FUSION

You ask, we answer!

WINTER

EDITION

2025

From the editors

WHO WE ARE

Hi everyone! We're a group of students at Sevenoaks School with a passion for the sciences. We want to share our passion and interest with everyone!

OUR VISION

We want to expose younger students to the world of science by introducing them to simplified scientific literacy, providing long awaited answers to your exciting questions!

(A THANK YOU)

We would like to thank our teacher, Ms. Butte, for helping us to organise this. Thank you to every person on our team for dedicating their time and energy to this. Thank you to you, our readers, for being interested in science and reading our journal. But most of all, thank you to science for being so cool!

Meet the editors....

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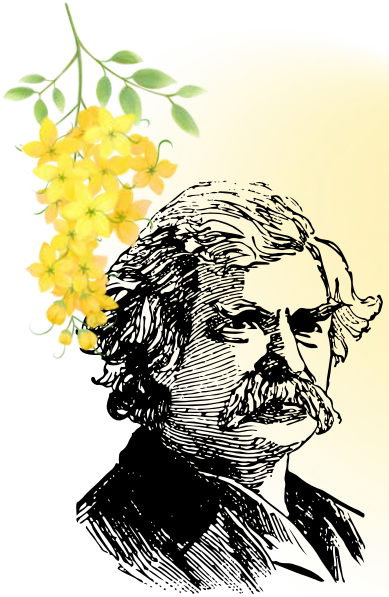
Albert Einstein



Who was Albert Einstein?

Albert Einstein was a German theoretical physicist who lived between 1879 and 1955. He studied maths and physics in Zurich and got his diploma in 1901. He won a Noble prize in Physics and became one of the most influential scientists of the time - and still is!

What cool things did he do?

He came up with the **Theory of Relativity** and he established the **Mass and Energy Equivalence formula:**

$$E = mc^2$$

The **Theory of Relativity** tells us how the speed of light is the same for all observers in a vacuum, independent of whether they are in motion.

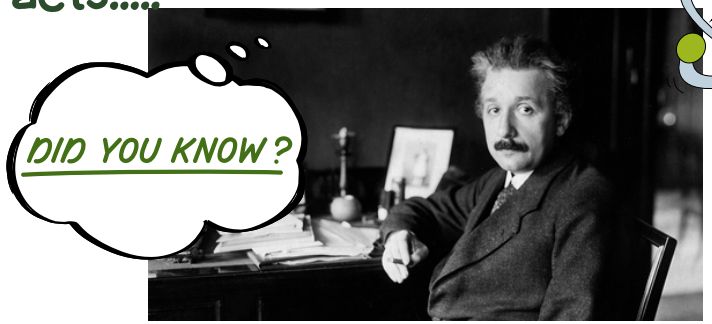
This theory revolutionised how we understand space and time!

The **Mass and Energy Equivalence formula** allows us to show how mass can be translated into energy and vice-versa

What we can learn from him:

- Follow your curiosity!
- Persistence is important to achieving your dreams
- Focus on the present
- Don't stop dreaming!

Fun Facts!!!!!



- Einstein was a late talker; he didn't speak until the age of 4, and refused to properly speak until he was 7!
- Before becoming a physicist, Einstein was training to become a teacher
- There is a rumour that he never wore socks!

Do Aliens Exist?

One of the biggest questions ever! Do aliens exist? - No one knows yet. But let's explore why!

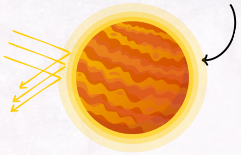
For life on Earth to exist, special conditions are needed, just like on Earth:

- A planet needs to be in the **"Goldilocks Zone"**

The optimum distance from the sun, which allows water to be liquid!

- An **energy source:** Just like we have our sun!

- **Protective atmosphere** (To prevent damaging light rays from entering the planet's surface)



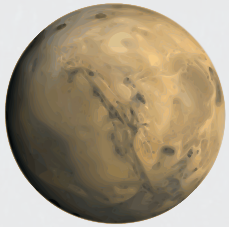
Our galaxy has **300 billion stars**: that's 11 zeros! Scientists estimate that there are 200 billion Galaxies! Don't you think that there could be life out there with so many planets?

