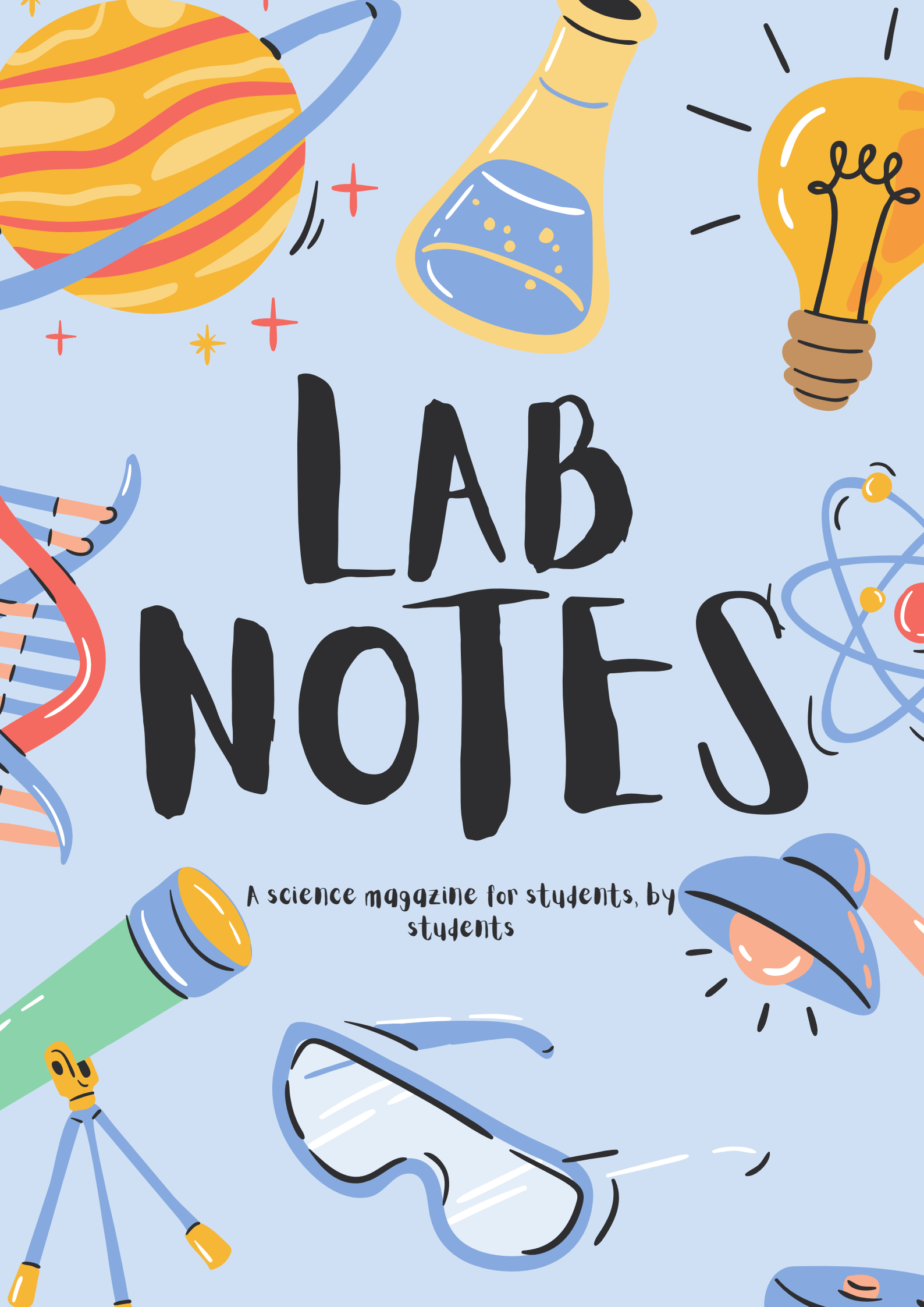




LAB NOTES

A science magazine for students, by
students

PHYSICS





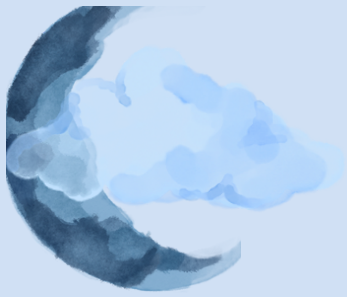
ARE WE REALLY ALONE?

