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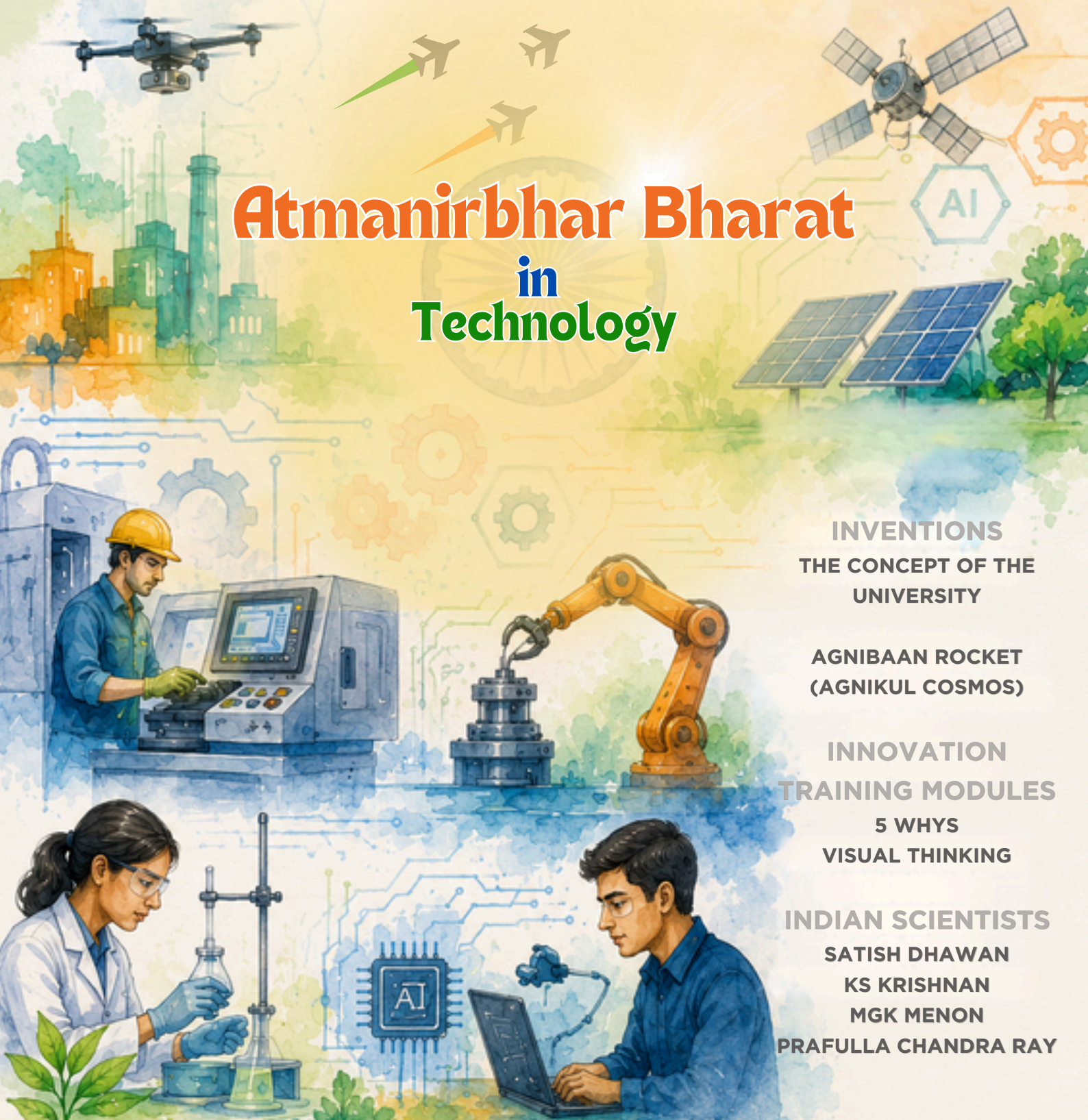
Young Scientist India

A Science & Innovation Magazine for Curious Teachers



Atmanirbhar Bharat in Technology

INVENTIONS

THE CONCEPT OF THE UNIVERSITY

AGNIBAAN ROCKET (AGNIKUL COSMOS)

INNOVATION TRAINING MODULES

5 WHYS

VISUAL THINKING

INDIAN SCIENTISTS

SATISH DHAWAN

KS KRISHNAN

MGK MENON

PRAFULLA CHANDRA RAY

Volume 02| Issue 03

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Young Scientist India

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From the Editor's Desk

Welcome, Young Scientists!

It is a pleasure to welcome you to another exciting edition of Young Scientist India. Our Cover Story, **Atmanirbhar Bharat Tech**, explores India's journey towards technological self-reliance. From indigenous innovations to homegrown scientific capabilities, this story highlights how technology can strengthen national development while inspiring young innovators to create solutions rooted in local needs and global aspirations.

This month's articles take you across fascinating intersections of science, technology and the future. In The **Language of Lines and Layers: From Barcodes to QR Codes**, you will discover how simple patterns and digital codes power communication and connectivity in our daily lives. **Climate Action Technologies** explores innovations helping the world respond to environmental challenges, while **Future Careers in Science** introduces exciting opportunities emerging across research, technology, sustainability, health, and space.

Innovation begins with the way we think and solve problems. This edition's Innovation Training Modules focus on **5 Whys** and **Visual Thinking**—two approaches that strengthen analytical and creative thinking.

We also celebrate the contributions of remarkable Indian scientists whose work shaped modern science and technology. From the visionary leadership of **Satish Dhawan** to the pioneering contributions of **K. S. Krishnan, M. G. K. Menon**, and **Prafulla Chandra Ray**, these stories reflect dedication, scientific excellence, and the courage to push boundaries.

India's spirit of innovation also comes alive through stories such as **Kojo**, the **Concept of the University**, and the **Agnibaan Rocket** developed by Agnikul Cosmos, showing how India's innovation journey spans centuries.

One of the most inspiring sections of this edition is our showcase of student innovations. Young innovators have demonstrated creativity through ideas such as **Smart Parking, Zenair Air Purifier, Multi Functional Trap Machine, Ambin Chaka, Energy Saving Device**, and **Go Green**. These innovations show how students are responding to real-world challenges with practical solutions.

This issue also introduces you to leading scientific institutions and laboratories including the **Indian Institute of Petroleum, Indian Institute of Toxicology Research, National Botanical Research Institute**, and **National Chemical Laboratory**, highlighting the importance of research and collaboration in shaping India's future.

As you explore this edition, I hope you are inspired not only to learn science, but to apply it thoughtfully and creatively in the world around you.

Stay curious. Keep exploring. The future is waiting for your ideas.

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

S&I Article

The Language of Lines and Layers

From Barcodes to QR Code

Have you ever noticed the black - and - white lines on products in a supermarket? Or scanned a square code to pay for snacks using your phone? These patterns may look simple, but they are actually a powerful **language of information.**

This language uses barcodes and QR codes, helping machines read data quickly and accurately. From shopping malls to railway tickets, from school textbooks to digital payments, these codes are everywhere in India today.

Understanding how they work is not just interesting; it opens the door to innovation, coding, and problem - solving. For students, this is a perfect example of how science and technology simplify everyday life.

What are Barcodes and QR Codes?

Barcodes and QR codes are **machine-readable patterns** used to store information.

- A **barcode** is a series of vertical black lines with spaces
- A **QR code (Quick Response code)** is a square pattern made of small blocks

Both are used to store data like:

- Product details
- Prices
- Website links
- Payment information

Why were they created?

Before barcodes, shopkeepers had to:

- Enter prices manually
- Maintain handwritten records

This caused:

- Errors
- Delays
- Inefficiency

Barcodes and QR codes were invented to:

- Speed up processes
- Reduce mistakes
- Store and share data easily

Where are they used?

They are used almost everywhere:

- Supermarkets
- Hospitals
- Libraries
- Railway stations
- Online payments

In India, QR codes are widely used for payments through apps like **Google Pay**.

When were they invented?

- Barcodes: Developed in the **1970s**
- QR codes: Developed in **1994** in Japan

Who invented them?

- Barcode: **Norman Woodland and Bernard Silver**
- QR Code: Developed by the **Denso Wave company**

How Barcodes Work

Barcodes store numbers using:

- Thick and thin lines
- Spaces between lines

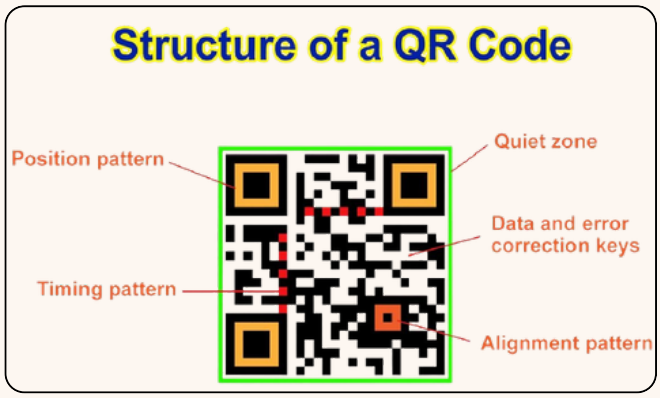
A scanner shines light on the barcode:

- Black lines absorb light
- White spaces reflect light

The scanner converts this into numbers, which are processed by a computer.

How QR Codes Work

QR codes store data in a **2D grid pattern.**

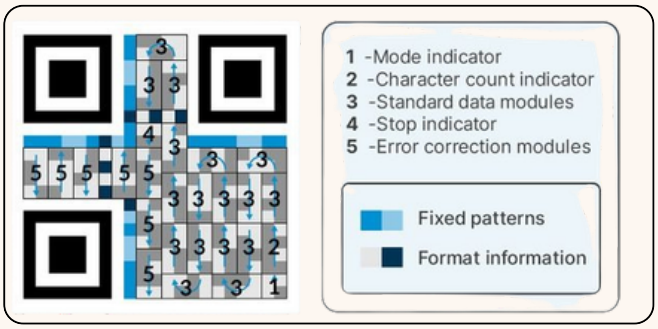


Key features:

- Can store more data than barcodes
- Can be scanned from any angle
- Faster processing

When scanned:

- The camera captures the pattern
- Software decodes it into information



Fun Fact

A QR code can store thousands of characters

Procedure of Usage in Daily Life
In a supermarket:

1. The product is scanned
2. Barcode is read
3. Price appears on the system

In digital payments:

1. The QR code is scanned
2. Payment details appear
3. User confirms transaction

Everyday Examples

In India, QR codes are used in:

- Small tea stalls
- Auto rickshaws
- School textbooks
- Government services

Advantages

They make processes faster and more efficient. They reduce human errors in billing and record - keeping. QR codes, in particular, allow instant access to information, making them useful in education, payments, and communication.

They are also cost - effective and easy to use, which is why even small businesses in India have adopted them.

Challenges

Barcodes can be damaged or unreadable. QR codes may be misused in scams if users are not careful. Internet connectivity issues can affect QR - based payments. These challenges highlight the importance of **cyber awareness and innovation.**

Success Stories

One of the biggest success stories in India is the widespread use of **UPI - based QR codes**. Today, even roadside vendors accept digital payments, making India a leader in digital transactions.

Another example is the use of QR codes in textbooks, where students can scan and access additional learning materials such as videos and explanations.

Hospitals use barcodes to manage patient records and medicines, improving efficiency and safety.

Future Impact: Beyond QR Codes

The future of this technology is exciting.

QR codes may be integrated with augmented reality, allowing users to interact with digital content in new ways. Smart packaging can provide detailed product information through scanning.

In industries, advanced scanning systems will improve automation and efficiency. Students who understand these technologies today can contribute to tomorrow's innovations.

DIY Activities for Students

1. Create Your Own QR Code

- Use a free QR generator
- Encode your name or a message
- Share with friends to scan

Learn how data is stored and shared.

