Year 3 Magnets and Forces

Background knowledge
This unit follows on from the materials topic in year 2 where the children have investigated how the forces of squashing, bending, stretching and twisting can change the shape of some materials. It can be taught in a range of contexts e.g. children helping a toy manufacturer as toyologists (a scientist who is involved in the manufacture of toys). A force is a push or a pull. When an object moves on a surface, the texture of the surface and the object affects how it moves. It may help the object move better or hinder its movement e.g. ice skater as opposed to walking on ice in normal shoes. A magnet attracts magnetic material, iron and nickel and other materials containing these e.g. stainless steel are magnetic. The strongest parts of the magnet are the poles. Magnets have 2 poles- a North and South pole. If two like poles are brought together, they will push away from each other (repel). If two unlike poles are brought together, they will pull together (attract). For some forces to act, there must be contact e.g. a hand opening a door. Some forces can act at a distance e.g. magnetism. The magnet does not need to touch the objects it attracts. <u>Common misconceptions.</u> ● The bigger the magnet, the stronger it is. ● All metals are magnetic.

Other useful sources of information
NB – keep magnets away from electronic/computer equipment Ensure children know to avoid dropping magnets (to maintain magnetic force in a magnet) and how to store magnets correctly to maintain magnetism BBC Bitesize

Magnetic putty (available from Amazon aprox £5 for small tin)

http://www.lovemyscience.com/cat_magnetic.html

https://explorify.uk/teaching-support/teaching-science/forces-tackle-the-tricky-bits

https://babbledabbledo.com/fun-science-experiments-magnet-magic/ for further ideas

What children should already know/can do
• I can explore how shapes can be changed by squashing, bending, twisting and stretching.

National curriculum objectives	**Children's objectives**
• Compare how things move on different surfaces. • Notice that some forces need contact between 2 objects, but magnetic forces 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. • Predict whether 2 magnets will attract or repel each other, depending on which way the poles are facing.	• I can explore and describe how objects move on different surfaces. • 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.
<u>Scientific enquiry</u> • setting up simple practical enquiries, comparative and fair tests	• I can set up a simple scientific enquiry to find out which is the strongest magnet.

• making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers • recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables • reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	• I can set up a test to compare the strength of magnets and say if a test is fair. • I can make a prediction about the strongest magnet giving a reason why. • I can make accurate observations. • I can make accurate measurements. • I can sort and classify objects into magnetic and non-magnetic. • I can use different methods to represent my data including, labelled diagrams, tables and simple bar charts. • I can use and spell appropriate scientific language. • I can explain my findings both orally and in writing. • I can draw simple conclusions

Assessment
Mime a push. Mime a pull. What direction does the force move? Can I move the car across the floor without touching it? What type of force will I need to move it away from me? Towards me? Is it easier to push a car on a smooth or rough surface? Why do you think that? Think of an example where there is low friction and one where there is high friction. Sort the materials into magnetic and non- magnetic. What did you notice? What happens when you put 2 magnets together if the poles are the same? If they are different? How could we find out which of these magnets is the strongest? How would we know? Was the strongest magnet the one you predicted? Why might this be? How do magnets help sort cans in recycling?

Working towards	**ARE**	**Exceeding**
I can recognise some push and pulls as forces. I can observe how things move on different surfaces. I can make measurements with support recording them in tables. I can sort materials into magnetic and non-magnetic. I can explain what happens when I put 2 magnets together. I can start to plan an investigation to	I recognise push and pulls as forces. I can compare how things move on different surfaces. I can make accurate measurements recording them in tables and bar charts stating what they show. I can sort materials into magnetic and non- magnetic using the correct terms. I	I recognise push and pulls as forces recognising the direction of the force. I can compare how things move on different surfaces and explain my ideas using the word friction. I can make accurate measurements recording them in tables and bar charts

determine the strongest magnet and state which is the strongest. I can state some uses of magnets.	can explain what happens when I put 2 magnets together using the terms attract and repel. I can suggest an investigation to determine the strongest magnet and explain my findings. I can state some uses of magnets	stating clearly what they show. I can sort materials into magnetic and non- magnetic using the correct terms. I can explain what happens when I put 2 magnets together using the terms poles, attract and repel. I can plan a fair test to determine the strongest magnet and explain my findings clearly. I can state some uses of magnets explaining how they work.

