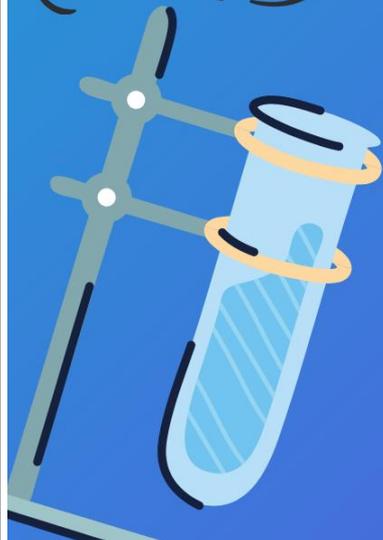
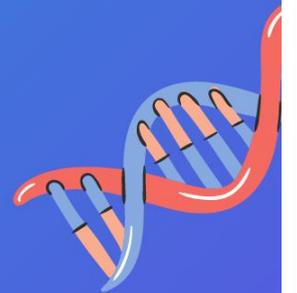
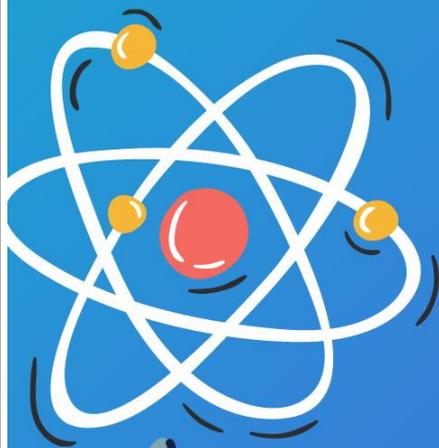


Made by: Paridhi, X IGCSE



The second edition of
EUREKA





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BT Brinjal: A Boon or A Curse



Bt Brinjal is a transgenic brinjal created by inserting a gene [Cry 1Ac] from the soil bacterium *Bacillus thuringiensis* into Brinjal. The insertion of the gene into the Brinjal cell in young cotyledons has been done through an Agro bacterium-mediated vector, along with other genes like promoters, markers etc.

It boosts yields while reducing dependence on pesticides. On average, a brinjal crop undergoes between 50-80 rounds of pesticide spraying. This is said to give the Brinjal plant resistance against lepidopteron insects like the Brinjal Fruit and Shoot Borer (*Leucinodes orbonalis*) and Fruit Borer (*Helicoverpa armigera*). It is reported that upon ingestion of the Bt toxin by the insect, there would be disruption of digestive processes, ultimately resulting in the death of the insect. It is being produced by India's number one seeds company Mahyco in collaboration with American multinational Monsanto, claims to improve yields and help the agriculture sector.

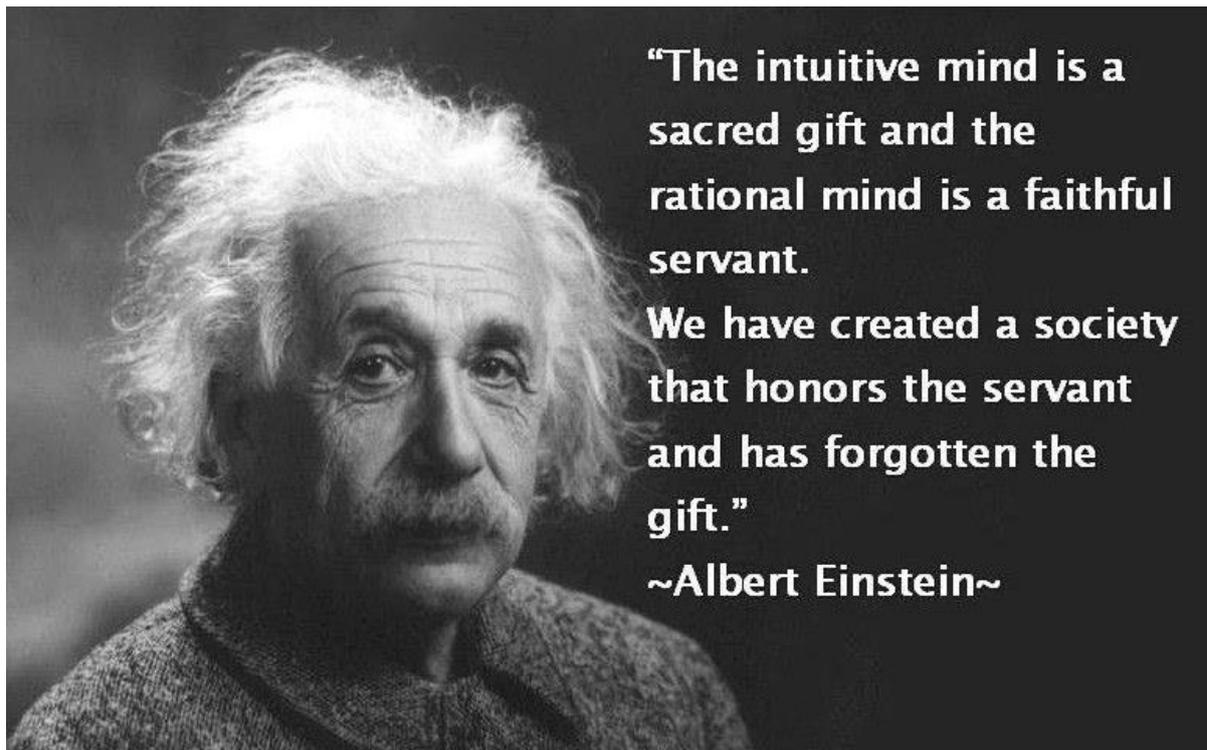
However, the debate over the safety of Bt brinjal continues with mixed views from scientists working for the government, farmers and environment activists. According to experiments the genes present in Bt brinjal were toxic and would affect the health of the consumers. Several studies on Bt crops in particular and Genetically modified crops in general show that there are many potential health hazards in foods bio-engineered in this manner. GM-fed animals in various studies have shown that there are problems with growth, organ development and damage, immune responsiveness and so on.

