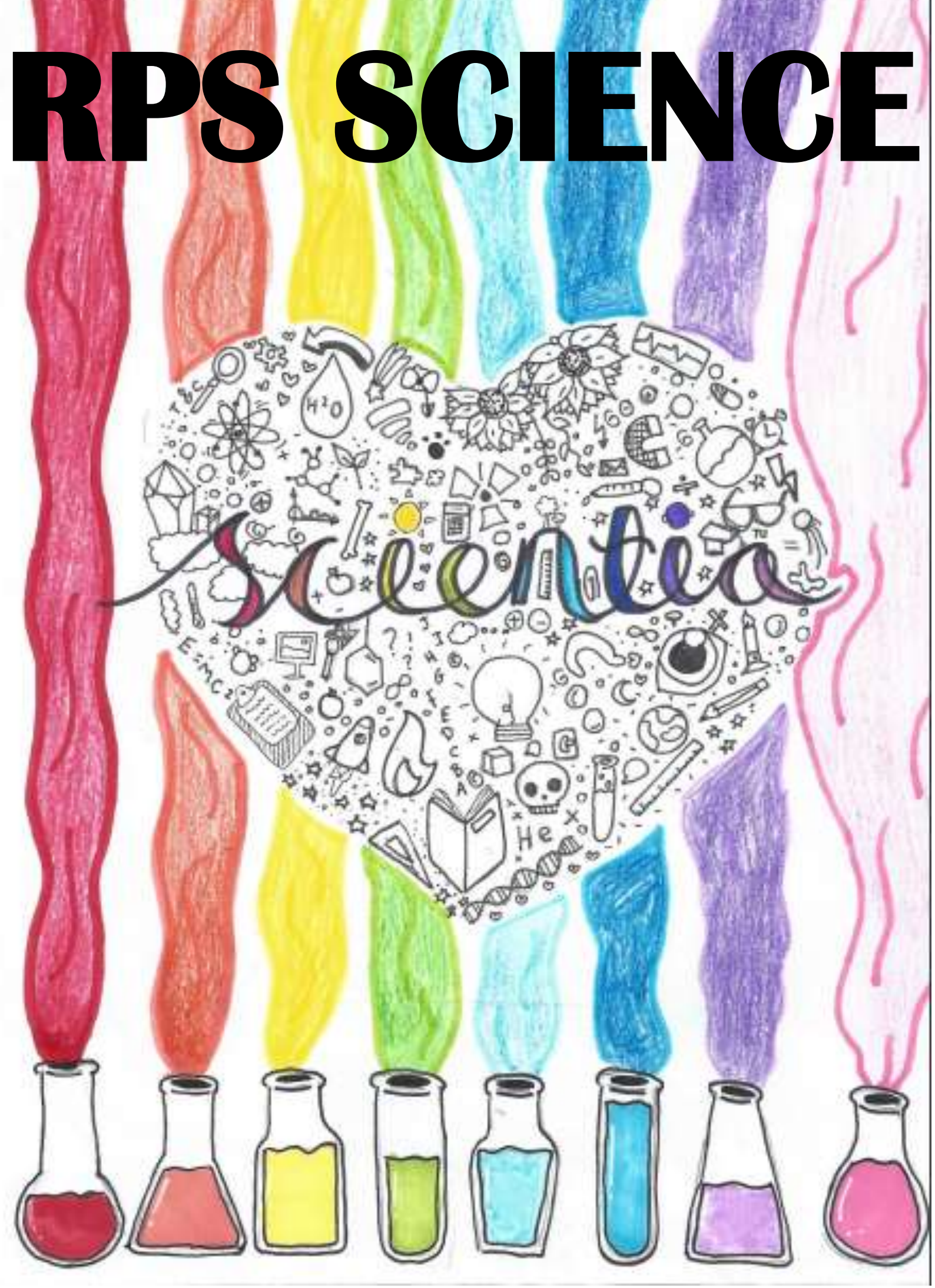
RPS SCIENCE



Welcome back everybody! Hope everyone had a relaxing summer holiday and is ready to learn again! If anybody is anxious about starting school again due to the covid situation there are plenty of teachers to talk to- if anybody does not feel comfortable doing that feel free to email Shadie or Sophie (the editors.) We are happy to help!

An introduction to Scientia, the first ever RPS Science magazine!

Welcome to the first issue of the RPS science magazine. We have gathered lots of interesting articles that will definitely teach you something new, as well as being fun and enjoyable to read. This issue also includes some puzzles and challenges along the way.

Meet the Editors:

Hey everyone, I am Shadie, one of the editors of the Science magazine. I wanted to put myself forward to this role and help edit Scientia with Sophie due to my love for Science and I know that my younger self would have loved to read a magazine like this! I am currently in Year 1 studying Biology, Chemistry and History: a bit of an unusual combination of A-levels but I love it none the less. I hope that everyone enjoys the magazine that me and Sophie have compiled together and thank you to everyone that sent anything in; it was all amazing!

Hi everyone, my name is Sophie, and Shadie and I make up your editors! It has been extremely interesting reading through all the articles written by various students around the school and have enjoyed editing with Shadie, thanks to my love for science! I cannot wait for you all to have a look through! I am currently in year 13 studying Biology, Geography and Chemistry.

Student photo wall:








Mrs Rashid's Learning Hacks

Even though the public exams have been cancelled for 2020, learning is a life skill and is something that requires ongoing effort, commitment and a little guidance.

SCIENTIA delves a little deeper into science-focussed learning and revision strategies available to students, and what grown-ups can do to help their son or daughter realise their full potential in science.

Of all the subjects in school, science often proves the most challenging for students, stemming from the myriad of often abstract concepts which need to be understood. Science courses, chemistry and physics in particular, make different demands on your learning skills than other subjects do. SCIENTIA offers the following tips for success in your study of science; be you a Year 7 or Year 13 student.

1. Don't fall behind!

As the course moves along, new topics will build on material already covered in class. If you don't keep up in your reading and problem solving, you will find it much harder to follow your lessons and discussions on current topics. Experienced teachers know that students who read the relevant sections of the textbook etc before coming to a lesson learn far more from the lesson and retain greater recall. Cramming just before an exam has been shown to be an ineffective way to study any subject, the sciences included. So now you know. How important to you, in this competitive world, is a good grade in Science?

2. Focus your study.

The amount of information you will be expected to learn can sometimes seem overwhelming. It is essential to recognise those concepts and skills that are particularly important e.g. all of Mrs Rashid's students know how to set out physics equation problems! Pay attention to what your teacher is emphasising. As you work through sample problems and homework assignments, try to see what general principles and skills they employ. Textbooks will usually give an outline of what lies ahead in a given chapter and your teacher will tell you what topics you are going to encounter in a particular unit on your course. A single reading of a chapter will simply not be enough for successful learning of chapter concepts and problem-solving skills. You will need to go over assigned materials and exercises more than once.

3. Keep good class notes.

Your class notes from lessons will provide you with a clear and concise record of what your teacher regards as the most important material to learn. Using your class notes, in conjunction with your textbook, is the best way to determine which material to study.

4. Skim topics in the textbook before they are covered in lessons.

Reviewing a topic before a lesson will make it easier for you to take good notes. Read the chapter outline and the end-of-chapter summary; then quickly read through the chapter, skipping sample exercises etc. Paying attention to the titles of sections and subsections gives you a feeling for the scope of the topics. Try to avoid thinking that you must learn and understand everything right away.

5. You need to do a certain amount of preparation before class.

More than ever, teachers are using the class period not simply as a one-way channel of communication from teacher to student. Rather, you are expected to come to class ready to work on problem solving and critical thinking. This is a very common approach across A-level in general, and not just in the sciences. Coming to class unprepared is not a good idea for any class environment, but it is certainly not an option for an active learning classroom if you aim to do well in your course.

6. After lessons, carefully read the topics covered in class.

As you read, pay attention to the concepts covered in lessons and to the application of these concepts in the sample exercises and model answers covered in class. Once you think you understand a model answer, test your understanding by working through end of chapter problems and past exam questions on the same topic.

7. Learn the language of Science.

As you study the sciences, you will encounter many new words. It is important to pay attention to these words and to know their meanings. Knowing how to identify chemical substances, for example, from their names is an important skill; it can help you avoid painful mistakes in examinations. For example, 'chlorine' and 'chloride' refer to very different things.

8. Attempt all homework and end-of-chapter problems.

Working through the problems selected by your teacher provides necessary practice in recalling and using the essential ideas within a given unit. You cannot learn merely by observing; you must be a participant. In particular, try to resist checking the answers at the back of the book until you have made a decent effort to solve the problem yourself. If you get stuck on a problem, ask your teacher or another student to work through the problem with you.

but in this report, I will be inquiring as to whether time is continuous.

For example, does it just flow at the smallest perceivable level or is it granulated into "quanta" and whether it will run its course at the same rate regardless of anything, anywhere.

DEFINITIONS OF TIME

Philosophers have also been curious in the concept of time, many giving their own definitions to it. The philosopher Adolf Grünbaum described it as "a linear continuum of instants"[1], whereas the Oxford

dictionary defines it as “the indefinite continued progress of existence and events in the past, present and future regarded as a whole”[2]. These two definitions are somewhat contrary in their understanding of time, with the comparison of “instants’ to “continued progress”. These differences may seem subtle but lend themselves towards the basis of different theories of time: whether time is made up of events (instants) or if it just flows continuously.

