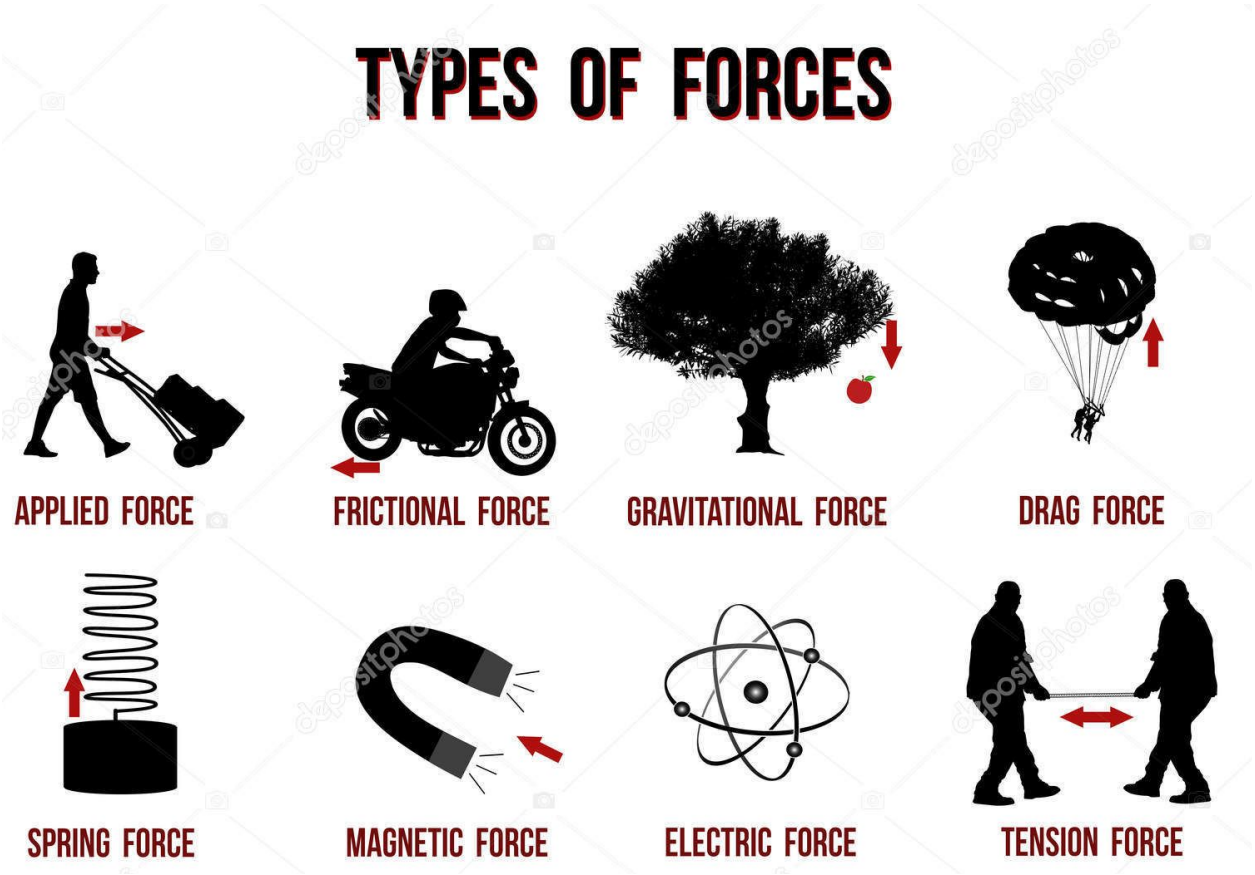
Science

Feel the force

Atlantic Academy Portland
an Aspirations Academy

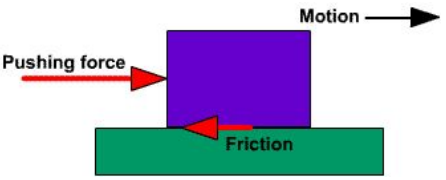
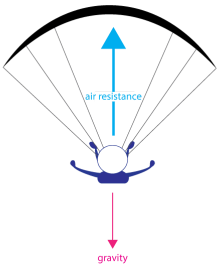
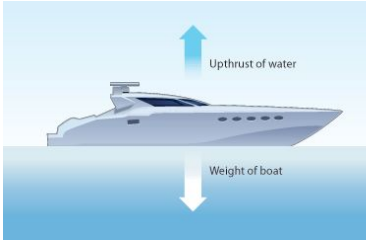
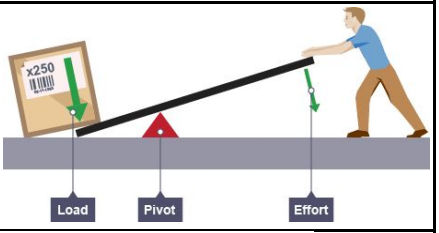


Year 5 - Summer 1

Name:_____

Class:_____

Year 5 Science Knowledge Organiser - Summer 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	**Gravity**	The force that attracts an object towards the centre of the earth.	
3	**Friction**	When two surfaces slide together, a force called friction makes them stick very slightly together.	
4	**Mass**	The amount of matter within an object.	
5	**Newton**	A newton (N) is the international unit of measure for force. One newton is equal to 1 kilogram meter per second squared.	
6	**Surface**	The outside or any one side of an object.	
7	**Air Resistance**	A force that is caused by air with the force acting in the opposite direction to an object moving through the air.	
8	**Action & Reaction Force**	Action force is force acting in one direction. Reaction force is force acting in the opposite direction.	
9	**Variables**	In science, a variable is any item, factor, or condition that can be controlled or changed.	
10	**Water Resistance**	A force that is caused by water with the force acting in the opposite direction to an object moving through the water.	
11	**Buoyant**	Things that float are buoyant.	
12	**Streamlined**	Streamline is something that has a shape that provides little resistance to air or fluid flow.	
13	**Surface Area**	In Science, surface area is the measure of how much exposed area a solid object has, expressed in square units.	
14	**Upthrust**	Upthrust is the force that pushes an object up and makes it seem to lose weight in a fluid.	
15	**Push**	To move something in a specific way by exerting force.	
16	**Pull**	To draw or houl towards oneself or itself, in a particular direction.	
17	**Stretch**	Elastic materials, and objects such as springs, change shape when a force is exerted on them: stretching happens when the material or object is pulled.	
18	**Elasticity**	Elasticity is a measure of how well a material returns to its original shape and size after being stretched or compressed	
19	**Levers**	A rigid bar resting on a pivot that is used to move a heavy or firmly fixed load.	
20	**Pivot point**	The point on which something balances on allowing movement to happen	
21	**Effort**	The physical work needed to apply a force.	
22	**Mechanisms**	The working parts of a machine (e.g. engine).	
23	**Fulcrum**	The "**fulcrum**" is the point on which the lever turns or balances, otherwise known as the pivot.	

