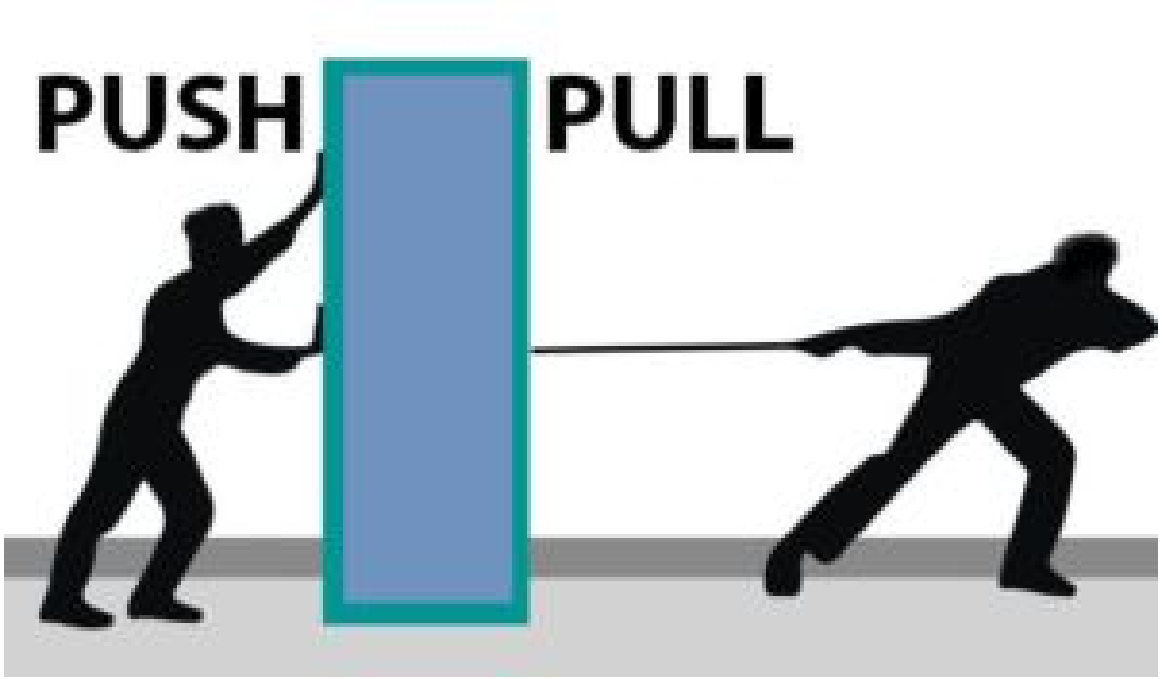
Science

The Power of forces

Atlantic Academy Portland
an Aspirations Academy



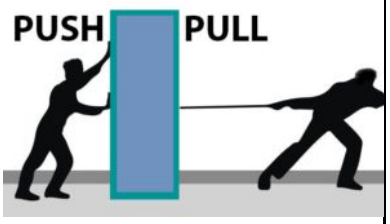
Year 3 - Summer 1

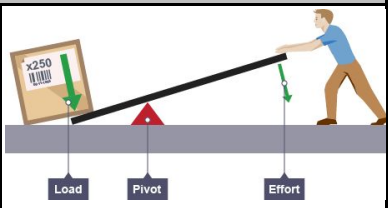
Name:_____

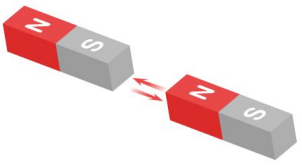
Class:_____

Year 3 Science Knowledge Organiser - Summer 1 -The power of forces.

Week 1 - Forces		
1	**Force**	A push or pull on an object. A force can cause something to speed up, slow down, change shape or change direction.
2	**Push**	To move something in a specific way by exerting force.
3	**Pull**	To draw or houl towards oneself or itself, in a particular direction.
4	**Twist**	An act of turning with force, coiling, or rotating.
5	**Rotate**	To turn about an axis or a center.
Week 2 - Levers		
6	**Levers**	A rigid bar resting on a pivot that is used to move a heavy or firmly fixed load.
7	**Mass**	The amount of matter within an object.
8	**Load**	Load is a heavy or bulky object.
9	**Pivot**	The point on which something balances on allowing movement to happen
10	**Effort**	The physical work needed to apply a force.
Week 3 - Gears & Pulleys		
11	**Gears**	A toothed wheel that works with others to alter the speed of a driving mechanism and the speed of the driven parts (e.g. wheels
12	**Mechanisms**	The working parts of a machine (e.g. engine).
13	**Pulleys**	A wheel with a grooved rim around that changes the direction of a force applied to the cord.
14	**Direction**	The path along which something moves.
Week 4 - Types of Force		
15	**Friction**	When two surfaces slide together, a force called friction makes them stick very slightly togethe
16	**Surface**	The outside or any one side of an object.
17	**Gravity**	The force that attracts an object towards the centre of the earth.
18	**Magnetism**	An invisible force that attracts or repels certain metals.
19	**Air Resistance**	A force that is caused by air with the force acting in the opposite direction to an object moving through the air.
20	**Water Resistance**	A force that is caused by water with the force acting in the opposite direction to an object moving through the water.
Week 5 - Magnetic		
21	**Material**	What something is made of.
22	**Metal**	Many metals are strong, shiny and hard. They are also often malleable, meaning they can be shaped without breaking or cracking.
23	**Magnet**	Objects that pull or push metals with magnetism.
24	**Non-Magnetic**	Objects that cannot be directly affected by magnetism.
Week 6 - Magnets		
25	**North Pole**	An end of a magnet that is attracted to the south pole of another magnet.
26	**South Pole**	An end of a magnet that is attracted to the north pole of another magnet.
27	**Attract**	If one object attracts another object, it causes the second object to move towards it.
28	**Repel**	When the same poles of magnets push away from each other.







