JUNE 4TH, 2023 *Seeking Science* VOL 23

SEEKING SCIENCE

by STEM Action Teen Institution

A MONTHLY STEM NEWSLETTER

ALLOYS

HONEYPOT ANTS

LIFE CYCLE OF STARS

and more...

This Edition's Staff

Edward Huang	*President*
Stephen Hung	*Vice President*
Brian Wang	*Design Director*
Cathie Zhu	*Lead Editor*
Arthur Liang	*Graphics Director*
Anna Dai	*Front Cover Designer*
Kenny Wu	*Quality Control Manager*
Eddie Zhang	*Advertisement Manager*
Wilson Zhu	*Advertisement Co-Manager*
Aidan Hong	*Marketing Manager*
Jerry Yang	*Marketing Co-Manager*
Cody Duan	*Community Reporter*

Owen Chen	*Community Reporter*
Ashley Chen	*Senior Designer*
Ryan Zhu	*Senior Designer*
Aimee Fan	*Senior Graphics Editor*
Denise Lee	*Senior Editor*
Donia Cao	*Designer*
Evan Lin	*Designer*
Lucas Li	*Graphics Editor*
Eason Fan	*Graphics Editor*
Richard Wang	*Editor*
Riley Lee	*Editor*

Table of Contents

Divulging the Mysteries of Open-World Games 4
Disaster in Trophic Levels: Toxins 6
What are Alloys? 8
Artificial Light in Caves 10
Life Cycle of Stars 12
Hawking & Black Hole Radiation 14
Antibiotics - A Blessing and A Curse 16
Briggs-Rauscher Reaction 18
How Skin Moisturizer Works 19
C++ vs. Python vs. Java 21
Honeypot Ants 23
Unveiling the Pinnacle of AP Science Courses 25
Saturn: The Ringed Planet 27
How Search Engines Work 29
What is Nuclear Fusion? 30
Nuclear Waste 32
The Horseshoe Crab 35
Decoding the Mind 37
Pangolins 39
Curiosity Rover 40

Divulging the Mysteries of Open-World Games: Secret to Mesmerizing Gameplay

Brian Wang

An Open World, defined as a virtual world in which a player can explore and interact with objectives freely, has only sometimes been the bait people have caught. While some realities catch the attention of some, others don't quite reel the users. Video game developers strive to design an open world to be both appealing and enthralling for players to be reeled in on the fishing rod of a game engine. Thousands of hours indulge unique conceptions that have spiraled about gaming industries for years, as video game design keeps evolving daily.

"Super Mario Odyssey" by othree, licensed by Flickr, under CC BY 2.0.
https://www.flickr.com/photos/othree/39341614672

At a foundational level, a prisonless world is only an open play field for a player to explore. For much of the inexperience, visions may be limited to placing various establishments in separate parts of the world, hoping to entice players through sheer chance. Nonetheless, those who are much more proficient follow a rule of obscure pathing, which submerges players to investigate one location after another before reaching their destination. Creating a trail of exhilarating essential areas hidden by topography to exclusively display an occasional few at once, players take long paths of infinite combinations. Notable games that use this procedure are those in the Legend of Zelda series, where players travel vast distances, while “baited” to correspond to different areas.

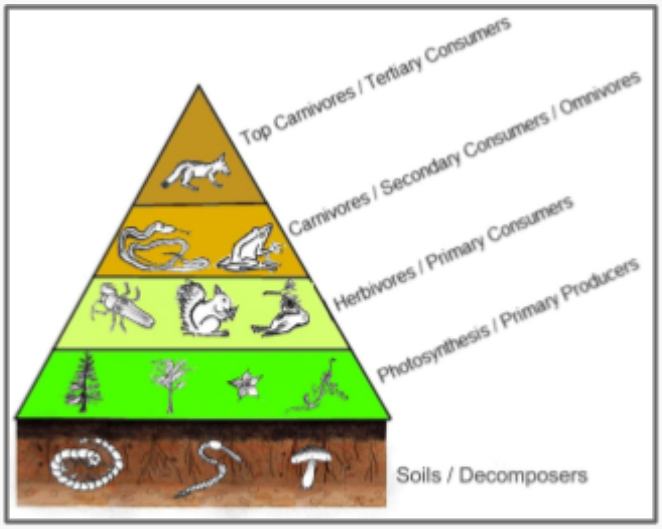
To have an authentic inquiry about “Where is this?” or “What is that place?”, a player will feel they are crossing themselves. A boundary that will quickly bring players back to actuality is when open worlds disclose level structures, those with invisible barriers that block them from crossing particular provinces. To have a chain around a partaker, sealing them from advancing reminds them they are only playing a game. Yet, within landscapes of chainless worlds, amidst their captivating wonders and unchartered territories, lies the subtle allure of the true magic of the rusting boundaries, those that allow players to go on an odyssey that mirrors the boundless expanse.

Disaster in Trophic Levels: Toxins

Cody Duan

The trophic levels are the different hierarchical organisms in a food chain. All the stages are connected for energy transfers from the producer to the primary consumer, secondary consumer, and tertiary consumer. However, energy is not the only thing transferred. Other potentially harmful toxins also pass through each trophic level. Throughout each trophic level, the effects of these toxins can have varying levels of impact.

Producers are the foundation of a food chain. These organisms are a necessity. For producers, these toxins can contaminate the soil, which can break down the nutrients the plant needs. As a result, the producer does not provide enough energy for the primary consumers, and the entire food chain falls apart.

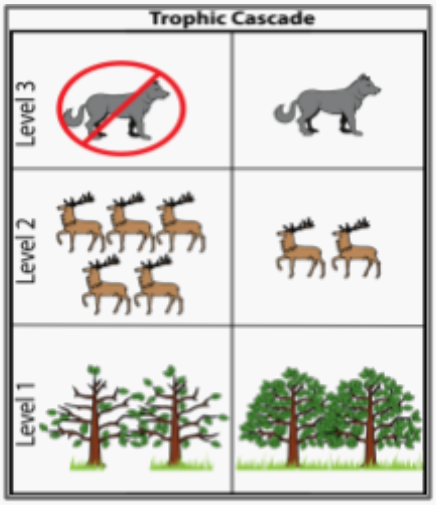


"File:Trophiclevels.jpg" by Thompsma, licensed by Wikimedia Commons, under CC BY-SA 3.0. https://commons.wikimedia.org/wiki/File:Trophiclevels.jpg

In the lower levels, a process called bioaccumulation, the toxins build up in the organism's tissues, occurs. These organisms can experience health and feeding

problems, which result in reproduction issues. When higher organisms eat the prey, the built-up toxins will transfer to the predator. As higher-order organisms prey on these consumers, the toxins will build up and increase through biomagnification. These apex predators will also experience feeding and reproduction problems, which renders them incapable of performing their ecological function.