Hence I strongly feel that science cannot declare any technology completely risk free, Although Genetically modified crops can eliminate some risk associated with conventional agriculture practices but on the other hand will also introduce new challenges that must be addressed.

Radhika Kapoor

Chemistry Teacher

Defying Science



There aren't many things that defy science, but the ones that do leave us all stunned and amazed. But what if I tell you that a part of science, that is to say that a branch of science itself defies science. “In philosophy, noetics is a branch of metaphysics concerned with the study of mind as well as intellect.” This is what Wikipedia defines it as. I slightly disagree, I would like to phrase and define noetics as a mystical branch of science that is based on vague and what might be called unrealistic ideas. What noetics is really based upon is the core belief that thoughts and ideas can change the physical world, the faith that thoughts and intentions can affect physical matter. A source states that the word ‘noetics’ is from a Greek word noētikos meaning intellectual. Other states believe that the word can be broken down to ‘the proper exercise of nous’, nous here means the mind. Dating back to when the Greeks were there in a prominent empire, noetics existed yet the fact of Greek etymological roots of Noetics being referred to as inner knowledge. People believe that these ideas and this branch of science is quite modern since the equipment used such as REG machines and CCD cameras. It isn't true, most of the noetic Science that we have developed today is basically us trying to prove the theories of ancient texts. Noetics as well has been penned down by mere civilizations, passed down through traditions and mystics and not modern science committees. Not surprising at all, because whatever wisdom we have procured in these days existed in the BCE's as well. Human kind just lost it on their way to conquer the universe. Coming back to the present. Directing the right thoughts towards the right physical matter in the right direction can truly lead to changes at physical state. Noetics defines the universe as this huge space all filled with waves and particles filled and surrounded with energy. Noetic consciousness is a vital part for understanding this

branch of science. It is the same as regular consciousness that allows us to be aware of the fact and to cognitively operate on objects and events, and relations among objects and events, in the absence of those objects and events. Just fancy terms.

Let's discuss one of the controversial elements that noetics proved right, that is: Thoughts have mass. Lynne McTaggart, one researcher in the field of Noetic Science experimented on this particular idea. The experiment proves that physical matter or particles react with our thoughts and our mind can generate enough energy to change physical matter. Ever heard of the placebo effect? In the medical world a sick patient is given a fake medicine (Most of the time either the case is not really anything medicinal but rather physiological and other times these are only done for research and development with patients prior consent), most of us think that the medicine will improve our condition and thus we blindly place our whole heartedly hope and faith in that small tablet or syrup. We have a ray of hope. This ray of hope or positivity that is generated sometimes is strong enough to make a sick human healthy even though the medicine given was just a small sugar capsule. Sometimes it isn't the medicine that does the work but the mentality. So you see, the story of the sick king with no cure is very much relatable, all the king had to do was get up from his bed and smile and start his day rather than lying in his cushions and weeping and moaning, placing prizes on his cure and executing people who gave him hope. Instead of thoughts right now let's take a grain of salt. It has a mass, very negligible but there is some mass involved, which means that gravity is pulling it to the ground, again the gravity applied is very negligible but we can't deny the fact that it exists. Now, instead of one grain we take many-many-many small salt grains don't they have the power to change the taste of the food, commit catastrophes and yet give an indispensable and irreplaceable flavor to our meal. Now what if thoughts had mass? Thoughts do have masses, very less but yet again there exists some mass and some relative gravity to pull it that too down to the decimals still the fact is undeniable. But what happens when many people share that one thought? It's very much true that it can always change the taste of one of the most vital elements of our life. Use your intentions and ideas wisely, they are small and strong enough to do almost anything and everything.

By- Aditi Ghosh

(8th-B)

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Wikipedia

The Lost Symbol- Dan Brown

Exploring Beyond the Solar System



Kepler 16-b-

What happens when we walk in a hot afternoon? The first thing we observe is our shadow. It is formed when we obstruct the path of light. But on this amazing planet Kepler 16-b we can see two shadows at a time. This is because this planet orbits two stars. If we were suddenly teleported to this planet without any space suit we would die because of the scorching heat on the surface of this planet.

GJ1214-b-

Well our earth is also called the blue planet but this massive planet (GJ1214-b) is completely covered with oceans. It is more massive

than earth. From this planet our pacific ocean would just look like a puddle! The water on our planet covers 70% of the entire surface and 0.05% of its mass whereas in GJ1214-b the water may account for up to 10% of its mass which means that the entire planet would be covered in an ocean which is 100's of kilometers deep. Our own ocean goes down only till 11 kilometers deep. This planet might support alien life! As we go deeper down the ocean the pressure is so high that it gets converted into an ice called ice 7.

