"Discovery consists of seeing what everyone has seen and thinking what no one else has thought." — Albert Szent-Györgyi

STEM 2

QUANTUM QUILL

THE HYDERABAD PUBLIC SCHOOL, BEGUMPET

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$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

CONTENTS

BIDDING ADIEU

An Ode to a Lasting Legacy

The classroom has witnessed a remarkable transformation over the past 30 years, reshaping every aspect of teaching and learning. Three decades ago, classrooms were predominantly teacher-centered spaces, where learning happened mainly through chalk-and-board instruction and textbooks. There were charts, teaching aids and demonstrations. The teacher was the primary source of knowledge and the learning environment was structured and uniform. The resources were books and teaching strategies followed a fixed pattern. There was scope for a lot of imagination, creativity and people had a lot of memory as there was no click of button which would give information. All teaching practices were carried out manually. Over time, the word teacher is no longer used merely to describe a job. It has gradually evolved into terms like facilitator, mentor and guide.

MRS. D P SAILAJA, FORMER HOD OF PHYSICS

Very soon, it may even be seen as a partner–signifying that the learning journey is shared, with neither person positioned as superior, but both walking together toward growth. Today's classrooms have become dynamic learning spaces. With digital tools like smart boards, computers, tablets and online resources, the teaching-learning process has been transformed. Information is now easy to access, lessons are enriched through multimedia and students gain wider perspectives. Learning has moved from one-way instruction to an interactive and collaborative experience. Along with technology, teaching methods have also changed. Modern classrooms now focus on critical thinking, creativity, hands-on learning and problem-solving. Group work, STEM activities, project-based learning, flipped classrooms and experiential methods have replaced the old rigid approach.

However, this transformation has also brought challenges. Increased dependence on technology, reduced face-to-face interaction, digital distractions and the widening gap between teacher guidance and student autonomy have altered classroom dynamics. Maintaining meaningful connections, ensuring balanced participation and integrating technology without diluting interpersonal engagement are ongoing concerns.

Overall, the classroom of today is vastly different from that of 30 years ago – more advanced, more flexible and more student-centered. Yet, amidst all the change, the fundamental purpose remains the same - to create a space where learning is meaningful, engaging and connected to real life. If the challenges discussed above are addressed, meaningful connectivity and mutual trust between all stakeholders can be restored.

Education then regains its true purpose, reflected through STE(A)M as:

S – Students

T – Teachers

E – Empower

(A – Authentic)

M – Meaningful Learning

Even here, we notice that students come before teachers, highlighting the learner-centered nature of modern education.

-DP SAILAJA, FORMER HOD OF PHYSICS, HPS BEGUMPET

As our beloved teacher, Mrs. DP Sailaja concludes her distinguished tenure as the Head of the Physics Department, we all extend our heartfelt appreciation on the occasion of her superannuation. Her tenure has been marked by exceptional dedication, clarity in teaching, and a steady commitment to academic excellence. Her calm guidance, meticulous approach and consistent support have left a quiet yet lasting influence on both students and colleagues. As she embarks on the next chapter of life, we convey our warmest wishes for a fulfilling and well-deserved retirement. Her contributions will continue to be remembered with respect and gratitude. We wish to express our sincere appreciation for the clarity, discipline, and quiet dedication brought to her work each day, every bit. Her commendable ability to make complex ideas accessible, and unwavering commitment to students and colleagues alike, have left a meaningful and lasting influence on our school.

We thank her for the years of guidance, support and professionalism that has shaped both the department and the many young minds entrusted to her. Her presence has set a standard that will continue to guide us.