These toxins can set off a trophic cascade in which the ecological structure of an ecosystem becomes altered. For example, if the population size of the apex predator is too small, an abundance of prey will arise. In turn, the producer and primary consumer receive more stress, and the balance of the ecosystem is disrupted. The ecosystem is a delicate chain in which a small change can lead to catastrophic consequences.



"File:Trophic Cascade 1.svg" by Zirguezi, licensed by Wikimedia Commons, under CC BY 3.0. https://commons.wikimedia.org/wiki/File:Trophic_Cascade_1.svg

What are Alloys?

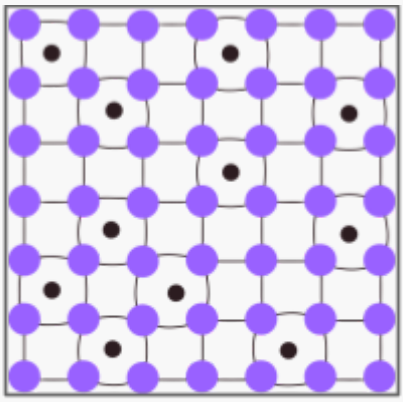
Edward Huang

Metallic elements such as iron, copper, and aluminum, are used in many different applications. Whether it be a frying pan, a refrigerator, a bicycle, or even a bag of chips, metal is one of mankind's most important and useful resources. But, while there are only a few metallic elements on the periodic table, scientists and engineers can create so many vastly different products by mixing these different metals, along with other elements.

Nearly all instances of metal in a product are actually *alloys*, which are combinations of a metallic element, like iron or copper, and another metallic or non-metallic element. One common alloy is steel, which is the alloy of iron and small amounts of carbon. Pure iron itself is a decently strong metal, but its strength is enhanced when small amounts of carbon are added to the mix. Iron with a little bit of carbon results in steel, where the strength is magnified. Oftentimes, trace amounts of other elements are also added. For example, stainless steel contains iron and carbon, along with very small amounts of chromium, nickel, manganese, nitrogen, and sulfur, which all help give stainless steel its strength and resistance to corrosion. Stainless steel shines in its ability to resist rusting, as the added chromium atoms cause stainless steel to rust much slower than pure iron.

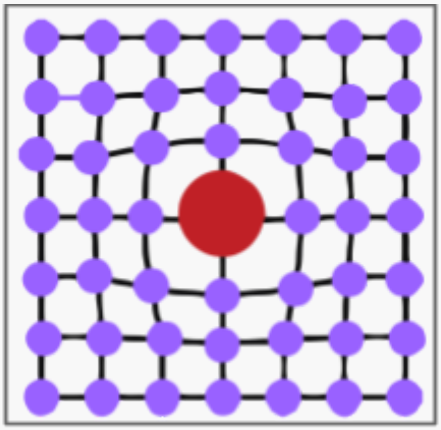
Another common alloy is bronze, the alloy between copper and zinc. Typically, brass is about two-thirds copper and one-third zinc, and has high malleability, corrosion resistance, and acoustic properties, making brass very useful in instruments such as the tuba. Brass can also be seen in piping and tubes, where again, its resistance to corrosion makes it the optimal material to use. Along with bronze, brass was one of the first alloys developed and refined by mankind, with its usage dating back to 500 BC.

But how exactly do alloys work? How are alloys so much stronger and more useful than their ingredients? The answer lies in the molecular structure of metals. When making steel, small carbon atoms are inserted into the spaces between the larger iron atoms, which help enhance the strength of the metal. Steel is an example of an *interstitial* alloy, where a lattice of a metal, such as iron, is enhanced by adding a smaller element into the spaces between atoms in the lattice. The addition of the smaller-sized atoms makes interstitial alloys stronger and less easy to break but reduces their malleability as a result.



"File:Interstitial solute.svg" by Siamrut, licensed by Wikimedia Commons, under CC BY-SA 3.0. https://commons.wikimedia.org/wiki/File:Interstitial_solute.svg

Interstitial alloys are one kind of alloy; another kind is the substitutional alloy. Bronze and brass are substitutional alloys, where whole atoms in the lattice are swapped out for a different element. This requires both elements to have roughly the same atomic radius so that the lattice shape is conserved. The varying atoms in the mix cause distortions in the lattice, making the metal less prone to breakage, which helps increase the metal's strength.



"File:Substitutional solute.svg" by Siamrut, licensed by Wikimedia Commons, under CC BY-SA 3.0. https://commons.wikimedia.org/wiki/File:Substitutional_solute.svg

In conclusion, the application of metals is typically done through the use of alloys, or the mixing of different metallic and nonmetallic elements to produce a new material that has enhanced properties. Whether it be malleability, strength, resistance to corrosion, electrical or thermal conductivity, or resonance, alloys are always being refined and developed to create an optimal metal that is better than the individual constituents.

Artificial Light in Caves

Cathie Zhu

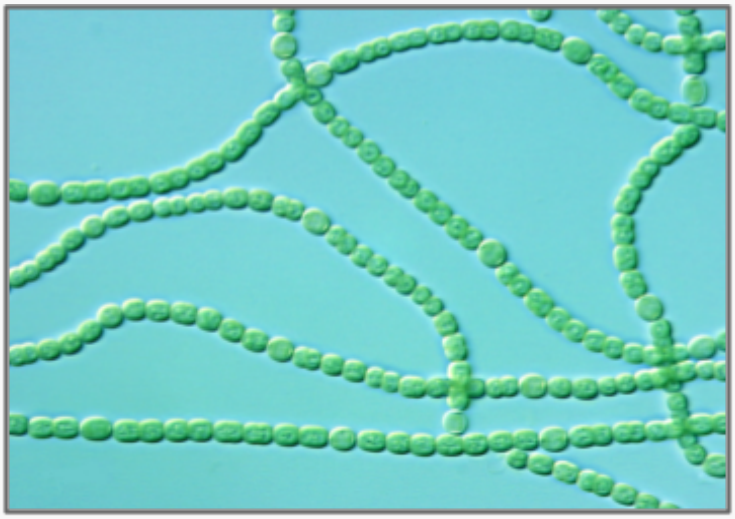
Cave tourism has seen a significant increase in recent years, transforming once-dark and secluded caves into well-lit attractions for the general public. However, this rise in cave lighting has unintentionally caused the proliferation of lamp flora, which refers to photosynthetic organisms growing around artificial lighting systems in caves. Lampenflora, similar to dental plaque, forms sticky biofilms that can damage natural cave features like stalactites and stalagmites.

