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Grade-3

HUNGRY MIND

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INNOVATION KNOWLEDGE IDEATION TRANSFORMATION

ROBOTICS

AI

MECHATRONICS



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Grade-3

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PADMANABH INNOVATIONS LLP

ROBOTICS AI MECHATRONICS

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Preface

This book is dedicated to my **Guru** and the **educational leaders** of our society, who have provided us with the opportunity to develop collaborative learning environments through **I-KIT STEAM Labs.**

We believe that invention and problem-solving are not limited to scientists or researchers secluded in laboratories. Children—from elementary to high school—are capable of remarkable achievements. They can create real products that solve real-world problems.

We also believe that schools are the most critical foundation for shaping the curious minds of young learners. For over a century, schools have played a pivotal role in nurturing intellectual culture and building ecosystems of innovation and creativity.

This book is especially designed for students who are part of **I-KIT STEAM Labs** across India. These young minds are observing, understanding, analyzing, and solving problems using their unique creativity and divergent thinking.

I-KIT STEAM Labs support schools in engaging all kinds of learners, integrating them into mainstream education, and empowering them to generate original, valuable ideas using the principles of Science, Technology, Engineering, Arts, and Mathematics (STEAM). This book will help children transform their creative ideas into tangible projects in **Science, Mathematics, Mechatronics, Artificial Intelligence, and Robotics.**
Through hands-on experiential learning activities, students will learn how to use tools, components, and equipment, while developing their imagination, ideation skills, and interdisciplinary understanding of science, math, and art. **QR codes** are included to give students easy access to instructional videos and additional resources for each project.

Dear Students,
We are working hard to connect your **imagination** with **future innovations,** and we are thrilled to present the **first edition** of this activity notebook to spark your curiosity. We look forward to co-creating many more innovative projects with you in the academic year **2025–26.**

Thank you.

Warm regards,
Gopal Krishan Sharma
Author

Syllabus

Unit 1 : Imagination and art

Chapter	Learning Objective	STEAM Outcome
Introduction	Create understanding through experiential learning about – ▪ Imagination and creativity ▪ Line, shape and form	▪ ***Art*** - Understand what is imagination and creativity. - Use the 7 elements of art (line, shape, form, etc.) in creations. - Compare Stone Age tools with modern art tools. ▪ ***Math*** - Design 2D/3D art using geometry and materials.
3D Pen	Create understanding through experiential learning about – ▪ Materials, geometric shapes ▪ Construction using a 3D pen	▪ Material and filament of 3-D Pen. ▪ Drawing 3-D objects and geometric shapes. ▪ Drawing various creative shapes. ▪ Paper circuit activity using 3-D pen shapes.

Unit 2 : STEAM - Technology

Chapter	Learning Objective	STEAM Outcome
Intoduction to Play Trons	Create understanding through experiential learning about – ▪ Sensors and their relation to human/ animal senses ▪ AI, biomimicry, robotic components ▪ Sound waves, magnetic fields, obstacle detection, sensor-driven responses.	▪ ***Technology*** - Understand how robots mimic human and animal senses using sensors. - Identify the roles of different sensors – sound, light, magnetic, proximity, temperature, etc. ▪ ***Science*** - Understand the concept and applications of soundwaves, magnetic fields and echo in order to design and build the robots and intellegent machine.
Star Projector	Create understanding through experiential learning about – ▪ Rays, beams, light reflection and refraction ▪ Lenses, stars, shapes, angles and projection.	▪ ***Science*** – Understand how light travels, the behaviour of light and study different phenomena of light to create technology like projector. ▪ ***Technology*** – Identify and explore the projection equipment used in star projectors. ▪ ***Engineering*** – Learn about the structure and working mechanism of a star projector. ▪ ***Art*** – Design creative star patterns and constellations to display through the projector. ▪ ***Maths*** – Estimate angles, distances, and patterns in star projections to mimic real constellations.
Street Light	Create understanding through experiential learning about – ▪ Flow of current, conductors, insulators, switches, ▪ Input-output systems, paper crafting, measuring length, angles.	▪ ***Science*** – Develop the basic understanding about current conductors, insulators and switches in order to create mechanism like street light. – Identify the roles of components like power module and LED in building circuits. ▪ ***Technology*** – Explore how street light systems work and relate them to smart street light of your city. ▪ ***Art*** – Design a layout or visual model of a smart street lighting system. ▪ ***Maths*** – Identify the relation between the height of a street light and the angle at which it's mounted.
Reverse Parking	Create understanding through experiential learning about – ▪ Sound, waves, vibrations, sensor signals. ▪ Distance measurement, crafting, input-output connections.	▪ ***Science*** – Understand how vibrations create sound and how sensors detect nearby objects. ▪ ***Technology*** - Understand how proximity sensors improve modern equipment and why they are so useful. ▪ ***Maths*** – Estimate and measure distances between objects to trigger sensor alerts effectively.

Unit 3 : STEAM - Circuit Designing in Robotics

Chapter	Learning Objective	STEAM Outcome
Intoduction to Play Tronix	Create understanding through experiential learning about – ▪ Basic electronic components, circuits and sensors. ▪ Power regulation, signal control, and sensor-based input-output systems.	▪ ***Science*** **–** Develop understanding about basics of electricity. ▪ ***Engineering*** **-** Understand the role and function of electronic components in creating circuits. ▪ ***Technology*** **-** Learn how sensors (like sound, light, magnetic, and proximity) are used to mimic human and animal senses in machines.
Electricity	Create understanding through experiential learning about – ▪ Concept of electric current, types of current, conductors, insulators. ▪ Electrons, building simple electric circuits.	▪ ***Science*** **–** Distinguish between direct current (DC) and alternating current (AC) and understand their behavior. **–** Classify materials based on conductivity and understand their use in circuit design. **–** Identify types of electricity and their effects.
Circuits	Create understanding through experiential learning about – ▪ Electric circuits, electron flow, battery functions. ▪ Input-output concepts, circuit path importance, crafting circuit models.	▪ ***Science*** **-** How batteries produce electric current. - Understand the difference between open and closed circuits. - Understand how a switch opens or closes an electric path. - Identify the role of DC current in circuit. ▪ ***Engineering*** **-** Construct working circuits using batteries, wires, and bulbs.
Glowing LED	Create understanding through experiential learning about – ▪ Electricity flow, LED working principle, light reflection, refraction, dispersion. ▪ Prism-based light tools, circuit troubleshooting, rainbow creation.	▪ ***Science*** **–** Understand how LEDs convert electrical energy into light . **–** Learn about the formation of colourful rainbow with the help of glass prism. ▪ ***Engineering*** **–** Design and build circuits that use LEDs to demonstrate light emission.
Branch of Resistors	Create understanding through experiential learning about – ▪ Current damage to components, energy control, resistance, resistor properties. ▪ Safety in electronic gadgets, use of switches, resistors, LEDs, resistance impact.	▪ ***Science*** **–** Observe how resistors limit current to protect LEDs and affect brightness. ▪ ***Technology*** **–** Explore practical uses of resistors and switches in electronic devices. ▪ ***Engineering*** **–** Build circuits using resistors and switches to control LED behavior safely. ▪ ***Art*** **–** Design circuit diagrams showing resistor placement creatively.

Unit 4 : STEAM - Computation Thinking

Chapter	Learning Objective	STEAM Outcome
Introduction	Create understanding through experiential learning about – ▪ Flowcharts, algorithms, computational thinking, block-based coding. ▪ Inputs/outputs, creativity, addition, subtraction, logic, reasoning.	▪ ***Science*** **-** Use computational thinking to break problems into smaller parts. ▪ ***Technology*** **-** Use logic to make decisions in algorithms. - Apply block-based coding to implement AI. ▪ ***Engineering*** **-** Identify inputs and outputs in engineering systems. ▪ ***Art*** **-** Design flow-charts using creativity in unique styles. ▪ ***Maths*** **-** Learn arithmetic operations like addition and subtraction through flow-charts and block based coding.

Unit 5 : STEAM - AI Coding

Chapter	Learning Objective	STEAM Outcome
Intoduction to Pee Cee Pocket	Create understanding through experiential learning about – ▪ Artificial Intelligence, input-processing-output system, sensors. ▪ Smart devices, real-world AI applications. ▪ Role of AI in daily life, human-machine similarities.	▪ ***Science*** **–** Explore how light, sound and motion are processed by machines. ▪ ***Technology*** **–** Relate PeeCee's working to technologies like smartwatches, self-driving cars. ▪ ***Engineering*** **–** Design intelligent systems that collect inputs and produce meaningful outputs. ▪ ***Art*** **–** Create interactive and expressive AI projects using lights, colors, sounds and display animations. ▪ ***Maths*** **–** Apply concepts like distance, speed, angle and time in sensor data interpretation.
Plode App. Interface with Play Mode	Create understanding through experiential learning about – ▪ App control, Bluetooth/Wi-Fi, speech-to-code, block-based coding. ▪ Robotics, remote control, interactive play.	▪ ***Science*** **–** Understand how wireless communication enables device control. – Understand different scientific principles in order to create a simple robot. ▪ ***Technology*** **–** Explore app interfaces and voice/button controls for devices. – Explore the functions of a microcontroller.
Illumination with PeeCee	Create understanding through experiential learning about – ▪ Light properties, RGB LED, reflection, dispersion, ▪ Microcontroller, Plode app, block coding, circuit setup, color mixing.	▪ ***Science*** **–** Understand light phenomena like color mixing, intensity and brightness using RGB LEDs. ▪ ***Technology*** **–** Control RGB lights using coding platforms or microcontrollers. ▪ ***Engineering*** **–** Build and test coded circuits to manage LED color, intensity and timing. ▪ ***Art*** **–** Create colorful lighting patterns and effects using RGB combinations.
Left-Right Indicator	Create understanding through experiential learning about – ▪ Sound, LED behavior, electricity & battery. ▪ Microcontroller, real-time input processing, block-based coding, input-output systems, symmetrical LED patterns.	▪ ***Science*** **–** Understand how inputs like switches control electric circuits and trigger responses. ▪ ***Technology*** **–** Use coding to control LEDs and sound modules through interactive inputs. ▪ ***Art*** **–** Create engaging visual or sound-based feedback designs using lights and tones.
Light Up and Smile	Create understanding through experiential learning about – ▪ LED function, light, biomimicry. ▪ Plode software, microcontroller, robotics, hardware-software integration.	▪ ***Science*** **–** Understand how timing and sequences affect the behavior of electronic components like LEDs. – Understand biomimicry in order to create efficient and advance machines which can imitate expression and different functions of living creatures. ▪ ***Technology*** **–** Link coding logic with hardware to control outputs effectively. ▪ ***Art*** **–** Design creative LED patterns and light shows using loops and sequencing.

Unit 6 : STEAM - Machine Making (Simple Machine)

Chapter	Learning Objective	STEAM Outcome
Simple Machine	Create understanding through experiential learning about – ▪ Simple machines like lever, wheel & axle, inclined plane, wedge, screw and pulley. ▪ How machines make work easier.	▪ ***Science*** - Understand what simple machines are and how they help in doing work with less effort and force. - Identify six types of simple machines in everyday tools, games, and surroundings.

Lever	Create understanding through experiential learning about – ▪ Force, motion, simple machines, mechanical advantage, ▪ Load, effort, fulcrum, prototyping mechanisms, model building, distance measurement.	▪ ***Science*** **–** Understand the principles of levers, including the roles of fulcrum, load and effort. – Understand how lever helps in force reduction, direction change and increasing speed. ▪ ***Engineering*** **–** Explore how mechanical advantage helps reduce effort in simple machines. ▪ ***Art*** **–** Create models showing the classes of levers. ▪ ***Maths*** **–** Calculate effort, load and distances.
Pulley	Create understanding through experiential learning about – ▪ Force, motion, work, simple machines (pulley). ▪ Designing and assembling pulley models, creative design.	▪ ***Science*** **–** Understand the working principle of pulleys and how they reduce effort through mechanical advantage in order to make daily tasks easier. ▪ ***Engineering*** **–** Identify and analyze the parts of fixed, movable and compound pulley systems. ▪ ***Art*** **–** Build creative pulley models ▪ ***Maths*** **–** Calculate effort and load ratios to understand how pulleys multiply force.
Wheel and Axle	Create understanding through experiential learning about – ▪ Force, motion, wheel and axle design. ▪ Speed, distance, mechanical advantage, rotational motion.	▪ ***Science*** **–** Understand how the wheel and axle use rotational motion to reduce effort and increase efficiency. – Understand how a circular shape loke wheel can cover more distance as compare to the other shapes when an external force is applied. ▪ ***Engineering*** **–** Explore how changing wheel or axle size impacts speed, force and control in mechanical designs. ▪ ***Art*** **–** Create diagrams or models showing different wheel-axle setups in creative applications.
Inclined Plane	Create understanding through experiential learning about – ▪ Force, motion, friction, simple machines (inclined plane), ▪ Structure design, creative ramp building, angle measurement.	▪ ***Science*** **–** Understand how inclined planes help reduce the effort needed to lift objects. – Explore how inclined plane increases the speed of an object. ▪ ***Engineering*** **–** Explore how changing the angle of the inclined plane affects the force and effort required. ▪ ***Maths*** **–** Relate angle measurements with effort and speed using simple calculations and comparisons.
Screw and Wedge	Create understanding through experiential learning about – ▪ Simple machines, mechanical advantage, screw and wedge designs. ▪ Tool application for gripping, cutting, carving, science-art integration, tool handling skills.	▪ ***Science*** **–** Understand how a screw converts rotational motion into linear motion and increases grip in order to make day-to-day task easier. – Understand how a wedge multiplies force to cut, split or hold materials in order to make day-to-day task easier. ▪ ***Engineering*** **–** Explore how screw threads affect effort and precision in holding or lifting objects. – Analyze the shape and angle of wedges to understand their cutting efficiency.

Unit 7 : STEAM - Compound Machine

Chapter	Learning Objective	STEAM Outcome
Compound Machine	Create understanding through experiential learning about – ▪ Compound machines formed by combining simple machines. ▪ Efficiency in multi-part machines.	▪ ***Science*** - Identify common compound machines. - Learn how compound machines make work easier, quicker, and more efficient then simple machine. - Develop critical thinking by understanding how machine parts work together.

Catapult	Create understanding through experiential learning about – ▪ Potential and kinetic energy, elasticity, projectile motion, ▪ Catapult construction, unique shapes, angle measurement.	▪ ***Science*** – Understand energy transformation from potential to kinetic energy in catapults and explore elasticity. – To develop basic understanding about projectile motion. ▪ ***Engineering*** – Design and build catapults, adjusting components to improve performance. ▪ ***Art*** – Create artistic models or diagrams illustrating the catapult's structure and motion paths. ▪ ***Maths*** – Analyze projectile angles, distance and trajectory using basic trigonometry and measurements.
Lifting Bridge	Create understanding through experiential learning about – ▪ Force, motors, pulleys, levers. ▪ Model building, creative design, cultural representation, angle measurement.	▪ ***Science*** – Understand the principles of pulleys and levers in lifting and load distribution. ▪ ***Technology*** – Explore real-world applications of simple machines in bridges and construction. ▪ ***Engineering*** – Build and test a functional lifting bridge model using pulleys and levers. ▪ ***Art*** – Design detailed diagrams and aesthetic models of lifting bridges. ▪ ***Maths*** – Measure angles to evaluate efficiency of the lifting mechanism.

Unit 8 : Mechatronics - Project Based Learning

Chapter	Learning Objective	STEAM Outcome
Smart Dustbin	Create understanding through experiential learning about – ▪ Vibrations, waves, frequency, amplitude, ultrasonic sound, echo. ▪ Energy transformation (electrical to mechanical), friction, gears, sensors, microcontroller, block coding, mechanical movement, creative design, distance calculation.	▪ ***Science*** – Understand how ultrasonic sensors use sound waves and echoes to detect distance and motion in order to create smart machines. – To build understanding about energy transformation in order to develop efficient motors which release less heat. ▪ ***Technology*** – Learn how sensors and controllers are used to build intelligent machines and automation systems. ▪ ***Engineering*** – Integrate ultrasonic sensors into functional circuits ▪ ***Maths*** – Interpret and apply formulas related to speed, distance, and time in the context of sound wave motion.
Obstacle Avoiding Car	Create understanding through experiential learning about – ▪ Ultrasonic sound, frequency, echo, magnets, electromagnets, energy conversion, motors, motion. ▪ Ultrasonic sensors, block coding, microcontroller, structural and electronic components, circuit connections, creative design, distance, RPM.	▪ ***Science*** – Understand how ultrasonic sensors mimic echolocation in nature (like bats) for obstacle detection. – Understand the different phenomenon of physics in order to develop knowledge and working of different types of sensors. ▪ ***Technology*** – Learn how motors and electromagnets convert electrical energy into motion in machines. – Block-based coding provides an intuitive software environment that enhances understanding of microcontroller functionality. ▪ ***Engineering*** - Troubleshoot wiring or circuit errors. - Design a model of an car which works more efficiently by using difrent kind of sensors and by applying diffrent scientific formulas and principles related to sound, frequency, echo, electro magnets, ect. ▪ ***Maths*** – Use distance, speed, and time formulas to calculate sensor-triggered movements and motor responses.

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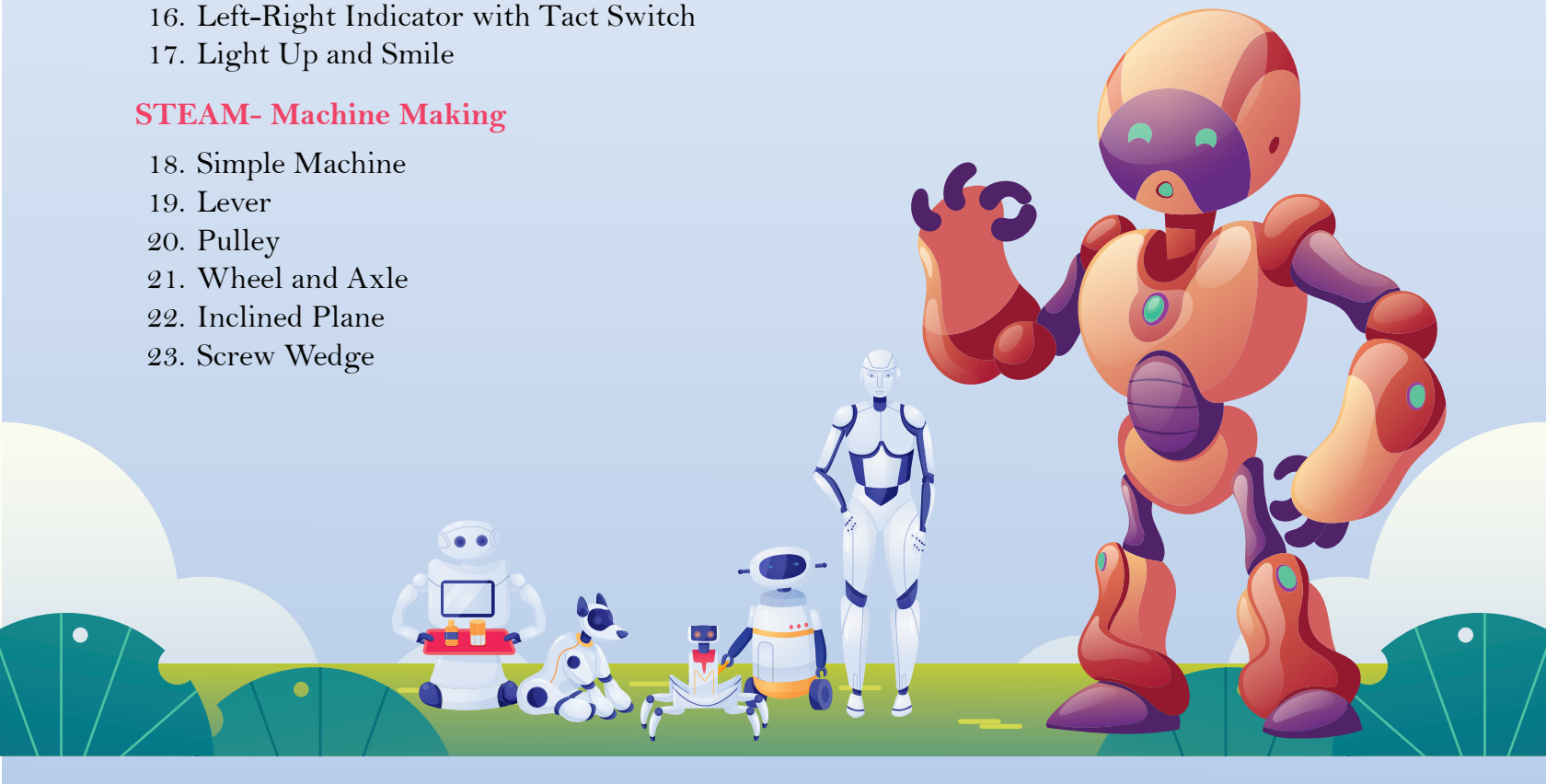




Imagination and Art



Introduction



Have you ever seen something in the clouds? A Dog? A dragon? A smiling face?
But wait… were those things really in the sky? Or did your mind just create them?