2. Design a Barcode System

- Assign numbers to objects in your home
- Create simple barcodes using paper
- Simulate a billing system

Classroom Activities for Teachers

1. Scan and Learn Activity

Teachers can:

- Place QR codes around the classroom
- Link them to the study material

Students move around and scan to learn.

2. Problem - Solving Task

Ask students:

- Where can QR codes solve problems in your community?

3. Group Innovation Project

Students design:

- Smart classroom systems
- Digital school management ideas

Conclusion:

From Lines to Innovation. Barcodes and QR codes may look simple, but they represent a powerful idea: **how patterns can carry information.**

They show us that:

- Science can simplify life
- Technology can solve real problems
- Innovation can start from small ideas

For students, this is a reminder that even the simplest patterns can lead to powerful inventions.

Fun Fact!

Those large squares in the corners (and sometimes a smaller one tucked away) are "positioning detection patterns." They tell your phone's camera which way is up, so you can scan them from any angle—even upside down.

Energy Saver Multipurpose Winnowing Machine From Waste Materials

Bagul Rahul Prakash
10th Class

In many rural areas, especially in regions like Konkan, where rice is a major crop, farmers depend on natural wind to separate grain from husk through winnowing. Traditional winnowing machines are often expensive, unsuitable for small quantities, and sometimes require electricity. Small - scale farmers are left waiting for favourable wind conditions, delaying their work and affecting productivity. Recognising these challenges, this project focuses on creating an affordable, practical, and employment-generating agricultural tool using waste and easily available materials.

The machine is built using recycled components such as an old bicycle wheel rim, chain, freewheel, pedals, ball bearings, iron angles, a small fan, a wooden circle, and a dynamo. Mounted on a sturdy iron frame, the pedal-operated system generates airflow through a fan, eliminating dependence on wind or electricity, also produces up to 20 volts of electricity while operating.

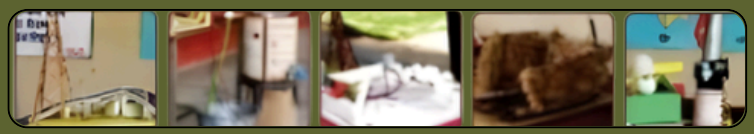
Costing approximately ₹400, the device is simple, space-efficient, and ideal for small farmers. Beyond winnowing, it can be adapted for lifting water, cutting plywood sheets, and separating sunflower seeds. This low-cost, multipurpose innovation demonstrates how waste materials can be transformed into powerful rural solutions.

(Source: INSPIRE MANAK NLEPC 2011 Booklet)

Energy Saving Device

Jaspreet Kaur
10th Class

With the threat of an energy crisis becoming increasingly real, conserving electricity has become just as important as generating it. This project presents a series of simple, practical innovations designed to reduce unnecessary power consumption in homes and public spaces. Many everyday appliances - fans, streetlights, water motors, and lighting systems - continue to run even when not required, leading to wastage. By introducing automation and smarter design, energy use can be significantly optimised without expensive infrastructure.



Thoughtful small-scale innovations can greatly improve energy efficiency and sustainability. Automatic ceiling fans, LDR-based streetlights, relay-based motor cut-offs, shared bathroom lighting, improved desert coolers, and energy-recycling tandoors help save electricity and reduce wastage. Solar-powered devices and automated streetlights further lower dependence on conventional power, especially in rural areas, while replacing tungsten bulbs with CFLs can save up to 70% energy. Together, these solutions effectively sustainably address large-scale energy challenges.

(Source: INSPIRE MANAK NLEPC 2011 Booklet)

Indian Scientist

Satish Dhawan

Padma Vibhushan (1981), Padma Bhushan (1971)

(25 September 1920 – 3 January 2002)

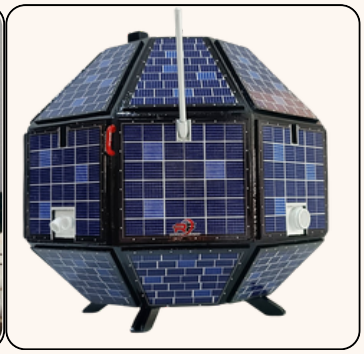
While many know the names of India's space pioneers, **Satish Dhawan** stands out as the visionary who transformed the Indian Space Research Organisation (ISRO) into a world - class powerhouse. A brilliant **mathematician and aerospace engineer**, Dhawan was born in Srinagar and cultivated his genius through a diverse education spanning both India and the United States. He is widely remembered as the "Father of Experimental Fluid Dynamics" in India.

Pioneering Contributions

Dhawan's most significant contribution was his transformative leadership as the **Chairman of ISRO** (1972 - 1984). He didn't just build rockets; he built the infrastructure of the Indian space program. Under his guidance, India developed its first satellite launch vehicle, the **SLV - 3**, and successfully launched **Aryabhata**, the nation's first satellite, in 1975.

His research in **Fluid Dynamics** and the creation of **Supersonic Wind Tunnels** at the Indian Institute of Science (IISc) laid the fundamental groundwork for Indian aeronautics.

He was also instrumental in the development of the **INSAT** and **IRS** satellite programs, which revolutionized how India manages telecommunications and resources today.



Achievements and Leadership

Beyond technical milestones, Dhawan is legendary for his **leadership philosophy**. When the first SLV - 3 mission failed in 1979, he took the blame himself. When it succeeded a year later, he stepped aside and let his team (including a young A.P.J. Abdul Kalam) take the credit. This culture of accountability remains ISRO's greatest strength.

Honours and Recognitions

In recognition of his towering legacy, the Indian government awarded him:

- **Padma Vibhushan** (1981)
- **Padma Bhushan** (1971)

In a final tribute, India's primary spaceport at Sriharikota was renamed the **Satish Dhawan Space Centre (SDSC)**. His life remains a masterclass in how mathematical precision and ethical leadership can propel a nation toward the stars.

Indian Inventions

Kojo

An Indian Innovation Making Coding Fun and Meaningful

When we talk about Indian innovations, we often think of rockets, satellites, or digital payment systems. But some of the most powerful innovations quietly shape young minds in classrooms. **Kojo** is one such Indian innovation designed not in Silicon Valley, but in India, with Indian classrooms and students in mind.

Kojo was developed to solve a very real problem in Indian education: **How do we teach coding, mathematics, and scientific thinking in a way that is simple, visual, and enjoyable for students?** Instead of copying complex foreign tools, Kojo was built as a learner - friendly platform that matches how Indian students naturally learn - by experimenting, visualising, and creating.

One of Kojo's biggest strengths as an Indian innovation is its **accessibility**. It is completely free and open - source, making it ideal for government schools, low-budget private schools, and learning centres across the country. In a nation where not every student has access to expensive software or high - end devices, Kojo ensures that **quality coding education is not limited to a privileged few.**

Kojo also reflects the Indian learning culture. Concepts like patterns, symmetry, repetition, and design commonly seen in rangoli, kolams, textiles, and architecture are naturally explored through Turtle Graphics. When students create mandalas, spirals, or geometric designs using code, they are unknowingly connecting **traditional Indian art with modern computational thinking.**

his makes learning feel familiar rather than foreign.

Indian classrooms often treat math, science, and computers as separate topics. Kojo breaks these walls. Students use math to draw, science to simulate motion, and coding to tell stories. This aligns well with India's growing focus on **experiential and interdisciplinary learning**, as encouraged by modern education reforms.

Kojo also helps build skills that India needs for the future: **logical thinking, creativity, and problem - solving.**

By learning how to break problems into steps, test ideas, and fix errors, students develop a mindset that prepares them for careers in science, technology, research, and innovation.

In essence, Kojo proves that **India is not just consuming educational technology, it is creating it.**

It shows how homegrown ideas can make global - quality learning tools while staying rooted in local realities. Kojo is a shining example of how Indian innovation can empower students to learn, create, and imagine a better future.

Word Search 2603 - Technologies

L	U	N	G	S	I	P	P	H	A	R	Y	N	X
H	N	A	P	I	E	E	B	R	O	N	C	H	I
E	A	R	N	T	M	E	D	H	I	G	X	H	A
G	S	E	E	T	P	L	A	C	R	N	H	O	O
I	A	S	U	O	H	S	A	R	Y	R	I	M	R
L	L	P	M	L	Y	C	D	R	B	E	R	E	C
O	P	I	O	G	S	S	A	C	T	A	A	O	H
E	A	R	N	I	E	L	P	H	E	E	L	S	R
V	S	A	I	P	M	I	S	I	E	H	U	T	O
L	S	T	A	E	A	E	E	S	A	C	L	A	N
A	A	I	E	L	T	N	L	E	A	A	L	S	I
P	G	O	G	Y	A	M	T	O	C	R	E	I	C
U	E	N	A	G	N	A	I	O	B	T	C	S	T
C	L	D	I	A	P	H	R	A	G	M	U	O	M

Find these words

Larynx
Pneumonia
Epiglottis
Alveoli
Emphysema
Cellular
Lungs
Nasal Passage
Diaphragm
Bronchi
Respiration
Pharynx
Homeostasis
Chronic
Trachea

(Answers on Back Cover Inside)

Invitation to the Writers

Young Scientist India Magazine invites Educators, Teachers, Writers, and Enthusiasts to write Science and Innovation related articles for Indian High School Students and Teachers.

Register your details through the link: YSI Mag Writers Registrations From

or you may also contact Mr. Kiran on 9985592223 and Ms. Padma on 9966775534.

Cover Story

Atmanirbhar Bharat in Technology

Imagine an India where the technology we use every day, mobile phones, apps, satellites, electric vehicles, and medical devices, is designed, developed, and manufactured within the country. This vision is captured in one powerful idea: Atmanirbhar Bharat.

"Atmanirbhar" means self-reliant. But it is not about isolation; it is about innovation, capability, and confidence. It encourages India to build strong internal systems while also contributing to the global community. It is an invitation to innovate.

What is Atmanirbhar Bharat Tech?

It refers to the use of **science, engineering, and innovation** to make India self-reliant in:

- Technology
- Manufacturing
- Research and development

It includes sectors like:

- Space technology
- Electronics
- Renewable energy
- Artificial intelligence

Why is it important?

India has long depended on imports for:

- Electronic components
- Advanced technology
- Semiconductor chips

This creates challenges like:

- High costs
- Supply disruptions
- Limited innovation control

Atmanirbhar Bharat aims to solve this.

Where is it applied?

Across India:

- Urban tech hubs (Bengaluru, Hyderabad)
- Rural innovation centres
- Schools and colleges

When did it begin?

The initiative gained major focus in **2020**, but the idea of self-reliance has roots in India's development journey since independence.

Who is involved?

- Government of India
- Scientists and engineers
- Startups
- Students and educators

You are also a part of this ecosystem.

How It Works: Methods, Procedures, Usage

1. Innovation Ecosystem

India is building innovation through:

- Incubation centres
- Research labs
- School innovation programs

Example: **Atal Tinkering Labs**

Students can:

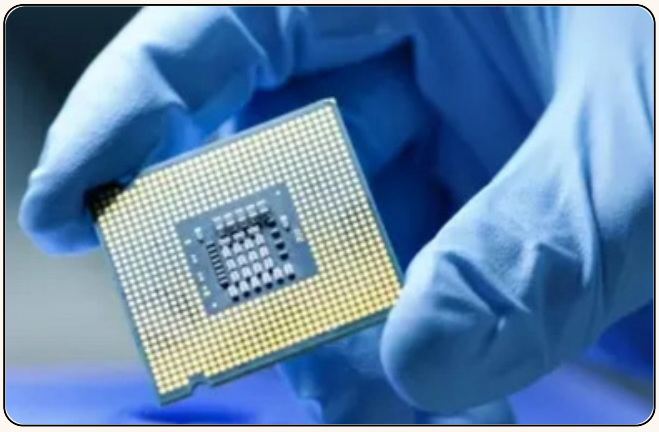
- Build prototypes
- Experiment
- Solve local problems

2. Make in India & Manufacturing

Encourages production of goods within India.