To combat lampenflora, scientists have typically used bleach, but this method can further harm the cave formations and produce unpleasant odors. An alternative approach suggested by researchers involves modifying the intensity and color of the artificial cave lighting. Light exists in various colors and intensities, with different wavelengths associated with warmer or cooler colors. Photosynthetic bacteria and algae, the main components of lampenflora, absorb specific wavelengths of light using pigments.

To test the hypothesis that adjusting lighting conditions can curb lampenflora growth, a team of researchers from New Mexico Tech, the National Park Service, and the National Cave and Karst Research Institute conducted a study in Carlsbad Caverns. They compared lampenflora samples from three sites with normal lighting to three sites with reduced blue light. For a year, the researchers collected samples and identified the lampenflora species through genetic sequencing.

Cyanobacteria were found to be the most common bacteria, while Chlorophyta and Ochrophyta were the dominant algae. These organisms reflect green and red light, respectively, as they perform photosynthesis. Using reflected-light spectrophotometry, the team measured lampenflora growth based on the light color reflected by the biofilms. Surprisingly, they did not find statistically significant differences in growth between the sites with different light colors. This led them to conclude that changing the lighting color

alone is insufficient in treating lampenflora and suggested combining lighting adjustments with other cleaning methods such as bleaching. The authors also proposed future research to consider additional factors like foot traffic, as they could not control access to the research sites or the frequency of visitors. By taking a comprehensive approach, it is hoped that effective strategies can be developed to address the issue of lampenflora growth and preserve the natural beauty of tourist caves.



"Cyanobacteria" by Argonne National Laboratory, licensed by Flickr, under CC BY-NC-SA 2.0.
https://www.flickr.com/photos/argonne/5909383026

Life Cycle of Stars

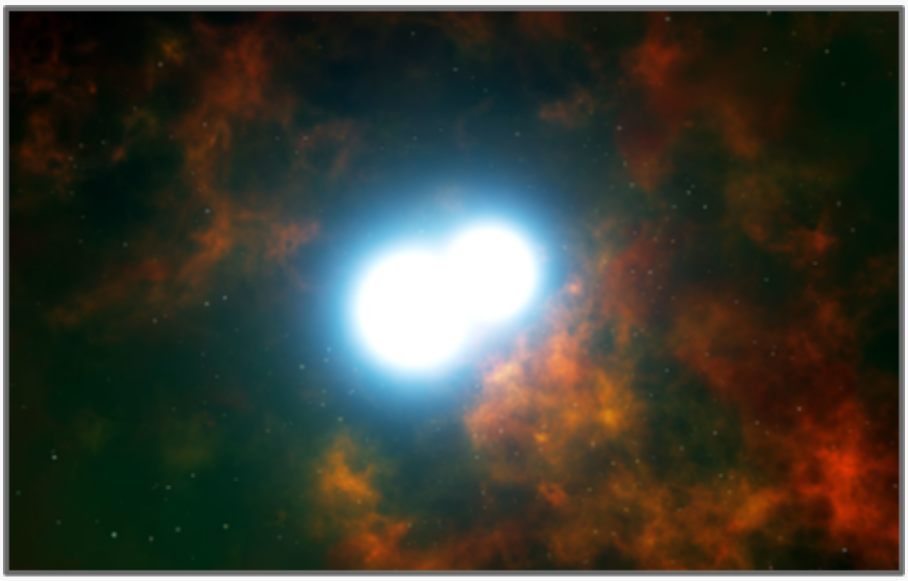
Owen Chen

The lifespan of a star can range from thousands to millions of years, with its duration determined by its initial mass. More massive stars have shorter lifespans due to their higher temperatures, which cause them to burn through their hydrogen fuel more rapidly. However, a star's journey doesn't abruptly end after fuel depletion; it undergoes fascinating phenomena such as supernovae before eventually fading away.

Stars begin their life cycle within vast, dense regions called nebulae, consisting of gas and dust. Occasionally, molecules within the nebula collapse and cluster together, forming protostars with their gravitational fields. As the clouds contract and accumulate more dust particles over time, they heat up and fragment into smaller rotating gas disks. These disks continue to accrete matter, eventually giving rise to the formation of the main stars.

During the main sequence phase, stars remain stable for the majority of their lives. They sustain themselves by burning hydrogen in their cores, releasing energy, and maintaining a delicate balance between gravitational forces and outward pressure. However, as the star's hydrogen supply depletes over billions of years, it becomes unstable. The lack of energy production triggers the red giant stage, characterized by the shrinking of the core to burn up the remaining dense energy while the outer layers expand. Eventually, the outer layers are shed due to the reduced gravitational field, leaving the core exposed.

In the white dwarf stage, the core of the star remains alone, having exhausted its nuclear fuel. It emits its remaining energy and gradually cools off, fading away into a remnant called a black dwarf. It's important to note that there are various types of stars, and their life cycles may differ, with some ending as black holes or undergoing supernova explosions.



"Artist's impression of two white dwarf stars destined to merge and create a Type Ia supernova" by European Southern Observatory, licensed by Wikimedia Commons, under CC BY 2.0. https://www.flickr.com/photos/esoastronomy/15886005223

Hawking & Black Hole Radiation

Arthur Liang

Black holes once appeared to scientists to be places where gravity collapsed in on itself, forming a hole with an immensely strong gravitational pull. It would make sense that these rips in space-time would stay forever, but Stephen Hawking proposed a theory that uncovers the true fate of black holes.

In 1974, Stephen Hawking proposed the idea of Hawking Radiation. Essentially, black holes will slowly emit particles over time due to quantum mechanical effects near their borders. According to quantum mechanics, in the vacuum of space, particles and antiparticles constantly generate and obliterate each other as every moment goes by. Near the edge of the black hole, one of these particles may fall into the black hole, leaving the other to radiate away. The escape causes a net loss in energy, resulting in the gradual evaporation of black holes over a very long period.

Hawking Radiation not only has an impact on our understanding of the lifespan of black holes but also the conservation of information in the universe. It appears to us that objects which fall into a black hole are made uniform and potentially lost forever. The information that was carried by those objects is subsequently lost as well. However, the radiation of black holes challenges the notion that nothing can escape a black hole's gravitational pull, showing that information may not be completely lost.

Stephen Hawking's theories of black hole radiation are groundbreaking in our investigation of mysterious black holes. As we learn more about how black holes decay away, it may allow us to further unravel the fundamental rules and nature of our universe.

Antibiotics - A Blessing and A Curse

Eddie Zhang

Antibiotics are a class of drugs that are commonly used to treat bacterial infections. They work by either killing the bacteria or preventing them from multiplying, which allows the body's immune system to fight off the infection. Antibiotics have been a crucial tool in the medical field, saving countless lives and improving health outcomes.