COROT-7b-

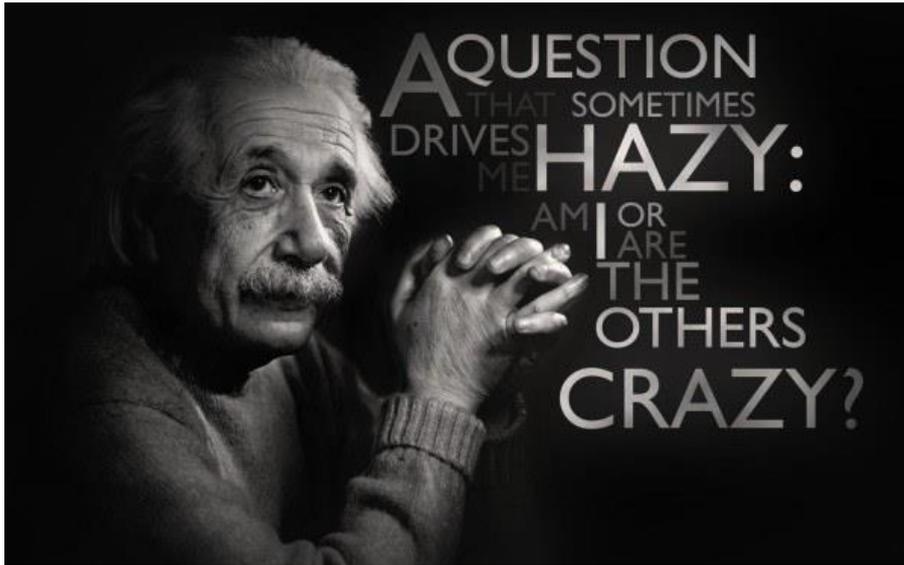
We know that our planet faces changes in weather conditions. Hence we experience rainfall. Well do you know that there's a planet which rains rocks instead of water?! This planet's one side's surface temperature goes up to scorching 2000°C while the other side is far cooler at 177°C. The temperature on the hot side is hot enough to vaporize rocks and just like water evaporates and condenses to form clouds on earth rocks will evaporate and condense to form rock clouds on this planet. These clouds will rain molten rocks back on the planet!

HD 189773-b-

This planet is 63 light years away from us and it's a little larger than Jupiter and looks stunningly beautiful from space. It looks this way because the planet's atmosphere is made up of silicate particles. Winds on the planets can scream for up to 5,400 miles per hour. The temperature is 930°C. The planet rains glass sideways at a speed of 2km per second!

By: Prapti Samanta

Albert Einstein



Albert Einstein, known for Theory of Relativity, was born in Germany on 14 March 1879, in Wurttemberg, Germany, into a Jewish family. His father Hermann was a salesman, and mother Pauline Einstein a homemaker.

He had an interesting childhood. He spoke his first word at an late age of four. There were times when he would incoherently repeat his words and sentences till the age of seven. Many, including his grandmother, thought he was kind of dim-witted.

His father gifted him a magnetic compass and that was his start of love for Science and Physics. His early experience at School cannot be called smooth though he showed promising talent in Maths and Science. Later he famously said that 'The only thing that interferes with learning is my education'.

During his teens, his family moved to Milan (Italy). In 1900, Einstein graduated with Maths and Physics from Zurich Polytechnic. He then joined the Patent Office in Bern (Switzerland) as Clerk / Assistant Examiner Level III in 1902. Albert Einstein is so famously known for his research paper Theory of Relativity which was published in 1905. Till today the most famous science formula is $E=MC^2$ or Energy (E) equals mass (M) times the speed of light (C) squared. In short, it means that Energy and Mass / Matter are interchangeable and absolutely nothing can exceed the speed of light. Since speed of light is a very very big number, very very tiny mass/ matter such as wheat grain has huge energy reserve to keep Delhi state lighted for months. It's just that we don't have the technology to harness that energy from mass.

In 1921, Einstein won a **Nobel Prize** in Physics for his discovery of the Law of the Photoelectric Effect. Science Historians regard Albert Einstein as the most original and accomplished Theoretical Physicist. His way of out of the box thinking was truly inspirational. There are numerous instances which tell us of his unique sense of humour and humility. He was also a good musician and played Violin.

Interestingly, Albert Einstein is an anagram of '**Ten elite brains**'. Some of his views and quotes, as stated below, shows us how that great mind used to work and inspire us to stay curious throughout our lives:

ü *“Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world.*

ü *The important thing is to not stop questioning. Curiosity has its own reason for existing.*

ü *Life is like riding a bicycle. To keep your balance, you must keep moving.*

ü *Look deep into nature, and then you will understand everything better.*

ü *When you are courting a nice girl an hour seems like a second. When you sit on a red-hot cinder a second seems like an hour. That's relativity.*

ü *Education is not the learning of facts, but the training of the mind to think.”*

It is encouraging to know that our **National Education Policy (NEP) 2020** is also aimed for the development of education and learning in the country.

Albert Einstein died on 18 April 1955 at Princeton, New Jersey. But he has left behind lots of unfinished quests for we students to work upon.

By- Sanskriti Suryesh

Time Travel

Time travel is a concept that has attracted many celebrated scientists all around the world and is something that everyone looks forward to in the future.

With today's technology time travel isn't possible but there are some ways that the scientists look forward to as a mean to travel through time. The first one is by using speed, this is known to be the easiest way to travel through time. As per Einstein's general relativity, the faster you go, the slower the time becomes but this could only be realistically observed when travelling at speed closer to the speed of light. This concept has been proven by using twin atomic clocks, scientists kept one clock on the surface of earth and the other on a plane. Afterwards the time difference between the two clocks was observed and we had the answer to travel time using speed. This says that you are traveling through time when you are just sitting in a moving car.

The next method is by using gravity, as the gravity increases the time becomes slower. The closer you are to earth the slower the time is for you. This concept is beautifully shown in the movie 'interstellar'. This method is also supported by Einstein's special relativity and has been proven experimentally. They used twin atomic clocks and kept one on the ground and one 33 cm above the ground. After this there was a time difference observed between the two clocks, the clock on the ground was slower. This means that the time near your feet is slower than the time near your head.

The third way is using suspended animation. This method involves the person going into hibernation and therefore changing (slowing) their perception of time until the targeted time is reached. This involves technology which is way beyond today's technology but scientists are trying to make devices that can hibernate you for a short time to save people from cardiac arrests.