Date:

LESSON ONE: Pushes and Pulls

Retrieval Practice

What I already know about forces.	Questions I still have about forces.
•	•
•	•
•	•
•	•

Outcomes	Key Vocabulary
To notice that some forces need contact between two objects by identifying the different types of forces acting on objects.	Force, push, pull
Knowledge needed	
It will be useful if children have learnt about changing materials by force.	

Everybody Reads

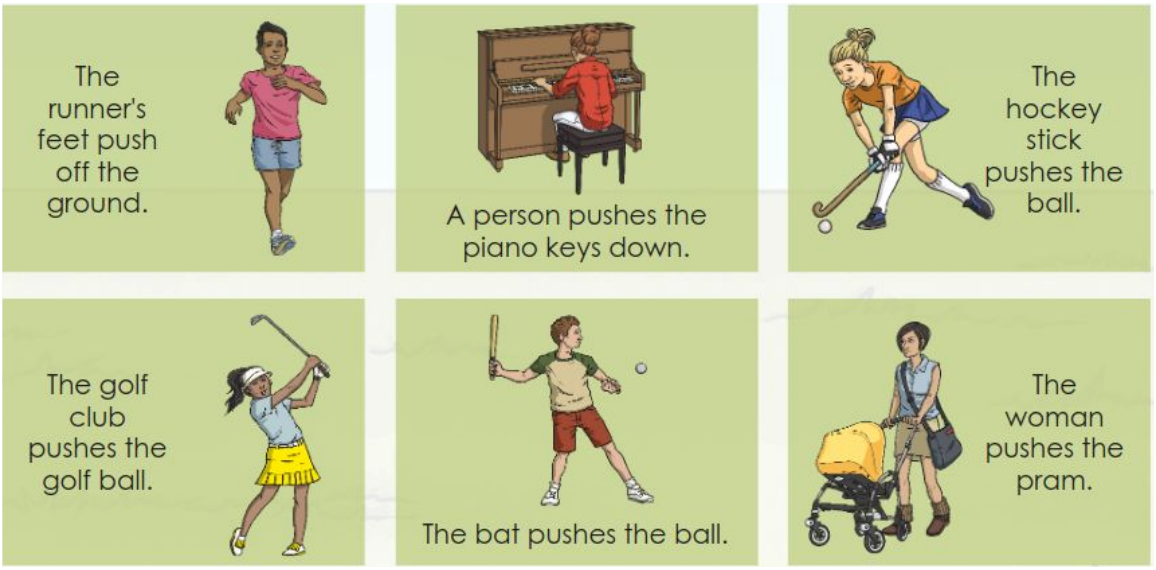
Definition: A force is a **push or pull** acting on an object as a result of the object's interaction with another object.

Forces can make objects **stop or start** moving. Watch the video to find out more!
https://www.bbc.co.uk/bitesize/topics/zn77hyc/articles/zptckqt

Whilst you are watching, think of any more examples of pushes or pulls that you use.
https://www.bbc.co.uk/bitesize/topics/zvpp34j/articles/zywcrdm

These are all examples of pulling forces.

These are examples of pulling forces.



Forces in action

Think of an action that shows how forces move objects. You could choose an action from the clips you watched earlier or think of your own.
Work with a partner (or on your own) to create a freeze frame of the action you have chosen.

Show your freeze frames to the rest of your class. Can your classmates decide if you are demonstrating a pushing force or a pulling force?

Independent Task

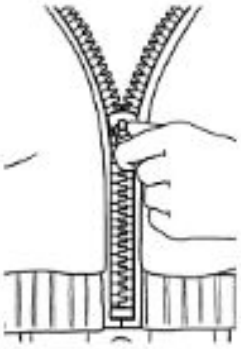
Below are some pictures of children using pushing and pulling forces. Write down **push** or **pull** in the force box. Does the force cause something to start or stop moving? In the second box write **start** or **stop**.

1. Force:

Start or Stop?

2. Force:

Start or Stop?



3. Force:

Start or Stop?

4. Force:

Start or Stop?

5. Force:

Start or Stop?

When you kick a football, what type of force do you use? Can you describe other sports or activities that involve pushing or pulling?

Exit Ticket

Look around the room and write down two objects you pull and two objects you push. Also write if the force makes you stop or start.

Date:

LESSON TWO: Faster and Slower

Do now: Vocabulary Practice

m	a	f	o	r	c	e	l	p	i	t	a
a	t	l	e	o	l	d	w	u	o	m	t
g	s	o	u	t	h	a	n	s	o	n	t
n	c	p	o	l	e	e	t	h	o	l	r
e	d	m	e	t	h	a	t	t	o	f	a
t	a	m	l	l	p	u	l	l	i	n	c
i	l	a	o	v	e	w	a	s	i	m	t
c	p	g	o	c	o	m	p	a	s	s	s
s	i	n	b	s	u	r	f	a	c	e	b
l	e	e	b	n	o	r	t	h	u	t	i
k	n	t	o	w	i	t	s	n	o	t	p
r	r	e	p	e	l	a	i	s	e	b	e

force
magnetic
north
south
pole
push
pull
magnet
repel
attract
compass
surface

Outcomes	**Key Vocabulary**
To compare how things move on different surfaces by investigating the speed of a toy car over different surfaces.	Force, push, pull, friction, surface.
Knowledge needed	
Children will have learnt about pushes and pulls in lesson 1.	

Everybody Reads
Forces make things move. Whenever an object starts to move or moves faster, it is a force making this happen.

Forces can also make things stop moving or slow down.

- Forces are pushes and pulls.
- These pushes or pulls will always change the motion of an object. They will either make it start to move or speed up, slow it down or even make it stop.