The discovery of antibiotics in the early 20th century revolutionized medicine. Before antibiotics, bacterial infections often resulted in serious complications or even death. With the development of antibiotics, however, many once untreatable infections became curable.

There are various types of antibiotics, each with its strengths and weaknesses. Some antibiotics are broad-spectrum, which means they can treat a wide range of bacteria, while others are narrow-spectrum and only target specific types of bacteria. Additionally, certain antibiotics are more effective against particular types of bacteria than others.

"Antibiotic Drugs" by Global Panorama, licensed by Flickr, under CC BY-SA 2.0.
https://www.flickr.com/photos/121483302@N02/14200527505

Unfortunately, the overuse and misuse of antibiotics have led to the development of antibiotic-resistant bacteria. When antibiotics are used excessively or incorrectly, bacteria can become resistant to them, rendering the drugs ineffective against infections caused by those bacteria. This can lead to serious complications and make infections much more difficult to treat.

To combat antibiotic resistance, it is essential to use antibiotics only when necessary and to use them appropriately. This involves using the right antibiotic for the specific type of infection and completing the full course of antibiotics as prescribed, even if symptoms improve before the medication is finished.

In conclusion, antibiotics have been a vital tool in treating bacterial infections, but their misuse and overuse have led to the development of antibiotic-resistant bacteria. It is crucial to use antibiotics judiciously and to take measures to prevent the spread of antibiotic-resistant bacteria to maintain the effectiveness of antibiotics in the future.

Briggs-Rauscher Reaction

Kenny Wu

The Briggs-Rauscher reaction is a fascinating chemical process that exhibits oscillatory activity and changes color repeatedly over time. Iodine, organic molecules, and hydrogen peroxide in a solution interact in this process. The process first begins with a colorless slurry. Iodine ions are created when hydrogen peroxide and iodine interact. The organic molecules and these iodine ions subsequently combine to form a brief blue-black complex, which temporarily changes color and produces a spectacular color change.

Furthermore, the solution gradually turns colorless, then slowly loses its blue-black hue. However, the Briggs-Rauscher reaction's ability to continue oscillating is what makes it so fascinating. The colorless solution experiences a series of complex and dynamic changes over time that result in the reformation of iodine ions and the revival of the blue-back hue. This continual oscillation between the colorless and colored states produces an astonishing impression.

In addition, the Briggs-Rauscher reaction not only demonstrates chemical oscillations intriguingly but also emphasizes the complex nature of chemical systems. It is believed that the reaction involves a complicated interplay of chemical reactions and feedback loops, despite the precise mechanism of the reaction is not entirely understood. Scientists and researchers nowadays are still investigating this oscillatory behavior in an attempt to unravel this mystery.

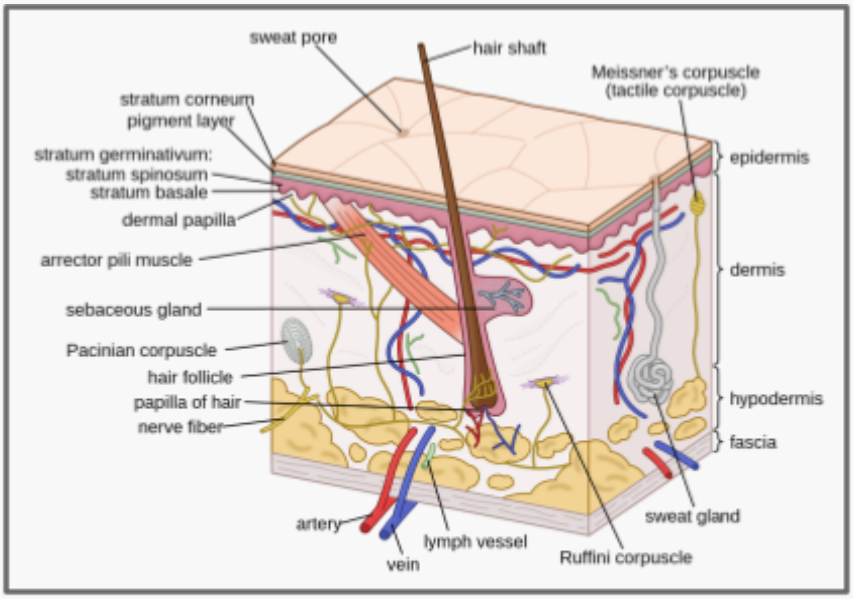
All in all, the Briggs-Rauscher reaction is a remarkable illustration of a chemical reaction that displays oscillatory behavior, altering between several color states over time. Scientists are expanding their knowledge of chemical systems and the fundamental principles that control their dynamic behavior by analyzing and deciphering the complexity of this reaction.

How Skin Moisturizer Works

Anna Dai

For many individuals, skin moisturizer is a common step in maintaining skin health and preventing dryness. Lotions, creams, and other skincare products work to hydrate the skin, decrease texture, and prevent the skin from breaking out. With the help of skin moisturizers, and the science behind it, people can achieve healthy, smooth skin.

Skin is made up of three layers, the epidermis, dermis, and hypodermis. The epidermis is responsible for providing a barrier against external factors and the loss of water. However, this layer can become compromised, causing dryness and lack of moisture. To restore the barrier and maintain the skin's moisture balance, skin moisturizers are used.



"File:Human skin structure.svg" by Tomáš Kebert & umimeto.org, licensed by Wikimedia Commons, under CC BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Human_skin_structure.svg

Three main ingredients in moisturizers allow it to do its job. Humectants such as hyaluronic acid, sorbitol, and glycerin are substances that attract water and keep moisture and are usually found in most moisturizers. These substances replenish hydration to enhance the skin's suppleness. Another component of moisturizers is emollients. Emollients are used by directly applying to the skin for soothing and hydration. Natural oils, lipids, and silicones are emollients that work by filling gaps between skin cells, creating a smooth surface while reducing the loss of water. Finally, some occlusives seal moisture from the skin, preventing evaporation. Vaseline, or petrolatum is a very commonly used occlusive that is applied to the skin to form a physical barrier. This extra barrier traps moisture within the skin and protects the skin from becoming irritated.

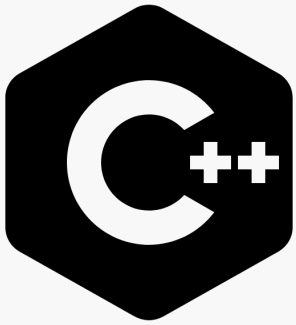
Many ingredients are often combined to maximize their effect on the skin. However, it is important to note that every individual has different and unique types of skin that may require specific formulas based on factors like sensitivity, climate, and personal taste. People often have to experiment with different brands and products before finding the right formula that is best suited for them.