NANOTECHNOLOGY

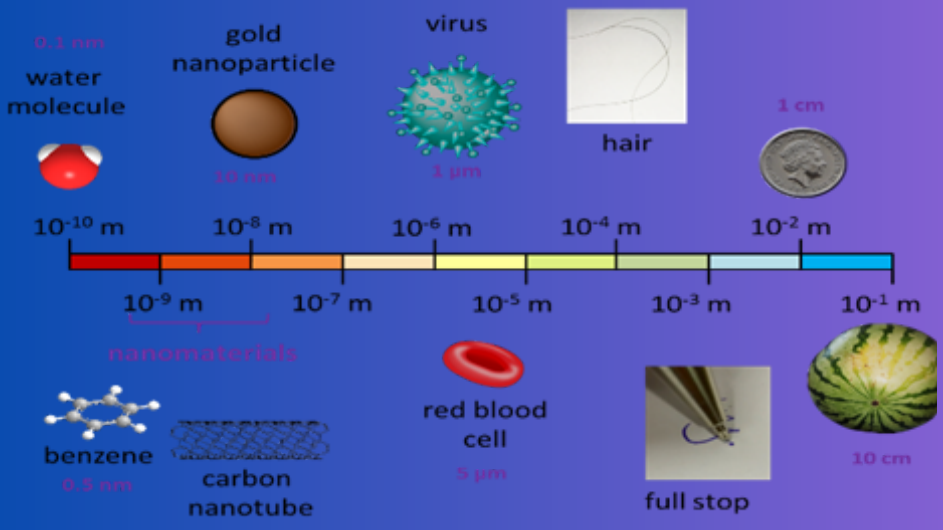
An Article

Nanotechnology is a rapidly advancing field focused on the design, synthesis and manipulation of materials at the atomic and molecular scale (1–100 nm). It enables precise control of matter, leading to innovations that were once unimaginable.
The concept of nanotechnology was introduced in 1959 by physicist Dr. Richard Feynman, whose visionary ideas laid the foundation for modern nanoscience.

Applications of Nanotechnology:

1. **Nanomedicine: Healing at the Nanoscale –**
Nanomedicine is the application of nanotechnology in the field of medicine. It includes utilizing nanomaterials, Nano electronics, biosensors, application of molecular nanotechnology. It revolutionizes drug delivery and therapy, with the assistance of Nano robots that deliver drugs precisely to the affected areas in the body, ensuring optimal treatment. Nanoparticles can be designed to target specific cells or deliver drugs with precision. Imagine cancer treatments that attack only cancer cells, leaving healthy cells untouched.

2. **Smart Fabrics: Nano Magic in Textiles –**
Nanotechnology enhances fabric properties, making them water-repellent, stain-resistant, antimicrobial, and durable. Advanced applications include bullet-resistant jackets and smart textiles that respond to environmental or physiological changes.

