

Young Scientist India

A Science & Innovation Magazine for School Students

LOW COST INNOVATIONS

NAUTAM BHAGWANLAL BHATT

SHEKHAR CHINTAMANI MANDE

GOPALASWAMY DORAISWAMY NAIDU

SRIKUMAR BANERJEE

POSTER PRESENTATIONS

BLUE SKIES THINKING

INTERNET OF THINGS (IOT)

BUILDING ON THE PAST

DIY

Young Scientist India

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From the Editor's Desk

Hey there, young innovators!

It's awesome to connect with all of you through the 5th edition of *Young Scientist India*. Our **GYS Program** is all about sparking your curiosity and fueling your innovative ideas. And guess what? A huge part of that is our **GYS Avishkar Awards**! This national competition is where we discover brilliant minds like yours, showcasing innovative ideas that can really make a difference in the world and even have the potential to become something big. I'm excited to announce that the **Avishkar Awards** are back, and our website will be open for you to submit your amazing projects this month. We can't wait to see what you've created!

Now, let's dive into this month's edition! Ever been fascinated by world-famous sci-fi stories like the movie *Interstellar*? Get ready to explore even more mind-blowing concepts that are real! Our articles on **Quantum Theory & Nuclear Physics**, **Lunar Water**, and the **Chandrasekhar Limit** and **Chandrasekhar Number** delve into space, time and energy, with interesting insights from our very own brilliant scientists.

Our cover story, **Low-Cost Innovations**, proves that innovation can spark from anywhere – even your own home, using simple, affordable materials! Those clever everyday "Jugaads", when refined with proper guidance, can truly become our Nation's next big breakthroughs. Plus, prepare to be inspired by a compilation of amazing innovations developed by students just like you.

My absolute favourite part in every edition are the **Training Modules**. This month, we'll explore **Blue Sky Thinking**, teaching you how to imagine ideas without limits, truly believing the sky's the only boundary! And once you create your innovation, presenting it is key. Become a master of **Poster Presentations** with our article. You'll also be inspired by stories of India's pride, our scientists: Nautam Bhagwanlal Bhatt, Shekhar Chintamani Mande, Gopalaswamy Doraiswamy Naidu and Srikumar Banerjee.

It's important to understand our past as we build the future. The decades of discoveries and inventions by our scientists are the stepping stones for today's new innovations. Learn how in our article, **"Building on the Past"**. Plus, discover the technology transforming the present and future: **"IoT"**. And to help the budding innovator in you become a professional scientist, we're showcasing top Science and Innovation labs and organizations. This month features institutes like RCB, RRI, Bose Institute and RCESH, which groom talent in physical sciences, biotechnology and even happiness!

We hope you enjoy this edition as much as our previous ones. Keep an eye out for exciting events, contests and all the fun knowledge-building activities packed inside!



Vennela Valiveti, B. Des.
YSI Magazine Editor
Interior Designer
Ph. 9030600470



IoT

S&I Article

Internet of Things

Where Everything is Connected

The Internet of Things (IoT) is a network of physical objects like appliances, cars, or even wearable devices that have sensors, software, and other technologies built into them. These objects can connect to the internet and share data without the need for people to control them all the time.

For example, a smartwatch can track your steps and send the information to your phone. IoT makes everyday things smart by letting them collect and exchange information, helping us automate tasks and make better decisions in our daily lives.

Evolution of IoT

- In 1999, Kevin Ashton coined the term "Internet of Things" at MIT, linking RFID technology with the internet to track and manage objects.
- The number of connected devices grew rapidly, surpassing the number of people on Earth around 2008-2009.
- IoT is now integrated with advanced technologies like artificial intelligence (AI) and blockchain, making devices smarter and more secure.

How Does It Work?

1. Sensors detect changes like temperature, motion, or location.
2. Connectivity (like Wi-Fi or Bluetooth) allows devices to send and receive data.
3. Cloud computing stores and processes this data.
4. User interfaces (like mobile apps) let you interact with the system.

Where Can We See IoT?

IoT is already part of our daily lives, often without us noticing

- **Smart Homes** include lights that turn off automatically, fans that adjust based on temperature, and voice assistants like Alexa
- **Smart Cities:** Traffic signals that respond to real-time traffic, dustbins that notify when they're full
- **Smart Schools:** Automated attendance, air-quality monitors, smart boards
- **Smart Health:** Wearable devices that track heart rate and oxygen levels and send alerts
- **Smart Farming:** Sensors that measure soil moisture and automate irrigation

Smart Homes: How Technology is Making Lives Easier

What if your home could think for you? Imagine lights that switch on when you enter the room, doors that lock themselves, or a fridge that tells you when you're out of snacks. Welcome to the world of smart homes, where technology is making everyday life easier, safer, and more efficient.

A smart home is a house equipped with devices that can be controlled remotely using a smartphone, voice command, or even automation.

Everyday Comfort and Convenience

+

Saving Energy and the Environment

Here's how smart homes simplify life

- **Smart Lights:** Turn on/off automatically based on your movement or time of day.
- **Smart Thermostats:** Adjust the temperature based on your habits to save energy
- **Voice Assistants:** Control your home with simple voice commands like "Turn off the lights"
- **Robot Vacuums:** Clean your floors while you relax or study
- **Smart doorbells:** Let you see who is at the door from your phone
- **Security cameras:** Send alerts if they detect movement
- **Smart locks:** Allow you to lock your door from anywhere

This means lower bills and a smaller carbon footprint, smart living for a better world.

Smart Innovations making Cities Greener

Here are a few real-world eco-innovations powered by IoT and creative thinking:

- **Smart Streetlights:** Turn on only when people are nearby, saving electricity
- **Air Quality Sensors:** Track pollution and alert people when the air is unhealthy

- **Smart Waste Bins:** Notify city workers when they're full, no more overflowing trash!
- **Green Roofs with Moisture Sensors:** Grow plants on rooftops and water only when needed
- **Bike-Share Programs:** Use GPS and data to make cycling easier, safer, and more popular

How Do Students Start an IoT Journey?

If you're curious about technology, IoT is the perfect playground for your creativity.

- Join your school's STEM clubs, coding bootcamps, maker fairs, or robotics club
- Learn online platforms like Arduino, Raspberry Pi, Tinkercad, and MIT App Inventor
- Participate in innovation contests (e.g., Atal Tinkering Labs, GYS Avishkar Awards, or Google Science Fair)

- Enter science fairs or innovation competitions
- Collaborate with NGOs or local governments on tech-for-good projects and share your project online



Innovations You Can Try as a Student

You don't need a big budget or fancy lab to start making a difference. Here are simple eco-smart projects students can try.

- **Smart Walking Stick for the Visually Impaired:** Ultrasonic sensors are used to detect obstacles and send vibrations and audio alerts via an app, enhancing independence and safety for blind users.
- **IoT Waste Segregation Bin:** Automatically separates dry and wet waste and alerts authorities when it's full, promoting clean cities and improved recycling.
- **IoT Pet Feeder:** The mobile app has features like scheduling pet feeding times. It requires a servo motor, Man CU, a timer module, and an app to trigger feeding.



Benefits of IoT

- Improved efficiency and productivity
- Real-time monitoring and control
- Cost savings through automation
- Enhanced user experience
- Predictive maintenance in industries

Challenges of IoT

The Internet of Things (IoT) brings transformative potential but also introduces several significant challenges across technical, security, and societal domains.

- **Security & Privacy:** Devices are often vulnerable to hacking and may expose sensitive data
- **Interoperability:** Lack of common standards makes it hard for devices from different makers to work together
- **Power & Maintenance:** Many IoT devices have limited battery life and are hard to update or repair

- **Data Overload:** Huge amounts of data require advanced processing and storage solutions
- **Legal & Compliance Issues:** Regulations like the DPDP Act affect how data is collected, stored, and shared

The Future Is Connected

As IoT grows, so do the possibilities. Students like you are already building smart projects, from IoT plant watering systems to school safety monitors. Learning about IoT isn't just about technology; it's about solving real-world problems.

As smart technology continues to evolve, our homes are becoming more than places to live; they're becoming living assistants. With a mix of creativity and coding, you could be the one to invent the next big smart-home breakthrough. After all, in a connected world, even your home has a brain.

Sudoku Challenge 2505

6					9			4
	8	9	5				1	6
5				6		3		9
8	3	1				7		5
	2						6	
9		7				8	4	2
2		6		1				8
3	7				6	9	2	
1			3					7

Solutions are on Inside Back Cover.

Riddles 2505

1. I am under your face and outside your mind. What am I?
2. When liquid splashes me, none seeps through. When I am moved lot, liquid I spew. When I am hit, color I change. And color, I come in quite a range. What I cover is very complex, and I am very easy to flex What am I?
3. This is your stomach's way of letting you know you've neglected it.
4. I am a ball that can be rolled, but never bounced or thrown.

Indian Scientist

Nautam Bhagwanlal Bhatt

The Visionary Shaping India's Defence Technology



10 APRIL 1909 – 06 JULY 2005

Imagine building technology that helps detect hidden threats and protects a nation. This was the kind of work Nautam Bhatt dedicated his life to as a key scientist in India's defence research.

A Foundation in Brilliance

Bhatt wasn't just any scientist; he honed his skills under the guidance of giants. He earned his master's in physics from the Indian Institute of Science (IISc) under Nobel laureate C.V. Raman. His quest for knowledge then led him to MIT in the US, where he earned his doctorate focusing on wave theory and acoustics.

Architect of Defence Institutions

After returning to India, Bhatt immediately plunged into nation-building. He didn't just teach, he built!

- **Pioneering at IISc:** He became the first acting head of the Electrical Communications Engineering Department at IISc, shaping future generations of engineers.

- **Defence Science Laboratory (Delhi):** A key figure in its creation, setting the stage for India's indigenous defence research.
- **CEERI (Pilani):** From 1953–1957, he worked tirelessly to establish the Central Electronics Engineering Research Institute, a hub for cutting-edge electronics.
- **DRDL (Hyderabad):** He spearheaded the organization of radar research in Delhi, which later evolved into the Defence Research and Development Laboratory.
- **SSPL (Delhi):** As the founding director of the Solid State Physics Laboratory from 1962 to 1969, he led groundbreaking work in:
 - a. Producing high-purity silicon.
 - b. Developing solar cells and lasers.
 - c. Creating other vital semiconductor devices.

The Secret Weapon: VT Fuse

Among his classified contributions was his crucial role in developing the VT Fuse. It was a game-changer! Unlike older fuses that required direct impact or precise timing, the **VT Fuse** (or "variable time fuze") used radio waves to automatically detonate a projectile when it came within a certain distance of its target. This significantly increased the effectiveness of artillery against moving targets like aircraft in the 1960s, a vital step in bolstering India's air defence.

For his monumental contributions, Nautam Bhatt was awarded the **Padma Shri in 1969**. His dedication laid the groundwork for many of India's current defence technologies, making him a true hero of Indian science!

Device to Prevent Ambulance Service Delays

The student has developed a device to address road accidents and delays in ambulance services by utilizing accelerometer sensors and GSM modules to detect collisions. Upon detecting an accident, the system immediately sends alerts to the police, hospitals, and nearby locations, helping to prevent fatalities. It also monitors and reports overspeeding incidents, further enhancing road safety.



