GOLDSBOROUGH SICKLINGHALL FEDERATION

INSPIRE NURTURE BELIEVE ACHIEVE

*Working **together** to be the **best** that we can be.*

Happiness	Perserverance	Resilience	Kindness	Friendship	Respect

Science: Forces and Magnets Progression of Skills and Milestones Document

Year 3
Forces and Magnets

- **compare how things move on different surfaces**
- **notice that some forces need contact between 2 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 2 poles**
- **predict whether 2 magnets will attract or repel each other, depending on which poles are facing**

Notes:

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 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.

Key Vocabulary	Common Misconceptions
Force, push, pull, twist, contact force, non-contact force, magnetic force, magnet, strength, bar magnet, ring magnet, button magnet, horseshoe magnet, attract, repel, magnetic material, metal, iron, steel, poles, north pole, south pole	Some children may think: • the bigger the magnet the stronger it is • all metals are magnetic.

Activities	Possible Evidence
• Carry out investigations to explore how objects move on different surfaces e.g. spinning tops/coins, rolling balls/cars, clockwork toys, soles of shoes etc. • Explore what materials are attracted to a magnet. • Classify materials according to whether they are magnetic. • Explore the way that magnets behave in relation to each other. • Use a marked magnet to find the unmarked poles on other types of magnets. • Explore how magnets work at a distance e.g. through the table, in water, jumping paper clips up off the table. • Devise an investigation to test the strength of magnets. *TAPS practical assessments to be used at the end of each unit.*	• Can give examples of forces in everyday life • Can give examples of objects moving differently on different surfaces • Can name a range of types of magnets and show how the poles attract and repel • Can draw diagrams using arrows to show the attraction and repulsion between the poles of magnets • Can use their results to describe how objects move on different surfaces • Can use their results to make predictions for further tests e.g. it will spin for longer on this surface than that, but not as long as it spun on that surface • Can use classification evidence to identify that some metals, but not all, are magnetic • Through their exploration, they can show how like poles repel and unlike poles attract, and name unmarked poles • Can use test data to rank magnets *Concept Cartoons' and 'Exit Cards' to be used at the end of lessons to assess understanding.*

Lower Key Stage 2 Working Scientifically

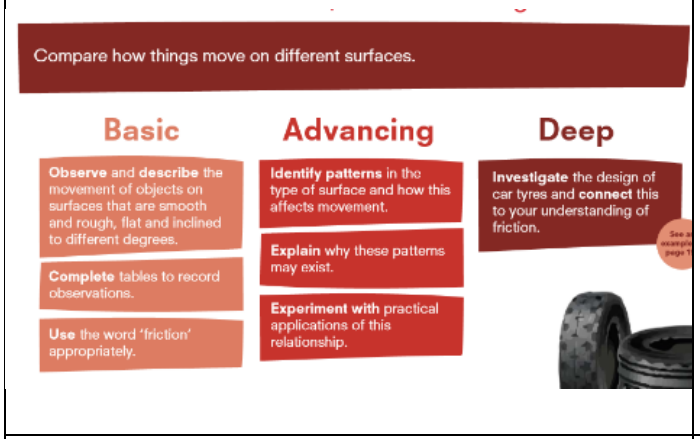
- **Setting up simple practical enquiries, comparative and fair tests**

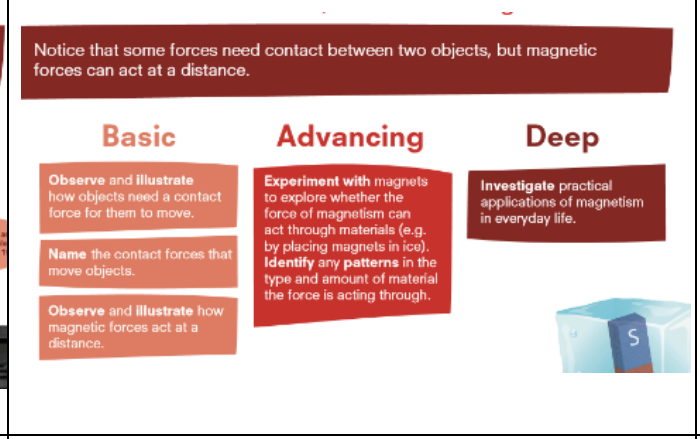
The children select from a range of practical resources to gather evidence to answer questions generated by themselves or the teacher. They follow their plan to carry out: observations and tests to classify; comparative and simple fair tests; observations over time; and pattern seeking.

