

Topic: Science	Year group	Term
Forces	Year 5	Autumn (7 weeks)

Background knowledge

A force causes an object to start moving, stop moving, speed up, slow down or change direction. Gravity is a force that acts at a distance. Everything is pulled to the earth by gravity. This causes unsupported objects to fall.

Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water, or the air and water may be moving over a stationary object.

A mechanism is a device that allows a small force to be increased into a larger force. The pay back is it requires a greater movement. The small force moves a long distance and the resulting large force moves a small distance e.g. a crowbar or bottle top remover. Pulleys, levers and gears are all mechanisms, also known as simple machines.

Common misconceptions.

Some children may think

- The heavier the object, the faster it falls because it has more gravity acting on them.
- Forces always act in pairs which are equal and opposite.
- Smooth surfaces have no friction.
- Objects always travel better on smooth surfaces.
- A moving object has a force which is pushing it forwards and it stops when the pushing force wears out.
- A non-moving object has no forces acting on it.
- Heavy objects sink and light objects float.

Reach out CPD forces and magnets Upper primary (4 units) is full of excellent background knowledge and practical ideas. There is information in these units on how to make balloon powered cars, bottle rockets or egg parachutes.

There are some really good ideas in "A creative approach to teaching science" by Nicky Waller including a carousel of gravity activities and a zip wire investigation to find out about friction.

What should I already know?

I can explore how shapes can be changed by squashing, bending, twisting and stretching. (Y2)

I can explore and describe how objects move on different surfaces. (Y3)

I can explain how some forces require contact and some do not giving examples.

I know magnets have 2 poles.

I can explore and explain when magnets attract and repel.

I can predict whether objects will be magnetic and carry out an enquiry to test this out.

I can use the terms attract, repel, magnetic and non- magnetic correctly.

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National Curriculum Objectives / Key Skills	The Journey
<u>Explain that unsupported objects fall towards the earth because of the force of gravity acting between the earth and the falling object.</u> <u>Identify the effects of air resistance, water resistance and friction that act between moving surfaces.</u> Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. I can explain what gravity is and its impact on our lives. I can identify and explain the effect of air resistance. I can identify and explain the effect of water resistance. I can identify and explain the effect of friction. I can explain how levers, pulleys and gears allow a smaller force to have a greater effect. I know how scientists help develop the theory of gravitation. <u>Scientific enquiry</u> <u>planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary</u> <u>taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate</u> <u>reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a</u>	1. Recap on different forces describing movement of objects, the forces acting on them and recognising pushes and pulls. 2. Investigate friction by moving objects across range of surfaces. Measure force in Newtons. 3. Introduce gravity as a force and consider the idea of "a world without gravity". Explore gravity through a range of activities identifying that objects fall to earth because of the force of gravity. Consider the work of Newton and Galileo 4. Introduce air resistance. Consider parachutes and explain the forces acting on them including force arrows. Consider the results from the investigation and identify the factors affecting air resistance. Make predictions and look at the effect of streamlining on air resistance e.g., throwing javelin, paper planes and rugby ball. 5. Identify examples of water resistance e.g. swimming baths and investigate the factors involved through dropping different shapes of playdough into and observing their movement through water or similar. 6. Look at and investigate levers, pulleys and gears, producing annotated diagrams to show how they work and explain how they allow a smaller force to have a greater effect.

degree of trust in results, in oral and written forms such as displays and other presentations recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. I can independently ask scientific questions to answer about the spinner/ parachutes. I can plan different types of scientific enquiry when investigating forces. I can recognise the variables involved in the parachute/ spinner investigation and start to control them. I can use the outcome of my spinner/ parachute investigation to make predictions about which shapes will have least air resistance and travel further. I can select appropriate practical resources from a selection to answer my question when investigating spinners/ parachutes. I can measure accurately using an increasing range of equipment including timers (parachutes/ spinners) and rulers/metre sticks (friction) I recognise the need for repeated readings in my friction investigation. I can report findings from enquiries in a range of ways. I can explain my findings using my subject knowledge. I can record data and results using scientific diagrams and labels (forces) and tables. I can read, spell and pronounce scientific vocabulary accurately	7. TAPs assessment - Spinner investigation posing question, changing one variable, making repeated readings and recording results. Children to select own equipment to use. Make repeated readings. During this topic, formative assessments will be made to identify gaps in the children's knowledge resulting from the pandemic. When gaps are identified, the activities will alter according to the key objectives the children need to be taught.
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Outcomes

An overview of what children will know / can do

Working towards: I know what gravity is and its impact on our lives. I can explain air resistance and how it and gravity work on parachutes. I can think of a question to investigate about air resistance with support. I can recognise whether a test is fair or not. I can make repeated readings, record my results in a table or bar chart and talk about what they show. I can recognise the effect of stream lining in terms of air and water resistance. I can state examples of low and high friction. I can give examples of levers, pulleys and gears and know how they are useful.