Aliens- the possibility of them truly existing seems childish and far fetched, something that only exists in science fiction movies and books, not in real life. However, multitudes of data point towards the likeliness of extra terrestrial life actually existing- maybe not as swamp green humanoids, with bulging eyes, but rather simple species, similar to phytoplankton and algae- or even more complex creatures, far more advanced than us.

For instance, the James Webb Telescope detected possible signs of life on an exoplanet that's 124 light years away from Earth- Planet K2-18b. Whilst it is cooler than Earth, it's still close to it's star- and thus receives similar amounts of solar energy as Earth. Furthermore, it's within the "habitable zone" and thus could potentially allow for liquid water- which is essential for all forms of life. Additionally, certain chemicals have been detected on this planet- carbon dioxide, methane, and possibly, dimethyl sulphide(DMS). These chemicals are typically associated with life, especially DMS, as its solely produced by living organisms such as algae and phytoplankton on Earth. CO₂ and CH₄, on the other hand, indicate the possibility of an ocean in K2-18b Whilst this is an exciting discovery, it's difficult for scientists to conduct definitive research on this, as the atmosphere of exoplanets like K2-18b is extremely challenging to study. Nevertheless, whilst the chances do seem low, K2-18b proves that life does have a chance of being present on planets apart from Earth.

Furthermore, we're one planet out of billions, in one galaxy out of trillions, in a universe that's infinitely expanding, with an observable radius of 46 billion light-years. Galaxies are constantly moving away from our own, which makes it harder to investigate life in galaxies beyond our own. It's extremely unlikely that we're the only creatures out there, as other species may be present in planets too far away for us to observe, and may go forever undiscovered by us. After all, in the words of Carl Sagan, "the absence of evidence isn't the evidence of absence".





FUN FACTS



Olympus Mons, on Mars, is the tallest mountain in our solar system! It's 3 times as tall as Mount Everest

We're all made of stardust! The elements we're composed of- nitrogen, oxygen, and carbon- all originated from dying stars billions of years ago

One "teaspoon of a black hole" would weigh 6 billion tonnes- if it were possible to measure a teaspoon of a blackhole, its density would be so immense that it would weigh 6 billion tonnes!

A day on Venus is longer than a year on Venus! Venus takes 243 days to complete one rotation on its axis, but only 225 to complete one orbit around the Sun

There's a planet made of diamond! Exoplanet 55 Cancri e is extremely rich in carbon, which means that it could form copious amounts of diamond at its core, and its high surface temperature of 2000c+, could help vaporise the carbon and turn the exoplanet into a diamond like atmosphere!

The universe is constantly expanding- scientists have observed that neighbouring galaxies are moving farther and farther away from our own galaxy, which suggests that the universe is expanding

Bananas are naturally radioactive- they contain potassium-40, a radioactive isotope of potassium- and hence emit small amounts of radiation! It's not significant enough to cause any harm though

AURORA BOREALIS- WHAT CAUSES THESE MAGICAL DISPLAYS?

Like streaks of glitter across the night sky, this captivating phenomenon is caused by the Sun!

The sun constantly radiates out streams of charged particles, protons and electrons, which collectively form the solar wind, flowing through space. Once this wind reaches Earth, it crashes into the invisible magnetic field that surrounds Earth. This field is meant to protect Earth from the solar wind, but around the North and South Poles, the field strength is weaker, so some of the charged particles emitted by the sun enter earth's atmosphere, and collide with gases like nitrogen and oxygen. Upon colliding, energy is released, which creates vibrant displays of light spattered across the night sky.

