



Year Three – Forces – Forces and magnets

National Curriculum Objectives:

- Compare how things move on different surfaces.
- Know how a simple pulley works and use making lifting an object simpler
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract and 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.

Non statutory: Pupils should observe that magnetic forces can act without direct contact, unlike most forces, where direct contact is necessary (for example, opening a door, pushing a swing). They should explore the behaviour and everyday uses of different magnets (for example, bar, ring, button and horseshoe). Pupils might work scientifically by: comparing how different things move and grouping them; raising questions and carrying out tests to find out how far things move on different surfaces and gathering and recording data to find answers their questions; exploring the strengths of different magnets and finding a fair way to compare them; sorting materials into those that are magnetic and those that are not; looking for patterns in the way that magnets behave in relation to each other and what might affect this, for example, the strength of the magnet or which pole faces another; identifying how these properties make magnets useful in everyday items and suggesting creative uses for different magnets.

Inspiring science key ideas:

- Compare how some 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.

Working scientifically

- Comparing how different things move and grouping them.
- Raising questions and carrying out tests to find out how far things move on different surfaces and gathering and recording data to find answers to their questions.
- Exploring the strengths of different magnets and finding a fair way to compare them.
- Sorting materials into those that are magnetic and those that are not.
- Looking for patterns in the way that magnets behave in relation to each other and what might affect this, for example, the strength of the magnet or which pole faces another.
- Identifying how these properties make magnets useful in everyday items and suggesting creative uses for different magnets.

Prior learning	Key Learning – What the pupils need to know		Vocabulary
<p>In Year 2:</p> <ul style="list-style-type: none"> • No Forces National Curriculum objectives in KS1. • May have an awareness of how to make things stop and start. 	<ul style="list-style-type: none"> • What materials are attracted to magnets? • When/where are magnets useful? • How strong are magnets? • Are all magnets the same strength? • Will a magnet attract plastic covered paperclips? • What if everything was magnetic? • How can we make it move? • How can we stop things? • How can we change the movement? • How can we slow down a moving object? • Do different surfaces make a difference? • What if we could only push but not pull? 	<ul style="list-style-type: none"> • What magnets do. Magnets exert attractive forces on some metals. • Magnets don't need to touch. Magnetic forces work through other materials including air, so magnets don't need to be touching to exert their force. It is called a non-contact force • Magnets attract and repel. Each end of a magnet is called a pole, opposite poles are called north and south. Magnets exert attractive forces on each other when the poles facing each other are north and south (opposites). Magnets exert repulsive forces on each other when the poles facing each other are the same. • Chapter 4: What affects magnetic strength? The strength of magnetic forces are affected by: The strength of the magnet. The distance between the magnet and the object. The material the object is made from. 	<p>Move, movement: fly, bounce, slide, spin, roll, swirl, swing, forward, backward, upwards, downwards, faster, slower, accelerate, decelerate, ramp, incline</p> <p>push, pull, squeeze, springy, attract, repel, magnetic, non-magnetic, attraction, repulsion, names of common metals (e.g. iron, copper, aluminium), poles, horseshoe magnet, bar magnet, ring magnet, button magnet</p> <p>Stronger / weaker, best / worse</p>
<p>In Year 5:</p> <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 and the impact of gravity on our lives. • Identify the effects of air resistance, water resistance and friction, which act between moving surfaces • Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. • 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
- Describe the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.