Have you ever closed your eyes and seen a place that doesn't exist?
A floating castle? A talking bird? A rainbow that sings?



Where did it come from?
It's not outside.
It's not in the book.
It's not in the drawing.
But still… you saw it.

That is your *imagination*.

Imagination is something very special that lives inside all of us. We cannot see it. We cannot touch it. But we feel it every day. It is the power to see things that are actully not really there. To dream new things. To create new ideas.

What do you do with such ideas?
Where do you put them?
How do you show them to the world?



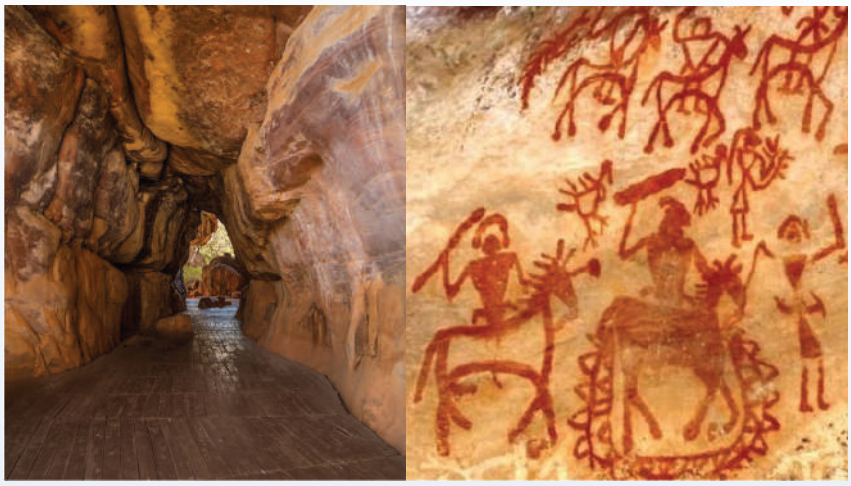
Some people paint it. With every brushstroke, they turn blank paper into dreams—flying birds, dancing stars, or underwater cities.

Some people write poems or stories. A single line of poetry can open up a whole new world—full of story, mystery, drama, or laughter.

Some create music. Organized sounds that are produced by voices, instruments, or electronic means those that evoke emotions, convey ideas, and tell stories.

Some love crafts, sculpture. Three-dimensional art sculptures are those that present the dimensions of height, width, and depth with hand-made techniques and the use of materials like wood, clay, glass, or textiles.

Art – the language of universe



So what do you think from where did the art originate from. Is the evidence of art a century ago or two. Or is it even older than we think. The evidence of arts are being found since the existence of the human in stone age. Ancient men or cavemen also drew different things on the walls of the caves.

Researchers and historians have found proof of art from Stone Age times. Ancient people, often called cavemen, made drawings on cave walls. They used sticks, stones, and natural colours to show animals, hunts, or the world around them. A prominent example of cave stone paintings in India are the Bhimbetka cave paintings, a UNESCO World Heritage Site located in Madhya Pradesh. These cave paintings, dating back as far as 30,000 years, depict a range of daily life scenes, including hunting, dancing, and music.



Even today, experts study and observe how ancient people expressed stories, beliefs, and feelings—without using a single word. They used drawings or carvings to pass information from one person to the other.

The elements of art

The Elements of Art are like the building blocks of all artworks. The seven elements of art – line, shape, form, space, value, color, and texture – are fundamental building blocks used by artists and designers.



Just like we use letters to make words and bricks to make a house, artists use these elements to create drawings, paintings, sculptures for in 2-D design and model making of any new creative idea.

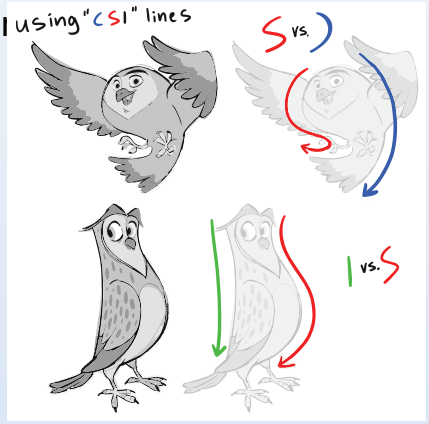


Let us learn some of these elements of art one by one

Line

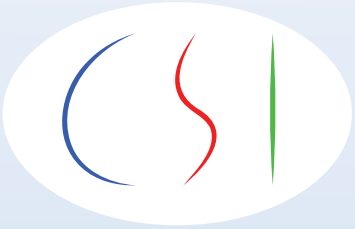
A line is a mark or stroke made between two points.
Lines can be straight, curved, thick, thin, broken, or can move in different directions.

Lines are used to make shapes, show direction, and even show m
drawing.



Artists often use C.S.I. lines:

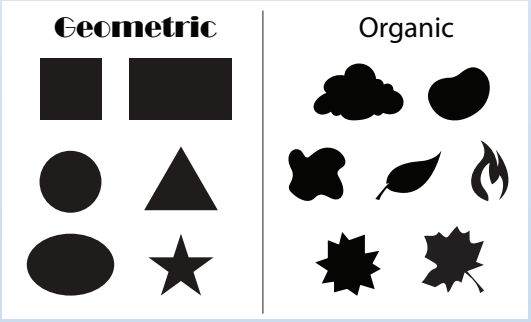
- C = Curved line
- S = 'S' shaped line
- I = Straight line



These lines help in drawing and designing.

Practice: *Take any rough paper or newspaper and fill it with C, S, and I lines.*

Shape



A shape is made when lines join or close.
Shapes are flat and only have length and width.
They are drawn in 2D (two dimensions).

There are two types of shapes:

- *Geometric:* square, rectangle, triangle, circle, oval, etc.
- *Organic:* natural and free shapes like leaves, hands, clouds, butterflies, etc.

You can mix basic shapes to make new and complex shapes, which are used in drawings and designs.

Practice: *Try drawing some geometric shapes without using scale, compass, or any tools.*

Form

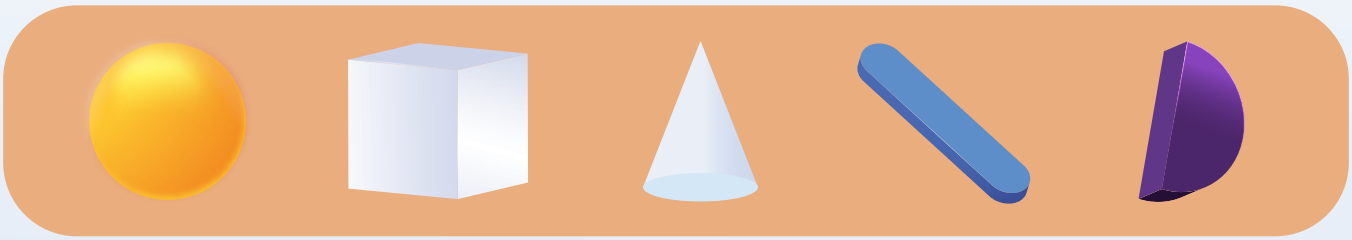
Form means a 3D (three-dimensional) shape. It has height, width, and depth.
Forms look solid and have volume. Like shapes, forms can also be geometric or organic.

Some basic 3D forms are:

- Cube, cuboid, pyramid, cylinder, sphere, and cone



When you add depth to a shape, it becomes a form. You can also make compound forms by joining two or more 3D shapes.



Practice: *- Draw a 2D shape and try to change it into a 3D form.*
- Try joining two shapes to make a new 3D form.

Let's know what is a design?

A *design* refers to the strategic and calculated arrangement of visual elements to create a visually pleasing and functional composition.

The purpose of creating a design is to communicate your thoughts by visual means, translating complex ideas into simple formats and plan out the process of making the actual product.



ACTIVITY

Using the elements you have practiced create a design of any object with your imagination or by observing an object in you surrounding.



3D Pen



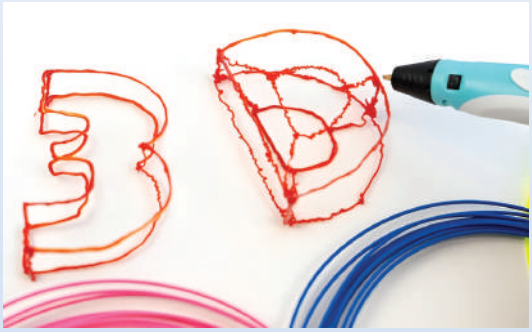
Everyone likes toys. Every child love to play with toys, but sometimes you don't get the toy you really desire.
What if you can make it by yourself? You can use your favourite colour, you can decide how will it look and you can decide how small or big you want to make it.
You can make it as good as your imagination.

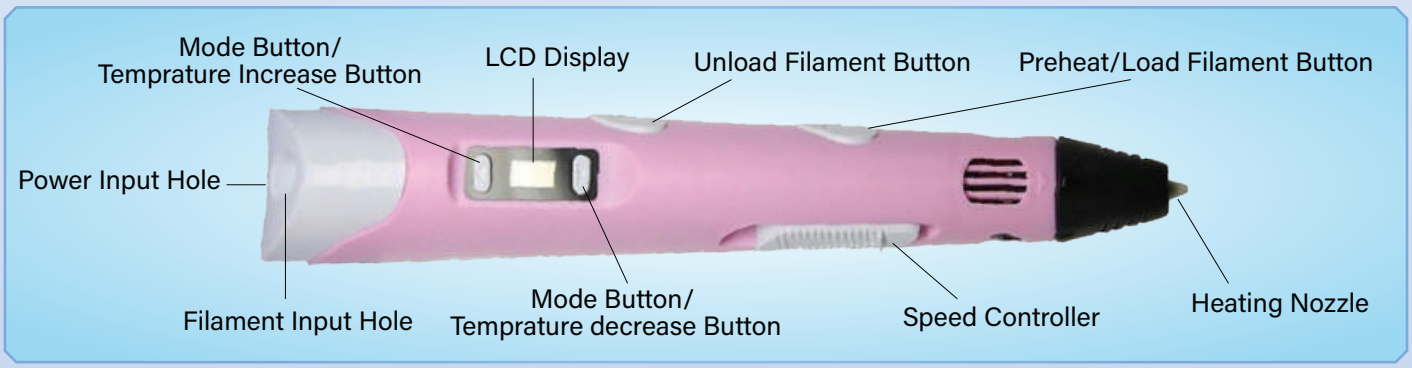
But how?
You can use a really creative device called *"3D pen"*. And not only toys you can create any thing you want to make. With help of a 3D pen and some creative thinking you can bring you imaginaton to life.

What is a 3D Pen ?

A 3D pen is a pen that extrudes heated or warm plastic from the pen's nozzle. 3D printer pens are used for creating DIY structures like 3D objects, sketch for models, prototypes, repair items and much more.

There are two type of filaments that are commonly used in 3D pens, PLA (Polylactic Acid) and ABS (Acrylonitrile Butadiene Styrene).





ACTIVITY

Draw a creature on a paper with your imagination and make it real with the help of a 3D Pen.



Technology

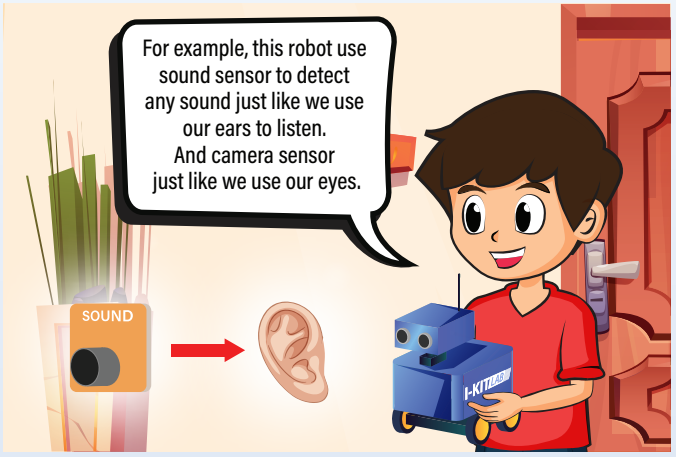


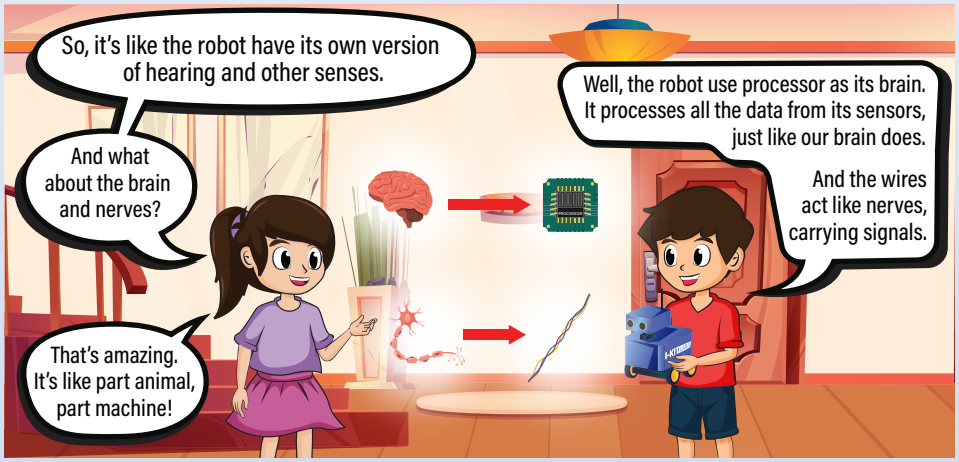
Introduction to Play Trons

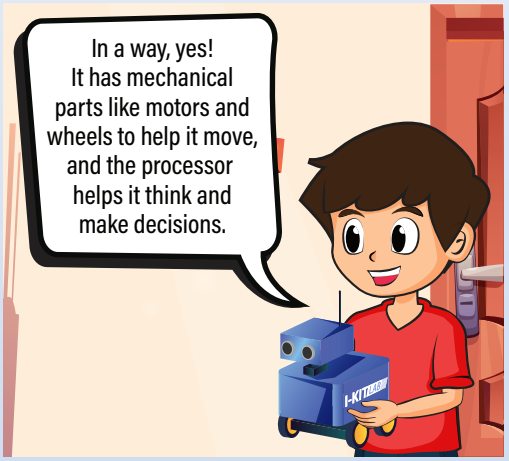


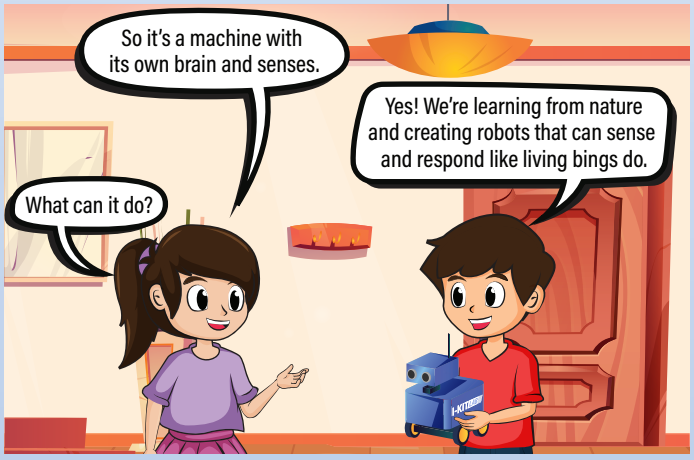
It was Aryan's birthday, he recived a special gift from his uncle who is a scientist and working with a Tech company in London. Aryan opened his gift, it was a ROBOT. Aryan was excited and spent whole night after his birthday party to understand its controls and functions. Next morning, Meera came to meet Aryan at his house. Aryan introduced her to his new robot friend. Meera and Aryan were curious about some special features of robot those were similar to the human intelligence.