ABSOLUTE TIME

Absolute time, or Newtonian time, is the theory that time just exists independently to any observer. It is unchangeable and universal, which means it is the same at any point in the universe. It is absolute and continuous.

Newton also stated that it is “imperceptible”, that it is difficult or impossible to perceive, it just happens, and that it can only truly be understood mathematically. This concept of time is perhaps the easiest to understand as it is what we, as humans living in a perceived constant time, would assume is true, that time just happens at the same pace, forever.

In physics, time is considered as a linear continuum, and is needed to be accurate to extreme levels of precision. Therefore, if time were continuous and constant it would make experimental data apply to the whole universe. However, this is not the case. The absolute time proposed by Newton was considered one of the fundamental scalar quantities along with mass, length and charge, meaning it can be expressed as a single real number with units. However, it has irregularities when put into practice. Once thought to be due to irregularities in the motion of the earth by Newton, it is now understood to be a flaw in the proposal of absolute time, perhaps better explained by theories such as quantum or relativistic time.

However, certain experiments have been able to measure the progress of a chemical reaction to the femtosecond (10^{-15} seconds) , thus leading to speculation that this model isn’t accurate and time is actually continuous even at the smallest level. Yet, if time were divided into discrete quanta, it would be at a much higher level of accuracy.

Perhaps time is divided into quanta at the level of Planck time (10^{-43} seconds), much less than a femtosecond. A hypothetical chronon unit has been theorised to represent this, and this would be the length of one of these quanta.

The Copenhagen interpretation of quantum theory is that if the position of a particle at a point in time can be described using a wave function, it has a probability of being in a certain place at a certain time. But when it is observed, the wave function collapses, and the particle is said to be definitely in a certain position at a certain time, so there is a difference between what we see and what actually exists (especially at the subatomic particle level).

This breakdown of the wave function cannot be undone, so all the information of the wave function has been lost and cannot be recreated, which means the process is time irreversible. This is used as evidence for the flow of time being one directional and continuous even if it may not continue at a certain pace

consistently. This inconsistency of the pace of the flow of time can be explained by the theory of relativity, which also contradicts the theory of quantum time.

RELATIVISTIC TIME

The fundamental core of the theory of relativity, proposed by Albert Einstein, is that if the speed of light is invariable, then space and time must be flexible to accommodate this. This theory has been proven time and time again to be 'remarkably accurate'.

Hermann Minkowski put forwards two definitions of two types of time:

Proper time- the actual time between two events measured by a clock that passes through and between each event.

Coordinate time- the apparent time between two events as measured by a distant observer.

These lead to the concept of 4-Dimensional Space-time, a collection of an infinite number of events. But the question still remains that is this "space-time" continuous or just a sequence of discrete time values? The implication that it is the collection of an infinite number of "events" shows that it may be discrete, that each event carries its own set time, perhaps the chronon unit, and that the sequence of these gives the illusion of one continuous flow. But the infinite nature of these events contradicts this, if there are an infinite number of events, there will be no gap between each event, that gap would be filled by another event and so on until infinity. Thus, implying that at the most precise level, time is continuous.

However, another contradiction to the flow of time lies within this same theory. Each particle's past, present and future (its complete history) is thought to form a line in space-time, so time is not regarded as passing or flowing, or even happening. The past, present and future just *are* there, mapping a line through space-time. Time does not flow, it just *is.*

The perception of "now" is ever changing, giving the illusion of a continuous forwards movement through time.

ARROW OF TIME

At the macroscopic level, time is perceived as forwards moving, that is to say at the level we can observe with our own eyes. But as we look more closely at the microscopic level at nature, lots of processes seem to be reversible or asymmetric, meaning that this is not the reason for our perception of the "arrow of time", the direction that time seems to be moving.

In fact, almost all physical processes are time reversible, so what is it that gives us this distinction of the past, present and future and what they really mean.

But one law of thermodynamics seems to solve this problem, the 2nd Law.

It states that: "as one goes forwards in time, the net entropy, that is to say the degree of disorder, must increase or at least stay the same for a closed system. For example, a house may crumble, but a pile of bricks will never spontaneously become a house, or it is at least unfathomably unlikely. The meaning of entropy is that things have a tendency to disperse, heat dissipates and spreads out evenly across a system, but never spontaneously comes to one hot point surrounded by a colder area.

It seems to be only the fact that so many natural processes are part of this second law of thermodynamics that we actually remember the past instead of the future, as the entropy was lower in the past than the future. So, this shows that time is continuously "forwards moving", it can never reverse, or create negative entropy in a closed system, so it is continuous.

CONCLUSION

In conclusion, the question 'is time continuous?' has multiple different answers to different interpretations of its meaning, some which physics is yet to, or cannot answer. But overall, at the smallest, most accurate level time *could* be quantified, just as light is into photons, which has helped explain many physical dilemmas. But perhaps nothing happens in the length of one chronon unit. The granulation of time can only be theorised and perhaps never measured, as what accuracy would it be measured to? Could you measure a fraction of a chronon, and what would this look like, because a chronon is a discrete unit, that can only take whole number values.

The other question that my title proposes is; does time carry on continuously forwards, forever? The answer seems to be yes, but not necessarily at the same pace, and it may be already there in space-time, just a point yet undiscovered that will make up our future.

REFERENCES

[1] - http://www.exactlywhatistime.com/physics-of-time/quantum-time/

[2] -https://languages.oup.com

Britannica, Authors- Arnold Joseph Toynbee. John Jamieson Carswell Smart, William Markowitz, https://www.britannica.com/science/time Last accessed- 20-4-2020

Carlo Rovelli (2019), The Order Of Time, London, Penguins Books

Exactly what is time, *http://www.exactlywhatistime.com/physics-of-time/the-arrow-of-time/* Last accessed- 20/4/2020

Stephen Hawking, http://www.hawking.org.uk/the-beginning-of-time.html Last accessed- 20/4/2020

H Wall, 12S

A journey around our solar system

1

Welcome to Out of this World Travel. We are taking you on a once in a life time trip around our solar system in only 3 weeks! It has never been possible to travel to Pluto before as it would have taken up to 9 and a half years! However, with our new and improved spaceship, you can get a breath taking view of the entire solar system in just 3 weeks.

2

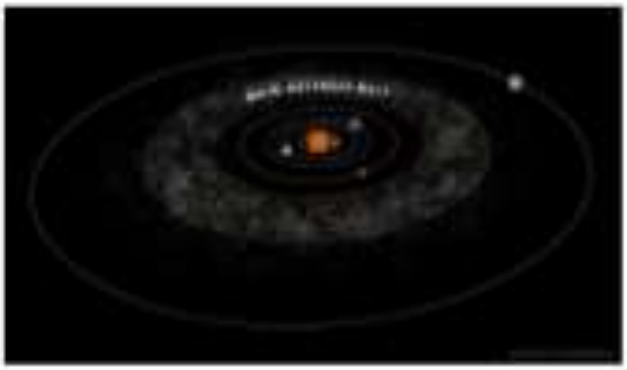
Your journey will begin with our first stop at the moon where you will see hundreds and thousands of craters. These are caused by asteroids and meteors colliding with the lunar surface. Whether you like it hot or cold, the moon temperatures range from minus 173 degrees to plus 127 degrees Celsius! On the moon the length of a day is thirteen and a half earth days but we'll be able to fly around it in less than day.

3

Our amazing journey around the solar system will cover every Space enthusiast's interests. You will see Venus, our hottest planet in the solar system reaching temperatures of 465 degrees Celsius and Uranus which has the coldest climate, with temperatures as low as -224 degrees Celsius.

4

If we get lucky we may experience the sight of some stunning meteor showers too as approximately 30 meteor showers occur each year. Meteor showers usually occur very late at night so look out for our late night timetables!



5

During our journey we will get as close as possible to the sun, bearing in mind that the suns temperatures reach 5600 degrees Celsius on the surface and 15,000,000 Celsius towards the centre.

6

For those who love a thrill, we will be travelling through the asteroid belt where it could get a little bumpy due to the many vast rocks we will have to negotiate our way through!

7

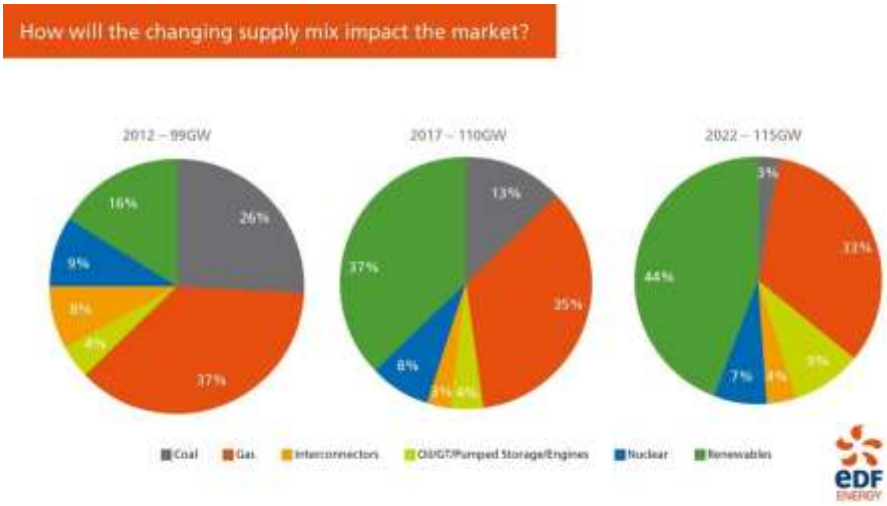
We've saved the best part of the trip until last. We will do a close fly-by of the rings of Saturn and the beautiful gas giant, Jupiter. We will then fly you home via the red planet, Mars, before collecting your souvenir album.