The fourth and the final way is by using wormhole. Wormhole is a structure that links 2 different points in spacetime. These two points can be billions of kilometres away and therefore by going through wormhole you'll cover that distance in relatively no time whereas light could take thousands of years to reach that point.

From this the question arises 'will time travel ever be possible?'. To answer that we need to be more specific, 'in the past?' or 'in the future?'. The answer to both the questions is yes but conceptually. To travel to the future is majorly possible through 4 ways, through high speed, using gravity, suspended animation and using wormhole. Travelling to the past is rather much more difficult as well as theoretical. Recent theories say that by using a high-speed wormhole, we can travel to the past.

When we talk about time travel then we often forget about the consequences. If we travel to the past and even pick one flower, this could make a whole new timeline. Well known paradoxes like the grandfather paradox come into action. You can be trapped there forever. Not only this but the whole world could be different in the future than the one you left at the first place. A very well-known and celebrated scientist Stephen Hawking said that the nature might not allow us to travel to the past or the future.

If we ever were successful in the future to make the time travel a reality then the biggest question arises, where are the people from the future? Its correctly quoted by Jim Bishop "Nothing is as far away as one minute ago".

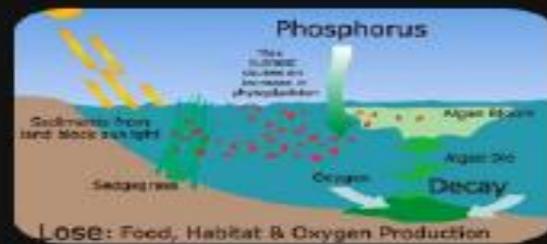
- Siddharth Sahay

Eureka

How can we shift the balance of a reaction



EUTROPHICATION



Data about the last century

Over our study period (1900–2005)

- Median population density has increased by a factor of 5.4 in urban source watersheds.
- Ranching and cropland use have increased by a factor of 3.4 and 2.0
- Nearly all (90%) of urban source watersheds have had some level of watershed degradation
- Average pollutant yield of urban source watersheds increased by: 40% for sediment, 47% for phosphorus, and 119% for nitrogen.¹

What is eutrophication?

Eutrophication, dystrophication or hypertrophication, is when a body of water becomes overly enriched with minerals and nutrients which induce excessive growth of algae. This process may result in oxygen depletion of the water body.⁴

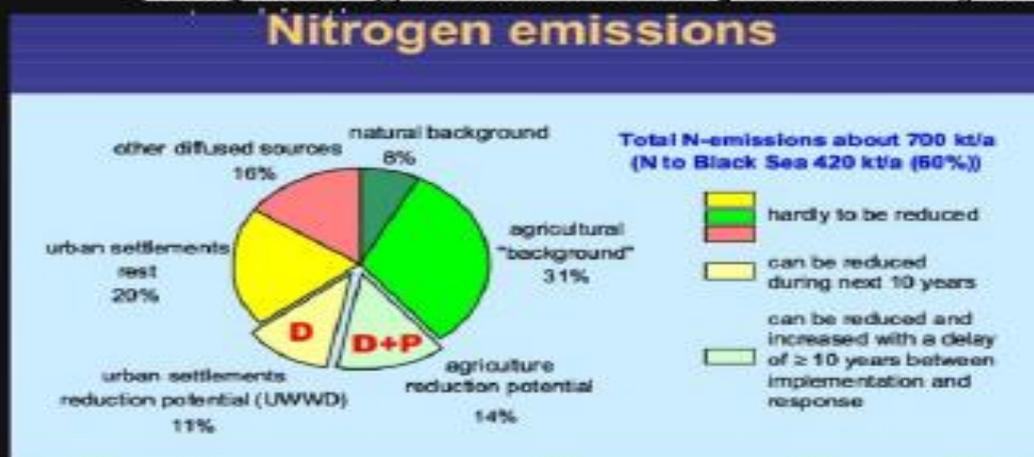


The Danube River Basin

Excessive amounts of nutrients were discharged into the water bodies within Danube River Basin starting with the 1960s and peaking in the late 1980s. Since then, these discharges declined. They originate from domestic and from agricultural sources.

These excess nutrients cause intensified growth of plant life in water (eutrophication), and thus can disturb the ecological balance in the river network and the Black Sea. The water can become murky and can be filled with algal blooms. Entire food webs, including valuable fish stocks, were seriously affected by

Nitrogen emissions



https://www.researchgate.net/publication/228615581_The_Relation_between_Nutrient_Management_in_the_Danube_Basin_and_Eutrophication_Problems_in_Receiving_Black_Sea_Coastal_Waters

How are Nitrogen fertilisers applied?

**109
Million
tonnes**



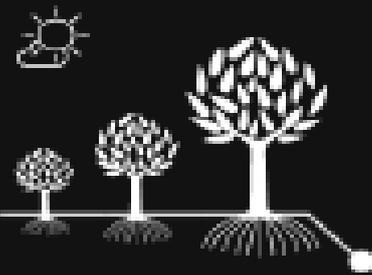
Fertilizer nitrogen (N) produced by the Haber-Bosch process using fossil fuels has played a key role in improving global food production.

Unfortunately, less than half of the 109 million tonnes of nitrogen fertilizer currently consumed by agriculture each year is assimilated into the above ground biomass of crops.