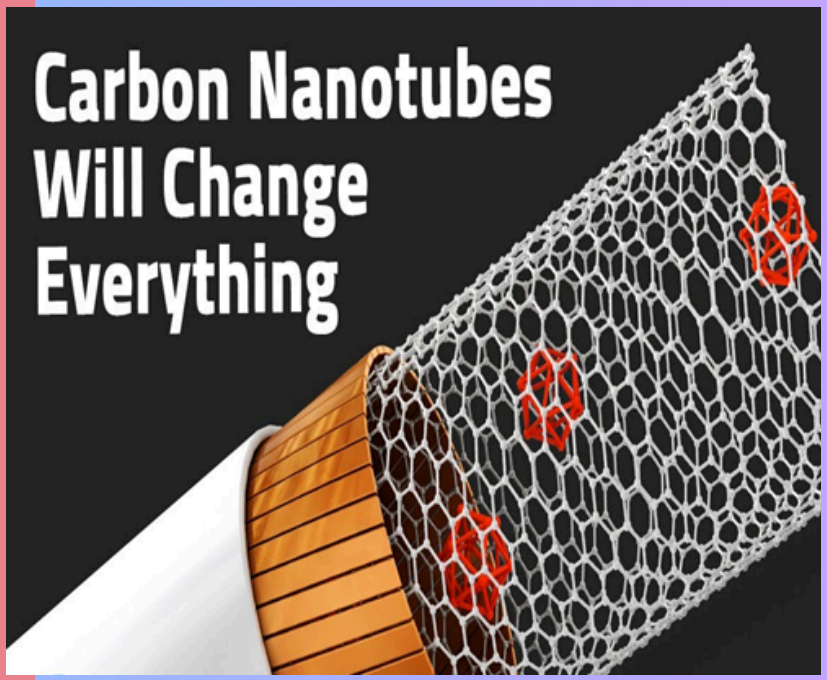


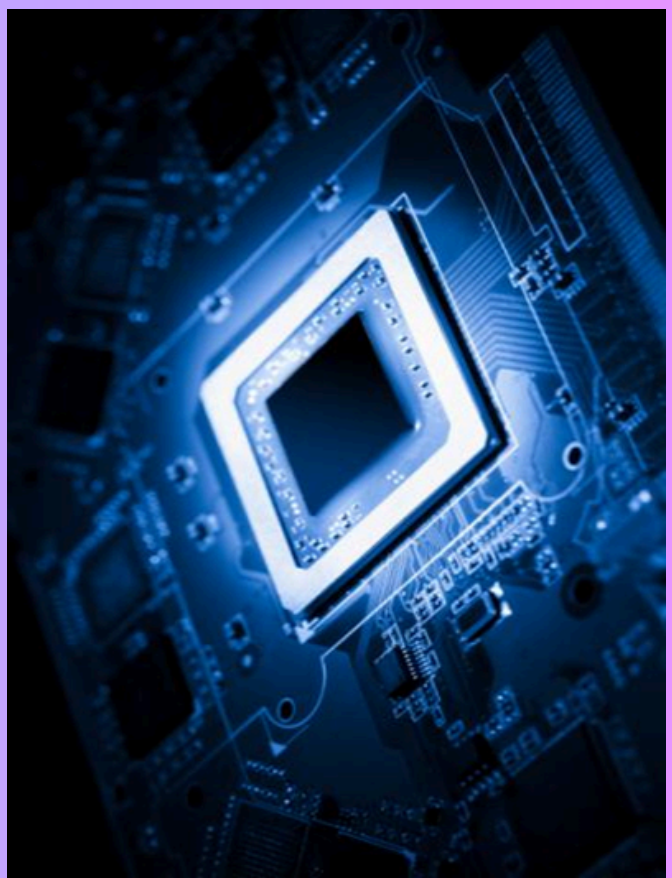
3. Electronics: Smaller, Faster, Smarter –
Nanowires and nanolithography are revolutionizing electronics by enabling thinner, flexible displays and powerful microchips. These advancements support innovations such as e-paper, wearable displays and augmented-reality windshields.

4. **Computing at the Nanoscale –**
Carbon nanotubes exhibit exceptional strength, electrical conductivity and sensitivity. They are used in lightweight structures, advanced sensors and next-generation computing devices, pushing the limits of speed and efficiency.

5. **Nano Cosmetics –**
Nano cosmetics use nanoparticles to improve skin penetration and product performance. Applications include sunscreens with enhanced UV protection and anti-aging creams. However, safety and environmental concerns highlight the need for responsible use and regulation.

Conclusion –
Nanotechnology is transforming medicine, textiles, electronics, computing and cosmetics. Its vast potential continues to blur the line between science fiction and reality, shaping a smarter, healthier and more innovative future.