8

In all this will be the trip of a lifetime for the privileged few so don't delay in booking your place now!

Can vehicle-to-grid electric car chargers help the UK use renewable energy more often?

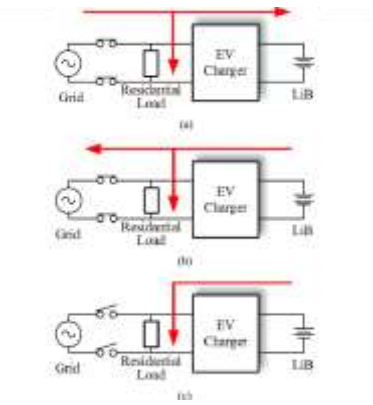
Energy companies buy electricity from various sources, nuclear plants, coal or gas fired power stations and renewable sources such as wind, solar & tidal. Renewable electricity is the cheapest option for these companies as it has the lowest wholesale price. This has been shown as renewable energy sources overtook fossil fuels in the final quarter of 2019 for the first time since the UK's first power plant started up in 1882. As well as this, as part of the Conservative party's green policies, a coal phase out was issued meaning all coal plants must close by 2025 because of new pollution standards. Emissions have been cut by 40% since 1990 alongside growth in the economy of two thirds. On top of this, as climate change is creating more and more severe weather conditions within the UK, winds are contributing a much larger quantity of energy than they would have in past years, with wind contributing 44% of our energy which was consumed during Storm Ciara in February of this year, which was greater than nuclear and gas combined.

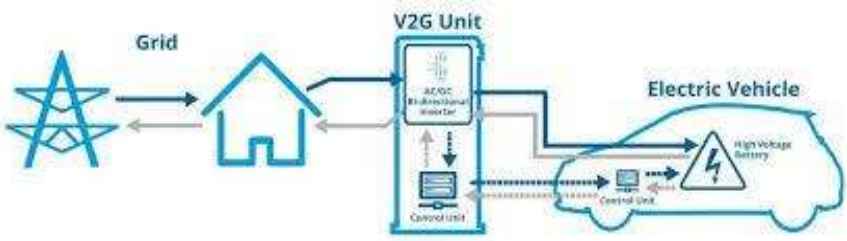


One problem with renewable energy sources is that they are not entirely consistent. Solar only produces energy in daylight, wind farms only produce energy when the wind blows. That is not to say that coal or gas power stations run 24 hours a day, they require far more maintenance and can be closed for weeks on end whilst complex industrial components are fixed or replaced.

In order for energy companies to use more renewable energy, thus boosting their profits but also improving the environment, they need to find ways to store the energy produced. This is where home energy storage comes into play, also known as batteries or thermal stores, which allow you to capture heat or electricity while it is readily available and save it for a time when it is useful.

One solution of these solutions is vehicle to grid electric car chargers. This is a process in which plug-in electric cars communicate with the power grid, by letting electricity flow from the car to the electric distribution system and back. This can earn the owner of the car money for selling unused electricity back to the grid. The one my family is trialling is with OVO. They are an energy supplier, who have recently begun trialling these chargers, with their scheme being one of the largest when we decided to go with them. They have a mobile app in which you can control the charger from, the charger then charges the car when demand on the grid is low, and exports when demand is high, then anything exported that isn't used to power the home, they sell back to the grid, therefore saving money on the electricity bill.





Sales of electric cars have rocketed recently but whilst this is great news when it comes to reducing carbon emissions, it also brings problems for the power grid as demand will increase considerably. Electric car sales rose by 144% in 2019, even with business and consumer confidence at a low due to Brexit. However, they still only account for 38,000 sales, or 1.6% of the total of over 2 million, while they would need to hit around 600,000 to match current targets.

If more and more people purchase electric cars and plug them in as soon as they get home from work, this could cause considerable strain on the grid. Allowing the energy companies to choose when they charge the vehicles can balance out the peak times. Our car has a 40kWh battery which stores more than enough energy to power our house for a day. It usually charges at night when demand on the grid is low and so is the wholesale price of energy. The peak demand time for the grid is between 16:00 & 22:00 each day as this is when most people have finished work, return home, cook dinner, watch TV etc. During this time our house is running off our car battery, we are not drawing any energy from the grid and in fact much of the time we are exporting the energy we don't use back into the grid. When the car is charging, we are paying 15p per kWh, when the car is discharging (either to our house or the grid) the energy company pays us 31p per kWh. So, we make 16p for every kWh we export which is not much but over 6 months it amounted to around £250. We are also helping to balance demand on the grid & using as much renewable energy as possible. One other benefit that appeals to us is the fact that most cars are parked and not used for 95% of the time. When you spend £30,000 on a car it seems ridiculous that for the majority of the time it sits there doing nothing. With our charger our car is in use nearly 20 hours a day, even though it is not being driven, it is still being useful as an energy storage system.

There is also the argument that batteries are not very environmentally friendly especially as they contain cobalt which is a very controversial component (the blood diamond of battery construction). It is worth noting however that cobalt is also used in every smartphone on the planet & also in oil refining, it is how sulphur is removed which creates unleaded petrol. Generally, an electric car battery will last for 10-15 years in a car at which point it cannot hold enough energy to power the car. At this point it is still good enough for 2nd life use which is often as an energy storage system for buildings. In the Netherlands they have many office blocks with solar panels on the roof & containers in the car park full of old electric car batteries. They store the energy created during the day & run the office on the batteries when the sun goes down. The batteries can do this for another 10-15 years at which point they are no longer usable but 98% of an electric car battery can be recycled & made into a brand-new battery.

There are also lots of people working on finding a way of creating batteries without cobalt, Tesla seem to be on the brink of this already, they are in talks to use batteries from CATL (Contemporary Amperex Technology), which contain no cobalt (the usually are nickel-cobalt-aluminium or nickel-manganese-cobalt batteries). Instead they are lithium iron phosphate batteries, which not only is better for the environment, but also lowers production costs, however they must negotiate the lower energy density compared to the usual batteries as otherwise this could lead to less miles per charge. They plan on boosting the density and safety by working on a so-called 'cell-to-pack' technology.

Sources:

(Para 1)

https://www.ofgem.gov.uk/data-portal/all-charts/policy-area/electricity-wholesale-markets

https://www.theguardian.com/business/2019/oct/14/renewable-electricity-overtakes-fossil-fuels-in-uk-for-first-time

https://electrek.co/2020/02/17/egeb-britain-new-daily-record-wind-energy-storm-ciara-costa-rica-solar-illinois/

(Para 3)

https://energysavingtrust.org.uk/renewable-energy/energy-storage

(Para 4)

https://www.ovoenergy.com/electric-cars/vehicle-to-grid-charger

(Para 5)

https://www.independent.co.uk/news/uk/electric-car-sales-sales-diesel-brexit-business-a9271041.html

(Para 7)

https://www.wired.co.uk/article/cobalt-battery-evs-shortage

E Sanders. 12W

Science word search

By L. King and L. Dockree

E	N	E	R	G	Y	A	P	M	A	S	S
O	O	N	D	R	E	V	B	I	I	C	S
L	P	Z	L	A	B	O	J	N	R	I	K
O	A	Y	M	V	F	L	G	E	H	E	J
P	R	L	W	I	Q	U	K	R	L	N	O
X	T	L	L	T	N	M	Y	A	M	C	S
S	I	N	N	Y	W	E	L	L	B	E	S
J	C	J	Y	M	F	O	S	S	I	L	T
Y	L	L	E	C	L	R	W	B	X	U	Q
B	E	N	E	J	H	G	R	J	D	Z	K
K	L	T	H	E	O	R	Y	E	B	B	T

Can you find all these hidden words?

Energy
theory
fossil
cell
mass
mineral

Particle
gravity
tube
science
volume
lab

BLOOD AND THEIR ROLES

RED BLOOD CELLS

Their job is to transport oxygen to the body's tissues in exchange for carbon dioxide, which is carried to and eliminated by the lungs.

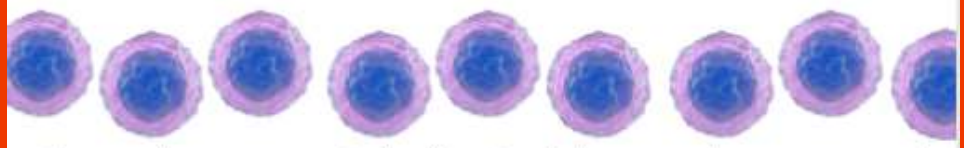
PLATELET BLOOD CELLS

These are tiny blood cells that react to bleeding from blood vessel injury by clumping, thereby initiating a blood clot.

