Olympics lessons

Science of movement - forces and motion

- Forces - push and pull, what they do, examples in sports (3 weeks) Focus on friction and gravity.
- Newton’s laws of motion
- Energy - motion is energy
- Food and energy - healthy eating, digestive system. (y8 book)

The Olympic Games and the science of movement

LI: To begin exploring what forces are and why they are important in sport.

1. In your groups, choose 3 olympic sports:

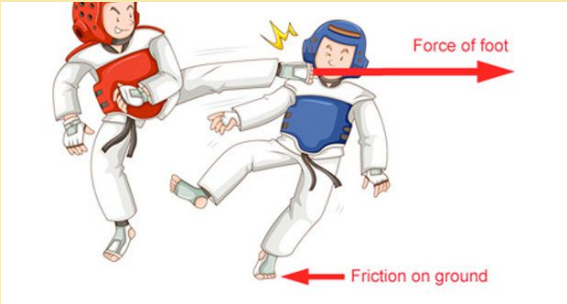
2. Write the **name** of each sport in the **middle** of a piece of A4 paper

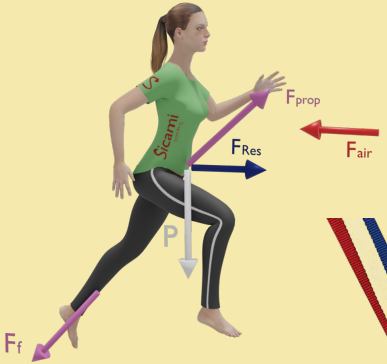
Brainstorm for each sport:

1. What **parts of their body** do they mainly use for the sport?
2. What **movements** do they have to make, and what **direction** do these movements go?
3. What makes a person the **best** at this sport?
4. What **equipment** do they need for this sport?
5. Draw a **diagram**

Why are forces important in sports?

All sports and involve forces - *applying* them, working *with* or *against* them, *reducing* or *increasing* them.





The most skilled force-users

What is a force?

A force is a **push** or a **pull** applied to one object by another object.

Push, Pull or Both?

push pull both

push pull both

push pull both

push pull both

push pull both

push pull both

Activity

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:

2

force:

3

force:

4

force:

We may not be able to *see* a force, but we can tell that it's there because it affects the object it is applied to.

Forces can:

a) change the speed of an object

b) change the direction of movement of an object

c) change the size or shape of an object

The Olympic Games and the science of movement

LI: To recap forces and begin exploring examples

What is a force?

A force is a **push** or a **pull** applied to one object by another object.

Forces cause objects to **change** their **speed, direction** or **shape.**

PUSH & PULL FORCES

SCIENCE FOR KIDS

We may not be able to *see* a force, but we can tell that it's there because it affects the object it is applied to.

Forces can change:

a) the speed of an object

b) the direction of movement of an object

c) the size or shape of an object

Write a sentence explaining…

1. *How does a spring change when we pull it or push down on it?*
2. *What happens to a still marble when pushed?*
3. *What happens to a rolling marble when pushed?*
4. *What happens to a rolling marble when pushed sideways?*

Can you think of 3 **other** examples of a **force** in action causing something to...

1. Change shape?
2. Change speed?
3. Change direction?

Friction and gravity

The Olympic Games and the science of movement

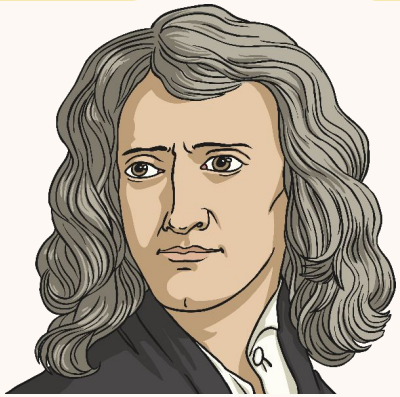
Hei mahi

1. What 3 different things can forces do to an object?
2. What are some types of forces you can remember?

How do we measure forces?

Forces are measured in **newtons**, using a **newton meter.**

The unit of force is named after Isaac Newton, who first theorised about forces.



Forces circus!

1. Work in pairs or 3 (maximum)
2. Go around each of the **stations**. FOLLOW THE INSTRUCTIONS on your worksheet carefully to write the **answers** to your questions.
3. Act sensibly! This is <u>not</u> playtime. Silly behaviour will result in a time-out.

Types of forces - gravity

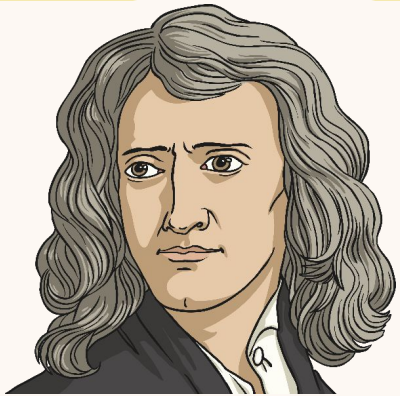
LI: To explore gravity and the legend who figured out how it worked

Hei mahi:
What are forces measured in? Who is this named after?

Forces

Forces are measured in **newtons**, using a newton meter.

The unit of force is named after Isaac Newton, who first theorised about forces.

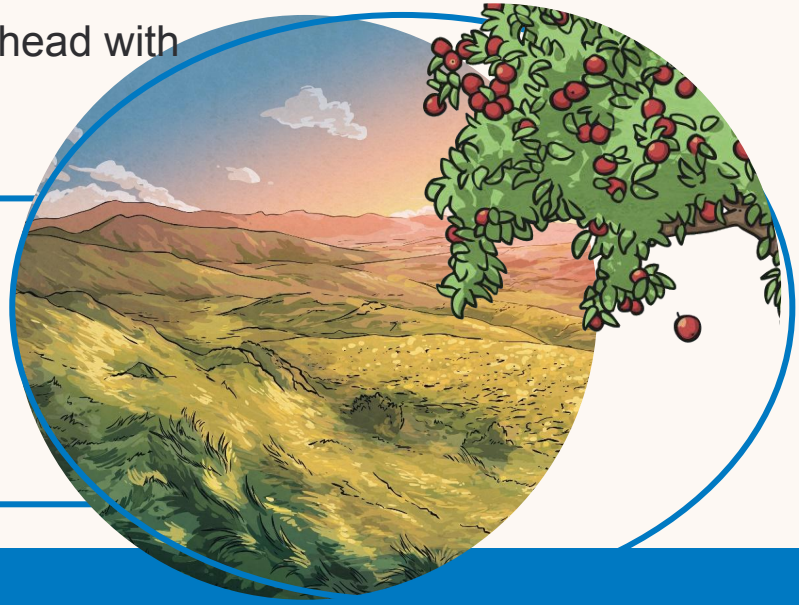


The Apple from the Tree

The eureka moment….

Legend has it, that Newton was hit on the head with an apple and that is how he discovered gravity. This isn't quite true…

He did see an apple fall from a tree, but rather than hitting him on the head, it got him thinking and that's how he worked out that gravity must exist.