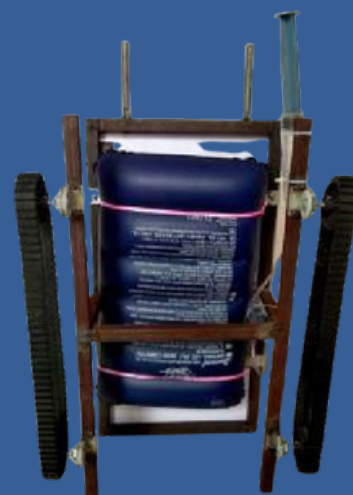
Rupesh Kumar
10th Class

An accompanying app provides live vehicle location updates, notifies users of nearby accidents, and offers additional features such as storing important documents like the driving license, vehicle registration certificate (RC), pollution under control certificate (PUC), and emergency contact information. This comprehensive system promotes improved road safety and a more efficient emergency response.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

All-in-One Stretcher

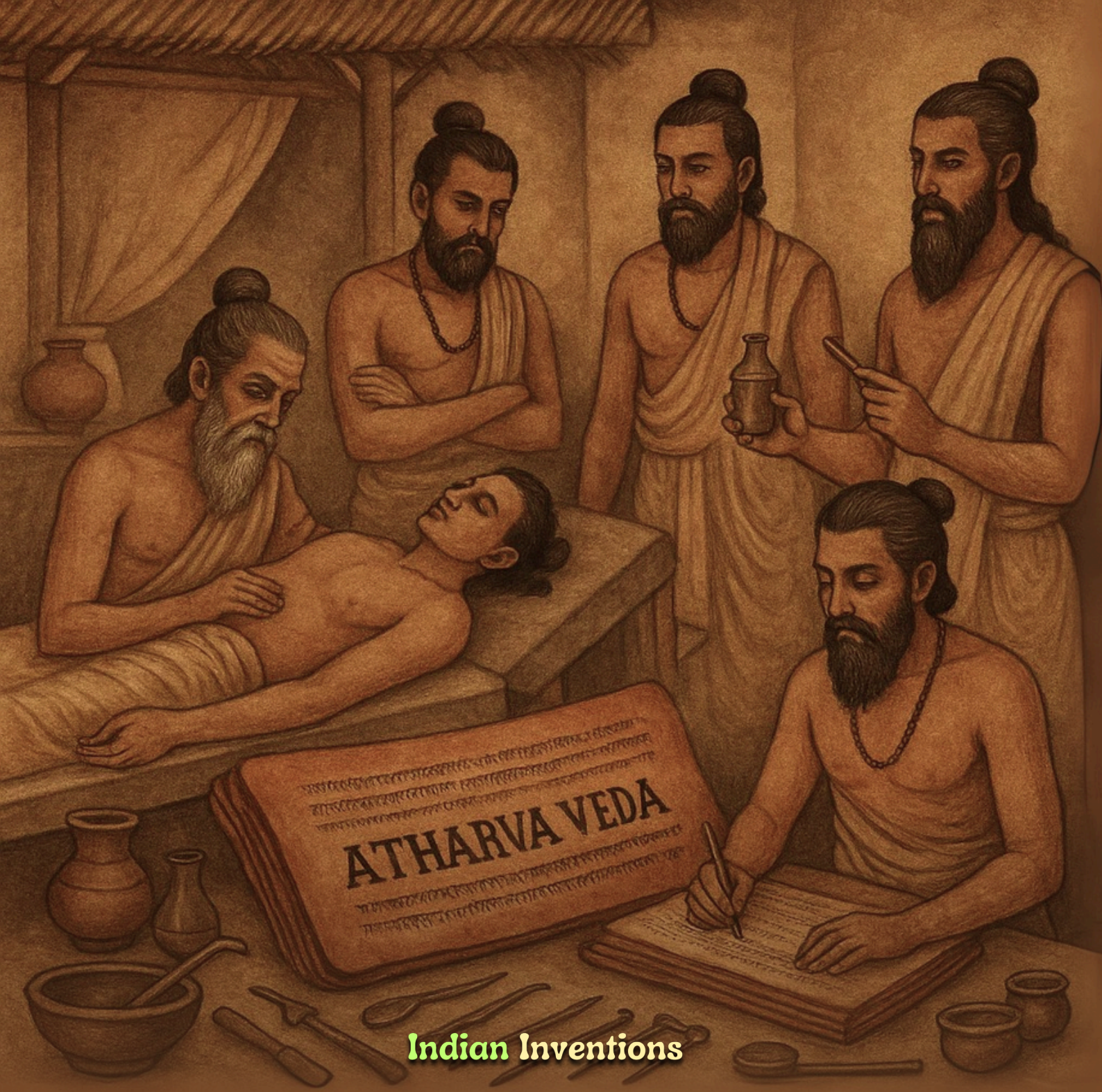
Jyotindrasinh observed that transporting a patient quickly to the nearest hospital with first aid support can be challenging, especially when the patient's condition is critical. To address this issue, he developed an all-in-one stretcher. The design includes bedding, a hydraulic system, airbags, a three-wheeled system, chains, plain wheels, and sliders.



Jyotindrasinh Gajendrasinh Chauhan
6th Class

Thanks to its unique structure, this stretcher can be used in difficult geographical conditions such as high-rise staircases, icy surfaces, rough roads, and other challenging terrains. According to the student, this model can help save lives by providing rapid assistance during emergencies.

(Source: INSPIRE MANAK NLEPC 2022 Booklet)



Indian Inventions

Cure For Leprosy

Unravelling the Cure for Leprosy!

Imagine a time when a daunting disease caused severe disfigurement and social isolation, with no real hope for recovery. For centuries, that was the grim reality of leprosy. But did you know that the earliest understanding and even remedies for this challenging illness might have emerged right here in India, long before modern medical science? It's a remarkable tribute to our nation's deep and proud history of scientific and medical discovery!

India has long been a hub of innovation, and our ancient texts hold incredible wisdom. While the specific discoverer remains unknown, the **Atharva Veda (1500-1200 BCE)**, one of our oldest sacred texts, mentions both leprosy and special healing practices for it. This was even before the **Sushruta Samhita (6th century BCE)**, a foundational ancient surgery book, which also discussed leprosy and other conditions like the formation of body stones. This rich historical background highlights how India has consistently contributed to the global understanding and eventual cure of this once-feared disease.

What is Leprosy Today?

Leprosy, also known as Hansen's disease, is a long-term infection caused by a tiny germ called *Mycobacterium leprae*. It mainly affects the skin, nerves, and breathing passages, leading to patches on the skin, numbness, and muscle weakness. In the past, it led to noticeable changes in appearance, and people faced much unfairness and isolation. The good news? Today, leprosy is completely curable!

The Cure: A Modern Triumph (with Ancient Echoes!)

The biggest breakthrough arrived in the 1980s when the World Health Organization (WHO) introduced **Multi-Drug Therapy (MDT)**. This revolutionary treatment uses a combination of strong antibiotics: **Rifampicin, Dapsone, and Clofazimine**. Taking these medicines for 6 to 12 months completely eliminates the bacteria, stops the disease from getting worse, prevents further nerve damage, and renders the person non-infectious.

While MDT is a true marvel of modern medicine, it's fascinating to consider that India was already observing, documenting, and attempting to treat this disease thousands of years ago. Our ancestors' early insights, though basic by today's standards, hinted at the comprehensive approach seen in modern MDT – addressing the disease's effects throughout the body.

India's Continuing Role: Awareness and Eradication

Finding leprosy early is crucial to prevent serious problems like lasting nerve damage, physical changes, or even blindness. Signs can include lighter or darker skin patches, loss of feeling, or weak muscles. If detected promptly, MDT can stop all these issues.

India has been a key player in the global fight to get rid of leprosy. Thanks to widespread awareness campaigns and the free availability of MDT, the number of leprosy cases has significantly decreased worldwide. However, it is still present in some parts of India, Brazil, and Indonesia. Our nation continues to be a vital participant in the global fight, focusing on quick diagnosis and ensuring free treatment reaches everyone who needs it.

A Future Without Fear

The journey from ancient remedies to modern MDT showcases humanity's persistent fight against illness. India's historical engagement with leprosy, combined with its current leadership in its elimination, stands as a strong testament to our nation's ongoing dedication to health and scientific progress. We can anticipate a future where leprosy no longer causes suffering or discrimination, and the disease is entirely eradicated.

Innovation Training Module

Poster Presentations

Master the Art of Poster Presentations



Poster presentations are how bright minds, from schools to top research labs, visually showcase their incredible work.

Instead of just writing a report or talking for ages, a poster lets you tell your story in a super engaging and interactive way. It's a chance to transform your research into an eye-catching display and become a confident presenter.

So, are you ready to master this unique skill and make your discoveries pop? Let's dive in!

What is a Poster Presentation?

Imagine your project squeezed onto a big, colorful board, packed with key info, catchy visuals and only the most important words. That's your poster! It's a visual summary of your work, kind of like a movie poster for your research project. You'll stand next to it during a "poster session," ready to explain your findings and answer questions.

Why is it Special?

Unlike a standard speech or a written report, poster presentations offer a unique experience:

- **It's Interactive:** Instead of talking at an audience, you're talking with them. People walk up, read and then ask questions. It's a two-way conversation!
- **More Personal:** You get to chat one-on-one or in small groups, really connecting with people interested in your specific work.
- **Visual Storytelling:** You use graphics, photos, and diagrams to make your point quickly and clearly. A picture really is worth a thousand words here!
- **Flexible Learning:** Viewers can spend more time on sections that interest them, skipping parts they already know.

Think about it: have you ever been to a science fair where a poster really caught your eye and made you want to know more? That's the power of a great poster presentation!

When and Where Will You See Them?

You'll encounter poster presentations across the world of science and education. They're common at **school science fairs** for class projects and at college admissions events for showcasing scientific work. Major **national and international science competitions** in India and globally in India and globally frequently use posters for detailed sharing. You'll also find them at **academic conferences**, from medical breakthroughs in Mumbai to physics discoveries in Bengaluru, where scientists present new research.

How to Craft a Winning Poster Presentation!

Making a great poster isn't just about printing a giant document. It requires strategy!

1. Plan Your Strategy First!

Before diving into design, carefully plan your presentation. Think: **Who is your audience?** (Do they know your topic? What will they gain? Also, consider **where** you'll present—printed or virtual? Then, **outline your content**. Gather the most interesting information from your research to draft a logical structure with clear section headlines. Finally, **write concisely**. Summarize your research, avoiding long paragraphs. Craft a **catchy title** and consistent headlines for a storytelling approach, not just copy-pasting.