Example:

- Mobile phone manufacturing
- Electric vehicles



3. Digital Transformation

India leads in:

- Digital payments
- Online education
- E-governance

Example: Unified Payments Interface

4. Research & Development

Focus on:

- Indigenous technologies
- Scientific research

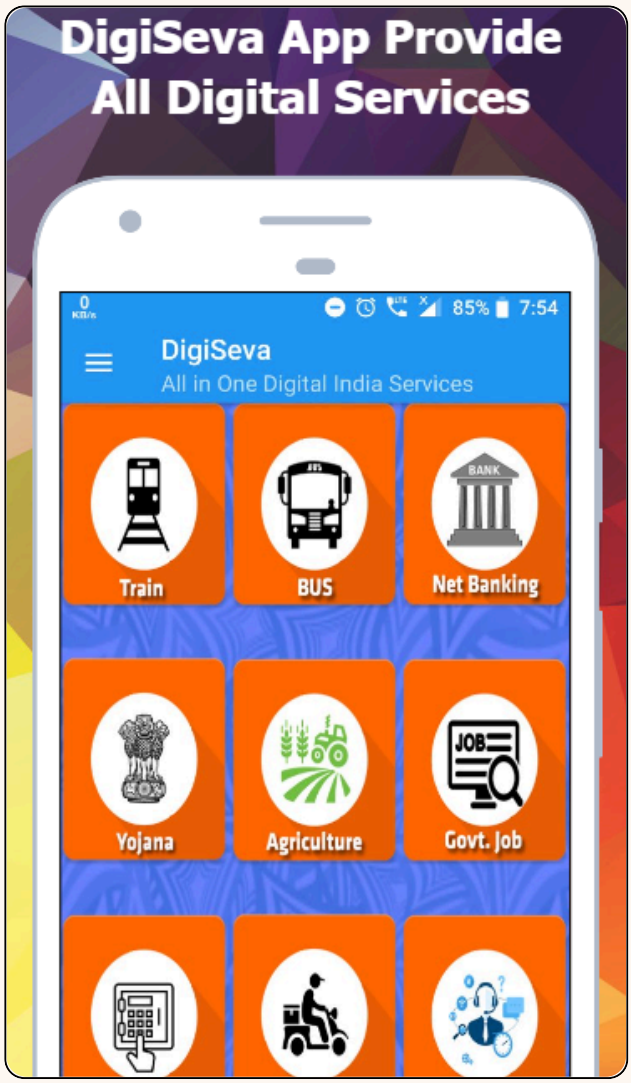
Institutions like:

- ISRO, DRDO

5. Skill Development

Programs train youth in:

- Coding, Robotics and AI



Fun Fact

Indian space missions are known for being cost-effective while achieving high success rates.

Advantages of Atmanirbhar Bharat Tech

One of the biggest advantages of this initiative is the creation of opportunities. When technologies are developed within the country, it generates employment and encourages entrepreneurship. It also reduces dependency on imports, making products more affordable.

Another important benefit is the promotion of innovation. When students and young professionals are encouraged to think creatively, they develop problem-solving skills that are essential for the future. Atmanirbhar Bharat also strengthens national confidence. It shows that India is capable of competing globally in science and technology.

Challenges of Atmanirbhar Bharat Tech

Despite its advantages, achieving technological self-reliance is not easy. It requires significant investment in research and infrastructure. Advanced technologies like semiconductor manufacturing are complex and expensive.

Another challenge is the digital divide. While cities have access to advanced technologies, some rural areas still lack basic infrastructure. Bridging this gap is essential to ensure inclusive development.

Skill development is also crucial. Students need access to quality education and training in science and technology to contribute effectively.

Examples

1. Digital Payments Revolution

- UPI transformed transactions
- Even small vendors accept digital payments

2. Space Missions

- **ISRO** missions like Chandrayaan

3. Vaccine Development

- India developed and produced vaccines during COVID-19.

Future Impact

The future of Atmanirbhar Bharat Tech is full of possibilities. India can become a global leader in areas such as renewable energy, space technology, and digital innovation.

Emerging fields like artificial intelligence, robotics, and biotechnology will play a major role in shaping the future. Students who develop skills in these areas will have the opportunity to contribute to groundbreaking innovations.

Sustainable development will also be a key focus. Technologies that protect the environment while supporting growth will be essential.

Role of Schools in Building Innovation

Schools are no longer just for textbooks; they are becoming **innovation hubs.**

Activities like:

- Science clubs
- Innovation contests
- STEM labs
- Hackathons

help students turn ideas into reality.

Classroom Activities for Teachers

Teachers can play a vital role in encouraging innovation. One effective activity is to ask students to identify problems in their surroundings and suggest solutions. This helps develop observation and critical thinking skills.

1. Innovation Brainstorm Session

Ask students:

- What problems exist in your locality?
- Can you design a solution?

2. Group Project

Topics:

- Smart village model
- Waste management system

3. Student Innovation Challenge

"Design for India" Challenge

Create a solution for:

- Water conservation
- Waste management
- Energy saving

Conclusion

Atmanirbhar Bharat Tech is more than a national initiative; it is a movement that invites every student to participate. It encourages you to observe the world around you, ask questions, and develop solutions.

The journey from a simple idea to a successful innovation begins with curiosity. By learning science, experimenting with ideas, and thinking creatively, you can contribute to building a self-reliant India.

Quick Quiz

1. What does "Atmanirbhar Bharat" mean?

a) Dependence on imports **b)** Self-reliant India **c)** Only rural development **d)** Foreign investments

2. Which Indian platform enables instant digital payments?

a) DigiLocker **b)** UPI **c)** Aadhaar **d)** ISRO

3. Which organisation launched Chandrayaan missions?

a) DRDO **b)** NASA **c)** ISRO **d)** BARC

4. What is the first step in innovation?

a) Marketing **b)** Problem identification **c)** Selling **d)** Coding

5. What skill does GYS Talks mainly develop?

a) Drawing **b)** Memorisation **c)** Communication & presentation **d)** Sports

Answers:

1-b, 2-b, 3-c, 4-b, 5-c

Riddles 2603

1. Made in India, I fly beyond the sky and explore space. What am I?
2. I carry money without cash and make India digitally strong. What am I?
3. Built in Indian labs, I can fly without a pilot. What am I?
4. I am a smart chip that powers phones and computers made in India. What am I?
5. I turn sunlight into electricity to power an independent nation. What am I?

(Answers on Back Cover Inside)

Sudoku Challenge 2603

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

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Indian Scientist

Kariamanikkam Srinivasa Krishnan

The Silent Architect of the Raman Effect

(4 December 1898 – 14 June 1961)

While the world celebrates the "Raman Effect," few realize that the groundbreaking discovery was a dual effort. **K.S. Krishnan** was the dedicated co - discoverer alongside Sir C.V. Raman, serving as the backbone of experimental physics in India. A man of immense humility and deep intellectual range, Krishnan was as much a philosopher and scholar of Tamil literature as he was a world-class physicist.

Pioneering Contributions

Born in **Tamil Nadu**, Krishnan was a brilliant **physicist and mathematician**. His most famous contribution occurred at the Indian Association for the Cultivation of Science, where he worked tirelessly with C.V. Raman. It was Krishnan's meticulous experimental records and observations that were vital in proving the existence of the **Raman Effect** in 1928.

Later, he turned his focus to **Magnetism**. He developed the "Krishnan Method" to measure the magnetic anisotropy of crystals, a feat that earned him international acclaim.

His work provided deep insights into the molecular structure of solids, making him a pioneer in **Solid State Physics.**

Achievements and Leadership

Krishnan's leadership was pivotal in building India's scientific infrastructure after Independence. He served as the **first Director of the National Physical Laboratory (NPL)** in New Delhi. Under his guidance, the NPL became a center of excellence for standards and measurements in India.

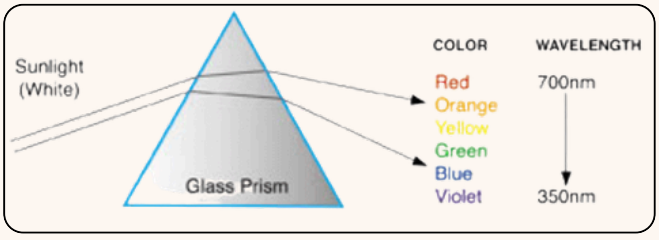
He was also a close associate of Homi J. Bhabha and Vikram Sarabhai, helping steer the Atomic Energy Commission. His leadership style was defined by **intellectual integrity;** he believed that true science required both rigorous mathematics and creative intuition.

Honours and Recognitions

In recognition of his profound impact on global science, he received:

- **Padma Bhushan** (1954)
- **Knight Bachelor** (1946)
- **Fellow of the Royal Society (FRS)** (1940)

Sir K.S. Krishnan remains a hero for young innovators because he proved that great scientific breakthroughs require patience, precision, and the ability to work harmoniously within a team.



Innovation Training Module

5 WHY'S

FIND THE ROOT CAUSE. DRIVE LASTING SOLUTIONS.

A simple yet powerful technique to dig deeper, identify the real cause and prevent problems from happening again.

IDENTIFY
THE ROOT CAUSE

UNDERSTAND
THE WHY BEHIND THE PROBLEM

SOLVE
THE RIGHT PROBLEM AT THE SOURCE

Hello teacher, imagine this your school notices that students are not submitting homework on time. Teachers assume students are careless. Students feel pressured. Parents get concerned. Meetings happen. Rules get stricter.

But the problem still continues.

What if the real issue is not laziness at all?
What if no one stopped to ask the most powerful question: **Why?**

Welcome to one of the simplest yet most powerful thinking tools in the world of innovation: the **5 Whys.**

The Power of a Simple Question

We often think innovation is about big ideas, advanced technology, or complex inventions. But in reality, innovation begins with something much simpler:

Understanding the real problem.

Most of us are quick to jump to solutions. We see a problem and immediately try to fix it. But here's the catch, if we don't understand the root cause, even the best solutions fail.
That's where the 5 Whys comes in.

This technique was popularized by Sakichi Toyoda, the founder of Toyota Motor Corporation. His idea was simple: if you keep asking "Why?" again and again, you can uncover the true cause behind any problem.

What is the 5 Whys Technique?

The 5 Whys is exactly what it sounds like.
You take a problem and ask **"Why did this happen?"**

Then you take the answer and ask **"Why?"** again.

You repeat this process, usually around five times, until you reach the root cause.

It's not about the number five. Sometimes it takes three questions, sometimes more. The goal is to **dig deeper**.

Let's Try It Together

Let's go back to the earlier example.

Problem: Students are not submitting homework on time

Now let's apply the 5 Whys:

1. **Why** are students not submitting homework?

→ Because they forget to do it

2. **Why** do they forget?

→ Because they don't note it down properly

3. **Why** don't they note it down?

→ Because instructions are rushed at the end of class

4. **Why** are instructions rushed?

→ Because time management in class is not effective

5. **Why** is time management not effective?

→ Because lesson plans do not include time for closure

Suddenly, the problem looks very different.
It's not about students being irresponsible.

It's about how the class is structured.
That's the magic of the 5 Whys: it shifts your perspective.

Why This Matters for Young Innovators

As a student, you might wonder: Why should I care about this?
Because this is exactly how real-world problem-solving works.
Imagine:

- A scientist trying to understand why a crop is failing
- An engineer figuring out why a machine keeps breaking
- A designer solving why users don't like an app

If they stop at the first answer, they solve the wrong problem.

But if they dig deeper, they create solutions that actually work.

The 5 Whys helps you:

- Think critically
- Question assumptions
- Avoid quick but wrong conclusions
- Design better solutions

In short, it trains your brain to **think like an innovator.**

Where Do We Go Wrong?