WHITE BLOOD CELLS

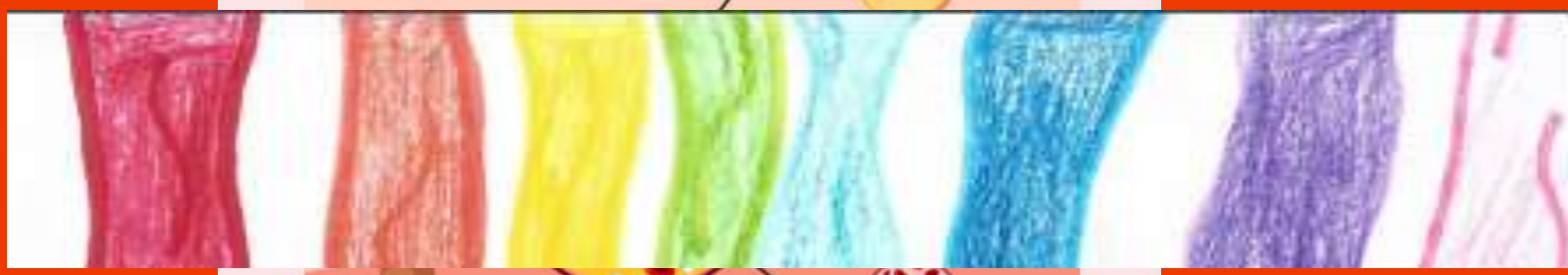
These are the cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders. They are produced and derived from hematopoietic stem cells found in bone marrow.

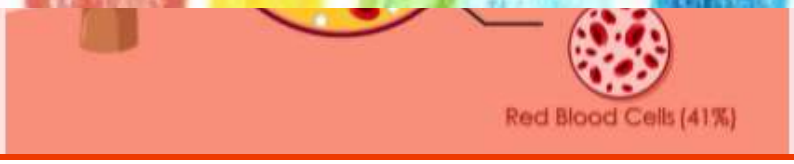
PLASMA CELLS



Plasma cells are a type of white blood cells that excret large amounts of antibody which targets microbes for destruction by other immune cells.

COMPOSITION OF BLOOD



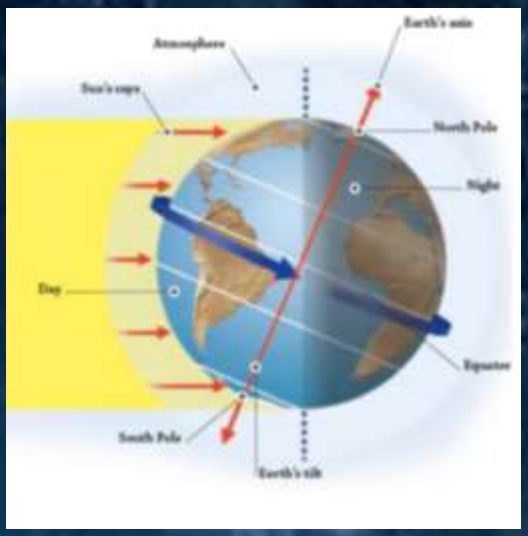


G Mosely Year 8

Tardigrades

Tardigrades, also known as the Water Bear, are microorganisms that are very well known for their incredible endurance and ability to survive extreme things and situations that most known creatures would die in. Some of these things are: surviving in space, through nuclear war, asteroid impacts, and volcanic eruptions. Some scientists even believe that tardigrades will survive right until the sun dies. They can grow up to around 1mm at largest, and they feed on algae and invertebrates. As far as indestructible goes, tardigrades are the closest it gets to that on Earth, and nobody knows what the future may hold for these unique and intriguing creatures. They can also reproduce by either asexual or self-fertilisation. Depending on the type, they can survive for 3-4 months or around 2 years.

Why do we have day and night?



The earth rotates in 2 ways: the first is around the sun, which creates seasons and years and the second way is rotating on a hypothetical line called its axis; this is the one that controls day and night. It finishes a rotation every 24 hours this way. If the Earth's axis were perpendicular to its orbital path around the Sun, all places on Earth would experience equal amounts of day and night 12 hours of day and night, every night respectively and there would be no seasonal changes such as heat and weather. What helps humans survive is seasonal variability to grow crops and to bring variation to life. It also puts a variable cycle on weather and helps with commercial advertising, so we can thank Thea for our varied daylight and our moon. Nevertheless, the simple explanation for there being a day and night is the earth itself. Our planet blocks half of itself from getting sunlight and the only natural light at night is from stars and the moon reflecting the sun's light, as seen on the diagram. The earth's tilt also makes our length of day different throughout the year.

What causes eclipses?

There are 2 types of eclipses: lunar and solar. The most recognised type of eclipse is a solar eclipse. This occurs when the moon gets in front of the sun, blocking its light. Complete solar eclipses happen about once every one to two around the earth and partial solar eclipses where the moon only partly covers the sun happens at least twice a year. A solar eclipse in the same place is rare though, as the Earth, Sun and moon have to align identically. So, it's only noticeable in a small part of the world at a time. In fact, it occurs only every 375 years in the same place. In a lunar eclipse, a full moon can become almost invisible as the earth blocks the light to it. This doesn't happen every lunar month as it isn't always covered by the Earth's shadow.

The Life Cycle of a Star: All Possibilities

Stars can take many different evolutionary routes, which can greatly change the current and future state of it, with some becoming great supernovas and some becoming dead black dwarfs. But all stars begin as protostars, giant masses of excess matter, forming a great cloud around a central point, which will eventually be fully absorbed by the central point, which is the star. Now the paths diverge, with the size of the star, determined by the size of the protostar and everything around it, becomes a crucial turning point.

If it is less than 0.07 of a standard solar mass, it will become a brown dwarf, a star which has failed to gain a large enough mass and amount of energy to provide enough force to maintain a neutron star is the core of a star which has gone supernova. These star remnants are incredibly dense, excluding black holes. They are very faint and nearly

R. Goodchild Year 8M

Terminal Velocity by A. Shah year 10

Have you ever wondered why a spider isn't harmed when you throw it out your bedroom window?

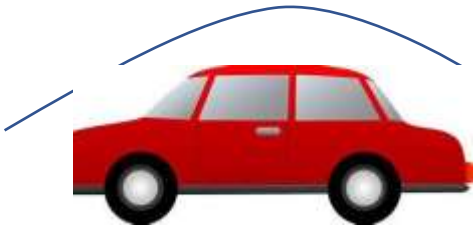
Friction is always there to slow things down

1. If an object has no force propelling it along it will always slow down and stop because of friction (unless you're in space where there's nothing to rub against).
2. Friction always acts in the opposite direction to movement.
3. To travel at a steady speed, the driving force needs to balance the frictional forces.
4. You get friction between forces in contact, or when an object goes through a fluid (drag).

Drag increases as speed increases

1. Drag is the resistance you get in a fluid (a gas or a liquid). Air resistance is a type of drag.
2. The most important factor by far in reducing drag is keeping the shape of the object streamlined. This is where the object is designed to allow fluid to flow easily across it, this would reduce drag. Parachutes work in the opposite way – they want drag which is why they are a cone shape when filled with air.
3. Frictional forces from fluids always increase with speed. A car has much more friction to work against when travelling at 70mph compared to 30mph. So at 70mph the engine has to work much harder just to maintain a steady speed.

Air flows easily over a streamlined car

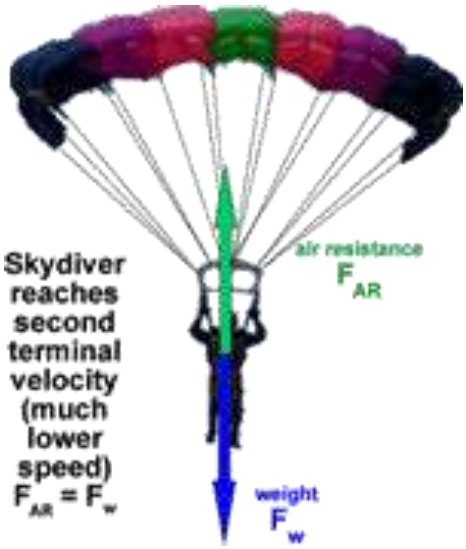


Objects falling through fluids reach a terminal velocity

When a falling object first sets off, the force of gravity is much more than the frictional force slowing it down, so it accelerates. As the speed increases the friction builds up. This gradually reduces the acceleration until eventually the frictional force is equal to the accelerating force (so the resultant force is zero). It will have reached its maximum speed or terminal velocity and will fall at a steady speed.

Terminal Velocity depends on shape and area

The accelerating force acting on all falling objects is gravity and it would make them all fall at the same rate if it wasn't for air resistance. This means that on the Moon, where there's no air, bricks and spiders dropped simultaneously will hit the ground together. But, on earth, air resistance causes things to fall at different speeds, and the terminal velocity of any object is determined by its drag in comparison to its weight. A spider is not harmed when it falls from a bedroom window because its surface area is large enough to counteract gravity and significantly lower its terminal velocity, allowing it to land, unharmed.



Try this at home – Egg Trick

The Science

Friction, gravity and buoyancy combine together to make you look clever

Time

3 minutes, more if you make a mess

What you need

3 eggs

3 wine glasses

1 corked back table mat

3 empty tubes (like Pringles)

Water

Step 1 Half fill the wine glasses with water and arrange in a triangle

Step 2 Put the mat on the glasses, cork side up

Step 3 Stand the tubes on the mat, open end up, centred over each glass

Step 4 Place an egg on top of each tube

Step 5 Hit the edge of the mat, it'll slide out of the way, and……

Let us know what happened!

Multiple Sclerosis

Multiple Sclerosis (MS) is a potentially disabling disease of the brain and spinal cord. The immune system attacks the nerve fibres which then causes problems with communication between the brain and the rest of the body.

The symptoms of MS are:

-Vision problems

-Tingling and numbness

-Pain and spasms

-Dizziness

-Weakness or fatigue

-Bladder issues

-Cognitive disfunction

0.33% of the world's population has MS and generally it affects them in their day to day life. You take steroids so that it reduces the severity of attacks that it causes and so you can carry on with your day to day life. The steroids can also delay or reduce disability.