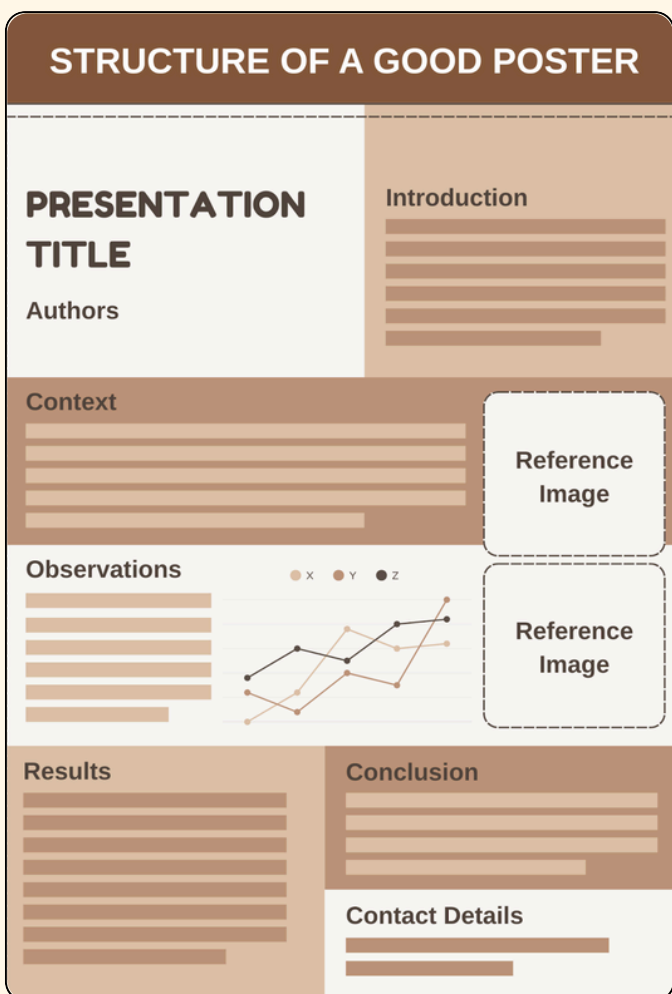
2. Crafting a Stunning Layout & Design:

Your poster needs to grab attention and be easy on the eyes.

- **Visual Appeal:** Make important points stand out with bigger fonts or bold text. Keep all elements (text, images) neatly lined up. Use empty space wisely so your poster isn't crowded.
- **Font Power:** Choose two clear fonts for titles and body text. Ensure headlines are large (e.g., 48pt or more) and main text is readable from afar (24pt or more). Use colors for text and background that provide good contrast.
- **High-Quality Visuals:** Use sharp, relevant images, charts, and diagrams. No blurry pictures

3. Delivering a Clear & Organized Message:

Your poster should tell your story quickly and logically.



- **Catchy & Concise:** Start with a short, punchy headline (aim for 6-8 words).
- **Logical Flow:** Arrange content clearly, perhaps top-to-bottom or left-to-right, using strong headings for sections (e.g., Introduction, Methods, Results, Conclusion).
- **Less Text, More Impact:** Use bullet points and short sentences for all details. Include only essential information and ensure about 30-40% of the poster is empty space.
- **Visual Storytelling:** Incorporate relevant icons, symbols, or simple infographics to explain complex ideas at a glance

4. Be Ready to Talk!

- **Practice Your Pitch:** Prepare a short (1-2 minute) summary of your project. What's the main idea? What did you do? What did you find? What does it mean?
- **Anticipate Questions:** Think about what people might ask.
- **Be Enthusiastic:** Your passion for your project is contagious! Make eye contact, smile, and show you're excited.

Your Project, Your Impact!

A fantastic poster presentation is **more than just a display**; it's a powerful way to communicate your hard work, gather valuable insights, and inspire others.

Learning to present visually is a **vital skill** for any path, from science and engineering to business, wherever clear and compelling communication is required. Turn your research into a masterpiece and prepare to engage!

Regional Centre for Biotechnology (RCB)

This is a place where cutting-edge science meets real-world problems, from fighting diseases to boosting agriculture. Regional Centre for Biotechnology (RCB) in Faridabad, Haryana! This isn't just any lab; it's an Institution of National Importance, born from a partnership between the Indian government and UNESCO. RCB is where brilliant minds are shaping the future of biotechnology for India and beyond!

Where Innovation Blooms

RCB is a vibrant hub for biotechnology education, training, and research. Think of it as a powerhouse where different scientific disciplines — engineering, medicine, and pure science — come together to find solutions.

- **Diverse Research:** RCB's scientists are tackling huge challenges in areas like Infectious Disease Biology, Cancer and Cell Biology, Agricultural Biotechnology, and even Systems and Synthetic Biology. They're working on making us healthier, our food supply stronger, and our environment cleaner!
- **Future-Ready Programs:** From MS-PhD programs to specialized diplomas and research training, RCB offers diverse pathways for students like you to become the next generation of biotech innovators.

State-of-the-Art Science

This center boasts incredible facilities! Imagine working with...

- High-resolution optical imaging and electron microscopy to see life at its tiniest scales.
- Advanced platforms for genomics and proteomics to study genes and proteins.
- A BSL-3 facility for safely handling serious pathogens.
- The Indian Biological Data Centre (IBDC), a national hub for all kinds of biological data.

Global Connections

RCB isn't just local; it's global! It serves as a regional hub for biotech cooperation among Asian UNESCO member countries and collaborates with international giants like the **European Molecular Biology Organization (EMBO)** and Japan's AIST. This ensures a constant exchange of ideas and the latest scientific advancements.

RCB is truly a beacon for science and innovation, fostering interdisciplinary approaches to solve real-world problems. Could your future be in biotechnology?



S&I Article

The Science of Seed Bombs

Help Reforest Your Community



Imagine reforesting barren land or making flowers bloom in vacant lots, without traditional planting. This is possible with seed bombs: a simple yet impactful method for ecological restoration. By dropping a small ball of soil packed with clay, individuals, especially volunteers and students, can actively participate in restoring green cover.

Amid deforestation and urbanization, seed bombing in India offers an inexpensive, interactive way to promote sustainability and biodiversity.

What are seed bombs?

Seed bombs are small balls made from clay, compost, and seeds, designed to be tossed onto the ground. The clay protects the seeds until conditions are right for germination. Since they don't require digging or direct planting, they're ideal for inaccessible areas such as abandoned lots or even roadsides.

In India, the best time to use them is just before the monsoon, when rainfall provides the moisture needed for sprouting. The government, environmentalists, and students nationwide are adopting seed bombing as a cost-effective way to combat desertification and restore ecosystems.

Did you know that even “YOU” can make a Seed Bomb?

Materials Needed

- **Seeds:** Any plant of your choice.
- **Clay:** Acts as a protective layer for the seeds.
- **Compost or Cow Dung:** Provides essential nutrients.
- **Water:** Helps to bind the mixture together.

Procedure

1. **Mixing:** Combine 5 parts clay with 1 part compost/cow dung.
2. **Adding Seeds:** Mix seeds into the mixture, ensuring even distribution.
3. **Forming Balls:** Add water gradually to form a dough-like consistency, then shape into balls to 2-3 cm in diameter.
4. **Drying:** Allow the seed bombs to dry in a shaded area for 24-48 hours.

How to plant with seed bombs?

Just scatter the dried seed bombs across your chosen area. That's it!

As rain falls, it slowly breaks down the clay, giving the seeds the moisture they need to sprout and grow.

Benefits and Challenges

Benefits:

- **Eco-friendly:** All ingredients are biodegradable.
- **Cost-effective:** Inexpensive to make, especially in bulk.
- **Easy to Use:** Can be made or used by anyone; no special tools or expertise needed.
- **Educational:** Offers a hands-on approach for students to learn about biology, ecology, and sustainability.

Challenges

- **Success depends on timing:** Without adequate rain, seed bombs may not break down properly.
- **Seed selection matters:** Using non-native or invasive plant species can harm local ecosystems.
- **Predation:** Animals or birds may eat seeds if the clay cover is too thin.

- **Not suitable for every terrain:** Rocky or urban cemented spaces may not support seed growth due to a lack of permeable surfaces.

Success Stories

1. Delhi's Asola Bhatti Wildlife Sanctuary:

The forestry department launched a project to disperse 100,000 seed balls using drones and catapults to enhance green cover.

Result: Within a year, satellite images and field assessments showed increased vegetation, especially in barren zones.

2. Susunia Hills, West Bengal: Forest staff used seed bombing to restore 20-year-old infertile land, particularly effective in elephant-prone areas where sapling planting is difficult.

Result: Within 8–10 months, native grasses, shrubs, and trees began to grow. Biodiversity, including birds and insects, also started returning.



3. The Shri Ram School, Gurgaon: Students participated in making and dispersing seed bombs locally, promoting environmental awareness and hands-on learning.

Response: Green patches increased, and student interest in sustainability grew. Germination was observed, and the project is now part of the school's annual curriculum.



The Future of Seed Bombs

Seed bombs hold the potential to revolutionize reforestation efforts in India. As urban areas expand and natural habitats shrink, this method offers a scalable solution to restore greenery.

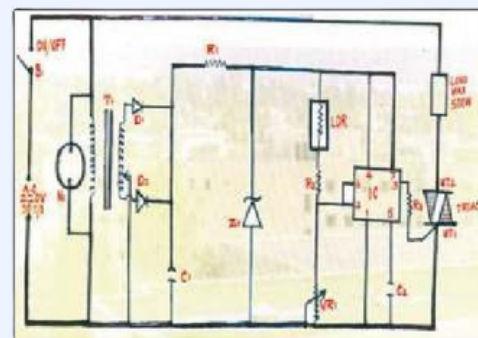
Incorporating seed bombing into the school curriculum can further instil environmental responsibility in students. Technological advancements like drone dispersal make large-scale implementation feasible, aiding in combating climate change and promoting biodiversity.

Conclusion

Seed bombs not only showcase how simple solutions can tackle complex environmental problems but also present a hands-on approach to teaching students and teachers about the practical aspects of conservation and sustainability. By embracing seed bombing, communities can actively participate in restoring the nation's green cover, ensuring a healthier environment for future generations.

Auto Switch for Energy Conservation

In the present context, energy is the master key to the all-around development of a country. As energy resources in our country are limited, we must adopt all possible measures to conserve our hard-earned energy. One common example of energy wastage is leaving lights on unconsciously, which causes a significant national loss of energy when calculated across the country.



Vishal Sahoo
8th Class

Vishal came up with a solution using a Light Dependent Resistor (LDR) as its key component. When light falls on the LDR, its resistance increases significantly, which causes the voltage at pins 2 and 6 of the 555 IC to drop. As a result, the TRIAC (a three-terminal semiconductor device that acts as a bidirectional AC switch) does not activate, and the bulb remains off.

However, when no light falls on the LDR, its resistance decreases, and the voltage at pins 2 and 6 increases. This triggers the output pin (pin 3) of the 555 IC to send a DC current, which activates the TRIAC, thereby switching the bulb on. This solution regulates unnecessary usage of lights when sufficient daylight is available and thereby conserves energy.

(Source: INSPIRE MANAK NLEPC 2012 Booklet)

Automatic Self-Cleaning of Overhead Water Tank

As a high school student from North Sikkim, Leyangreep noticed that while groundwater is commonly used to fill overhead tanks, not much attention is given to cleaning the silt, muck, and debris that settle at the bottom. Over time, this can lead to unclean water and even cause waterborne diseases.

To solve this issue, he designed a self-cleaning water tank system. The setup has a silt remover pipe connected to the bottom of the tank.



Leyangreep Lepcha,
10th Class

Attached to this pipe is a transparent vertical cylindrical pipe on the outside of the tank. This pipe is taller than the float valve (bulb cork) inside the tank. A sensor is placed on the pipe, just below the water outlet. When the silt level reaches the sensor, it activates an alarm, reminding us that the tank needs to be cleaned. By simply opening the valve on the silt remover pipe, the collected dirt and debris can be flushed out easily. This system helps keep the tank clean, reduces health risks, and ensures that safe, clean water is available for everyone.