Key vocabulary	
Attract- to pull towards. Contact force- forces that act when 2 objects touch each other e.g. friction. Friction- the resistance of movement when there is a contact between 2 surfaces. Force- a push or a pull or a combination of these. Gravity- The force which pulls objects towards the earth. Magnet- a piece of rock or metal that can pull certain types of metals towards it. Magnetic field- the area around the magnet in which there is a magnetic force. Magnetic material- a material that is attracted to a magnet. Motion- moving from one place to another. Non- contact force- forces that don't need contact e.g. magnetism. Non- magnetic- a material that isn't attracted by a magnet. Pole- the end of a magnet where the magnet force is strongest. Repel- to push away. Resistance- a force which slows down a moving object or vehicle.	Bar chart – a way of displaying information Classify- sort into groups according to properties. Conclusion; To look at our results and explain what we have found out. Investigation – to find something out Measure – to see find out the amount something is. Observe – to look at something closely Predict – to say what you think might happen Result – what we have found out

Character opportunities	Possible STEM careers linked to unit
Curiosity and critical thinking(finding out about the world around us) Ambition and self motivation (finding solutions)	Aeronautical engineer (dsigns, develops and maintains aircraft) Pilot (pilt planes) Astronomer (studies space) Astrophysicist (studies the physics of space and objects in space)

Objectives	Working Scientifically	Lesson Objectives	Activities
Magnetism			
To observe how magnets attract or repel each other and attract some materials and not others	Ask questions Make observations Use results to draw simple conclusions	To understand that magnets exert a force. Observe how magnets attract some materials c not others Begin to understand that a magnetic force can act at a distance	Creative starter – Tie a paper clip to a piece of thread which should then be taped to a table. Using a strong magnet, lift the pap clip until it is suspended above the table attached to magnet with the thread taught. Ask children what will happen if you lift the magnet higher. Seek answers and reasons for these. If you lift the magnet higher, the paperclip *should* still float in mid air. How does this happen?
To observe how magnets attract or repel each other and attract some materials and not others To describe magnets as having 2 poles To predict whether 2 magnets will attract or repel depending on facing poles	\Using straightforward scientific evidence to answer questio or to support findings Make decisions on what observations to make	To know a magnet is attracted and repelled by another magnet Use the terms attract and repel correctly	Use magnets to experience the forces of attraction with different materials. Using pairs of magnets, explore what happens when like poles and unlike poles are put together .
Notice that some forces need contact but magnetic forces can act at a distance To observe how magnets attract and repel each other and attract some materials and not others	Setting up simple practical enquiries, comparative and fair te Making decisions about what observations to make	To know that magnets can be tested for streng	Plan an investigation to test the strength of magnets.
To observe how magnets attract and repel each other and attract some materials and not others To compare and group a variety of everyday materials on the asis of whether they are attracted to a magnet and identify some magnetic materials	Gathering, recording, classifying and presenting data in a variety of ways to help answer questions Record findings using simple scientific language, drawings, labelled diagrams, bar charts and tables	To investigate whether magnets will work through a variety of materials	Plan an investigation to test which materials magnets will work through (See Scholastic resource book for ideas for recording)
To observe how magnets attract and repel each other and attract some materials and not others	Identify differences, similarities or changes related to simpl scientific ideas and processes Making accurate measurements using standard units using a range of equipment Recognising when and how secondary sources might help to answer questions	To know that magnets have uses	Investigate the use of magnets and super magnets in everyday life including the use of a compass to tell us direction
Forces			
To find out how the shapes of objects made from some materials c be changed by squashing, bending, twisting and stretching To notice that some forces need contact between 2 objects but th some forces can act at a distance.	Ask relevant questions Record findings using simple scientific language, drawings and lableed diagrams, keys bar charts and tables	To review the action of sliding, rolling falling, flying, walking and running To know that forces can make moving objects g faster, slow down, change direction or change shape	Use a concept map to elicit ideas on forces and ideas on how things move. Create class collage of annotated drawings to show the different ways things move
To notice that some forces need contact between 2 objects but th some forces can act at a distance.	Ask relevant questions Record findings using simple scientific language, drawings and labeled diagrams, keys bar charts and tables	To now the different types of forces To identify pushes, pulls and twists as example of forces in action	Look at examples of toys/PE equipment that require a force, a push, pull or a twist to operate them.