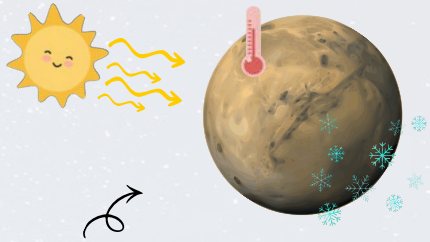
Life in the Universe

Even if NASA was unable to find life, did you know that astronomers have been able to find planets which could be potential candidates? Let's meet **Kepler-168**:

KEPLER 186-F is:

- Roughly the same size as the Earth
- In the Goldilocks zone

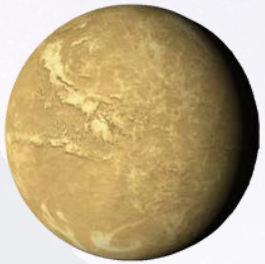




So, could there be life in Kepler-186f?

- Unfortunately, Kepler-186f has a side that permanently faces its sun - it is tidally locked

This means that the other remains in darkness, which would lead to temperature differences, making life in Kepler-168 extreme and difficult!



Let's also take a look at...

PROXIMA B:

- it is within the Goldilocks zone

What are some challenges to life on Proxima B?

- Its red dwarf star can send radiation to the Promixa B and make it difficult to have a protective atmosphere
- It is also tidally locked

To conclude!

There are many other planets in the universe with certain special conditions which allow the existence of life. But the truth is we have not found any - even tiny microbial life!

Why?

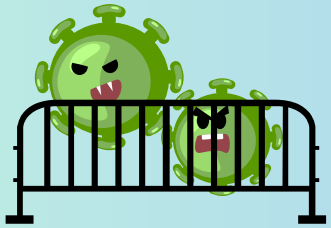
- Life out there may not be intelligent and able to communicate;
- Life might exist under the surface of a planet, which we are unable to see directly;
- They could be many light-years away! Long-distance space travel isn't yet possible for us & it would take thousands of years for an alien message to reach us.

WHAT ARE BLOCKED NOSES AND WHY DO WE GET THEM?

Think back to the last time you got in bed and suddenly, you can't seem to breathe in or out through one side of your nose! After lots of useless forceful blowing and turning in bed, it starts to clear - just for the other side to get blocked up instead.

Why does this happen?

Your nose contains tiny tunnels called nasal passages. Inside them are small blood vessels and mucus that block and trap germs and dust.

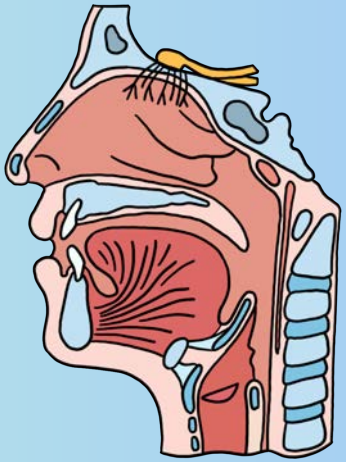


When you're sick, the walls in these passages get swollen, and make extra mucus to fight against these germs. The swollen passages block off airways, stopping you from being able to breathe from that side of the nose.

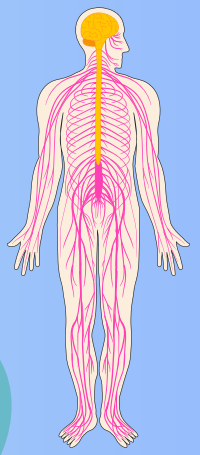
Sometimes one of your nasal passages is blocked while you're lying down. Turns out, a change in gravity can make blood and mucus move differently. When you lie down, blood flow increases to your head, leading to the swelling of nasal tissues, and gravity can't drain the mucus from the nose.

Why do I only have a blocked nose on one side?

Everyone experiences something called the **Nasal Cycle**: This is when one nostril feels blocked while the other remains clear.



After a while, the blocked nostril suddenly clears, and the other nostril becomes blocked. This process happens automatically, and is controlled by our nervous system.



This cycle helps us by allowing one side of the nose to rest while the other continues to support breathing.

Other Causes of Blocked Noses

- Infections
- Allergies
- Colds / Flu

Recovering Faster from Blocked Noses

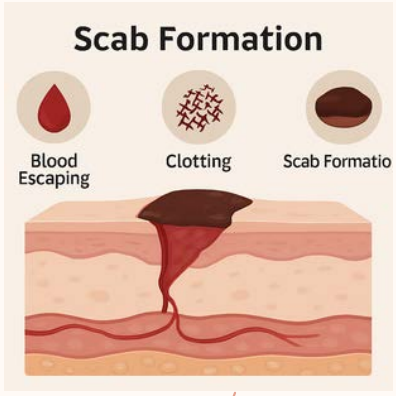
- Hot showers
- Saline nasal sprays
- Elevated head while sleeping

Why do we get scabs?