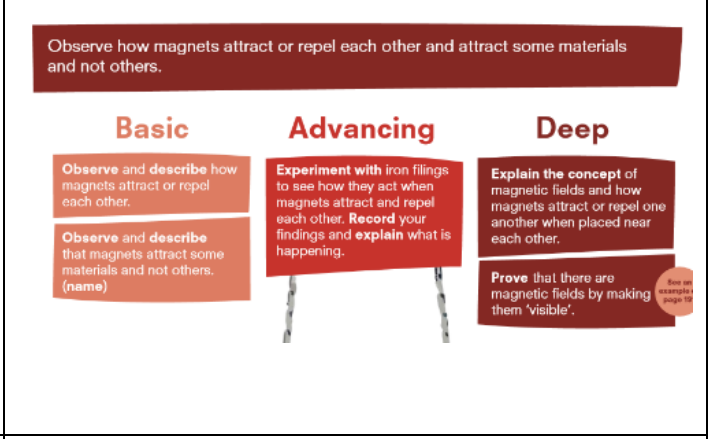
Explanatory note
A comparative test is performed by changing a variable that is qualitative e.g. the type of material, shape of the parachute. This leads to a ranked outcome.

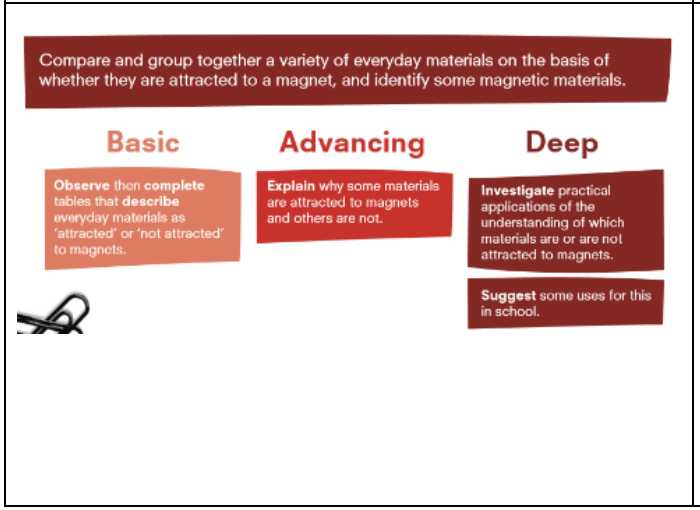
A fair test is performed by changing a variable that is quantitative e.g. the thickness of the material or the area of the canopy. This leads to establishing a causative relationship.

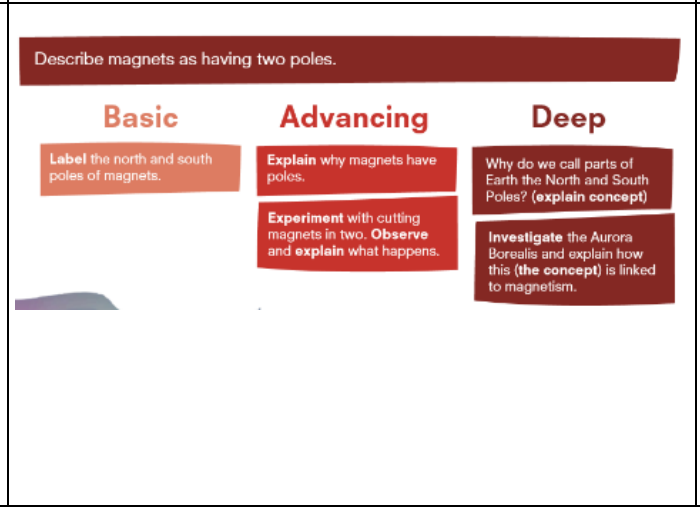
Proof of Progress (Working Towards, Age Related Expectation or Greater Depth)