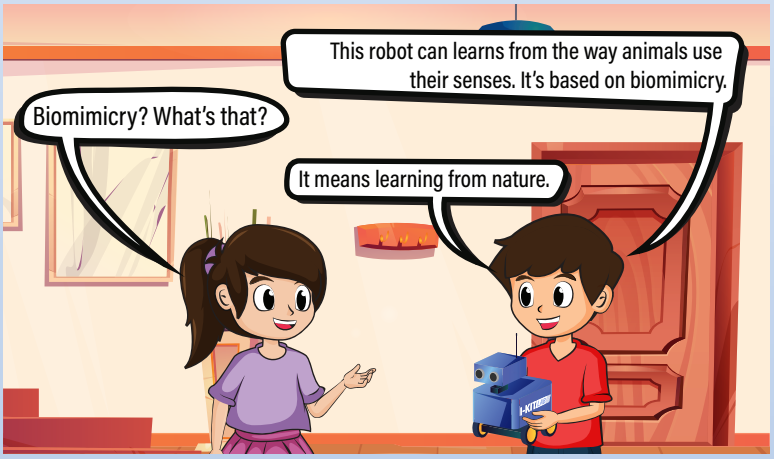


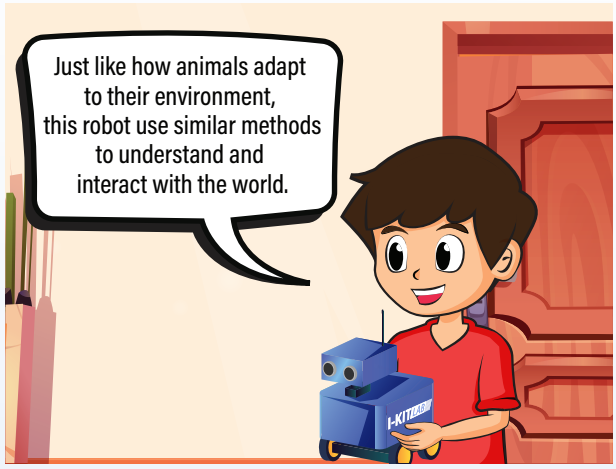


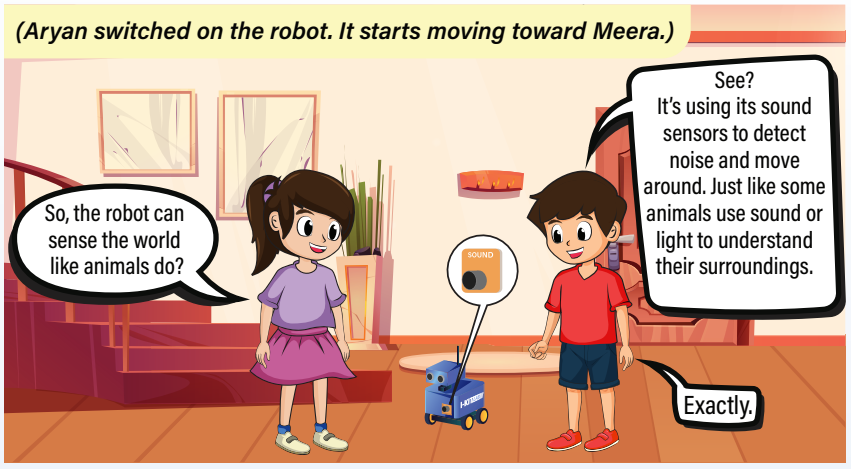


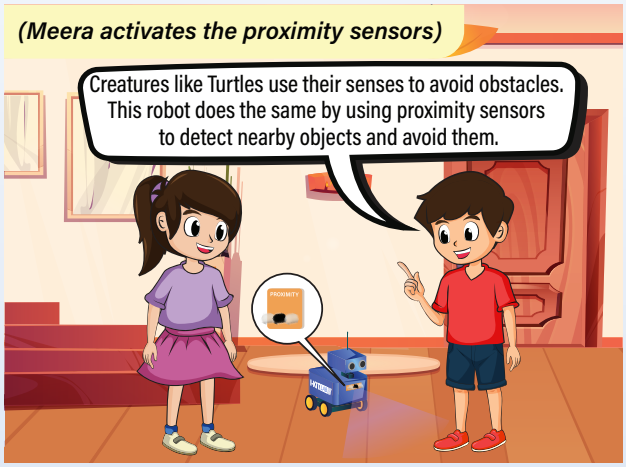


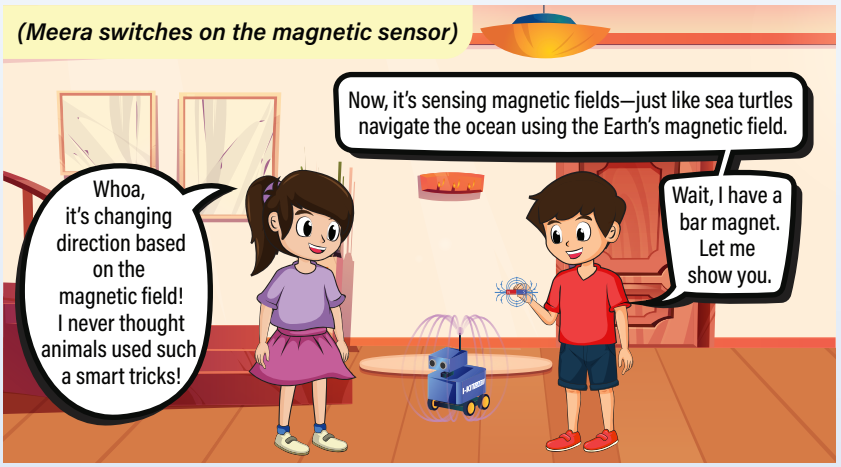


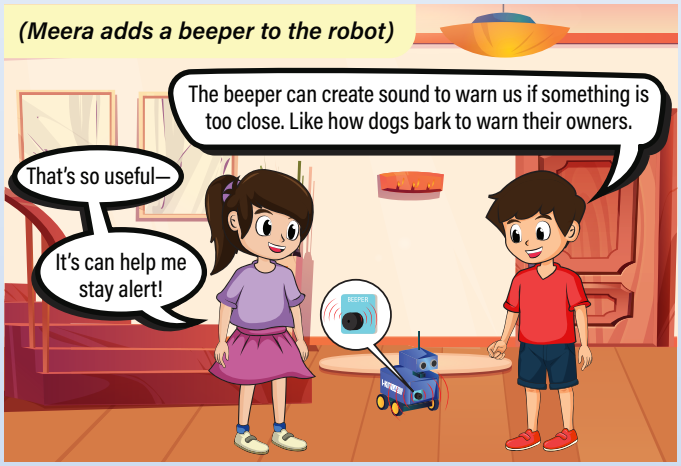


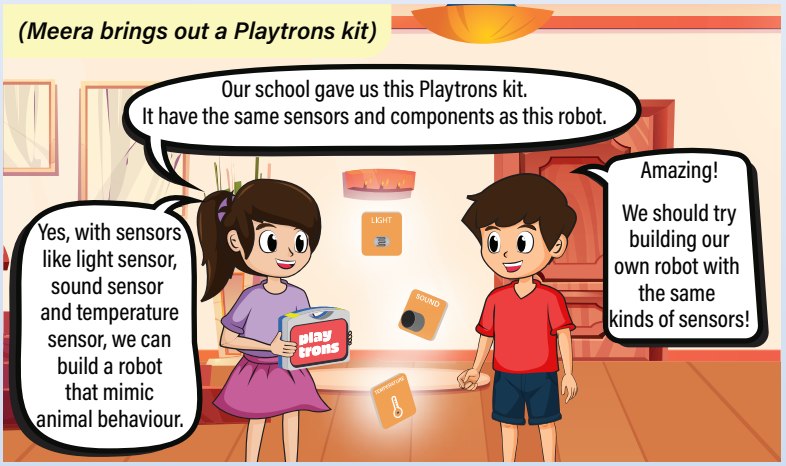

Just like how animals adapt to their environment, this robot use similar methods to understand and interact with the world.

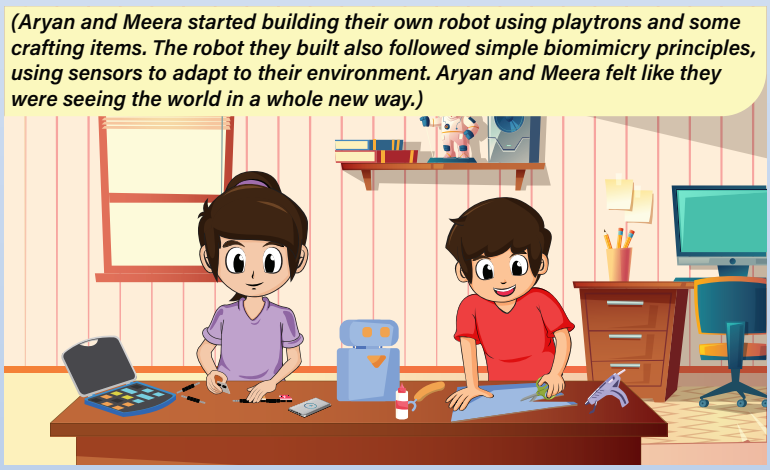

(Aryan switched on the robot. It starts moving toward Meera.)
So, the robot can sense the world like animals do?
See? It's using its sound sensors to detect noise and move around. Just like some animals use sound or light to understand their surroundings.
Exactly.


(Meera activates the proximity sensors)
Creatures like Turtles use their senses to avoid obstacles. This robot does the same by using proximity sensors to detect nearby objects and avoid them.


(Meera switches on the magnetic sensor)
Now, it's sensing magnetic fields—just like sea turtles navigate the ocean using the Earth's magnetic field.
Whoa, it's changing direction based on the magnetic field! I never thought animals used such a smart tricks!
Wait, I have a bar magnet. Let me show you.


(Meera adds a beeper to the robot)
The beeper can create sound to warn us if something is too close. Like how dogs bark to warn their owners.
That's so useful—
It's can help me stay alert!


(Meera brings out a Playtrons kit)
Our school gave us this Playtrons kit. It have the same sensors and components as this robot.
Amazing! We should try building our own robot with the same kinds of sensors!
Yes, with sensors like light sensor, sound sensor and temperature sensor, we can build a robot that mimic animal behaviour.

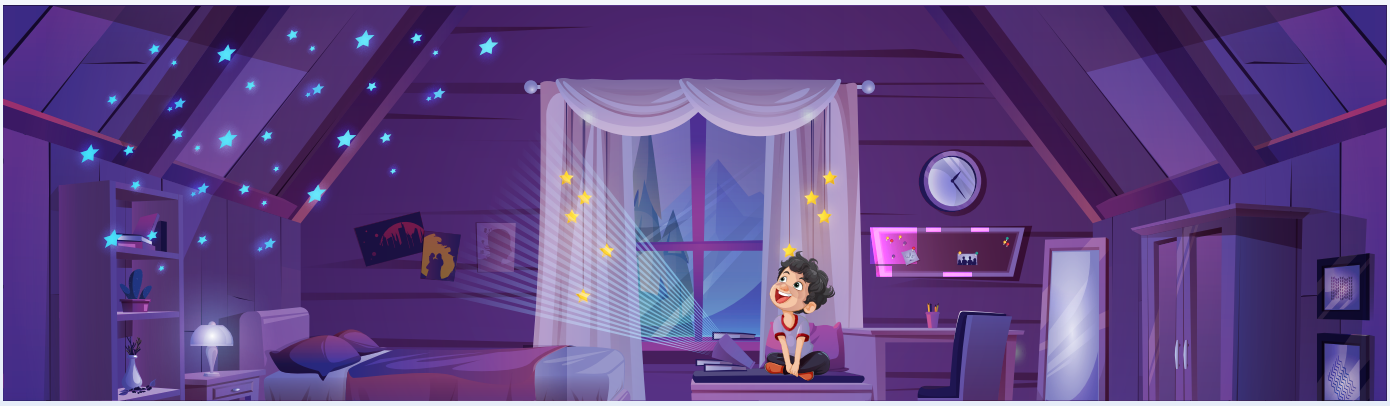

(Aryan and Meera started building their own robot using playtrons and some crafting items. The robot they built also followed simple biomimicry principles, using sensors to adapt to their environment. Aryan and Meera felt like they were seeing the world in a whole new way.)


Aryan, this is awesome.
That's the power of biomimicry and Playtrons.
I feel like I'm learning how animals think and survive.
Nature is the best teacher—and now, we're learning from it through technology.



Star Projector





On 12th November, all the children were excited for a camping trip. Everyone was looking forward to the best part – watching the stars at night. Aryan was excited too. But no one was more excited than Meera.



Meera loves learing about the stars. She would often sit near her window at night, looking up at the sky and smiling. She had a tiny notebook where she sketched star patterns and names of stars. For Meera, stars were not just lights in the sky. They were her dreams, her friends, and her happy place.

But just one day before the camping trip, Meera got fever and she couldn't go for camping. Aryan heard the news and felt a sharp sadness. "She was waiting for this day. How can she miss seeing the stars she loves so much?" he thought. He went to meet her and said softly, "Don't worry, Meera. I'll bring the stars to you."







The next morning after returning back from camping, he didn't rest. He planned some thing special for Meera. Instead, he opened his Playtrons kit and got to work. Aryan took a small cardboard box. He covered one side with black chart paper and used a safety pin to make tiny star-shaped holes. Then he carefully connected the Playtrons power module, LED light, switch, and battery.



He carried it to Meera, who was still resting in her room. Aryan turned off the lights and switched on his creation. Meera looked up — and gasped. The walls and ceiling were filled with twinkling stars, just like the real sky. Her eyes filled with happy tears. "It's beautiful… it's like the stars came to visit me," she whispered.





Meera looked closely at the little device glowing in her room. "How did you make this?

Aryan laughed softly. " It's science! Want to know how it works?"

"Yes, please!" Meera said





“Alright,” said Aryan, pointing at the projector, “this star projector works on a few cool principles. First-- light. Light is a form of energy that allows us to see things. Without light, everything would be dark and invisible!”

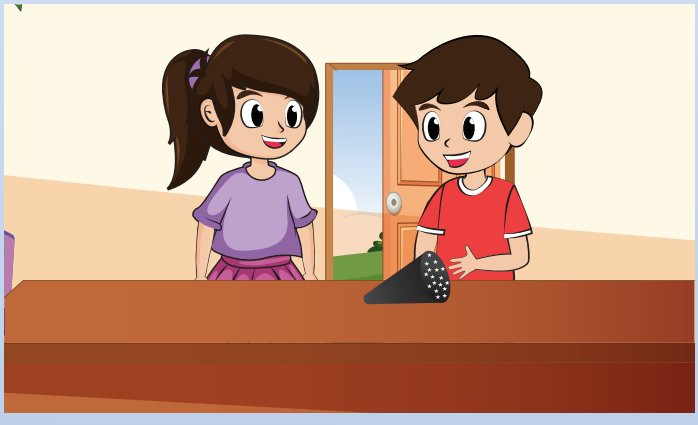


Light travels in a straight line. This is called a ray. So whenever you switch on a torch or a bulb, the light goes in straight lines from the source. That’s why shadows form — because something blocks that straight path.”



“Next,” Aryan continued, “when many light rays move together in the same direction, they form a beam of light. Our LED bulb inside the projector makes a strong beam. That’s the second principle.”

He opened the box gently to show her the parts.



“Now look here,” he said, pointing to the black paper. “See these holes? I used a pin to make them in the shape of stars. When the beam of light passes through these tiny holes, the light travels through and hits the wall or ceiling. Because light moves straight, it creates the same shape as the hole — like a mini version of a real projector!”



Meera's eyes widened. "So each dot on the ceiling is a ray coming through one tiny hole?"

"Exactly!" Aryan said. "That's image projection using light rays. And here's something even cooler — the distance between the projector and the wall decides how the stars look. The farther the box is from the wall, the bigger and softer the stars appear. If you bring it closer, the stars look smaller and sharper."

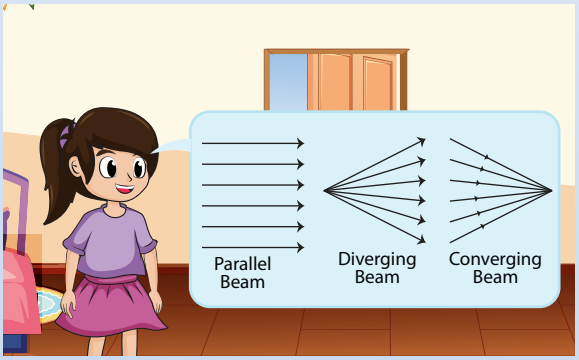
He quickly wrote in her notebook:
Projection Size ∝ Distance from Wall



"It means the projection size increases as the distance increases."

Then Aryan drew a simple diagram and explained:

1. Parallel beam – All rays move side by side without meeting. Like sunlight or laser light.



2. Converging beam – Rays come closer and meet at a point. That happens with lenses when you focus light.

3. Diverging beam – Rays spread out from one point. That's what our LED does — it sends out a diverging beam, and that's why we see stars spreading across the wall."

Meera whispered the line, repeating it to herself. "That's so cool. I never knew stars could come from science like this."

That night, Meera didn't miss the camping trip anymore. As they admired the stars together, Meera began asking questions with curiosity:



- "Why can we see stars only at night?"
- "Why are there fewer stars in the sky these days?"
- "How far away are the stars? Can we really see something that far?"
- "Are all stars the same in size? Do they move?"
- "Can we ever visit a star yet?"

Aryan smiled and said, "You know, when you connect stars into a pattern, it's called a constellation. Long ago, people imagined shapes of animals, gods and heros in the sky by connecting stars."





Meera listened carefully as he explained more:
"One of the most famous constellations we see is Saptarishi. It's also called the Big Dipper. It looks like a big spoon or a cart. In Indian stories, Saptarishi means 'seven great sages' — each star representing one wise sage."

Meera quickly drew it in her notebook.



"And another famous constellation is Orion," Aryan said, "It looks like a hunter with a belt made of three bright stars. Orion is seen in winter skies and is one of the easiest to find because it's so bright."

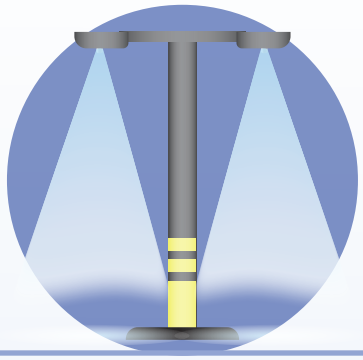
She lay under her starry ceiling, holding her sketchbook close and whispered to herself, "Some stars shine in the sky... and some shine in your heart."
And under her newest drawing, she wrote:
Nothing is more beautiful than the twinkling stars.

ACTIVITY

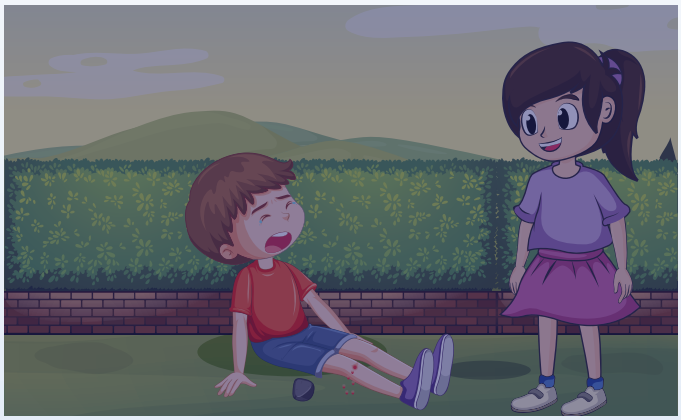
Using some playtron magic and some crafting work, make your own star projector and create your own stars in your room.



Street Light







One evening, Aryan and Meera were walking back after their robotics club meeting. As they passed the garden path, Aryan tripped over a stone. “Ouch! I didn’t even see that,” he said, rubbing his knee. “street lamps are not working on this path.” Meera replied. Aryan nodded, “This is not safe. Why are street lamps are not functioning?”



The next day during their STEAM class, they discussed the problem with their teacher. Teacher asked some questions regarding this problem –

How many street lights are there in the city and who is responsible to On/Off the Lights?

Why sometimes street lights are not working at night and sometimes working at day time during sun light?





All these problem are related to the almost every city and why don't you try building a model of a smart street light system?" the teacher suggested. "You can use the Playtrons kit and show how it would work."

Once getting ready final street light project, Aryan flipped the switch.



'Click'
Both LED lights glowed brightly. "It works!" Meera shouted.
And the other children joined them too, so they began discussing again about this topic

Aryan: "When electric current flows through the filament in a normal bulb, it gets hot and glows. That's called the heating effect of current."

Meera: " LEDs glow because they are small light-emitting diodes. They need only a little current to work, and they last long, They glow when electricity passes through a microchip inside them. They're 90% more efficient than those old yellow bulbs."

Ishan: "So, less electricity wasted, more light! That's why cities are using LED street lights now."



Zoya: "Also, have you noticed the mirror behind real street lights? It's a convex mirror. It helps spread the light in many directions. That's how one lamp covers a wide road!"

Zoya: "Also, have you noticed the mirror behind real street lights? It's a convex mirror. It helps spread the light in many directions. That's how one lamp covers a wide road!"

Aryan: "So the switch is our input device. When I press it, I'm giving the command."

Zoya: "And the glowing LEDs are the output. It shows that the signal is received and electricity is flowing!"

Meera: "Wait, how do they decide the height of real street poles?"

Ishan: "It depends on the angle of light. If the light beam is narrow, the pole must be taller or there must be more lights. For wider angles, fewer poles work!"

Zoya: "And to calculate the best height, you can use trigonometry — the distance it should cover and the angle gives you the ideal height!
They cut cardboard to make a lamp post, wrapped it with silver tape, and painted it with yellow accents.

Meera: "Let's make the light post beautiful! This is our design project too."

Zoya: "We could even use colour filters to show yellow or white light beams."

Aryan: "We could later upgrade this with a light sensor so the street light turns ON only when it's dark!"

Ishan: "Oh! Like an automatic system — now that's real-world engineering!"

That afternoon, they showed the model to the headmistress and explained how street lights could make the garden path safer.

"Very impressive," the headmistress said. "Let's speak to the maintenance staff about installing real ones."

Aryan smiled and whispered to Meera, "A small switch made a big change."

And they all are smiling.

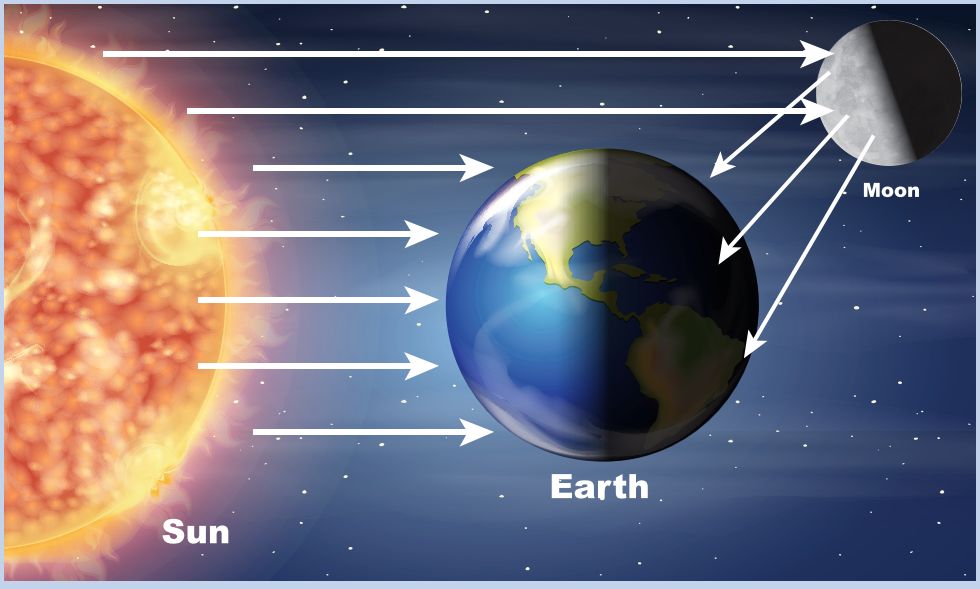


ACTIVITY

Let's make your streets and walkways safer by creating you own SMART Street lights using Play Trons kit.

Out Of Box – Fun Facts

The moon has no light. What we see at night is the light of the Sun that reflects off the moon and reaches the Earth. You are actually looking at sunlight.





Reverse Parking





It was lunch break at school, but Aryan, Meera, Anaya, and Veer were discussing about one problem. Meera asked. "Someone scratched Principal Ma'am's car again! due to limited parking space in the school parking". "Yes!" said Veer, "She was very angry. It keeps happening every week. We must do something!"

Aryan said the driver uncle said that reverse parking system can solve this problem. "What is reverse parking system" Veer asked. Meera added " Reverse car parking system help us in detecting obstacles and alerting, especially in tight spaces and low light intensity. It helps drivers during reverse parking, such as detecting obstacles or judging the distance to them. Which otherwise can lead to potential damage to the car or other casualties"





Aryan stood up with excitement. "Let's build a reverse parking helper using Playtrons! We can stop this before it happens again."