Talk Task
Talk to your partner about examples of forces changing the motion of different objects.

Making things move

Cyclists sometimes travel over different surfaces.
By pushing the pedals harder or faster, he can change the motion of the bicycle. It will speed up.

When the cyclist pulls on the brakes, the brake pads will push on the wheels, changing the bicycle's motion. It will slow down, and eventually stop.

Cyclists sometimes travel over different surfaces, such as grass, gravel, sand and road.

Talk Task

How do the different surfaces affect the motion of the bicycle?

Everybody Reads

These surfaces all exert a force on the bicycle. This force is called friction.
Friction is a force that holds back the movement of an object. Friction acts in the opposite direction to the movement of the object.

Different surfaces create different amounts of friction.
The amount of friction created by an object moving over a surface depends on the roughness of the surface and the object, and the force between them.

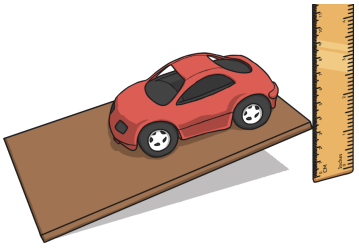
Group Task

You are going to work in groups to set up your own investigation into the amount of friction created by different surfaces.
You will use:

- A toy car
- Boards covered with different surfaces
- A ruler

Method

1. Place the car at the end of one of the boards.
2. Place the ruler at the side of the board, so you can measure the height of the board as you lift the end.
3. Lift the end of the board that the car is on 1 cm at a time.
4. Watch the car carefully, and notice at what height it starts to move.
5. Try this with each of the boards covered with different surfaces.



As you lift the ramp, gravity will pull the car down.

Friction will be pushing opposite to this.

Surfaces that create a lot of friction will need to be lifted higher for gravity to overcome the friction

and pull the car down the ramp.

Surfaces that don't create much friction will not need to be lifted much, as it will be easier for gravity to pull the car down.

Which surfaces will you test?

Which surface do you predict will create the most friction for the toy car?

Measure how high the ramp needs to be for the car to start to move over each surface.
Record your results below.

Surface	Height of Ramp When the Car Started Moving

Which surface created the most friction for the toy car?

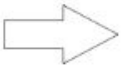
Which surface created the least friction?

Exit Ticket

Was your prediction accurate?

Can you explain your findings? Why did the different surfaces create different amounts of friction?

Use these words to help you explain your ideas.

rough  smooth  surface  force  friction 

Talk to a person from another group and use the questions to help you to discuss your findings:

- What did you discover?
- Which surface created the most friction?
- Which surface created the least friction?
- Was your prediction accurate?

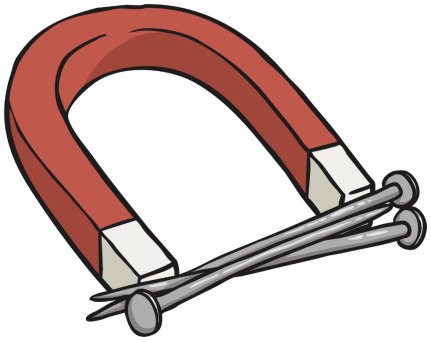
Date:

LESSON THREE: Scrap yard Challenge

Do Now: Talk Task
These children are using a magnet to pick up different objects. They are talking about what magnets are and how they work. Which child's ideas do you agree with?

Outcomes	**Key Vocabulary**
To notice that magnetic forces can act at a distance and attract some materials and not others by sorting materials. To compare and group materials according to whether they are magnetic by sorting materials.	Force, magnet, magnetic, attract, magnetic field
Knowledge needed	
Children will have learnt about forces as pushes and pulls in lesson 1 and investigated friction in lesson 2.	

Everybody Reads
What is a magnet?



A magnet is a special type of object. It produces an area of magnetic force around itself, called a magnetic field.

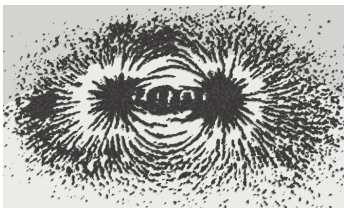
If certain materials enter this magnetic field, they will be attracted to the magnet. This will cause the materials to stick to the magnet.

Try it! Move a magnet slowly towards a steel paper clip. As the paper clip enters the magnetic field around the magnet, it will 'jump' towards the magnet.

A magnetic field is the area around a magnet that produces a pulling force on certain materials. The magnetic field is invisible, so we can't see it.

Demonstration

Try this activity to detect where a magnet's magnetic field is, and what shape it is:



- Place a bar magnet in the centre of a tray, and place a piece of paper on top of the magnet.
- Sprinkle a few iron filings onto the paper from a few centimetres above it.
- Keep sprinkling small amounts of iron filings onto the paper until you can see the lines of the magnetic field.

Everybody Watches

Let's watch this clip to see how magnets are used in a scrapyard to sort different materials.
https://www.bbc.co.uk/bitesize/clips/zcntsbk

Everybody Reads

The magnets in the scrapyard sorted the magnetic materials from the non-magnetic materials.
Magnetic materials are attracted to magnets. This means they will attract a magnet.
Non-magnetic materials are not attracted to magnets, and will not attract them.

But which materials are magnetic and which ones aren't?

Independent Task

Imagine that you are in charge of a scrapyard like the one in the clip you have just watched. You have a big jumble of materials to sort out, and you need to separate the magnetic materials from the non-magnetic materials.

Use a magnet to attract materials, and remove them from the pile.
Any materials that are left in the pile are non-magnetic.

Sort the mixed materials into those that are magnetic and those that are non-magnetic.

Magnetic	Non-magnetic

What sorts of materials are magnetic?

Are all metals magnetic?