Sclerosis means scarring and refers to scars (or lesions) that multiple Sclerosis causes in your brain or your spine. These will appear in MRI scans (magnetic image resonance). It is called 'multiple' sclerosis because the lesions happen in multiple places in the body.

Facts:

-More than 130,000 people in the UK alone are diagnosed with MS

-Multiple Sclerosis is not contagious or infectious

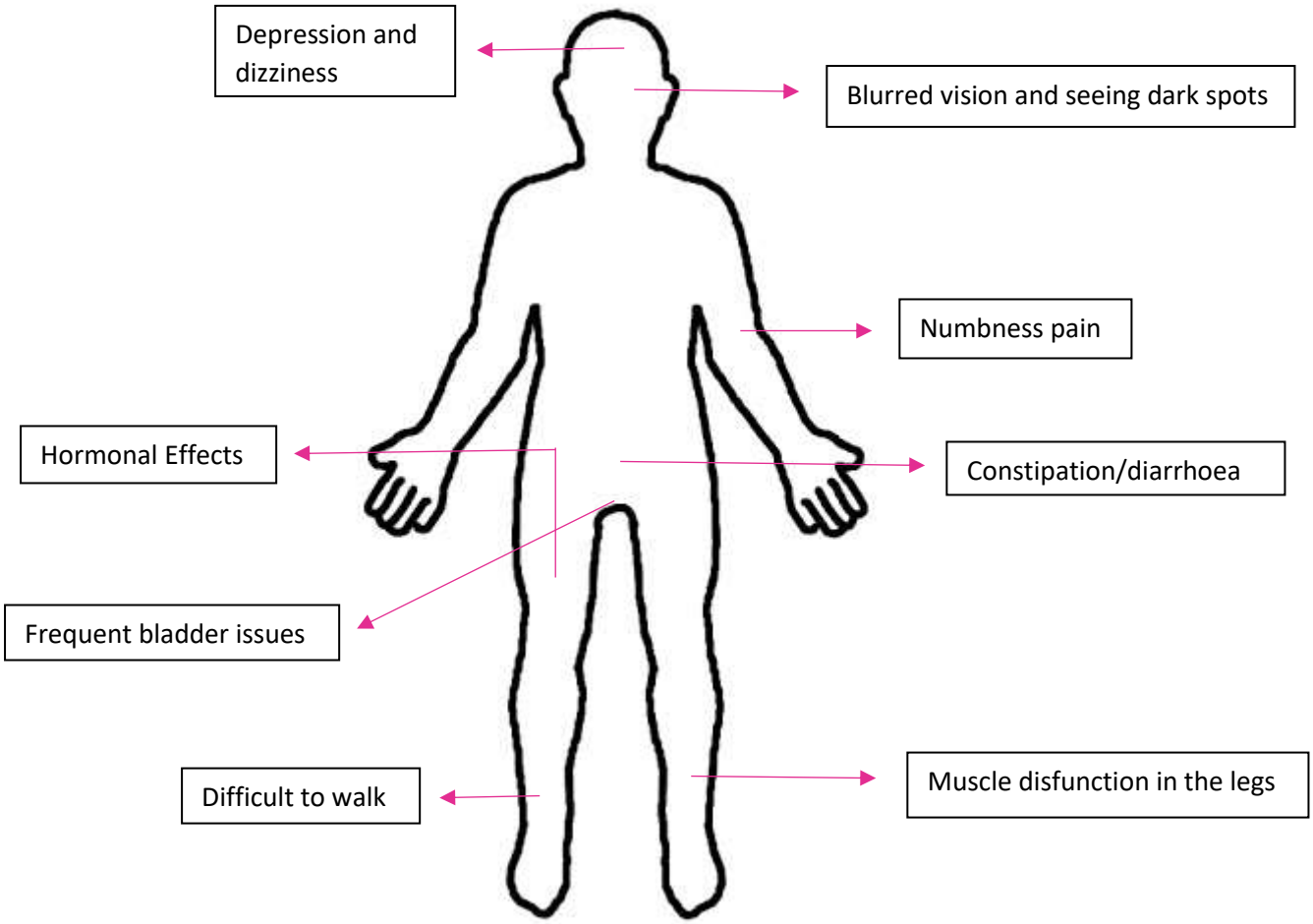
-Everyone's MS is different so no two people, even if related, will have the same symptoms

-MS is more common in countries furthest away from tropical countries around the equator

-MS is nearly 3 times more common in women than men

-You don't inherit MS but you do have a slightly higher risk of developing it

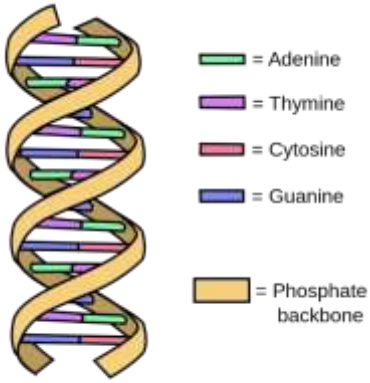
EFFECTS of multiple sclerosis ON THE BODY



The effects above may affect your everyday life but they do not disable you from doing daily activities. The steroids help do this.

O Bartlett and N Edmondson 8M

Underappreciated Scientists: Who really deserves the credit for the DNA double helix?



DNA

The structure of the DNA has been declared as one of the most important pieces of biological work of the last century; today, it is well-known that DNA is the molecule that contains our genetic code. However, do you know the name 'Rosalind Franklin' and how she played a major role in discovering the double helix?

DNA is a nucleic acid which consists of long chains of subunits known as nucleotides. Each nucleotide contains a phosphate, a sugar and one of the four bases: adenine (A), guanine (G), thymine (T) and cytosine (C).

By the 1950s, two teams of scientists were racing to discover the double helix. One team, based in Cambridge, was led by James Watson and Francis Crick, whilst the other team, based at King's College, consisted of Rosalind Franklin and Maurice Wilkins.

Rosalind Franklin worked hard to find the structure by looking at X-ray diffraction images; she was a world expert in crystallography and used this technique in order to determine the structure of crystalline molecules, such as DNA. Over a period of time, a series of structures were presented; Watson proposed a triple helix, although it was proven wrong.

Back at King's College, Franklin continued to study her X-Ray diffraction pictures. By January 1953, her initial findings were that DNA did show the characteristics of a helix. Yet, she was not ready to share these findings; she had wanted to confirm them first. But Wilkins had different ideas, and had grown increasingly impatient. Instead, he shared the images with Watson and Crick; without Franklin's permission! From these images, Watson and Crick discovered the double helix: DNA had two strands, each running in opposite directions with complementary base pairing.

The double helix was immediately accepted by the scientific world and has been declared as one of the 'most important pieces of biological work of the last century'. In 1962, Watson and Crick won the Nobel Prize for medicine/physiology, sharing it with Wilkins although Franklin's name was nowhere to be seen.

Now, few people know her name, it is only in recent years that she has gained the recognition she deserved. Rosalind Franklin unfortunately died of ovarian cancer, supposedly due to her work with X-ray images. So, who really deserves the credit for our current knowledge of DNA? And would the name Franklin be as familiar as Watson & Crick if she had been a man working alongside them at Cambridge?

S Green 13C

The Rock Cycle

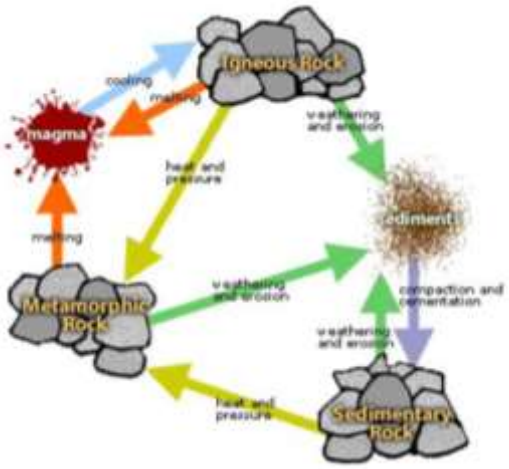
Erosion - The wearing away of pieces of rock, soil and other solid material.

A cycle - A series of events that are regularly repeated in the same order.

The rock cycle -

Sedimentary rock could turn into metamorphic rock by being put under heat and pressure. Igneous rock could turn into sedimentary rock by weathering and erosion, which then can form into sedimentary rock by compaction and cementation. Metamorphic rock could turn into igneous rock by melting into magma then the magma cooling into the igneous rock.

Structure of the earth



The Earth's crust:

- Outermost layer on earth.
- The crust is very thin
- Thinnest layer under the ocean floor

Mantle:

- Just under the earth's crust.
- Made of solid rock but behaves like really thick liquid.
- 2890km thick.

Outer core:

- Layer beneath the mantle.
- Made of liquid iron and nickel.
- Iron and nickel are magnetic metals and it is their presence in the core of the earth that causes the earth to have a magnetic field.