In conclusion, skin moisturizers are used to maintain the skin's moisture balance, prevent dryness or irritation, and enhance skin appearance. A combination of ingredients like humectants, emollients, and occlusives work together to deliver hydration and protection for the skin. Depending on the skin type, condition, or person, the moisturizer formula may vary to appropriately treat their skin. Understanding the science behind skin moisturizers can assist individuals in choosing what is right for them.

C++ vs. Python vs. Java

Aidan Hong

C++, Python, and Java are arguably some of the most popular coding languages available, and they all offer their unique advantages and disadvantages. While some are more flexible, others aren't as flexible and are more prone to errors. On the other hand, some compile faster than others, and some offer the prospect of software development.



The first major difference between the 3 programs is the speed. Although Python is one of the most versatile and easiest programs to learn, it is also one of the slowest. Although C++ is more complicated than Python, it is also the fastest among the 3, making it popular for competitive programming, where speed is important. Java, on the other hand, is the lengthiest, and faster than Python but slower than C++.

The second major difference is their use cases. Java is primarily used for mobile app programming, with even Android App Studio using Java. Java is also used for game development, with Minecraft being programmed using Java. C++, on the other hand, is used for operating systems and browsers. This is because C++ allows access to hardware. Python is used for data science and machine learning. However, Python is typically not used to develop a GUI.

The final major difference is their flexibility. Python is arguably one of the most flexible programming languages. Programmers can import many libraries, like Numpy, Seaborn, TKinter, and more to suit their specific needs. Java can also import libraries, but there isn't as much as Python. However, C++ doesn't have as many libraries as Python does.

Python, Java, and C++ all have their specific use cases and advantages, as well as disadvantages. Despite being slow, Python is also one of the most versatile languages. C++ is one of the fastest languages but is not as versatile as Python. Java offers a combination of both. Regardless, all three are extensively used daily and have made profound impacts on our lives.

Honeypot Ants

Ashley Chen

Surely you've heard of honey bees, but what about honeypot ants? Although the two species appear to have a similar operation in collecting nectar and sugar, they function distinctly from one another, particularly in their methods of storing their "honey".

These intriguing insects, scientifically known as the "Myrmecocystus mimicus", gather nectar and sap to store as honey within their colony. But what gave these ants the name of "honeypots"? These insects were first discovered in the late 19th century by the naturalist Henry Christopher McCook, then studied further by William Morton Wheeler in the study of insects and ants. Within their research, it was noted that this particular species of ants kept enlarged, bloated members of its colony within their underground habitat, filled to the brim with a sweet liquid, and used as storage units.

"File:HoneyAnt.jpg" by Greg Hume, licensed by Wikimedia Commons, under CC BY 2.5. https://commons.wikimedia.org/wiki/File:HoneyAnt.jpg

Honeypot ants, similar to many other ant species, take off on a nuptial flight to mate, often after adequate rainfall. The portion of honeypot ants who have developed wings (also known as the queens) take off from their birth colony to reproduce. Once they have found another ant to mate with, the queen sheds her wings and then lays her eggs in preparation for the birth of a new honeypot ant colony.

The biggest ants of each batch of the offspring are chosen to become “repletes”, who are the special workers that are turned into tiny, immobilized bulbs, functioning as the colony’s food storage. Repletes make up nearly half of the honeypot ants’ colony. These ants remain within the colony’s chambers and are fed sap and nectar by the other ants until the repletes’ abdomen is filled and fully swollen. When an ant needs feed, the repletes extracts the sweet liquid from its stomach, and the hungry and sips from its mouth.

Honeypot ants, often appearing as small, dark brown, and black insects, are also considered to be a delicacy to some, and most notably, to the indigenous Australians. Repletes found in the wild appear similar to the other workers in color and size, except their abdomen, which is usually round, clear amber in color, and swollen to several times the size of the rest of its body.

Unveiling the Pinnacle of AP Science Courses: AP Physics, AP Calculus, and AP Computer Science

Stephen Hung

As thIn the realm of Advanced Placement (AP) courses, certain subjects stand out for their academic rigor, real-world relevance, and ability to develop critical skills. Among these, AP Physics 1/2, AP Calculus AB/BC, and AP Computer Science A consistently rank as top choices for students aspiring to excel in science, mathematics, and technology. In this article, we will delve into the unique features and benefits of these courses, shedding light on their importance in shaping future academic and professional pathways.

AP Physics 1/2:

AP Physics 1/2 courses serve as a foundation for understanding the fundamental principles of physics. Beyond the subject matter itself, these courses foster critical thinking, problem-solving, and analytical skills that extend into various disciplines. The hands-on nature of physics provides tangible examples and demonstrations, making the coursework engaging and relatable. Aspiring STEM (Science, Technology, Engineering, and Mathematics) students find immense value in AP Physics, as it showcases academic rigor and is highly regarded by colleges and universities.

AP Calculus AB/BC:

AP Calculus AB/BC courses delve into advanced mathematical concepts that may initially appear daunting. However, these courses build upon the knowledge acquired in previous math courses, instilling a sense of accomplishment as students progress. By equipping students with critical mathematical skills, AP Calculus becomes a cornerstone for careers in engineering, economics, and other quantitative fields. The course presents opportunities to solve complex problems with real-world applications, fostering a fascination for the subject. It comes as no surprise that AP Calculus consistently ranks among the most popular AP courses, as acknowledged by the College Board.

AP Computer Science A:

The AP Computer Science A course focuses on Java programming, accompanied by logical and conceptual thinking. The well-organized AP Exam format comprises targeted free-response questions that assess specific topics, streamlining exam preparation. The growing demand for computer scientists in the job market, projected by the Bureau of Labor Statistics, underscores the significance of this course for future career prospects. AP Computer Science A empowers students with versatile programming and problem-solving skills, opening doors to endless possibilities in the realm of technology.

AP Physics 1/2, AP Calculus AB/BC, and AP Computer Science A represent the epitome of excellence in the world of AP science courses. These courses not only provide a strong academic foundation but also develop critical skills necessary for success in STEM fields and beyond. The hands-on nature of AP Physics, the complexity of AP Calculus, and the programming prowess gained from AP Computer Science A offer students unparalleled opportunities for growth and achievement. As students consider their academic pursuits, these top AP science courses stand out as beacons of intellectual challenge and future potential.

Saturn: The Ringed Planet

Aimee Fan

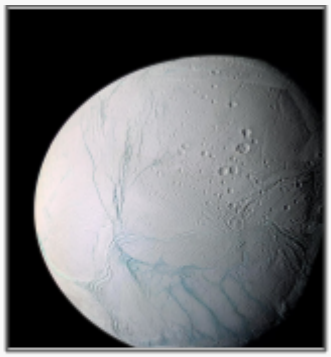
Humans are always amazed by the universe. From how planets were formed in galaxies to the unique way of rotation that they each have, scientists have longed to discover the mysteries that the universe hides. Each planet also has different things they have that make them stand out, for example, a ring that surrounds the planet. And the only planet that has that unique thing is Saturn.