Most of us are trained to accept the first explanation we hear.
"Students are lazy."
"Traffic is bad."
"The system is broken."

But these are not root causes. They are **surface - level answers.**
The real causes are often hidden beneath layers of habits, systems, and behaviours.

The 5 Whys teaches you to:

- Slow down
- Stay curious
- Keep digging

And most importantly, it teaches you that:
The first answer is rarely the best answer.

Try It in Your Own Life

Let's make this personal.

Problem: You are unable to wake up early

Try asking yourself:

1. Why can't I wake up early?

→ Because I sleep late

2. Why do I sleep late?

→ Because I use my phone at night

3. Why do I use my phone so much?

→ Because I don't feel tired

4. Why don't I feel tired?

→ Because I don't have a proper routine

5. Why don't I have a routine?

→ Because I don't plan my day

Now the problem is not "waking up early."

The real problem is **lack of planning and routine.**

That's where the solution lies.

A Tool for Schools and Communities

The 5 Whys is not just for personal problems. It can be used to solve larger issues, too.

Think about your school or neighbourhood:

- Why is plastic waste increasing?
- Why are students stressed before exams?
- Why are common spaces not maintained properly?

Instead of blaming people, the 5 Whys helps identify system – level issues.
And when you fix systems, you create lasting change.

The Golden Rules of the 5 Whys

To use this tool effectively, keep these in mind:

1. Be Honest

Your answers should reflect reality, not what sounds good.

2. Stay Logical

Each answer should clearly connect to the previous one.

3. Avoid Blame

Focus on processes, not people.

4. Go Deep

Don't stop too early. Push yourself to think further.

5. Be Curious

There is no single "correct" answer, only a better understanding.

From Problem to Innovation

Here's the most important part.
The 5 Whys doesn't just help you understand problems it helps you **solve them better**.

Once you find the root cause, your solutions become:

- More effective
- More creative
- More impactful

For example:
If the issue is unclear homework instructions, the solution is not punishment, it's better communication.

That's real innovation.

A Small Habit, A Big Change

Imagine if you started using the 5 Whys regularly.
Every time something goes wrong, instead of reacting quickly, you pause and ask:

"Why did this happen?"

Then again.
And again.

Over time, you will notice something powerful:

- You will think more clearly
- You will make better decisions
- You will solve problems more effectively

And most importantly, you will start seeing the world differently.

Final Thought

In a world full of answers, the real skill is asking the right questions.

The 5 Whys reminds us that sometimes, the simplest questions can lead to the deepest insights.

So the next time you face a problem – big or small don't rush to fix it.

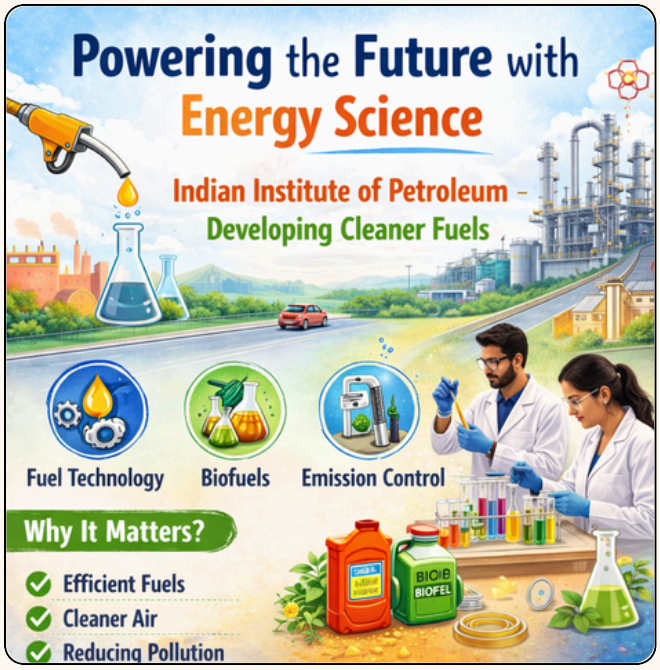
Pause. And ask: **Why?**

Indian Institute of Petroleum (IIP)

Energy is essential for modern life. From transportation and electricity generation to cooking and manufacturing, fuels play a major role in powering our daily activities. Scientists at the **CSIR - Indian Institute of Petroleum (IIP)** work to develop cleaner, more efficient fuels and energy technologies that support sustainable development.

Located in **Dehradun**, the institute is part of the **Council of Scientific and Industrial Research (CSIR)** and is one of India's leading research centres dedicated to **petroleum, fuels, and energy technologies.** The institute focuses on improving fuel quality, developing advanced refining processes, and exploring alternative sources of energy.

One of the major research areas at IIP is **fuel technology and refining processes.** Scientists study how crude oil can be converted into useful products such as petrol, diesel, aviation fuel, and lubricants.



Their work helps industries improve fuel efficiency and reduce harmful emissions.

The institute is also actively involved in **biofuel and renewable energy research.** Researchers explore fuels produced from natural resources such as plant materials, agricultural waste, and algae. These fuels can help reduce dependence on fossil fuels and lower environmental pollution.

Another important area of work at IIP is **environmental protection and emission control**.

Scientists develop technologies that help reduce pollution from vehicles and industries, contributing to cleaner air and a healthier environment.

Activity Idea for Teachers

Teachers can help students understand the concept of **energy and fuels** through a simple classroom activity. Ask students to list different fuels used in their daily lives, such as LPG for cooking, petrol for vehicles, or electricity for appliances.

Students can discuss questions like:

- Why are different fuels used for different purposes?
- What makes a fuel efficient?
- How can renewable fuels help protect the environment?

This activity helps students understand the importance of **energy science and sustainable fuels,** while also connecting classroom learning to real - world research carried out at institutes like IIP.

S&I Article

Climate Action Technologies

Innovating today for a sustainable tomorrow.

Across India, from scorching summers in cities like Delhi to unpredictable rainfall in the villages of Maharashtra, climate change is becoming a visible reality. Rising temperatures and water scarcity are no longer distant problems; they are part of our everyday lives. To tackle these challenges, scientists are developing **Climate Action Technologies** solutions designed to protect our environment and ensure a sustainable future.

For students, this topic is about applying physics, chemistry, and biology to solve real - world problems.

What are Climate Action Technologies?

These are scientific tools developed to reduce environmental damage. Their primary goals are to lower greenhouse gas emissions, conserve natural resources, and promote sustainable living.

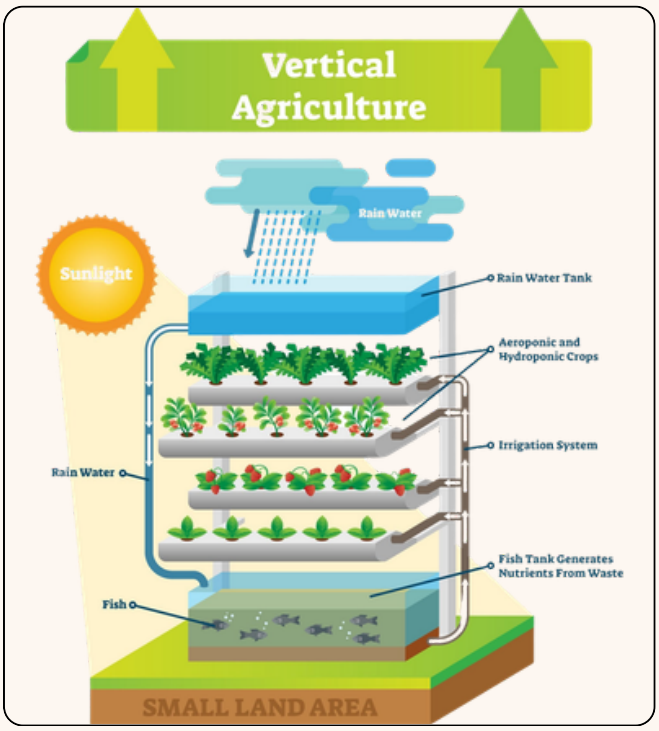
In simple terms, these technologies help us live better while harming the planet less. They include things like:

- **Renewable Energy:** Harnessing power from the sun or wind.
- **Green Transport:** Vehicles that run on electricity instead of petrol.
- **Resource Management:** Systems that save water or turn kitchen waste into "black gold" (compost).

Why are they Important?

India is particularly vulnerable to climate change due to its diverse geography. Rising heat affects our crops, while irregular monsoons lead to both floods and droughts.

These technologies provide a "shield." For example, using **Green Hydrogen** in factories can reduce industrial smoke, and **Vertical Farming** in crowded cities can provide fresh food using 90% less water than traditional farming.



Where are they Used?

You can see these technologies in action everywhere:

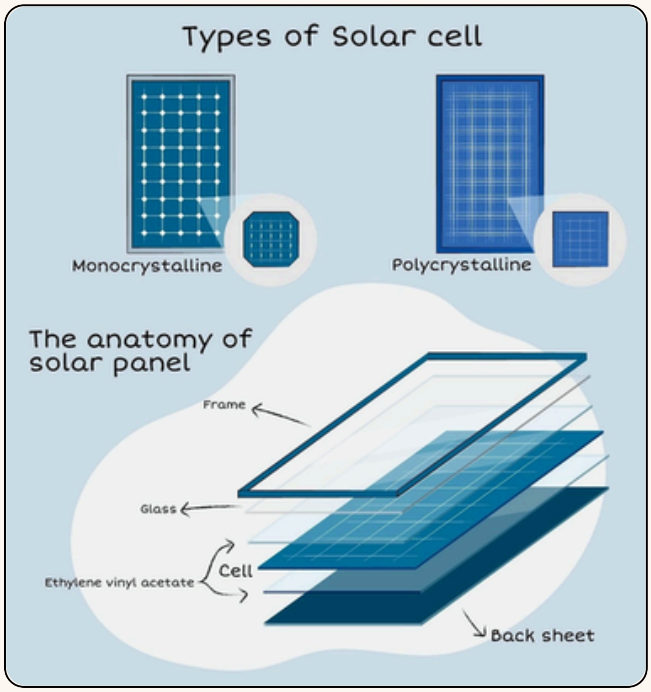
- **In Cities:** Metro trains use **Regenerative Braking** to save power every time they stop.
- **In Rural Areas:** Farmers use **Solar Water Pumps** instead of diesel engines, which is cheaper and cleaner.

- **At Home:** LED bulbs use much less electricity than old glass bulbs to give the same amount of light.

How do they work? (The Concept of Efficiency)

Climate action tech works by being more efficient. Efficiency is the ratio of useful output to the total input.

For instance, old coal power plants are only about 33% efficient, meaning a lot of energy is wasted as heat and pollution. Modern Monocrystalline Solar Panels are reaching higher efficiency levels, converting more sunlight into electricity in a smaller space. By increasing efficiency, we use fewer resources to get the same result.



Who is Involved?

Climate action is a collective effort involving many groups. Governments create policies and support programs, scientists and engineers develop technologies, industries manufacture products, and communities adopt sustainable practices.

Students also play an important role. Through school projects, innovation challenges, and awareness campaigns, they contribute ideas and solutions. Teachers guide and inspire students to think scientifically and creatively.

This collaboration makes climate action technologies a shared responsibility and opportunity.