(Source: INSPIRE MANAK NLEPC 2022 Booklet)

Shekhar Chintamani Mande

Structural and Computational Biologist



BORN ON 5TH APRIL, 1962, IN PUNE

Get ready to be inspired by Dr. Shekhar Chintamani Mande, a brilliant Indian scientist who has been at the forefront of understanding life's building blocks and battling big health challenges like tuberculosis. His work has fundamentally advanced how we figure out the tiny structures of things like bacteria and how we can find new ways to fight diseases, paving the way for crucial medical breakthroughs and strengthening India's scientific leadership globally.

Unlocking Life's Blueprints

Dr. Mande is a master of structural biology, which is like being a detective for proteins – the tiny machines that make our bodies work and also allow bacteria to survive. He used advanced techniques like **X-ray crystallography** to literally "see" the shapes of these proteins, especially those from **Mycobacterium tuberculosis**, the germ that causes TB. His work revealed how crucial bacterial proteins, like **chaperonins**, help the

TB bug survive inside us. Understanding these shapes is key to finding new ways to stop the disease.

Beyond the Microscope: Digital Biology

Dr. Mande did not just stop at looking at tiny structures. He is also a pioneer in **computational biology**, using powerful computers to analyze huge amounts of biological data.

He developed tools to map out **protein-protein interactions** – how these tiny machines talk to each other within a cell. This helps us understand complex biological networks and pinpoint weaknesses in disease-causing organisms.

A Leader for India's Science

Dr. Mande's impact extends far beyond the lab. As a key figure in India's science policy and administration, he has helped guide our nation's research efforts, even playing a crucial role in India's COVID-19 response! His dedication to science communication ensures that complex discoveries reach everyone.

He has been honored with prestigious awards like the **Shanti Swarup Bhatnagar Prize (2005)**, a testament to his groundbreaking contributions.

Dr. Mande's work truly bridges biology and technology, inspiring young minds to explore how understanding the smallest parts of life can lead to the biggest breakthroughs for our country and the world!

Raman Research Institute (RRI), Bengaluru

We all read about Sir C.V. Raman's Nobel-winning Raman Effect, a fundamental discovery about light, in the previous magazine issue. But his genius extends beyond that. He also founded the Raman Research Institute (RRI) in Bengaluru in 1948, creating a vibrant hub where his legacy lives on. RRI continues his tradition of hands-on, curiosity-driven science. Today, RRI stands as a hub where students, researchers and scientists work together to explore the secrets of the universe.



Exploring the Universe, One Discovery at a Time

Since 1972, RRI, an autonomous institute supported by the Indian Government, has been a leading hub for physical sciences.

- **Astronomy & Astrophysics:** Fascinated by black holes and galaxies? Scientists here study radio waves from space, exploring pulsars, the Milky Way, and cosmic background radiation.

- **Light & Matter Physics:** They delve into how light interacts with materials, including quantum optics. RRI notably demonstrated quantum key distribution, a super-secure messaging method using quantum physics, vital for future cybersecurity.
- **Theoretical Physics:** This team uses math and logic to understand concepts like quantum gravity and general relativity, foundational for technologies like GPS and space travel.

Global Reach, National Impact

RRI's achievements span various fields, from pioneering **radio astronomy** in India to making significant discoveries in **soft condensed matter research** (like liquid crystals). They also develop advanced instruments, contributing to national projects like **LIGO-India**.

The institute collaborates with top national (IISc, TIFR) and international (Cambridge, MIT) organizations, promoting advanced research and interdisciplinary innovation. RRI upholds Raman's experimental tradition, preserving his instruments and research. Pure science at RRI, driven by curiosity, continues to lead India's scientific progress.



Indian Inventions

Lunar Water

The Moon's Hidden Treasure

What if the driest-looking place in the sky is actually hiding water? Let's explore how the Moon went from "dry desert" to "cosmic oasis".

Water on the Moon? Seriously?

Look up at the Moon on a clear night. That glowing ball seems cold, dusty, and dry. For a long time, scientists believed that the Moon was completely waterless. After all, there's no atmosphere, no clouds, no rain, no oceans, nothing like Earth.

But that changed with one simple question: What if the Moon isn't as dry as we think?

In 2009, NASA's LCROSS mission decided to crash a rocket into a dark crater at the Moon's south pole to see what would fly out. And what flew out wasn't just dust, it was water vapor and ice particles. Decades of assumptions gone in an instant.



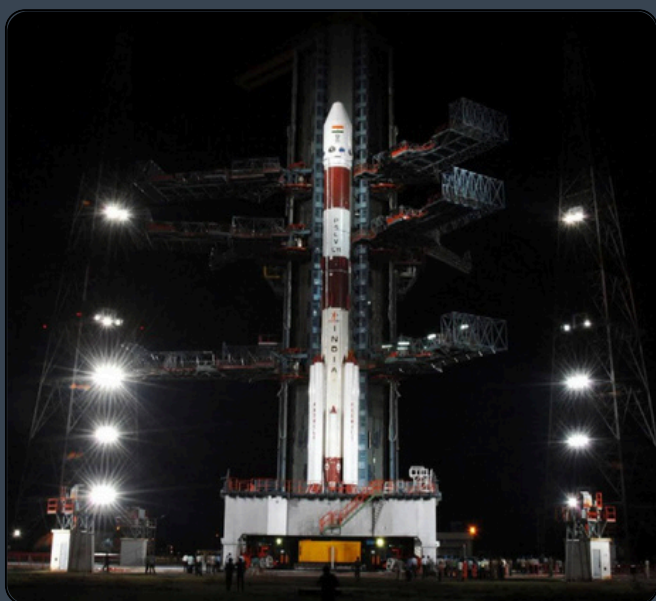
And here's the best part: India's Chandrayaan-1 orbiter had already spotted signs of water using an onboard NASA instrument called the Moon Mineralogy Mapper (M3). It detected water molecules (H₂O) and hydroxyl (OH) in the Moon's surface soil.

How does ice stay frozen when there's no refrigerator up there?

Some parts of the Moon are always in shadow. These areas, called permanently shadowed regions (PSRs), are so cold (as low as -240°C) that ice can stay frozen for billions of years. These are found in craters near the lunar poles that sunlight never reaches, not even a single beam.

Where Is This Lunar Water Hiding?

- **Permanently shadowed regions**
- **Molecules in the Lunar Soil:** Water molecules are also mixed with Moon dust in very small amounts. Imagine microscopic beads of water stuck to grains of dirt. This water comes and goes, depending on how much sunlight hits the surface.



Chandrayaan-1

- **Thin Water Vapour in the Exosphere:** The Moon doesn't have a real atmosphere, but it has a super-thin "exosphere" where some water molecules float around briefly before escaping into space.

Why Does Lunar Water Matter?

Rocket Fuel Production: Water (H₂O) can be split into hydrogen and oxygen, the building blocks of liquid rocket fuel. Future missions could use Moon water to refuel on the Moon itself, saving huge costs of launching everything from Earth.

Sustaining Life: Astronauts need water to drink, grow food and even breathe (by extracting oxygen).

Moon Bases and Beyond: Permanent lunar bases (yes, like in sci-fi movies) become more realistic when local water is available. It could serve as the foundation for deeper space missions to Mars and beyond.

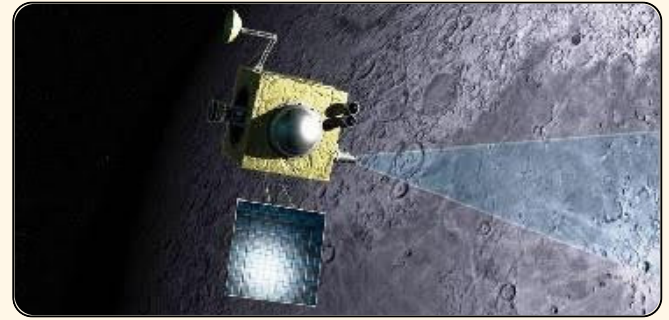
In short, water is the key to turning the Moon from a pitstop into a platform for space exploration.

Challenges in Extracting Lunar Water

Difficulty in Extraction: Most of the Moon's water is locked inside lunar soil or trapped in tiny glass beads left behind by ancient volcanic eruptions.

To get that water out, we'd need to heat, melt or chemically process the material. It takes a lot of energy, and that's not easy to come by in a place with no power plugs.

Harsh Lunar Conditions: The Moon is a Temperature Nightmare. In sunlight, it can reach 121°C (250°F)—hot enough to boil water.



Chandrayaan-1 Rover

In the shade, temperatures can plunge to -157°C (-250°F), cold enough to freeze steel.

So any tanks, pipes, or machines would need to survive both blazing heat and deep freeze, sometimes within a few feet of each other.

Small Quantities: Yes, lunar water is precious, but there are relatively small amounts of ice or molecular water.

To support astronauts, build Moon bases, or make rocket fuel, we'd need to mine and process huge volumes of dusty material, all for just a few drops of water. The cost, effort and tech needed are still being figured out.

Missions and the Future

- NASA's Artemis Program aims to return astronauts to the Moon and explore its south pole, where ice is most likely to be found.
- India's Chandrayaan-3 successfully soft-landed near the south pole in 2023. Its robotic rover confirmed mineral data and is part of a broader effort to understand lunar water chemistry.
- China's Chang'e missions are gathering lunar samples and bringing them back to Earth for analysis.

So the next time you gaze at the Moon, remember: it's not just a glowing ball in the night sky. It's a cosmic oasis, holding the key to our future among the stars.

Cover Story

LOW-COST INNOVATIONS



Introduction

Imagine solving big problems with simple, affordable ideas—using just a plastic bottle, cardboard, or a drop of water! Low-cost innovations are creative and practical solutions that use everyday materials to make life better, especially in places like India, where resources may be limited. They use local or recycled materials, cost little to make, and are easy to scale.

These innovations are not just inspiring, they're something you can try at home or school to spark your own scientific discoveries.

This cover story explores how low-cost innovations work, why they matter, and how you can create your own to make a difference.

Why do they matter?

They empower communities, especially in developing countries like India, to solve problems sustainably.

Where are they used?

From rural villages to urban schools, these innovations are everywhere. You can find them in small workshops, local markets, community health centers or even at your own home. They show up wherever there's a need and a clever mind ready to find a simple solution.

When did they start?

They've been around for decades, but India's focus on economic and grassroots solutions has grown since the 2000s.

Who makes them?

Ordinary people, students, farmers, and often supported by organizations like the National Innovation Foundation (NIF) and SRISTI.

How is it done?

Want to invent your own low-cost solution? It's simpler than you think!

1. **Spot a Problem:** Start by keenly observing what's bothering people or what's too expensive around you.
2. **Use What's Available:** Get resourceful! Look for everyday, affordable materials you already have or can easily find.
3. **Think Creatively:** Unleash your inner "jugaad" master! Cleverly combine those materials to find a simple, practical fix for the problem.

Here are a few student-friendly projects you can try for yourself or take inspiration from:

1. Water Bottle Drip Irrigation System

What: A recycled plastic bottle that slowly waters plants.

Materials: Used plastic bottle, needle/pin and water.

How: Poke small holes in the bottle's cap using a needle. Fill the bottle with water, screw on the cap, and place it upside-down in the soil near a plant. The water drips slowly, keeping the soil moist.

Usage: Perfect for school gardens or home plants, teaching water conservation.



2. Solar Oven Using a Pizza Box

What: A cooker that uses sunlight to heat food.

Materials: Pizza box, aluminium foil, black paper, cling wrap (a transparent food wrap), scissors.