If you've ever scraped your knee, you've probably noticed that it forms a scab afterwards. But have you ever wondered why? Well, you're in luck! We're going to delve into what scabs are, why you get them, how they form, and how to give your body a little extra help when you get hurt!

What are scabs?
A scab is the protective crust made of dry blood that forms over a cut or a wound.

How do they form?
Scab formation is all in the magic of your blood. Your blood is exceptionally good at knowing when it's outside of your body, letting it know when to form a scab.



In your blood, you have special cells which clump together, creating a special net which will trap other blood cells together, kind of like a spider web, making it solid and forming a barrier. This is a **blood clot.** The blood clot will then dry, and it forms a hard, crusty scab within seconds or minutes.

But why do you actually need scabs?
Scabs do three main things:

1. **Stopping bleeding:**

Scabs **stop you from bleeding**, making sure that you don't lose any more blood. If you were unable to form scabs, it would be difficult to stop you from bleeding, even in really small cuts.

2. **Protecting you**
Scabs form a shield around your wound, stopping germs from entering it. If you didn't have scabs protecting you, they could enter and cause **infection,** making the healing process a lot longer.

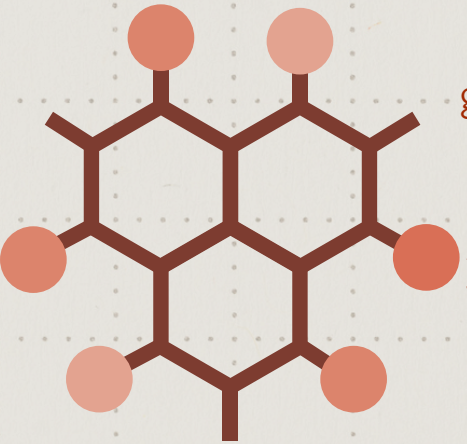
3. **Cause the skin underneath to heal**
Scabs cause the skin underneath to heal so that when the scab comes off, you probably won't even be able to tell it was there!

So what should you do when you get a scratch?

1. Use a soft, clean cloth to stop the bleeding.
2. Run it under water and clean with soap. Wash out any dirt or debris like gravel if you can.
3. Put a small amount of antibiotic ointment on it, killing the germs. Make sure you're not allergic!
4. Cover it with a bandage or gauze
5. Wash it and cover it with a new bandage every day
6. Don't pick at your scab!

For more information: https://kidshealth.org/en/teens/cuts.html

HOW DO WE GROW?



Have you ever wondered why we all grow in size as we get older, and why people have different sized? Well, growth involves many biological processes and are caused by several different factors, including the hormone levels in our body, nutrition intake , and other biological factors such as mitosis.

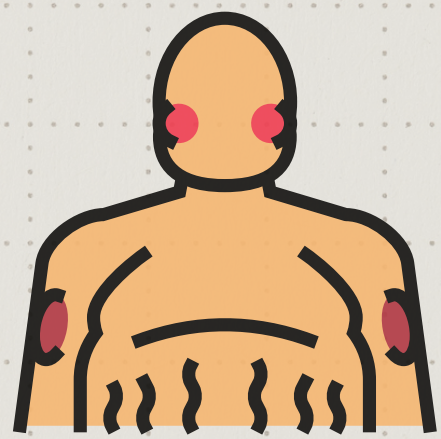
You might ask, what are hormones and mitosis? We can breakdown the processes step by step for a better understanding.

Hormones are chemical signals in our bodies controlled by different glands that regulates our body, including blood pressure, sugar level, and other processes that sustain the function of organisms.

The hormones that controls the growth in our body sizes is known as human growth hormone, secreted by the pituitary gland, it binds to receptors on cells to stimulate mitosis, aka cell division, so cells duplicate and most make an exact copy of themselves while others specialize to perform specific functions, which is how we grew from the combination an egg and a sperm into an embryo, then an infant, to what we are now.

Apart from directly interacting with cells, growth hormone also influence our growth through other indirect actions through interacting with other substances to create a chain reaction which again result in growth.

But wait, what happens if we don't have enough growth hormones or too much growth hormones? Well, these are all sicknesses that influences people's heights and appearances.