KO Quiz: / 5 Date: _____

LESSON ONE: Fabulous Forces

Retrieval Practice

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

Outcomes	Key Vocabulary
To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object by identifying forces acting on objects. To identify the effects of air resistance, water resistance and friction by identifying forces acting on objects.	Force, push, pull, gravity, air resistance, water resistance, friction.
Knowledge needed	
Children have studied forces in year 3.	

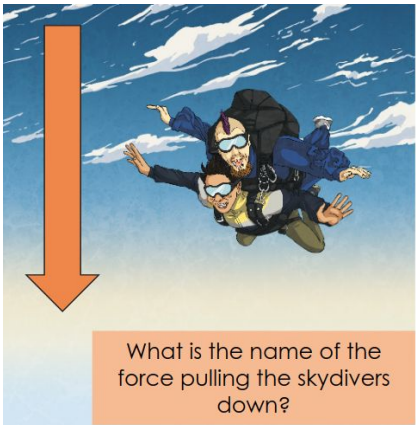
Talk Task
What Are Forces?
Forces are often referred to as pushes and pulls.

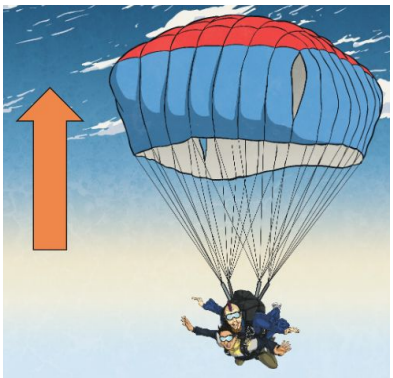
Look at the pictures below and talk to your partner about whether each picture shows an example of a pushing or pulling force.

Forces affect the movement or shape of an object. They can make an object start to move, stop moving, move faster or move more slowly. They could also make an object change its shape or cause a moving object to change direction.

Gravity is a pulling force exerted by the Earth. The gravitational force from the Earth pulls in a direction towards the centre of the Earth.

Gravity is pulling the skydivers towards the Earth.





In this image, you can see that a force is slowing the skydivers down.

This force is pushing in the opposite direction to gravity.

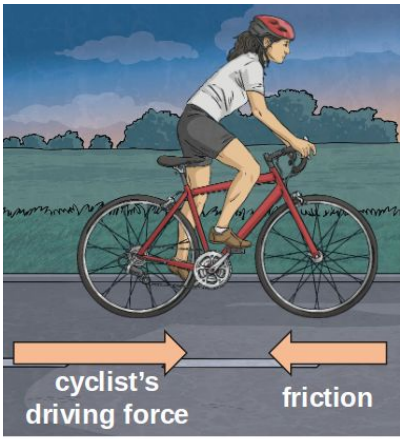
Talk to your partner about what is happening in this picture.

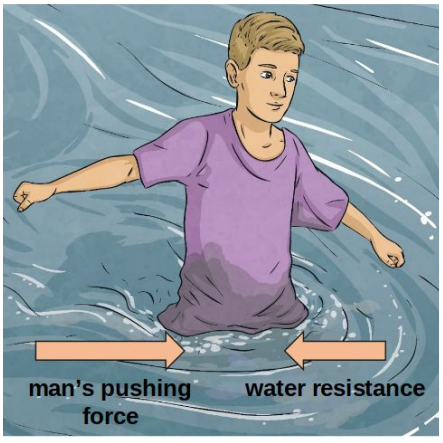
Air resistance is the name of the force that is pushing up against the parachute.

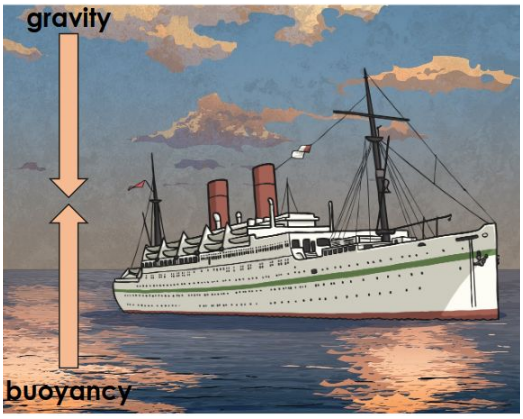
Gravity is pulling the skydivers towards the ground. However, they are slowed down because a force (air resistance) pushes against the inside of the parachute and they descend more slowly.

Gravity and air resistance are opposing forces in this situation.

As well as gravity and air resistance, there are other forces that can act on objects.







In this example, the boat doesn't sink because there is a buoyant force (upthrust) created by the volume of water. It is the balance of the gravity and the buoyancy that keeps the boat floating.

Independent Task

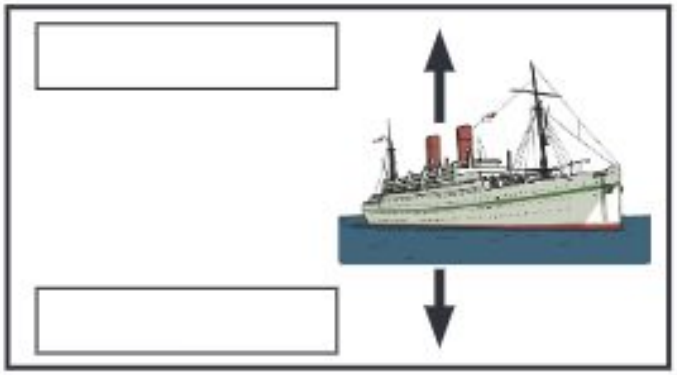
Read the story together. Highlight or underline examples of forces in the story. Then, in the second column, briefly explain the forces that are being applied in each example. The first one has been done for you.

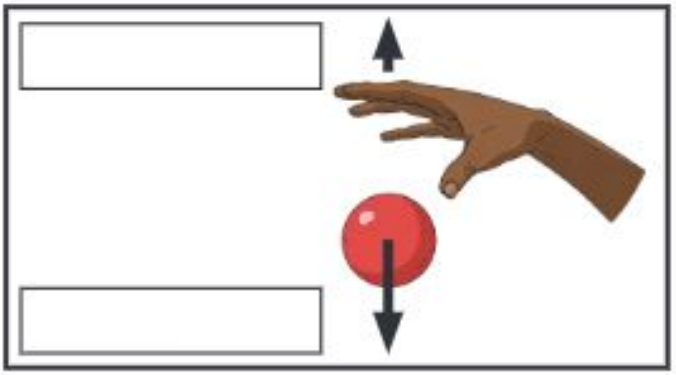
The magician reached inside her magic box and lifted up a gigantic magic wand high into the air. She pushed her very heavy magic box along the wooden floor so that it was by the side of the stage. Next, she juggled with silk handkerchiefs. After she threw them into the air, they fell gently downwards for her to catch. After, she lifted a robot penguin out of the box. She held it high in the air. There was a screen behind the magician and she pushed the screen to one side. Behind the screen was a paddling pool. The magician placed the penguin into the water and it started to swim a length of the pool. The children laughed and cheered, although they weren't sure what was magical about the robot swimming in the pool! The magician ended her show by popping a big party popper. The popper shot long strips of colourful paper into the air, which then fell softly to the ground.	**The magician's force is lifting it up and gravity is pulling it down to Earth.**