"Yes!" said Anaya. "We'll use science and smart thinking to solve the problem!"

They opened their STEAM kit

Anaya attached the proximity sensor to the back of a toy car. She said. "It can detect objects from a distance and it doesn't even touch them! So, it doesn't get damaged easily."

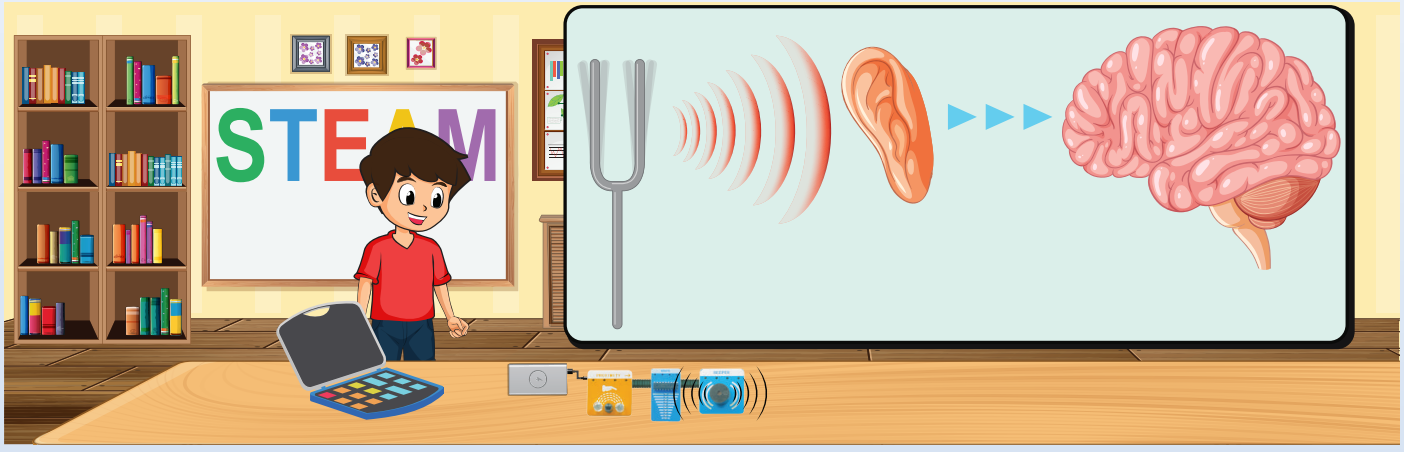


Aryan connected the power bank to the power module and started fixing the cables. “The sensor will sense if something is coming close from behind. Then the beeper will make a sound, and the graph module will show lights.”

Meera slowly moved a book behind the car. BEEP... BEEP... BEEEEEP!

The beeper started beeping faster as the book got closer.
Aryan smiled. “This is because of sound waves! The beeper vibrates and makes sound.”





“Sound is a type of mechanical wave,” Meera added. “It needs something to travel through — like air, water, or even solids.”
Veer nodded. “First, the sound is made when something vibrates. That creates pressure waves. These waves move through the air in all directions.”
“Exactly,” said Anaya. “In air, sound travels as compressions and rarefactions — some parts where the air is tightly packed and others where it is loose.”
Aryan added, “Then the sound waves reach our ears. The eardrum inside vibrates and sends signals to our brain. The brain understands it as sound.”

They all turned to look at the graph module.

"Look at this!" said Meera. “The LED lights blink faster when something is closer. This is like a bar graph. Each bar or light shows how close the object is.”



"The closer the object, the more lights blink!" said Veer. "And that helps the driver know when to stop."
"We used proximity sensors, sound waves, and a graph to help someone park safely," said Anaya proudly.
"Science saved the day again," said Meera. "And no cars were harmed this time!"
"STEAM Spy Squad – always ready!" said Veer, holding up the power module like a trophy.

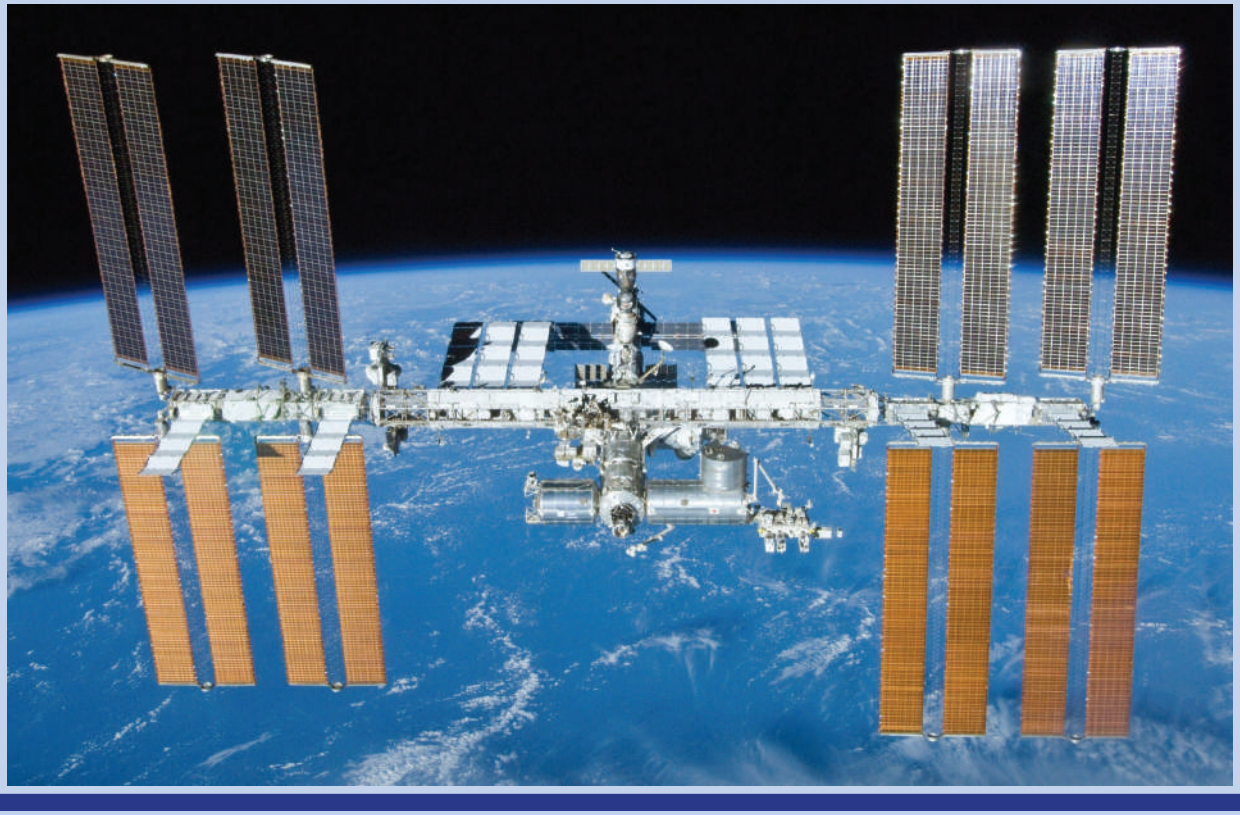


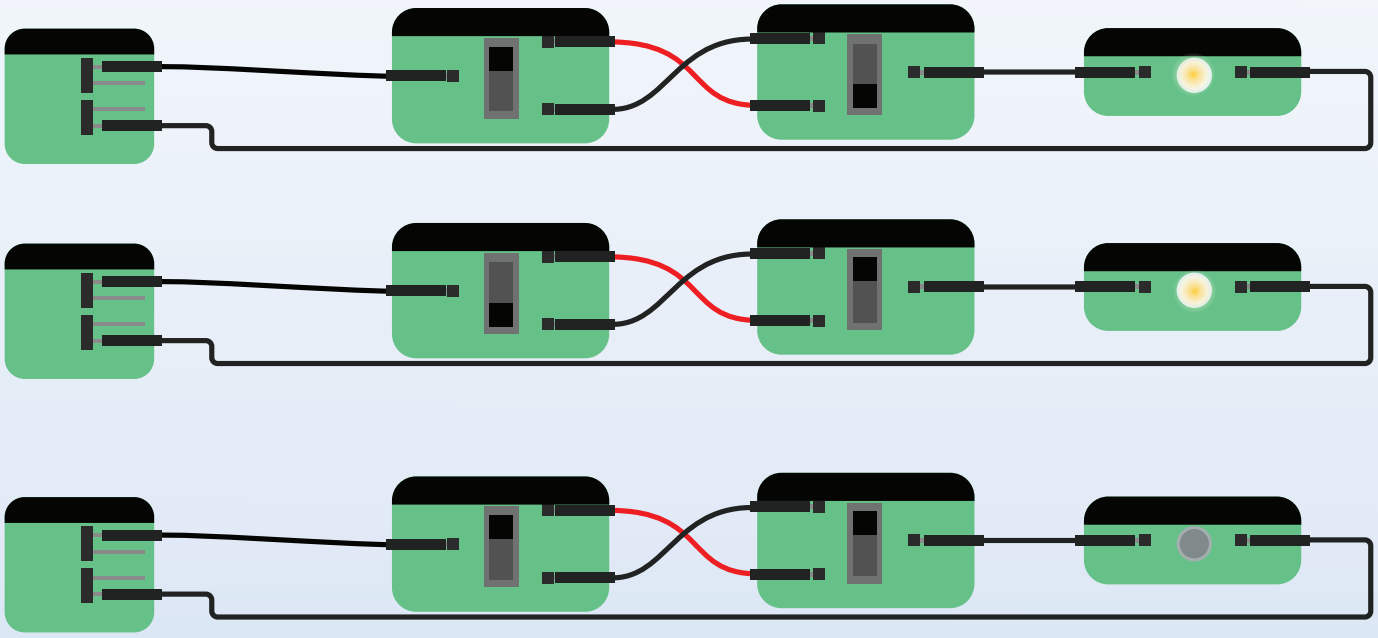
ACTIVITY

Let's make a reverse parking system using Play Trons kit to help you park your car easily and safely.

Out Of Box – Fun Facts

The International Space Station (ISS) has been continuously inhabited since 2000, built through collaboration between robots and astronauts.





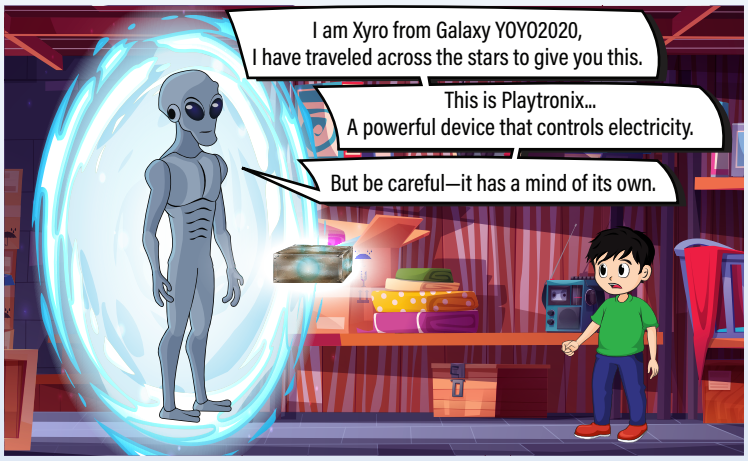
Circuit Designing in Robotics



Introduction to Play Tronix



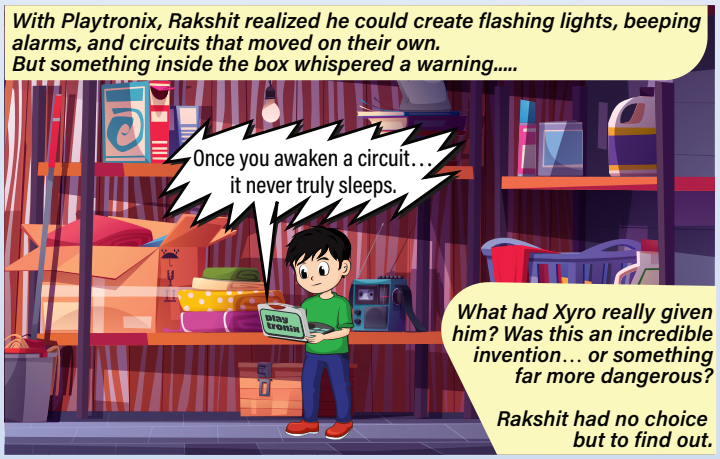
One evening, Rakshit was playing hide-and-seek with his friends inside his house. He wanted to find the best hiding spot, so he went to the store room and locked the door behind him. The air was dusty, and the room felt strangely cold. As he looked around, a bright blue light shining through a crack in the ceiling. Suddenly, a strange humming sound filled the room. Before Rakshit could react, a glowing portal opened right in front of him and something walked out if it!

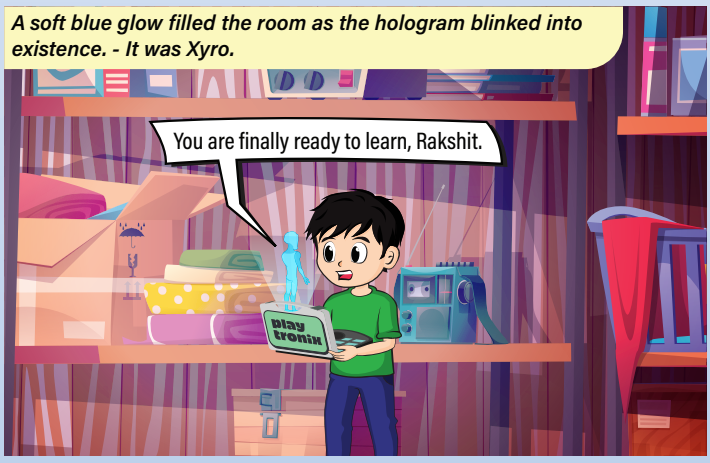


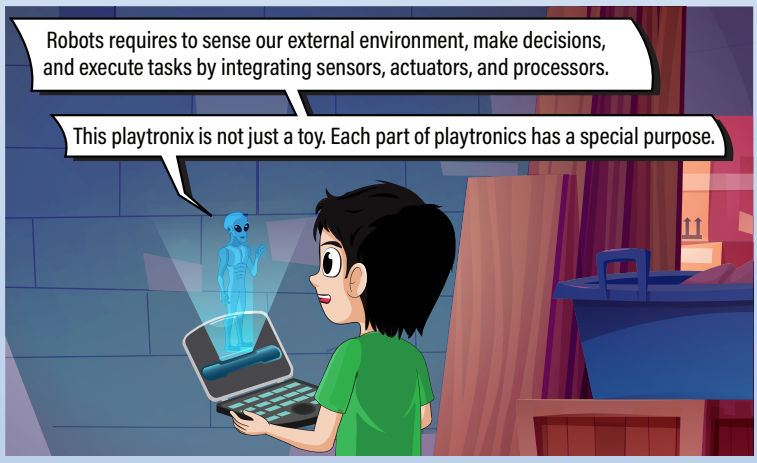


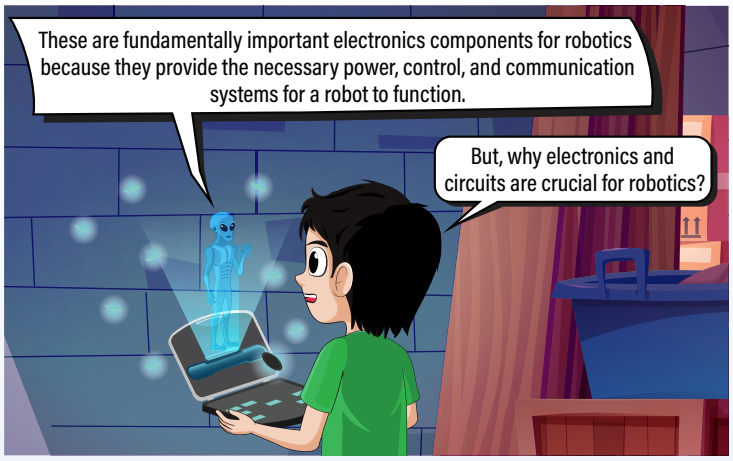


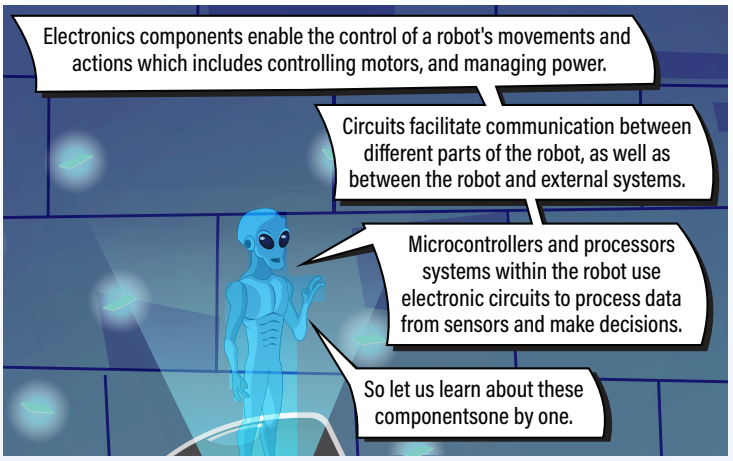


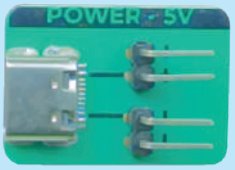
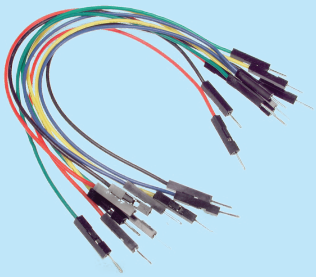


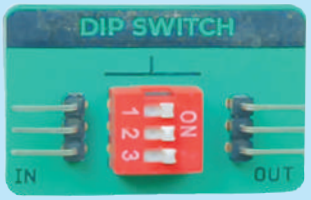
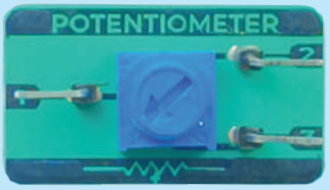


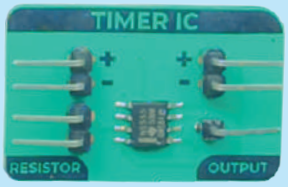






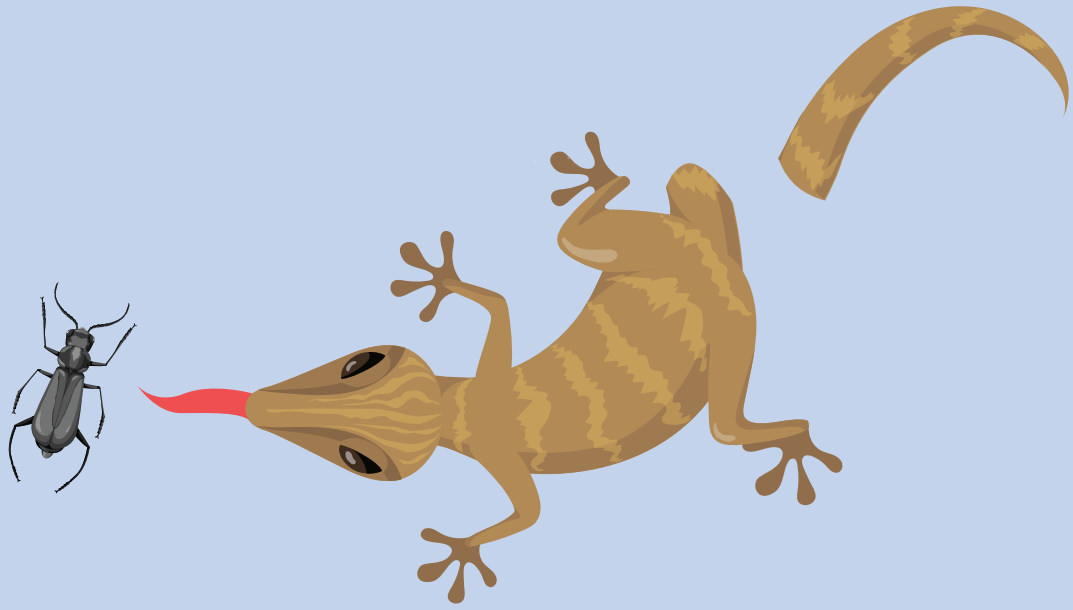
1. Power module	It convert and regulate power supply and provide stable current for circuits.	
2. Junction module	It is the connection point of multiple components and it ensures proper circuit connectivity.	
3. Resistors: The Protectors	Electricity is strong. Too much can be dangerous. Resistors keep it under control. They are controlling current flow, adjusting voltage levels, and enabling precise circuit behavior. They are essential for protecting sensitive components, regulating voltage, and even sensing temperature.	
4. LEDs: The Lights	Lights help us see. These LEDs show if a circuit is working. LED (Light Emitting Diode) circuits are important due to their versatility, efficiency, and long lifespan compared to traditional incandescent bulbs.	
5. Jumper Wires: The Connectors	They carry electricity and connect parts together. Jumper wires are designed to be easily inserted and removed, allowing you to quickly change circuit configurations and reuse the wires.	