Gravity

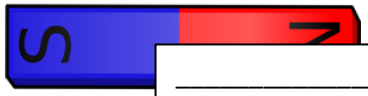
Children understand that there is a force called gravi	Using straightforward evidence to answer scientific question or to support their ideas		*Issaac Newton and the apple falling from the tree: Why does the apple fall downwards and not sideways or upwards?* *Talking points: (give each group a statement to discuss and they have to come to an agreement)* *The apple falls down because it is tired* *There is an invisible force that pulls the apple down* *The wind blew the apple to the ground* *Nothing makes the apple fall it is just something they do* *Birds push apples to the ground* *The apple would fall upwards in Australia* *It falls to the ground because it is heavy* *If the apple were lighter it would fall upwards* *Groups then negotiate a definition of the word gravity*
Children begin to understand the concept of the forc of gravity	*Learn to use new equipment* *Make careful observations and take accurate measurements ways* *Presenting data in a variety*	*Children can measure the pull of gravity using forcemeters using the unit Newtons* *Weight is caused by the pull of gravity*	*Children estimate and measure the force of gravity of apples and various items using forcemeters (newtonmeters)* *Present information in a barchart/table*
Children begin to understand the concept of the forc of gravity	*Asking questions* *Make predictions* *Make careful observations and taking measurements*		*Do heavier objects fall faster than lighter ones?* *How could children test?* *Drop tennis ball and piece of paper. Ball falls first. Do children recognise that paper creates air resistance due to flat shape.* *Screw paper up into ball roughly size f ball. Repeat test (ball and paper should fall at roughly like speed.* *Discuss reason for paper initially falling slower – acting like a parachute* *Do all objects fall at same rate? Children can set up own tests using different objects*

Friction

See ideas from scout association below to support ideas
https://www.scoutactivitycentres.org.uk/wp-content/uploads/2014/01/frictionTeachingIdeas.pdf

Children recognise that there are forces between objects		Cildren understand that friction is caused between two surfaces but this is different depending on type of surface	Ask children to rub hands together quickly and for aprox 1 minute. What do they feel (warmth
Children recognise that there are forces between objects	*Asking questions* *Make predictions* *Make careful observations and taking measurements* Setting up enquiries comparative and fair tests Making systematic and careful observations and where appropriate, taking careful observations Using results to draw conclusions Reporting from findings from enquiries including oral and written explanations, displays or presentations of results and conclusions	Cildren understand that friction is caused between two surfaces but this is different depending on type of surface	Discuss the use of different materials for 'grippiness'. Look at shoe treads – especially trainers. Why do we ask children to wear sandshoes/trainers for PE? Test the slippiness of different shoes on a surface Compare the movement of the same object on different surfaces How are things made more slippery – ice, oil consider safety issues for drivers Consider sports equipment design eg rugby balls - how do companies make them 'grippy' 'Tribology' the science of friction' https://www.sheffield.ac.uk/news/nr/six-nations-rugby-union-tribology-ball-grip-1.262791 See here for more interesting information https://phys.org/news/2021-06-sticky-baseballs-physics-latest-scandal.html Further challenges Marble run – who can keep their marble in the run as long as possible using friction to slow down Jamie Bond investigation - https://www.tes.com/teaching-resource/jamie-bond-test-for-friction-ks2-forces-and-motion-64434

Magnets and forces assessment



How does this floating magnet trick work?

Write down 3 things that would be attracted to a magnet.

1.

2.

3.

Write down 3 things that would not be attracted to a magnet.

1.

2.

3.

**This is a compass. People use it to show them directions. How does it work?

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Give 2 examples of where magnets are used in everyday life.

1.

2.

Tilly and John have made a marble run. Give 2 ways that they could slow the marble down..

1.

2.

Why would these trainers be useful for walking on muddy surfaces?

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