If someone has too much growth hormones, they might get a symptom called acromegaly, which causes them to have swollen hands and feet, joint pains, abnormal height, as well as sleep difficulty and many more symptoms.

Some football fans might be able to think of a famous football player that suffer from, and his name is Lionel Messi. Messi has a symptom known as Growth Hormone Deficiency which is caused by the malfunctioning of his pituitary gland that causes him to look shorter than others as a child, but he was able to receive a treatment which required him to regularly inject hormones into his leg which allowed him to grow taller.

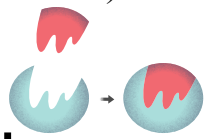
WHY DO ONIONS MAKE US CRY?

Every time we chop onions, our eyes start to sting and tears roll down our cheeks. But why though?

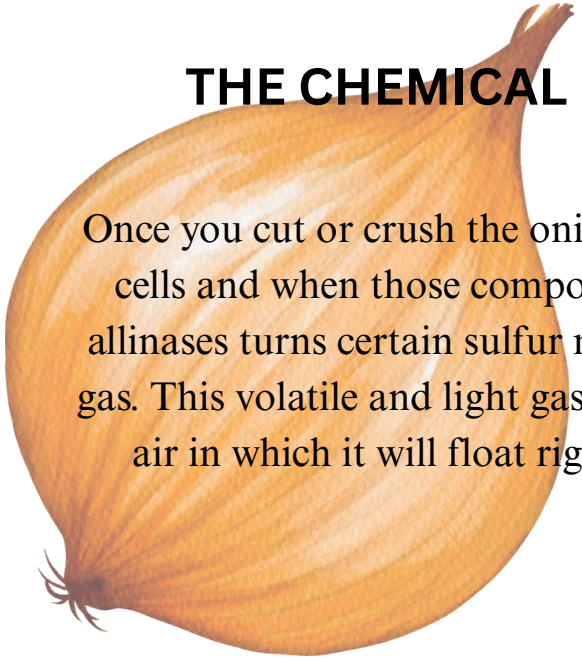
THE ONION'S SECRET WEAPON

Inside every onion cell are two special things kept apart like ingredients in a chemistry set:

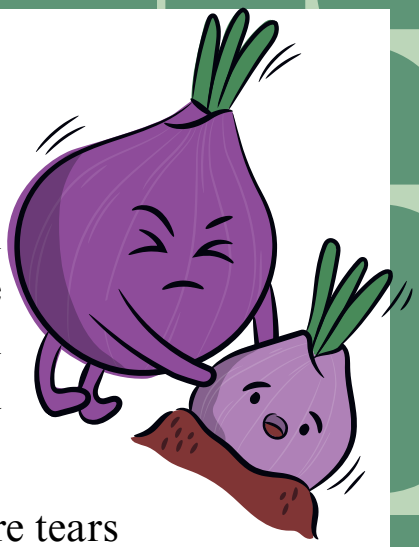
- Sulfur compounds (from the soil the onion grew in)
- Enzymes (called alliinases)



THE CHEMICAL REACTION



Once you cut or crush the onions, you break open the cells and when those compounds mix, the enzyme allinases turns certain sulfur molecules into a volatile gas. This volatile and light gas will be released into the air in which it will float right up into your eyes.



The Eye Defense system

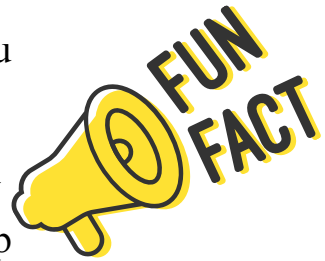
Your eyes are super sensitive! When the gas reaches them, it reacts with the water in your tears to make a mild sulfuric acid. That is what gives you the burning sensation.

Your tear glands start producing more tears to flush away the irritant

The onion's point of view

From the onion's point of view, THIS IS SURVIVAL STRATEGY

The chemicals prevents the animals and pests that might eat it. When a worm or animal bites the onion bulb, the gas irriates them and therefore they will stop eating.



