YEAR 3: AUTUMN 2 – ROBO-DOG
SCIENCE: Forces and Magnets

Ocean Academy Poole
an Aspirations Academy

UNDERSTAND, DESCRIBE AND EXPLAIN: Forces

To understand and describe different types of forces and whether they are creating a push or pull reaction

To understand and describe the force of friction

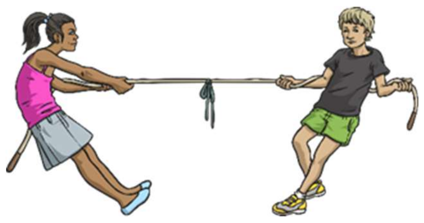
To compare how things move on different surfaces

Learning links:
Year 5: Science Forces
Year 3: DT Building and testing magnetic cranes with a pulley system

Force	*Push*	*Pull*	*Twist*	*Stop*	*Start*	
Balanced	*Unbalanced*	*Size of force*	*Forces 'acting' on an object*	*Motion*	*Direction*	
Energy	*Speed up*	*Slow down*	*Change direction*	*Friction*	*Rough*	*Smooth*

What is a force?

A ***force*** is a ***push***, ***pull*** or ***twist*** acting on an ***object*** because of the object's ***interaction*** with ***another object***. ***Forces*** can make objects ***stop*** or ***start*** moving.
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***.
Can you think of times when you use a push, pull or twist force?



THINKING POINT:

What do forces do? What are the 3 different types of force?

Balanced forces:

If ***two forces*** are ***balanced***, it means the forces are the ***same size*** but are ***acting*** in ***opposite directions***. If ***two balanced*** forces are ***acting*** on an ***object***, that object will ***not change*** its ***motion***. If it is ***still***, the object will ***stay still*** or if it is ***moving***, it will ***continue moving*** in the ***same direction*** and at the ***same speed***.

Unbalanced forces:

When ***two forces acting*** on an ***object*** are ***not equal*** in ***size***, we say that they are ***unbalanced forces***. Unbalanced forces ***do change*** the way something is ***moving***. They can ***make objects start to move***, ***speed up***, ***slow down*** or ***change direction***.

THINKING POINT:

Can you find any examples of balanced and unbalanced forces?

How much force?

The ***amount of force*** needed to ***push*** or ***pull*** an ***object*** depends on the ***amount of friction*** or ***resistance*** acting on the object.
If an ***object*** is ***very heavy*** (***weight***), the ***size of force acting on the object*** to ***push*** or ***pull*** will need to be ***greater***.
To push an object across a ***rough, bumpy surface*** (like a gravel path) would be very ***difficult.***
However, if that ***same object*** was on a ***slippery, smooth surface*** (like an ice rink), ***less force*** would be ***needed*** to ***push*** it across the ***surface***.

THINKING POINT:

What can change the amount of force that is needed to move an object?

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***.
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***. For example, if you were riding a bike and ***stopped pedalling***, you would ***eventually slow down and stop***. This is because the ***friction*** of the ***tyres*** on the ***surface slows down*** the ***motion*** of the ***bicycle*** until it eventually ***runs out of energy from the force*** that gave it the forward motion (pedalling). If you were ***cycling*** on a particularly ***bumpy*** or ***rough surface***, the ***friction*** would be ***greater*** and the bike would come to a ***stop sooner*** than if on a ***smooth*** tarmac road.

THINKING POINT:

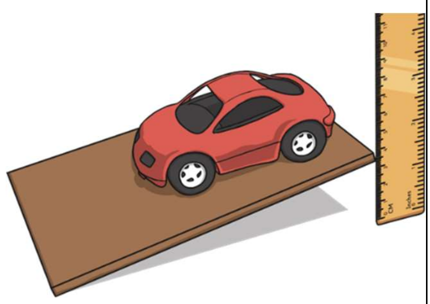
Would it be easier to cycle on a smooth road or a bumpy path? Why?

EXPLORE AND INVESTIGATE:

HYPOTHESISE
ENQUIRE
TEST
RECORD
REPORT
CONCLUDE

Investigating friction:

1. Locate some boards covered in different surfaces with varying textures (rough and smooth), a ruler and a toy car.
2. Place the car at the end of one of the boards.
3. Place the ruler at the side of the board, so you can measure the height of the board as you lift the end.
4. Lift the end of the board that the car is on 1 cm at a time.
5. Watch the car carefully, and notice at what height it starts to move. Record this measure.
6. Try this with each of the boards covered with different surfaces.
7. Record the results in a table and evaluate the findings.
8. What did you discover? Which surface created the most friction? Which surface created the least friction? Was your prediction accurate?