6. The Multimeter: The Truth Teller	A measuring tool hovered. This shows numbers—voltage, resistance, current. They are essential tools for troubleshooting, diagnosing faults, and verifying the proper functioning of electronic devices and systems."	
7. The DIP Switch: The Controller	"This turns parts on and off. But in Playtronix, some switches move on their own.	
8. The Potentiometer: The Adjuster	This controls electricity, making it stronger or weaker.	
9. The Capacitor: The Memory Keeper	It stores energy. They have ability to store and release electrical energy, filter out unwanted signals and smooth out voltage fluctuations. They are fundamental for stabilizing power supplies, decoupling circuits and creating timing circuits.	
10. The Transistor: The Power Booster	This makes weak signals stronger, used for amplifying signals, switching circuits and controlling electrical power in various electronic devices.	
11. The Diode: The One-Way Path	They have ability to flow electricity one way. AC-to-DC conversion (rectification), signal processing, and circuit protection.	
12. The Buzzer: The Voice	It makes sounds. It converts electrical signals into audible sounds, such as beeps, tones, or alarms.	
13. The LDR: The Code Finder	A light-sensitive part hovered. It reacts to light, crucial for detecting and responding to light changes in various applications.	

14. Two-way switch	It's a dual position switch and it is controls circuits from two locations. It is essential for controlling a light or appliance from two different locations.	
15. The IC: The Brain	A black chip which is made out of a semiconductor material called Timmer IC. blinking LED displays for indicators or decorations, these are major projects you can implement directly using it.	
16. The Push Button: The Final Decision	Push button switches typically completes or interrupts a circuit when pressed.	

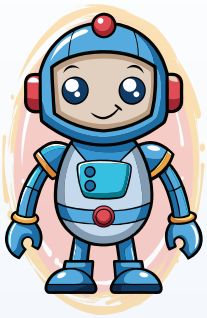
Out Of Box – Fun Facts

A lizard smells with its tongue. Lizard can shed its tail to escape when attacked by a predator.





Rakshit, Xyro and Electricity



Rakshit stared at the mysterious Playtronix box, his fingers hovering over the glowing button. He took a deep breath and pressed it.



Suddenly Xyro teleported in his storeroom. Xyro's voice was deep and commanding. "Rakshit. You have activated Playtronix.

If you wish to understand its power, you must first understand the basics.



" Rakshit, can you answer a few of my questions?"

"What makes a bulb shine? What makes a T.V. work? What runs an electric car, a computer, or even a robot?"

Rakshit answered "maybe electricity"

Xyro floated up and said, yes, "The answer is simple Electricity! We cannot see it with our eyes, but we can feel its power all around us."

What is Electricity?

Xyro showed Rakshit a battery connected to a small fan.



Rakshit smiled. "So electrons are like little delivery boys running with energy?"

"Yes!" Xyro laughed. "Fast and invisible!"

Where Did Electricity Come From?



Xyro opened a hologram and showed a man flying a kite.

"Electricity is a natural energy that exists in our world, it is not invented by any scientist. It has to be studied and understood how it is discovered. Most people give credit to Benjamin Franklin for discovering electricity."

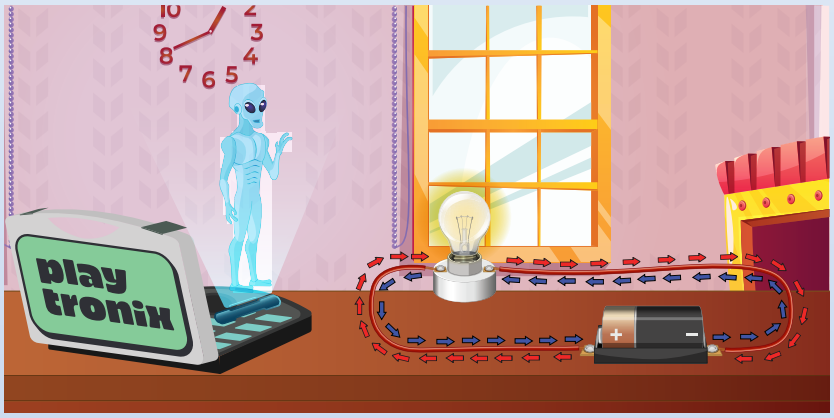
"In 1752, Franklin conducted his famous kite experiment. In order to show that lightning was electricity, he flew a kite during a thunderstorm. He tied a metal key to the kite string to conduct the electricity."

Rakshit was shocked. "He flew a kite during lightning? That's dangerous!"

Xyro nodded. "Yes, very risky. But it helped people understand that lightning is a form of electricity."

Types of Electric Current

Xyro waved his hand and showed two marching lines of cartoon electrons.



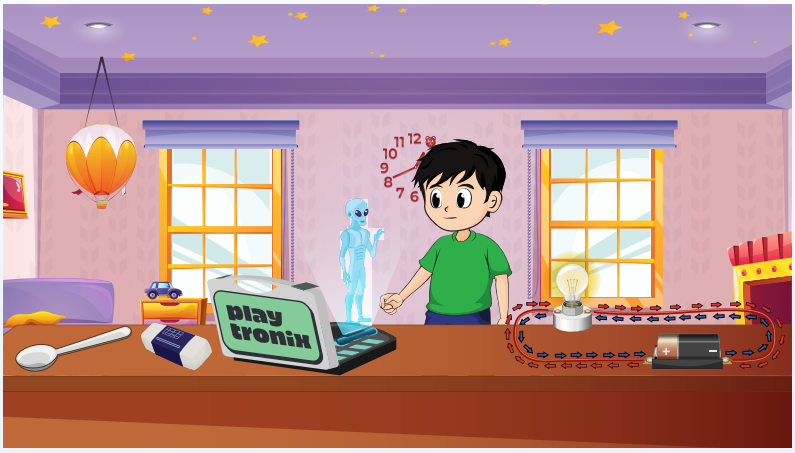
"Imagine charged particle soldiers (electrons) marching in a parade. When they move in a steady, orderly line in one direction, it's called Direct Current (DC)—like a well-organized marching band.
This type of current flows consistently in a single direction, making it ideal for powering devices like batteries and flashlights."

"On the other hand, if these energy soldiers switch directions back and forth, it's known as Alternating Current (AC)—similar to dancers moving forward and backward in a lively dance.

AC is commonly used to power homes and buildings because it can be transmitted over long distances more efficiently."
Rakshit clapped. "AC and DC! Now I finally understand!"

Conductors and Insulators

Xyro picked up a metal spoon and a piece of rubber.



"Not all materials let electricity pass through them. Some are great at conducting electricity which we call Conductors, while others are not good in conducting electricity are known as Insulators. Can you tell which one is conductor and which one is insulator this metal spoon or this rubber?"

Conductors: The Superhighways of Electricity

Conductors let the electricity travel through them like a highway for fast-moving cars.



Examples: Metals like copper, aluminum, and even salty water (yes, water can carry electricity, so don't mix electronics with water!), human body etc.

These materials are called conductive materials. The property of a conductor to conduct electricity is called conductivity.

Conductors: The Superhighways of Electricity

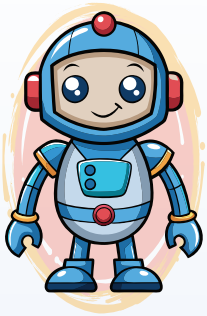
Insulators don't let electricity pass through them, acting like giant walls blocking traffic.

Examples: Rubber, plastic, and dry wood. That's why electric wires are covered in rubber—to keep us safe from shocks!

Rakshit nodded. "That's why Mummy says not to touch wires with wet hands!"
Xyro gave him a glowing high-five. "Now You are ready to explore more!"



Rakshit, Xyro and Circuits







Xyro asked one question to Rakshit "Rakshit, think carefully. You have seen a fan, an electric vehicle, a phone, and even this small LED. What is common between all things?"

Rakshit frowned. "Uh… they all need power or current?"

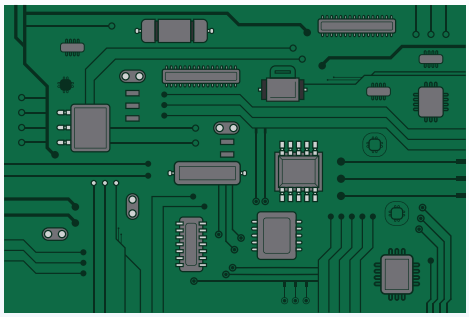
Xyro asked again "but their intended functions are different!!" Xyro flicked of his hand, multiple holograms appeared—a ccc a giant factory machine. Look at all these equipments, common power source with different functions? "

Rakshit thought harder.



He pointed at the fan and the train. "They move."
Then at the bulb and LED. "They give light."
"Electric scooter moving fast due to electic motor"
"Then the washing machine and the robot. They follow commands."
Xyro nodded. "Yet all of them have a single source of power that is current but their outcomes are different"
He waved his hand, and all the images transformed into one thing—a circuit diagram.
"They all need circuits. No circuit, no electricity. No electricity, no function."

"A circuit is crucial for the proper functioning of all electronic components. It provides a closed loop through which electricity can flow, enabling components to perform their intended functions"



Rakshit's eyes widened. "So whether it's a tiny light or a huge machine, everything runs because of circuits?"

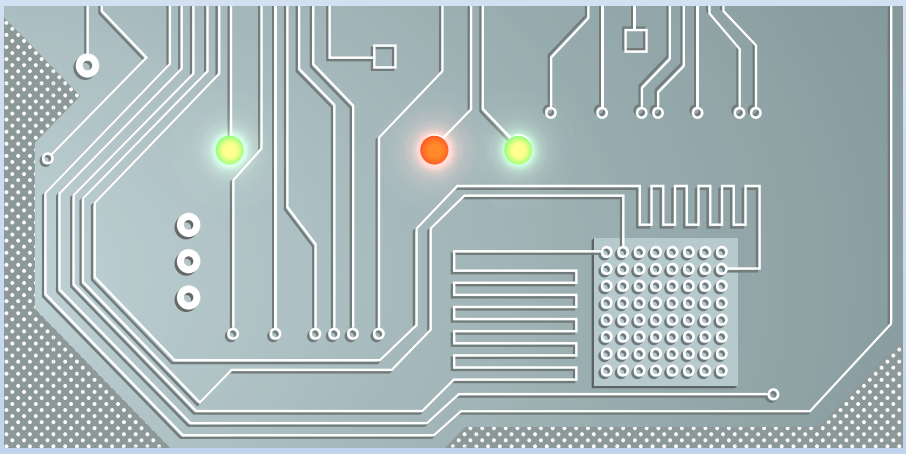
"Exactly. And your journey begins with understanding them, one step at a time."



Xyro's waved of his hand, an image appeared in the air—a small electric fan spinning slowly.

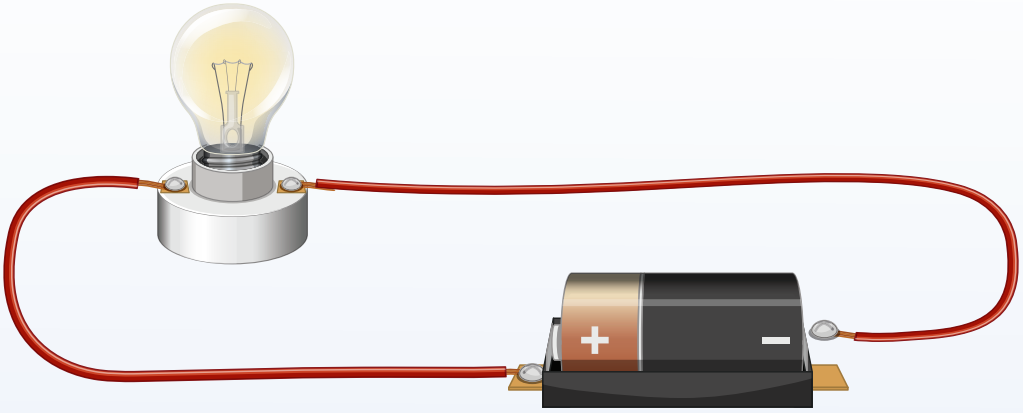
"Imagine this fan," Xyro said. "It works only when electricity flows through it. But now…"
The fan transformed into a electric car, its engines roaring to life.
"An electric car also runs on circuits. From a tiny fan to a powerful car motor, the principle remains the same. A circuit is the path that allows electricity to flow, making things move,

Rakshit's eyes widened. "Wait, so circuits are everywhere? In fans, in cars…?"



Xyro nodded. "In everything that uses electricity."

A circuit is a path through which electricity flows," Xyro explained. "Electricity, much like water, needs a complete path to move. This path is called a closed circuit."



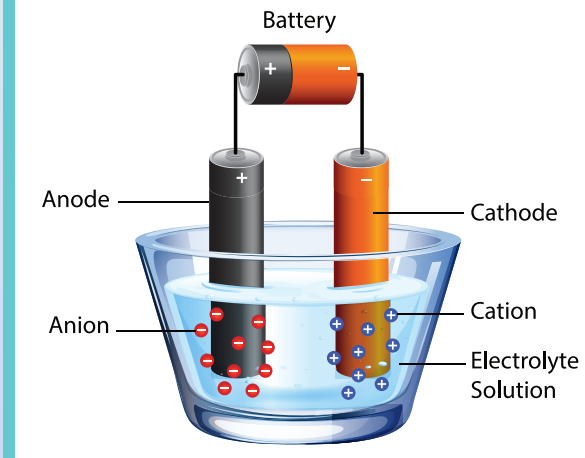
The screen changed. Now, the wire was disconnected, and the LED was off.
"But if the path is broken, the electricity cannot flow. This is an open circuit."
Rakshit scratched his head. "So… it's like a race track. If the road is complete, the cars—uh, electrons—can go around. But if there's a gap, they stop?"
Xyro nodded. "Correct. Rakshit, answer this: What makes electricity move through a circuit?"

Rakshit hesitated. "Uh… the c?"
Xyro nodded. "Correct. But why?"
Rakshit scratched his head. "Because… it has power?"
Xyro's hand flickered, and an image of a battery appeared in the air.



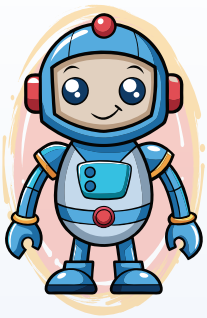
"A battery has two sides: a positive terminal and a negative terminal. Inside, tiny particles called electrons are stored at the negative side. When we connect a wire, the electrons rush towards the positive side, creating a flow of electricity. This movement of electrons is what powers everything—your fan, your phone, even cars." A battery is like a pump for electrons. Inside, a chemical reaction creates a force called voltage. This voltage pushes the electrons from the negative terminal to the positive terminal through the circuit. Without this force, the electrons would stay still, and nothing would work."

ELECTROLYSIS





The Glowing LED





Xyro gave a task to Rakshit

He said " Complete this circuit and make the LED glow,"

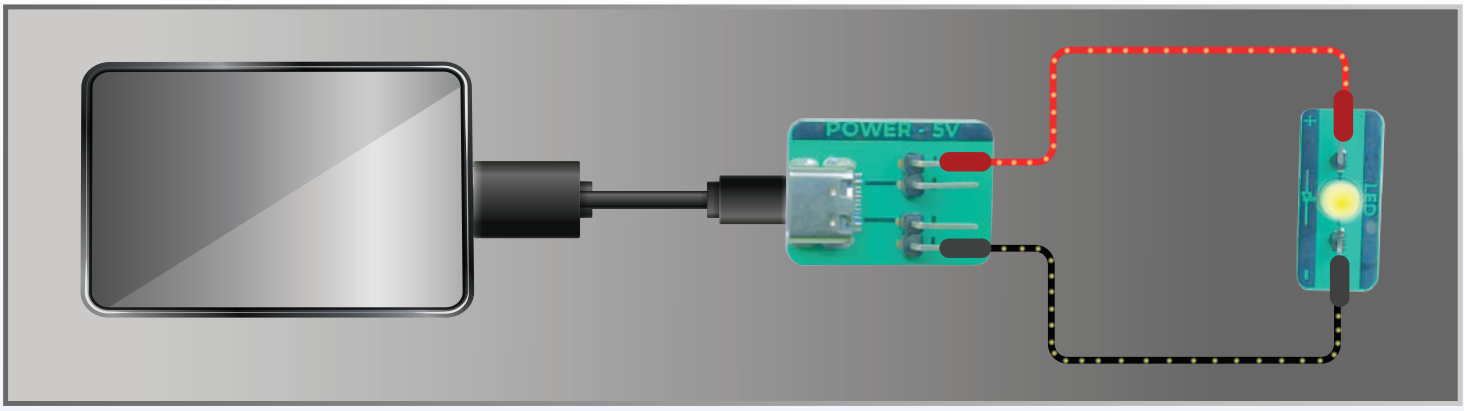
Rakshit looked at the Playtronix components in front of him. He was a little nervous, but also excited.

He picked up the wires and began.

First, he connected one wire from the battery's negative terminal to the LED's negative terminal. Then, he carefully attached the positive terminal of the LED to the battery's positive terminal.

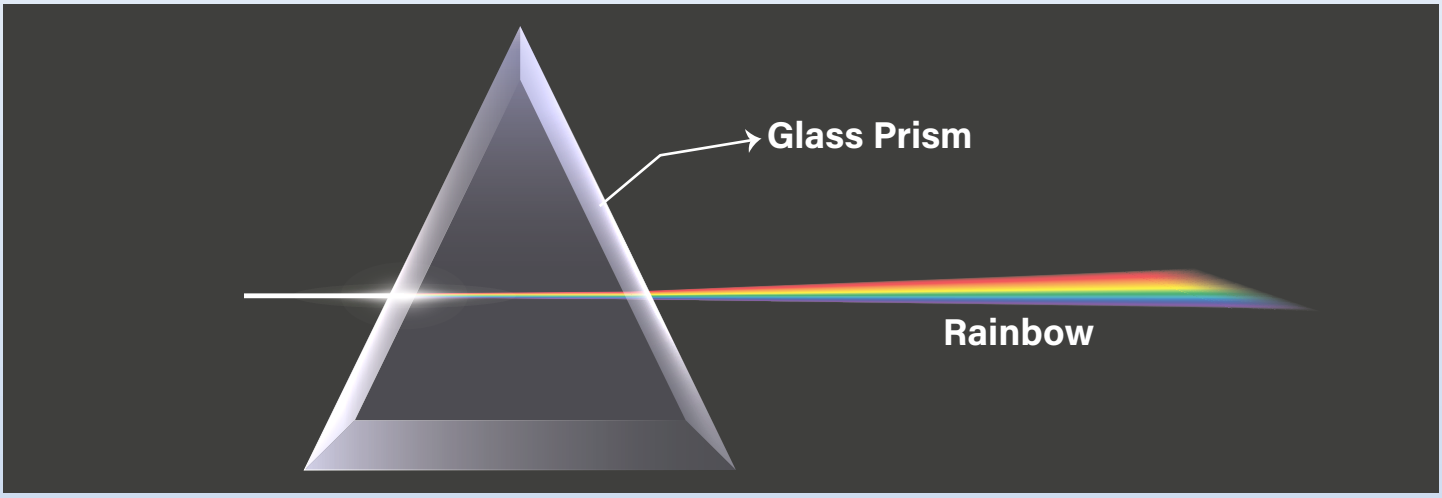


Click!
The LED flickered, then shone brightly.
"It works!" said Rakshit, his eyes wide with happiness.
"You have completed a basic circuit. The tiny particles (electrons) are now flowing through the wires, powering the LED."
Rakshit stared at the glowing LED.



How Does an LED Work?

Rakshit asked "Xyro", "How does this small light glow with just a battery?"
Xyro nodded and explained:
"LED means Light Emitting Diode. It is a small electronic component that allows current to flow only in one direction.
When electrons move through it, they release energy in the form of light. That's why it glows!"
Rakshit said, "So it is like the electrons get excited and shout out as light?"
Xyro laughed. "Exactly! In their own tiny way!"