While some fertilizer N will also be recovered by roots, much of the remainder is either leached or lost as environmentally harmful gas emissions.²



Ammonium Nitrate



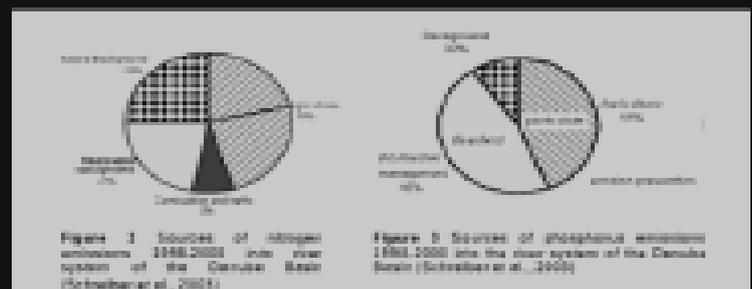
- Ammonium nitrate provides plants with required amount of nitrogen, which is especially important during the period of intensive growth.
- Fertilisation ensures effective growth and ripening, faster root development, rapid nutrient absorption and prevents leaf yellowing.
- Nitrogen stimulates and regulates many vital plant growth processes. Plants fertilised with ammonium nitrate consume less water, contain more proteins and sugar, have longer vegetation period.²

Current measures being taken to restore the health of the Danube Basin

- Construction of municipal sewer systems and wastewater treatment plants
- Reduction of industrial wastewater,
- Reduction of emission of harmful substances from agriculture like methane, nitrous oxide, ammonia, hydrogen sulphide
- Maintenance and restoration of wetlands and floodplains of the Danube and its tributaries
- Integrated water management
- Reduction of risks of accidents with hazardous substances,
- Investments,

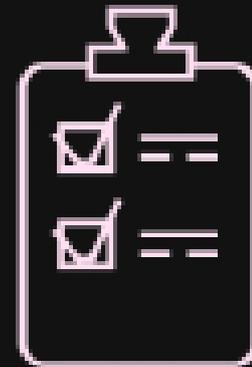


- Phosphorus loads transported by Danube have decreased by more than 30 % as compared to the situation in the eighties
- Phosphorus is the limiting nutrient for algae growth



Possible Solutions:

- Controlling application amount and timing of fertiliser.
- Surface water run-off from the nearby agricultural field can contribute towards the excessive level of phosphate in the surface water bodies. The same can be brought down within the allowable limit with the help of developing a protective barrier around the water body. It will captivate the entry of runoff into the water stream and also will slowly absorb the excess of phosphate from the water. The process is lengthy and time consuming but effective.
- Grassing the water ways to reduce soil erosion and amount of nutrients reaching the waterways



SOURCES

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3. <http://www.chema.it/nitrogen-fertilizers>
4. <https://en.wikipedia.org/wiki/Eutrophication>

CREATED BY

Paridhi Timari



Physics Nobel Prize 2020 Panel Discussion Report



A webinar was on 19th October 2020 by the AFAS talking about the 2020 Nobel Prize winners in the field of Physics (Roger Penrose, Andrea M. Ghez and Reinhard Genzel) while also covering topics such as cosmology, general relativity and black holes.

The discussions were unique, engaging and rose a lot of interesting questions such as the role of symmetry in singularity. The panelists helped us link seemingly advanced topics to our current knowledge about physics that really helped put things into perspective. Healthy discussions were brought up by the panelists talking about important things such as Women Contribution and Recognition in the field of physics. The webinar also answered all our queries in a proper manner which inspired us furthermore.

Encouragement from Sunny sir was extremely helpful which added to the experience of this brilliant virtual panel discussion. Thank you for giving us this opportunity to join such an eccentric event!

By: Prashuchi Pandey

FACTS ON ASTRONOMY THAT WILL BLOW YOUR MIND!



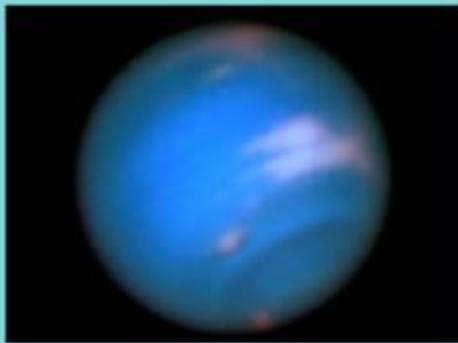
THE MOON IS LEMON SHAPED

Our natural satellite is nowhere near round. It has flattened poles and bulges on both the near and far end around its equator.



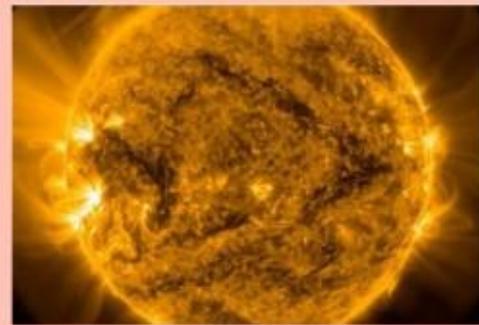
THE CLOUDS AT THE CENTRE OF THE MILKY WAY SMELL OF RUM, TASTE OF RASPBERRIES AND ARE FILLED WITH BOOZE

The physical properties of the chemical, Ethyl Formulate are responsible for giving raspberries their flavour and has the smell of rum.



NEPTUNE HAS ONLY COMPLETED ONE ORBIT AROUND THE SUN SINCE ITS DISCOVERY

Neptune takes a whopping 165 years to complete one full orbit around the sun. Since its discovery in 1846, it has only finished its first full orbit in 2011.



THE SUN LOSES A BILLION KILOS PER SECOND

Our star sheds around 1.3 trillion trillion particles every second. This equates to roughly one billion kilograms of matter per second, or one Earth every 185 million years.



IF YOUR SPACESUIT STARTS LEAKING, YOU CAN ONLY SURVIVE FOR A COUPLE OF MINUTES

Our blood and other body fluids will start boiling and our body would swell up due to low pressure, our eyes will freeze (due to low temp) and our lungs would gradually be deprived of oxygen.