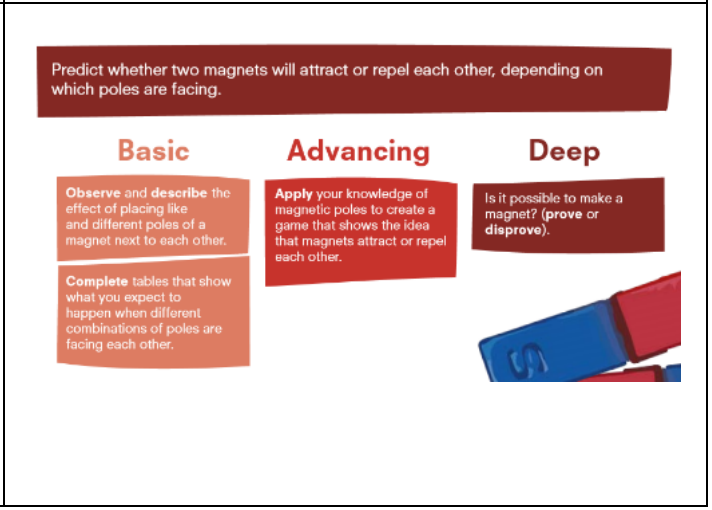












End of Lower Key Stage 2 Age Related Expectations

Milestone indicator	Basic	Advancing	Deep
Compare how things move on different surfaces.	**Observe** and **describe** the movement of objects on surfaces that are smooth and rough, flat and inclined to different degrees. **Compete** tables to record observations. **Use** the word friction appropriately.	**Identify patterns** in the type of surface and how this affects movement. **Explain** why these patterns may exist. **Experiment with** practical applications of this relationship.	**Investigate** the design of car tyres and **connect** this to your understanding of friction.
Notice that some forces need contact between two objects, but magnetic forces can act at a distance.	**Observe** and **illustrate** how objects need a contact force for them to move. **Name** the contact forces that move objects. **Observe** and **illustrate** how magnetic forces act at a distance.	**Experiment with** magnets to explore whether the force of magnetism can act through materials (such as placing magnets in ice, etc.) **Identify** any **patterns** in the type and amount of material the force is acting through.	**Investigate** practical applications of magnetism in everyday life.
Observe how magnets attract or repel each other and attract some materials and not others.	**Observe** and **describe** how magnets attract or repel each other. **Observe** and **describe** that magnets attracts some (**name**) materials and not others.	**Experiment with** iron filings to see how they act when magnets attract and repel each other. **Record** your findings and **explain** what is happening.	**Explain the concept** of magnetic fields and how magnets attract or repel one another when placed near each other. **Prove** that there are magnetic fields by making them 'visible'
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.	**Observe** then **complete** tables that **describe** everyday materials as 'attracted' or 'not attracted' to magnets.	**Explain** why some materials are attracted to magnets and others are not.	**Investigate** practical applications of the understanding of which materials are or are not attracted to magnets. **Suggest** some uses for this in school.
Describe magnets as having two poles.	**label** the north and south poles of magnets.	**Explain** why magnets have poles. **Experiment with** cutting magnets in two. **Observe** and **explain** what happens.	Why (**explain concept**) do we call parts of Earth the North and South poles? **Investigate** the Aurora Borealis and explain (**the concept**) how this is linked to magnetism.
Predict whether two magnets will attract or repel each other, depending on which poles are facing.	**Observe** and describe the effect of placing like and different poles of a magnet next to each other. **Complete** tables that show what you expect to happen when different combinations of poles are facing each other.	**Apply** your knowledge of magnetic poles to create a game that uses the idea that magnets attract or repel each other.	Is it possible (**suggest**) to make a magnet? **Prove** or **disprove** this. .

Year 5
Forces and Magnets

- 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

Notes:

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 cupcake 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.