Did you know?

This is why the weight of 1 Newton is approximately the same as one apple.

Questions

1. When was Isaac Newton born?

3. What fruit did Newton see falling from a tree?

4. In which direction does gravity pull objects?

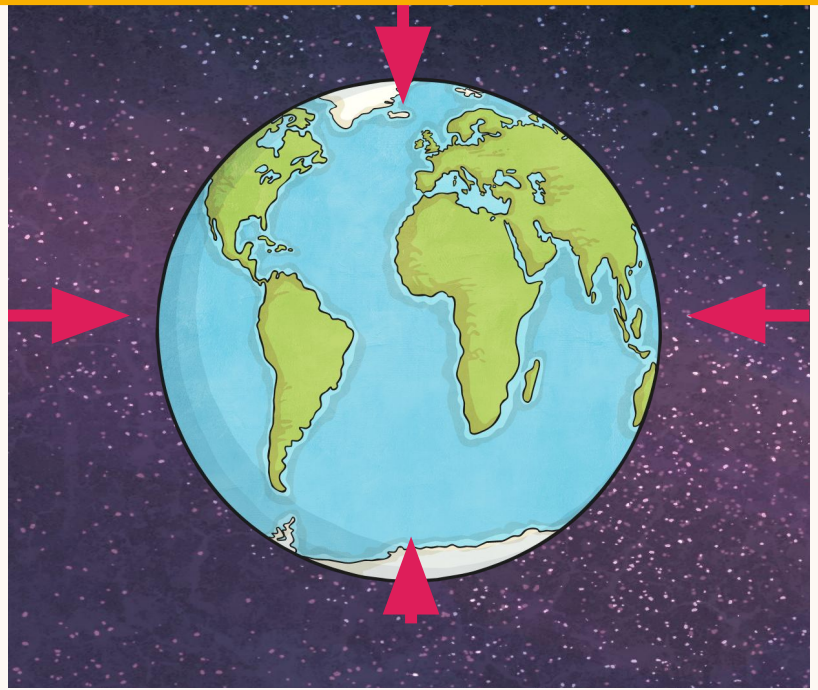
5. Why does the Moon stay in orbit around the Earth?

6. What are forces measured in?

7. What did Albert Einstein think of Isaac Newton?

Gravity is a Force

Gravity is an invisible non-contact force that pulls everything towards the centre of Earth.



Gravity is measured in metres per second squared (m/s^2).

Weight force due to gravity is measured in **Newtons.**

Group discussion

What *role* does gravity play in:

1. **Basketball?**

basketball

2. **Diving?**

diving

3. **Powerlifting?**

powerlifting

Weight and Mass

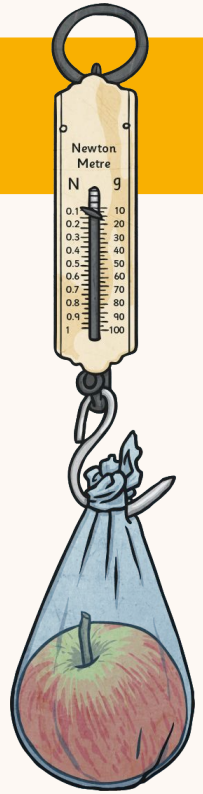
Mass is the amount of ‘stuff’ inside an object, measured in **kilograms** (kg).

Gravity is measured in metres per second squared **(m/s^2).**

Weight force is the strength of gravity pulling an object down. It is measured in **newtons** (N).

Objects with more **mass** have a **greater weight**, as the force of **gravity** pulls them down more strongly.

Weight, Mass and gravity



The equation to measure **weight force** due to gravity is: **Weight (N) = Mass x Gravity**

Mass is measure in **kilograms**

Gravity on Earth is 9.8m/s

Question: Ms Naidoo has a backpack with a mass of 3.75kg. What is its weight force?

Weight, Mass and gravity

Weight (N) = Mass x Gravity

Mass is measure in **kilograms**

Gravity on Earth is 9.8m/s

2. Miss R-B has a dog with a mass of 13kg. What is his weight force?

Weight, Mass and gravity

Weight (N) = Mass x Gravity

Mass is measure in **kilograms**

Gravity on Earth is 9.8m/s

3. Mr Whatman has a car with a mass of 800kg. What is its weight force?

Brainpop task - gravity

Find the link on google classroom

Types of forces - Gravity and Drag (air resistance)

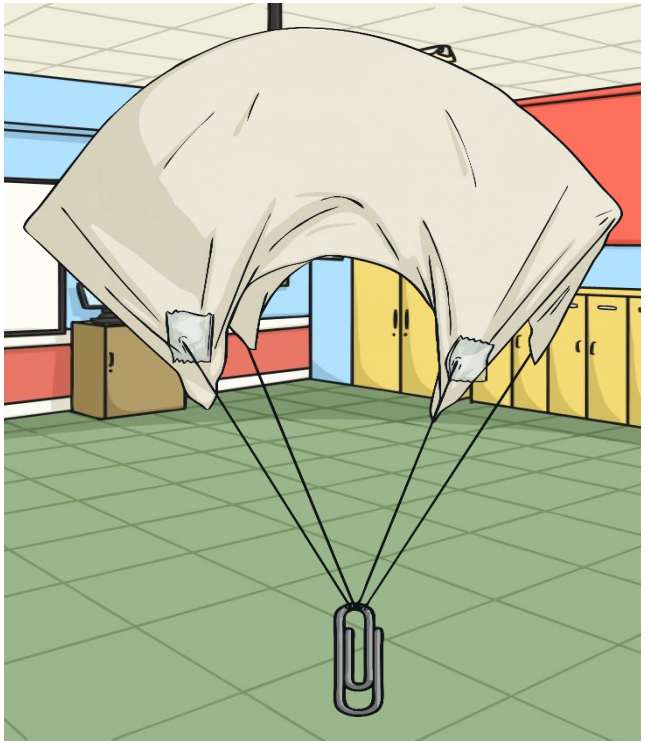
LI: To investigate how gravity and air resistance affect objects.

Question: Which one will fall the fastest? Why?