GAMMA-RAY BURSTS CAN RELEASE MORE ENERGY IN 10 SECONDS THAN OUR SUN WILL IN ITS ENTIRE LIFE

Gamma-ray bursts produce the most intense flash of high-energy radiation in the whole universe



THERE IS GRAVITY ON THE ISS

The onboard gravity is actually 10-11% weaker than it is on Earth's surface. Astronauts float freely due to the ISS's continual state of free-fall, the same effect experienced by skydivers.



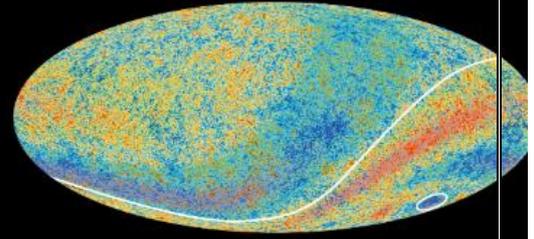
OUR DAYS ARE GETTING LONGER

Every year, it takes our planet a little longer to complete one full revolution on its axis. Hence, Earth slows 1/500th of a second each century .

The Cold Spot



As the name says the cold spot is cold but not that cold only about 0.0007 K colder than the rest of the universe



What's so interesting about it ?

Scientists theorize it being a universal collision between our universe and another universe

Why it is a big deal ?

The temperature difference between that spot and the universe is nothing big but if the rest of the universe's temperature is so constant why is that part not



Why is that part cold ?

When the big-bang had taken place our universe wasn't the only one born and there are other universes that were born and while they were growing some might have bumped into each other which released matter and energy from that part which made the spot colder

Some more interesting facts!!



The Eiffel Tower grows 15 cm taller during the summers

- This happens because of the principle of thermal expansion.

Water causes metals like Potassium, Lithium and sodium to explode

This happens because they are very reactive.

Hawaii is moving 7.5cm closer to Alaska every year

-It is situated on the Pacific Plate which is drifting towards the North-American Plate. The movement is as fast as the growth of our finger nails!

Polar bears cannot be detected by infrared cameras

- This is because Polar Bears know the art of conserving heat and thermal cameras operate only by detecting the heat lost by the subject.

Stomach acid can dissolve stainless steel!

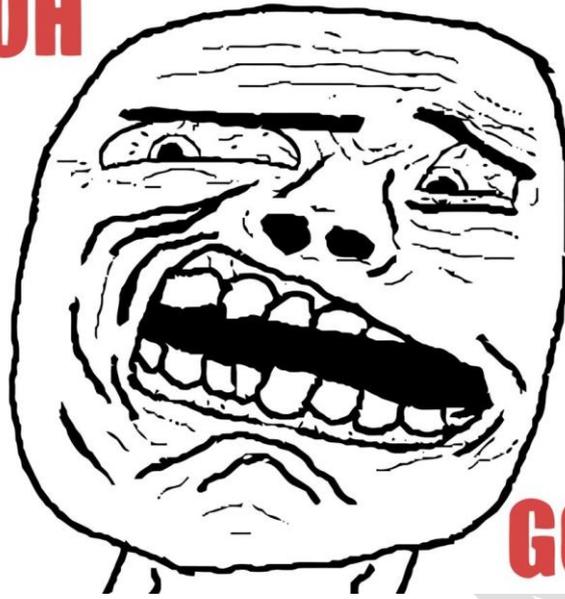
This is because of Hydrochloric acid which is very corrosive. A new stomach lining is formed after every four days in our body.

Venus is the only planet to spin clockwise!

-While all planets move counter clockwise, Venus spins clockwise due to the effects of the asteroids which knocked it off course.

By: Pratyush Gupta

OH

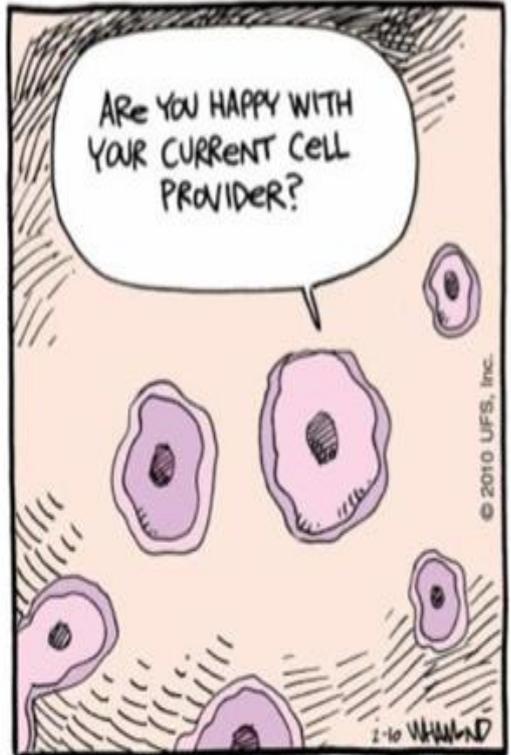


GOD

When 2 tectonic plates bump into each other, they say, "Sorry my fault."

Why shouldn't you make fun of a paleontologist?
Because you will get Jurasskicked. (don't mess with em)

Watt is love?



NEWTON'S 1ST LAW



**A BODY AT REST
WANTS TO STAY AT REST.**

Prof: Can you show DNA and RNA
visually?

ME:



TRYING to Calculate Frequency?

It's so easy that it hertz (pun intended)

**When you hear someone saying
"my weight is 70 kg" instead of
"my mass is 70 kg"**



WHAT DO YOU CALL AN ACID WITH ATTITUDE?

A-MEAN0-OH ACID

QUIZ 1 - Pranjal Dwivedi



Q 1) What is the formula of Force?