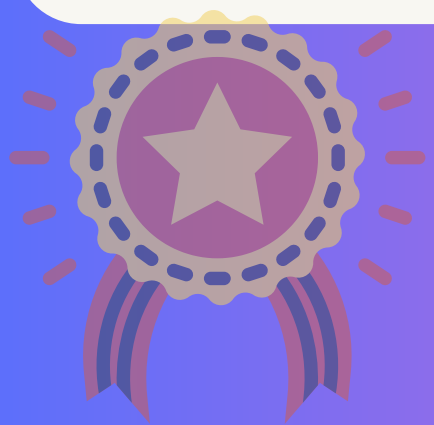


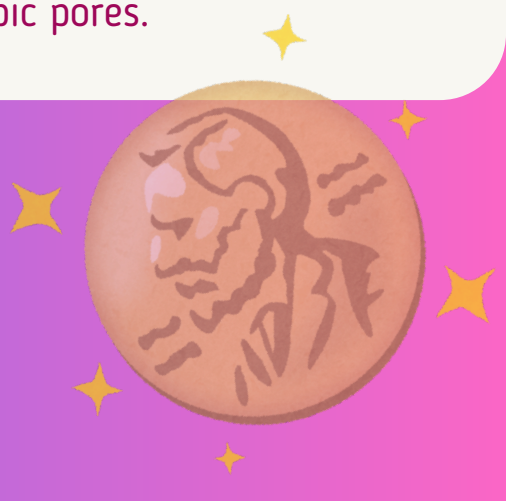
NOBEL LAUREATES

A Tribute - 2025

The Nobel Prize in Physics 2025 was awarded to **John Clarke, Michel H. Devoret and John M. Martinis** "for the **discovery of macroscopic quantum mechanical tunnelling and energy quantisation in an electric circuit.**" The laureates performed experiments on electrical circuits in which they observed quantum mechanical phenomena such as tunnelling and quantised energy levels. Their work showed that quantum tunnelling is not confined to the quantum world, but it can also be reproduced in macroscopic electrical circuits. In recognition of this award, Nature Portfolio presents a collection of research, review and opinion articles that celebrates the contributions by the awardees and the technological advances they have enabled.

The Nobel Prize laureates in Chemistry, 2025 have created molecular constructions with large spaces through which gases and other chemicals can flow. The scientists that have been honoured with the **Nobel Prize in Chemistry for the year 2025: Susumu Kitagawa, Richard Robson and Omar M. Yaghi**. They have been recognised for the **development of metal-organic frameworks**. These constructions, metal-organic frameworks, can be used to harvest water from desert air, capture carbon dioxide, store toxic gases or catalyse chemical reactions. Through the development of metal-organic frameworks, the laureates have provided chemists with new opportunities for solving some of the challenges we face. The 2025 Chemistry laureates revolutionized materials science with their creation of metal-organic frameworks (MOFs)–crystalline structures that act like molecular sponges. These frameworks are composed of metal ions linked by organic molecules, forming vast networks of microscopic pores.

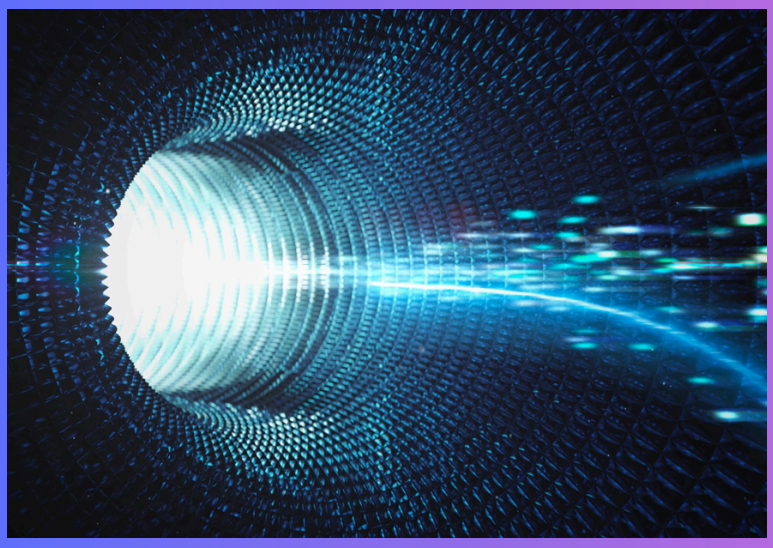




NOBEL LAUREATES

Mary E. Brunkow, Fred Ramsdell and Shimon Sakaguchi were the three **Nobel Laureates in the field of Physiology and Medicine for the year 2025.** They have been recognised for making **groundbreaking discoveries concerning peripheral immune tolerance** that **prevents the immune system from harming the body.** The body's powerful immune system must be regulated, or it may attack our own organs. Their discoveries have laid the foundation for a new field of research and spurred the development of new treatments, for cancer and autoimmune diseases. They understood how the immune system is kept in check and elucidated the scientific background of immune tolerance, the identification of regulatory T cells and FOXP3.

Their findings didn't just illuminate biology; they opened new paths in medicine. Therapies inspired by their work are now being explored to treat autoimmune disorders, improve transplant success and even enhance cancer immunotherapy. What once seemed an abstract idea–immune self-regulation–is now a cornerstone of modern biomedical science.