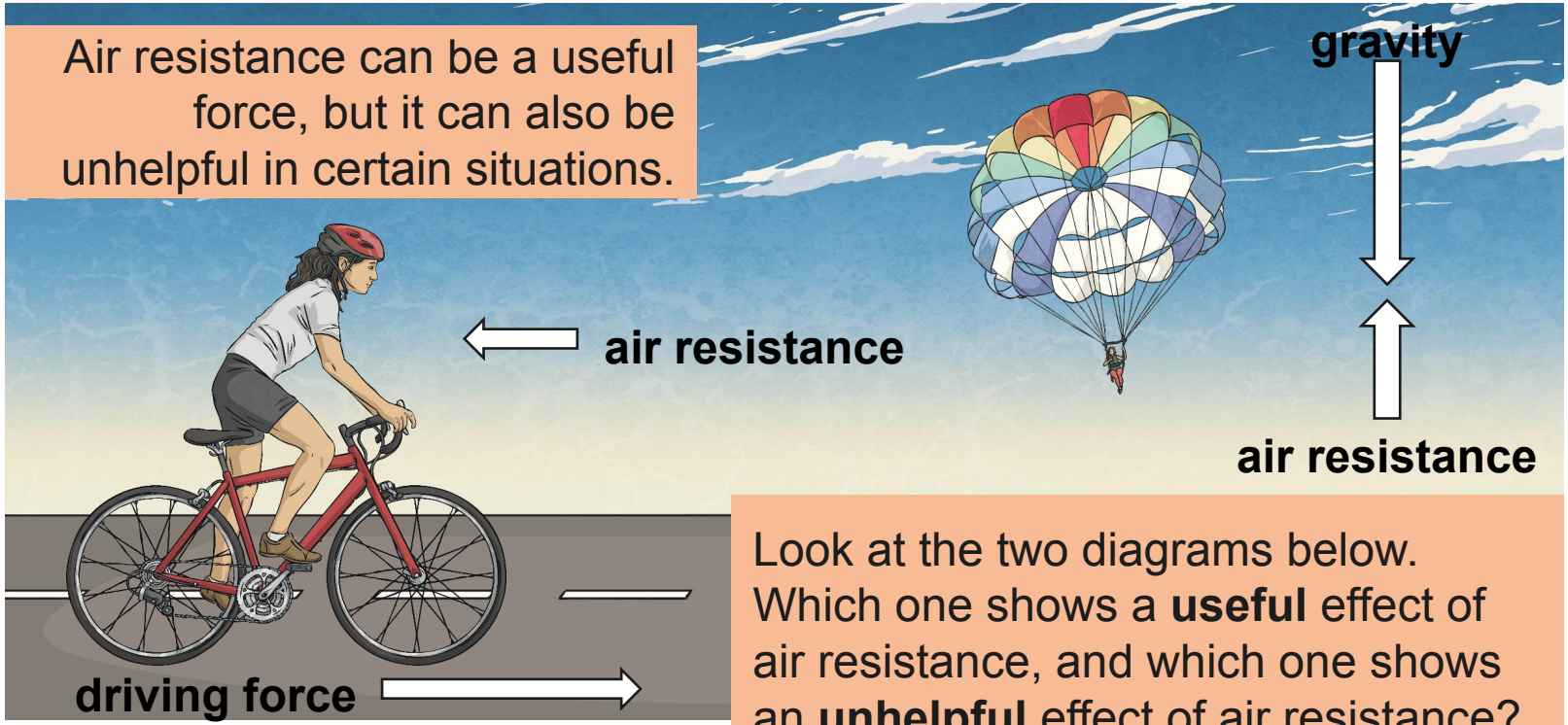
What is air resistance?

When an object moves through the air, air particles hit the object and create air resistance, slowing the object down.

For example, the **air particles** that hit an open parachute make it difficult for it to move through the air, because of its **shape and size.**

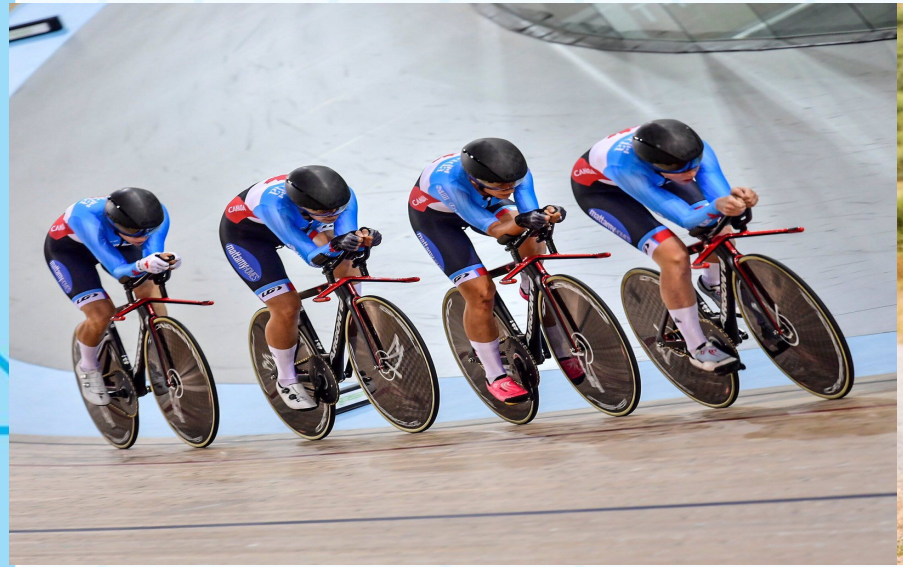


Air Resistance



Look at the two diagrams below. Which one shows a **useful** effect of air resistance, and which one shows an **unhelpful** effect of air resistance?

- Spot the difference



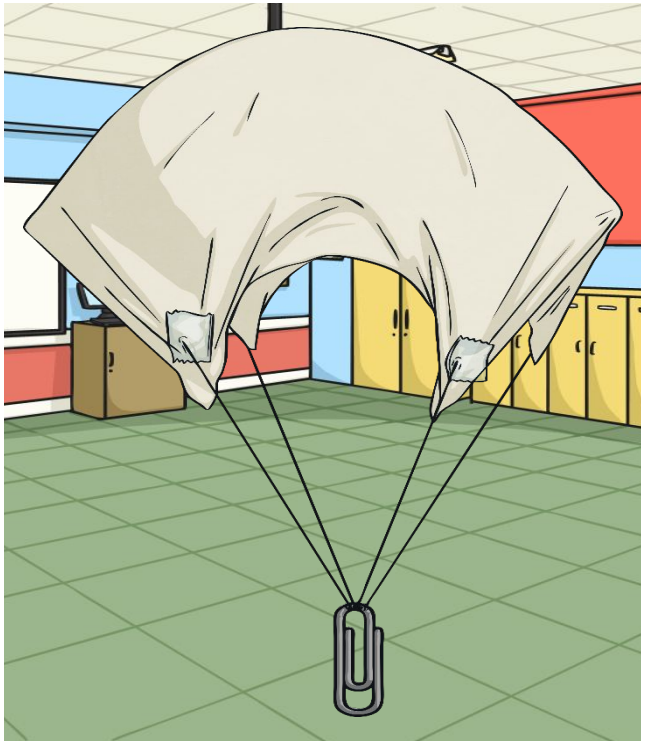
The **shape and area** of an object affects its air resistance.

Some objects are **streamlined** which means that they will have less **air resistance** and move through the air **easily.** Objects that are not streamlined will have **more air resistance.**

The Perfect Parachute

In groups of 2 or 3, You will make two different parachutes and drop them from a height.