Exit Ticket

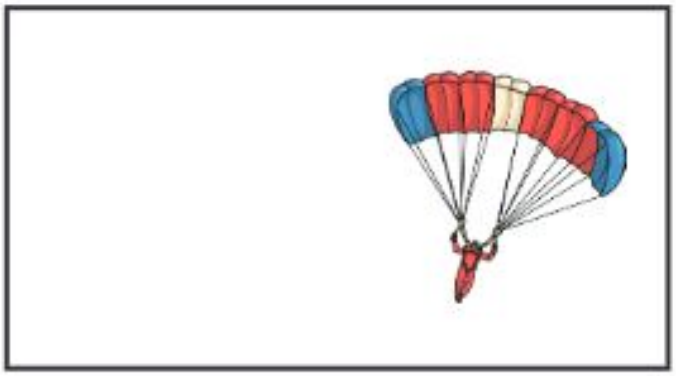
In the two pictures below, the arrows represent forces acting.

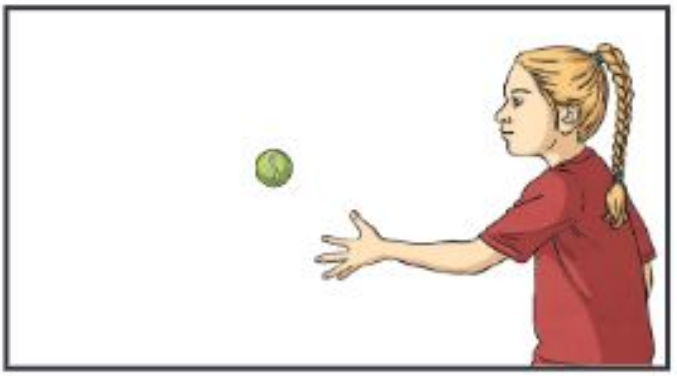
Write the names of the forces in the boxes.





Draw your own arrows and label them to show the forces acting.





Draw your own pictures in the boxes below. Then label and draw your own arrows to show the forces acting.

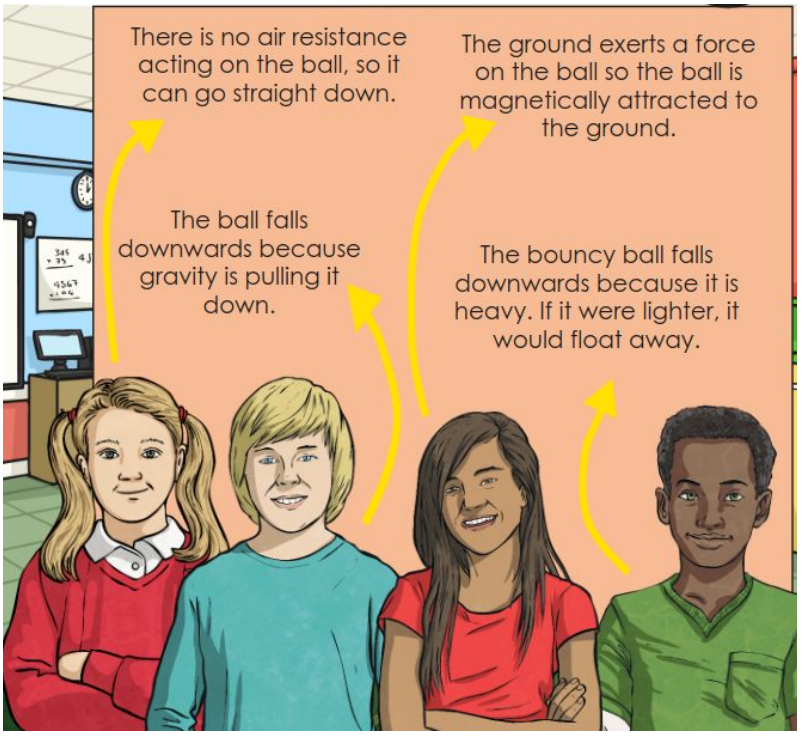
KO Quiz: / 5 Date:_____

LESSON TWO: Gravity

Do now:

Watch the first 20 seconds of this video of a ball bouncing (https://www.youtube.com/watch?v=aY3TrpiUOqE). What does it do?

These children are discussing why the bouncy ball falls down rather than falling up, sideways or staying still. Which child or children do you agree with?



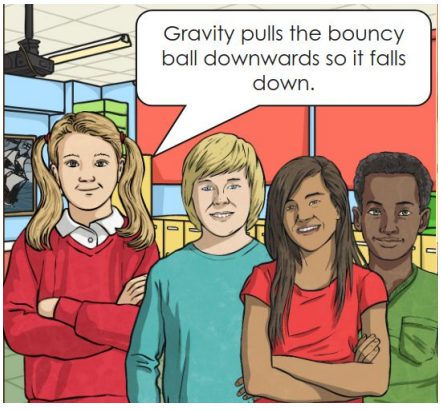
Outcomes	**Key Vocabulary**
To explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object by measuring the force of gravity pulling on objects.	Gravity, force, Isaac Newton, newton, newton meter, weight, mass.
Knowledge needed	
The children will have learnt about gravity as a pulling force in Lesson 1.	

Everybody Watches

Did you agree with this girl?
Gravity is the force that means that objects are pulled towards the centre of the Earth.

All objects exert a gravitational pull. However, the strength of an object's gravitational pull depends on its mass. The Earth is a huge object with an extremely high mass, so its gravitational pull is very strong.

The force of gravity keeps us on the ground. Gravity also causes objects to fall down if they are dropped.



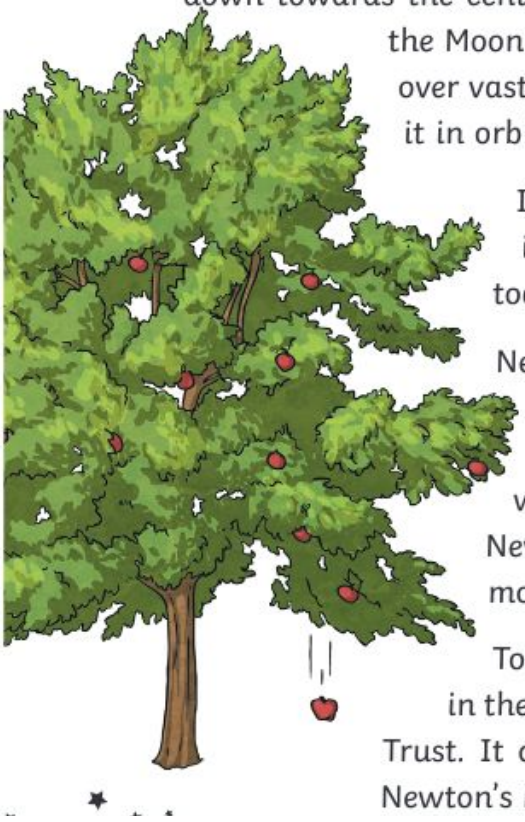
Everybody Reads

Isaac Newton was an English scientist and mathematician. He made many discoveries in his lifetime. One of the most important and influential discoveries that he made was the law of gravity.