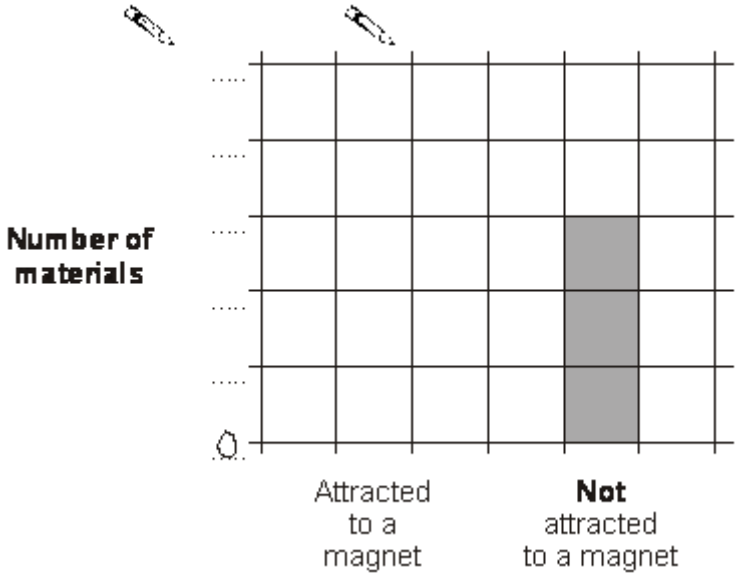
Can you explain what a magnet is?

Exit Ticket - Exam Style Question

(a) Some children investigated whether or not some materials are attracted to a magnet. They made notes of their results.

Attracted to a magnet	**Not attracted to a magnet**
Iron nail Steel clip.	Metal coin, Chocolate, Modelling clay.

(i) Write the numbers to show the scale on the chart below.
A number has been done for you.



(ii) Draw a bar on the chart to show the number of materials attracted to a magnet.

(b) Jane wrote 'Our investigation was good' as her conclusion for the investigation.

Why is this **not** a useful scientific conclusion?

.....

.....

(c) Ali and Jane describe their ideas about metals.

Jane recorded some observations from their investigation in a table.

Does each observation support their ideas?
Tick **ONE** box on each row of the table.

Observation	Supports Ali's and Jane's ideas	Supports only Jane's idea	Does not support either idea
The iron nail is attracted to the magnet.			
The steel clip is attracted to the magnet.			
The metal coin is **not** attracted to the magnet.			
The modelling clay is **not** attracted to the magnet.			
The chocolate is **not** attracted to the magnet.			

(d) Ali said 'To improve our test we should have measured how far each material moved when it was attracted to the magnet'.
Jane said 'This would not improve our test'.

Why was Jane right to think this would **not** improve their test?

.....

.....

Date:

LESSON FOUR: Magnet Strength

Do now: FEEDBACK

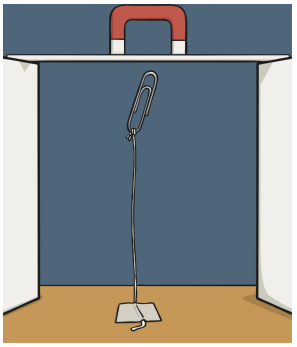
Look through what you have completed in your booklet so far and complete any blank pages. If you were absent, read the **Everybody reads** sections and write **ABSENT BUT READ** in **purple pen** and your sign your name.

If you **complete all** of your feedback, on your whiteboard write 3 questions about forces for another person in the class to answer.

Outcomes	**Key Vocabulary**
To observe how magnets attract or repel each other and attract some materials and not others by investigating the strength of different magnets.	Magnet, attract, force.
Knowledge needed	
Children will have learned about magnets and magnetic materials in lessons 2 and 3.	

Everybody Reads

Try this trick to make a paper clip hover:



1. Tie a length of cotton thread to a paper clip.
2. Tape the end of the thread to the table.
3. Hold a magnet above the paper clip.

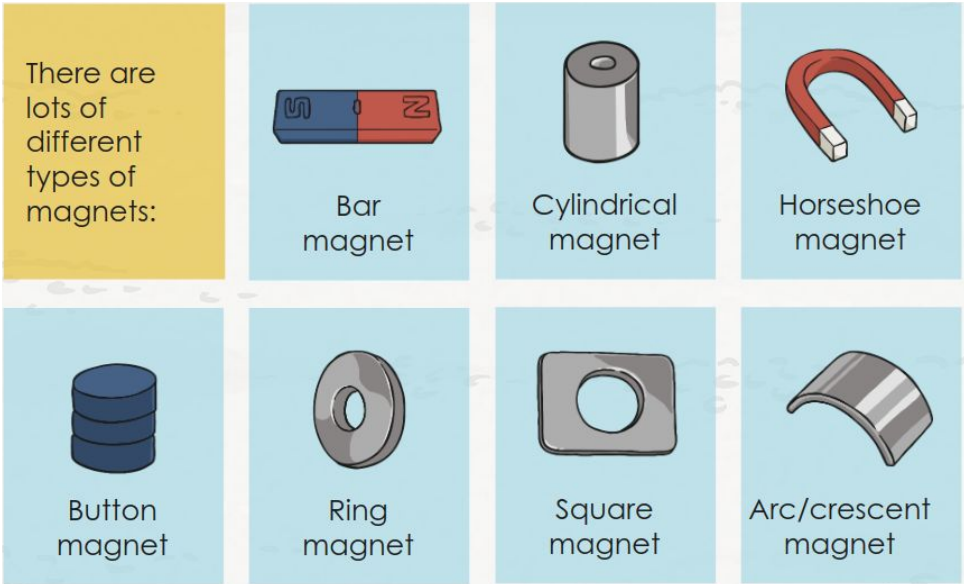
Can you make the paper clip hover above the table?

As you move the magnet away from the paper clip, it will fall back to the table.