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



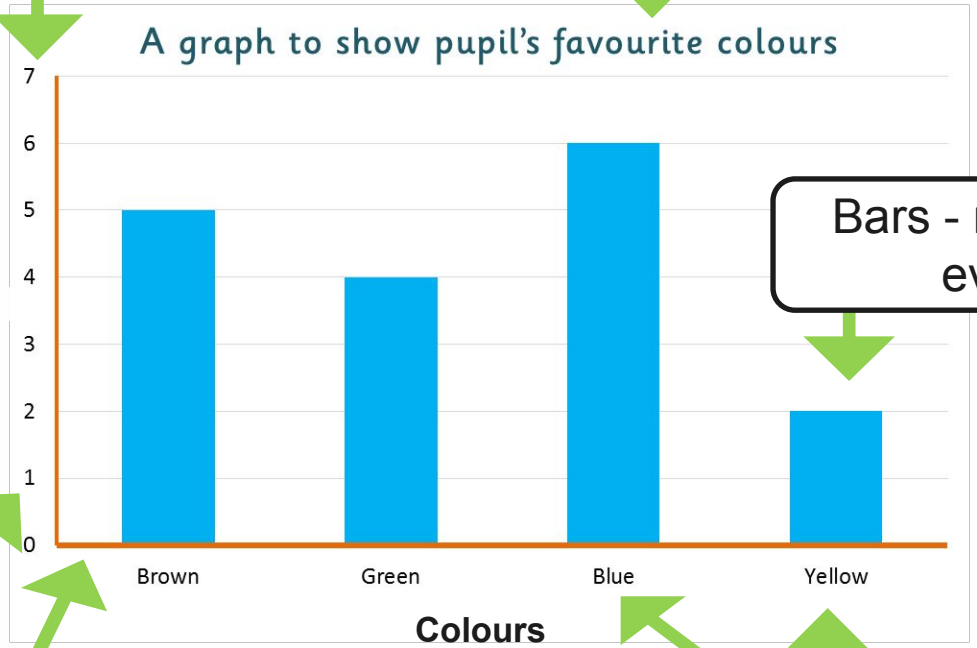
If you did not complete your parachute tests, copy these results into your book:

Time taken for parachutes to fall

	Trial 1	Trial 2	Trial 3	Average
Large				
Small				

Measurements - from 0 to above the maximum

Title - what does the graph show?



Bars - ruled and straight, evenly spaced

Axis

Axis title

Categories - what were the 2 types of parachutes?

Types of forces - friction

LI: to investigate friction force and examples of useful and non-useful friction

Brainstorm: What do you already know about friction?

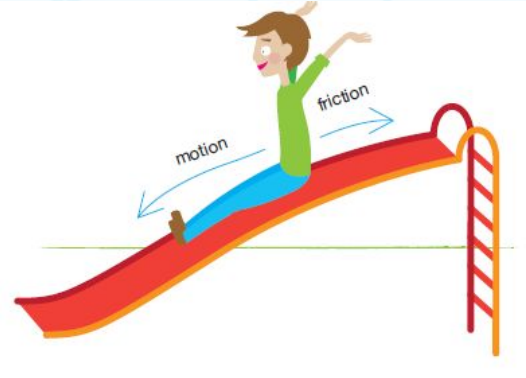
In pairs/3s task:

Put into order from easiest-hardest which surfaces you think it would be to slide across in your socks:

- Polished metal
- Wood
- Concrete
- Carpet
- Grass
- Vinyl flooring (eg. school bathrooms)

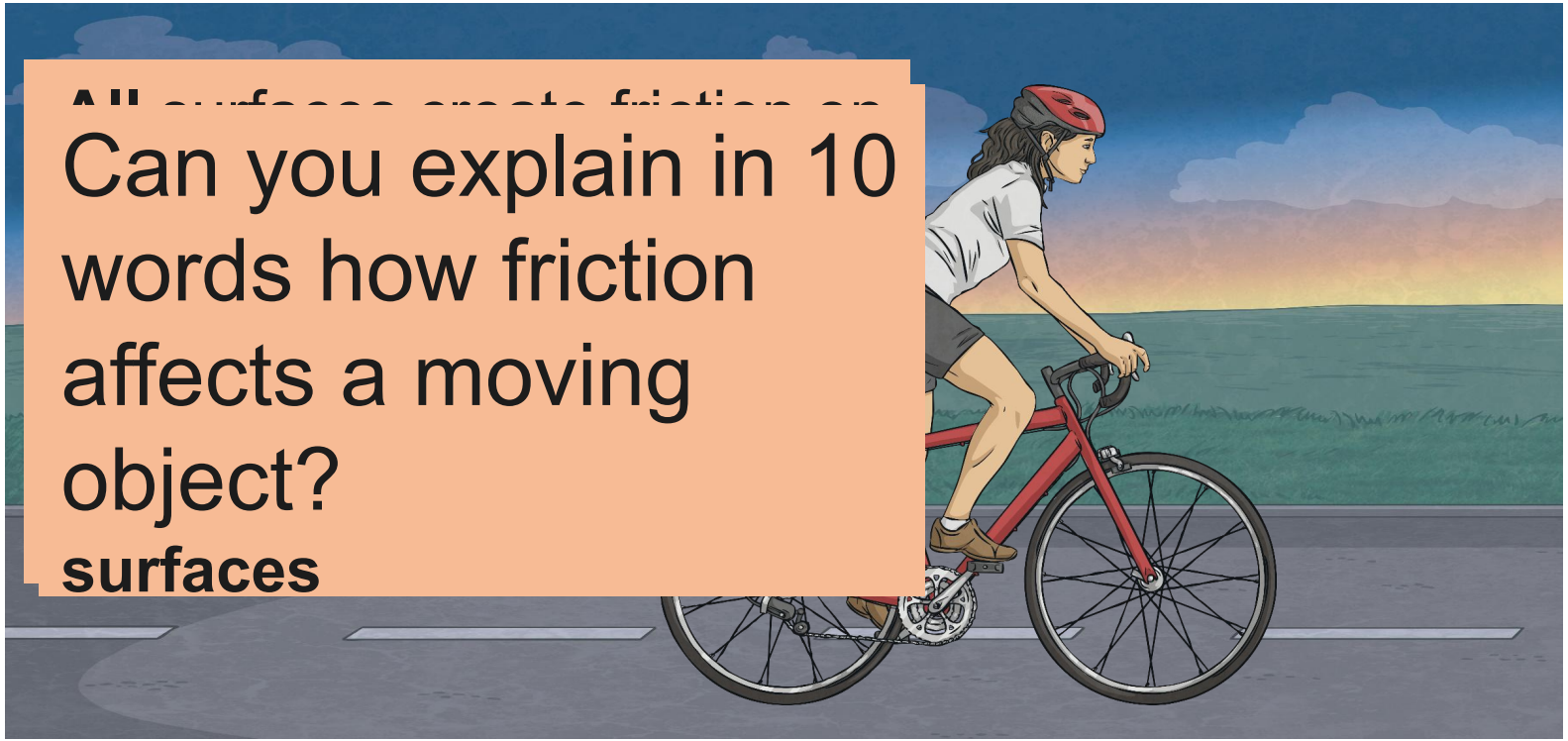
WHAT IS FRICTION?