Newton was born in 1643 at Woolsthorpe Manor in Lincolnshire. He worked hard at school, and was accepted to study at Cambridge University. He worked there for many years, but in 1665, the plague broke out and he was forced to move back to Woolsthorpe Manor.

While Newton was in the garden at Woolsthorpe Manor one day, he saw an apple fall from a tree. Some say it fell on his head but there is no evidence that this definitely happened. The sight of the apple falling down from the branch to the ground inspired Newton to think about the way it fell. Years later, he told his friend William Stukeley that he wondered why the apple fell down rather than sideways or upwards. He concluded there must be a 'drawing power' in the Earth and that 'the sum of the drawing power must be in the Earth's centre, not in any side of the Earth.'

Newton spent a lot of time thinking hard about the force of gravity, and how it pulls objects down towards the centre of the Earth. He was particularly interested in the way the Moon orbits the Earth, and he reasoned that gravity must extend over vast distances, pulling the Moon towards the Earth and keeping it in orbit.



In 1687, Newton published his discoveries about gravity in his famous book, The Principia. His findings are known today as Newton's Law of Universal Attraction.

Newton died in 1727, but his legacy lives on. All forces are measured in newtons (N), using a newton meter – both of which are named after Isaac Newton. Even Albert Einstein, writing in 1927, 200 years after Newton's death, described Newton as a 'shining spirit', and claimed he had one of the most brilliant minds of anybody who had ever lived.

Today, the apple tree that inspired Newton's ideas still grows in the gardens at Woolsthorpe Manor, now owned by the National Trust. It can be seen from the window of the room that was Isaac Newton's bedroom.

Independent Task

1. When was Isaac Newton born?

2. Why do you think the outbreak of plague forced Newton to move from Cambridge back to Woolsthorpe Manor?

3. What inspired Newton to explore the force of gravity?

4. How did Newton describe the way gravity pulls objects?

5. What did Newton discover about the way gravity affects the Moon?

6. Why do you think forces are measured in newtons with a newton metre?

7. Look at this phrase: *Even Albert Einstein, writing in 1927, 200 years after Newton's death, described Newton as a 'shining spirit'*. What does the word 'Even' make you think about Albert Einstein?

8. Why do you think the National Trust have kept and looked after the apple tree in the gardens of Woolsthorpe Manor?

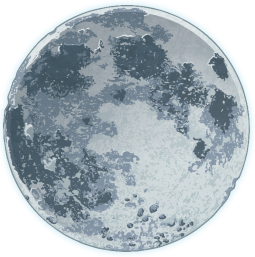
Everybody Reads

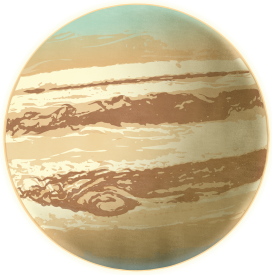
People often use the words weight and mass to mean the same thing.

Mass is a measure of the amount of 'stuff' inside an object, and is measured in **kilograms** (kg).
Weight is actually a measure of the strength of gravity acting on an object. It is measured in **newtons** (N).
The **weight** of an object is caused by **gravity** pulling it down. Objects with more **mass** have a greater weight, as the force of gravity pulls them down more strongly.

An object's mass will stay the same even if it is in a place with weaker gravity, like the Moon.

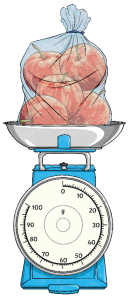
However, an object's **weight** can **change**! If the object were on the Moon, although it would have the same mass, it would weigh much less as the gravity would not be pulling it down as strongly. The Moon's gravity is much weaker than the Earth's.





Jupiter is a much bigger planet than Earth so it has a stronger gravitational pull. Although an object would have the same **mass** on Jupiter as anywhere else, it would **weigh** much more due to the gravity pulling it more strongly.

REMEMBER

MASS	WEIGHT
Mass is how much **matter** (or 'stuff') is inside an object. It is measured in **kilograms** (kg).	**Weight** is how strongly **gravity** is pulling an object down. It is measured in **newtons** (N).
	

Group Task

- You are going to measure the weight and mass of different objects.
- The weight of an object is measured using a newton meter. Remember, weight is a measure of how strongly gravity is pulling on the object.
- The mass of an object is measured using a set of scales. Remember, mass is a measure of how much matter (or 'stuff') is in the object.
- You can find an object's weight by placing the object in a bag and hanging the bag from the newton meter to measure how strongly gravity is acting on the object.

Measuring Gravity - Prediction and results sheet

Measure the weight and mass of different objects.

Do you think there will be a link between the weight and mass of each object?

_____

_____

Record the mass and weight of each object in the table below.

Object	Mass (kg)	Weight (N)

Did you notice a link between the weight and mass of each object?

Describe what you found out below.

_____

_____

Fill in the key words below to explain how gravity gives objects their weight.

All objects are made of _____, or stuff. The amount of matter they are made of is called their mass. This is measured in _____.

_____ pulls all objects down towards the _____ of the Earth. It pulls objects with a larger mass down with a stronger _____. The pulling force of gravity on an object is its weight. It is measured in _____.

Exit Ticket - Talk Task

Did you notice a link between each object's **weight** and its **mass**?
Talk to a partner about the link you spotted.
Did they see a similar link?
Can you explain any results that don't follow this link?

Let's look at the final slide and see if your results match the findings.

KO Quiz: / 5 Date:_____

LESSON THREE: Air Resistance

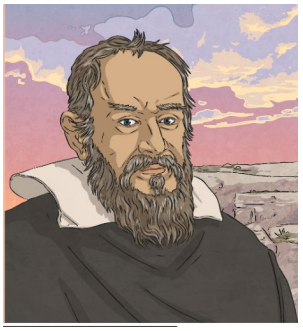
Do Now: Vocabulary Practice

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

opposing	Newton	
gravity	Galileo	pulley
resistance	lever	machine
friction	gear	

Outcomes	**Key Vocabulary**
To identify the effects of air resistance by investigating the best parachute to slow a person down.	Gravity, air resistance, Galileo Galilei, mass, parachute, force, prediction, investigation, measure, observe, variables, results.
Knowledge needed	
The children will have learnt about the opposing forces of gravity and air resistance in Lesson 1.	