Jargon Buster

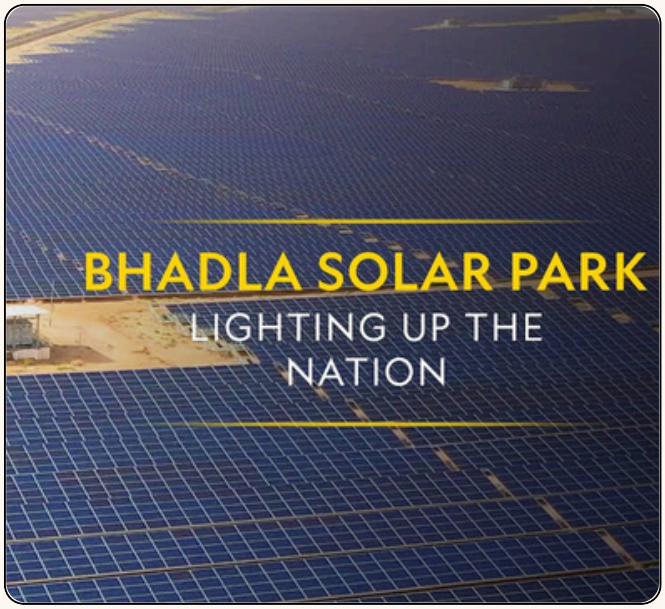
Think of this as your "Green Dictionary" to help you understand the common terms used in climate science today.

- **Carbon Footprint:** The total amount of greenhouse gases produced by our individual actions (like travelling or using AC).
- **Net Zero:** A state where the amount of greenhouse gas we add to the atmosphere is no more than the amount we take away.
- **Circular Economy:** A system where we stop "using and throwing" and start "repairing and recycling" everything.

Success Stories in India

India is a global leader in this field.

- The **Bhadla Solar Park** in Rajasthan is one of the largest in the world. In Gujarat, solar panels have been placed over water canals, which generate electricity while simultaneously preventing water from evaporating in the heat!
- **Biogas from Temple Waste:** Major temples across India, like the Siddhivinayak Temple in Mumbai, have installed **Biogas Plants.** Instead of throwing away tons of flower offerings and food waste, they convert it into clean cooking gas used in the temple kitchens, proving that "waste" is just a resource in the wrong place.



- **Electric Rickshaws (The Silent Revolution):** India is home to one of the world's largest fleets of electric vehicles, the E-Rickshaw. These simple vehicles have replaced thousands of petrol-run autos in cities, significantly reducing noise and air pollution while providing affordable transport for millions.

Career Corner: Your Green Future

If you want to work in climate tech, here are some practical paths:

1. **Solar Technician/Engineer:** Installing and maintaining the millions of solar panels India is deploying.
2. **Electric Vehicle (EV) Designer:** Working on battery technology or the software that runs electric scooters and buses.
3. **Waste - to - Value Expert:** Finding chemical ways to turn plastic waste or crop stubble into useful fuel or construction materials.
4. **Green Architect:** Designing houses that stay naturally cool during Indian summers without needing heavy air conditioning.

Conclusion

Climate action technologies demonstrate how science can be used to address global challenges. They show that innovation is not limited to laboratories; it can begin in classrooms and communities.

For students, this is an opportunity to become problem-solvers and innovators. By understanding and applying these technologies, they can help build a sustainable future for India and the world.

Innovation Challenge:

The "Cool Roof" Experiment

The Problem: *Concrete roofs in India absorb massive amounts of heat, making rooms unbearable.*

The Challenge: *Can you find a low - cost way to reduce your room's temperature?*

- ***Try This:*** *Paint a section of a dark surface with "cool roof" white paint and leave another section as is. Use a thermometer to measure the temperature difference after two hours in the sun.*
- ***Think Further:*** *Could recycled glass or mud pots be used on a rooftop to create an insulating layer?*

Death - Free Solution

Naveen D.S
7th Class

In many villages across India, unmanned railway level crossings pose a serious threat to public safety. In Naveen's village, there were no gates installed at the railway crossing, leading to three to four accidents every year. Despite repeated requests from villagers, the railway department cited financial and staffing constraints and did not appoint a gatekeeper. Discussions with his mentor teacher revealed that this was not an isolated issue - many such crossings across the country remained unprotected, putting countless lives at risk. Recognising the urgency of the problem, Naveen decided to search for a practical and affordable solution.

Since appointing a gatekeeper was not feasible, the project proposed an automatic, unmanned railway gate system. With guidance from his mentor, Naveen built a working model of a motor - operated gate that could automatically open and close as a train approached or passed. This system eliminates the need for manual operation while ensuring safety at crossings. The model was demonstrated to villagers and appreciated by community leaders. By combining technology with social awareness, this innovation offers a scalable, life - saving solution to prevent accidents at unmanned railway crossings across the country.

(Source: INSPIRE MANAK NLEPC 2011 Booklet)

Smart Parking

Anant Parkash
10th Class

Synopsis: Smart Parking is an AI-powered system that monitors parking slots in real-time using a USB webcam, OpenCV, and Arduino-controlled LEDs. A Flask web app shows slot availability, enables remote booking with QR code payments, and sends confirmations. This cost-effective, scalable solution reduces search time, minimizes congestion, and improves convenience for urban drivers.

Problem: Finding parking in urban areas is time-consuming due to growing vehicles and unorganized spaces. Drivers waste fuel and time, causing congestion and pollution. Traditional systems lack real-time updates or remote booking, leading to inefficiency and frustration for users.

Solution: Smart Parking uses AI and computer vision to detect slot occupancy via a webcam. Arduino-controlled LEDs indicate availability, and a Flask web app allows users to view slots, book remotely, and pay via QR code. The system reduces congestion and improves user convenience.

(Source: GYS Avishkar Awards 2025 Booklet)

Link for the project's video presentation
YouTube.com/@GETAYoungScientist

Indian Scientist

M. G. K. Menon

The Master Planner of Indian Science

(28 August 1928 – 22 November 2016)

While some scientists are known for a single discovery, **Mambillikalathil Govind Kumar Menon,** affectionately known as **Goku,** is celebrated as the man who engineered the very landscape of modern Indian science. A brilliant **physicist and mathematician**, Menon was born in **Mangalore** and educated in India before earning his PhD under the Nobel Laureate Cecil Powell at the University of Bristol, UK.

Pioneering Contributions

Menon's primary scientific work was in **Particle Physics**, specifically focusing on cosmic rays. His experiments in the deep mines of the **Kolar Gold Fields** were world-renowned, providing some of the earliest and most significant data on high - energy interactions and "neutrinos."

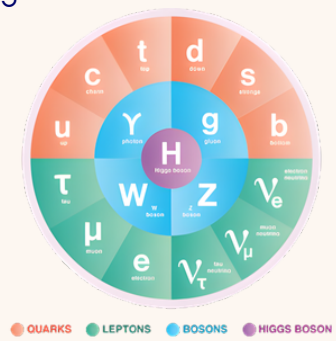
However, his greatest "experiment" was the development of India's scientific institutions. Following the sudden passing of Homi J. Bhabha, Menon stepped in to lead the **Tata Institute of Fundamental Research (TIFR)** at the young age of 38. He didn't just maintain the status quo; he expanded India's capabilities into electronics, oceanography, and environmental science.

Achievements and Leadership

Menon was a "Scientist - Statesman." He held almost every major scientific leadership role in India, serving as:

- **Chairman of ISRO** (briefly, following Vikram Sarabhai).
- **Director General of the CSIR.**
- **Secretary of the Department of Science and Technology.**

He was a master of **Systems Thinking**, believing that for a nation to innovate, its scientific departments must talk to one another. He was instrumental in drafting India's science policies that moved the country toward technological self - reliance.



Honours and Recognitions

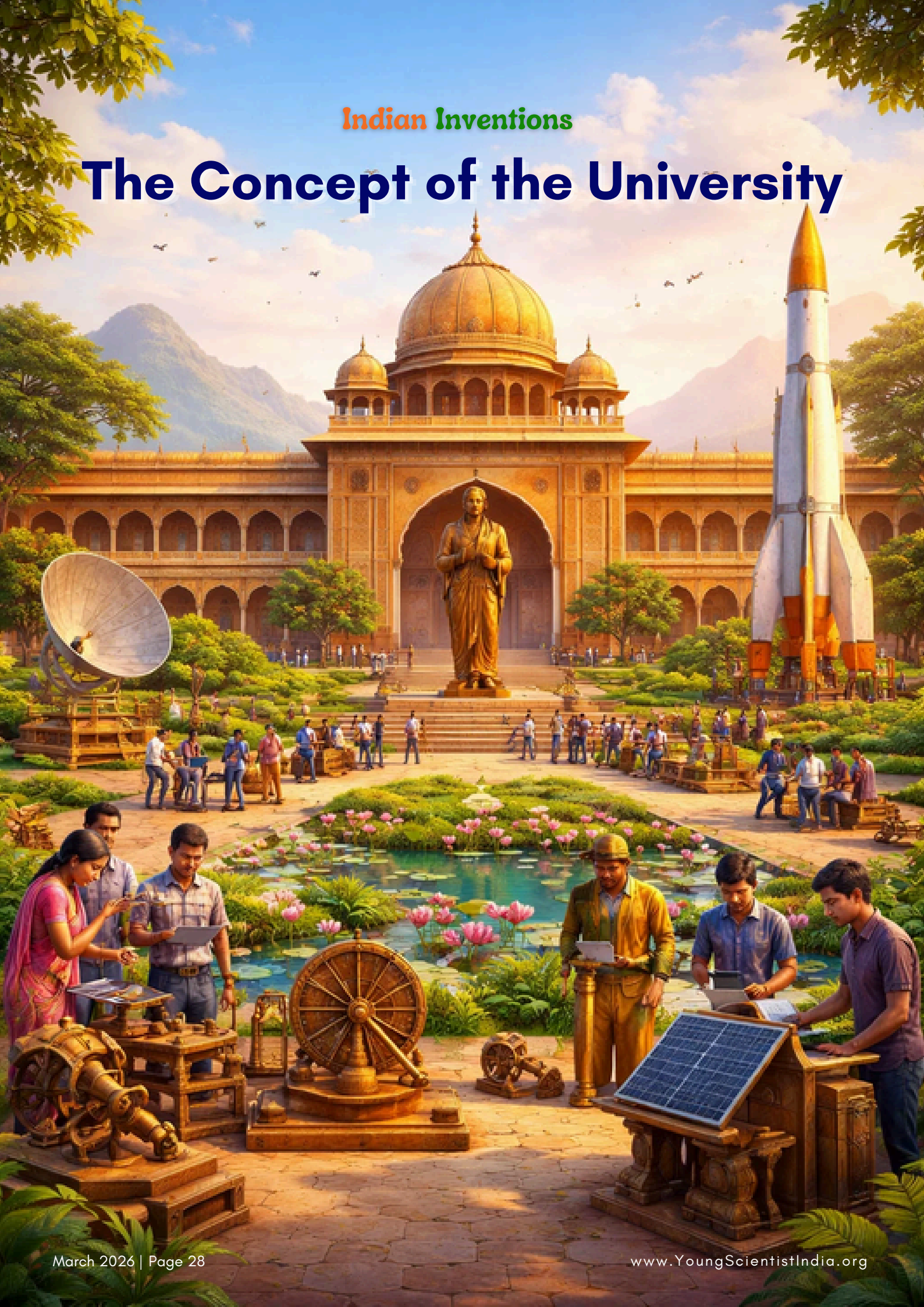
Menon's tireless service earned him the highest civilian honours:

- **Padma Vibhushan** (1985)
- **Padma Bhushan** (1968)
- **Fellow of the Royal Society** (FRS) (1970)

M.G.K. Menon proves to every young innovator that science isn't just done in a lab it's done by building communities, drafting visions, and leading with a global perspective.

Indian Inventions

The Concept of the University



Today, universities are places where students from around the world gather to learn, research, and exchange ideas. Institutions such as universities and colleges play an important role in shaping knowledge, innovation, and leadership. But many people may not realise that the **concept of large, organized centers of learning existed in India more than 2,000 years ago.**

Ancient India developed some of the earliest known institutions that functioned very much like modern universities, attracting students and scholars from many regions.

Early Centres of Learning in Ancient India

One of the most famous early centres of higher learning was **Takshashila**, which flourished around the 5th century BCE.