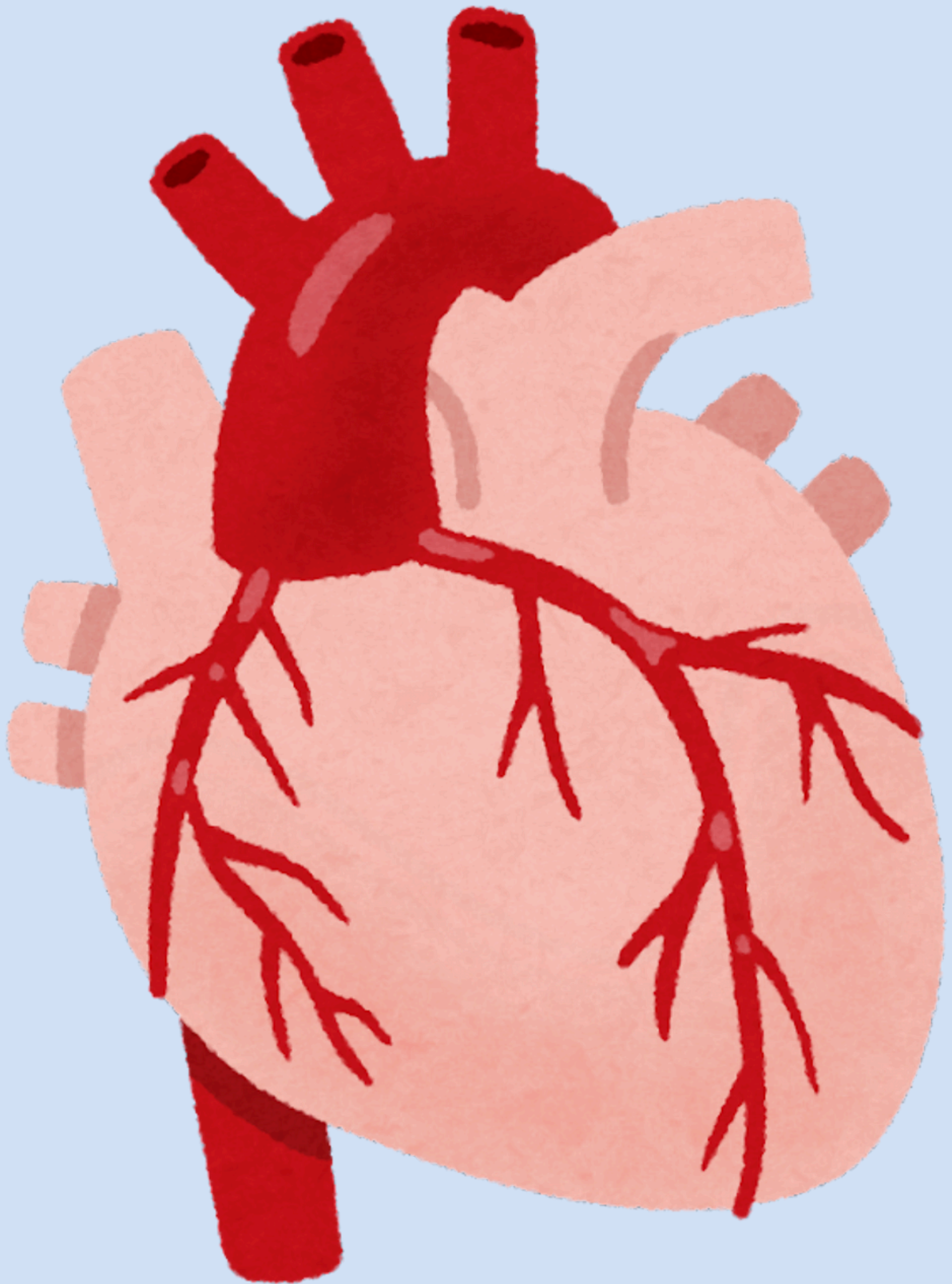
The different colours of the aurora depends upon what gas the charged particles collides with, and the altitude at which the collision occurs. For instance, when oxygen collides with the particles at lower altitudes, green colour is produced, and at higher altitudes, a rare red aurora is produced. Nearer to the ground, collisions with nitrogen cause purple and blue auroras.