How: Line the inside of the pizza box with foil. Cover the bottom with black paper to absorb heat. Cut a flap in the lid, cover it with cling wrap to trap heat, and angle it to reflect sunlight. Place food (e.g., chocolate) inside and set it in the sun.

Usage: Melt chocolate for a quick treat or warm up a small serving of leftover roti and sabzi for a simple snack, all while learning about the amazing power of solar energy!



A pizza box oven with a student cooking food in sunlight.

3. Handmade Microscope Using a Water Drop

What: A smartphone and a water drop to magnify tiny objects.

Materials: Smartphone, clear plastic sheet, water dropper.

Materials: Smartphone, clear plastic sheet, water dropper.



How: Place a small drop of water on the plastic sheet. Hold it over your phone's camera lens. Place a small object (e.g., a leaf) under the drop and look through the camera to see it magnified.

Usage: Explore leaves, insects, or fabric to learn about optics and biology.

Advantages and Challenges

Advantages:

- **Affordable:** Uses cheap or recycled materials, accessible to everyone.
- **Sustainable:** Reduces waste and promotes eco-friendly solutions.
- **Scalable:** Easy to replicate in schools, homes, or villages.
- **Empowering:** Encourages students to solve local problems creatively.

Challenges:

- **Durability:** Recycled materials may wear out quickly (e.g., plastic bottles degrade).

- **Scalability Limits:** Some solutions may not work for large-scale needs.
- **Awareness:** Students and communities may not know about these innovations.
- **Skill Gaps:** Basic knowledge of science or design may be needed for complex projects.

Types of Low-Cost Innovations

1. Frugal Innovation

Think “*doing more with less.*” These are smart, affordable solutions made with minimal resources. They’re simple, eco-friendly, and easy to replicate.

Great examples include the **Mitticool Fridge** (made of clay, no electricity!) and the **Jaipur Foot** — both life-changing, budget-friendly inventions.

2. Jugaad

Ever heard of 'Jugaad'? It's a fantastic Hindi word for clever, on-the-spot fixes using whatever's around. It's about solving problems fast and cheap! Imagine a fan made from scooter parts or a bike-turned-ambulance — Jugaad is pure DIY genius powered by local creativity.

3. Grassroots Innovation

These are solutions developed by everyday people, often in rural or local communities, without formal training.

They arise from real needs and use local materials. Think of a tree-climbing tool or a washing machine powered by a bicycle — created *by the people, for the people.*

4. Disruptive Innovation

Starts small, grows big. These are low-cost solutions that eventually transform entire industries. Remember how digital cameras took over film? Or how apps like Uber changed travel? Disruptive innovations begin small but make a big splash.

5. Social Innovation

These innovations aim to do good. They tackle challenges like poverty, education, and access to energy. From solar lamps in villages to free learning on Khan Academy — social innovations put people and planet first, not profits.



Other Types of Innovation

These innovations differ from low-cost ones because their primary focus isn't necessarily on being cheap to create or use. They often involve significant investment in technology or strategy.

Business Model Innovation changes how companies work and make money, like Netflix's subscription streaming instead of DVD rentals.

Business Model Innovation changes how companies work and make money, like Netflix's subscription streaming instead of DVD rentals.

Process Innovation improves internal methods for efficiency (e.g., Amazon's robots), making operations smoother.

Technology and Digital Innovation uses advanced tech like AI for new digital solutions.

Design Thinking is a creative problem-solving process that explores user needs deeply.

These approaches involve major strategic shifts, making them quite different from simple, low-cost creations.

Success Stories

India is a hub for low-cost innovations that inspire students:

Mitticool Fridge: Mansukhbhai Prajapati, a potter from Gujarat, created a clay fridge that keeps food cool without electricity. It costs less than ₹3000 and is used in rural homes. Students can experiment with clay to understand cooling mechanisms.



Mansukhbhai Prajapati with his Mitticool fridge.

- **Jaipur Foot:** A low-cost prosthetic limb developed by Dr. P.K. Sethi, costing as little as ₹1500, has helped millions walk again. Students can study its design to learn about biomechanics.
- **Tata Nano:** Launched in 2008, this “people’s car” was designed for India’s middle class, showing how frugal innovation makes products affordable.

Future Impact

Low-cost innovations can shape India’s future by making education, healthcare, and agriculture accessible to all.

For students, these projects build STEM skills, spark curiosity, and open doors to careers in science and technology.

Imagine a future where every school has a “maker lab” for students to create their own innovations, or where rural communities use student-designed solutions for water or energy needs.

By 2030, India’s Digital India and Startup India initiatives aim to support such innovations, creating opportunities for young scientists.

Conclusion

Low-cost innovations prove that you don’t need big budgets to make a big impact. From a water bottle irrigation system to a clay fridge, these ideas show how creativity and science can solve real-world problems. High school students like you can start small—try one of the projects above in your school or backyard. Join organizations like the National Innovation Foundation or SRISTI to share your ideas. Your innovation could be the next big thing for India!

AutoSwitch—Intelligent Room Occupancy-Based Automation System

AutoSwitch is a cost-effective and efficient automation system that counts the number of people inside a room and activates lights and fans accordingly. AutoSwitch intelligently counts the number of people entering and exiting a room using two ultrasonic sensors. Sensor 1 is installed outside the room, and Sensor 2 is inside the room.



Ashish Kumar,
12th Class

The system assigns a True value when a person comes within a specified distance from a sensor. The algorithm works as follows:

- If the True signal appears in the increasing order of sensor numbers (Sensor 1 → Sensor 2), it indicates that a person has entered the room.
- If the True signal appears in the decreasing order (Sensor 2 → Sensor 1), it indicates an exit.

Each event updates a person count variable and the current count determines whether to activate or deactivate the room's lights and fans. Additionally, a temperature sensor is incorporated to optimise resource usage further.



(Source: GYS Avishkar Awards 2024Booklet)

Smarty Washer

The Smarty Washer is a hygienic utensil-cleaning solution specifically designed for street food vendors and bachelors. Recognizing the common but unhygienic practice of reusing the same water to wash utensils, this project offers an affordable, compact, and practical solution, improving hygiene while saving both time and effort.



Rudraksh Chaturvedi
7th Class



Atul Pandey
7th Class

This project introduces a three-chamber system that automates the cleaning process. Starting in the first chamber, utensils are sprayed with high-pressure water. In the second chamber, utensils are cleaned using motorised soap dispensers and rotating scrubbing brushes. Then utensils are again sent to the first chamber for rinsing. Finally, the warm air mechanism in the third chamber dries the utensils for their reuse.

(Source: GYS Avishkar Awards 2024Booklet)

Gopalaswamy Doraiswamy Naidu

The Edison of India



23 MARCH 1893 – 04 JANUARY 1974

Have you ever imagined building a car, a fan, or even an electric razor—all on your own? Gopalaswamy Doraiswamy Naidu, one of India's great inventors and engineer, did exactly that. Known as the **"Edison of India"** and the **"Miracle Man,"** Naidu turned his love for machines into inventions that changed everyday life.

Career and Contributions

Naidu only had a primary education. He began his career as a hotel server but became fascinated by machines after dismantling a motorcycle. From there, he taught himself engineering, founded Universal Motor Service in 1920, and launched one of India's first successful transport businesses.

By 1937, Naidu had built India's first indigenous electric motor, beating global standards using

local materials. He later invented India's first electric razor and motorized fan and even tried assembling India's first home-built car in the 1930s.

His contributions weren't just in electronics. Naidu:

- Modernised textile automation in Tamil Nadu
- Designed tools for agriculture and food processing
- Researched hybrid crops and worked on water conservation
- Made advances in photography and optics, building lenses and lighting systems
- Once built a house in just 11 hours

Naidu also believed in sharing knowledge. He founded institutions like Coimbatore Institute of Technology (CIT) and India's first polytechnic college, supporting hands-on education for youth.

Recognition from the Legend himself

Though he created over 100 machines, government support was limited. Yet Nobel laureate C.V. Raman praised him as a national treasure.

Naidu's legacy reminds us that you don't need a lab to become a scientist—just curiosity, courage, and creativity.

His life shows how innovation can come from anywhere, even a small-town garage. Maybe your next invention is waiting to be built too!

Science & Innovation Organization

Bose Institute, Kolkata

Imagine a place where scientific boundaries blur, where different fields of study come together to unlock new discoveries. That's the **Bose Institute (or Basu Bigyan Mandir)** in Kolkata, India's oldest and Asia's first modern interdisciplinary research center! Founded over a century ago by the visionary **Acharya Jagadish Chandra Bose**, it has been a beacon of innovation, rivaling India's top natural science research institutes.

Under the Government of India, this autonomous institution carries forward its founder's pioneering spirit, constantly pushing knowledge boundaries and building India's scientific self-reliance.

A Century of Cutting-Edge Research

Since its establishment on November 30, 1917, the Bose Institute has pioneered research that crosses traditional academic lines, aligning with global scientific trends.

Scientists here delve into fascinating areas like Functional Plant Biology, Molecular Medicine, Computational Biology, Applied Microbiology, and even Environmental Science. They're exploring everything from how plants work to understanding complex diseases and advanced physical systems.

Acharya Jagadish Chandra Bose himself directed the institute for its first twenty years, followed by luminaries like **Debendra Mohan Bose**, ensuring a legacy of excellence.

Nurturing Future Innovators

The Institute isn't just about groundbreaking research; it's also about nurturing the next generation of scientists.

- **Advanced Programs:** It offers Ph.D. programs across its interdisciplinary specialisations and even an integrated M.Sc.-Ph.D. program, drawing in bright minds eager to make a difference.
- **Impressive Facilities:** With its main campus in Bidhannagar and specialised facilities elsewhere, the Institute provides a vibrant environment for scientific exploration.

A Hub of Scientific Greatness

The Bose Institute's prestige is undeniable, having hosted numerous Nobel laureates and distinguished scientists throughout its history. It stands as a testament to India's rich scientific heritage and its ongoing commitment to pushing the frontiers of knowledge.



The true laboratory is the mind, where behind illusions we uncover the laws of truth.

- Jagadish Chandra Bose

Scientific research is not a luxury, but a necessity for the nation's development.

- Meghnad Saha

Blue Sky Thinking!

Unlock Your Imagination: Dive into the Realm of Blue Sky Thinking!

Ever stare up at a vast, clear blue sky and feel like anything is possible? That feeling of limitless potential is exactly what **"blue sky thinking"** aims to capture! It's a powerful tool for sparking creativity and generating truly innovative ideas, a skill you can develop right now.

Imagine you're solving a tricky science problem. Instead of getting stuck on what's realistic, what if you just let your mind wander and dream big? That's blue sky thinking! While the phrase is more recent, the idea of thinking without limits has always existed, even in India's ancient wisdom. So, buckle up young innovators! We're about to explore this concept, why it's super useful and how you can use it to achieve great things

What exactly is this "Blue Sky" stuff?

At its core, blue sky thinking is a creative brainstorming method where you come up with ideas without any initial rules or limits. Think of it as a mental freefall where you let your thoughts fly without the immediate pressure of whether they're practical or easy to do.