Inner core:

- The inner core is the bit in the middle of the earth.
- It is made of solid iron and nickel
- It is as hot as the sun

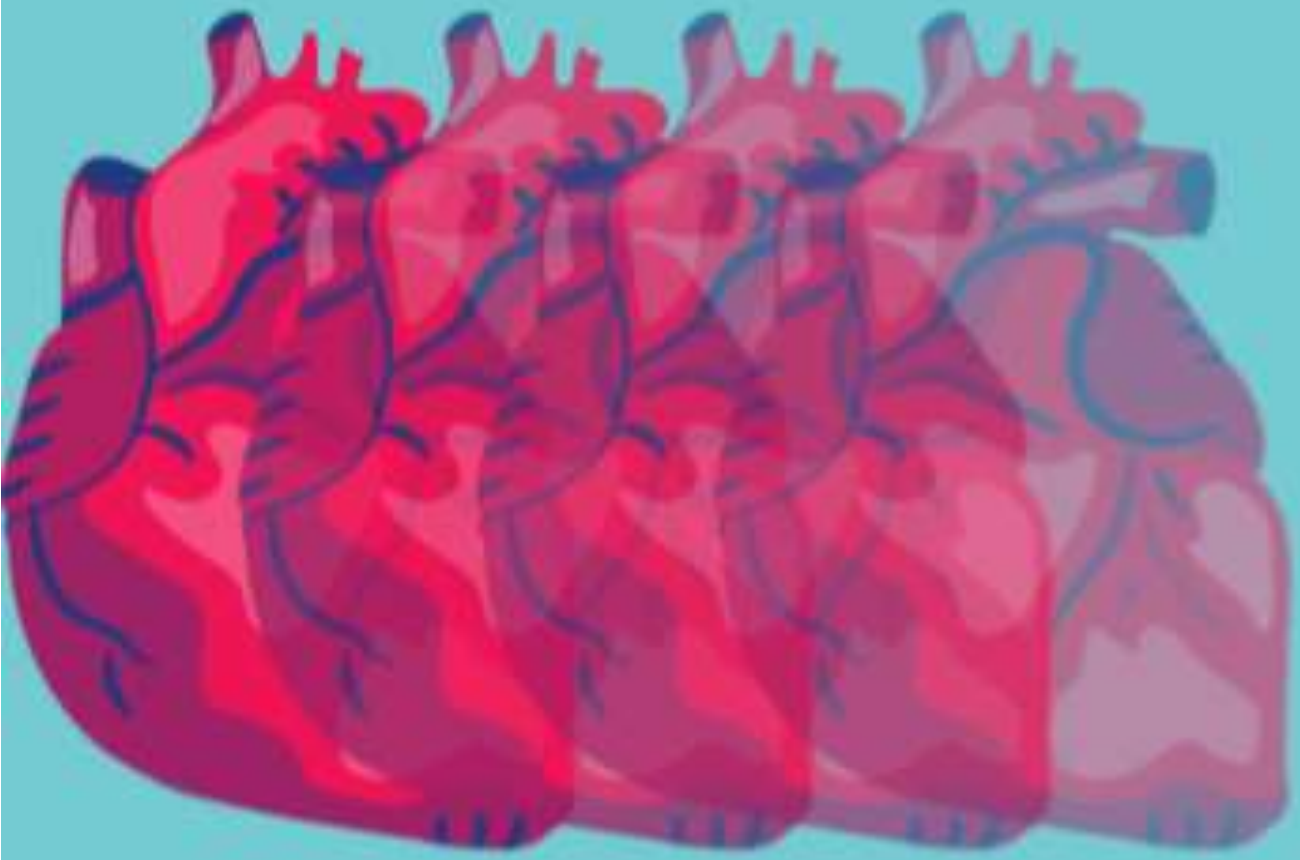
T Rimmer 8M

Science Word Search

Find science-related words in this puzzle by searching across, down and diagonally.

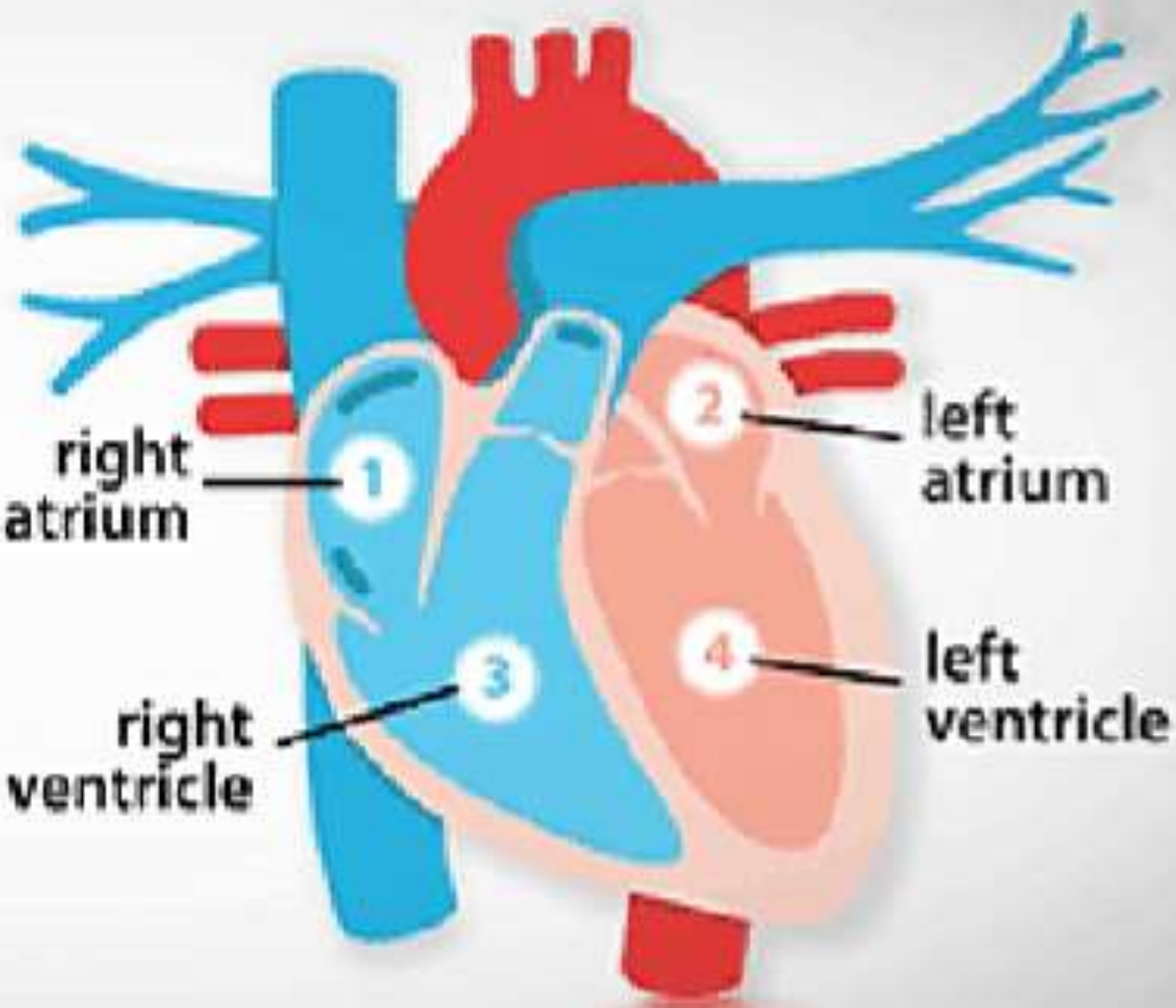
G	T	P	J	O	M	E	N	E	R	G	Y	K	M	Y
I	H	X	C	E	L	L	S	F	X	L	V	M	A	G
N	E	R	E	X	P	E	R	I	M	E	N	T	G	M
V	R	Z	E	T	E	L	E	S	C	O	P	E	N	I
E	M	L	M	S	O	R	G	A	N	I	S	M	I	C
N	O	L	E	C	E	P	H	Y	S	I	C	S	F	R
T	M	D	A	P	F	A	D	G	U	F	H	Q	I	O
O	E	R	S	B	G	Y	R	R	U	L	E	R	E	S
R	T	I	U	E	O	A	X	C	G	B	M	C	R	C
B	E	O	R	A	W	R	T	E	H	D	I	H	V	O
W	R	J	E	K	O	V	A	S	O	A	S	E	U	P
S	C	A	L	E	S	O	R	T	U	T	T	C	O	E
I	J	B	Q	R	H	Y	A	B	O	A	R	V	N	G
T	R	G	B	I	O	L	O	G	Y	R	Y	P	L	T
X	M	A	T	T	E	R	Y	J	X	R	Y	G	Z	V

BEAKER	INVENTOR	PHYSICS
BIOLOGY	LABORATORY	RESEARCH
CELLS	MAGNIFIER	RULER
CHEMISTRY	MATTER	SCALES
DATA	MEASURE	TELESCOPE
ENERGY	MICROSCOPE	THERMOMETER
EXPERIMENT	ORGANISM	