Year Five – Forces – Friction, Air/Water Resistance, Gravity – Levers and pulleys

National Curriculum Objectives:

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- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object and the impact of gravity on our lives.
- Identify the effects of air resistance, water resistance and friction, which act between moving surfaces.
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Non statutory: Pupils should explore falling objects and raise questions about the effects of air resistance. They should explore the effects of air resistance by observing how different objects such as parachutes and sycamore seeds fall. They should experience forces that make things begin to move, get faster or slow down. Pupils should explore the effects of friction on movement and find out how it slows or stops moving objects, for example, by observing the effects of a brake on a bicycle wheel. Pupils should explore the effects of levers, pulleys and simple machines on movement. Pupils might find out how scientists, for example, Galileo Galilei and Isaac Newton helped to develop the theory of gravitation. Pupils might work scientifically by: exploring falling paper cones or cup-cake cases, and designing and making a variety of parachutes and carrying out fair tests to determine which designs are the most effective. They might explore resistance in water by making and testing boats of different shapes. They might design and make products that use levers, pulleys, gears and/or springs and explore their effects.

Inspiring science key ideas:

- **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.**
 - There are different types of forces (push, pull, friction, air resistance, water resistance, magnetic forces, gravity).
 - Gravity can act without direct contact between the Earth and an object.
 - Friction, air resistance and water resistance are forces which slow down moving objects.
 - Friction, air resistance and water resistance can be useful or unwanted.
 - The effects of friction, air resistance and water resistance can be reduced or increased for a preferred effect .
 - More than one force can act on an object simultaneously (either reinforcing or opposing each other).

Working scientifically

- Exploring falling paper cones or cup-cake cases and designing and making [exploring] a variety of parachutes and carrying out fair tests to determine which designs are the most effective.
- Exploring resistance in water by making and testing boats of different shapes.
- Design and make artefacts that use simple levers, pulleys, gears and/or springs and explore their effects.
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<u>Prior learning</u>	<u>See light and astronomy unit to link ideas to gravity.</u> (Force exerted by magnets may also be briefly revised from prior learning met in year 3). Teaching about up-thrust is no longer a statutory requirement in UKS2.	<u>Key Learning – What the pupils need to know</u>		<u>Vocabulary</u>
In Year 3: <ul style="list-style-type: none"> • Compare how things move on different surfaces. • Know how a simple pulley works and use making lifting an object simpler • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. • Observe how magnets attract and 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 	Air resistance and water resistance are forces against motion caused by objects having to move air and water out of their way. b) Friction is a force against motion caused by two surfaces rubbing against each other. c) Some objects require large forces to make them move; gears, pulley and levers can reduce the	1: Water and air resistance. <ul style="list-style-type: none"> • When objects move through air and water they have to push it out of the way. The water and air push back with forces called water resistance and air resistance. The harder it is to push the material out of the way the greater the resistance. • Gases weigh less than liquids and so water resistance is greater than air resistance 	Friction. <ul style="list-style-type: none"> • Friction is a force against motion caused by two surfaces rubbing against each other. It occurs because no surfaces are perfectly smooth; they have bumps and undulations that can interlock when placed on top of each other. 	Friction, air resistance, water resistance, forcemeter, Newtons, surface area, gravity, movement, between surfaces Push, pull, friction, air resistance, water resistance, magnetic forces, gravity, newton, force-meter



<p>whether two magnets with attract or repel each other, depending on which poles are facing.</p>	<p>force needed to make things move.</p>	<ul style="list-style-type: none"> To move one interlocking surface over another one of three things must happen: 1. The surfaces must rise slightly 2. The bumps on the surface must bend 3. The bumps on the surface must break all of these actions requires a force, this is what causes friction. <p>Managing forces. Levers and pulleys – After exploring the different types of forces in the ‘Friction, air resistance and water resistance’ (including push, pull, and gravity too) children could be given the opportunity to apply their learning. Children to consider forces working together and simple machines and mechanisms. A focus for this unit can be recording forces working together diagrammatically.</p> <p>Some objects require large forces to make them move; gears, pulley and levers can reduce the force needed to make things move.</p>	<p>Direction arrows, size arrows, balanced, unbalanced, force diagram, effect of a force</p> <p>Move, speed up, faster, accelerate, slow down, slower, decelerate, stop, still, stationary, at rest, not moving</p>
<p>In KS3:</p> <ul style="list-style-type: none"> opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) change depending on direction of force and its size. 			