- **No Limits (At First!):** The main idea is to put aside judging ideas and forget about things like money, time, what technology we have or even how things normally work. The first goal is to get lots of new and wild ideas, not to worry about doing them right away

- **Focusing on "What If?":** Blue-sky thinking thrives on asking open-ended questions that push boundaries. "What if our school had a garden that magically grew all the food we need for everyone?" This simple question is incredibly powerful; it forces us to step beyond existing limits and imagine alternative realities.
- **Dreaming Big:** It's about picturing the best possible outcome, the most exciting solution or the wildest idea, even if it seems impossible right now. These "impossible" ideas can often lead to more clever yet practical solutions later on.

Why Unleash Your Inner "Blue Sky" Thinker?

So, why should you, as a budding scientist or innovator, care about blue sky thinking? Here are some strong reasons:

- **Sparks True Innovation:** By ignoring early limits, you open the door to ideas you might never have thought of before. This is often where truly new and game-changing innovations begin.
- **Breaks Through Stuck Thinking:** When you're stuck on a problem, blue sky thinking can help you escape old ways of thinking and see things from fresh angles.
- **Generates Many Options:** This free-flowing way of thinking leads to a much –

larger pool of ideas. This boosts your chances of finding really effective and creative solutions.

- **Encourages Teamwork:** When a group uses blue sky thinking without judging ideas, it creates an open and friendly space where everyone feels comfortable sharing even their wildest thoughts.
- **It's Fun!** Letting your imagination run free can be an enjoyable and energizing process, making tough problems feel more like an exciting adventure.

Blue Sky in Action: Ideas for Young Indian Innovators

How can you use blue sky thinking in your life as a high school student? Here are a few ways:

- **School Science Project:** Instead of just making a standard volcano, imagine: "What if we could create a device that cleans all the polluted air in our city using only sunlight and things we can easily find?" This might lead you to explore clever ways to filter air or use living things to clean up.
- **Tackling Local Issues:** Think about problems in your community, like managing waste. A blue sky approach could be: "What if our neighbourhood had a system where all trash magically turned into useful things, with nothing wasted?" This could spark ideas about advanced recycling, converting waste into energy or even local sharing platforms to reduce waste.
- **Science Club Challenges:** For a club activity, try: "What if we could talk to plants and they could tell us what they need?" This seemingly impossible question could –

lead to amazing explorations of plant biology, how living things communicate or even inventing new kinds of sensors.

Notice that the first "what if" questions might sound a bit like fantasy. But they open up paths for exploring ideas that more normal questions might miss. Later, you can always bring the ideas back down to earth and figure out what you can actually do.

Great Minds, Limitless Thinking: Inspiration from History

Many great innovators throughout history likely used a form of blue sky thinking, even if they didn't call it by that name

- **Albert Einstein's "Mind Experiments":** Einstein often used "thought experiments," imagining situations in his head without needing a real lab. His famous idea about riding on a beam of light led to his revolutionary theories about how space and time work. He dared to imagine what seemed impossible.
- **The Wright Brothers' Dream of Flight:** For hundreds of years, people dreamed of flying. The Wright brothers didn't just try to make better gliders; they dared to imagine a machine heavier than air that could fly by itself. Their first ideas might have seemed crazy, but they kept going and changed history.
- **India's Space Program:** India's journey into space began with a bold vision. Remember our Bollywood superhit movie, *Mission Mangal*? It's a perfect example of "blue sky thinking" Faced with a huge challenge – reaching Mars on a tiny budget.

But scientists didn't quit. Instead, they got super creative, even using everyday ideas like making "puris" to solve complex space problems. This shows that by dreaming big and thinking outside the box, you can achieve amazing things, even when it seems impossible

From Big Dreams to Real Results: Making Ideas Happen

Remember, blue sky thinking is just the start. Once you have a lot of wild ideas, the next steps involve careful thinking, checking facts, and figuring out what's practical. You'll need to decide which ideas are worth pursuing, understand what might stop you, and then work out how to make them a reality.



So, the next time you face a challenge or want to come up with something new, take a moment to look at the "blue sky" of possibilities in your mind. Don't be afraid to dream big, think freely, and let your imagination fly. You never know what amazing ideas you might discover!

Word Search 2505

Bird Word Search

DIRECTIONS: Find and circle all of the bird names. They may be horizontally, vertically, or diagonally placed.



	E	Y	E	K	R	U	T	W	F	I	P	R	P	V	Z	O	X	M	
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- BLUE JAY

CANARY

CRANE

CROW

DOVE

DUCK

EAGLE

EGRET

EMU

FALCON

GOOSE

GULL

HAWK

HERON

IBIS

KINGFISHER

KIWI

LARK
- LOON

MACAW

MAGPIE

ORIOLE

OWL

PELICAN

PENGUIN

PUFFIN

QUAIL

QUETZAL

RAVEN

ROBIN

STORK

SWALLOW

SWAN

TERN

TOUCAN

TURKEY

WREN

Solutions are on Inside Back Cover.

Chandrasekhar Limit & Chandrasekhar Number

Ever wondered how heavy a star can get before it explodes? Or how fluids behave in space? Well, both of these cosmic and curious questions have something in common: they're linked to one man's brilliant mind, Subrahmanyan Chandrasekhar. He won the Nobel Prize in Physics in 1983 for his work.

The Chandrasekhar Limit: When Stars Say "Enough!"

Let's start with something massive, like a dying star. When a star burns through all its fuel, what happens next depends on its mass. If it's small, it quietly shrinks into a white dwarf. But if it's too massive, boom! Supernova.

Where's the Tipping Point?

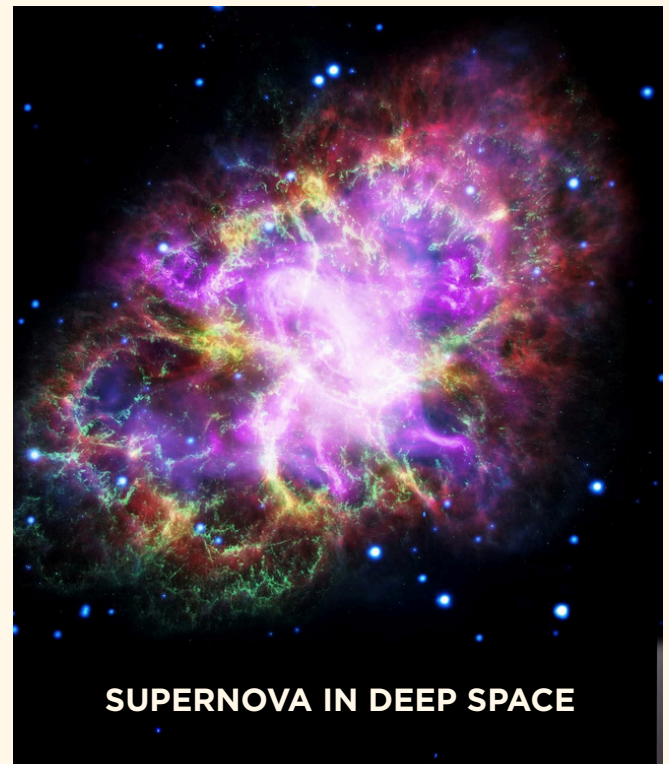
Chandrasekhar calculated that this critical mass is about 1.4 times the mass of our Sun, and this is known as the Chandrasekhar Limit. If a star is heavier than that, it can't become a white dwarf. Instead, it collapses into a neutron star or even a black hole.

The Chandrasekhar Number: Fluid Chaos

Now let's shift gears, from exploding stars to swirling fluids. Ever noticed how hot soup circulates in a pot, even without stirring? That motion is due to convection, heat rising, and fluids flowing. But add a magnetic field to that mix (like in the Sun or Earth's outer core), and things get complicated.

Here's where the Chandrasekhar Number comes in. It measures the effect of magnetic -

- forces on fluid motion, especially in magnetohydrodynamics (which studies the behavior of electrically conductive fluids interacting with magnetic fields).



Why Does this Matter?

It helps scientists understand how magnetic fields influence the flow of hot fluids, like plasma inside the Sun or molten metal in Earth's core. This insight is super useful for predicting solar storms, improving nuclear fusion reactors, and even designing advanced cooling systems for high-tech machinery!

Why did Chandrasekhar have two groundbreaking discoveries named after him?

Because he was brilliant, persistent, and didn't shy away from big, messy questions whether about stars, math, or magnetism.

Axle Camera for School Buses

Today, many parents struggle to ensure their children's safe transportation to and from school. In most cases, the school bus provided by the management is the only available option.

Each year, hundreds of tragic incidents are reported in which innocent children lose their lives in school bus accidents. One of the causes is the driver not being able to see the area directly below the bus.



Mustyala Pooja Sri
7th Class

To address this critical issue, Pooja has designed an innovative wheel-mounted camera system. Cameras are installed on the axles of the bus, while monitoring screens are placed inside the bus in front of the driver. This setup allows the driver to see the area beneath the bus in real time.

If someone or something is detected under the bus, the driver can take immediate action and stop the vehicle. This simple yet effective system greatly enhances the safety of school children and helps prevent tragic accidents.

(Source: INSPIRE MANAK NLEPC 2022 Booklet)

Jogging Charger

A student has developed an innovative wearable device that generates electricity through movement. The device consists of two wooden strips that are attached to the legs using Velcro belts. As the wearer walks, the device captures muscular movement and converts it into DC electricity using a gear motor.

The generated electrical energy is stored in a battery or capacitor, where it is filtered and stabilized for practical use. To increase the output, an XL6009-E module is integrated into the system, which boosts the voltage up to 30 volts.



Adarsh
9th Class

The stored energy can be used to charge small electronic devices, such as mobile phones and earbuds. In addition, the device includes a built-in light source, making it especially helpful during early morning or late evening walks.

This wearable innovation not only promotes energy efficiency but also provides a sustainable power source for everyday needs—anytime, anywhere.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

Rekhi Centre of Excellence for the Science of Happiness (RCESH), Kharagpur

Ever thought a top engineering institute would study happiness? At IIT Kharagpur, they do just that! The Rekhi Centre of Excellence for the Science of Happiness (RCESH) is a unique place where scientists explore what truly makes us thrive. Started in 2016 thanks to a generous gift from alumnus Dr. Satinder Singh Rekhi, this center blends the ideas of happiness and positive psychology into school, work, and everyday life.

The Science of Smiles

RCESH isn't just about good feelings; it's about real scientific study! Its goal is to understand and promote well-being through research, helping create a kinder society. They do both basic and practical research, connecting new technology with old wisdom. Imagine looking at how apps can make people feel better or studying ancient ideas with science! Researchers focus on things like positive emotions, how to bounce back from tough times, mindfulness (being present), and even **Gross National Happiness (GNH)** – an idea that values a country's overall well-being, not just its money. This makes learning important for living a happy and full life.

Spreading Joy, Building Leaders

RCESH wants to make a real difference, especially for young people.

- **Academic Programs:** They create courses on happiness for individuals and groups, giving students chances for projects and training. This means you could learn about the science of well-being right alongside your engineering or science subjects!
- **Wider Reach:** Beyond the campus, RCESH holds international conferences and workshops. They share what they learn and help people grow in every way. They believe that happier students and teachers are more creative and succeed more often!