Everybody Reads
You have learnt that **gravity** pulls objects towards the centre of the Earth.
But do you think all objects are pulled as fast as each other?
These two balls are the **same size**, but one has a much **greater mass**.
Do you think they will hit the ground at the **same time** when dropped from a height?



Galileo Galilei (1564-1642) was an Italian scientist and mathematician who wondered about this.

In 1590, he decided to carry out an investigation to find the answer.
He climbed to the top of the Leaning Tower of Pisa with two balls of similar shape and size, but with different masses.

He dropped both of the balls from the top of the tower at the same time.
Both balls hit the ground at the same time.
Galileo's experiment proved that **all objects fall at the same rate**, no matter what their mass is.
But this can seem hard to believe!
Think about a feather and a hammer. If you dropped both objects at the same time, would they hit the ground at the same time?

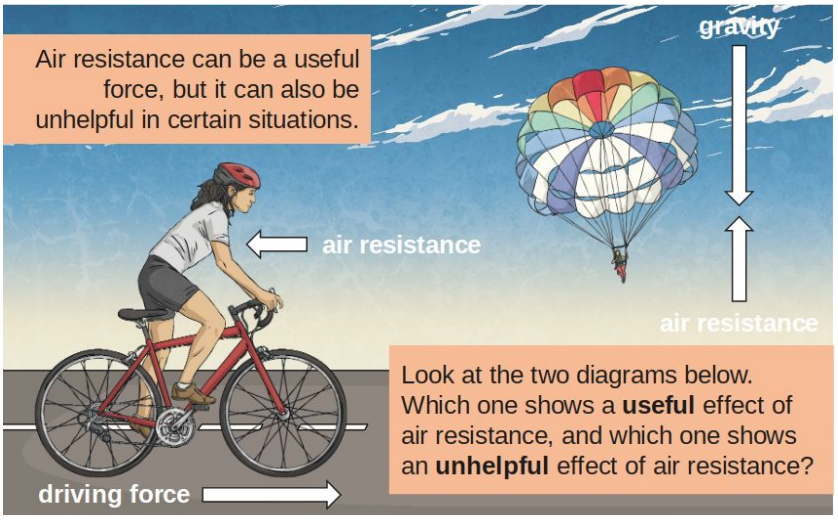
Talk Task - Gravity and falling
What do you think happened when astronauts stood on the Moon and dropped these two items at the same time?

Everybody Reads
The feather and the hammer hit the surface of the Moon at the **same time**!
This proves that Galileo's findings are correct.
Can you think why the two objects might fall at the same speed on the Moon but the feather falls so much more slowly on Earth?
What is different about the Moon and the Earth that could cause this to happen?

Air Resistance
There is **no air** on the Moon.
Air pushes against any object moving through it. This is known as **air resistance**.

On Earth, air resistance acts on both objects. The feather has a large surface area in comparison to its mass. The hammer has a small surface area in comparison to its mass. Air resistance therefore has a greater upwards force on the feather.

Since there is no air on the Moon, there is no **air resistance** to push against the feather, so the two objects fall at the **same speed**.



Air resistance pushes up on the parachute, **opposing** the force of **gravity** and making the parachute and the person fall more slowly. This is a **useful** effect.
But **air resistance** pushes the cyclist back, **opposing** the **cyclist's force** from them pedalling the bicycle and making the bicycle travel more slowly. This is an **unhelpful** effect.

Group Task - The perfect parachute

The Super Skydiving Company are redesigning the parachute they use to allow people to perform skydives from aeroplanes. They want to make sure that the parachute they use allows their customers to fall from the aeroplane as **slowly** and **safely** as possible.

You are going to investigate a helpful effect of **air resistance** by finding the best design for their new parachute.

The perfect parachute will be the one that makes a person fall the **slowest**. It will cause **air resistance** to push it up with the **biggest force**.

Method

You will make three parachutes and drop them from a height. Each of the three parachutes should be slightly different.

You will observe which of your parachutes falls the **most slowly**. This parachute will have the most **air resistance** pushing it up.

Construct your parachutes using a sheet of plastic or card. Tie or tape string to the corners, and tie or tape the four pieces of string to an object such as a toy figure, paper clip or piece of modelling clay.

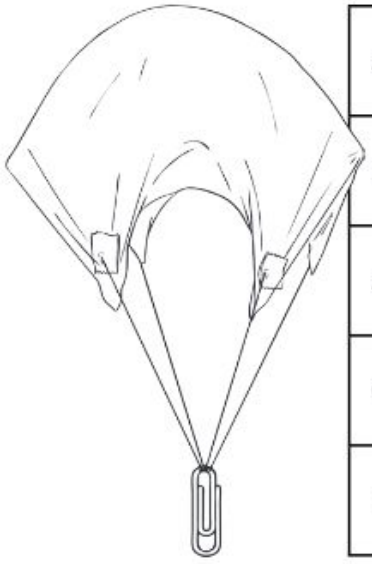
How many variables can you think of?

Did you come up with any of these?

- Object attached to the parachute,
- Shape of parachute
- Length of string to attach the object
- Size of parachute
- Height of drop

You have been asked to redesign a parachute for the Super Skydiving Company. You will make three parachutes and see which type of parachute falls the slowest. Which variable will you change about your parachute each time? Which variable will you measure?

Variable that I will change about my parachute each time:



Size of parachute	
Height of drop	
Shape of parachute	
Object attached to parachute	
Length of string to attach object to parachute	

Variable that I will measure: _____

Why is it important to keep the other variables the same?

_____

_____

My prediction: (explain what you think will happen, which parachute will have most air resistance and which will fall the slowest):

_____

_____

Complete your results in the table below:

Parachute 1		
Parachute 2		
Parachute 3		

You now need to explain your findings to the Super Skydiving Company.

Let them know the best design for their new parachute and explain why it works well.
In your answer, make sure to explain how air resistance affects moving objects.

The Super Skydiving Company are waiting for your report! How should they redesign their parachute to make it fall slowly? Use your results to tell the company what their parachute should look like or be made of in order to create the most air resistance.

Draw and label your suggestion for the new parachute.

Complete these sentences to explain which parachute fell the slowest, and why. Our results show that the parachute that was the slowest was

_____

This parachute created the most air resistance because

_____

_____

_____

_____

The new parachute should be

_____

_____

Exit Ticket - Talk Task

Talk to your partner about air resistance, use the word bank and question prompts to help you.

Word Bank

gravity, air resistance, Galileo Galilei, mass, parachute, force prediction, investigation measure, observe variables, results.

- What it air resistance;
- Famous experiments associated with it;
- How it is helpful and unhelpful;
- Where you see air resistance every day;
- What your investigation showed.

KO Quiz: / 5 Date:_____

LESSON FOUR: Water Resistance

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 sign your name.

If you **complete all** of your feedback, on your whiteboard write 5 questions about **forces** for another person in the class to answer.