The magnetic force pulling the paper clip up to the magnet is not as strong.

By seeing how many paper clips are attracted to a magnet, you can measure the strength of the magnet's force.

Types of magnet



But which is the strongest? You are going to investigate which type of magnet is the strongest.

Group Task

1. To measure the strength of each magnet, you will hold a paper clip to a magnet so that it is attracted to it.
2. You will then hold another paper clip to the first one to see if it is also attracted to the magnet, through the first paper clip.
3. Keep adding paper clips in a chain, until no other paper clips are attracted in the chain.
4. Keep a record of how many paper clips were in the chains for each magnet.
5. The magnet with the longest chain of paper clips is the strongest, as its magnetic force can pull the paper clips over the longest distance.

Prediction and results

Which magnets are you going to test? Draw and name them in the box below.

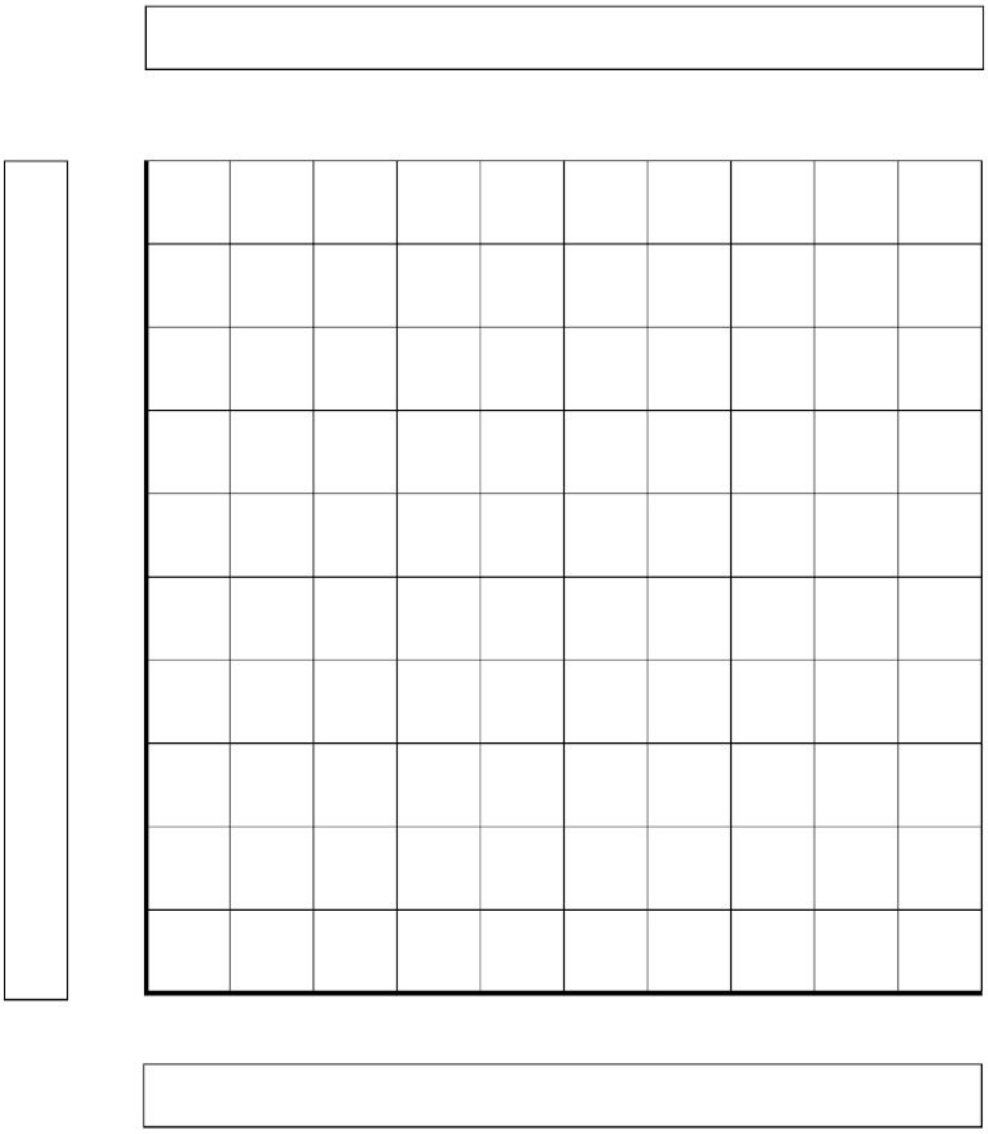
Which magnet do you predict will be the strongest?

Why do you predict this?

Complete this table with your results.

Type of magnet	Number of Paper Clips Attracted in a Chain

Use these axes to draw a bar chart of your results. Remember to give your bar chart a title and to label the axes.



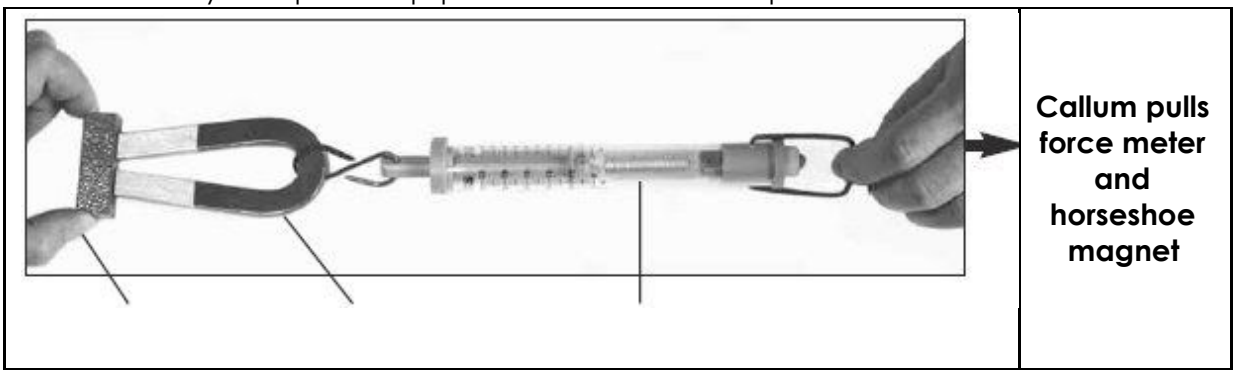
Which magnet was the strongest?