1) Sweet onions or spring onions make you cry less because they have less sulfur levels

2) Cold onions release less gas, that is why refrigerating them before chopping can help

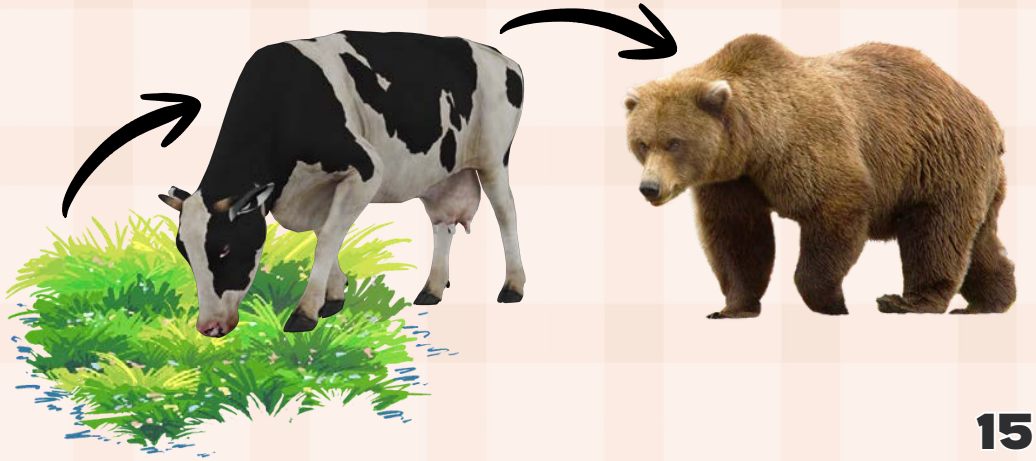
3) Cutting under running water or near a fan helps too, the gas gets washed or blown away before it hits your eyes.

Why don't we eat CARNIVORES?

Humans eat a lot of meat. In the UK, the average person eats around 80 kg of meat a year. That's the same weight as an adult male! Don't get any ideas.

Of these we mostly eat cows, chickens, pigs, lamb, and fish. They all eat mostly grass and plants: they are **HERBIVORES**. So where are all the **CARNIVORES**? Where are the lion burgers, fried eagles, and crocodile roasts? Nobody really knows. But there are a few different theories.

Before this, we should learn what a **FOOD CHAIN** is. A food chain shows which animals eat what. An example is shown below:



As animals go about their lives, a lot of nasty stuff gets stuck in their bodies. These can be heavy metals, viruses, bacteria and parasites. When a carnivore eats another animal, all these nasty things become stuck in the carnivore's body. As carnivores eat a lot of animals, their bodies can become full of this nasty stuff. For a human, eating the carnivore's meat may be dangerous due to all of the nasty things in it.

When an animal eats food, most of the energy goes into keeping the animal alive. Only a tiny portion (around 10%) of the food energy actually goes into building meat that we can eat. So, if you feed 10,000 kilocalories of grass to a cow, you'll only get 1000 kilocalories of beef out. If you then feed that beef to a carnivore, like a bear, you'll only be left with 100 kilocalories of tiger meat. That's 45 grams of bear meat compared bear a whole steak!

Nobody really knows, and nobody's bothered to look too much into it. It may be because of safety, inefficiency, taste, or something completely different. Someday, we might know the answer. Maybe one of you will find out!

Why do our

beat faster when we are scared

Have you ever felt scared or surprised when your sibling hid and then jumped out to scare you? Or maybe you felt frightened during a scary movie? Well, if so, you might have noticed that your heart starts to beat loudly and quickly.

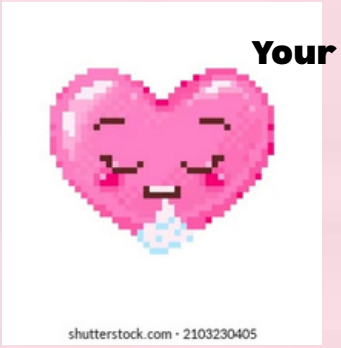
Not to worry though! That is actually your body's way of keeping you safe.

You have a little alarm system in your brain called the amygdala.
It quickly alerts the rest of your body when it thinks you are about to be scared, for example if you hear loud noises or see creepy shadows.

Because of this, your body releases chemicals, which tell your heart to pump blood more quickly! This is why your heart beats faster and seems louder.

This is helpful because it sends extra blood and energy to your muscles which allows you to react to the danger, for example, you would be able to run away faster, because you would have more energy, because your heart was pumping more blood.

It's your body's built-in safety mode, often called fight-or-flight—even if nothing truly dangerous is happening.



Fun Fact:

Your heart slows back down once your brain decides everything is safe again!

Why do leafy greens sometimes taste bitter?