Key Vocabulary	Common Misconceptions
Force, gravity, Earth, air resistance, water resistance, friction, mechanisms, simple machines, levers, pulleys, gears	Some children may think: • the heavier the object the faster it falls, because it has more gravity acting on it • 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.
Activities	**Possible Evidence**
• Investigate the effect of friction in a range of contexts e.g. trainers, bathmats, mats for a helter-skelter. • Investigate the effects of water resistance in a range of contexts e.g. dropping shapes through water and pulling shapes, such as boats, along the surface of water. • Investigate the effects of air resistance in a range of contexts e.g. parachutes, spinners, sails on boats. • Explore how levers, pulleys and gears work. • Make a product that involves a lever, pulley or gear. • Create a timer that uses gravity to move a ball.	• Can demonstrate the effect of gravity acting on an unsupported object • Can give examples of friction, water resistance and air resistance • Can give examples of when it is beneficial to have high or low friction, water resistance and air resistance • Can demonstrate how pulleys, levers and gears work • Can explain the results of their investigations in terms of the force, showing a good understanding that as the object tries to move through the water or air or across the surface the particles in the water, air or on the surface slow it down • Can demonstrate clearly the effects of using levers, pulleys and gears

• Research how the work of scientists such as Galileo Galilei and Isaac Newton helped to develop the theory of gravitation. *TAPS practical assessments to be used at the end of each unit.*	*Concept Cartoons' and 'Exit Cards' to be used at the end of lessons to assess understanding.*

Upper Key Stage 2 Working Scientifically

- **Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.**
- **Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.**

Children independently ask scientific questions. This may be stimulated by a scientific experience or involve asking further questions based on their developed understanding following an enquiry. Given a wide range of resources the children decide for themselves how to gather evidence to answer a scientific question. They choose a type of enquiry to carry out and justify their choice. They recognise how secondary sources can be used to answer questions that cannot be answered through practical work. The children select from a range of practical resources to gather evidence to answer their questions. They carry out fair tests, recognising and controlling variables. They decide what observations or measurements to make over time and for how long. They look for patterns and relationships using a suitable sample.

The children select measuring equipment to give the most precise results e.g. ruler, tape measure or trundle wheel, force meter with a suitable scale. During an enquiry, they make decisions e.g. whether they need to: take repeat readings (fair testing); increase the sample size (pattern seeking); adjust the observation period and frequency (observing over time); or check further secondary sources (researching); in order to get accurate data (closer to the true value).

Proof of Progress (Working Towards, Age Related Expectation or Greater Depth)

Describe magnets as having two poles.

Note: this standard also appears in Milestone 2 and the tasks here are replicated.

Basic	Advancing	Deep
Label the north and south poles of magnets.	**Explain** why magnets have poles.	Why do we call parts of Earth the North and South Poles? **(explain concept)**
	Experiment with cutting magnets in two. **Observe** and **explain** what happens.	**Investigate** the Aurora Borealis and explain how this **(the concept)** is linked to magnetism.

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

Basic	Advancing	Deep
Observe and **describe** the effect of the force of gravity.	**Interpret data** about the rate that different materials fall towards Earth. Summarise your findings.	Which will reach Earth first if dropped from the same height: 1kg of feathers or 1kg of steel? **(explain concepts)**

Identify the effect of drag forces such as air resistance, water resistance and friction that act between moving surfaces.

Basic	Advancing	Deep
Observe and **describe** the effect of air resistance.	**Apply** your knowledge of friction to positive applications. Explain your ideas.	**Relate** the size of a drag force to the size of the object it is acting on.
Observe and **describe** the effect of water resistance.		
Observe and **describe** the effect of friction.		
Describe these forces as drag forces.		

Describe, in terms of drag forces, why moving objects that are not driven tend to slow down.

Basic	Advancing	Deep
Observe and **describe** how objects tend to slow down because of drag forces.	**Apply** your knowledge of drag forces to some positive applications.	**Always, sometimes or never?** The slowing effect of drag forces can be overcome if an object is driven.* **(explain concept, make generalisations)**

Understand that force and motion can be transferred through mechanical devices such as gears, pulleys, levers and springs.

Note: we recommend linking this indicator to mechanical systems in Design and Technology.

Basic	Advancing	Deep
Observe and **describe** how forces and motion can be transforred through gears, pulleys, levers and springs.	**Apply** your knowledge of forces and movement to make a working mechanism.	Can a rotary motion be changed into a linear (up and down) motion? **(prove** or **disprove)**
Label the forces and **draw** the directions in which they transfer.		