Takshashila was not just a school but a large center of education where students came to study various subjects. Teachers specialized in different areas, and students could choose subjects based on their interests.

Some of the subjects taught included:

- Mathematics
- Medicine
- Philosophy
- Political science
- Astronomy
- Military strategy

Students from different parts of Asia traveled long distances to study there.

Nalanda: One of the World's First Residential Universities

Another remarkable institution was **Nalanda University**, which flourished between the 5th and 12th centuries CE.

Nalanda was a large residential university where thousands of students and teachers lived and studied together. Historical records suggest that the university had **over 10,000 students and 2,000 teachers.**

The campus included:

- Lecture halls
- Libraries
- Monasteries
- Student residences

Nalanda was especially famous for its enormous library, which contained thousands of manuscripts on subjects such as science, medicine, philosophy, mathematics, and literature.

Scholars from countries such as China, Korea, Tibet, and Southeast Asia travelled to Nalanda to study and exchange knowledge.

The Gurukul Tradition

Before the development of large universities, education in India often took place through the **gurukul system**.

In a gurukul, students lived with their teacher, known as the *guru*, and learned through close interaction and practical experience.

Education in the gurukul focused not only on academic subjects but also on:

- Discipline
- Ethics
- Physical skills
- Life values

This system emphasised **holistic education**, where knowledge, character, and responsibility were all considered important.

Why These Institutions Were Innovative

Ancient Indian universities introduced several ideas that are still important in modern education.

For example:

- Students travelled from different regions to learn.
- Teachers specialise in different subjects.
- Students could choose areas of study.
- Discussions and debates were encouraged

These features are similar to the structure of modern universities today.

The idea that **knowledge should be shared and discussed openly** was central to these early institutions.

Did You Know?

The ancient library at Nalanda was said to be so large that it had **multiple buildings filled with manuscripts,** making it one of the greatest libraries of the ancient world.

Classroom Activity

Teachers can help students understand the concept of universities through a simple activity.

Ask students to imagine they are designing their **own university.**

They can decide:

- What subjects will be taught?
- What facilities will the campus have?
- How will students learn – through lectures, projects, or experiments?

Students can draw a map of their university campus and present their ideas to the class.

Conclusion

The concept of the university bringing together teachers, students, and knowledge in one place has deep roots in India's history.

Ancient centres of learning such as Takshashila and Nalanda played an important role in spreading knowledge across Asia and shaping early systems of higher education.

These institutions show that India has long valued **learning, discussion, and the sharing of knowledge.**

The story of these early universities reminds us that **education has always been one of humanity's greatest innovations.**

Indian Institute of Toxicology Research (IITR)

Every day, we come into contact with many chemicals through food, medicines, cosmetics, air, and water. While many chemicals are useful, it is important to understand how they affect human health and the environment. Scientists at the **CSIR - Indian Institute of Toxicology Research (IITR)** work to study the safety of chemicals and protect public health.

Located in **Lucknow**, IITR is a research institute under the **Council of Scientific and Industrial Research (CSIR)**. The institute specializes in **toxicology**, the science of studying how chemicals, pollutants, and other substances affect living organisms.

Researchers at IITR examine how exposure to certain chemicals may impact human health. Their work helps identify harmful substances in **food, water, air, medicines, and consumer products.** By studying the effects of these substances on cells, tissues, and organs, scientists can determine safe levels and suggest ways to reduce risks.

The institute also works on **environmental health and pollution research.** Scientists study contaminants in air and water and analyze how they may affect ecosystems and human populations. Their findings help governments and industries create better safety guidelines and environmental regulations.

IITR also plays an important role in **drug safety and chemical testing.** Before many products are approved for public use, they must undergo careful testing to ensure they are safe.

The research carried out at IITR helps ensure that medicines, chemicals, and industrial products meet safety standards.

Activity Idea for Teachers

Teachers can introduce the concept of **chemical safety and environmental health** through a simple observation activity. Ask students to identify common products at home or school that contain chemicals, such as cleaning liquids, soaps, perfumes, or pesticides.

Students can discuss questions like:

- Why is it important to use chemicals safely?
- How can pollution affect human health?
- What steps can we take to reduce exposure to harmful substances?

This activity helps students understand the importance of **safety in science and responsible use of chemicals,** while also connecting classroom learning to the real - world work carried out at institutes like IITR.

Innovation Training Module

Visual Thinking

How Visual Thinking Can Transform the Way You Learn

Close your eyes for a moment and imagine this: A giant tree with roots spreading deep into the ground.

On each branch, there are ideas, colours, shapes, and arrows connecting them.
Now open your eyes.

What you just experienced is not just imagination; it's a powerful way of thinking called **visual thinking.**

In a world filled with text, notes, and long explanations, visual thinking helps you **see ideas instead of just reading them.** And once you start seeing ideas, something interesting happens: you understand them better, remember them longer, and connect them faster.

What is Visual Thinking?

Visual thinking is the ability to **represent ideas using images, diagrams, symbols, and patterns instead of just words.**

Instead of writing long paragraphs, you might:

- Draw a diagram
- Create a mind map
- Use arrows to show connections
- Sketch symbols to represent ideas

It is not about being an artist.
It is about making thinking **visible**.

Why Our Brain Loves Visuals

Have you ever noticed how easy it is to remember:

A map A logo A simple drawing

But difficult to remember a full page of text

That's because the human brain is naturally wired to process **visual information faster than words.**

When you use visual thinking:

- You reduce confusion
- You organise ideas clearly
- You see relationships between concepts

In simple terms, visuals help your brain **work smarter, not harder.**

From Notes to Meaning

Let's take a simple example.

Topic: Water Cycle

Most students write: "Evaporation, condensation, precipitation..."

But with visual thinking, you draw:

- A sun heating water
- Arrows showing evaporation
- Clouds forming
- Rain falling

Suddenly, the concept is not just words-it's a **story you can see.**
And when you can see it, you can understand it.

The Power of Seeing Connections

One of the biggest advantages of visual thinking is that it helps you **connect ideas.**
For example, when studying a chapter, you can create a **mind map:**

- Main idea in the centre
- Branches for subtopics
- Smaller branches for details

This helps you:

- See the big picture
- Understand how ideas relate to each other
- Avoid memorising randomly

Instead of learning in pieces, you start learning in **patterns**.

Visual Thinking in Everyday Life

You may not realise it, but you already use visual thinking in many ways:

- Drawing diagrams in science
- Using flowcharts in computer classes
- Highlighting notes with colours
- Watching videos to understand concepts

Visual thinking is not new; it's just **underused**.
Once you start using it consciously, it becomes a powerful tool.

Try This Simple Exercise

Take any topic you recently studied.
Now, instead of writing notes:

1. Draw the main idea in the centre
2. Add branches for key points
3. Use arrows, shapes, and symbols
4. Add colours to group similar ideas

You don't need perfect drawings.
Even simple shapes like:

- Circles
- Boxes
- Arrows

can make a big difference.

Visual Thinking and Innovation

Innovation is not just about new ideas; it's about seeing problems differently.

Visual thinking helps you:

- Break down complex problems
- Spot patterns others may miss
- Communicate ideas clearly

Imagine explaining a solution:

- With only words → confusing
- With a simple diagram → instantly clear

That's why designers, engineers, and innovators rely heavily on visuals.

Common Myths About Visual Thinking

Let's clear a few misunderstandings:

❌ **"I am not good at drawing"**
You don't need to draw well. Stick figures and simple shapes are enough.

❌ **"It takes too much time"**
At first, yes. But soon, it saves time by improving understanding.

❌ **"It is only for creative subjects"**
Not true. It works for science, math, history, everything.

Simple Tools You Can Use

You don't need special materials. Start with:

- A notebook and a pen
- Colored pens or highlighters
- Sticky notes

If you prefer digital tools, you can also use apps like **Canva or Miro** to create diagrams and visual notes.

From Chaos to Clarity

One of the biggest benefits of visual thinking is that it brings **clarity**.
When ideas are only in your head, they feel confusing.

But when you draw them:

- You see gaps in your understanding
- You organise thoughts better
- You gain confidence

It's like turning a messy room into a clean, structured space.

A Skill for Life

Visual thinking is not just useful for exams.
It helps you in:

- Presentations
- Problem - solving
- Planning projects
- Explaining ideas to others

In fact, some of the world's greatest thinkers, from scientists to entrepreneurs, have used diagrams, sketches, and visual notes to develop their ideas.

Start Small, Think Big

You don't need to change everything at once.
Start with:

- One diagram per chapter
- One mind map per topic
- One visual summary per subject

Over time, this small habit will transform how you learn.

Final Thought

In a world full of information, the real skill is not just collecting knowledge - it's understanding it.

Visual thinking helps you do exactly that.

It turns:

- Words into pictures
- Ideas into connections
- Confusion into clarity

So the next time you study something new, don't just write it.
Draw it. See it. Understand it.

NBRI – National Botanical Research Institute

Plants play a vital role in sustaining life on Earth. They provide food, oxygen, medicines, and raw materials, and they help maintain ecological balance. Scientists at the **CSIR - National Botanical Research Institute (NBRI)** work to understand plants better and explore how they can benefit both people and the environment.

Located in **Lucknow**, NBRI is one of the research laboratories of the **Council of Scientific and Industrial Research (CSIR).** The institute focuses on research in **botany, plant biodiversity, plant biotechnology, and conservation of plant resources.** Its work helps scientists and policymakers understand how plants can be protected and used sustainably.

One of the major areas of research at NBRI is **plant biodiversity and conservation.** India is home to a vast variety of plant species, and many of them are rare or endangered. Scientists at NBRI study these plants, develop methods to conserve them, and maintain collections in botanical gardens for research and education. These gardens also serve as living laboratories where researchers and visitors can learn about plant diversity.

NBRI is also known for its work on **ornamental plants and landscaping species.** Scientists develop new varieties of flowering plants that are more colorful, resilient, and suitable for different climates. These plants are widely used in parks, public spaces, and home gardens, helping make urban environments greener and more beautiful.

Another important research area is **plant biotechnology.**

By using modern scientific techniques, researchers study plant genetics, improve crop productivity, and develop plants that can better resist pests and diseases.

Activity Idea for Teachers

Teachers can encourage students to observe and document plants around their school or home. Students can create a **simple plant diary** by drawing leaves, flowers, and fruits they see and noting their characteristics.

This activity helps students develop curiosity about **plant diversity, ecology, and the importance of conservation,** while also connecting classroom learning to the real-world research carried out at institutes like NBRI.

S&I Article

Future Careers in Science

Have you ever wondered what you want to become in the future? A doctor, an engineer, a space scientist, or maybe something entirely new that doesn't even exist yet?

Science is not just a subject in your textbook; it is a gateway to endless career opportunities.

Everything we see around us involves science. For example, the chair you are sitting on right now has multiple aspects of science involved. The material was discovered or invented by a **Material Scientist**, manufactured using techniques designed by an **Industrial Engineer**, and marketed using digital mediums created by **Computer Scientists.**

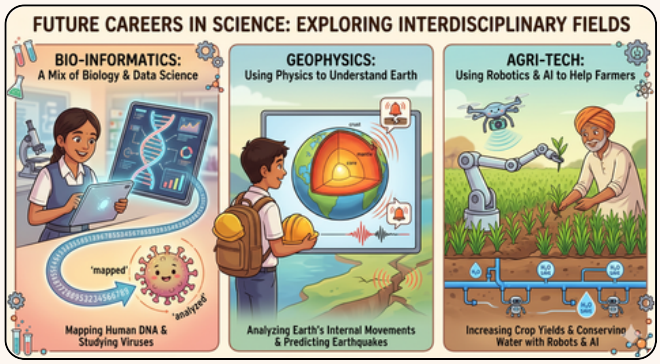
Every step of the way, someone with scientific expertise was involved.