Have you ever wondered why leafy greens taste bitter for some people? How is this possible? Well stay tuned to find out more about why this happens!

Taste buds:

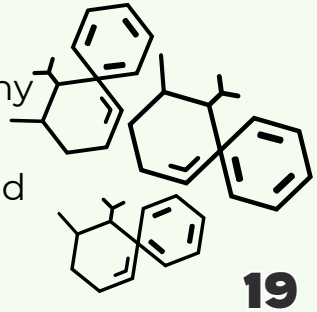
As you may know our tongues are covered with *many many* tiny taste buds responsible for detecting, sweet, salty, bitter and savoury flavours.

Defence!

A long time ago bitterness was a warning sign for humans as many poisonous plants taste bitter. Because of this, humans evolved a higher sensitivity to bitter chemicals. But we now know that some bitter greens are edible, our bodies haven't caught up yet!

Chemicals:

Leafy greens contain loads of ***phytochemicals*** – these are special healthy compounds found in greens which help protect your body from many diseases and support your immune system. They are what make leafy greens bitter!



Age and experience::

Babies and young children are more sensitive to bitter flavours as they are still learning what is and isn't safe to eat. Sometimes this means that they initially find greens to taste really bitter.

Does that mean I don't need to eat greens as a kid?

No, not at all! The ***nutrients*** in greens are really healthy! The more often you include them in your diet, the more likely you are to enjoy them. That's why consistency with eating your greens is key!

Genes:

Scientists have discovered that some people are born with a gene that makes them more sensitive to bitter taste – these are known as "super-tasters". Super tasters have more taste buds on their tongues compared to regular tasters and therefore taste bitterness much more!

Cooking:

Cooking also makes a huge difference. Cooking leafy greens breaks down some of these ***phytochemicals*** and makes them sweeter which is why sometimes the chef might be *guilty* of the bitter taste of your greens

How does the Sun Shine?

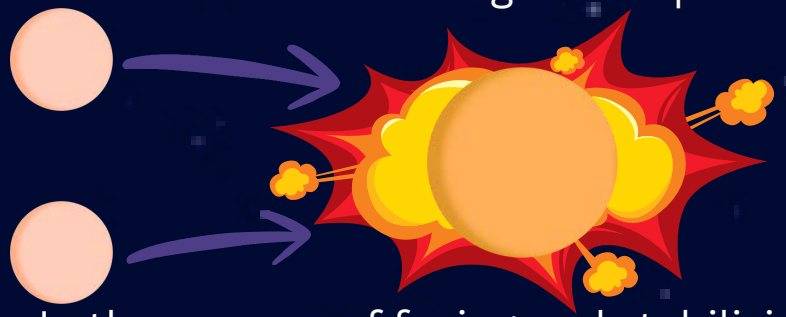
Every day we look up at the sky and see the sun, our closest star, but **how does it actually work?**

Why do stars shine, but not planets?

For starters, it is the **mass** that matters. Mass is a measure how much stuff the planet or star is made of - if something has more mass, it's going to be heavier. **Stars usually have a lot more mass than planets.** This means stars are **heavier** and often many times larger than the average planet.

Okay, so we know that **one difference between a star and a planet is how much stuff it is made of.** But how does this explain why stars shine and planets do not?

The answer lies in a process called **fusion**. Because **stars are so heavy**, gravity pulls the stuff the star is made of into its centre, **squishing everything so closely** that they fuse together like pieces of dough. As the individual, smaller pieces are squished into one bigger thing, it becomes **more stable,** like a line of individual domino pieces is more unstable and easier to push over than one long slab of plastic.



In the process of fusing and stabilising, the previous instability of the smaller pieces has to go somewhere; **energy is released**. This **energy transforms** into the energy we know as **heat and light**, which we see from our sun!

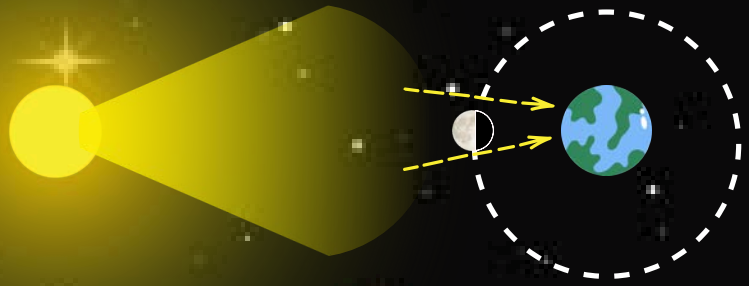
How Do Eclipses Work?