ANSWER- Force = Mass x Acceleration

Q2) What is the chemical formula of Alum?

ANSWER- $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Q3) Is "inert gas" similar to "noble gas"? If yes, then what are the inert/noble gases?

ANSWER- Inert gases and Noble gases are the same thing. They are – Helium, Neon, Argon, Krypton, Xenon, and Radon

Q4) What is atomicity?

ANSWER- The number of atoms present in a molecule is atomicity

Q5) The process of converting monomer to polymer is

ANSWER- Polymerization

Q6) Who is the king of acids?

ANSWER- Sulphuric Acid

Q7) What are stars made up of?

ANSWER- Stars are mostly made up of hydrogen and helium

Q8) How to calculate density?

ANSWER- Density = Mass ÷ Volume

Q9) Iodine is used to test the presence of what in Potatoes?

ANSWER- Starch

Q10) Is it true that we use only 10% of our brain?

ANSWER- No, we do not use 10% of our brain

Q11) Can light change its direction? If yes, then what is it called when light changes its direction? Give an example.

ANSWER- Light can change its direction. It is called Refraction when light changes its direction. For example, if light travels from vacuum to water, it will bend a little bit.

Q12) Antibiotics kill viruses and bacteria. True or False?

ANSWER- False, antibiotics kill only Bacteria

Q13) Electrons are smaller than atoms. True or False?

ANSWER- True

Q14) In electronics, what does DC and AC stand for?

ANSWER- Direct Current and Alternating Current

Q15) At what temperature are Celsius and Fahrenheit equal?

ANSWER- -40 Degrees

Q16) On a periodic table, what is the symbol for Silver?

ANSWER- Ag

Q17) At which temperature water has maximum density?

ANSWER- 4 degrees Celsius

Q18) How many vertebrae does an average human have?

ANSWER- 33

Q19) What is the most abundant gas in the Earth's atmosphere?

ANSWER- Nitrogen

Q20) The wire inside an electric bulb is known as the what?

ANSWER- Filament

QUIZ 2 - Vrishaank Sinha

Instructions;