Saturn is the sixth planet from the Sun and the second-largest planet in our solar system. It is a gas giant and one year in Saturn is about eleven thousand Earth days. Saturn's distance to the sun is about nine hundred kilometers. Saturn's outer ring is made of a lot of chunks of ice and rock, which makes it look smooth when you see it from a far distance. Like the other gas giant Jupiter, Saturn is also a massive ball made mostly of hydrogen and helium. Because Saturn's orbit is an ellipse, and it is the second largest planet in our solar system, Saturn is very far away from the sun. According to NASA,

"Latest Saturn Portrait" by European Space Agency, licensed by Flickr, under CC BY 2.0.
https://www.flickr.com/photos/europeanspaceagency/48725470858

Saturn has 124 moons that orbit around it. Saturn's environment is not safe for life to continue it. The temperatures, pressures, and materials that this planet contains are very extreme and volatile for life to occur.

While the planet Saturn is not a nice place for life to take place, many of its moons can do that. Satellites like the Enceladus and Titan, which are home to internal oceans, could hold life.



"Enceladus" by NASA's Marshall Space Flight Center, licensed by Flickr, under CC BY-NC 2.0. https://www.flickr.com/photos/nasamarshall/37288643825

Saturn has the second-shortest day in the solar system. A day on Saturn takes only 10.7 hours, and Saturn makes a complete orbit around the Sun in about 29.4 Earth years. Saturn's axis is tilted by 26.73 degrees for its orbit around the Sun, which is similar to Earth, which has a 23.5-degree tilt. This means that similar to Earth, Saturn also has seasons. Saturn's ring system extends up to 175,000 miles away from the planet, but its height is only about 30 feet in the main rings. The rings are named alphabetically in the order they were discovered, and they are very close to each other. Except for a gap that is 2,920 miles in width called the Cassini Division that separates Rings A and B. The main rings are A, B, and C. The rest of the rings are fainter and were discovered recently. Much farther out the E ring, there is a very faint Phoebe ring in the orbit of Saturn's moon Phoebe.

How Search Engines Work

Wilson Zhu

Search engines such as Google, Bing, and Yahoo are software systems that are used to find web results that relate to the web search of a user. They search the World Wide Web using various algorithms and have become an important part of our lives in the current society since they can provide information fast.

The process used by search engines involves multiple steps. Firstly, these search engines use bots to find noteworthy content in a process called crawling, they scan the internet for new and updated web pages then with this newfound information, it will store and then organize the information in a process called indexing. Additionally in the process of indexing, the search engine analyzes the content of each web page and stores it based on its relevance to the search terms that the user provides to the search engine. Finally, a process called ranking is used to display results relevant to a user's search, the search engine uses complex algorithms to determine which results are most relevant and sorts them in order of relevance.

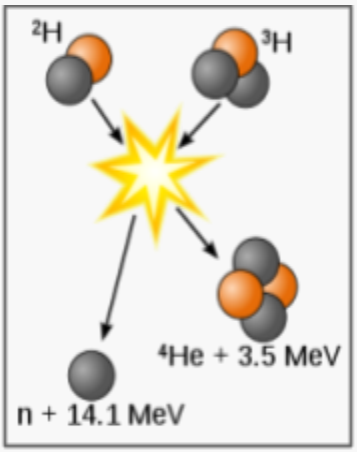
Most of these search engines display links to web pages, images, videos, and many other files related to the web search of the user. Search engines use many techniques that are polished through machine learning. Overall, search engines have greatly impacted the way we access and consume information. They have made the process of accessing information much simpler and more rapid. By constantly improving their algorithms and incorporating new technologies, search engines continue to provide us with fast and accurate access to the information we need.

What is Nuclear Fusion?

Richard Wang

Imagine you were told that there was a holy grail of energy. This clean energy source would not be intermittent like solar energy. This energy source would not be damaging to our Earth as coal is. This energy source is called fusion. The idea of creating efficient fusion energy has been around for decades, but it has been extremely difficult to achieve. Nuclear fusion can meet human demands for energy for millions of years to come.

With all the news about nuclear fusion, an important question must be answered: What exactly is nuclear fusion? Nuclear fusion reactions are the reactions that power stars such as our sun. It involves fusing two nuclei which create a single nucleus that is of a lower mass which results in a huge release of energy. This collision of nuclei occurs in plasma at extremely high temperatures such as those of the sun. Not to be confused with nuclear fission, nuclear fusion produces four times more energy than that of nuclear fission.



"File:Fusion reaction of deutrium.png" by Shrriramsughir, licensed by Wikimedia Commons, under CC BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Fusion_reaction_of_deutrium.png

The most recent breakthrough occurred at the Lawrence Livermore National Laboratory where the first nuclear fusion reaction occurred which outputted more energy than what was inputted. A tiny fuel pellet was subjected to 192 laser beams, or two million joules of energy which created a fusion ignition. The ignition produced an output of three million joules. This major accomplishment only marks the beginning of the nuclear fusion industry.

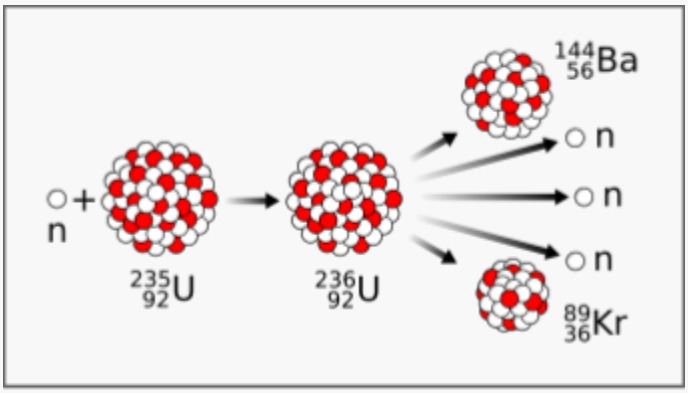
Previously, nuclear fusion lacked growth due to funding. However, in the last year, billions of dollars have been funded. According to the fusion industry, nuclear fusion may be on the grid by around 2030. Currently, we are still in the process of turning it into a practical energy source which explains why we still have to wait many more years. Once nuclear fusion becomes successful commercially, it will be able to provide the energy demands of the still-growing population and will contribute to the mitigation of climate change.

