PHYSICS



### Overview and rationale:

Following on from their work on forces and magnetism in Year 3, our Year 5s now broaden their knowledge of other natural powers. They observe and investigate water and air resistance and how friction can be a help and a hindrance on Planet Earth, before taking their first look at gravity, beginning with the concepts of Sir Isaac Newton and leading them wonderfully into their next exciting science-based topic on Space. Our budding professors then look at the way in which human beings harness the power of our planet's natural forces and consolidate their knowledge by developing their enquiry skills, experimenting in using levers, pulleys and gears.

### SCIENCE LEARNING STATEMENTS

Area of Learning	Knowledge and Skills
Scientific Enquiry and applying knowledge in context	I can use my science experience to explore ideas and raise questions about the world.
	I can talk about how different scientific ideas have developed over time.
	I can select and plan, with help, the most appropriate type of scientific enquiry I might use to answer questions and give justifications.
	I can recognise when and how to set up comparative and fair tests. I can explain which variables need to be controlled and why.
	I can use and develop keys and other information records to identify, classify and describe living things and materials. I can identify patterns that might be found in natural environments.
	I can recognise which secondary sources will be most useful to research my ideas and begin to separate opinion from fact.
	I can make decisions about what observations to make, what measurements to use and how long to make them for.
	I can spot causal relationships in my data and identify evidence that refutes or supports my ideas.
	I can choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. I can take repeat measurements where appropriate.
	I can decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
	I can identify scientific evidence that has been used to support of refute ideas or arguments.
	I can use relevant scientific language and illustrations to discuss, communicate and justify my scientific ideas, use oral and written forms (such as displays and other presentations) to report conclusions, causal relationships and explanations of degree of trust in results.
I can use results to make predictions and identify when further observations, comparative and fair tests might be needed.	

### NATIONAL CURRICULUM OBJECTIVES

1. explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
2. identify the effects of air resistance, water resistance and friction, that act between moving surfaces
3. recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect

### MATHS AND SCIENCE ACROSS THE CURRICULUM – Data Handling and Statistics

Science NC: recording data and results of increasing complexity using scientific diagrams and labels, tables, line graphs

### KEY VOCABULARY

force, bend, twist, push, pull, tension, compression, gravity, Earth, air resistance, lift, drag, thrust, particles, water resistance, friction (high and low), mechanisms, simple machines, levers, pulleys, gears, Isaac Newton

'CORE' KNOWLEDGE	'ADDITIONAL' KNOWLEDGE
<p>1) I know that a force is a push, a pull, a bend or a twist that causes an object to start moving, stop moving, speed up, slow down or change direction. I know that this can lead to compression or tension.</p> <p><b>REVIEW: EVALUATE: BRIDGE ENGINEERS</b></p>	<p>a) I know that all forces come in pairs and no force works alone – just like I learnt in Y3 with magnets!</p> <p>b) I know that Isaac Newton said, 'For every action, there is an equal and opposite reaction.'</p> <p>c) I know that forces can make objects change shape and can give examples...  - When you <b>bend</b> an object's ends past each other, eg when an Olympic diver stands on the end of a diving board.  - When you <b>pull</b> an object's ends apart - eg when a rubber band is stretched.  - When <b>push</b> an object's ends together, eg when an empty drinks can is squashed.</p>
<p>2) I know that Isaac Newton is a famous physician of the 17<sup>th</sup> and 18<sup>th</sup> century (but his mother wanted him to be a farmer!).</p>	<p>a) I know that the famous story of an apple falling to the ground from a tree illustrates how Newton's work on gravity was inspired by things he observed in the world around him.</p> <p>b) I know gravity is an invisible force that acts at a distance, pulling objects toward each other - so, the closer objects are to each other, the stronger their gravitational pull is. Earth's gravity comes from all its mass. All its mass makes a combined gravitational pull on all the mass in your body</p> <p>c) I know that everything is pulled to the Earth by gravity. This causes unsupported objects to fall. I can demonstrate the effect of gravity acting on an unsupported object.</p> <p><b>REVIEW: Interpret and Report: ROCKET MICE</b>  <b>DO: Gather and record data: CRATERS</b></p>
<p>3) I know that friction is a contact force that acts between moving surfaces.</p>	<p>a) I can give examples of when it is useful to have high and low friction (like tread on tyres/road); and low friction (ice/snow and skis)</p> <p>b) I know that friction works in the opposite direction of movement and that the force acting on an object must be greater than friction for it to move. <b>PLAN: Set up enquiry: ZIPLINE TESTING</b></p> <p>c) I know some ways in which forces can affect movement. <b>REVIEW: Evaluate: MARBLE RUN– DT link</b></p>
<p>4) I know that air resistance is a type of friction between the air and another material. The object may be moving through the air or the air may be moving over a stationary object.</p>	<p>a) I can give examples of air resistance, like when an aeroplane flies through the air, the air particles hit the aeroplane and make it more difficult to move.</p> <p>b) I know that things can be made more aerodynamic to decrease air resistance and make it easier to travel through the air, or less aerodynamic to increase air resistance. I know how this can be done!</p> <p><b>PLAN: Ask questions and plan enquiry: PAPER PLANES</b>  <b>REVIEW: Interpret and Report: ROCKET MICE</b>  <b>DO: Observe and measure: SPINNERS (Making Parachutes – DT link)</b></p> <p>c) I know that lift, drag, gravity and thrust are some forces that act on an aeroplane. <b>PLAN: Ask questions and plan enquiry: PAPER PLANES</b></p>
<p>5) I know that water resistance is a type of force. The object may be moving through the water or the water may be moving over a stationary object.</p>	<p>a) I know that water resistance is a type of force that uses friction to slow things down that are moving through water. It is often called drag. <b>REVIEW: Evaluate: AQUADYNAMICS</b></p> <p>b) I know that swimming is an example of water resistance when there is friction between our skin and water particles.</p> <p>c) I know some ways to reduce water resistance/drag (like wearing swimming hats) and realise that certain sea creatures, like sharks, have evolved to be fast in the water.</p>
<p>6) Pulleys, levers and gears are all mechanisms, also known as simple machines.</p>	<p>a) I know that a mechanism is a device that allows a small force to be increased to a larger force. The pay back is that it requires a greater movement. I know an example of this is a crowbar or a bottle opener.</p> <p>b) I know that a pulley is a rope or wire wrapped around a wheel that changes the direction of force. A basic compound pulley has a rope or wire attached to a stationary point looped around one wheel and then around a second wheel. Pulling on the rope pulls the two wheels closer together.</p> <p>c) I know that a lever works by reducing the amount of force needed to move an object or lift a load. I can give an example – like how a seesaw works!</p> <p>d) I know that gears wheels with teeth that slot together. When one gear is turned the other one turns as well. If the gears are of different sizes, they can be used to increase the power of a turning force. The smaller wheel turns more quickly but with less force, while the bigger one turns more slowly with more force.</p>

**Possible 'higher order' questioning**

<b>Remember</b>	In what ways do human beings harness natural forces?
<b>Understand</b>	Can you order the following objects into their likely speed through the air? Justify your order. Where would you least like to ride your bike? Why?
<b>Apply</b>	How and why do levers work? What is it about levers that makes it lighter work for us?
<b>Analyse</b>	Why is it that less friction means objects travel faster?
<b>Evaluate</b>	What is the effect of adding greater air resistance to an object? How can this be mitigated by altering the object's shape?
<b>Create</b>	Can you plan a fair experiment to test what surface is best to run on?