Additionally, auroras aren't solely confined to Earth. Saturn, Uranus, and Jupiter also witness these displays of light, due to their strong magnetic fields and interactions with solar wind

However, auroras may bring along some undesirable side-effects, as the geomagnetic storms that enhance the auroras also disrupt satellite connections, power grids, and GPS systems, that could lead to various consequences.



BIOLOGY



GENE EDITING—A DOUBLE EDGED SWORD

As Christian Louis Lange says, 'Technology is a useful servant but a dangerous master'.

The scientific breakthrough of gene-editing technology has the potential to radically alter our environment and reshape what it means to be human. Recently, powerful devices such as CRISPR-Cas9 have evolved, enabling scientists to accurately alter the genetic code of living organisms. Even while this technology is still in its infancy, it has the power to completely revolutionise agriculture, medicine, and even the course of human history as we know it today.

The science of gene editing presents previously unheard-of possibilities for medical advancements. With the ability to pinpoint and manipulate specific genes linked to genetic disorders, scientists may be able to eradicate hereditary diseases in the future. Even seemingly incurable genetic diseases like sickle cell anaemia, cystic fibrosis, and muscular dystrophy, caused by a change in the number or structure of chromosomes, can be prevented or treated with precise genetic alterations. Additionally, the possibility of personalized medicine—which would modify care according to each patient's particular genetic composition—is becoming closer.

Gene editing technology offers the possibility of augmenting desirable human qualities in addition to healing diseases. The potential to enhance cognitive function, increase resistance to specific diseases, or even lengthen lifespans is a thrilling premise, even though it also raises ethical dilemmas. The question arises – does it align with our morals to modify someone's personality and characteristics, with or without their consent?



The traditional argument would be that nature bestowed a certain assortment of attributes in each one of us, and to go against this force would mean taking your destiny into your own hands by changing the qualities you entered life possessing.

However, to the more open-minded individuals, this revolutionary application

of technology is exciting, opening doors to a future unlike anything we've experienced before.

The uses of gene editing are not just for humans. It has the potential to improve crop resilience, diminish food shortages, and lessen the effects of climate change on agriculture. Scientists can create crops that are more nutritious, resistant to pests, and drought-tolerant by changing the genetic characteristics of plants. This has the potential to transform both sustainable agricultural methods and global food security.

However, in the words of Spiderman, with great power comes great responsibility. The ethical implications of gene editing are significant. Careful consideration must be given to issues of consent, equal access to new technologies, and the possibility of unforeseen consequences. To prevent manipulation of this technology and steer clear of unforeseen societal repercussions, it's crucial to strike a balance between encouraging innovation and guaranteeing responsible use. Strong regulatory frameworks must be established to control the use of gene-editing technology. Guidelines that cross national borders must be developed through international cooperation and consensus. We can all work together to manage the ethical, legal, and social ramifications and make sure that the dangers are kept to a

minimum while the rewards are distributed fairly by promoting an international conversation.

In summary, the development of gene-editing technology could lead to a world in which crops are hardy, diseases are eliminated, and humankind may even be able to improve upon itself. But this authority also carries with it the duty to resolve moral conundrums and make sure the advantages are used for the benefit of society. As Socrates once said, 'Wonder is the beginning of wisdom,' and so with the right amount of creative thinking, free will and open-mindedness to exciting new opportunities for the future, we can usher in the dawn of a new age.

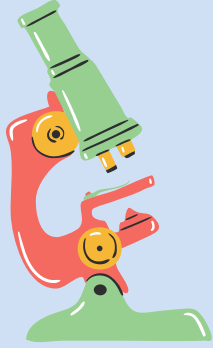
WEAVER



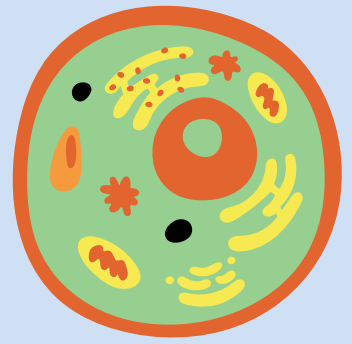
This is an illustration of the leaf coiling Weevil (family curculionidae of beetle)Pupal.