Outcomes	**Key Vocabulary**
To identify the effects of water resistance by creating and racing streamlined boats.	Water resistance, streamline, force.
Knowledge needed	
The children will have learnt about water resistance as an opposing force in Lesson 1, and will have learnt about air resistance in Lesson 3.	

Talk Task
How does it feel to walk through deep water?
Think of some words and phrases to describe the feeling.

_____

_____

_____

_____

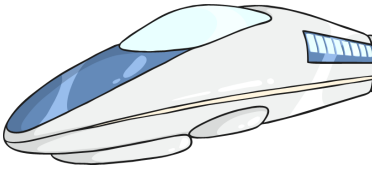
Share your ideas with the class.

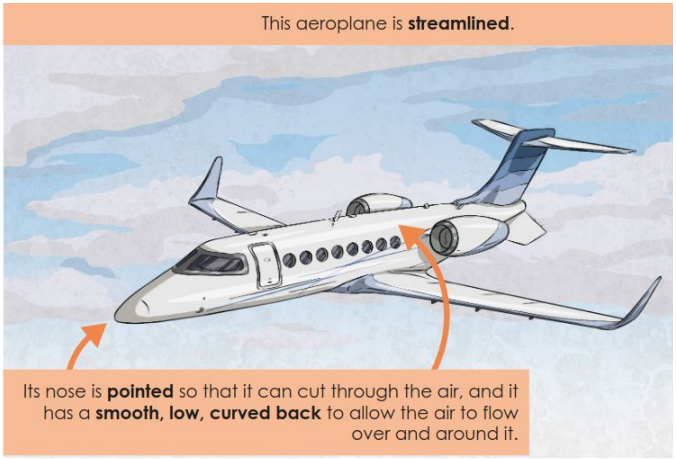
Everybody Reads
If you have ever walked through water, you will have felt the effects of **water resistance** pushing against you.

Whenever an object moves through water, it experiences the force of water resistance. Water resistance **pushes** against objects, making it hard for them to move through water.

However, this also helps you to swim, as when you push against the water with your hands, the water resistance pushes back and helps you to move forward, like using oars to push against the water to row a boat.

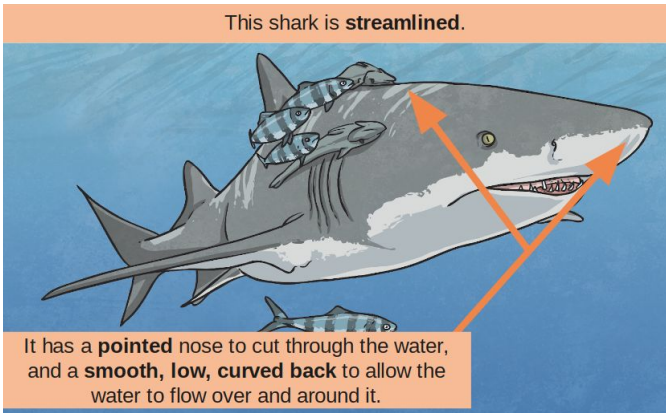
It is possible to reduce the effects of water and air resistance. Objects that do not experience much water or air resistance are described as **streamlined**.



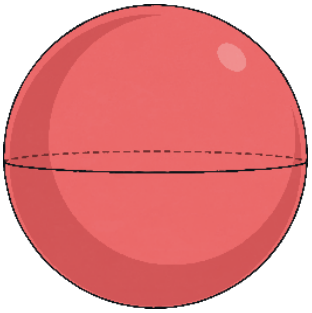


Streamlined shapes
Aeroplane
It does not create much **air resistance** so it can move through the air easily.

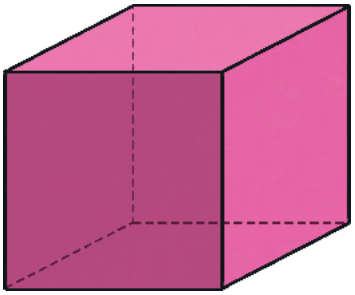
Shark
It has a **pointed** nose to cut through the water, and a **smooth, low, curved back** to allow the water to flow over and around it.



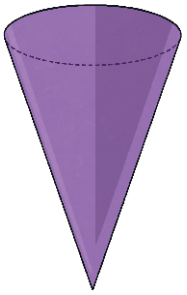
Demonstration
We are going to mould some playdough into the three different shapes. We are then going to drop them in a measuring cylinder of water.



sphere



cube



cone

Which shape do you think will fall the **fastest**? Which will fall the **slowest**? Try it out!

Results
The **cube** should have fallen the **slowest** through the water. It is the **least streamlined** shape because it has a **flat** surface which creates a lot of **water resistance**. The water pushes against the flat surface, slowing it down.

The **cone** should have fallen the **fastest** through the water. It is the **most streamlined** shape as it has a **pointed** end to cut through the water.

What do you think would be the best shape for your boat?
The **most streamlined** boat will create **the least water resistance**, and will move through the water the **fastest**.

Independent Task
Use plasticine to create a boat that will float well - think about the work in today's lesson to help you design it.

Draw and label your boat here.

Why have you designed your boat this way?

Do you think your boat will move through the water easily and quickly? Why/why not?

How long did it take your boat to cross the water tray?

How did your boat do compared to the other boats?

Why do you think your boat performed this way? Refer to water resistance and streamlined shapes.

Exit Ticket - Talk Task

A swimming teacher wants to buy some animal toys for younger children to use in her lessons. She will throw the toys to the bottom of the pool for the children to swim down to collect.
Thinking about the shape of each animal toy, which toy would sink to the bottom of the pool the quickest? Talk to your partner about your ideas.

Let's look at the final slide and find out if your ideas were correct.

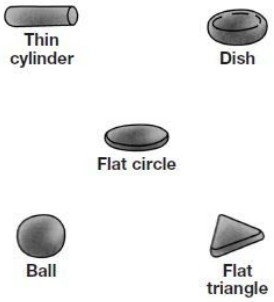
KO Quiz: / 5 Date:_____

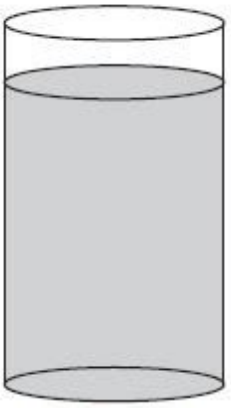
LESSON FIVE: Friction

Do Now: Exam Style Question

(a) Sarah makes five different shapes using modelling clay.

She uses the same amount of clay for each shape.



Sarah fills a container with syrup. She drops each shape into the syrup. She times how long it takes each shape to reach the bottom of the container.	 Container of syrup

Tick **ONE** box to show why clay is a good material to use to make different shapes.