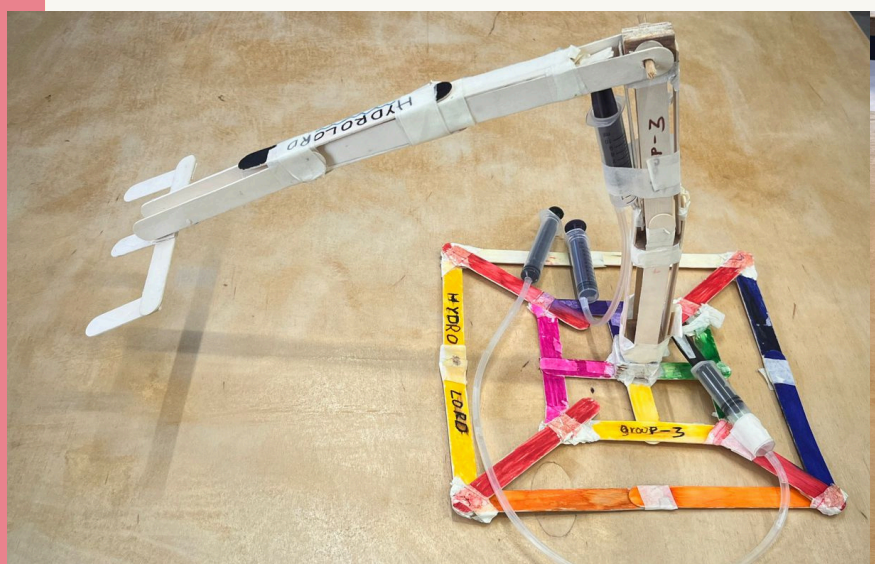


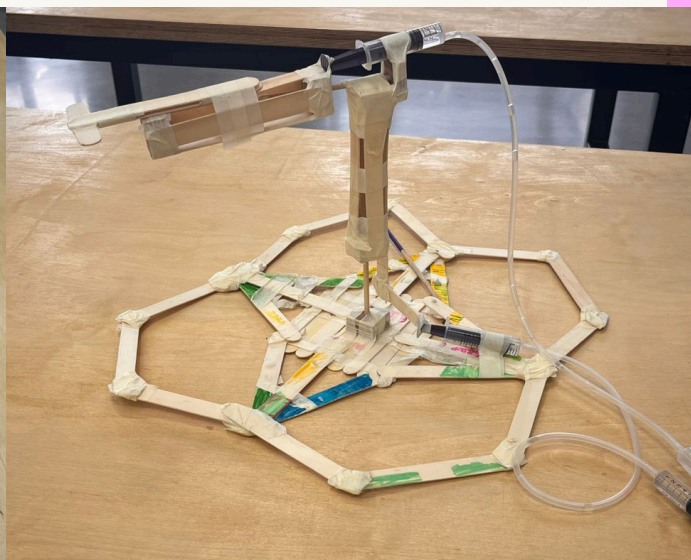
CLUB CORNER

ROBOTICS AND INNOVATION CLUB

The Robotics and Innovation Club had an active and engaging term from September to December, providing students with multiple hands-on learning opportunities that promoted creativity, teamwork and engineering thinking. One of the most exciting events was the “Robotics World – HydroBot Challenge,” which saw the participation of 76 students working in teams to design and construct hydraulic robots using simple materials such as popsicle sticks, syringes, tubing and masking tape. The activity concluded with a friendly “Judo Fight” competition, allowing students to test their designs while applying principles of hydraulics and mechanics.

In the initial stages of the HydroBot activity, students found it challenging to work with fragile materials while attempting to create structures that were both robust and movable. However, through guided discussions and by encouraging them to critically evaluate their designs using the design-thinking process, students gradually identified flaws, brainstormed solutions and made thoughtful improvements to their models. This hands-on troubleshooting strengthened their problem-solving skills, creativity and perseverance. By the end of the session, every group successfully built a functional HydroBot, demonstrating their ability to apply engineering concepts and collaborate effectively to overcome design challenges. Regular STEM build sessions and team challenges further strengthened problem-solving skills, collaboration, creativity and confidence. Overall, the club successfully created a dynamic platform for experiential learning, nurturing innovation and technical curiosity among students.





STEM CLUB

The middle school students enrolled in the STEM program showcasing exceptional enthusiasm and curiosity as they engaged in two exciting hands-on projects: the **“Electromagnetic Crane”** and **“How Steady Is Your Hand?”** These activities provided students with meaningful opportunities to explore concepts that connect Physics, Chemistry, Biology and Art.