How do you know?

Exit Ticket

(a) Callum and Izzy want to find out the force needed to pull different bar magnets apart from a horseshoe magnet.

They set up the equipment as shown in the photo.



Callum needs to measure the force as the magnets separate.

It is difficult. The force meter reading goes back to zero as soon as the magnets separate.

Would the suggestions below help Callum get more reliable results? Write **yes** or **no** after each suggestion.

	Yes or **no**?
Take a practice measurement to find out roughly when the magnets separate.	.....
Pull the force meter very quickly.	.....
Take the measurement three times.	.....
Use a different horseshoe magnet each time.	.....

(b) Callum measures the force using N as the unit of measurement.

What unit of measurement does N stand for?

.....

(c) Callum and Izzy test more bar magnets. In the table they record the force needed to pull each bar magnet apart from the horseshoe magnet.

Bar magnet tested	**Length of bar magnet (cm)**	**Force needed to pull magnets apart (N)**
A	1.5	2.5
B	5.0	1.8
C	7.0	7.0
D	7.5	3.0

What was the **length** of the weakest bar magnet?

..... cm

(d) Before the test, Callum made a prediction. He said, 'Longer magnets will need more force to separate them from the horseshoe magnet.'
The results do not support Callum's prediction.

Describe how the results do **not** support Callum's prediction.

.....

.....

(e) Callum and Izzy think of different questions they could investigate.

Write **true** or **false** next to each question to show if the investigation would compare how **strong** the magnets are.

	True or **false**?
How many layers of paper will stop each magnet attracting a pin?	.....
How many types of materials will the magnets attract?	.....
How many paperclips will each magnet hold?	.....

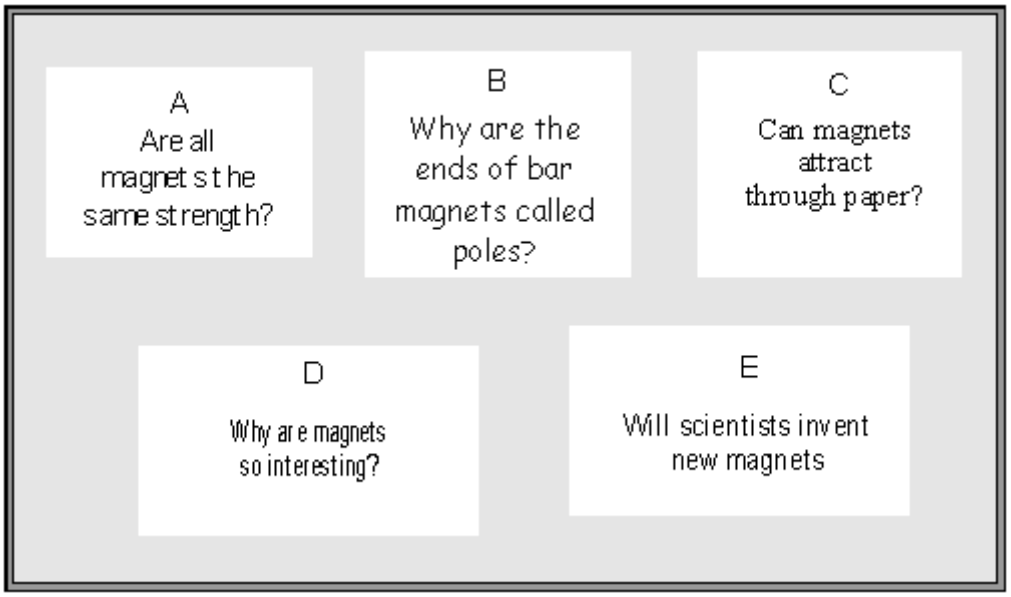
Date:

LESSON FIVE: Magnetic Poles

Do Now: Exam Style Question

(a) Some children have questions about magnets.

They write their questions on pieces of paper and pin them to a board.



Which **TWO** questions can be answered by **testing** with magnets in the classroom?

Write the **TWO** letters here. ..... and .....

(b) The children have some new and old 1p coins.

The new and old coins are made from different metals.

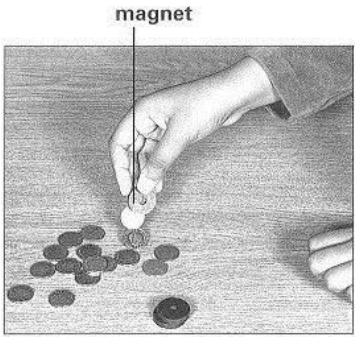
Tick **ONE** box to show why a magnet does **not** attract the **old** coins.

They are rusty	☐	They are not made of a magnetic metal	☐
They are dirty	☐	They repel the magnet	☐

(c) The children want to find out how many new coins they can pick up at one time.