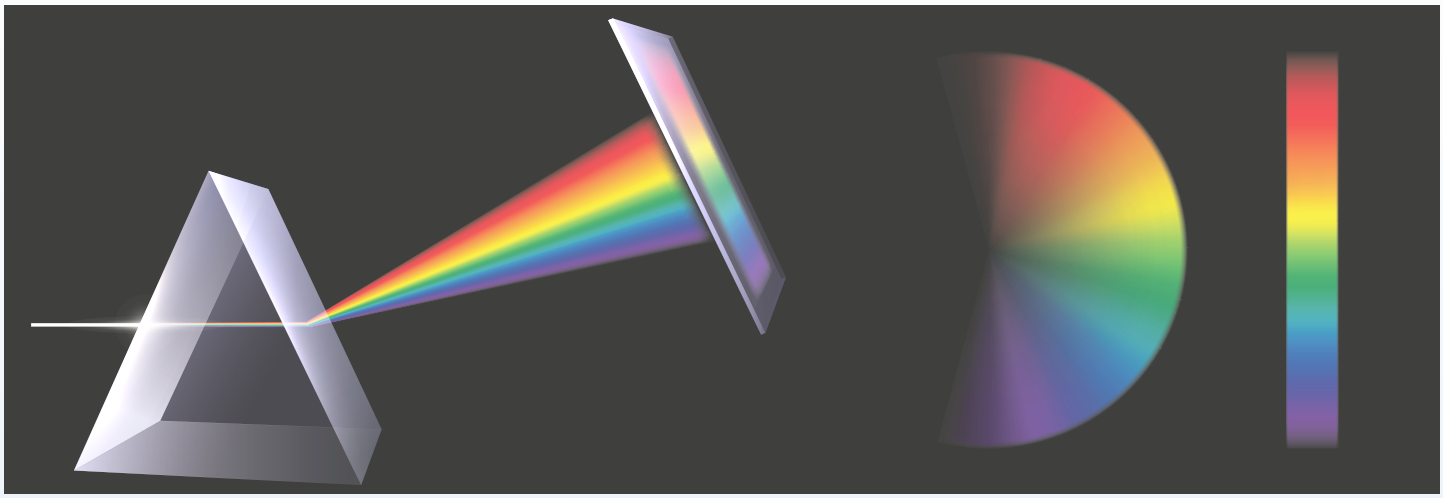


Reflection and Refraction — Light's Play

Xyro took a small glass prism from his pocket and shone the LED through it. A beautiful rainbow appeared on the table.

Rakshit was shocked and said. "Wow! What just happened?"

Xyro said, "That's called refraction. When light travels from one material to another—like air to glass—it bends. That bending of light is refraction.
It helps us make lenses, glasses, and even microscopes!"



He then placed a mirror behind the LED.
"Now look," he said.
Rakshit saw the LED light bouncing off the mirror.
"This is called reflection," said Xyro.
"When light hits a shiny surface and bounces back, that's reflection. It helps us see ourselves in mirrors!"

Xyro continued when white light is passed through a glass prism it splits into its spectrum of colours (in order violet, indigo, blue, green, yellow, orange and red) and this process of white light splitting into its constituent colours is termed as dispersion. The splitting of white light into its different colors like a rainbow. It's like when you see a rainbow after it rains, and white light is breaking into its constituent colors. This happens when light passes through a prism or other objects like soap bubbles or CDs

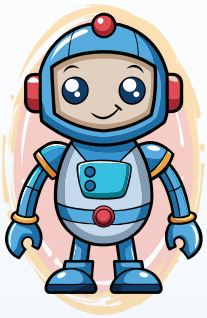
Rakshit looked at the glowing LED, the glass prism, and the mirror.
So much learning from just a little light!
He said softly, "It's not just a glow. It's science, it is one of the secret of this earth.
Xyro smiled and nodded. "This tiny light holds the power to show you the universe. Keep asking questions, Rakshit. That is how true learning begins."

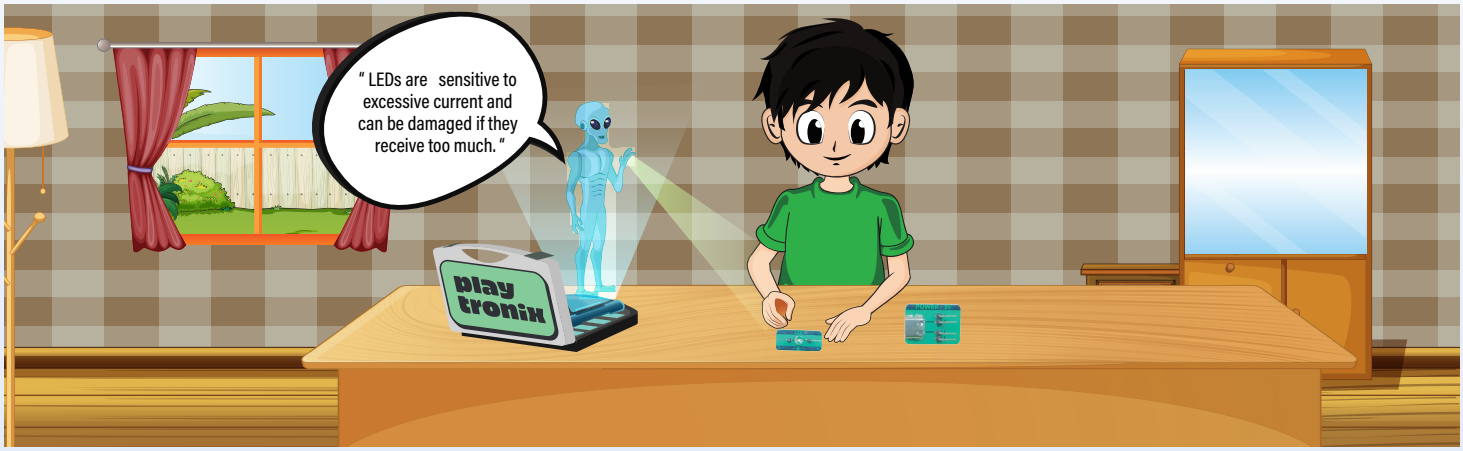
ACTIVITY

Builda Circuit to light up the LED



Branch of Resistor





One evening, Rakshit was trying to build own LED glowing system, Rakshit noticed a soft green glow coming from the Playtronix box on his desk. It was Xyro again to give him very special message : **"Mission: Control the Flow. Learn how resistors protect your LEDs."**

Rakshit nodded. He knew that Xyro was helping for new project. Xyro said " LEDs are sensitive to excessive current and can be damaged if they receive too much. "

He opened the box. Inside were:


1 Power Module



A Two-Way Switch



Two Resistors


Two LEDs

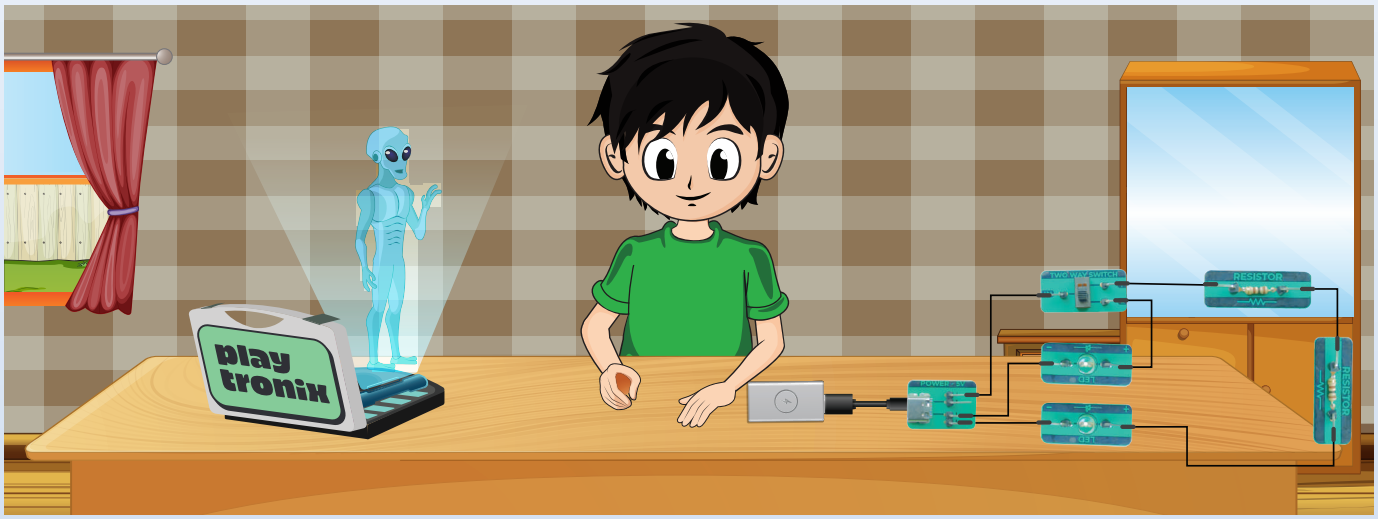

Jumper Wires


A Type-C Cable


A Power Bank

Step by step, Rakshit made the setup:

- First, he connected the Power Module to the Power Bank using the Type-C cable.
- Then, he connected the positive terminal of the Power Module to the input of the Two-Way Switch.
- From the **first output terminal**, he connected **Resistor 1**, then **Resistor 2**, and finally connected it to **LED 1**.
- He connected the negative terminal of LED 1 back to the negative terminal of the Power Module.
- From the **second output terminal** of the switch, he connected directly to LED 2 (without any resistor).
- The negative terminal of LED 2 also went back to the negative terminal of the Power Module.



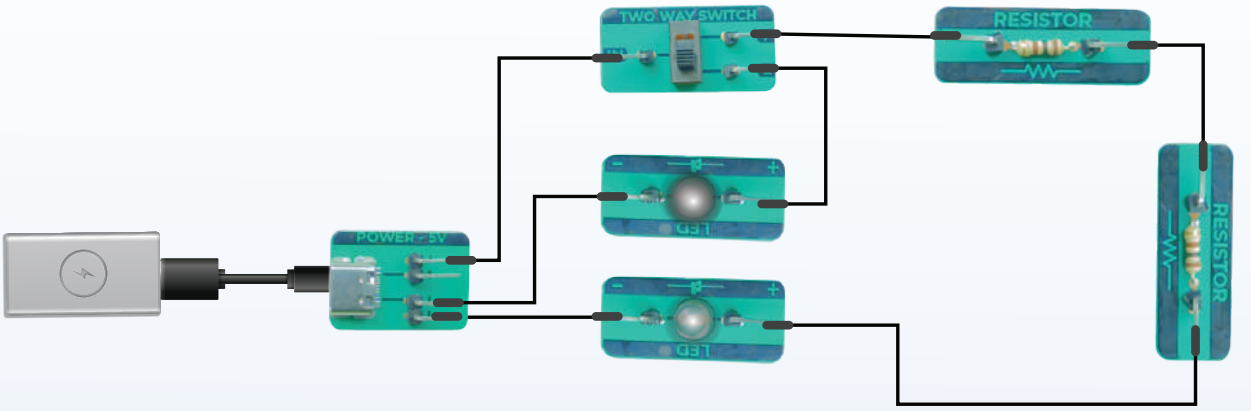
Rakshit flipped the switch to the first side. LED 1 glowed, but very dimly.
Then he flipped the switch to the second side. LED 2 glowed—bright and clear.

"Why is LED 1 so weak?" Rakshit thought.

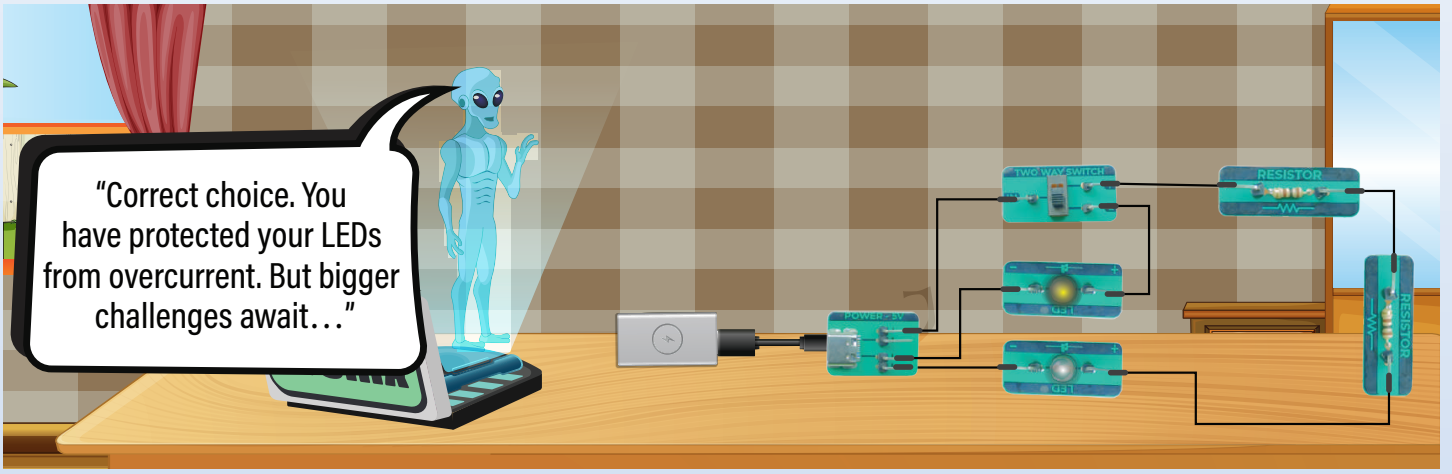
Xyro told him:
"Resistors are like traffic police. They slow down the current so your components don't get hurt."

Rakshit smiled and spoke out loud:
"In the first path, the current had to pass through two resistors before reaching LED 1. So the current became slow and less, and the LED glowed dim."

"In the second path, there was no resistor, so the current flowed freely to LED 2. That's why it glowed bright!"



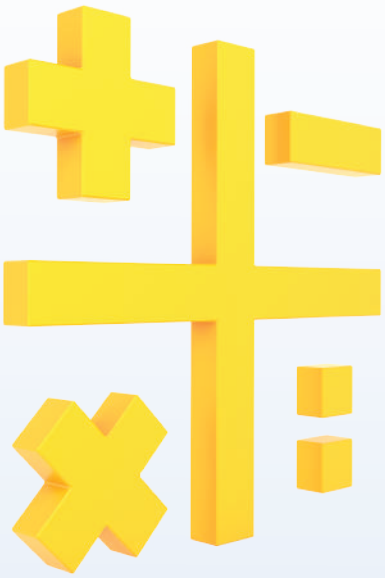
Rakshit's Conclusion (in his own words): "The story of a resistor in a circuit is a story of control, protection, and energy management. It's a fundamental component that enables a wide range of electronic applications, from simple circuits to complex systems. This activity shows me that resistors can control the flow of electricity. When the current goes through resistors, it becomes slow. That's why LED 1 was dim. But when there is no resistor, the current is full power, and LED 2 glows bright. So, if I want to protect a device, I can use resistors to reduce the current and save it."



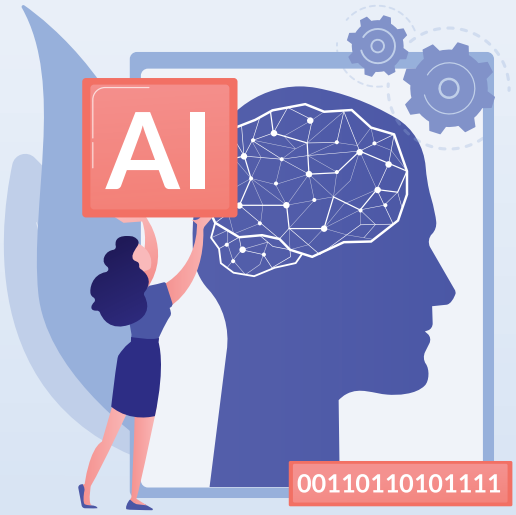
Just then, the Xyro glowed again and whispered:
"Correct choice. You have protected your LEDs from overcurrent. But bigger challenges await…"

ACTIVITY

Design a circuit to explor LED Brightnes using Resistors



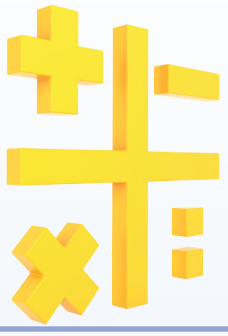




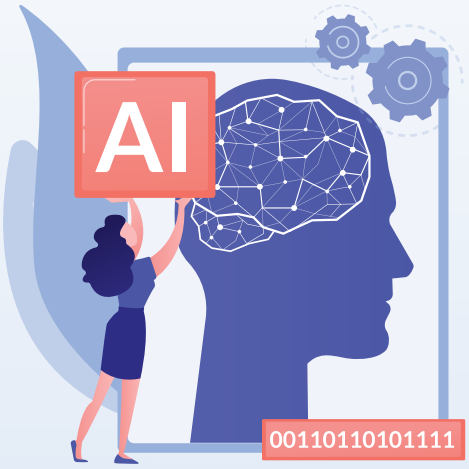
Computation Thinking



AI with Maths







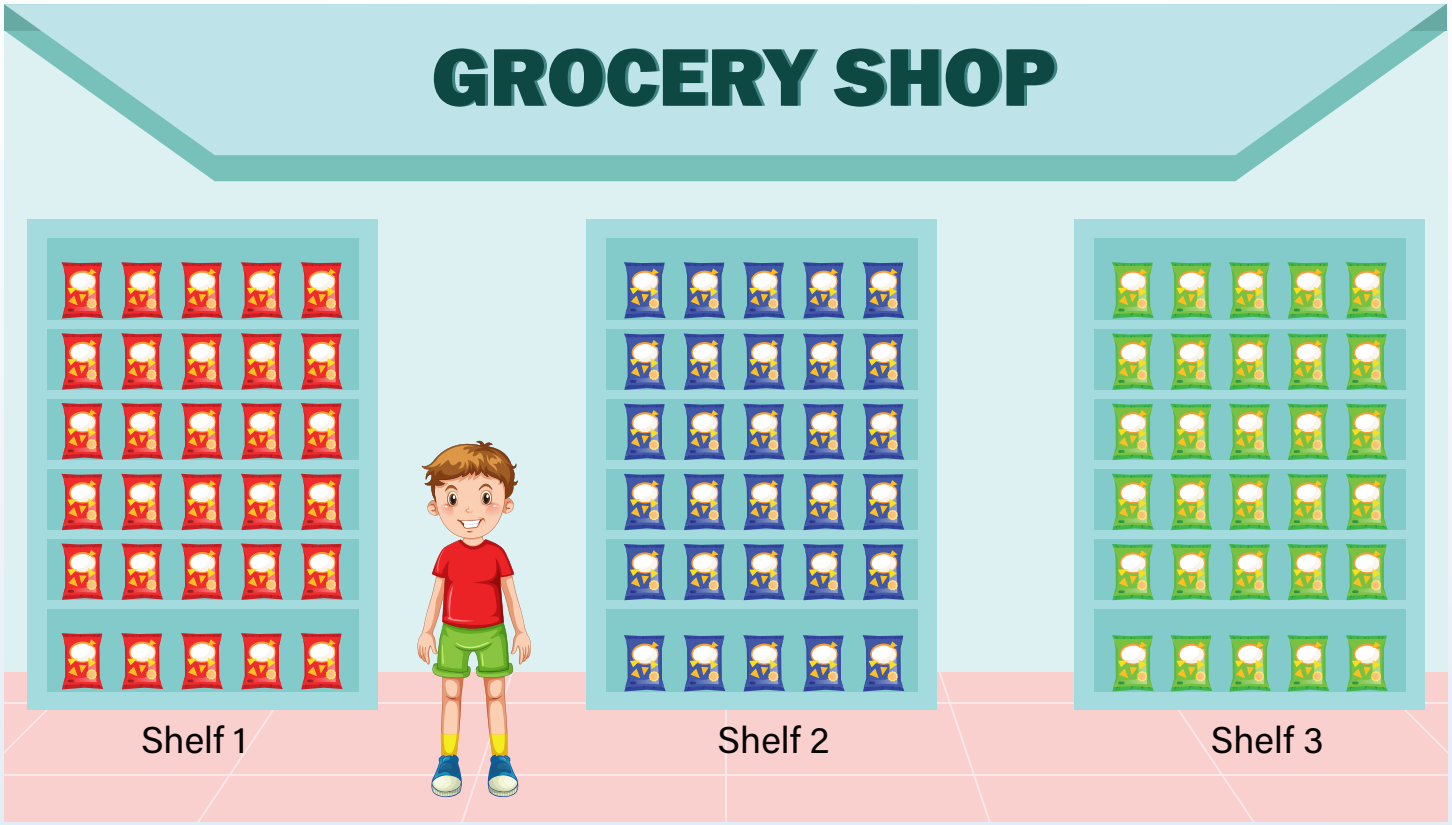
Hello kids! How are you all?
I know you are all full of curiosity! You love to use innovation to solve real life problems with scientific approach. Let us improve our ability to solve real world problems for next level with our logical thinking.
In everyday life, we are faced with numerous decisions, big and small. A toy costs Rs. 50 and you have Rs. 100 How much change will you get back? If a shirt is in 25% off and it originally costs Rs. 500 how much is the discount?
Math gives us logical reasoning, to make correct decisions whether we are choosing the most cost-effective option or understanding profit loss, math guides us towards best choices.
Today, I want to talk to you about some real-life situations. These are problems that people face in their daily life. Let's see how you can solve them using your smart thinking and logic building with Maths!