Some of you will have seen that on special days at specific times, we can see a blood-red moon in the sky - this event is due to a specific way the Sun, Moon and Earth line up and is linked to the science behind 'eclipses'.

*Image Taken by NASA of a Total Solar Eclipse

An eclipse happens when one body (like a moon, planet, or star) blocks the amount of light that can reach another body by moving into its shadow. We experience two main types of eclipses: a solar (dealing with the Sun) and lunar (dealing with the Moon) eclipse.

A **solar eclipse** happens when the Moon gets in the way of the Sun. This means that, as it moves in front of the Sun, it appears as a dark spot, with the Sun's light shining behind it. An example of this is shown on the page.



Total Solar Eclipse

*Only light from the Sun that goes around the edges of the moon can be seen - this gives it the ring shape shown in the NASA Image.

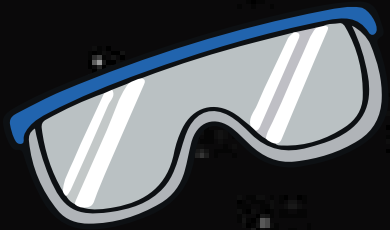
There are 2 types of Solar Eclipse:

1) Total Solar Eclipse – when the moon completely covers the light from the Sun – this happens roughly every 18 months.

2) Partial Solar Eclipse – when the moon only partially covers the light from the Sun – this happens roughly two times every year.

Partial Solar Eclipse

WARNING: For your sake, please do not stare straight at the sun during a solar eclipse – even though it might feel easier to look at, it is still dangerous, and looking at it without protection (specially made glasses for viewing it) could lead to severe or permanent eye damage.



On the other hand, a **lunar eclipse** happens when the Earth itself blocks any light from reaching the moon.

This means that during the night, the moon goes very dark as the Earth's shadow covers it up.

Sometimes, the moon appears red at this stage because some of the red and orange colours from the Sun don't stay in Earth's **atmosphere** and instead are to the moon.

This gives it its most common name – a 'blood moon' (thankfully, nothing to do with blood). Like the solar eclipse, it has partial and total versions too – the total lunar eclipse happens at least once every 3 years.

RIDDLES

My appearance is lovely, my shape is round, I come to life when turned upside-down.

What am I?

How is it possible for Santa Clause to go 8 days without sleeping?

2 mothers and 2 daughters went out for christmas dinner. Each person ate one portion, yet only 3 portions were eaten in total - how is this possible?

Using the letters that are missing from this incomplete alphabet, work out what winter-themed word you can make.with all the missing letters.

B - C - D - G - H - I - J - M - P - Q - R - T - U - V - X - Y - Z

Five glasses are placed in a row. The first three are filled with water, and the last two with poison. By only moving one glass, make it so no two glasses with water are next to each other.

HOW MANY DID YOU GET?

(Answers on pg. 35)

JOKES!

Why did the chemist get fired?
Because they didn't react well under pressure!

Two blood cells met and fell in love. But it was all in vein.

What's a geologist's favorite type of music?
Rock.

Why did the scientist remove their doorbell?
They wanted to win the no-bell prize

How does a universe hold a party?
It invites all the stars!

Chemistry is like cooking. But don't ever lick the spoon!

How does the moon cut its hair?

Eclipse it!

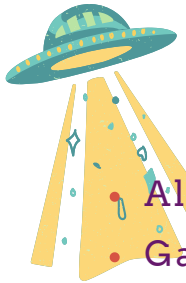
What's the difference between a dog and a marine biologist?
One wags a tail and the other tags a whale

What is a biologist's favorite instrument?
A cell-o.

A group of protestors in front of a lab:

What do we want?
Time-travel!
When do we want it?
Irrelevant!

GLOSSARY!



Do Aliens Exist?

- Aliens: life outside our planet
- Galaxies: large systems of stars and stellar matter
- Astronomers: People who study the Universe and its objects
- Microbial life: tiny life that can't be seen with the naked eye
- Light years: the measure of distance travelled by light in a year (around 9.5 Trillion Kilometres)

WHAT ARE BLOCKED NOSES AND WHY DO WE GET THEM?

- **Nasal passage:** The tunnel in your nose that directs airflow
- **Mucus:** A clear, gel-like liquid produced by your body to trap germs
- **Swelling:** The gathering of fluid in a part of a body causing that area to grow in size
- **Nervous System:** A system connecting the brain and rest of the body to send signals for controlling the body

Why do we get scabs?