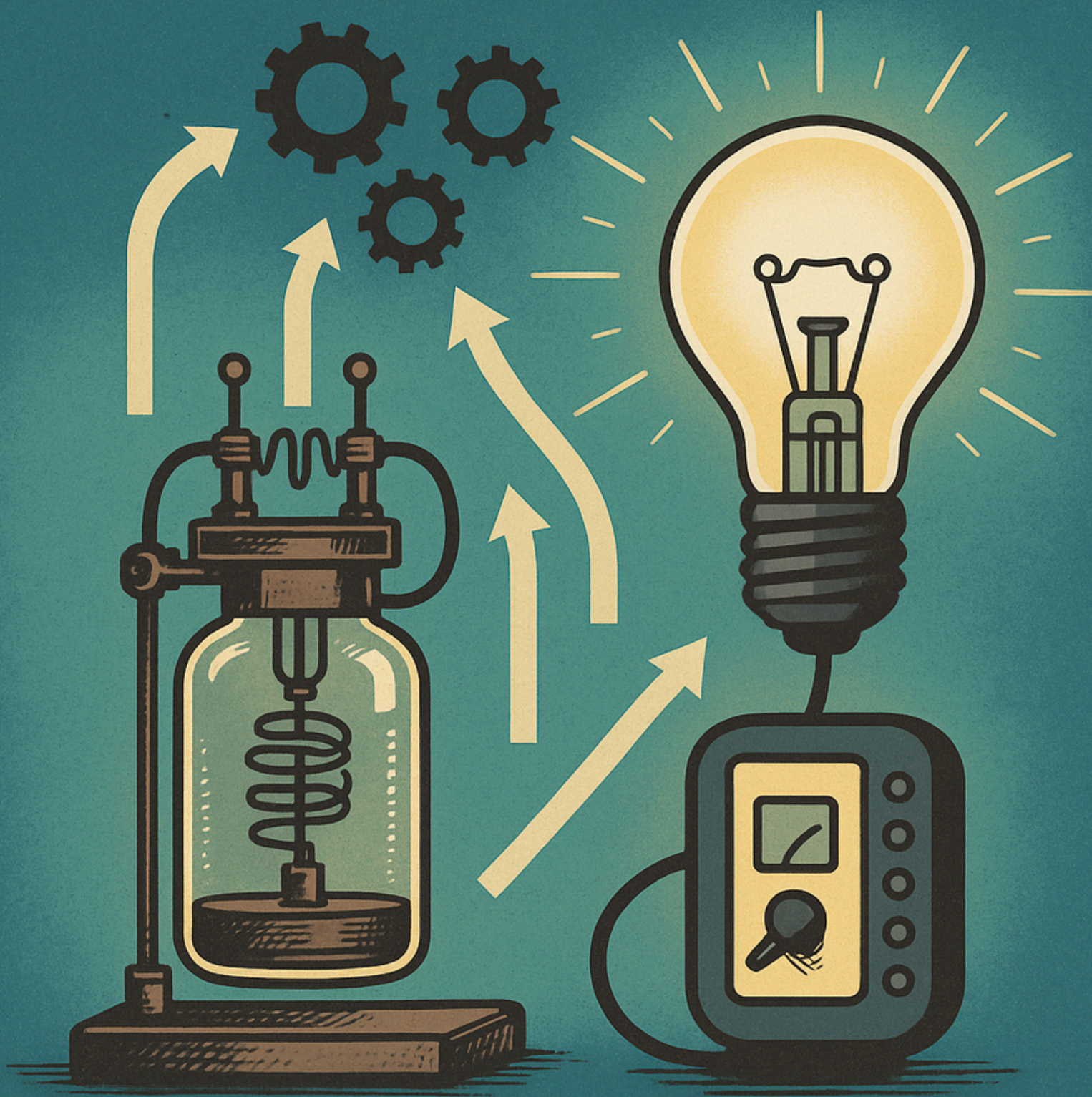


The center has amazing facilities for this research and works with groups worldwide. This helps them share ideas and stay updated on the latest in happiness science.

This center shows a modern way of thinking, proving that even in tough science, aiming for happiness is super important.

Building on the Past

How Existing Science Leads to New Inventions



Ever wonder how cool inventions like smartphones and vaccines get made? It's not just one person's sudden idea! Science builds up over time, like stacking building blocks. Each new discovery uses what was learned before. This "scientific inheritance" means scientists don't start from scratch. They look at old experiments, ideas, and theories, and then they add their own new pieces to create something amazing. So, the past isn't just history; it's the launchpad for tomorrow's coolest inventions! also started returning.

Historical Examples of Scientific Inheritance

Electricity

The history of electricity is a classic case of layered innovation.

Alessandro Volta invented the first electric battery in the 1800s.



Michael Faraday then invented electromagnetic induction, which gave us electric generators.



Thomas Edison developed prior concepts to create a workable light bulb.



Next came Nikola Tesla and his transformation of electrical transmission through alternating current (AC).

Each scientist innovated on top of the previous one to get us to the electrified world we know today.

Vaccines

The invention of vaccines also demonstrates how science from the past influences science today.

In the 18th century, Edward Jenner developed the smallpox vaccine.



Louis Pasteur later developed the concept with his work on vaccines against anthrax and rabies.



Decades of virology and molecular biology research led to the development of mRNA vaccines during the COVID-19 pandemic in the twenty-first century.

Without the efforts of earlier scientists, these discoveries would not have been possible.

How Scientists Apply What They Know?

Rarely does invention start with nothing. Examining published works, analyzing data from previous studies, or putting tested models to the test are common ways for researchers to get started. This procedure benefits them as they:

- Do not make the same mistakes twice
- Improve previous designs
- Apply proven ideas to new problems

Additionally, cross-disciplinary innovation is expanding. For instance, developments in genetic engineering have resulted from a combination of biology and technology.

Difficulties in Expanding on the Past

Building on the past isn't always a smooth ride, though! Sometimes, those "outdated concepts" or "earlier studies" might be incomplete or even plain wrong. Think about how the model of the atom kept changing as scientists learned more – it wasn't perfect from day one!

Scientists have to be super careful. They can't just blindly accept old ideas;

they need to test and question everything to make sure the foundation is solid. Plus, taking old tech and using it in new ways, like applying AI to facial recognition, can bring up tough privacy and ethical issues that need careful thought.

Most importantly, if you just copy without truly understanding, your new "discovery" might simply lead to flawed results. That's why critical thinking is just as important as knowing your history!

Advice for Aspiring Young Inventors

- Examine the problem's history before coming up with a solution.
- Examine unsuccessful experiments to understand why they were unsuccessful.
- Utilize pre-existing models as a starting point, but make innovative improvements or modifications.

Working together—combining several ideas often results in innovation.



Inventing the wheel is not the same as innovation. Sometimes it's as simple as reshaping the wheel or putting it to a new use. As students, your ideas may one day solve global challenges, like clean energy, water purification, or affordable healthcare.

These future inventions will not come out of thin air—they'll be shaped by what we already know. By understanding and applying existing science, you can turn today's knowledge into tomorrow's breakthroughs.

To sum it up...

Remember! Every big scientific leap starts with a step on the shoulders of those who came before. Your future innovations, whether it's solving climate change or curing diseases, will grow from today's knowledge.

Embrace scientific inheritance, think critically, and you'll be ready to shape tomorrow's amazing breakthroughs!



Dr. Srikumar Banerjee

Padma Shri (2005) for Contributions to Nuclear Energy



25 APRIL 1946 – 23 MAY 2021

Meet Dr. Srikumar Banerjee, a brilliant Indian metallurgical engineer and nuclear scientist whose work powered our nation! He wasn't just a scientist; he was a national hero who helped shape India's self-reliance in nuclear technology.

The Master of Materials

Dr. Banerjee's brilliance lay in understanding how materials behave, especially under the extreme conditions inside nuclear reactors. He studied **radiation damage** and **phase transformations** in metals like zirconium and uranium, ensuring our reactors run safely and efficiently. Imagine being able to make the "skin" of nuclear fuel incredibly strong – that's what he did by optimizing **fuel cladding materials** for India's power plants.

Fueling India's Future

As Director of the **Bhabha Atomic Research Centre (BARC)** and later Chairman of the **Atomic Energy Commission of India (AECI)**

and Secretary of the Department of **Atomic Energy (DAE)**, Dr. Banerjee championed **indigenous development**. This meant India built its own reactor components and developed its own nuclear fuels, reducing reliance on foreign countries.

He was a strong supporter of India's **Three-Stage Nuclear Power Program**, especially pushing for **thorium-based reactors**, a game-changer given India's vast thorium reserves.

A Legacy of Excellence

Dr. Banerjee's impact was monumental. He received:

- **Padma Shri** (2005) – Fourth-highest civilian award in India.
- **Shanti Swarup Bhatnagar Prize** (1989)— India's top science award.
- Fellow of:
 - Indian Academy of Sciences
 - Indian National Science Academy
 - Indian National Academy of Engineering
- Lifetime Achievement Award from the Indian Nuclear Society.

His 200+ research papers and mentorship inspired countless young scientists. He ensured India's place on the global nuclear stage and fostered scientific self-reliance, contributing to both our energy security and national defence. Isn't it inspiring how one person's dedication built such a strong foundation for our nation's future?

Quantum Theory and Nuclear Physics

Quantum Theory and Nuclear Physics are fundamental areas of modern physics that describe the behavior of matter and energy at microscopic scales. While quantum theory lays the foundation for understanding atomic and subatomic particles, nuclear physics focuses specifically on the properties and interactions of atomic nuclei.

Quantum Theory: A Peek into the Weird and Wonderful World

Have you ever wondered how the tiniest particles in the universe behave? Imagine a world where things can be in two places at once or spin in two directions at the same time.

Welcome to the mind-bending realm of Quantum Theory!

Quantum theory is a fundamental field of physics that studies the behavior of particles that behave in ways that defy classical physics. Classical physics describes macroscopic objects in the world around us.

Why Should You Care?

If you're using a smartphone, GPS or watching a laser light show, you're already reaping the benefits of quantum theory. It's what powers our modern technology and is shaping the future of computing, medicine and space applications.

Fundamental Principles of Quantum Theory

- **Quantization:** Energy isn't a smooth, continuous flow, it comes in packets called quanta. Think of climbing stairs (quantized) vs a ramp (continuous). Electrons can jump from one energy level to another, but can't exist between levels.
- **Wave-Particle Duality:** It states that quantum objects like light and electrons exhibit both wave-like and particle-like properties, depending on how they are measured or observed.
- **Uncertainty Principle:** You can't know both a particle's position and momentum exactly. The more you know about one, the less you know about the other. This isn't due to poor tools, it's how nature works.
- **Superposition:** Particles can exist in multiple states at once, like being "on" and "off" at the same time until measured. This is what powers the idea of quantum computers.
- **Entanglement:** When two particles become linked, their properties remain connected, even if separated by light-years. Changes in one particle leads to reactions in the other particle instantly. Einstein called this "spooky action at a distance."

Breakthroughs in Quantum Physics Around the World

Teleportation: Not Just in Movies! Scientists in China and the US have teleported quantum information (not humans yet!) across hundreds of kilometers using entangled photons.

It's called quantum teleportation, and it's the backbone of future quantum communication.

Google's 105-Qubit "Willow" Processor: It ran an application in under five minutes, whereas today's best classical supercomputer would need 10 septillion (that's a 1 followed by 25 zeros!) years to run the same application.

And in India...

Quantum Key Distribution (QKD): Researchers from ISRO and DRDO have successfully tested quantum encryption over 300+ km. This means unhackable communication for satellites, banks and defence.

QSim – India's First Quantum Simulator: Developed by IISc, CDAC, and IITs, this helps students and researchers experiment with quantum algorithms without needing a quantum computer.