Nuclear Waste

Eason Fan

What do you think of when you hear the word nuclear waste? The iconic green gooey stuff in the Simpsons or the numerous nuclear meltdown disasters. But nuclear power is a proven and safe method of getting energy. According to world nuclear.org, “France gets up to around 70% of its electricity from nuclear energy, while Ukraine, Slovakia, Belgium, and Hungary get about half from nuclear power.” Why might this be the future of clean energy and how does nuclear fission work?

Nuclear power plants use small fuel pellets containing uranium-235. The pellets are then put into long rods with water fill on the outside. Inside the rods, nuclear fission happens. It is the process in which a neutron hits a large atom splitting it apart. The split atom then hits others causing a chain event. Water is run through the whole system getting heated up to boiling point. Then, the water steam is used to spin a turbine.



“File:Nuclear fission reaction.svg” by MikeRun, licensed by Wikimedia Commons, under CC BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Nuclear_fission_reaction.svg

One of the problems of running a nuclear power plant is that it creates a lot of nuclear waste. The waste is split into many different categories ranging from High-Level Waste (HLW) - direct spent fuel in the core of the nuclear reactor to Low-level waste, including leftover equipment like protective clothing or paper. The pellets that used to be fuel will remain at high levels for thousands of years.

According to nrc.gov, “Transuranic wastes, sometimes called TRU, account for most of the radioactive hazard remaining in high-level waste after 1,000 years.” That is one of the key problems of nuclear energy.

We currently store the pallets in a big secure concrete container certified for only 40 years. This doesn’t mean that unsafe radioactive fuel is lying unprotected after 40 years. This just means that we don’t have a long-term solution yet.

There are many solutions to storing pallets. For example, according to Forbes, people are starting to solve this issue, “Finnish waste management company Posiva Oy, announced the start of excavation on their deep geologic nuclear waste repository for their spent nuclear fuel (SNF) at ONKALO.” These are solutions using technology already invented.

“Massive containers hold spent nuclear fuel” by Nuclear Regulatory Commission, licensed by Wikimedia Commons, under CC BY 2.0 https://commons.wikimedia.org/wiki/File:Massive_containers_hold_spent_nuclear_fuel_%2815420175144%29.jpg

Another way of dealing with the waste is recycling the waste as fuel back through to the power plant. Also using technology that is already proven and invented. Japan is doing this right now. According to the World Nuclear Association, “Japanese policy since 1956 has been to maximize the utilization of imported uranium, extracting an extra 25-30% of energy from nuclear fuel by recycling the unburned uranium and plutonium as

mixed-oxide fuel (MOX).” By doing this, it shortens the time that the fuel stays radioactive and saves money spent on mining the uranium. Again, according to the World Nuclear Association, “ Used nuclear fuel has long been reprocessed to extract fissile materials for recycling and to reduce the volume of HLW.”

The issues that are to be solved are not problems based on technology. Running nuclear power plants is just simply a logistical and financial problem. Next time, don’t look at the power plant as a lost cause. It may very well be the energy solution of the future.

The Horseshoe Crab

Riley Lee

Why exactly are horseshoe crabs amazing? Horseshoe crabs are amazing because they are ancient creatures that have survived for around 450 million years. Horseshoe crabs are not exactly true crabs, they are a combination of crabs, spiders, and scorpions. Horseshoe crabs are found along the shallow waters of the coastal waters in the Atlantic Ocean and the Gulf of the United States of America. Horseshoe crabs can also be found in some parts of Asia.

"Limulus polyphemus (Atlantic horseshoe crab) (Sanibel Island, Florida, USA) 1" by James St. John, licensed by Flickr, under CC BY 2.0 https://www.flickr.com/photos/jsjgeology/24335711680

Horseshoe crabs have a shell that protects their organs and their body while having five pairs of legs with two of the legs being pincers. Horseshoe crabs have no jaw and they usually break down or crush their food with their legs. As Horseshoe crabs have an aggressive look, they are not violent or harmful to humans. They are known to be completely harmless to humans as they can't make real injury to humans. A huge interesting fact about horseshoe crabs is their blue blood. The blue blood of horseshoe crabs is used to test for bacterial species in vaccines, medical equipment, and other

objects. Horseshoe crab blood can sell a gallon for 60,000 and their blood is one of the most expensive blood in the whole wide world while saving human lives countless times. Some parts of the horseshoe crabs are edible meat, but you have to remove the organs before you eat the meat to reduce the chances of poison.

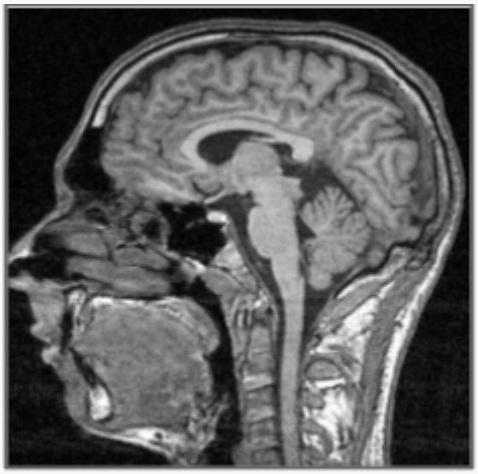
Horseshoe crabs play an important role in the ecosystem because they are the food source of sea turtles, shorebirds, and their eggs help feed the migratory birds passing by. Horseshoe crabs can live up to or around 20 years and a nickname they are called filter feeders because they help remove organic matter and pollutants from the water. While horseshoe crabs play an important factor in the ecosystem, they face a lot of threats. Some threats to horseshoe crabs include pollution, overfishing, and their environmental loss. In addition, horseshoe crabs like to come up the shore at night to mate and lay their eggs.

In conclusion, horseshoe crabs are important amazing creatures that play an important role in the ecosystem while facing multiple threats. Horseshoe crabs are inspiring because they have been around for millions of years and still make an impact on life on Earth.

Decoding the Mind

Denise Lee

Brain scanners are one of the closest technologies known to humans that can decode people's thoughts. After trying to design a machine that could better allow those who cannot talk to communicate, scientists have created brain scanners that can almost read minds.



"File:FMRI-scan sectie 85.JPG" by Erik1980, licensed by Wikimedia Commons, under CC BY-SA 3.0 https://commons.wikimedia.org/wiki/File:FMRI-scan_sectie_85.JPG

Computer scientists, Alexander Huth and Jerry Tang, from the University of Texas at Austin combined functional magnetic resonance imaging (fMRI), an artificial intelligence (AI) that measures what words you want to say. The fMRI is very similar to the AI, ChatGPT, because it is programmed and trained to predict the next word in a piece of text. A study published in Nature Neuroscience shows three volunteers laying in an fMRI scanner and it recorded the individuals' brain activity while they listened to 16 hours of podcasts each. The fMRI scanner measured the blood flow through the volunteer's brains which transferred the information with details of the stories they were listening to. The neuroscientists developed an encoded map of how each individual's brain responds to different words and phrases using the research they gathered. The encoded map differed between individuals, meaning that the user would have to create a different map for every person they wanted to mind read.