KEY ASSESSMENT AND APPLICATION OPPORTUNITIES:

EXS:

1. How can we make objects move?
2. If I push/roll a ball or toy car on any surface, why does it eventually stop? Is it the same for every surface?

GDS:

1. If I push objects with different mass on different surfaces with an equal amount of force, they will all move the same distance. Agree or disagree?
2. How can friction be a useful force in everyday life?

UNDERSTAND, DESCRIBE AND EXPLAIN: Magnets

To understand that magnetic forces can act at a distance because of the magnetic field

To understand magnetic force and how some objects are magnetic and others are not

To describe magnets as having two poles and understand whether magnets will attract or repel

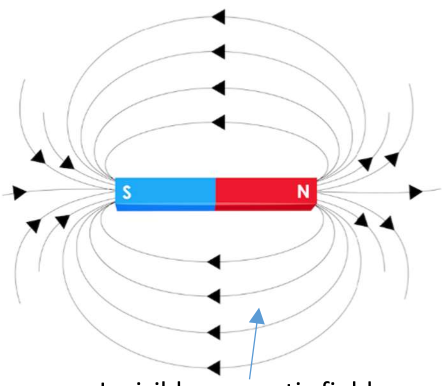
Learning links:
Year 5: Science Forces
Year 3: DT Building and testing magnetic cranes

Magnet		*Force*		*Magnetic force*	*Magnetic field*	*Materials*	*Magnetic materials*
Attract		*Repel*		*Magnetic materials*	*Non-magnetic materials*	*Invisible*	*Metal*
Iron	*Cobalt*	*Steel*	*Nickel*	*Attracted*	*Magnetic Poles*	*North*	*South*

What is a magnet and a magnetic field?

A ***magnet*** is a ***special*** type of ***object***. It produces an ***area of magnetic force*** around itself, called a ***magnetic field***. The ***magnetic force*** in a magnet ***flows*** from the ***North pole to the South pole***. This creates an ***invisible magnetic field*** around a ***magnet***.

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



Invisible magnetic field

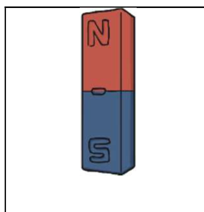
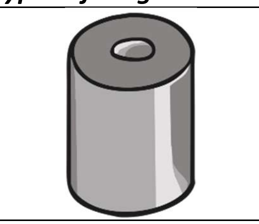
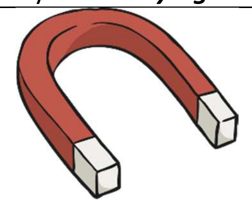
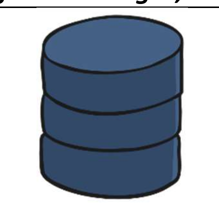
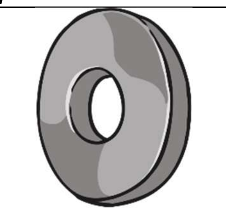
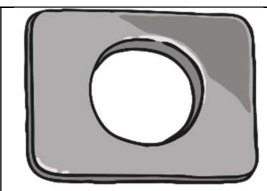
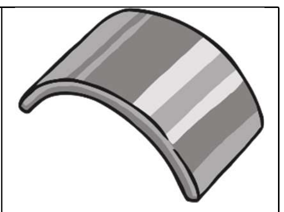
THINKING POINT:

What do we mean by a 'magnetic field'?

For example, as you ***move*** a ***magnet towards*** a ***steel nail,*** the nail will eventually ***enter*** the ***magnetic field*** around ***the magnet***, it will ***'jump'*** towards the magnet and ***stick***. The ***magnetic force*** within the ***magnetic field pulled*** the nail towards it. Therefore, the ***steel nail*** is ***magnetic***!

The ***stronger*** the ***magnet*** is, the ***larger*** its ***magnetic field*** will be. Therefore, it will be ***able to attract magnetic objects*** from ***further away*** and ***hold heavier weights*** of magnetic objects.