The sixteen students participating in the STEM program demonstrated outstanding teamwork and research skills throughout the process. As they built and tested their electromagnetic cranes, they gained insight into real-world engineering challenges, identified problems and devised solutions to overcome them. Discussions on the uses of electromagnets in medical and industrial fields helped deepen their understanding of their relevance in daily life.

Students also explored the composition of magnetic materials and investigated methods to improve the efficiency of electromagnets. These experiences enhanced their analytical thinking, creativity and problem-solving abilities. Adding to the scientific spirit, the Friday Activity Club transformed into a vibrant chemistry lab as students became Junior Chemists for an afternoon of colourful discovery. Their mission was to determine the pH of everyday household items, ranging from lemon juice to laundry soap, using both natural and synthetic indicators. The magical red cabbage extract and Universal Indicator paper revealed a spectrum of colours that helped students map substances on the pH scale. The highlight of this activity was the creation of a stunning, self-made pH Colour Chart. Each dramatic colour shift, from deep blue to fiery red or green to bright purple–captivated the students as they uncovered the scientific identity of various substances.

More importantly, the students realized the significance of pH in daily life and how chemistry plays a vital role in the world around them. Together, these STEM activities provided a perfect blend of fun, creativity, teamwork and scientific exploration. The students not only learned important scientific concepts but also developed a deeper appreciation for how science connects to real-life applications.

CLUB CORNER (REPORTS)

SCIENCE AND RESEARCH CLUB

Over the past four months, the 16 members of the Science and Research Club have immersed themselves in two major research themes–surface tension and pH. Guided by Ms. Kavitha Kakumanu (now Mr. Rahul Chamoli) Mr. Krishna Chaitanya and Mr. Shiva Challa the groups engaged in structured research, experimentation and original scientific inquiry.

Group 1: Surface Tension

Under Ms. Kavitha's guidance, Group 1 explored "The Science of Surface Tension: From Water Striders to Space Technology." Students built a strong foundation through literature reviews and preliminary experiments, studying how molecular structure, temperature, additives, and pH affect surface tension. They examined how organisms exploit this phenomenon for survival. Students connected their findings to real-world applications including NASA's zero-gravity fluid control systems, medical surfactants for respiratory therapy, industrial cleaning processes, and environmental impacts of surface-active pollutants.

Group 2: pH and Its Applications :

Led by Mr. Krishna Chaitanya, Group 2 worked on "Understanding pH and Its Applications," aimed at helping middle school students grasp pH in daily life.

Students studied the basics of pH, acids, bases, and measurement techniques, collecting initial data from household substances. They experimented with pH levels in common materials, investigated pH effects on plant growth, and explored pH-sensitive visualising their results through graphs. The group connected pH to human health, aquatic ecosystems, pollution, agriculture, and careers in science. Students conducted independent research on local water and soil pH, tested pH effects on materials, and developed innovative pH-based applications. Their findings were documented and presented creatively.

Outcomes:

Both groups gained strong conceptual understanding and essential skills in experimental design, data analysis, and scientific communication. Their independent research projects fostered critical thinking, creativity, and real-world application. We are extremely proud of their dedication and look forward to their continued scientific growth.

STEM STORIES

BIOLOGY DEPARTMENT

We are pleased to share our enriching participation in **WWF India's "Wildlife on Course: 11 years of Golfing** for Nature" program, which provided an exceptional platform for exploring regional biodiversity and understanding conservation practices. The event featured two key activities: creating migration and climate change models using recycled materials, which fostered creativity and sustainability awareness and the Ecosystem Action Game, which challenged participants to apply knowledge about Telangana's unique species through fast-paced, team-based tasks. The WWF team demonstrated outstanding organizational skills, maintaining an approachable and supportive environment throughout, while the hosting arrangements, including seamless logistics and quality catering, were executed to excellent standards. Beyond acquiring valuable knowledge about endemic species, ecosystems and wildlife protection, participants experienced significant personal development in areas including teamwork, problem-solving, confidence and critical thinking skills. The program successfully combined educational rigor with engaging, hands-on learning methodologies, creating a well-organized and impactful experience. We express our sincere appreciation to WWF India for this opportunity and enthusiastically look forward to participating in future conservation education initiatives that continue to inspire environmental stewardship and practical engagement with biodiversity protection.