Thought-to-speech technologies use brain implants that monitor activity in a person's motor cortex. According to Mind-reading machines are here: is it time to worry? by Sara Reardon, "The decoder generated sentences that got the gist of what the person was thinking: the phrase 'I don't have my driver's license yet', for instance, was decoded as 'she has not even started to learn to drive yet'." Even though it understood the gist of what the person was thinking, most of the time the sentences the decoder decoded didn't sense. The neuroscientists also found out that it was easy to trick the technology. When participants were thinking about anything other than the podcast, the decoder could not determine the words they were thinking.

In the end, we are still far from discovering the perfect technology to read minds, yet mind-reading scanners will be available in the future.

Pangolins

Ryan Zhu

There are a total of eight pangolin species in the world: four in Asia and others in Africa. The pangolins are not widely known outside Asia and Africa.

Pangolins are the only mammals covered by scales. Their scales are made of Keratin which is the same material as our hair and nails. In illegal wild trade, pangolin scales are often seen because some people think they have medicinal properties. Pangolins also play an important role in the ecosystems. They only eat ants and termites as food, it helps control the populations of these insects, thus keeping the balance of ecosystems. And they are harmless to people, when they are frightened, they will roll like a ball to protect themselves.

"File:Tree Pangolin.JPG" by Valerius Tygart, licensed by Wikimedia Commons, under CC BY-SA 3.0 https://commons.wikimedia.org/wiki/File:Tree_Pangolin.JPG

Now, because of illegal wild animals trade, destruction of habitats, and other reasons. Pangolins are faced with the problem of becoming extinct. All eight species are listed as endangered species by International Union for Conservation of Nature (IUCN). Additionally, pangolins are also protected by the laws of the distribution area country.

It's our responsibility to protect pangolins. If all the world is working together, we can make a better and safer future for pangolins.

Curiosity Rover

Donia Cao

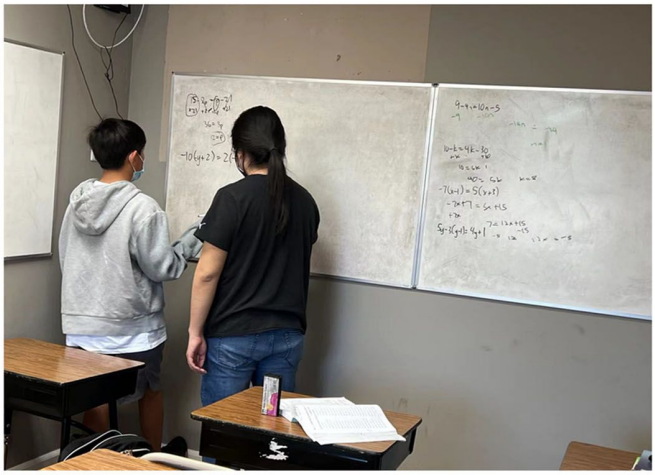
On November 26th, 2011, the Mars Science Laboratory successfully launched its Curiosity rover from Cape Canaveral. After navigating to the Gale crater on Mars, this remarkably advanced robotic explorer landed with extreme precision–within 2.4 km of its target–in Aeolis Paulson on August 6th, 2012. This achievement has quite an impact when considering the size of the rover that accomplished it.

Missions like the Curiosity landing focus on analyzing the Martian climate and geology to assess its hospitability for microbial life and to identify potential sites which may be suitable for human exploration. We also utilize testing methods to supplement these efforts so that we can better understand the conditions of Mars.

The 2012 Robert J. Collier Trophy, presented by the National Aeronautic Association, was awarded to the NASA/JPL Mars Science Laboratory/Curiosity Project Team in recognition of their outstanding work and accomplishment. With Curiosity's successful landing on Mars, the team has furthered technological and engineering development in the United States and increased humanity's understanding of a past Martian environment that may be conducive to life.

"Curiosity at Work on Mars" by NASA Goddard Space Flight Center, licensed by Flickr, under CC BY 2.0 https://www.flickr.com/photos/gsfc/6385411977

In 2012, The Curiosity mission was extended indefinitely, and NASA celebrated its 5th anniversary in 2017. On May 19th, 2023, the Mars Rover had been actively running on Mars for 3833 sols since it was launched in August of 2017. Over this period, a comprehensive report detailing the accomplishments of Curiosity over the last 10 years was released on August 6th, 2022. To this day, the rover remains operational.



週六下午就是數學大本營時間

科嶺數理電腦學院
CODING STEM ACADEMY

AI 人工智能教育 *最佳推手*

系統學習 基礎紮實 省時省力 卓越超群

AI人工智能資優兒童班
6-9歲 MIT Scatch , Virtual Robotics

AI人工智能進階班
10-14歲MIT Inventor ,Virtual Robotics

VEX 機器人隊
最有效益的課外活動
學術競賽與領導才能最大加分

Maker Portfolio
展現實作能力申請一級名校

AP Computer Principle
由編程及網路基礎觀念教起
全面建立堅實AI能力

AP Computer Science
* JAVA 程式語言編寫訓練 *
邏輯與電腦實務並重

AP Physics 1,2, C
著重公式練習與演算運用,同時準備SATII應考

AP Calculus BC, AB
講解清淅海量試題練習 同年應試二科省時省力

數學加強班
Algebra 1,2 Geometry

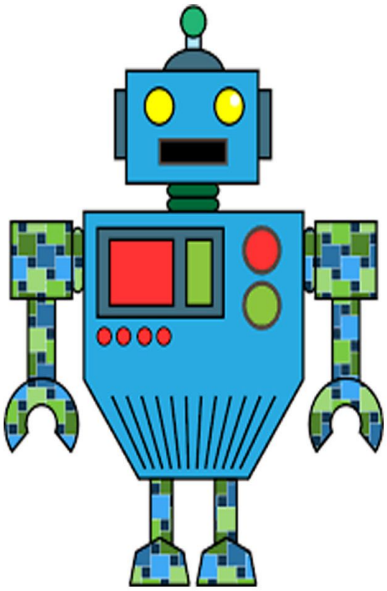
物理榮譽班
7-11年級・Honors課程・
為AP物理作充足準備

電腦編程基礎班 Java C++ Python

4-12年級為AP Computer 課程準備
並可參加全國及各項國際AI競賽

SAT 英文寫作班
4-12年級,閱讀,文法,寫作
** 因才施教 突破盲點 **

教室:核桃市,羅蘭崗,鑽石吧 626-510-0458



2022年賽季將結束，每個小朋友都忙著完成自己的機器人組裝和編程