This means you have a massive world of options to find a career that matches your specific interest.

The Shift: From "Laboratories" to "Everywhere"

In the past, a science career usually meant wearing a white coat and working in a lab. Today, science is **interdisciplinary**. This means different branches of science now work together:

- **Bio - Informatics:** A mix of Biology and Data Science to map human DNA or study viruses.
- Geophysics: Using Physics to understand Earth's internal movements and predict earthquakes.
- Agri - Tech: Using Robotics and AI to help Indian farmers increase crop yields and save water.



Emerging Frontiers

If you are looking beyond traditional medicine or engineering, consider these rapidly growing fields in India:

1. **Space Technology:** With the growth of ISRO and private space startups, India needs experts in satellite communication and rocket propulsion.
2. **Renewable Energy:** Scientists are needed to design better solar cells and hydrogen fuel kits to power our future.
3. **Biotechnology:** Creating "super - crops" that can grow in salty soil or developing new life - saving vaccines.
4. **Data Science & AI:** Analysing massive amounts of information to help doctors diagnose diseases faster than ever before.

When and How to Start?

You don't need to wait for college to start your journey. Building a career in science is like building a skyscraper; you need a deep, strong foundation.

- **Middle School (Classes 6 - 8):** This is the time for **curiosity**. Don't just read - observe. If you see a rainbow, look up the physics of refraction. If you see a rusting gate, ask about the chemistry of oxidation. Participating in school science fairs is not about winning; it's about learning how to test an idea.

High School (Classes 9 - 10): Focus on strong fundamentals. This is the stage where you begin to see how Math is the language of Physics and how Biology explains the complex systems of life.

Start following scientific journals or space missions like Gaganyaan to see how classroom theories are applied to real - world challenges.

- **Higher Secondary (Classes 11 - 12):** This is the time to **identify your niche.** If you love solving logical puzzles and math, you might lean towards Physics or Computer Science. If you are fascinated by the "code of life" and chemical reactions, Biology and Biotechnology might be your path.
- **The "Skills" Layer:** Regardless of your chosen subject, try to learn **Coding** and **Critical Thinking.** In the modern scientific world, a biologist who can write a simple program to analyse data has a significant advantage.

Jargon Buster

Think of this as your "Future - Proof Dictionary" to help you understand the evolving world of work.

- **Interdisciplinary:** Combining two or more academic subjects into one activity (e.g., mixing Biology and Engineering).
- **Sustainability:** Meeting our own needs without harming the ability of future generations to meet theirs.

- **Nanotechnology:** The science of building things at an incredibly small scale (about 1 to 100 nanometers).

Innovation Challenge: "The Career Mash - up"

The Problem: Most people think they have to choose either Science or another passion like Sports or Music.

The Challenge: Can you combine a scientific field with a hobby to create a "Future Career"?

- **Example 1:** Music + Physics = **Acoustic Consultant** (Designing concert halls with perfect sound).
- **Example 2:** Sports + Biology = **Sports Biomechanist** (Helping athletes run faster using body movement data).
- **Your Turn:** Pick one thing you love and one branch of science. Describe what that job would look like!

Conclusion

Science careers are not just about jobs; they are about **curiosity, creativity, and contribution**. Whether you are designing a more comfortable chair or a new medicine to help millions, you are using science to make the world better. By developing a scientific temper today, you are preparing yourself to lead the innovations of tomorrow.

Top Institutes in India for Science

If you are passionate about research and innovation, aiming for these top - tier institutions can give your career a massive head start:

Institute	Specialization	Major Entrance Exam
IISc Bangalore	Advanced Research & B.Sc. (Research)	JEE Advanced / IAT
IISERs (7 Locations)	Integrated BS - MS in Pure & Natural Sciences	IAT (IISER Aptitude Test)
IITs (Various)	Engineering, Math & Applied Sciences	JEE Advanced
NISER (Bhubaneswar)	Atomic Energy & Basic Sciences	NEST Exam
AIIMS (New Delhi)	Medical Research & Biotechnology	NEET
NCBS (Bangalore)	Biological Sciences & Research	TIFR Graduate School Exam
ISI (Kolkata/Bangalore)	Statistics, Math & Data Science	ISI Admission Test

Indian Scientist

Prafulla Chandra Ray

The Father of Indian Chemistry

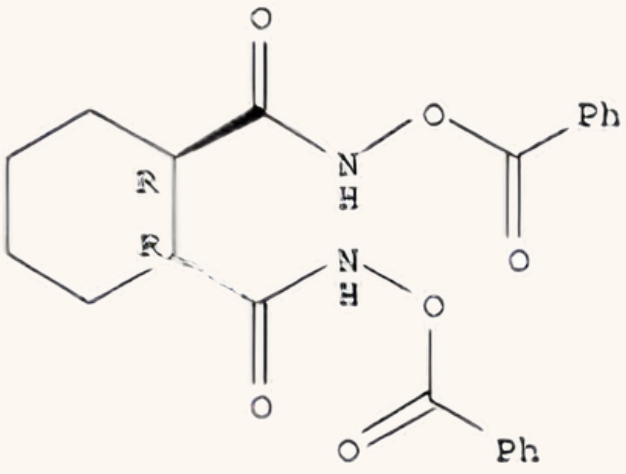
(August 2, 1861 – June 16, 1944)

In the history of Indian science, few figures are as legendary as **Acharya Prafulla Chandra Ray**. A pioneering **chemist, mathematician, and educator**, Ray was born in Bengal (now Bangladesh) and received his higher education at the University of Edinburgh, UK. He didn't just study chemistry; he used it to ignite a spirit of self-reliance in a pre-independent India.

Pioneering Contributions

Ray's most famous scientific breakthrough was the discovery of **Mercurous Nitrite** in 1896, a stable compound that had previously eluded chemists worldwide. This discovery put India back on the map of global chemical research.

However, his greatest contribution was his vision for "Industrial India."



He believed that science should not stay locked in a lab; it should create jobs and health. To prove this, he founded **Bengal Chemicals & Pharmaceutical Works**, India's first pharmaceutical company.

Starting with just a few hundred rupees, he transformed it into a massive industry that provided affordable medicines to millions.

Achievements and Leadership

Known as an **"Acharya"** (a great teacher), Ray mentored a generation of brilliant Indian scientists, including Satyendra Nath Bose and Meghnad Saha. His leadership was defined by **frugality and patriotism**. He lived a simple life, donating most of his salary to support poor students and scientific research.

He was also a dedicated historian of science, authoring the monumental book **A History of Hindu Chemistry**, which documented the advanced metallurgical and chemical knowledge of ancient India for the world to see.

Honours and Recognitions

His immense contributions earned him high international and national regard:

- **Knight Bachelor** (1919)
- **Companion of the Order of the Indian Empire (CIE)** (1912)
- **First President of the Indian Chemical Society** (1924)

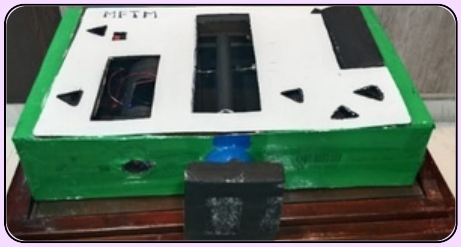
Prafulla Chandra Ray remains an inspiration for every young scientist because he proved that innovation is most powerful when it serves the people and builds a nation's economy.

MFTM - Multi Functional Trap Machine

Ishwarya Pandey
7th Class

Synopsis: MFTM, the Multi-Functional Trap Machine, is an eco-friendly device that safely traps rats and insects without harming them. Using a seesaw mechanism for rats and LED-attracted orange wax for insects, it prevents disease spread while preserving ecological balance. This innovative solution is both safe and humane, supporting both public health and environmental sustainability.

Problem: Rats and insects spread diseases such as plague, malaria, and dengue. Conventional traps harm or kill these creatures, disrupting ecosystems and food chains. There is a need for a solution that controls pests without ecological damage or unnecessary cruelty.



Solution: MFTM traps rats using a see-saw pipe mechanism and insects with LED-lit orange wax, capturing them safely without killing. This humane approach reduces disease transmission while preserving their role in ecosystems, ensuring an eco-friendly and sustainable method for pest management.

(Source: GYS Avishkar Awards 2025 Booklet)

Link for the project's video presentation
YouTube.com/@GETAYoungScientist

Ambin Chaka

Rebecca Mossing
12th Class

Synopsis: Ambin Chaka is a manual, user-friendly grain cleaning machine designed for rice, wheat, corn, millet, and other staples in Northeast India. It eliminates the need for electricity or specialised skills, reduces physical strain and preserves cultural practices. The machine efficiently separates grains using three layers and interchangeable sieves, empowering housewives with a safer solution.

Problem: Traditional grain cleaning in Northeast India is labour-intensive, time-consuming, and physically demanding, especially for housewives and older adults. Manual sieving causes fatigue, back and neck pain, and dust exposure, while commercial machines are expensive, often reliant on electricity, and inaccessible to rural communities.

Solution: Ambin Chaka is a manual, skill-free grain cleaning machine that separates rice, wheat, corn, millet, and other grains efficiently using three layers and interchangeable sieves. It reduces physical strain, avoids electricity use, and provides an affordable, sustainable and culturally appropriate solution for households.

(Source: GYS Avishkar Awards 2025 Booklet)

Link for the project's video presentation
YouTube.com/@GETAYoungScientist

CSIR – National Chemical Laboratory (NCL)

Chemistry plays an important role in shaping modern science and industry. From medicines and plastics to new materials and sustainable technologies, chemical research helps improve everyday life. Scientists at the **CSIR - National Chemical Laboratory (NCL)** work to develop innovative chemical solutions that support industries, technology, and environmental sustainability.

Located in **Pune**, NCL is one of the premier research laboratories of the **Council of Scientific and Industrial Research (CSIR)**. Since its establishment in 1950, the institute has been known for its contributions to **chemical sciences, materials research, catalysis, and polymer technology.**

One of the major research areas at NCL is **catalysis**, which involves developing substances called catalysts that speed up chemical reactions without being consumed. Catalysts are widely used in industries such as petroleum refining, pharmaceuticals, and environmental protection. By designing better catalysts, scientists can make industrial processes faster, cleaner, and more energy - efficient.

NCL is also a leader in **polymer and materials research.** Scientists study new types of materials that can be used in packaging, electronics, healthcare, and energy technologies. These materials can have special properties such as flexibility, strength, or resistance to heat and chemicals.

Another important focus of the institute is **green chemistry and sustainable technologies.** Researchers work to design chemical processes that produce less waste, consume less energy, and reduce environmental impact.

Activity Idea for Teachers

Teachers can help students explore the importance of chemistry through a simple **materials observation activity.** Students can identify different materials around them, such as plastic bottles, metal objects, glass items, or rubber products and discuss what properties make them useful.

Students can then think about questions like:

- Why are different materials used for different purposes?
- How do scientists design new materials?
- How can chemistry help create environmentally friendly products?

This activity helps students understand how **chemical science influences everyday materials and technologies,** connecting classroom learning with the innovative research carried out at institutes like NCL.

Indian Inventions

Agnibaan Rocket

(Agnikul Cosmos)

Introduction

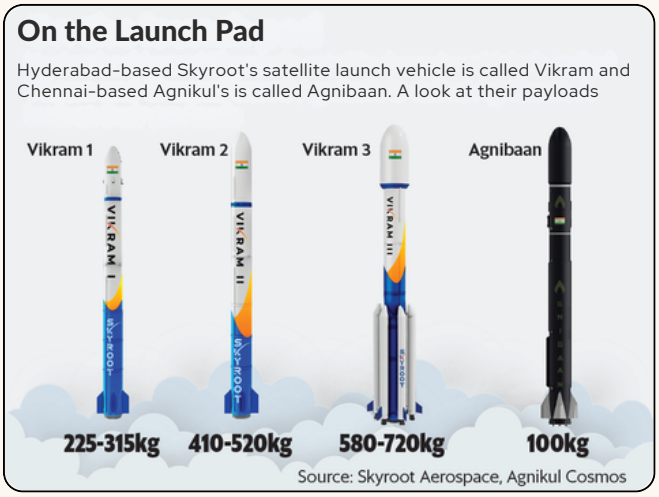
For decades, space missions were led only by national agencies. But today, a new wave is transforming space science and **private space startups.**

One of the most exciting among them is Agnikul Cosmos, which developed the Agnibaan Rocket, a launch vehicle built in India with cutting-edge technology like **3D - printed rocket engines.**

This is not just a rocket story. It is about **innovation, entrepreneurship, and how young Indians are shaping the future of space technology.**

What is Agnibaan Rocket?