There are lots of ***types of magnets*** and they have ***varying magnetic strength, shape and size***:

						
Bar magnet	**Cylindrical magnet**	**Horseshoe magnet**	**Button magnet**	**Ring magnet**	**Square magnet**	**Arc magnet**

THINKING POINT:

What will make one magnet stronger than another? It must have a larger ______.

Which materials are magnetic?

Magnetic materials are ***always*** made of ***metal***, but ***not all metals*** are ***magnetic***.

Iron is ***magnetic***, so any ***metal*** with ***iron in it*** will be ***attracted*** to a ***magnet***. ***Steel contains iron***, so anything made of steel will be attracted to a magnet. ***Most other metals***, for example ***aluminium***, ***copper*** and ***gold***, are ***NOT magnetic***.

Metals, which ***contain iron*** and are therefore ***magnetic,*** are: ***Iron, cobalt, steel and nickel***. A good way to ***remember*** this is: ***'I Can See Nick'***. You can ***test*** if a ***material*** is ***magnetic*** by holding a ***magnet*** close to it to see if it ***attracts*** or not.

THINKING POINT:

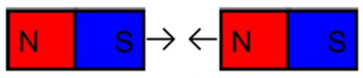
Which 4 metals are magnetic? Why are they magnetic?

What are magnetic poles?

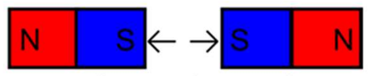
All magnets, regardless of their shape and size, have ***two*** different ***parts*** called the ***poles***. There is a ***north pole*** and a ***south pole***. The ***magnetic force*** in a ***magnet flows*** from the ***North*** pole to the ***South*** pole. This ***creates*** a ***magnetic field*** around the magnet. Magnetic force is strongest at the ends of the magnet.

Attract or repel?

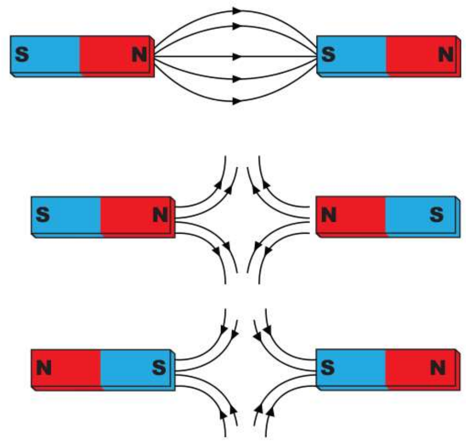
Have you ever held two magnets close to each other? They do not act like most objects. Have you noticed that, if you try to push the ***South poles together***, they ***repel each other***? If you try to push the ***North poles together***, they also ***repel each other***. However, if you push the ***North and South poles together*** they ***attract*** and ***pull together*** – with magnets, ***opposites attract***.



Opposite poles **attract**



Same poles **repel**



THINKING POINT:

Explain to a partner what 'attract' and 'repel' has to do with magnets.

EXPLORE AND INVESTIGATE:

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Testing magnetic strength and magnetic fields:

Test 1:

1. Testing a variety of magnets, add one paper clip at a time to test how many steel paperclips the magnet can hold.
2. Record the results of the different magnets.
3. What did you discover? What does this tell you about each magnet and its magnetic field?

Test 2:

1. Place a ruler flat on a table and a magnet at the 0 measure of the ruler.
2. Place a steel paperclip at the 30cm measure of the ruler. Does it attract to the magnet?
3. Move the paperclip, 1cm at a time, closer to the magnet and record whether it is attracted or not.
4. Repeat and record for different magnets.
5. What did you discover? What does this tell you about each magnet and its magnetic field?

Testing materials – magnetic or not?

1. Compile a collection of everyday objects.
2. Using a magnet, test whether these materials are magnetic or not.
3. Record your results.
4. What did you discover? What does this tell you about the properties of the material? What must it contain?

KEY ASSESSMENT AND APPLICATION OPPORTUNITIES:

EXS:

1. What is a magnetic force and how do we know if materials are magnetic?
2. Describe what happens when you put different parts of 2 magnets together.
3. Can you find objects around the classroom that are magnetic? What material is it?

GDS:

1. Explore the use of magnets and explain how they can be useful in everyday life.
2. Use a labelled diagram to explain to others what you understand about magnets, magnetic fields and poles.