STEM STORIES

CHEMISTRY DEPARTMENT

Keynote Address- Mr. Y Balajirao, on Careers in Nuclear Science –

On 7th November 2025, an insightful and inspiring session was organised for the students of Classes 11 and 12 of ISC and Cambridge Curriculum students by the Chemistry department of HPSB. The school had the privilege of hosting Mr. Y. Balajirao, a distinguished Nuclear Scientist, as the guest speaker for the day. Mr. Balajirao delivered an enriching presentation on Nuclear Science and the wide spectrum of career opportunities in the field. His address was highly informative, offering students a clear understanding of nuclear energy, its applications, current advancements, and the significant role it plays in national development. He also shared valuable guidance on academic pathways, skill sets, emerging prospects in nuclear research and allied careers. The session was extremely engaging and thought-provoking. The students were captivated throughout and participated enthusiastically. Overall, the session proved to be immensely beneficial, broadening the students' horizons.

BIOLOGY & CHEMISTRY

A VISIT TO KAMINENI HOSPITALS :

On the 8th of November, 2025, The Grades 11 and 12 Biology students visited the Kamineni Institute of Medical Science and Research, where they explored various departments and gained firsthand exposure to medical and research practices. They observed preserved specimens, sampling techniques and diagnostic procedures in Pathology, Histopathology, Cytopathology and Microbiology. They also learnt about dyes, equipment and processes used in analysing tissue samples. The Forensic Medicine session offered insights into post-mortem analysis and medico-legal procedures. A seminar by Dr. Annie Hasan highlighted the significance of Genetic Counselling, genetic testing methods and personalised healthcare. Students also viewed PCR, gel electrophoresis apparatus and stem cell samples. The visit was highly enlightening, inspiring scientific curiosity and reinforcing the importance of pursuing one's passion in the life sciences.

A VISIT TO SAI BABA POLYMER TECHNOLOGY PVT LIMITED:

On 10th October 2025 (Friday), 36 students from grades 8 and 10, along with two teachers visited two units under Baba Group of Companies near Gundud, Shadnagar as an educational trip organised by the Chemistry department. These companies specialise in plastic recycling and waste management technology. At Sai Baba Polymer Technology Pvt. Ltd., the students engaged in sessions on the different processes, learning about the making and designing of plastic containers with advanced machinery and different raw materials. In the Chandra container manufactures unit and the metal drums and barrels production unit, students were explained the steps involved in the production of these products , leaving the students in awe with the technology utilised. Few of the students had also interacted with the workers, gaining insights into their daily routine at the factory unit. Overall, this visit helped the students appreciate the environmental significance of recycling and also connect classroom teaching, such as environmental chemistry and waste management, with real-life applications.

STEM STORIES

PHYSICS DEPARTMENT

In December, Group 1 students had the opportunity to visit the Senior School Physics Laboratory for an experiential learning session on the theoretical and experimental aspects of surface tension.

During the session, students explored the concept of capillarity and understood how surface tension governs various natural and practical phenomena. They learned the construction, working, and precise scale reading of a travelling microscope, an essential instrument for accurate scientific measurements. Using it, students carefully measured the internal radius of a capillary tube and determined the surface tension of water through the capillary rise method.

Through hands-on experimentation, students observed how water rises in a fine capillary tube due to cohesive and adhesive forces, directly connecting theoretical understanding with real-world applications. The activity not only deepened their conceptual grasp but also enhanced their experimental techniques, data accuracy, and analytical reasoning.

This practical session exemplified the school's commitment to concept-based, experiential learning in science, encouraging students to question, observe, and understand the physics behind everyday phenomena.

CURIO CITY!

EXPT 1- MILK PLASTIC

Materials:

Milk, vinegar, bowl, spoon, filter paper

Procedure:

Heat milk gently. Add vinegar and stir slowly. Strain the solid formed and press it into a mold.

What happens?

Milk contains a protein called casein which lose their normal structure and clump together when acid is added separating from the liquid. These tangled protein chains can be molded and harden as they dry, forming a plastic-like material.