Friction is a ***resistant*** **force** that occurs whenever one object tries to **move over another.**



What is Friction?

What Is Friction?



All surfaces create friction on

Can you explain in 10 words how friction affects a moving object?

surfaces

Friction - advantages and disadvantages

Complete the worksheet on real life examples of friction, and whether they are an **advantage** or a **disadvantage.**

Can you think of 2 more examples where you can observe friction?

Is it an advantage or disadvantage here?

WHAT AFFECTS FRICTION?

Friction depends on:

- How **rough** the surfaces in contact are
- How hard the surfaces are pushed together.

*The **greater the weight** of a sliding object, the **greater the force** of friction*

Choose an olympic sport

Where can you see friction having an effect in this sport?

Types of forces - friction

Hei mahi:

Brainstorm some *more* examples where friction is an advantage or a disadvantage in real life

Today we will…

- **Explore more examples of friction in real life**
- **Examine at what affects friction and how to reduce or increase it**


Here the floor is smooth

1. What is friction?

a) A force that slows down objects
b) A force that speeds up objects
c) A force that sets objects on fire
d) A force that makes objects float

2. How does friction affect cars?

a) It helps them move smoothly
b) It slows them down and wastes energy
c) It makes them go faster
d) It has no effect on cars

3. Why do musicians like Wilson use rosin on their bows?

a) To reduce friction
b) To increase friction
c) To make the bow look shiny
d) To make the bow lighter

4. How does static friction help us when we walk?

a) It makes us slide
b) It helps us stop
c) It makes us jump higher
d) It has no effect on walking

5. What would happen if there was no kinetic friction?

a) Objects would slide forever
b) Objects would stop immediately
c) Objects would float in the air
d) Objects would explode

6. How does friction affect riding a scooter?

a) It helps the scooter go faster
b) It makes the scooter stop
c) It has no effect on riding a scooter
d) It helps the scooter start and stop

7. Why is friction important in our daily lives?

a) It helps us conserve energy
b) It makes everything more difficult
c) It causes accidents and injuries
d) It helps us perform everyday tasks

WHAT AFFECTS FRICTION?

Friction depends on:

- How **rough or smooth** the surfaces are
- How hard the surfaces are **pushed together**.

*The **greater the weight** of a sliding object, the **greater the force** of frictior*

Reducing friction….

Reducing and increasing Friction

- Friction can be reduced by adding a l**ubricant** - this makes the surfaces smoother eg. adding oil to a car engine.
- Friction can be reduced by moving an object using **wheels** instead of sliding an object on the floor
- Friction can be increased by adding a rough **texture or grippiness** to a surface. Eg. ridges on shoes

REDUCING FRICTION

- Find one example where people use techniques to **reduce or increase** friction in <u>sport</u>

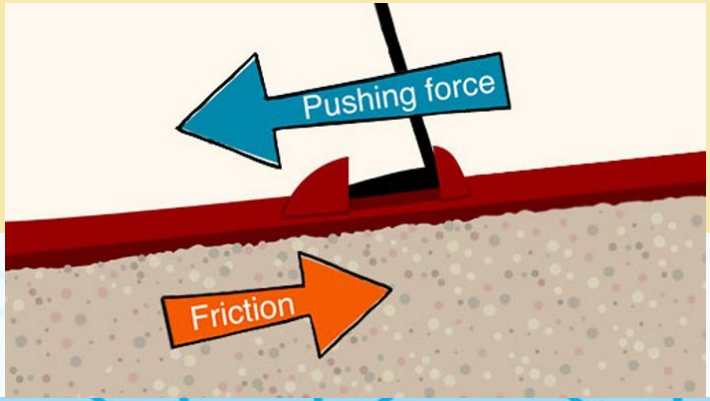
Draw a picture of this example

Assessment 2

Today: we are going to begin our assessment by planning an investigation

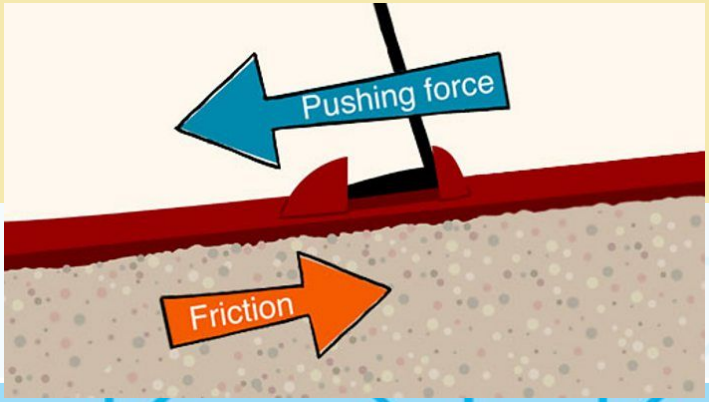
Types of forces - friction

LI: to investigate the friction exerted by different surfaces



Types of forces - friction

Hei mahi: Use your results to draw a bar graph **of the friction generated from each surface you tested**



Hei mahi: laptops closed, write down today's LI

Learning Intention:

To determine the link between time, speed and distance and use these to problem solve

What Are Time, Speed and Distance?

Time is…

Time is how long something takes to happen. It is the duration of an event or journey.

Distance is…

Distance is how far something travels.

Speed is…

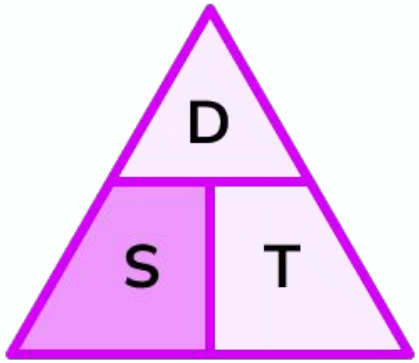
Speed is how fast something travels.

How are time, speed and distance linked?

If we know two of these factors, we can work out the third.

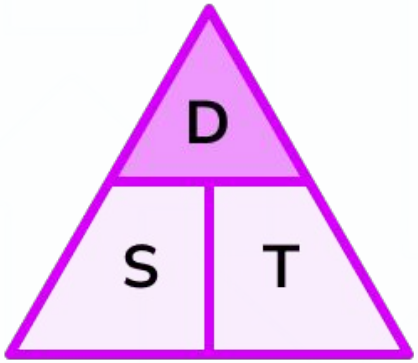
Speed distance time triangle

Speed



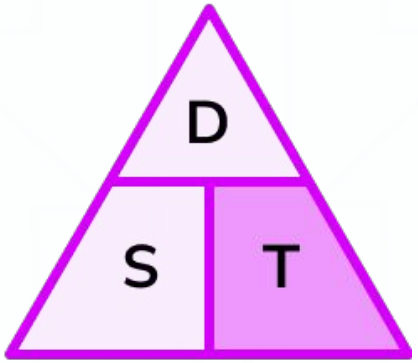
$$S = \frac{D}{T}$$

Distance



$$D = S \times T$$

Time



$$T = \frac{D}{S}$$

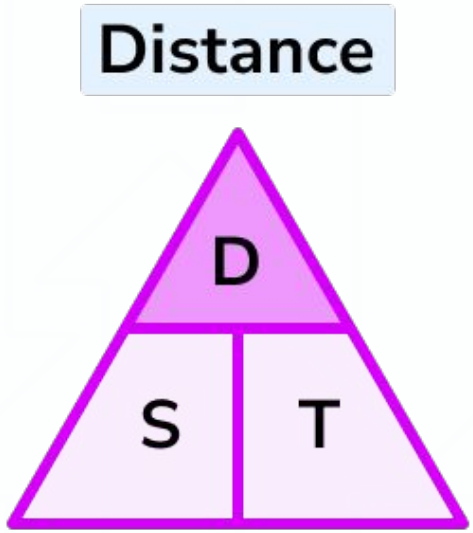
How to Calculate Distance

Examples:

Time = 1 hour
Speed = 60km per hour or 60km/h
so…

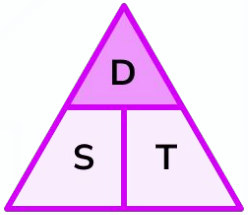
Distance = 1 × 60km = 60km

Time = 2 hours
Speed = 40km per hour or 40km/h
so…
Distance = 2 × 40km = 80km



$D = S \times T$

Distance



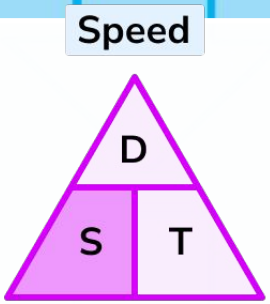
$D = S \times T$

Calculate Distance

You walk at **3km/h.** How far will you walk in **5 hours**?

$D = T \times S = 5 \times 3 = 15km$

Calculate Speed



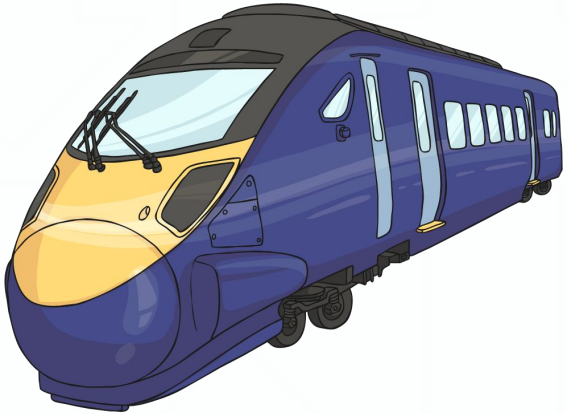
$$S = \frac{D}{T}$$

I walked 16km in 4 hours, what speed was I walking at?

S = D ÷ T = 16 ÷ 4 = 4km/h

A train travelled 900 miles in 5 hours. What speed was it travelling at?

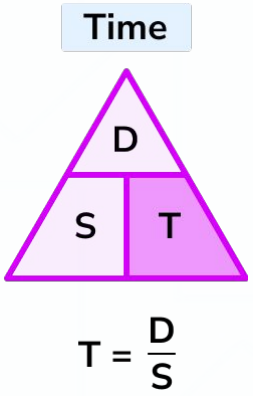
S = D ÷ T = 900 ÷ 5 = 180mph



Calculate Time

I walked 20km at a speed of 4km/h. How long did it take me?

$T = D \div S = 20 \div 4 = 5$ hours



The lorry travelled 600 miles at an average speed of 60mph. What was the total driving time?

$T = D \div S = 600 \div 60 = 10$ hours

Remember…

To calculate distance (D), we multiply time (T) by speed (S) or speed by time. D = S × T

To calculate speed (S), we divide distance (D) by time (T). S = D ÷ T

To calculate time (T), we divide distance (D) by speed (S). T = D ÷ S

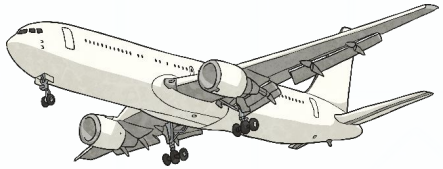
Questions

Can you work out the time, distance or speed for the following?

Charlie walks at 2mph. He walks for 6 hours. How far has he walked?

Amira completes a 10km race in 1 hour. What was her speed?

A plane flies 6000km in 10 hours. How fast was the plane travelling?



Answers

Answers

Charlie walks at 2mph. He walks for 6 hours. How far has he walked?

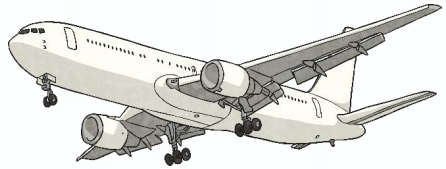
D = S × T = 2 × 6 = 12 miles

Amira completes a 10km race in 1 hour. What was her speed?

S = D ÷ T = 10 ÷ 1 = 10km/h

A plane flies 6000km in 10 hours. How fast was the plane travelling?

T = D ÷ S = 6000 ÷ 10 = 600km/h



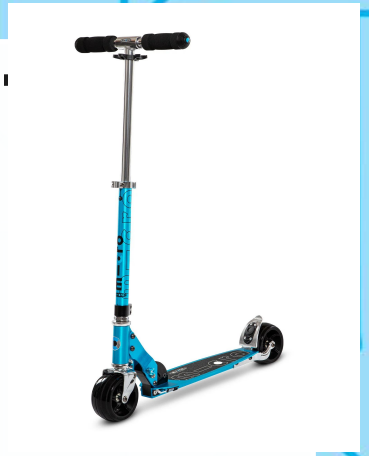
Problem sol

You're at your friends house, which is 2km away from your house.

Your parent texts you telling you to be home at 5pm.

What speed would you have to walk at, if you want to leave your friends house at 4:30pm to be back by 5pm?

Problem solving extra experts…



You have a scooter, and can ride 10km/h on it.

What time would you have to leave your friends house to get home by 5pm?

Remember - your house is 2km away.

To convert decimals to minutes, times the decimal by 60!

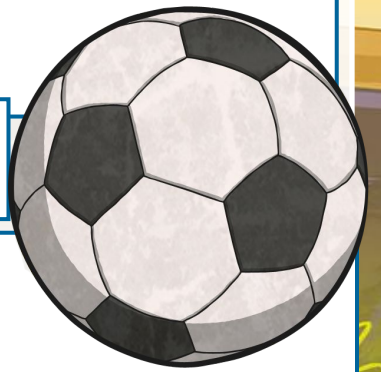
Newton and his laws of motion

LI: To investigate Newton's first law of motion - inertia

Newton's First Law of Motion

The first law is that **an object that is still, will remain still unless a force is applied to it.**
An object that is in moving will continue to move at the same speed and direction unless a **different force** is applied to it.

For example, a football that is on the ground won't move unless you kick it.



So when you kick the football, it won't change direction or speed unless it is kicked again, headed, hits something or air slows it down.