Expected: I can explain what gravity is and its impact on our lives. I can explain air resistance and explain how it and gravity work on parachutes using force arrows correctly. I can think of a question to investigate about air resistance. I can recognise variables and know how to devise a fair test. I can make repeated readings, record my results clearly in a table or bar chart and explain what they show. I can explain the effect of stream lining in terms of air and water resistance. I can state examples of low and high friction. I can give examples of levers, pulleys and gears and explain how they work.

Exceeding: I can clearly explain what gravity is and its impact on our lives. I can explain air resistance and how it and gravity work on parachutes using force arrows correctly varying their size to show the amount of force. I can confidently think of a question to investigate about air resistance. I can recognise variables and can independently devise a fair test. I can make repeated readings, explaining why they are necessary and record my results clearly in a table or bar chart and explain what they show using scientific vocabulary. I can confidently explain the effect of stream lining in terms of air and water resistance. I can state examples of low and high friction explaining why friction is important. I can give examples of levers, pulleys and gears and explain how they work allowing a smaller force to move a greater load.

Key Vocabulary	Timeline / Diagrams
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Air resistance; a force that acts between a moving object and the air molecules round it, slowing the object down. Parachutes create lots of air resistance, slowing down the parachutist as they fall through the air.

Balanced force; Two forces acting on an object that are equal in size but act in opposite directions.

Force; a push or pull or a combination of this such as a twist. A force can cause an object to speed up, slow down or change shape.

Friction; a force between two surfaces when they rub together. Friction creates heat and always slows down an object. Rough surfaces create more friction than smooth surfaces.

Gravity; The force that pulls objects towards the earth.

Magnetic poles- The ends of the magnet when its magnetic force is strongest.

Mass- the amount of material or "matter" in an object, measured in kg. The mass of an astronaut is the same on earth as it would be in space.

Matter; anything that physically occupies space and has mass.

Newton; a unit of force.

Pulley; a wheel with a grooved rim around which a rope or chain passes. They are simple machines used to move large objects up or down with a small amount of force.

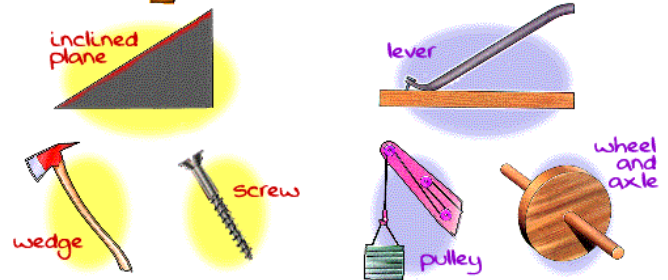
Streamlining; designing an object in a particular way so that amount of air/ water resistance is reduced. Streamlined shapes push air or water around them so they can travel faster.

Upthrust; The upward force that a liquid or gas exerts on a body floating in it.

Water resistance; a friction force that acts on a moving object as it travels through water, slowing the object down.



Simple Machines



Weight; the force acting on an object due to gravity. Causal relationship- a relationship between two variables. Conclusion- explanation of results. Fair test- an investigation changing only one variable and keeping the others the same. Repeated readings- Taking several readings to ensure results are accurate. Variable- A quantity or condition that can be changed.	
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Key people / places
Isaac Newton- laws of motion. "Give me a place to stand and a lever long enough and I will move the world" Archimedes. Galileo- Tower of Pisa STEM careers; Marine engineer, automotive engineer, aeronautical engineer.

Assessment questions / outcomes
What is a force? What is friction? Can you explain what gravity is? Draw the forces acting on a parachute and explain their effect to a friend. What is water resistance? Explain how a lever works. Give an example of a pulley and gear. TAPs assessment