Real-Life Puzzle 1: Confectionery shop

Problem statement

Ravi has a grocery shop. At the end of the day, he wants to know how many packets of chip are left.
He has chips kept in three different shelves.
Can you help Ravi find the total number of chip packets?
Think:

- What are the small steps you need to take?
- Can you break this big problem into small parts and follow a step-by-step plan?



Step-by-Step Plan

This scenario is based on imagination and computational thinking.

Step 1: Identify the Shelves

- Shelf 1
- Shelf 2
- Shelf 3

Step 2: Initial Chip Count (Assumption)

- Shelf 1: ***30 packets***
- Shelf 2: ***30 packets***
- Shelf 3: ***30 packets***

Total Chips Initially = 30 + 30 + 30 = 90 packets

Step 3: Chips Sold from Each Shelf

- Shelf 1 sold: ***10 packets***
- Shelf 2 sold: ***15 packets***
- Shelf 3 sold: ***15 packets***

Total Sold Chips = 10 + 15 + 15 = 40 packets

Step 4: Total Chips Left

- Chips Left = ***Total Chips - Sold Chips***

= 90 - 40 = 50 packets left

Step 5: Requirements Chips

To restore the shelves to full stock:

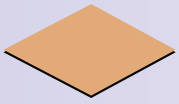
- Total Chips Capacity = ***90 packets***
- Left Packets = ***50 packets***
- Required Chips = ***Total Chips - Left Packets***

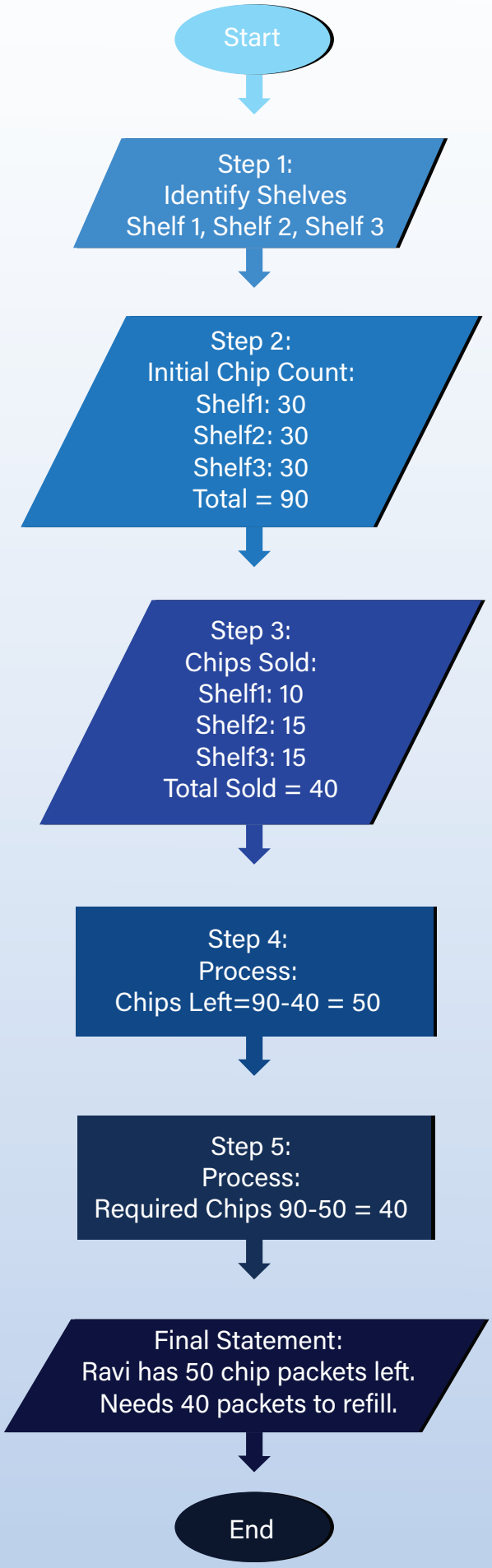
= 90 - 50 = 40 packets required

Final Statement:

Ravi has 50 chips packets left at the end of the day.
To refill the shelves back to full capacity, he requires 40 more chip packets.

Now let us code this and create permanent system/APP for confectionery shop. Can we do this?
Now you applied logic but here you need a flowchart because a flowchart helps break a big problem into small, easy steps. It shows the logic clearly using simple shapes and arrows. This makes it easier to understand, find mistakes, and explain ideas. Flowcharts are great for planning before coding and solving problems in a clear, step-by-step way.

Symbol	Name	Function
	Oval	Represents the start or end of a process
	Rectangle	Denotes a process or operation step
	Arrow	Indicates the flow between steps
	Diamond	Signifies a point requiring a yes/no
	Parallelogram	Used for input or output operations


Start
Step 1:
Identify Shelves
Shelf 1, Shelf 2, Shelf 3
Step 2:
Initial Chip Count:
Shelf1: 30
Shelf2: 30
Shelf3: 30
Total = 90
Step 3:
Chips Sold:
Shelf1: 10
Shelf2: 15
Shelf3: 15
Total Sold = 40
Step 4:
Process:
Chips Left=90-40 = 50
Step 5:
Process:
Required Chips 90-50 = 40
Final Statement:
Ravi has 50 chip packets left.
Needs 40 packets to refill.
End

Now we will code this and create permanent solution for bakers.

Real-Life Puzzle 3: School Bus Ride

A school bus started with 25 students. At the first stop, 7 students got off.
How many students are still in the bus?

Can you solve it like a computer?

Think:

- What information do you need first?
- Can you break it into simple steps?

Now let us code this and create permanent system/APP for confectionery shop. Can we do this?
Now you applied logic but here you need a flowchart because a flowchart helps break a big problem into small, easy steps. It shows the logic clearly using simple shapes and arrows. This makes it easier to understand, find mistakes, and explain ideas. Flowcharts are great for planning before coding and solving problems in a clear, step-by-step way.

Real-Life Puzzle 4: Library Books

Ritu borrowed 10 books from the library. After reading 6 books, she returned them.
How many books does she still have at home?

Can you help Ritu find out?

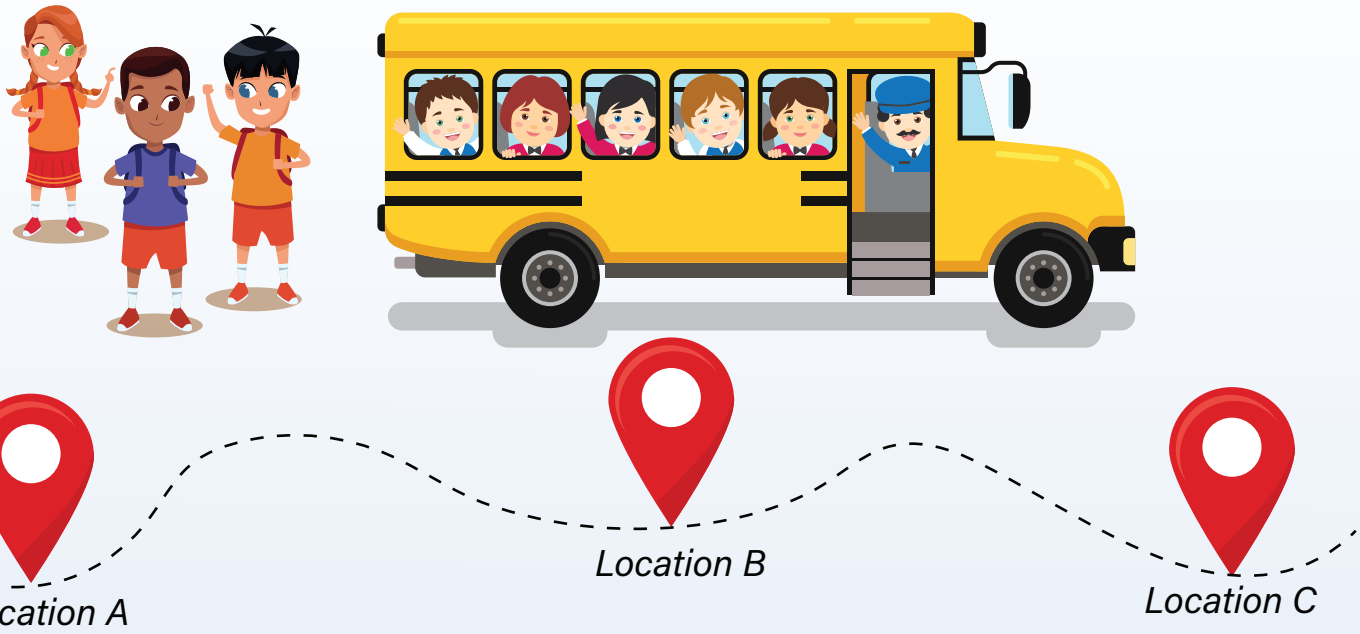
Ritu borrowed 10 books from the library. After reading 6 books, she returned them.
How many books does she still have at home?

Think:

- What is the total number of books?
- How many are returned?
- How would a computer solve this?

Problem statement :

A school is organizing a robotics Summer Camp for its students. To make travel easy, the school arranged one bus with a seating capacity of 50 students.
The bus drops students at three locations – Location A, Location B, and Location C.
Here's what happened during the trip with 50 students on board:
At Location B, 12 students get off.



The number of students getting off at Location A is 5 more than Location B.
The number of students getting off at Location C is equal to the number of students still left on the bus after students got off at Location A and B.
Can you help the driver uncle and find out:

1. How many students got off at Location A?
2. How many students got off at Location C?
3. How many students were dropped in total during the trip

Step 1: Total Students at Start of Trip

- Total students on the bus = 50
- This is the number of students on the bus before anyone gets off.

Step 2: Students Who Get Off at Location B

- At Location B = 12 students get off

Step 3: Students Who Get Off at Location A

- Location A students = Location B students + 5
  = 12 + 5
  = 17

Step 4: Total Students Who Got Off So Far

- Total Off at A and B = 17+12 = 29

Step 5: Students Remaining on the Bus After A and B

- Remaining on bus = 50 – 29 = 21

Step 6: Students Who Get Off at Location C

- Clue says:
- Students getting off at Location C = Students left on the bus after A and B

So :

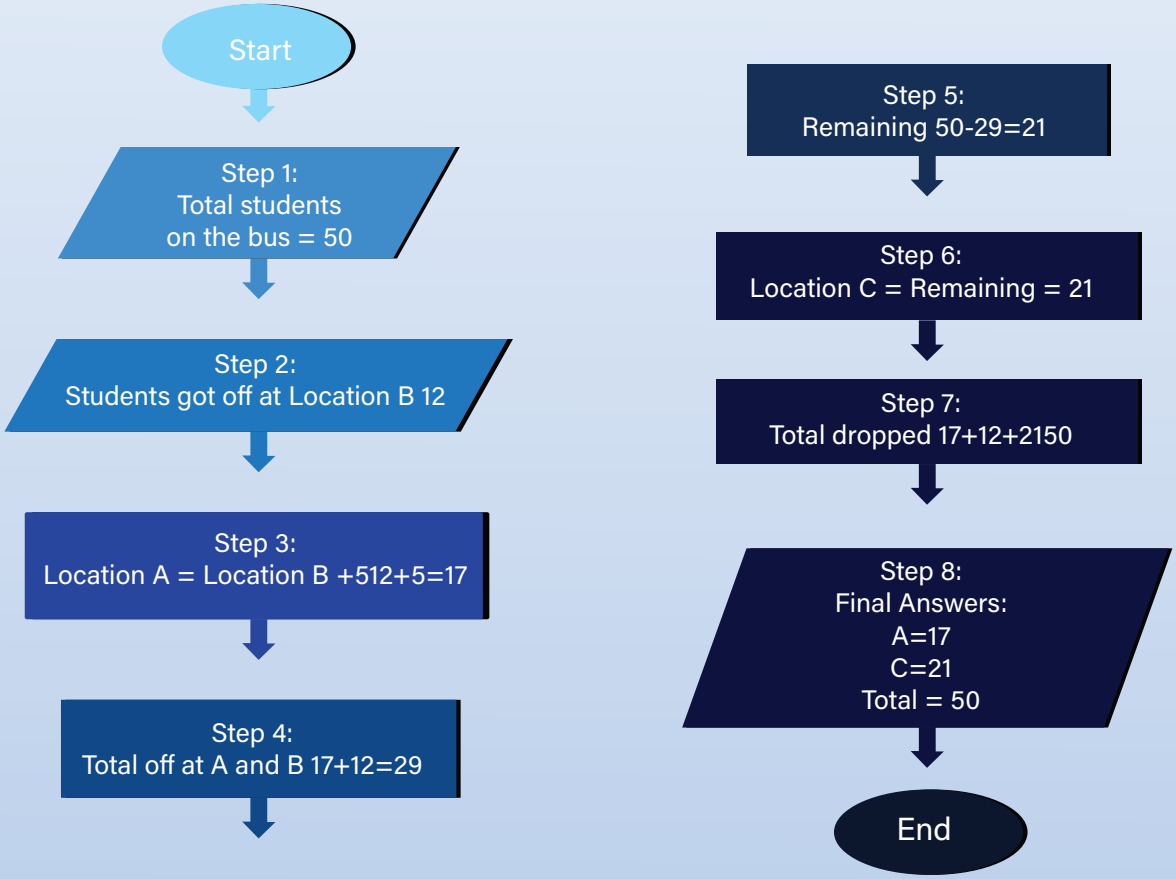
- Location C = Remaining = 21

Step 7: Step 7: Total Students Dropped During the Trip:

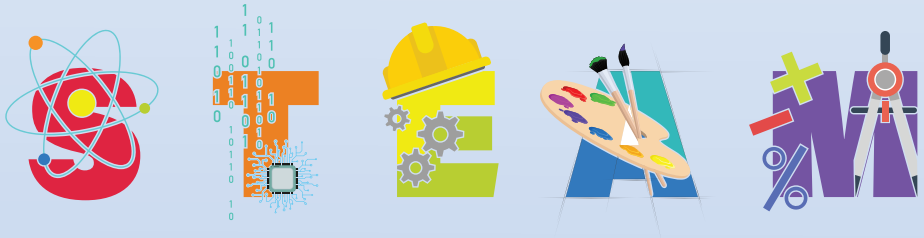
- Now, let's add all the students who got off at each location:
- Total Dropped = A+B+C = 17+12+21 = 50

Final Answers Summary:

Students got off at Location A = 17 students
Students got off at Location C = 21 students
Students were dropped in total = 50 students







AI Coding



Introduction to Pee Cee Pocket

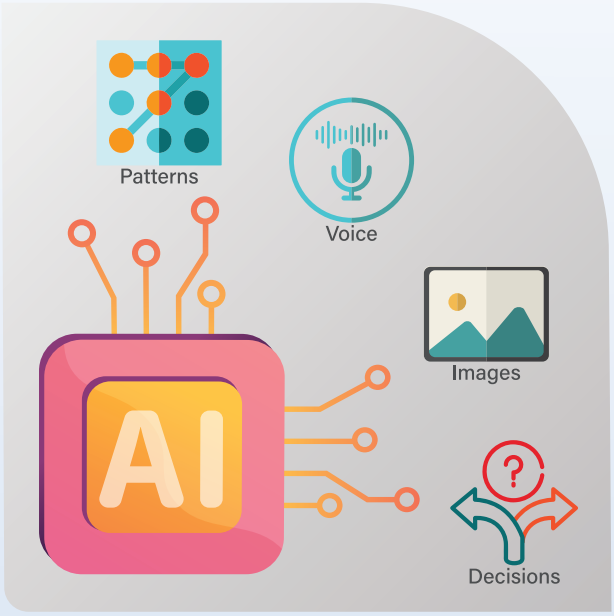


AI is like making computers, machines and robot smart, so it can do things that humans do, like learn, recognize patterns, voice, images and make decisions.

How AI helps voice assistants like Siri or Alexa understand your voice and respond accordingly?

How AI helps websites and apps recommend aproducts or movies you might like based on your previous choices?

How AI can control lights, temperatures, and other devices in aa smart home?





What if AI could connect directly to your brain? You can send messages just by thinking. You can directly learn a new language like downloading an app. Even blind people might see again with the help of AI.

Artificial Intellgence has immense potential. From just turning on or off the lights in your room, to helping you set reminders, to driving smart cars, and even creating humanoids — robots that can walk, talk, and behave like humans.

It is already changing the world around us, step by step. What was once only seen in science fiction movies is now becoming part of our real life.

But wait..... Do you think only scientists or engineers can use AI do these wonders?
Not at all!

You can also start learning AI right now — at your STEAM lab , using a small device — *PeeCee Pocket!*

It is small, cute, and very smart — just like your phone or smartwatch.
And guess what? You can carry it in your shirt pocket!

What is PeeCee Pocket?

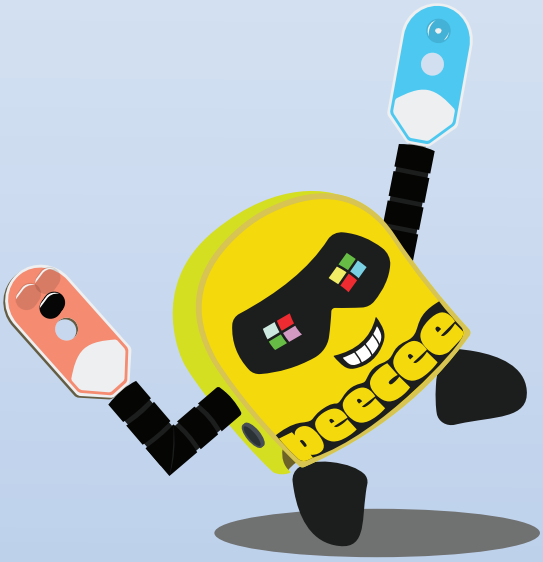


Meet PeeCee — our little Pocket Computer with a cute baby face and a big smile! He always looks happy, like a child who's excited to learn something new every day.

But hold on — PeeCee is not just smart, he's also stylish!
He wears a shiny masquerade mask, he is in full party look.

Peecee can also wink at you just like your naughty friend.
Peecee smiles you back when you smile at him. Don't you think peecee is cute.

Now let's talk about PeeCee's abilities: Just like us humans, he has senses —
He can hear with his sound sensor.
He can see with camera
He can feel the touch.
He knows when someone comes near — proximity sensor.
And yes, PeeCee can even TALK!
He says fun things like "Hello buddy" and "Coding is cool!"



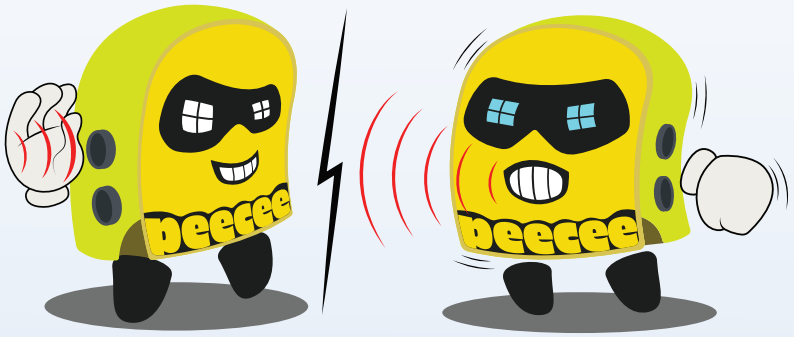
But here's the funny part —
Our eyes, ears, and nose are fixed, right? We can't move them.
But PeeCee proudly says:
"I am flexible I place my sensors whereever I want because I do yoga everyday."
He can shift his sensors anywhere he wants — left, right, up, down — full smart machine!

Also, PeeCee is a light artist too!
His glowing face uses RGB lights —
Red, Green, Blue.
When he mixes them, he makes many colours like yellow, cyan, pink, white — total disco mode!

So, PeeCee is not just a machine —
He's your talking friend, your light magician, your smart buddy with a cool masquerade mask, ready for any adventure!
"Unlike humans, whose senses are fixed, PeeCee can connect extra sensors through its ports. This way, it can add new abilities anytime and become more powerful!"