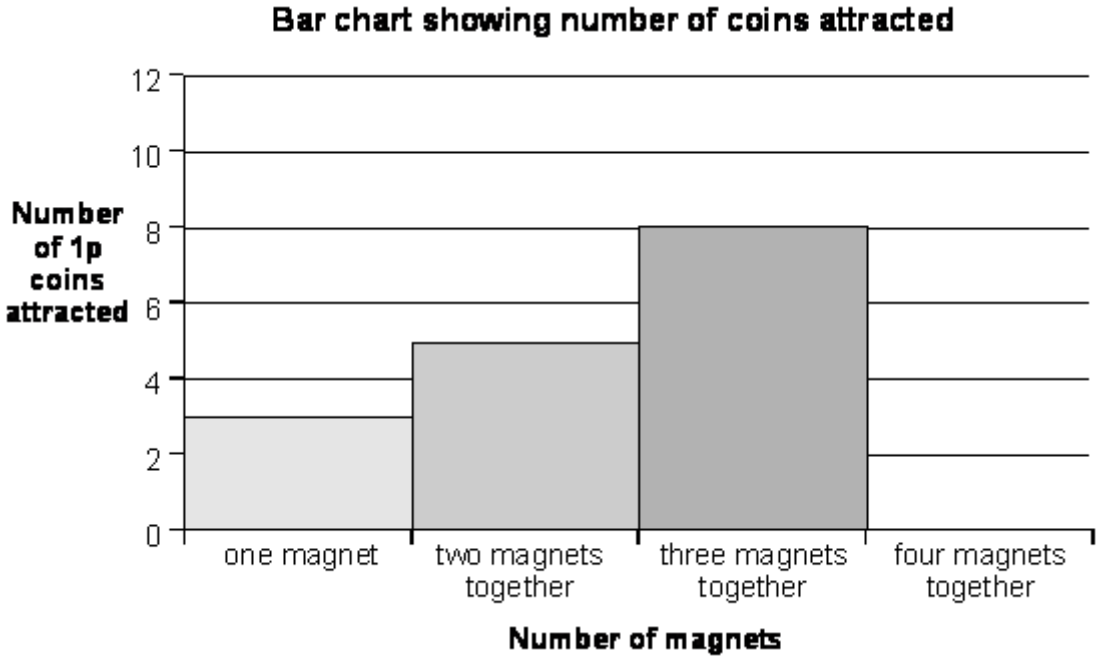
They try with one magnet, then with two magnets together and then with three.

magnet



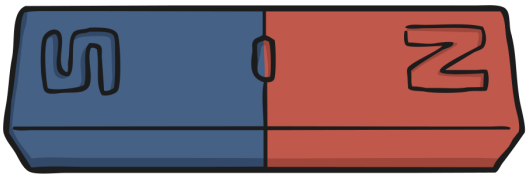
The bar chart below shows their results.

Draw another bar on the chart to show how many coins you expect **four** magnets together to pick up.



Outcomes	**Key Vocabulary**
To describe magnets as having two poles and to predict whether two magnets will attract or repel each other, depending on which poles are facing by making a compass to hunt for treasure.	Magnet, pole, north, south, attract, repel, compass, direction.
Knowledge needed	
Children will have learnt about magnetic attraction in lessons 3 and 4.	

Talk Task
Look at this bar magnet.
It has two different sections, which are often coloured red and blue.
But what are these sections called?



Everybody Watches
Watch this video to find out about magnets and their invisible forces (https://www.bbc.co.uk/bitesize/clips/zk9rkqt). Whilst you are watching, can you listen for the answers to these questions?

Which three metals are attracted to magnets?
What happens when two magnets repel each other?
What are the different parts of a magnet called?
Which way will a compass always point?

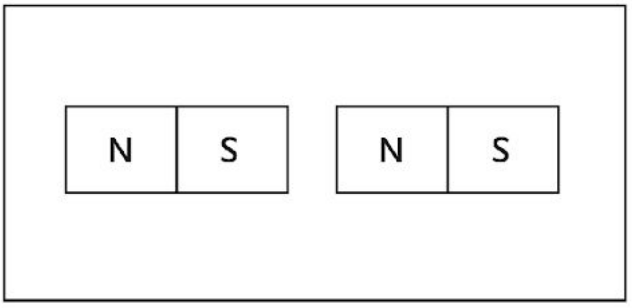
Everybody Reads
- The three metals that are attracted to magnets are **iron, cobalt** and **nickel**.
- When two magnets repel each other, they push away from each other.
- The different parts of a magnet are called the poles. There is a north pole and a south pole.
- A compass always points north-south.

Attract and Repel
Explore the poles of two magnets and feel them repel and attract.
- Take two magnets and place them so the two north poles are facing each other. Try to make them touch. What do you feel?
- Try this with the two south poles. What do you feel this time?
- You should feel the two magnets pushing away from each other – they are repelling each other.
- Now try to make the north pole of one magnet touch the south pole of another magnet. What do you observe this time?
- Did the two magnets connect together? They are attracted to each other.

Remember: **Like** poles **repel**, **opposite** poles **attract**.

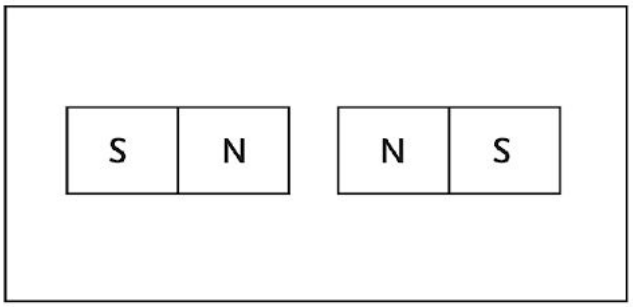
Independent Task

The north pole of a magnet will always attract to the south pole of another magnet. If two north poles or two south poles are put together they will repel each other. When this happens the magnets will move away from each other. Write whether you think the magnets shown below will attract or repel each other.