- **Cell:** A small, building block that carries out the things needed for life to work
- **Infection:** When harmful germs enter your body and cause illness
- **Antibiotic:** A type of medicine used to treat illnesses and infections

HOW DO WE GROW?

Hormones — **Chemical substances produced by the endocrine and other glands or cells and released into the bloodstream to act upon specific receptor sites in other parts of the body, so as to bring about various effects.**

Mitosis — **the ordinary process of cell division resulting in the formation of two daughter cells, by which the body replaces dead cells.**

Acromegaly — **excessive enlargement of the limbs due to thickening of bones and soft tissues.**

GLOSSARY!

Why do onions make us cry?

Enzymes — Enzymes are biological catalysts that speeds up chemical reactions in living organisms without being consumed in the process.

Volatile — In chemistry, a volatile substance is one which readily vaporizes.

Compounds — A compound contains atoms of different elements, chemically joined together.

Irritant — A substance that causes slight inflammation or other discomfort to the body.

Why don't we eat CARNIVORES?

Herbivore: Animals that only eat plants

Carnivore: Animals that only eat meat

Food Chain: The process showing how food and energy moves. ina cycle throuogh an ecosystem

WHY DO OUR HEARTS BEAT FASTER WHEN WE ARE SCARED?

Amygdala.

The amygdala is a small, almond-shaped part of your brain that acts as your body's emotion and fear centre. It helps you feel things like anger, sadness, and fear, and it works with your memory to help you remember what makes you feel that way

Why do least greens sometimes taste bitter?

- **Taste bud:** Sensors on your tongue that help you taste different flavours
- **Phytochemical:** Natural substances in plants that help with fighting disease, being healthy, and other benefits
- **Nutrient:** Substances found in food that are good for your body

GLOSSARY!

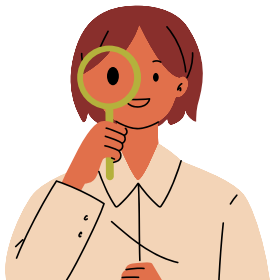
How does the sun shine?

Mass — The amount of stuff in an object.

Star — A large collection of stuff in space that glows (our sun is a star too!).

Fusion — The squishing of two smaller objects into one whole bigger object, which releases energy.

Gravity — The force that pulls two objects together, like earth pulls us in so we don't fly away!

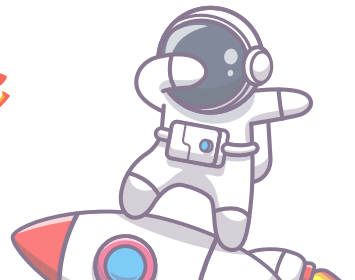


How do solar eclipses work?

Solar Eclipse — When the moon blocks incoming light from the Sun, leaving it as a black spot

Lunar Eclipse — When the Earth blocks incoming light towards the moon, making it appear darker and gain a reddish colour.

Atmosphere — A collection of gases which surround the Earth.



SCIENCE

RIDDLES

(ANSWERS)

1) A snow globe.

2) He only sleeps at night.

3) There were only 3 people - a grandmother, a mother and her daughter. The mother is both a mother and a daughter.

4) Snowflake.

Challenge) Pour the water from the second glass into the fourth, then place the empty glass second.

And finally....

OUR SOURCES!

This is where we got most of our information from:

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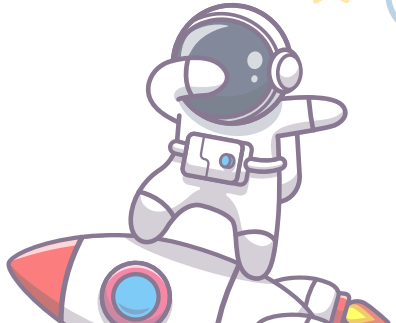
- Clevelandclinic
- Britannica
- BBC Bitesize
- Howstuffworks
- National Health Service (NHS)
- Center for Astrophysics (CfA)



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https://www.sciencefocus.com/the-human-body/why-do-onions-make-me-cry

Why don't we eat Carnivores?

Add

Why do our hearts beat faster when we are scared?

https://www.thehindu.com/sci-tech/why-does-our-heart-beat-rate-rise-when-we-get-frightened/article7668406.ece

Why do least greens sometimes taste bitter?

Add

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