Clay can float.	☐	Clay is soft and flexible.	☐
Clay dissolves in water.	☐	Clay is a heat insulator.	☐

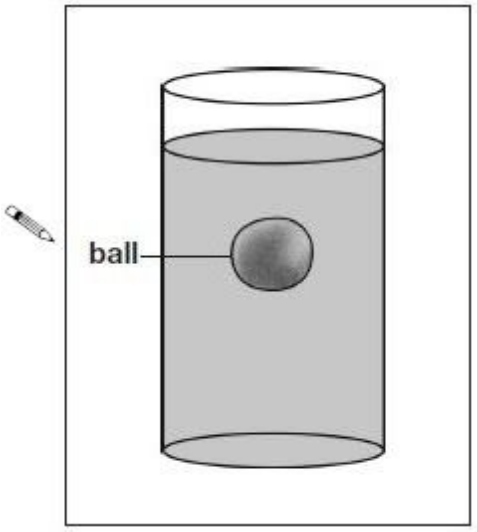
(b) Here are Sarah's results: Which shape fell the fastest?	**Shape**	**Time to reach the bottom of the container (seconds)**
	thin cylinder	1.0
.....	dish	8.0
	flat circle	4.0
	ball	0.5
	flat triangle	4.0

(c) Sarah found it difficult to time some of the shapes accurately.

Tick **ONE** box to show why Sarah found it difficult to time some of the falling shapes.

They are made out of the same amount of clay.	☐	They fell at different speeds.	☐
They fell quickly through the syrup.	☐	They are different shapes.	☐

(d) There is a force from the syrup acting on the shapes as they fall.

Draw **ONE** arrow on the diagram to show the direction of the force **from the syrup** on the ball.	

Outcomes	**Key Vocabulary**
To identify the effects of friction by investigating brakes.	Friction, force, brake, prediction, investigation, measure, observe, variables, results.
Knowledge needed	
The children will have learnt about friction in Year 3 and in Lesson 1 of this unit.	

Talk Task

Look at the statements about friction. Can you decide which are true or false? Discuss your ideas with your partner before sharing your thoughts with the class. Tick the ones you think are true.

Friction is a force.	Friction slows moving objects down.	Friction is always a useful force.
Friction is stronger than gravity.	All surfaces create friction on an object moving over them.	Friction produces heat.

Look at the presentation, the statements which turn green are true. How many did you get right?

Everybody Reads

What is friction?

Friction is a **force** that acts between two surfaces or objects that are moving, or trying to move, across each other. For example, when you try to push a book across the floor, friction makes this difficult.

Friction always acts in the **opposite direction** to the direction that the object is moving. It always **slows** a moving object down.

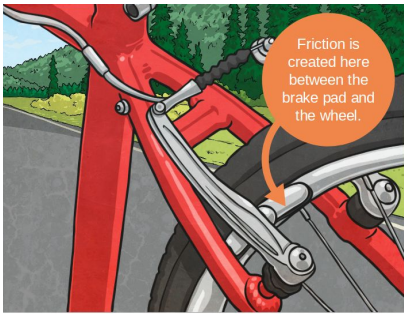
All surfaces create friction on an object moving across them. Rougher surfaces produce more friction, but even very smooth surfaces like ice produce some friction.

Can you explain to your partner how friction affects a moving object?

Air resistance and **water resistance** are both forms of **friction**. Gases and liquids create friction as well as solids.

Friction can be **useful** – for example, the soles of your shoes create friction with the ground, preventing you from slipping over.

However, friction can be **unhelpful** too – friction on a bike chain can make the bike harder to pedal.



The brakes on a bicycle or car work by creating friction between the brake pad and the wheels.
The friction opposes the movement of the wheels, slowing them down and eventually stopping them.

Group Task

A company that makes tricycles and scooters wants to create a new set of brakes for their latest model. They need to make sure their tricycles and scooters slow down and stop safely for the young children using them.

They have asked you to help them find the **best material** for their brake pads. The best material will be the one that creates the **most friction** between the brake pad and the wheel.
You will need to test different materials and demonstrate the best choice.

Method

To test the different materials for the brake pad, you will need a small tricycle or scooter, a piece of thick card (about the size of a playing card), different materials to wrap around the card and a stopwatch.
Work in groups. Spin the wheel of the tricycle or scooter, then carefully hold the piece of card with one material wrapped around it against the spinning wheel. Be careful not to put your fingers on the wheel. Use the stopwatch to time how long it takes for the wheel to stop completely.
Then wrap the card in a different material, and time how long that material takes to stop the wheel.

Complete this with each different material.

Variables

When scientists carry out investigations, it is important that they **control** all the **variables** to get **reliable** results.
In this investigation, the variable that is being tested is the **type of material** the brake pad is made

from. This will be changed each time.
The variable to be measured is the **time** it takes for the wheel to stop spinning.

All the other variables in the investigation will need to be kept exactly the **same** each time.

Can you think of any variables in this investigation that may be tricky to keep the same every time?

There are two variables that could be tricky to keep the same: the **speed** at which the wheel spins each time, and the **pressure** with which the brake pad is applied to the wheel.

If you press the brake pad onto the wheel very hard with one material, but gently with another, your results will not be reliable.

If the wheel spins very quickly when you try one material, but slowly when you try another, you will not get reliable results.

You will need to be very careful to control these two variables.

In your group, discuss how you could try to keep these variables the same.

Planning and results sheet

You have been asked to design a new brake pad for a tricycle or scooter. You will find out which material creates the most friction and stops the wheels the quickest.

Which materials will you test?

_____

Which material do you predict will be the best choice for the new brake pad?

_____

Can you explain why?

_____

Material being tested	Time taken for the wheel to stop (in seconds)

The company would like to see a demonstration of the best material in action. Stick a photo or draw a picture of your demonstration of the best choice for the new brake pad in the box.

Can you explain why this material is the best choice for the new brake pad?

_____

_____

_____

Exit Ticket

Your younger friends love sledging, but they wish the sledge would not go quite so quickly down snowy hills. Discuss with your partner:

- How would you change the design of the sledge to solve this problem?
- What would you say to the children to explain how you managed to slow down their sledge? As they are younger children, you must talk about friction in a simple way so that they will understand.

Write down some of your suggestions below.

_____

_____

_____

_____

_____

_____

_____

_____

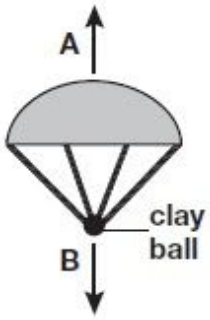
Look at the final slide, do you agree with the suggestion? Discuss this with your partner.

KO Quiz: / 5 Date:_____

LESSON SIX: Marvellous Mechanisms

Do Now: Exam Style Question

(a) Jamie has a parachute. The two arrows on the diagram below show two forces (A and B) acting on the falling parachute.

Label forces A and B on the diagram below. (i) Force A is ..... (ii) Force B is	

(b) Tick ONE box to show the effect force A has on the parachute.

It makes the parachute fall faster.	☐	It makes the parachute heavier.	☐
It makes the parachute fall slower.	☐	It makes the parachute lighter.	☐

(c) Jamie wants to find out if changing the material of the parachute affects the time it takes to fall to the ground.