Nuclear Physics - The Heart of the Atom

At the center of every atom is a tiny, incredibly dense core called the nucleus and nuclear physics is all about understanding what's going on in there.

It studies how protons and neutrons interact, what keeps them stuck together despite their electric repulsion, and what happens when the balance tips, like when atoms decay, split or fuse and release colossal amounts of energy.

Why is it so cool?

Because it's where the universe stores its most explosive secrets, Nuclear physics lets us peek inside the heart of matter and discover the forces that light up stars, fuel our cities, and –

- rewrite medical science. It explains how a tiny change in the nucleus of an atom can release more energy than burning tons of fuel. It's the science behind the Sun's endless glow, Nuclear power that could run entire countries, and life-saving radiation therapy in hospitals.

What's Happening Inside the Nucleus?

The nucleus is a party of positively charged protons and neutral neutrons, packed tightly into a space a hundred-thousand times smaller than the atom itself. But here's the twist: Protons repel each other, it's like pushing two magnets together.

So why doesn't the nucleus blow apart? That's where the strong nuclear force comes in, the true powerhouse of the subatomic world. It's an invisible force, but stronger than anything else in nature, overcoming the repulsion between protons to hold the nucleus tightly together.

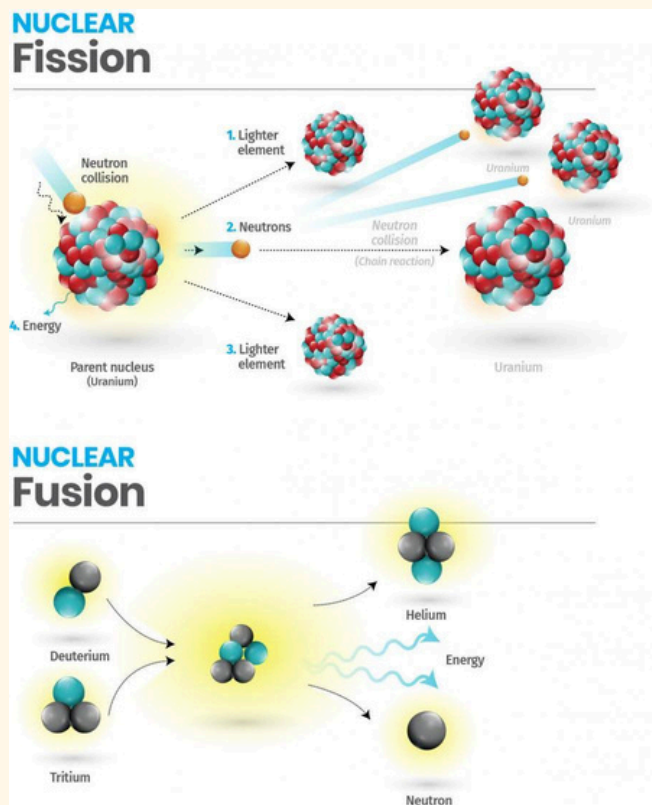
Nuclear Reactions: Power from the Core

Fission: A heavy nucleus splits into smaller ones, releasing energy. This powers nuclear reactors and atomic bombs.

Fusion: Two light nuclei merge to form a heavier one and it releases even more energy. It's how the sun works.

These processes release enormous energy, much more than chemical reactions (thanks to Einstein's famous equation: $E=mc^2$)

A tiny amount of mass becomes a huge amount of energy.



Applications of Nuclear Physics:

Medicine (Saving Lives with Atoms): When people think of "radiation", they often imagine danger. But in the right hands, it becomes a life-saving force.

- **Cancer treatment (Radiotherapy):** Targeted radiation beams destroy cancer cells without harming healthy ones.
- **Medical imaging (PET scans):** Radioactive tracers help doctors see inside your body in stunning detail.

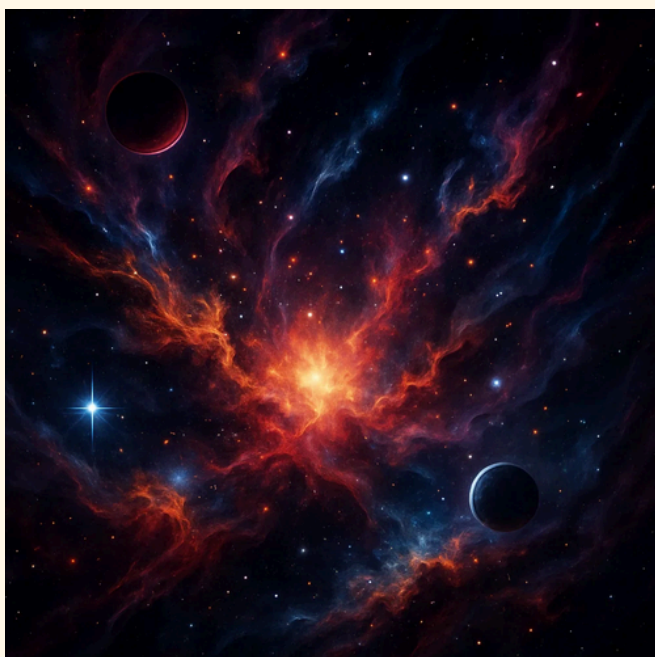
Energy (Power from the Nucleus): Split one atom of uranium, and you release millions of times more energy than burning a carbon atom. That's nuclear fission in action.

- **Nuclear power plants:** Use controlled chain reactions to generate electricity - no smoke, no carbon emissions.
- **Fusion power (future goal):** Still in development, fusion could offer clean, limitless energy, just like the sun.

Research (Probing the Secrets of the Universe):

From mapping the age of ancient rocks to discovering new elements, nuclear physics is a scientific detective tool.

- **Carbon dating:** Measures the age of fossils and artefacts by tracking radioactive decay.
- **Particle accelerators:** Smash atoms together to reveal what they're made of, and sometimes discover new particles altogether.
- **Astrophysics:** Helps us understand how stars live and die.



Security and Industry

- **Nuclear submarines:** Can stay underwater for months using compact nuclear reactors.
- **Smoke detectors:** Use a tiny bit of radioactive material to sense dangerous smoke particles.
- **Food safety:** Radiation can safely preserve food and kill bacteria without changing taste or nutrition.

Space Exploration (Power Beyond the Sun):

Solar panels don't work well in deep space, but nuclear batteries do.

- **Mars rovers:** Use nuclear power to explore where sunlight barely reaches.
- Future space missions may use nuclear propulsion for faster interplanetary travel.

Quantum Meets Nuclear – A Powerful Partnership

Nuclear physics relies on quantum theory to explain:

- How protons and neutrons behave inside the nucleus
- Why certain nuclei are stable and others radioactive
- How particles can escape a nucleus (via quantum tunneling)
- Why energy levels in nuclei are quantized, just like in atoms

For example, alpha decay (emission of a helium nucleus) is only possible because of **quantum tunneling**. Classically, the alpha particle is trapped inside the nucleus. But in quantum physics, it can "tunnel" through the potential barrier and escape, something no classical theory could explain.

Final Thoughts

Quantum theory teaches us that nature doesn't always behave the way we expect. Nuclear physics shows that immense power lies within the smallest particles. Together, they reveal a universe more mysterious, powerful, and beautiful than we ever imagined.

The universe is not only stranger than we imagine, it's stranger than we can imagine. But quantum and nuclear physics give us the tools to try.

Smart Wheelchair

Agrima designed a smart wheelchair for hospitals that integrates advanced technology to enhance both patient mobility and the overall healthcare experience.



Key features of this innovative wheelchair include:

- Navigation assistance
- IoT integration for real-time data monitoring
- Obstacle detection
- Remote control access for caregivers
- Health monitoring sensors
- Seamless connectivity with hospital management systems



Agrima Narula
10th Class

This smart wheelchair is designed to improve patient safety, streamline hospital operations, and provide a personalized and efficient mobility experience for patients.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

Manual Ditch Cleaning Machine

Udaybhan has developed a versatile solution for ditch cleaning: a manually operated ditch-cleaning machine integrated with JCB functionality. This innovative device combines the precision and power of a JCB (Backhoe Loader) with the simplicity of manual operation, allowing for the efficient removal of debris and sediment from open ditches.

The machine features a sturdy frame equipped with a JCB-style arm and bucket for heavy-duty digging and lifting. Manual controls enable the operator to maneuver easily in tight spaces and effectively clear obstructions.



Udaybhan Prajapati
6th Class

Additionally, the machine includes specialized attachments, such as:

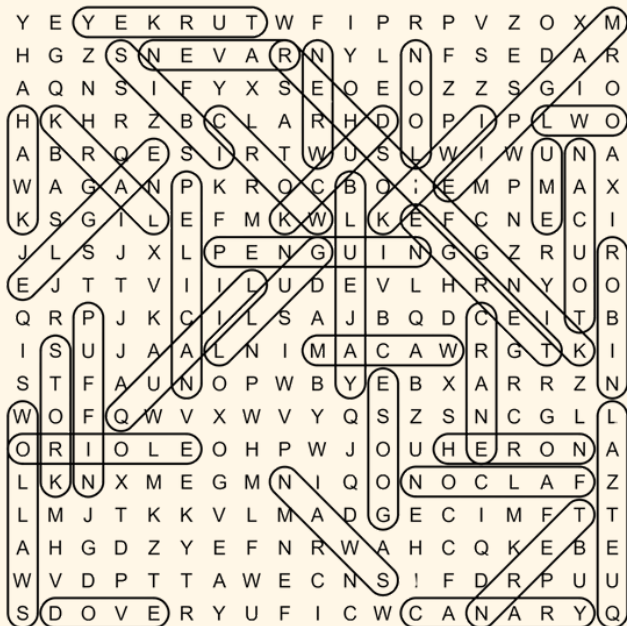
- Sieves to remove excess water from drainage waste
- A sanitiser spray to kill harmful microorganisms on the road surface

With its hybrid design, this manually operated ditch-cleaning machine offers a comprehensive and cost-effective solution for maintaining water channels across various terrains and environmental conditions.

(Source: INSPIRE MANAK NLEPC 2024 Booklet)

Key for Brain Teasers

Solution Word Search 2505



Solution Sudoku Challenge 2505

6	1	3	2	7	9	5	8	4
7	8	9	5	4	3	2	1	6
5	4	2	8	6	1	3	7	9
8	3	1	6	2	4	7	9	5
4	2	5	7	9	8	1	6	3
9	6	7	1	3	5	8	4	2
2	5	6	9	1	7	4	3	8
3	7	8	4	5	6	9	2	1
1	9	4	3	8	2	6	5	7

Riddle 2505 Answers: 1. Your Skull 2. Skin 3. Grumble 4. Eyeball

Science & Innovation Competitions to Watch



Last Date: 27-July-2025



Submissions Open



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FOR NEW INDIA USING DIGITAL DEVICES

Mock Test in September

NATIONAL CHILDREN'S
SCIENCE CONGRESS



Submissions Open

GYS *Avishkar* AWARDS 2025

A National Science Projects Competition

Theme: Low Cost Grassroots Innovation

Mode: Online Video Submission (3 to 7 mins)

Eligibility: Students from Classes 6 to 12

Winners: Certificates, Trophies, Cash Prizes

Attention: Guide Teachers are Rewarded



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One Lakh
Rupees
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for Student

₹10,000

for Guide Teacher



₹ 15,000

for Student

₹10,000

for Guide Teacher



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