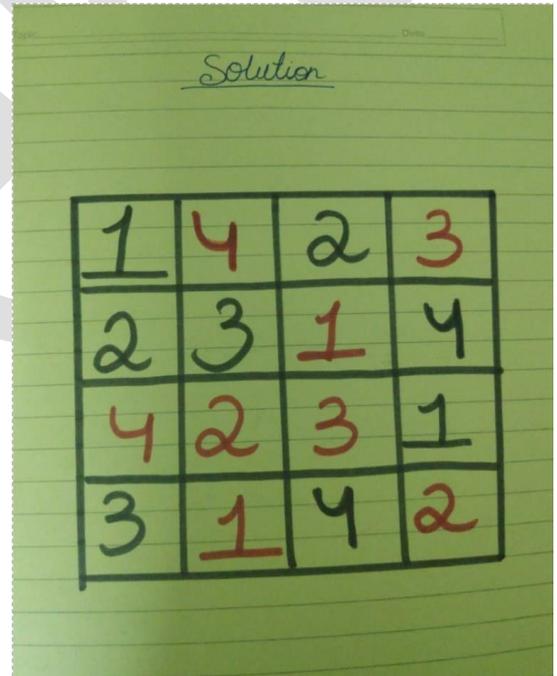
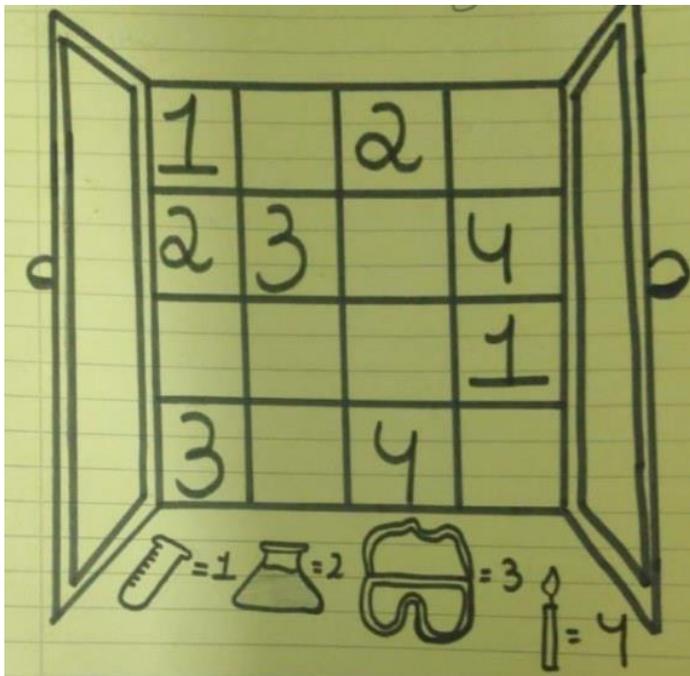
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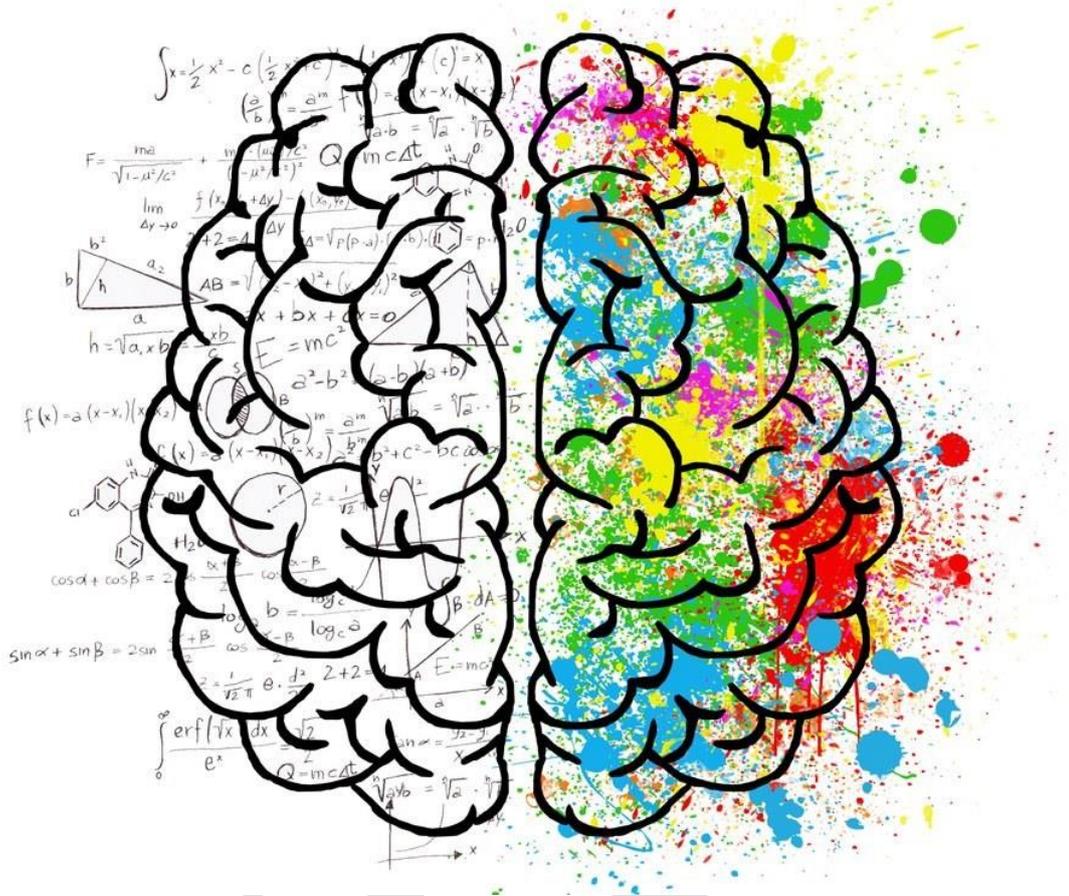
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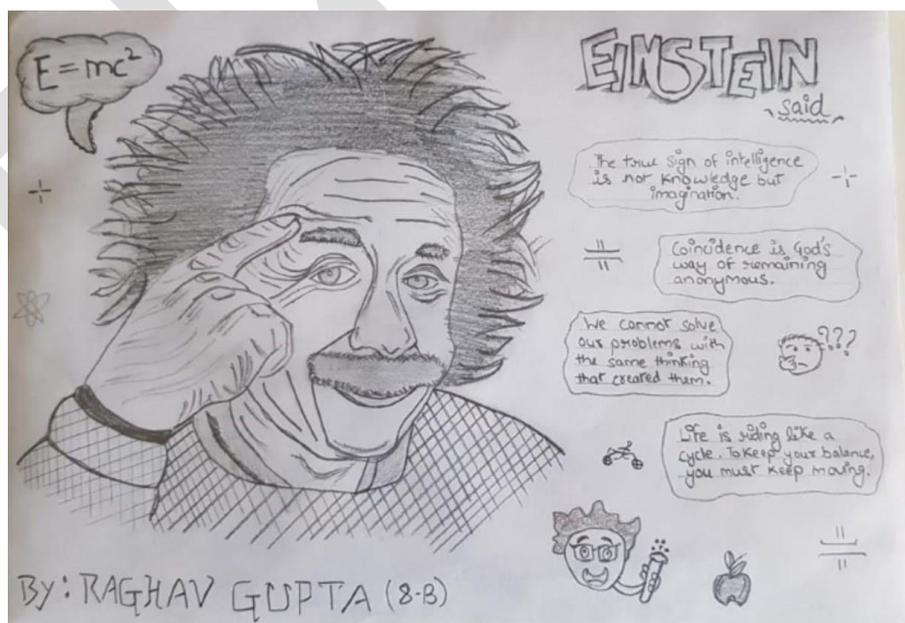
Can you put the items into the cupboard and complete the picture so that each row, each column and each block of 4 items is containing one of the 4 kinds of equipment



The Art Gallery



To get the creative juices flowing



1 - By Raghav Gupta (8B)

My artwork depicts many of the branches of science; physics, chemistry, astronomy and geoscience. The 'S' represents that all the branches are connected to one theme, Science. Science is not just one subject, in fact there are several divisions that make up this umbrella topic, many which I haven't even mentioned such as the social sciences and the formal sciences.

The message that I am trying to share here is that we may be different but at the same time, we are united.



4 - -Aaditya verma(7-B CBSE)

This artwork shows the futuristic Earth in which the humanity has created global warming on earth and due to which the asteroids break up the earth and make it lifeless .

Video gallery



<https://sway.office.com/aofU3jz7bQTVcbC9#content=UKhVv6jtd2ylZX>

Invisible text using water - Ruhaan Guglani



<https://sway.office.com/aofU3jz7bQTVcCbC9#content=Epe4AsVcUrG5eA>

DNA extraction - Esha Sajjanhar



<https://sway.office.com/aofU3jz7bQTVcCbC9#content=P6ckM7vsRnFZ8v>

Experiment with hot and cold water - Akshat Bansal

Credits

Editors:

- Arpit Bansal
- Mridul Jain

Design Team

- Aarush Dhar
- Aaditya Verma
- Akshat Bansal
- Avika Jain
- Myra Maheshwari
- Paridhi Tiwari
- Vani Sethi

Eureka