THE HEART & CIRCULALTION

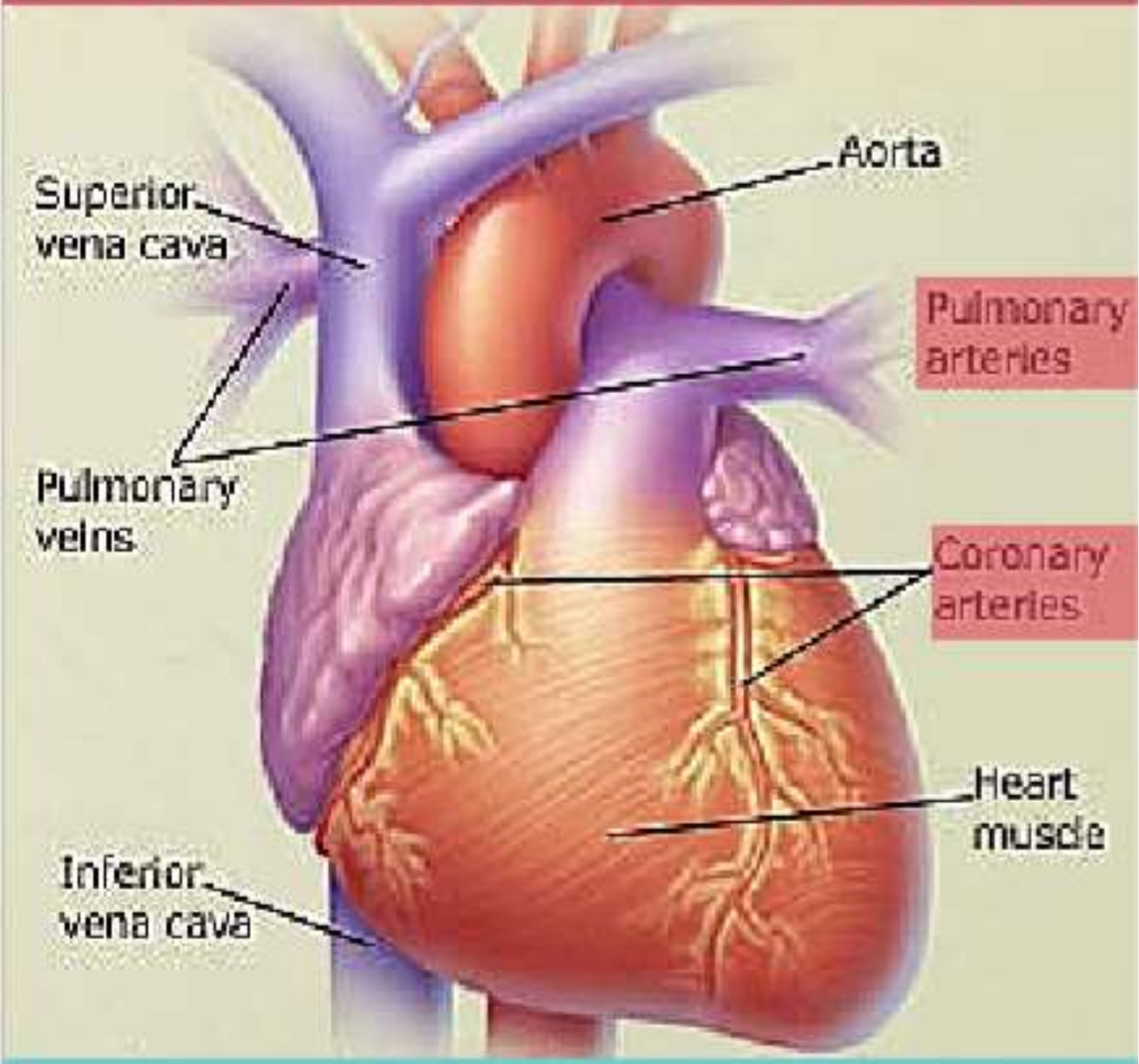
THE HEART CHAMBERS



how do the heart chambers work?

the right atrium receives oxygen-poor blood from the body and pumps it to the right ventricle which pumps the oxygen-poor blood to the lungs. the left atrium receives oxygen-rich blood from the lungs and pumps it to the left ventricle which pumps the oxygen-rich blood to the body.

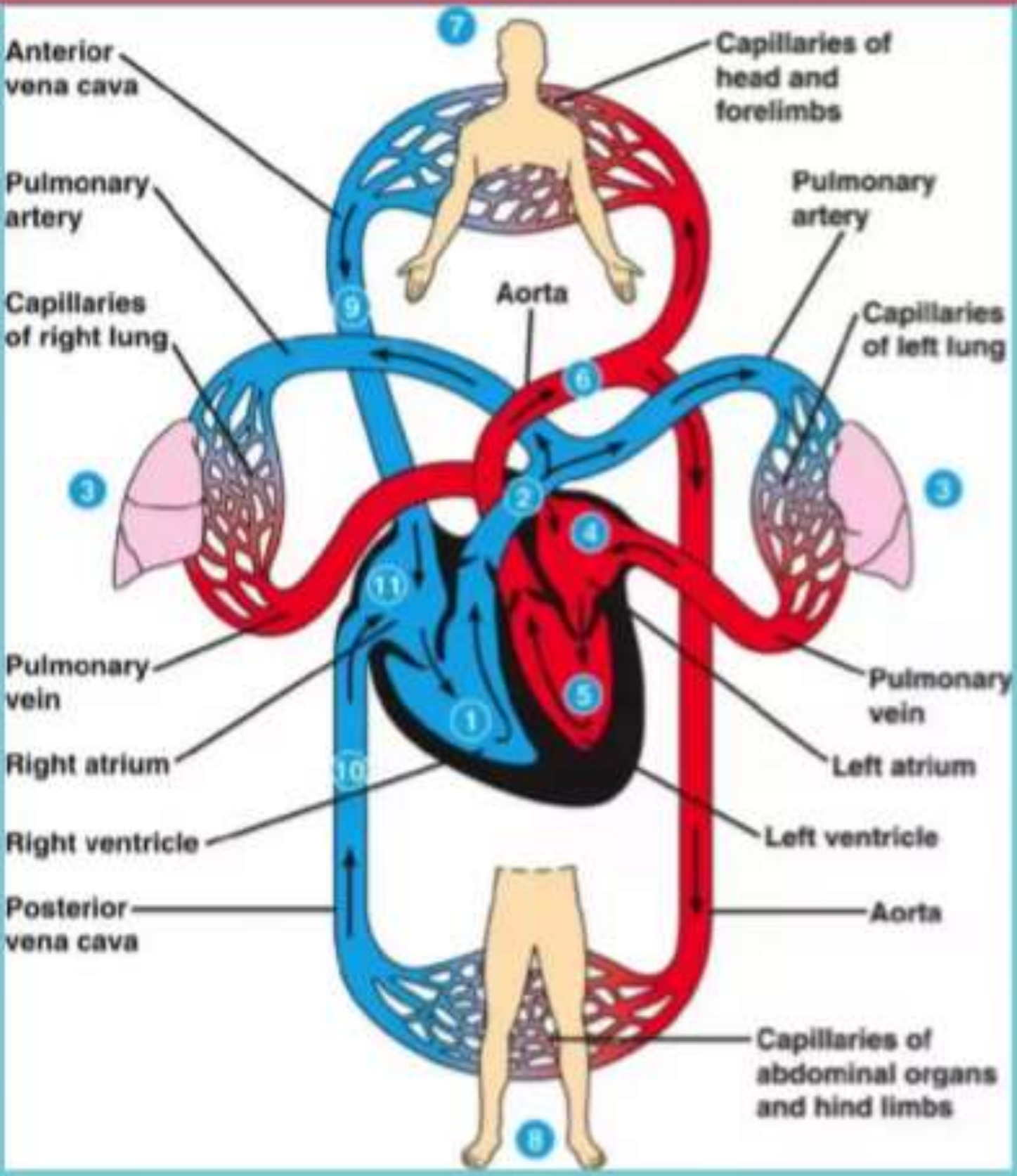
THE HEART VESSELS



what are the main heart vessels?

five great vessels enter and leave the heart: the superior and inferior vena cava, the pulmonary artery, the pulmonary vein, and the aorta.

CIRCULATORY SYSTEM



veins arteries capillaries

5 WAYS TO KEEP YOUR *heart* HEALTHY

eat healthy

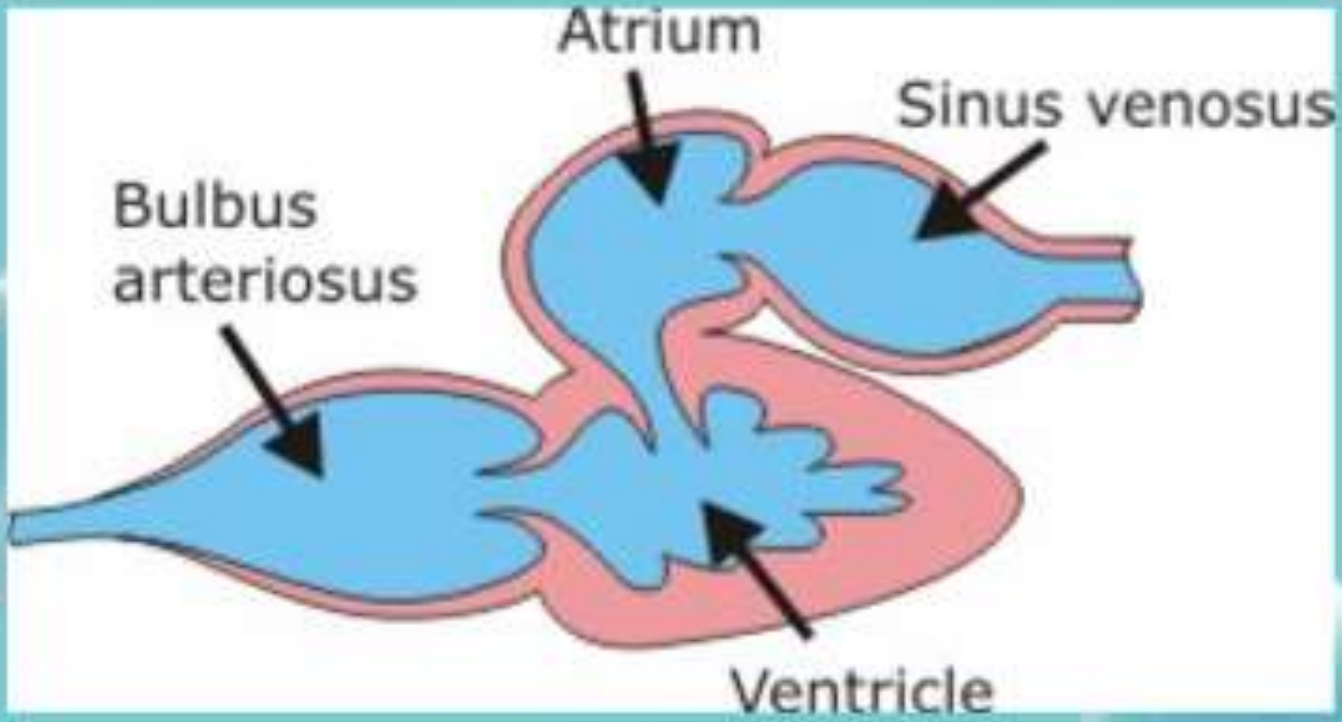
stay active

don't smoke

manage stress

limit alcohol

FISH HEARTS



Deoxygenated blood enters the atrium and then the ventricle where it is pumped to the body via the gills.