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

Note: we recommend linking this standard to mechanical systems in Design and Technology.

Basic	Advancing	Deep
Observe and **describe** the effect of changing gears on a bicycle.	**Apply** your knowledge of gears, pulleys and levers to **demonstrate** and **explain** how a small force can have a greater effect.	Using a pulley allows a small force to have a greater effect but increases the amount of pulls one has to make. Make **generalisations** about the **relationship** between forces and effect.*
Observe and **describe** the effect of using a lever to try to move a heavy object (e.g. to lift the teacher).		
Observe and **describe** the effect of using a pulley, or geared pulleys to lift heavy objects.		

*Emphasise continuous variables where the comparative degrees end in **er**.

End of Upper Key Stage 2 Age Related Expectations

Milestone indicator	Basic	Advancing	Deep
Describe magnets as having two poles. * Note - this indicator also appears in Milestone 2 and the tasks here are replicated.	**label** the north and south poles of magnets.	**Explain** why magnets have poles. **Experiment with** cutting magnets in two. **Observe** and **explain** what happens.	Why **(explain concept)** do we call parts of Earth the North and South poles? **Investigate** the Aurora Borealis and explain **(the concept)** how this is linked to magnetism.
Predict whether two magnets will attract or repel each other, depending on which poles are facing. * Note - this indicator also appears in Milestone 2 and the tasks here are replicated.	**Observe** and describe the effect of placing like and different poles of a magnet next to each other. **Complete** tables that show what you expect to happen when different combinations of poles are facing each other.	**Apply** your knowledge of magnetic poles to create a game that uses the idea that magnets attract or repel each other.	Is it possible **(suggest)** to make a magnet? **Prove** or **disprove** this. .
Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.	**Observe** and **describe** the effect of the force of gravity.	**Interpret data** about the rate that different materials fall towards Earth. Summarise you findings.	Which will reach Earth first if dropped from the same height: 1kg of feathers or 1kg of steel? **(explain concepts)**
Identify the effect of drag forces, such as air resistance, water resistance and friction that act between moving surfaces.	**Observe** and **describe** the effect of air resistance. **Observe** and **describe** the effect of water resistance. **Observe** and **describe** the effect of friction. **Describe** these forces as drag forces.	**Apply** your knowledge of friction to positive applications. Explain your ideas.	**Relate** the size of a drag force to the size of the object it is acting on.
Describe, in terms of drag forces, why moving objects that are not driven tend to slow down.	**Observe** and **describe** how objects tend to slow down because of drag forces.	**Apply** your knowledge of drag forces to some positive applications.	**Always, sometimes or never**: the slowing effect of drag forces can be overcome if an object is driven. **(explain concept, make generalisations)** (emphasising continuous variables noted by the use of comparative degrees ending in **er**)
Understand that force and motion can be transferred through mechanical devices such as gears, pulleys, levers and springs. Note: we recommend linking this indicator to mechanical systems in Design Technology.	**Observe** and **describe** how forces and motion can be transferred through gears, pulleys, levers and springs. **Label** the forces and **draw** the directions in which they transfer.	**Apply** your knowledge of forces and movement to make a working mechanism.	Can **(suggest)** a rotary motion be changed into a linear (up and down) motion? **Prove** or **disprove** this.
Understand that some mechanisms including levers, pulleys and gears, allow a smaller force to have a greater effect. Note: we recommend linking this indicator to mechanical systems in Design Technology.	**Observe** and **describe** the effect of changing gears on a bicycle. **Observe** and **describe** the effect of using a lever to try to move a heavy object (e.g. lifting the teacher) **Observe** and **describe** the effect of using a pulley, or geared pulleys to lift heavy objects.	**Apply** your knowledge of gears, pulleys and levers to **demonstrate** and **explain** how a small force can have a greater effect.	Using a pulley allows a small force to have a greater effect but increases the amount of pulls one has to make. Make **generalisations** about the **relationship** between forces and effect. (emphasising continuous variables noted by the use of comparative degrees ending in **er**)