Newton’s First Law of Motion

Newton's 1st Law of Motion:

An object at rest will stay at rest and an object in motion will stay in motion unless another force acts upon it. (Law of Inertia)

Create a 3-frame storyboard demonstrating Newton's first law of motion.
Use illustrations, labels, and sentences to share your story.

Newton and his laws of motion

LI: To carry out a ‘magic trick’ to observe Newton’s 1st law of motion

Newton's First Law of Motion

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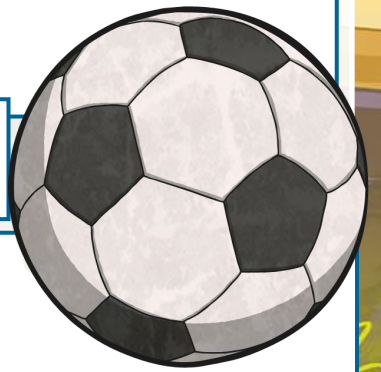


So when you kick the football, it won't change direction or speed unless it is kicked again, headed, hits something or air slows it down.

Recap

Card and coin ‘trick’

1. Place a card on top of the cup, and a silver coin directly in the middle
2. Slowly pull the card away from the cup. What happens?
3. Reset the cup, card and coin.
4. Now, quickly flick the card forward with your finger. Try a few times if it doesn’t work straight away.

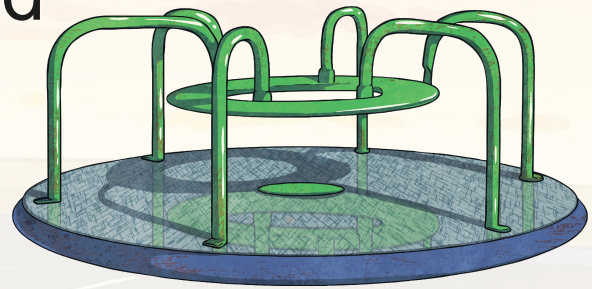
Summary - what happened? Finish the sentences

When we moved the card slowly, the coin…
This was because….

When we moved the card quickly, the coin…
This was because…

Newton's Second Law of Motion

Acceleration (speeding up) happens when a force is applied to an object.



The heavier the object (greater the mass), the more force will be needed to accelerate the object.

Newton’s Second Law of Motion

Brainpop

Watch the **brainpop video** and carry out the tasks about Newton's laws of motion

Brainpop

Watch the **brainpop video** and carry out the tasks about Newton's laws of motion

Y7 Science - ENERGY

LI: To learn what energy is and some different forms of energy

Brainstorm: What do you know about energy?

2 MINUTE DISCUSSION

How many ways can you think of to move a heavy box from this classroom to your home?

SHARE

Maybe you thought about:

Carrying/pushing the box,
Wheeling it in a wheelbarrow,
Putting it on your bicycle,
Using a car/bus/van/aeroplane……

But what do all of these have in common?

THEY ALL USE ENERGY!

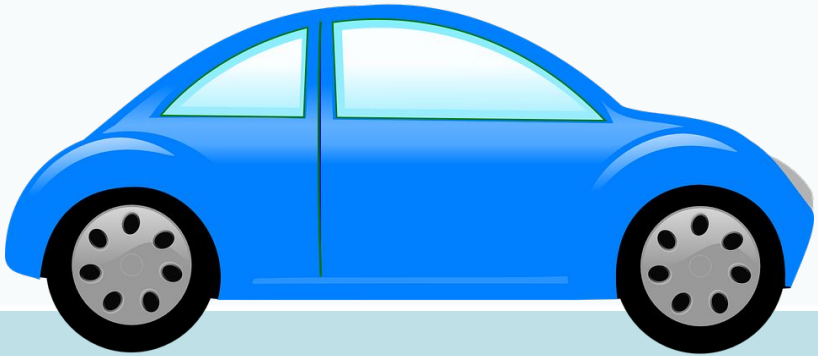
Think about what you have done, so far, today.

What have you done that uses energy?

BUT WHERE DO WE GET ENERGY FROM?

We have said that when we are moving we are using energy.
Where do we get that energy from?
For humans, our energy is stored in food.
Food stores chemical energy.

Where do cars get their energy from?



BUT WHAT IS ENERGY?

Energy means 'the ability to do work.'

It exists in different forms.
Can you think of any forms of energy?

Look at the first part on the website to find out about some forms of energy:
http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/what-is-energy/

Complete the 'what is energy?' worksheet

EXAMPLES OF FORMS OF ENERGY

Motion (kinetic)
Sound
Light
Thermal (Heat)
Electrical
Chemical
Nuclear
Gravitational
Stored Mechanical (elastic energy)

KINETIC OR POTENTIAL?

Forms of energy can be organised into two groups, Kinetic or Potential. Kinetic energy is found in movement. Potential energy is stored energy (it has not been used yet). For example, the energy we get from a banana is chemical. We haven't used it yet, it is just stored in the banana. So chemical energy is a form of potential energy.

If you imagine a skier at the top of the hill they are not moving but they have the **potential** to move because of gravitational energy.

Now the skier is moving down the hill they are using **kinetic** energy.

KINETIC OR POTENTIAL?

Forms of energy can be organised into two groups, Kinetic or Potential.

Which forms of energy do you think are kinetic and which do you think are potential? *Complete the table on your*

Kinetic Energy	Potential Energy

KINETIC OR POTENTIAL?

There are four forms of potential energy but many examples of kinetic energy

Kinetic Energy	Potential Energy
Motion	Chemical
Light	Nuclear
Sound	Gravitational
Thermal (Heat)	Stored Mechanical
Electrical	

FORMS OF ENERGY

Now we know there are different forms of energy and some are potential and some are kinetic. How we can define the different forms of energy?

Motion:

Sound:

Light:

Thermal (Heat):

Electrical:

Chemical:

Make a 'hexagonal foldable' with a definition for each form of energy.

FORMS OF ENERGY

Discuss examples for each form of energy:

Motion: The movement of objects from one place to another.

Sound: Energy produced by vibrations.

Light: Energy that may be released, for example, when an object is hot.

Thermal (Heat): Energy transferred by a change in temperature.

Electrical : Energy produced by the movement of electrons.

Chemical: Energy stored in molecules. (for example, food)

Gravitational : Anything which is high up has gravitational energy.

Nuclear: Energy stored in atoms which can be released by the joining or splitting of atoms.

Stored Mechanical : Energy stored in objects by force (for example, stretching a rubber band)

BUT WHAT HAS ENERGY?

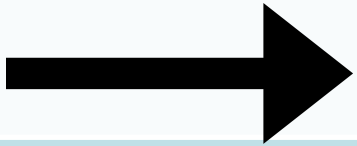
All substances and objects have energy. But you can't tell unless something happens to transfer the potential energy into a different form of energy. If you think of a firework it has potential energy as it has chemical energy inside of it but you can't tell until it is lit and the potential energy transfers to light, heat, movement and sound which we can see, hear and feel.