The heart of a fish has two chambers, an *atrium* and a *ventricle*

Making the Jump

"Think past the boundaries of everyday life and see the possibilities beyond"

SCIENTIA explores the challenges facing science students as they make the jump from GCSE to A level. *Extract adapted from RSC's The Mole, by Mrs. Rashid*

Congratulations! You have made it through to the beginning of your A-Level course. This is one of the most exciting periods of your life, you will make friends you will keep for a lifetime, learn an amazing amount and also begin to shape your career. You have made an excellent decision in choosing to study sciences. However, science A-Levels are considered to be the most difficult: there are challenging concepts, mathematics in new contexts and a lot of new vocabulary and facts to come to terms with. We have identified the top five challenges many students face when beginning their science A Level studies. You will need to work hard to make the most of your course but don't worry as there are lots of helpful tips and it will be very rewarding.

1. Increased workload

   Teachers will expect more you and you will also expect more of yourself. But how can you keep on top of everything? Think about how you will plan and spend your free time – allocate time for school work each evening and weekend and then break this down into subjects. It is important to relax and socialise but then stick to the plan. If you don't have specific homework, spend some time making sure you understand the concepts you have covered so far.

2. Trickier topics

   The jump from GCSE to A-Level is huge. Some parts of the course may come to you easily but others you may find extremely challenging. What if you get stuck? If you don't understand something it is quite likely that there is someone else in your group who doesn't either so never be afraid to ask for help. It is much better to make sure you understand the basics from the beginning rather than waiting until later. There are lots of resources out there to help you. Make good use of them! If you are struggling with a particular concept, try a different explanation.

3. Maths

   Many students struggle, not because they can't do the science, but because they find the maths hard. You might think it's impossible but if you look closely, the maths involved is normally quite straightforward. The secret is to keep asking for help, from your teacher or other students, and to practice, practice and practice! A useful tip: make sure you can still remember and understand what you covered at GCSE. This forms the foundation of what you will learn going forwards.

4. Solving problems

You are likely to come across questions and situations you have never seen before and need to apply your scientific knowledge. In many instances, it is not the maths of these problems that is difficult, but the requirement to use multiple different formulae and steps in solving a single problem. How do you handle problems like these? A key tip is to read the question carefully and take time to think about what it is asking you to do. For example, if it is a calculation question, what exactly does it want you to work out and what information have you been given? The number of marks the question is worth can give you a clue about what should be involved in the answer. Practice these types of questions from past papers as this can help you feel more confident in preparing for your exams.

5. Increased pressure

Lots of work, trickier topics, applying to university and making sure you keep up with extracurricular activities all add up to a lot of pressure. You may unintentionally have added to this yourself but it might also be coming from others who want you to succeed and reach your potential. But what if it all feels too much? Lots of students find the transition to A-Level studies overwhelming but don't let it get on top of you. Find someone to talk to and let them know how you are feeling. You are not alone and you will get through it. Talking to someone will help you to prioritise everything you need to do. You may enjoy the extra money from a Saturday job but would you benefit more from having that time to study?
Finally, keep working hard, ask for all the help you can get and make use of everything that is available to you. Enjoy the subject you are studying, keep the end goal in mind and don't forget to relax!

Oreo Phases of the moon, by I. Hartnett Year 8

Portrait of a Scientist

This edition: Ms Lidder

If you had to teach a subject outside of science, what would it be and why? English. I have always loved reading and being surrounded by books. I could write and rewrite things all day long. Understanding the skill and art of communication on paper is so important.

What do you do in your spare time? I like to be active, so exercise & DIY.

What is your favourite topic in science and why? Organic chemistry. Appreciating how carbon based molecules react is essential to understanding life on this planet. Organic chemistry is at the forefront of medical research and without it we would have many of the things we take for granted, such as paracetamol to relieve pain.

What is your favourite television show, music, film and book? Grand designs, any house renovation programme actually.
I have such a wide genre of music I listen to, depends on my mood. Currently binging on Indie pop, Foster the People, that kind of thing.
Books, as a child James and the Giant Peach by Roald Dahl, as an adult Holy Fools by Joanne Harris.

What is your favourite food? Thai Green Curry made from scratch not the paste from the jar!

What is the next destination for you (holiday/career)? We haven't seen many beauty spots in England, so this year we're planning to stay in Cornwall, provided the current situation eases up.
I think a career should be about learning and developing skills and if at some point that means you change jobs, then take the leap and do it! 😉.

Ms Lidder
Head of Chemistry

Student Photo Wall – CERN 2020

Think outside of the box

Puzzle 1: qwerty

The 10 letter keys on the top line of a typewriter are
Q W E R T Y U I O P
Can you find a 10-letter word that uses only these keys?

Puzzle 2: the double date

If two men each take the other's mother in marriage, what would be the relationship between their sons?

Puzzle 3: from Le Havre to New York

The following story about the 18th-century French mathematician Edouard Lucas is absolument authentique, according to a 1915 French maths text book. It took place many years ago, the author writes, at a scientific conference. Several well-known mathematicians were milling around after lunch. Lucas piped up and challenged them to the puzzle below. A few replied with the wrong answer. Most were silent. No one got it right.

Every day at noon in Le Havre an ocean liner sails to New York, and (simultaneously) in New York an ocean liner sails to Le Havre. The crossing takes seven days and seven nights in either direction. How many ocean liners will an ocean liner leaving Le Havre today pass at sea by the time it arrives in New York?

Puzzle 4: Smith, Jones and Robinson

Smith, Jones and Robinson are the driver, fireman and guard on a train, but not necessarily in that order. The train carries three passengers, coincidentally with the same surnames, but identified with a "Mr": Mr Jones, Mr Smith and Mr Robinson.

Mr Robinson lives in Leeds.

The guard lives halfway between Leeds and Sheffield.

Mr Jones's salary is £1,000 2s. 1d. per annum.

Smith can beat the fireman at billiards.

The guard's nearest neighbour (one of the passengers) earns exactly three times as much as the guard.

The guard's namesake lives in Sheffield.

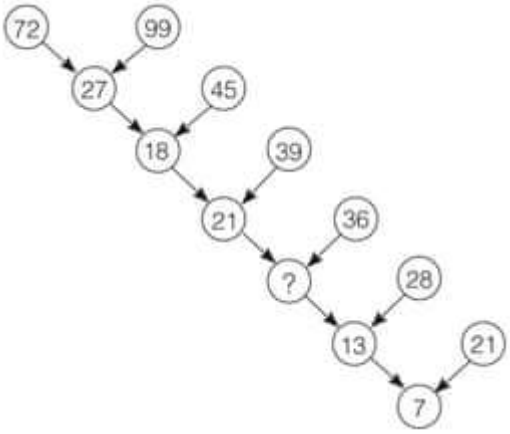
What is the name of the engine driver?

(The original phrasing of the puzzle has been kept, which uses the old British currency. The importance of the value £1,000 2s. 1d., or one thousand pounds, two shillings and one penny, is that you cannot divide it by three to produce an exact amount.)

Puzzle 5: the number tree

The Japanese puzzle inventor Nob Yoshigahara considered this puzzle his masterpiece.

The numbers below are arranged according to a certain rule. Once you've worked out the rule, fill in the missing number. The number seven in the final circle is not a typographical error.

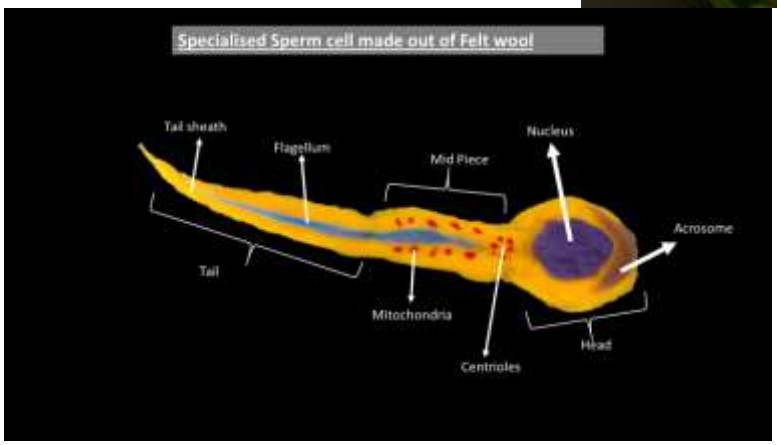


Year 9 Cell Models

C. Sivilay

J. Francey

S.Parfitt



Zara Perano 9O