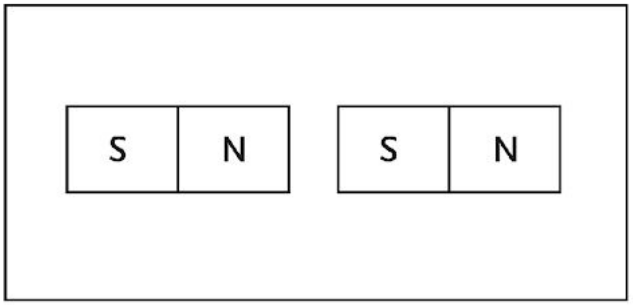
I think these magnets will _____

_____



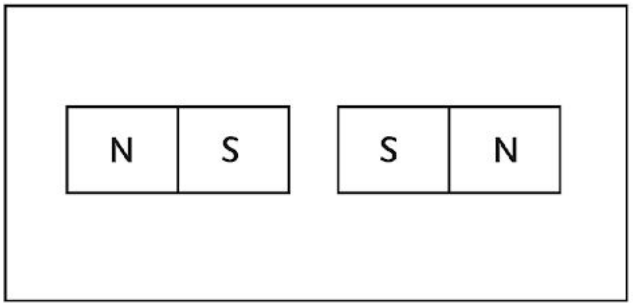
I think these magnets will _____

_____



I think these magnets will _____

_____



I think these magnets will _____

_____

Extension Task
Make a poster to explain how the magnetic poles attract and repel.

Exit Ticket

Vicky has a magnet in her hand.

There are some objects in the box.

Vicky is going to find out which objects are attracted by her magnet.

Compare the table of results by putting **ONE** tick so show the correct result for each object.

One has been done for you.

	is attached	**is not attached**
wooden pencil		✓
steel safety pin		
plastic bead		
cardboard box		
copper wire		

Date:

LESSON SIX: Marvellous Magnets

Retrieval Practice

Write the letters of the correct answer cards next to the questions below.

Questions	Answer Card Letter
1. Can you name a metal that is attracted to magnets?	
2. Will the north pole of a magnet attract or repel the north pole of another magnet?	
3. Can you name a magnet other than a bar magnet?	
4. Will an aluminium drinks can be attracted to a magnet?	
5. Will the south pole of a magnet attract or repel the north pole of another magnet?	
6. Will an iron nail be attracted to a magnet?	

Answer cards

A Button, horseshoe, cylindrical, arc or crescent, square or ring.	**B** No	**C** Push and pull	**D** Yes
E Repel	**F** Magnetic field	**G** Attract	**H** Iron, nickel or cobalt

Outcomes	**Key Vocabulary**
To observe how magnets attract or repel each other and attract some materials and not others by making, playing and evaluating a magnetic game.	Force, magnet, attract.
Knowledge needed	
Children will have learnt about magnetic attraction and repulsion in lessons 3, 4 and 5.	

Everybody Reads

Magnets have a magnetic field around them that produces a pulling force on some materials. This pulling force can go through other materials such as paper or wood.

Try it! Place a magnet behind a piece of paper and see if a paper clip is attracted to the magnet through the paper.

Useful magnets

This magnetic force can be used… to point north in a compass;	
To hold a fridge door closed;	
To sort coins in a vending machine.	
In a laptop lid so that the computer can tell if it is open or closed;	

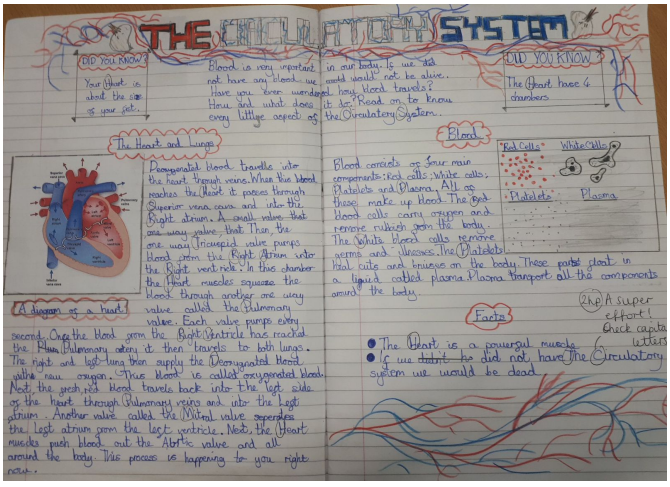
Independent Task

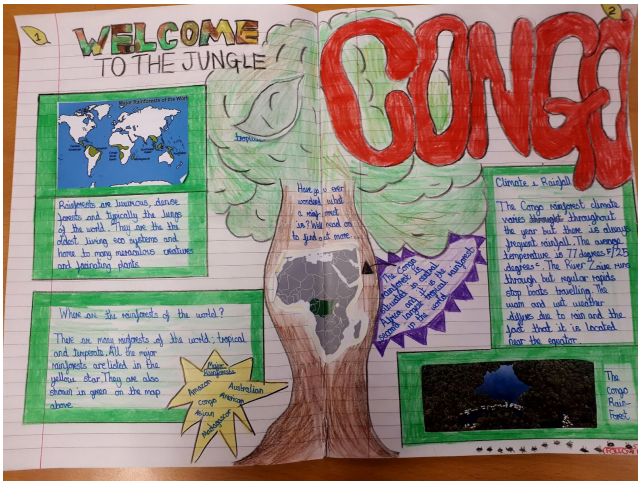
In today's lesson, you are going to produce a two page spread using everything you have learnt about magnets and forces in this booklet. Use the key words and information to help you to decide how to demonstrate your knowledge.

You will need to write under these headings

1. What is a force?
2. What changes the speed of a force?
3. What is a magnet?
4. Types of magnets
5. How do magnets work? What materials are magnets attracted to?
6. Uses of magnet and other interesting facts.

Examples of double page spreads.





Images from: https://missstanleyyr6.wordpress.com/2019/04/17/the-power-of-a-double-page-spread/

Exit ticket

Present your work to another person and verbally give them a **W**hat **W**ent **W**ell and an **E**ven **B**etter **I**f comment.