YOU CAN CHANGE ENERGY FROM ONE FORM TO ANOTHER BUT YOU CAN'T MAKE IT DISAPPEAR

Imagine you have eaten a banana and then gone for a cycle ride.

Discuss how energy has been transferred from the banana to making you cycle more. Where does the energy end up?

Look at the second part on this website to look at an example of this: http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/what-is-energy/



TRANSFER OF ENERGY

Think of these examples to discuss how energy has transferred:

A cold pan of water to a boiling pan of water on a stove

A seed to a growing tree

A stopped remote controlled car to a moving remote controlled car

A pile of sticks to a bonfire

Complete the transfer of energy worksheet

WE HAVE LEARNT THAT:

Everything we do uses energy

All things have energy (potential or kinetic)

There are different forms of energy which have names such as: motion, sound, thermal (heat), light, electrical, chemical, nuclear, stored mechanical and gravitational

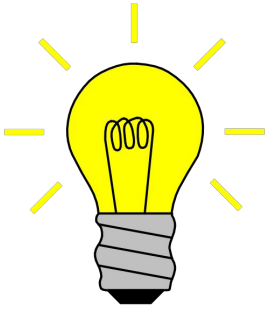
Energy forms can be organised into two groups: potential and kinetic

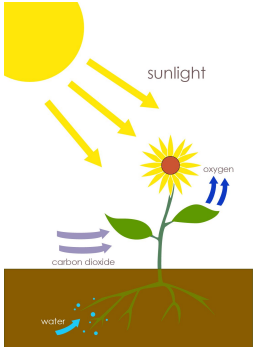
You can change energy from one form to another but you can't make it disappear

Complete the quiz to check your understanding:
http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/what-is-energy/

What is energy?

- **Energy is the ability to do work.** Work is applying force to an object and making it move in distance (Measured in joules (J)).
- Some substances and objects may have many forms of energy at the same time
- Energy exists in many different forms
- Energy can change from one form to another
- Energy cannot be created or destroyed, it can only be changed from one form to another.





Energy exist as kinetic or potential energy

Energy can be classified into two types:

- Active energy
- Potential energy

Active energy is when particles, waves or objects move.

All forms of stored energy are called potential energy - this cannot be seen until it is transformed (changed) into active energy.

Physics - Forms of Energy

Energy

Can be...

Active Energy
Energy that we can see the effect of

The Energy of Movement

Example:

- Kinetic Energy
  Energy associated with MOVEMENT
- Heat (Thermal) Energy
  Energy associated with HEAT and hot things
- Light Energy
  Energy our eyes can detect!
- Solar Energy
  Energy from the sun, combination of heat and light energies



Potential Energy
Potential energy is stored energy

The Stored Energy

Example:



- Gravitational potential energy
  Energy stored due to height above earth's surface
- Chemical potential energy
  Energy stored in matter, food and fuels
- Elastic potential energy
  Energy stored in stretched or compressed materials

Gunpowder: Chemical Potential Energy

Let’s do some practice

1. A basketball sits on the rim before falling into the hoop.

1. A stuffed toy laying on a table.
2. Someone running.

Physics - Types of Energy

Gravitational Potential Energy
(energy stored due to being high up)

Light Energy

Elastic Potential Energy
(energy stored in bent elastic objects)

Solar Energy
(energy from the sun)

Chemical Potential Energy
(energy stored in fuels and foods)

Sound Energy

Kinetic Energy
(kinetic = moving)

Heat Energy

Hei mahi: **True or False**

State whether each of the following is true or false:

a. Energy is not a substance
b. Energy is needed to make things move
c. Stored energy is called kinetic energy
d. Energy can be weighed
e. Heat is a type of active energy
f. Objects can have energy
g. Light is a type of potential energy
h. Only moving things have energy

Answers

a. True
b. True
c. False
d. False
e. True
f. True
g. False
h. False

Conservation of Energy

The Law of Conservation of Energy states:

Energy cannot be created or destroyed but it can be transformed from one form to another.

The total amount of energy never changes. Energy can transform from one type to another. All types of potential energy must be transformed into kinetic energy for work to be done.

Conservation of Energy

Energy cannot be created or destroyed but it can be transformed from one form to another

Light energy → ***Chemical potential energy***

Chemical potential energy → ***Kinetic energy***

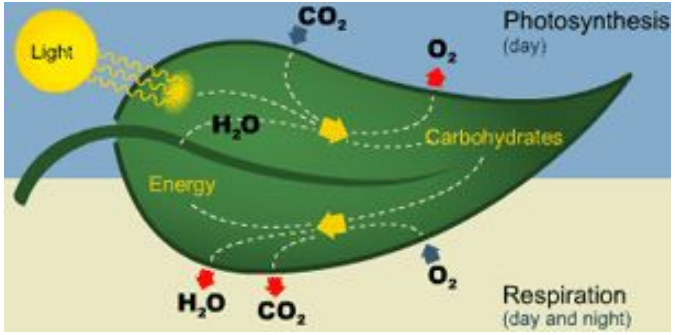
Electrical energy → ***Heat energy***

Chemical potential energy → ***Kinetic energy***

Energy in the universe

Energy Transfer Diagram - draw diagrams for these

Energy cannot be created or destroyed but it can be transformed from one form to another



Energy Transfer Diagram - some example answers

Energy cannot be created or destroyed but it can be transformed from one form to another

Electrical Energy → Light & Heat Energy

Gravitational Potential Energy → Kinetic Energy → Sound & Heat Energy

Wind Energy → Kinetic Energy → Electrical Energy

Chemical Potential Energy → Kinetic Energy + Sound & Heat Energy

Quiz:

Types of energy	**elastic potential** **gravitational potential** **light**	**chemical potential** **heat** **sound**	**kinetic (movement)** **electrical** **nuclear**

1. A light bulb will convert _____electrical_____ energy into _____light_____ energy along with some heat energy.

2. A loudspeaker turns electrical energy into _____sound_____ energy.

3. A burning candle changes ___chemical potential___ energy into _____light___ energy and ____heat_____ energy.

4. A catapult changes ___elastic potential_____ energy into _kinetic(movement)___ energy.

5. A person jumping up from the trampoline turn _elastic potential_____ energy into __kinetic(movement)___ energy to _gravitational potential__ energy, and again into __kinetic(movement)___ energy.

Hei Mahi:

The Law of Energy Conservation states that:

1. Energy cannot be _____ out of nothing.
2. Energy can be changed into different _____ but the total amount of energy remains the _____.
3. Energy can never be _____.

1. Created 2. Forms, Same 3. Destroyed

What energy transformations are occurring in the following events?

a. Falling rain
b. Music playing on speakers
c. Dynamite exploding
d. Person parachuting
e. Lightning flash
f. Waterfall
g. Tree burning
h. Going up a lift

a. Gravitational potential to kinetic
b. Electrical to sound
c. Chemical potential to sound, heat
d. Gravitational potential to kinetic
e. Electrical to light
f. Gravitational potential to kinetic, sound
g. Chemical potential to light, heat, sound
h. Kinetic to gravitational potential