On the left it is coiled in a leaf like a cocoon (made by its parents solely by folding without any adhesives). On the right I've shown a cross section view of the pupal within the leaf coil.

I came across these beetle larvae and pupal on my walk in Sanjay Gandhi national park during the Karvi bloom season (occurs once in 8 years). You don't need to go to national parks to find these nuggets, there are quite a few species of beetles spread all around urban areas which are perfect, moist breeding grounds for it.



WORDSEARCH



P D E A D S S D D F L K B O B Y T A H M
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1) DEOXYRIBONUCLEIC

5) PHOTOSYNTHESIS

9) TRANSPIRATION

2) MITOCHONDRIA

6) NUCLEOTIDE

10) CHROMOSOME

3) RIBOSOME

7) MEMBRANE

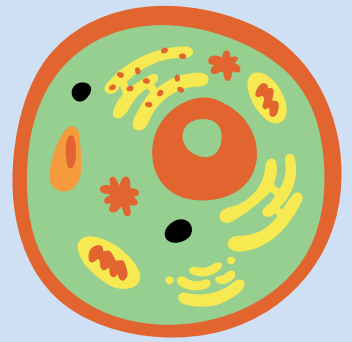
11) AMINO ACID

4) GLUCOSE

8) TRANSPIRATION

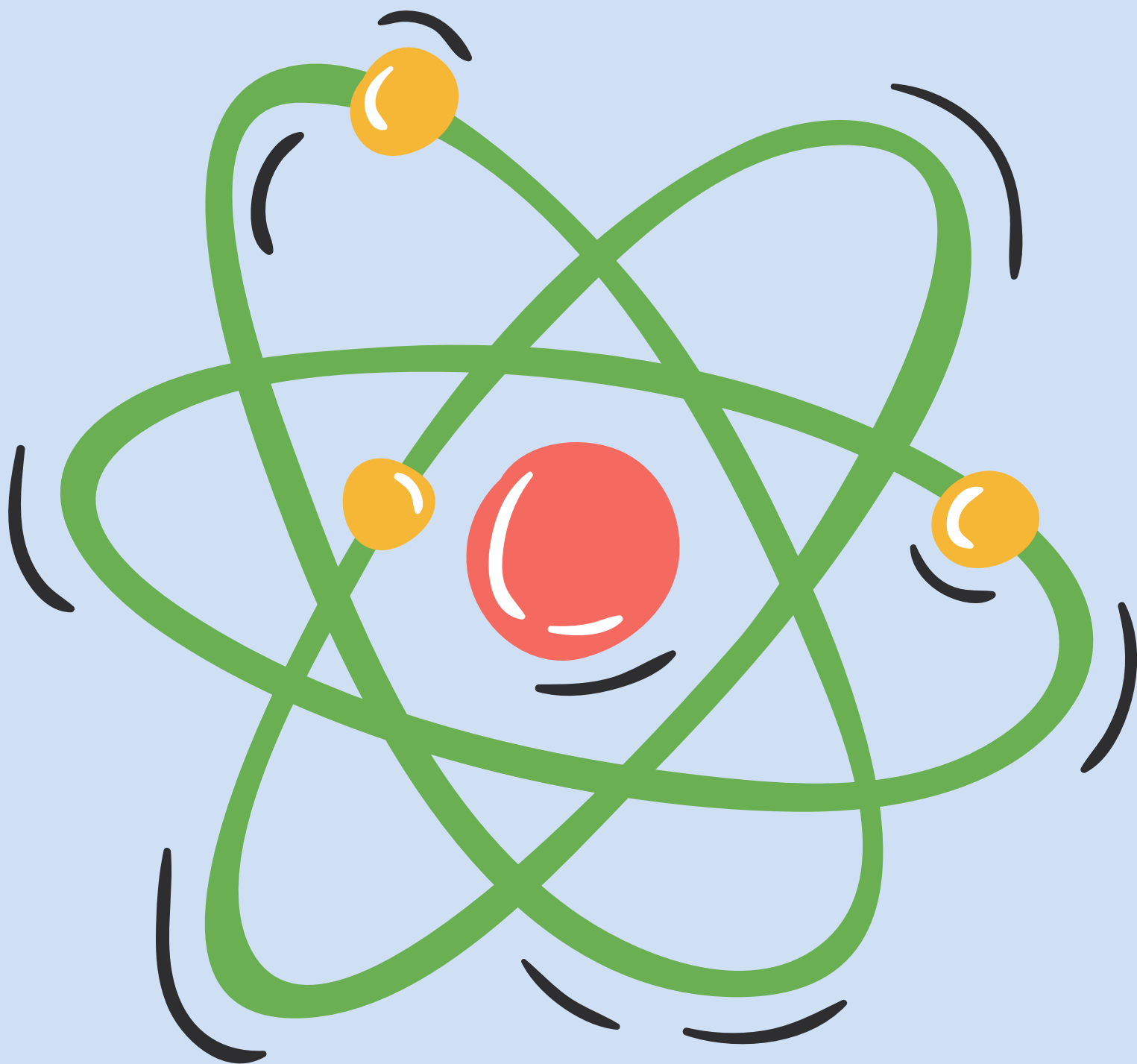


SOLUTIONS



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

CHEMISTRY



SCIENTIST SPOTLIGHT: MARIE CURIE

Marie Curie was born to two teachers in Warsaw, Russian occupied Poland in 1867. She was a remarkably brilliant student but was prevented from pursuing higher education due to her gender. In an act of rebellion, Marie enrolled in the Floating University, which was a secret institution that helped educate Polish youth. After working as a governess, teacher, and saving enough money, Marie travelled to France where she studied at the Sorbonne in Paris, earning degrees in both physics and math. She could mostly only afford to eat bread and drink tea, and sometimes she would faint due to being near starvation.

While she was in Paris, she met Pierre Curie. With their shared love of science and discovery, they soon fell in love and got married.

Marie was inspired by Henri Becquerel's work on uranium, and while doing her own research, Marie discovered that thorium too had similar properties to uranium; they both reacted with photographic films and were unaffected by physical or chemical changes.

Marie's discovery was monumental, and while researching with Pierre, Marie discovered that there was a wide assortment of elements that behaved that way.