The table shows some of the variables in Jamie's investigation.

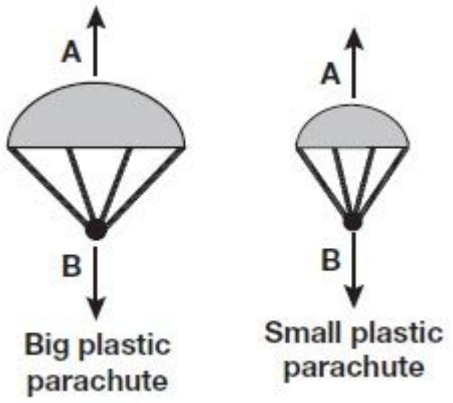
Complete the table to show how Jamie should do his investigation. Tick ONE box in each row.

Variable	Variable to be changed	Variable to be measured	Variable to be kept the same
height of drop			
mass of modelling clay			
size of parachute			
material of parachute			
time taken to fall to the ground			

(d) Jamie decides to test each of his parachutes three times. He records his results in the table below. One of the times in his results table looks wrong.
Circle ONE time in the results table that Jamie should check.

Parachute material	Time taken to reach the ground (seconds)		
	test 1	test 2	test 3
plastic	2.4	2.4	2.5
bubble wrap	2.1	2.0	2.0
netting	2.9	1.0	1.0

(e) Jamie makes a smaller parachute made of plastic.

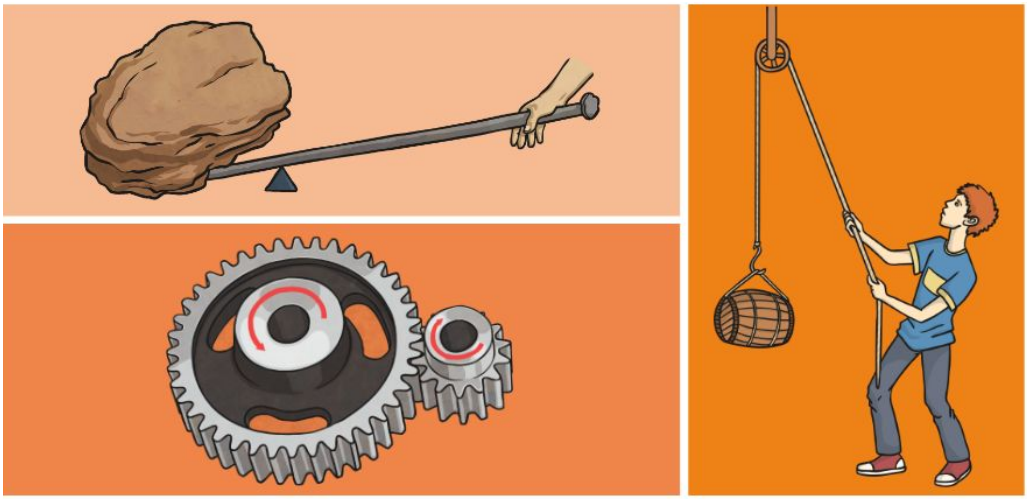


Predict the time it will take the smaller plastic parachute to fall to the ground.

..... seconds

Outcomes	**Key Vocabulary**
To recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect by exploring and designing a simple mechanism.	Mechanism, lever, gear, cog, pulley, machine, force.
Knowledge needed	
The children will have learnt about forces in Lesson 1.	

Talk Task
How do you think these images are related to the topic of forces? What do these images show?



A **mechanism** is a device that changes an **input force or motion** into a different **output force or motion**.
Some mechanisms make work **easier** to do by allowing a **smaller force** to have a **greater effect**.

There are different types of mechanisms.

Read the facts on the sheet and find out about a particular type of mechanism. Make notes about the mechanisms below.

Levers	Pulleys
Gears or cogs	

Can you identify whether these objects use **levers**, **pulleys** or **gears**? Write the word next to each picture.

Look at the next slide, did you identify the mechanisms correctly?

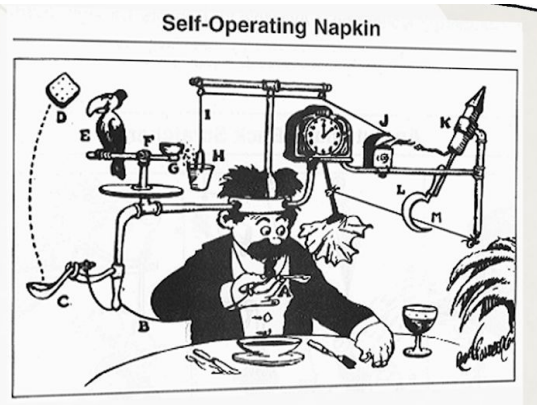
Everybody Reads

These types of mechanisms are used to make lots of machines work and help us to get jobs done in everyday life.
Look at the mechanisms inside a watch.

Which mechanisms can you see?

The gears turn to move the hands around the clock face.

Cracking contraptions



Some designers and cartoonists have fun drawing and creating crazy machines that use lots of mechanisms to achieve a simple task.
This is an invention drawn by Rube Goldberg, a famous cartoonist.
He has designed a 'Self Operating Napkin', so that when the man in the picture lifts his spoon, it sets off a series of mechanisms that eventually work together to lift the napkin to wipe his mouth!

There are lots of popular games where players set off a series of different mechanisms that work together to achieve an objective.

Everybody Watches

Wallace (from Wallace and Gromit) is always inventing crazy contractions to help around the home, they don't always go to plan! Let's watch one of these contractions in action!
https://www.youtube.com/watch?v=vGxRUglFFME

Independent Task

Now it's your turn to become an inventor!

Your task is to design a **machine** that will achieve a given aim, e.g. a machine that throws a ball or tidies your room.
Choose one of the aims below and design a machine to achieve that aim – or think of your own aim!

Water a plant.	Find a missing pen lid.	Run a bath.	Tidy a table.
Make a drink.	Collect mail from the letterbox.	Hang a coat up.	Tie a tie.
Pack a bag.	Make a bed.	Tie a pair of shoelaces.	Peel an apple.
Put toothpaste on a toothbrush.	Set a table.	Turn a light off.	Write a card.

Make sure your machine uses lots of **mechanisms** including **levers**, **pulleys** and **gears** to achieve its aim.

Design your marvellous machine in the box below.

Machine Name:

What is your machine's aim?

How does your machine work?

Your partner should write in this section to evaluate your machine and your explanation of how it works.

Exit Ticket

Share your Marvellous Machine with your partner.

Explain the aim of your machine, and how it works. Point out the different mechanisms your machine uses.

Then **listen** to your partner as they explain their machine.

Evaluate your partner's work on the bottom of their Marvellous Machines sheet. What do you like about their machine? Is there anything you would change or improve? Why?