Biomimicry:

Demonstrates how proteins in living systems can change structure and form strong materials, similar to collagen in bones and skin.

CLIMATE MODELLING AND EARTH SYSTEMS ANALYSIS

Climate modelers integrate atmospheric physics, geospatial data, and high-resolution simulations to forecast climate trajectories. They analyse temperature, ocean currents, and carbon cycles, generating predictive insights that inform global policy, environmental planning, resource management, and long-term climate resilience strategies.

EXPT 2- FLOATING RICE

Materials:

Water, glass, rice grains, needle

Procedure:

Fill a glass with water. Carefully place a needle on the surface. Sprinkle rice grains nearby.

What happens?

The needle slightly bends the water surface due to surface tension and creates tiny differences in surface energy around the needle, causing nearby rice grains to move toward it.

Biomimicry:

Models how cells, small organisms move along surface-energy gradients in biological fluids.

NEURAL-INTERFACE ENIGINEERING

Neural-interface engineers design biocompatible sensors and advanced signal-processing systems that translate neural activity into digital commands. Their work enables thought-driven prosthetics, restores sensory or motor function, enhances human–machine interaction, and propels next-generation neurotechnology for medicine, accessibility, and augmented cognition.

EXPT 3 - IMPACT FLUID

Materials:

Cornflour, water, bowl, spoon or small ball

Procedure:

Mix cornflour and water to form a thick fluid. Press it slowly, then apply a sudden force.

What happens?

As a non-Newtonian fluid, the mixture flows slowly because water moves between starch particles, but under sudden force, the particles lock, temporarily behaving like a solid.

Biomimicry:

Similar to how human muscles and joints stiffen instantly under sudden stress to prevent injury.

EXPT 3- pH INDICATOR

Materials:

Turmeric powder, water, paper, soap solution, lemon juice

Procedure

Mix turmeric with water to form a soln. Dip paper strips, allow them to dry. Place drops of soap solution, lemon juice on different areas.

What happens?

Turmeric's curcumin changes structure with pH: it stays yellow in acids like lemon juice and turns reddish-brown in bases like soap, making it a natural pH indicator.

DEBUNKED

Myth Busted!

1

"Cracking your knuckles causes arthritis."

Cracking your knuckles does not lead to arthritis, according to decades of medical research, this is a common misconception. The popping sound is caused by cavitation, which is the formation and collapse of tiny gas bubbles in the synovial fluid inside your joints. This process does not damage the cartilage or the bone. The long-term studies comparing habitual knuckle-crackers to non-crackers have found no difference in the incidence of arthritis. At most, frequent cracking may cause slight temporary swelling or reduced grip strength.

"Bulls get angry when they see the colour red."

2

Bulls do not become angry at the sight of the colour red because they are dichromatic animals that cannot see red at all. To a bull, red looks like a shade of gray. They cannot perceive colours like green, red but they see colours in the blue-yellow range. Their aggressive behavior in bullfighting is triggered entirely by the movement of the matador's cape, not its color. The rapid waving stimulates the bull's threat and chase instincts. The cape is traditionally red only for symbolism and not to provoke the animal.

STEM WORD SEARCH

Z	G	K	P	C	Y	U	U	I	J	S	U	A	C	B
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T	C	A	A	A	Q	Y	O	Z	E	L	T	I	M	F
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HUNT FOR :

CHROMATOGRAPHY

VECTOR

MECHANICS

BINOMIAL

ISOTOPE

ELECTROLYSIS

DATABASE

MAGNETISM

ANTIBODY

EQUILIBRIUM

HORMONE

ENCRYPTION

GENOME

OSCILLATIONS

OSMOSIS

Here's your sign to stay curious,
Keep up with the latest in STEM as we bring you fresh ideas and discoveries. Until our next issue, never let anything dull your spirit of curiosity, innovation and learning!

"The important thing is not to stop questioning. Curiosity has its own reason for existing." — Albert Einstein

Brought to you by:

Shaanvi Karri, 11A
Vaibhavi Iyengar, 11A

Special mention to our teachers

Dr. Preet Kaur
(Senior School Coordinator)
Mr. Rahul Chamoli
Mrs. Sudha Rani Palla