Agnibaan is a **small satellite launch vehicle (SSLV)** designed to carry lightweight satellites into space. It is flexible, customizable, and designed for quick launches.



Why is it important?

Today, many applications depend on small satellites:

- Weather forecasting
- Agriculture monitoring
- Communication
- Disaster management

Traditional rockets are expensive and not flexible for small payloads. Agnibaan solves this problem.

Where is it launched from?

Agnibaan is launched from **Satish Dhawan Space Centre.**

Agnikul has also built its own **private launchpad** within this spaceport, which is a first in India!

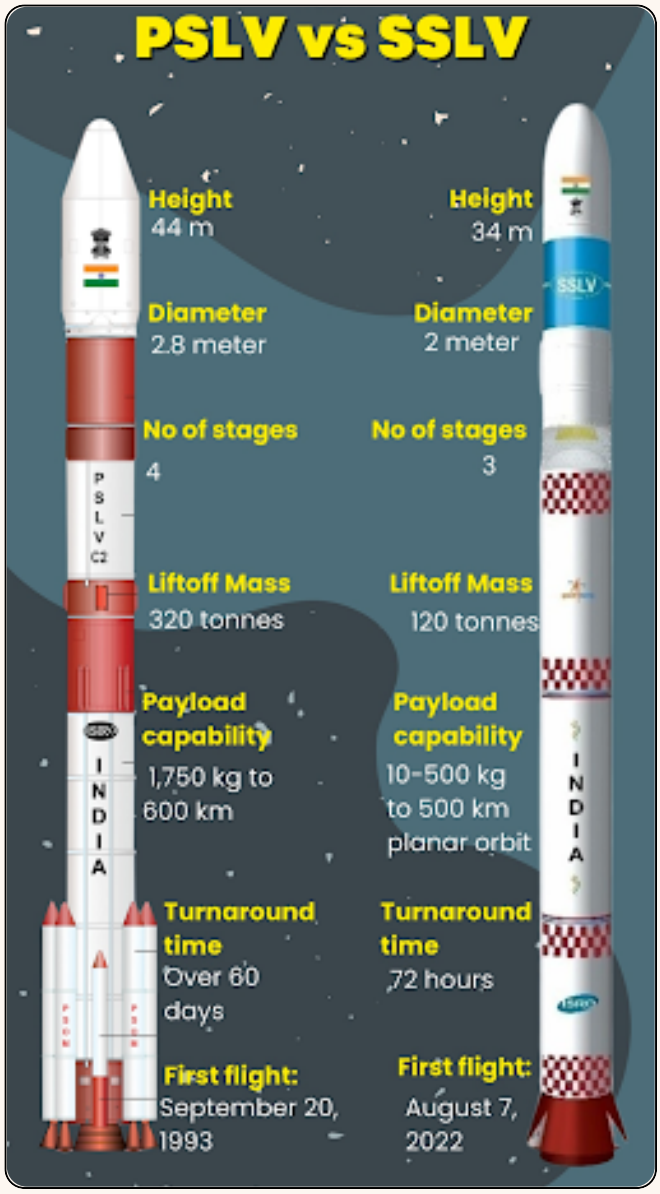
When did it launch?

The suborbital test mission **Agnibaan SOrTeD** was successfully launched in **2024**, marking a milestone in India's private space journey.

Who built it?

Agnibaan was developed by:

- **Agnikul Cosmos**
- Founded by young engineers from IIT Madras



The Problem

Challenges in traditional space launches:

- High cost
- Long waiting time
- Lack of flexibility

Why does India need this?

India is growing in:

- Startups
- Satellite technology
- Digital services

There is a need for **fast, affordable launch systems.**

Opportunity

- Growth of private space companies
- Job creation
- Innovation ecosystem

Definitions

1. Small Satellite (CubeSat)

A compact satellite used for research and communication.

2. Launch Vehicle

A rocket that carries payloads into space.

3. 3D Printing (Additive Manufacturing)

A process of building objects layer by layer.

4. Orbit

The path followed by a satellite around Earth.

Agnibaan Rocket

Core Idea

To create a **customizable, low-cost rocket** that can launch small satellites on demand.

Rocket Variants

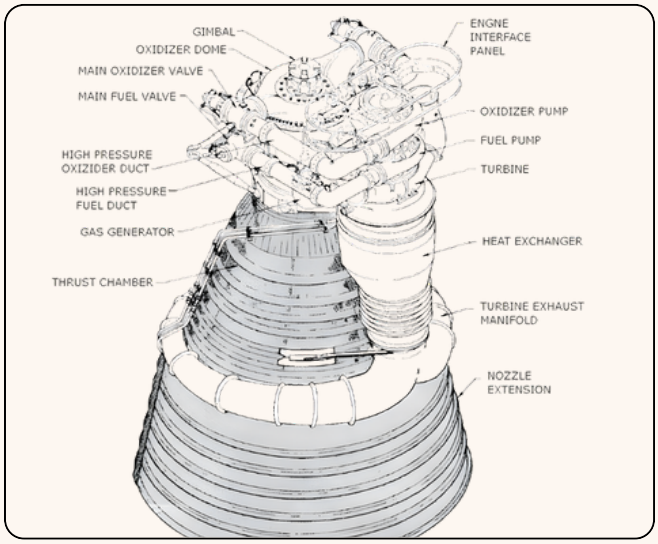
Agnibaan offers multiple configurations depending on payload size.

The Engine: SAgE

Key Features:

- Fully **3D-printed engine**
- Uses **semi-cryogenic fuel** (liquid oxygen + kerosene/methane variants)
- Faster manufacturing
- Reduced cost

First of its kind in India!



Teacher - led classroom activity

The teacher can begin by asking students:

- What is a rocket and how does it reach space?

Then guide the discussion with questions like:

- Why do we need small launch vehicles?
- What kind of satellites require such rockets?
- How can private companies contribute to space technology?

Introduce the Agnibaan rocket as a launch vehicle developed by an Indian startup and ask:

- How is it different from large rockets?
- What advantages do small rockets offer?

Encourage students to think about cost, flexibility, and quick launches. Conclude by discussing how innovations like Agnibaan are opening new opportunities in India's space sector and inspiring young innovators.

How It Works: Methods & Procedures

Rocket Launch Steps

1) Fuel loading 2) Engine ignition
3) Lift - off 4) Stage separation
5) Satellite deployment

Student Example

Blowing up a balloon and releasing it, air rushes out, and the balloon moves forward. Rockets work similarly!

Daily Life Connection

- Satellite TV
- GPS navigation
- Weather apps
- Disaster alerts

All depend on satellites launched by rockets like Agnibaan.

Advantages

- Low - cost launches
- Quick turnaround time
- Customizable missions
- Boosts private innovation

Limitations

- Smaller payload capacity
- Still under development
- Competition from global companies

Answer in your own words

- How can rockets be made reusable?
- Can we reduce fuel consumption?
- What materials can withstand high temperatures?

Conclusion

Agnibaan is not just a rocket; it is a **symbol of India's new space age**, where students, startups, and scientists come together to innovate.

It proves that:

- Innovation is not limited to big organisations
- Young minds can create big change
- India is ready to lead in space technology

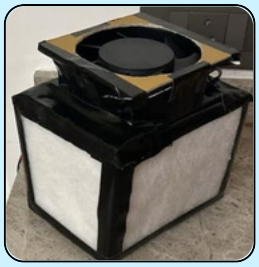
The sky is no longer the limit. It is just the beginning.

Zenair Air Purifier

Chinmayee Gawde
10th Class

Synopsis: ZenAir is a portable, cost-effective air purifier addressing Mumbai's high pollution levels. Using prefilters, carbon filters, and HEPA filters, it effectively removes pollutants of various sizes, including fine dust and allergens. Lightweight, easy to maintain, and efficient, ZenAir ensures cleaner indoor air for homes, offices, and schools, offering a practical solution for daily use.

Problem: Mumbai, the 4th most polluted megacity, faces severe air pollution from vehicles, construction, and climate change. Nine out of ten people inhale contaminated air, leading to respiratory diseases, asthma, and weakened immunity, while conventional purifiers are costly, heavy, or inefficient.



Solution: ZenAir combines prefilters, carbon filters, and HEPA filters with a central exhaust fan to purify indoor air effectively. Portable, lightweight, and affordable, it removes pollutants, allergens, and fine dust (0.3 microns), providing safer, cleaner air and improving daily living conditions.

(Source: GYS Avishkar Awards 2025 Booklet)

Link for the project's video presentation
YouTube.com/@GETAYoungScientist

Go Green

Synopsis: The Go Green project focuses on promoting A. P. J. Abdul Kalam's vision of a sustainable and self-reliant India through green technology. It emphasises eco-friendly energy, conservation of resources, and innovative solutions for cleaner living.

Problem: Rapid industrialisation, population growth, and consumerism have disrupted ecological balance, leading to overuse of fossil fuels, pollution, and environmental degradation, affecting all living beings.

Shubham Phaldessai

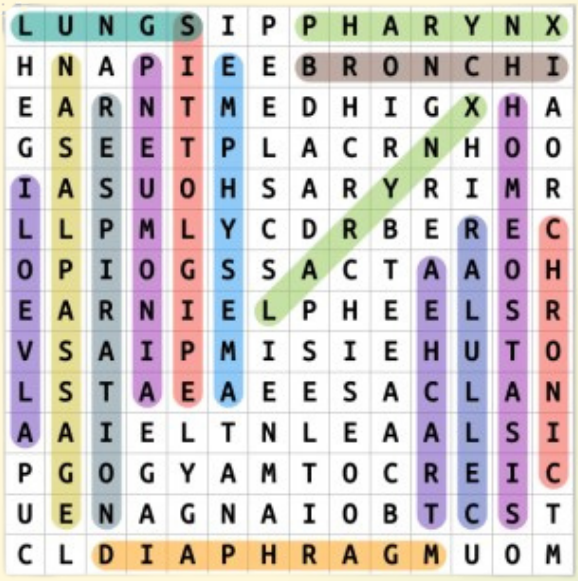
Solution: The project proposes adopting green technologies such as solar-powered vehicles, LED lighting, and alternative energy for rural electrification. It also suggests reducing traffic congestion and innovating public infrastructure (like playground equipment for water pumping) to conserve energy and resources, promoting a sustainable future.

(Source: INSPIRE MANAK NLEPC 2011 Booklet)

Solution
Sudoku Challenge 2603

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

Solution
Word Search 2603



Riddle 2603 Answer

1. Satellite / Rocket 2. Digital Payment / UPI 3. Drone 4. Semiconductor / Microchip 5. Solar Panel.

GYS GURU PURASKAR

Towards Building a Nation of Innovation

अभिप्रेरित अनुसंधान के लिए विज्ञान खोज में नवोन्मेष

inspire

Innovation in Science Pursuit for Inspired Research

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Submissions Open

MAR TO JUN 2026

GYS GURU PURASKAR 2026

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Submissions Open: April 2026 to June 2026

GYS Avishkar 2026 AWARDS

Grooming Future Innovators for the Nation

Submissions Open: May 2026 to July 2026