Pierre and Henri were nominated for a Nobel prize in physics, but no mention was given to Marie's essential contributions at all. Pierre stood up for Marie, and the three were able to share the Nobel prize that year, making Marie the first ever woman to be a Nobel laureate.

Unfortunately, Pierre soon passed away due to being crushed by a horse drawn carriage. Marie engulfed herself in her research and work to cope with her grief and began to teach at the Sorbonne University in Paris as its first female professor.

In 1911, Marie won another Nobel prize, for chemistry due to her discovery of the radioactive elements polonium and radium, and her analysis of radium. This made her the first-and only- person to win a Nobel Prize in two different sciences.

She went on to open various research institutes in Poland, investigated radiation's effects on tumours, improving the medical field. However, Marie's tireless work with radiations is believed to have led to her ultimate death due to bone marrow cancer. Marie has inspired generations of female scientists and has played a pivotal role in our understanding of radioactivity in chemistry and physics till this date, cementing her role as an utterly invaluable scientist and person



BOUNCY EGG EXPERIMENT

Equipment Required:

An uncooked egg

A glass/jar

White vinegar

Optionally- food colouring



Steps:

First, place the egg inside the glass and pour in enough vinegar to completely cover the egg. After doing this, you'll notice that bubbles are forming around the egg's shell. This is because the calcium carbonate that makes up the eggshell is reacting with the vinegar, to produce carbon dioxide!

Next, wait for 24-48 hours, until the eggshell has completely dissolved, and the egg feels rubbery, only enclosed by a thin membrane. Wash it gently, and viola! A bouncy egg!

The science behind this:

Since the eggshell is made of calcium carbonate, it reacts with acetic acid- vinegar-and forms carbon dioxide, water, as a byproduct, and calcium acetate, a soluble salt that dissolves in the vinegar! This causes only the thin inner membrane of the egg to be left behind, giving us a bouncy egg!

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