So could you answer who is more intelligent you or peecee?
PeeCee is like a tiny robot brain.
It works just like AI in your phone:

- *It can hear sound*
- *It can see your hand movements and colours*
- *It can react by making sounds or glowing lights*



Just like how your phone listens when you say "Okay Google" or how your watch tells you your heart rate — PeeCee also senses, thinks, and responds.
This is the same idea behind Artificial Intelligence!

How does it work?

PeeCee follows three steps — just like our brain:

1. Input: It sees or hears something (like a sensor noticing a sound or movement).
2. Processing: It thinks, "What should I do now?"
3. Output: It reacts — like turning on lights or making a sound.

This is the same idea behind Artificial Intelligence!

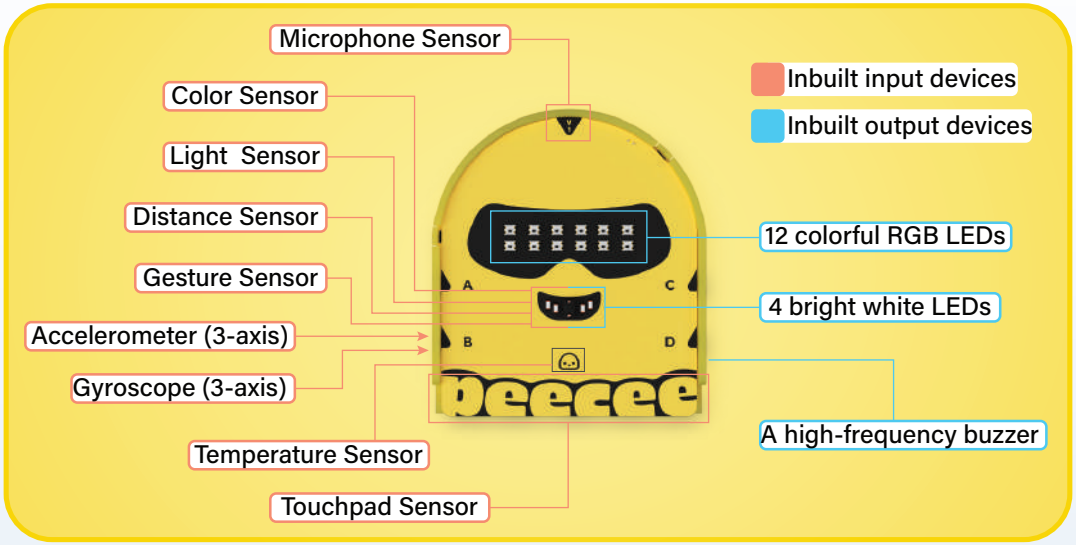
Example: PeeCee as a Cookie Guard
Suppose you want to stop your younger brother from stealing your cookies!
You can make PeeCee Pocket your cookie protector!



Here's how:

1. Use an ultrasonic sensor to check if someone's hand is coming near.
2. PeeCee will think: "Oh no, someone is trying to take the cookies!"
3. Then it will make a loud sound and blink red lights to scare them away!

This is just like a real smart AI security system!



Input:

Inbuilt input devices

1. Color Sensor – Detects and identifies different colors of light reflected from surfaces.
2. Light Sensor – Checks how bright or dark the light is.
3. Distance Sensor – Calculates the distance between the sensor and an object, using ultrasonic waves.
4. Gesture Sensor – Detect hand moves without touching and translate them into commands for PeeCee Like (Up, Down, Left, Right, etc.)
5. Microphone Sensor – Listens to sounds.
6. Accelerometer (3-axis) – Feels if something is moving or shaking
7. Gyroscope (3-axis) – Knows which way something is turning or tilting.
8. Temperature Sensor – Measures how hot or cold the object is
9. Touchpad Sensor – Works when touch it with your finger.
So Pee Cee can sense colors, light intensity, distance calculation, movements, gestures, hear, balance body, environment temperatures.

Apart from this you can also add some external components for input like –

1. Ultrasonic Sensor - Measures how far things are using sound waves, like a bat
2. Potentiometer - A knob you turn to make things go up or down, like sound.
3. Light-Dependent Resistor (LDR) - Checks how bright or dark the light is.
4. Rain Sensor - Tells if it's raining or water is falling on it
5. Joystick - can move to control direction, like in video games.
6. Switch - Turns something ON or OFF, like a light switch.
7. Push Button - can press to send a signal.
8. DIP Switch - Small switches you can turn ON or OFF to control settings
9. Range Sensor - Finds how far away an object is.
We have power of sensors and connected with our brain. Same way pee cee also connects all input sensors with its powerfull brain. The ESP32-S3 is a powerful mini-computer chip used inside the PeeCee. It acts like the brain. It helps run code, control motors, lights, sensors, and talk with other devices.

Like human are taking input from ear and sending signal to brain and then brain will process the information and give output to mouth for speaking and communicating

Inbuilt output devices

1. 12 colorful RGB LEDs - Look like eyes.
2. 4 bright white LEDs - Shine like teeth.
3. A high-frequency buzzer - Makes sound for guitar and piano.

External Output devices

1. Servo Motor – Moves to a certain angle.
2. DC Motor – Spins fast to move things like fans or wheels.
3. N20 Gear Motor – A small but strong motor used for moving parts slowly and with power.
4. LED – A tiny high bright light that turns ON or OFF.
5. LED 2C – Two LED that shows two different light indicators.
6. RGB LED – A special LED that can glow in many colors.
7. Laser Module – A tiny light that makes a straight, sharp beam like a laser pointer.
8. Speaker – Makes sound or music.
9. OLED Display – A small screen that shows words and Text Lines.
10. Motor Driver – Helps control motors by giving them power. It can control like motor backward and forward
11. Sound Card – It has a memory card slot to store music and plays the music using a speaker.





Plode App. Interface with play mode

Think about a situation, You're on a trip to Spain with your family. While exploring a crowded market, you get lost. You try asking for help, but everyone speaks Spanish, and you don't have your phone.

A kind person notices and hands you his phone with Google Translate. You speak in English or hindi, it translates to Spanish, and now you can explain your situation and find your way back. That phone became your bridge to communicate.



In the same way, the Plode App acts as a bridge between you and the Pocket PeeCee. You don't speak code, and PeeCee doesn't understand regular language. Plode translates your commands — through buttons, blocks, or voices — into actions and the device understands.

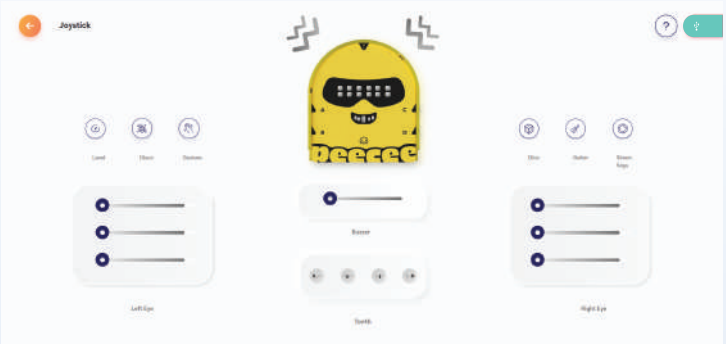
The Plode App is a smart and easy-to-use app that helps you control, code, and play with the Pocket PeeCee – a small but powerful learning device for robotics, and coding. It helps you send commands, write programs, and even talk to your robot using voice!

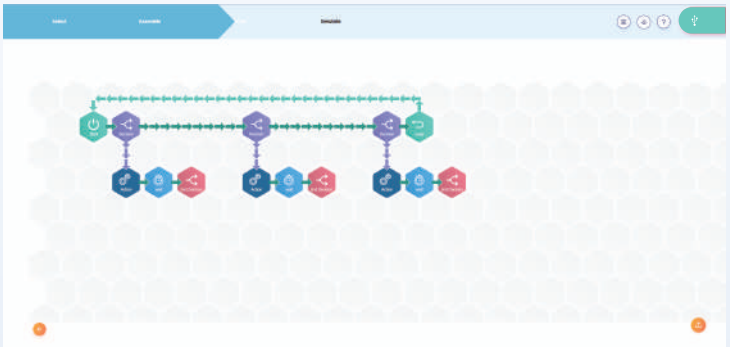


How Does Plode App Work?

The Plode App does two important jobs:

1. **Remote Control –** It works like a virtual remote for Pocket PeeCee.
2. **Coding Station –** It lets you write your own programs and send them to the device.





Play Mode -

In Play Mode, the app becomes a remote control:

- You can turn on lights, start buzzers.
- You can use sensors like sound, temperature, light, and more.
- You don't need to write any code. It has predefined code Just press and play!
- Great for beginners to try and see real results.

Code Mode –

In Code Mode, you can code for diffrent programs and it is like you commanding the pocket peecee what to do . You can also:

- Use colourful blocks to create your own logic and ideas.
  Start Block – This is where your code begins. Every program must start with this block.
  Stop Block – This block tells your program to stop all actions. End of program!
  Loop Block – Want something to repeat again and again? Use this block to make it happen!
  Action Block – These blocks make your device do something — like turn on a light, move a motor, or play a sound.
  Wait Block – Use this to pause between actions. For example: wait 2 seconds before the next step.
  Decision Block – The Decision Block takes input from sensors and makes smart choices based on that data.
  End If Block – It is used for closing a specific decision.
- Make it do things automatically when you code for some actions
- Easy drag-and-drop style, perfect for children and beginners.

Talk to Your Device -

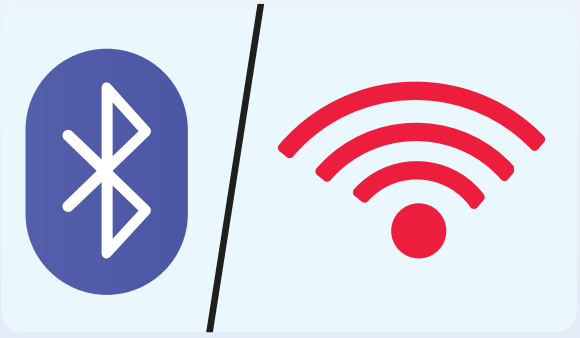


This is the coolest part! You can speak to the Plode App, and it will turn your words into actions:

Say: *"Turn on light"*

Plode understands → Sends command to Pocket PeeCee → Light turns on!

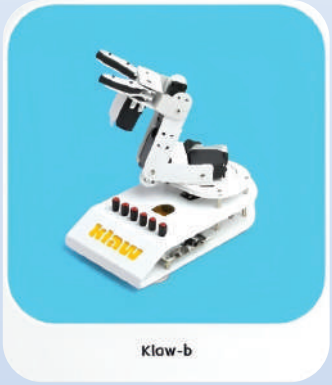
No need to type. Just speak and see the magic!



You can connect your device with pocket peecee with the help of ***Bluetooth or Wi-Fi.*** No need to connect wires or cables. And you can control your device from anywhere nearby.

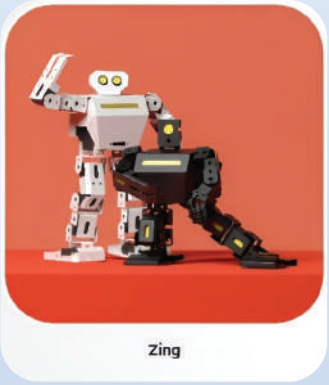
Control Real Robots Too!
With the Plode App, you can also control amazing robots like:

- ***Klaw-B*** – A robot arm that can pick things up
- ***Crawl-E*** – A crawling robot explorer
- ***Zing*** – A humanoid robot



Klaw-b


Crawl-e


Zing

You can control them using remote buttons, voice commands, or coding inside the app!
With the Plode App, your phone becomes a powerful tool to learn, play, and build cool things. Whether you are switching on a light or making a robot dance, everything is in your hands.
In Play Mode, the app becomes a remote control:

- You can turn on lights, start buzzers.
- You can use sensors like sound, temperature, light, and more.
- You don't need to write any code. It has predefined code Just press and play!
- Great for beginners to try and see real results.



Illumination with Pee Cee



One day, Rajat was standing on his terrace, looking up at the sky. He notices something interesting — the sky looks blue during the day, orange in the evening, and dark purple just before night.
Then, after a short rain, he sees a beautiful rainbow stretching across the sky. He wonders,
"Why do the colours of the sky change? And how does a rainbow appear?"



He runs to his teacher and asks her. She smiles and says,
"It's all because of light, reflection, and something called dispersion!"
She explains:
"When sunlight passes through tiny water droplets in the air, the light bends and splits into seven colours — violet, indigo, blue, green, yellow, orange, and red.
This splitting of white light into different colours is called dispersion. That's how a rainbow is formed!"
Rajat gets excited.
"So white light is actually made of many colours?"
Yes, as we can see in newton disc. This are seven colours in the round disk of the rainbow. When the disc is rotated fast in the daylight, the colours get mixed together and the disc appears to be whitish. This shows that white light is composed of seven colours.

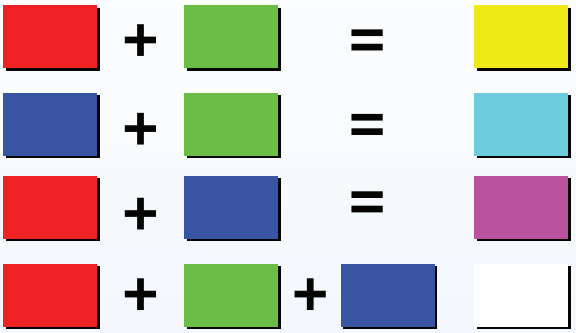


Then the teacher takes Rajat to the STEAM lab. There, she shows him a small play computer called Pocket PeeCee. It has tiny RGB LEDs — lights that can glow in Red, Green, and Blue.
She explains:
"Just like sunlight has many colours, RGB LEDs can also create many colours by mixing red, green, and blue light. This is called additive colour mixing."



Rajat tries it using block coding:

- Red + Green = Yellow
- Blue + Green = Cyan
- Red + Blue = Magenta
- Red + Green + Blue = White light



Then she says,
"And guess what? By changing the intensity (brightness) of each colour, we can make millions of shades!"

Intensity means how bright or dim a colour is. In Pocket PeeCee, Rajat can set the intensity of Red, Green, or Blue from 0 (off) to 255 (full brightness). By adjusting these levels, he can mix them in different amounts and create millions of beautiful colours.



For example:

- Red = 255, Green = 100, Blue = 0→gives orange
- Red = 200, Green = 0, Blue = 200→gives purple
- Red = 50, Green = 255, Blue = 50→gives light green

A small moment on the terrace turned into a journey through light, science, and creativity — all thanks to Rajat's curiosity, his teacher, and his Pocket PeeCee!

ACTIVITY *Perform the Illumination activity with Pee Cee Pocket.*

Out Of Box – Fun Facts

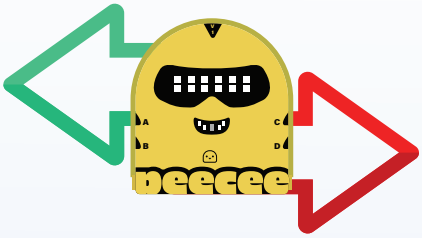
Honey has been found to be edible even after thousands of years.

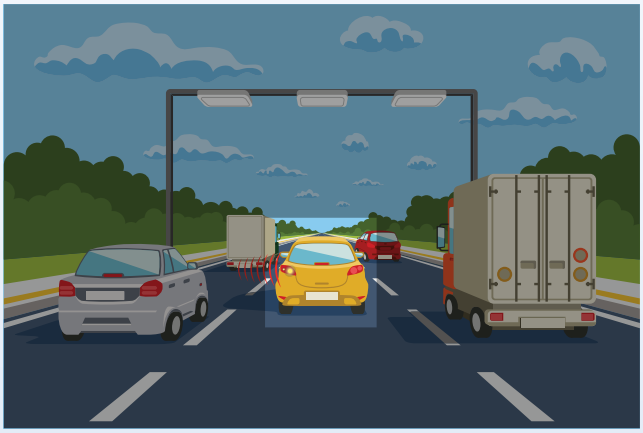






Left-Right Indicator with Tact Switch





Imagine you are sitting in the car with your father. Suddenly, he wants to turn right at the next street. What do you think he does?
Many of you might say, "He turns on the light at the back of the car!". Yes, exactly! That blinking light is called the right indicator or right turn signal. It flashes on and off to show other drivers and people on the road that your dad plans to turn right.
But wait—you also hear a click-click sound from the car, like a small beep. That sound helps grab attention so no one misses the signal.
These blinking lights and sounds are very important for road safety. They tell everyone which way the car is going to turn. Without them, other drivers wouldn't know your dad's plan—and that could lead to accidents.

So how does this work inside the car?



There is a special switch—a small lever near the steering wheel. When your dad pushes the lever to the right, it turns on a circuit. This allows electricity to flow like water through the pipe.
The electricity travels from the battery through wires, reaches the tiny lights (called LEDs), and makes them blink. It also makes a small speaker create the click-click sound.
And when the turn is done, your dad moves the lever back. This breaks the circuit, the electricity stops flowing, and the light and sound stop.

Isn't that cool?
A simple switch lets electricity flow to the right places to make lights blink and sounds beep!

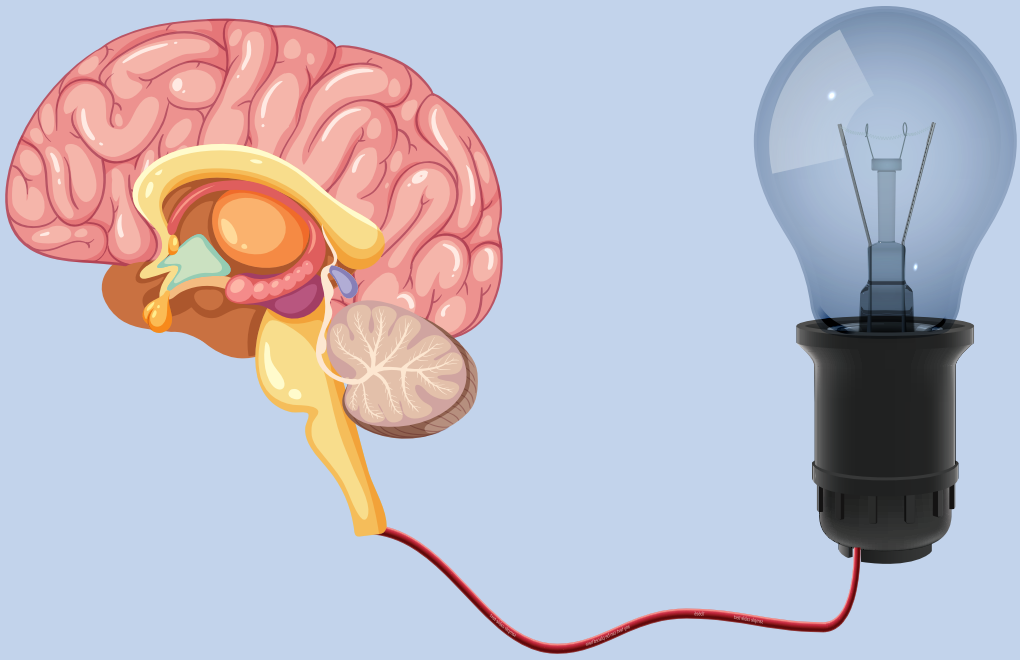
And guess what? We can learn how this works and even create our own blinking lights and sounds using PeeCee!. In the PeeCee lets us press buttons like those switches that makes lights blink and sounds beep, just like the indicators on a car or bike. By coding PeeCee, we can see how pressing a button sends electricity to LEDs to make them flash, helping us understand the science behind the indicators. So next time you see a blinking light on a car or bike, remember it's not just decoration—it's a smart signal helping keep the roads safe! add in this how electricity flows



ACTIVITY *Let's make our own Left-Right Indicator using Pee Cee pocket.*

Out Of Box – Fun Facts

The human brain generates enough electricity to power a dim lightbulb, about 20 watts.





Light Up and Smile



Now a days, robots are not just for hard work—they are getting smarter. Some robots can copy human feelings like smiling or looking surprised. One famous robot is Sophia. She looks like a human and can smile, move her eyebrows, and even talk.



Emo robots developed at Columbia University, is a type of robot designed to mimic human actions, expressions, and behaviors. These robots are equipped with AI models to detect human faces, control facial actuators, and even anticipate facial expressions like smiling. The aim is to improve human-robot interactions by making them more natural and intuitive.

We can also design our own robots to mimic human actions, expression and behaviours. Pocket PeeCee has special Smile LEDs that light up one after another to make a smiling face. With simple block coding, Pocket PeeCee shows how lights and programming can create happy faces. It's a small but fun way to teach machines to smile.





Pocket PeeCee smiles by turning on small lights called LEDs in a special way to make a smile. This is done using simple computer codes that control the lights. So, Pocket PeeCee's smile happens because the LED lights glow in the right order for making a happy face.

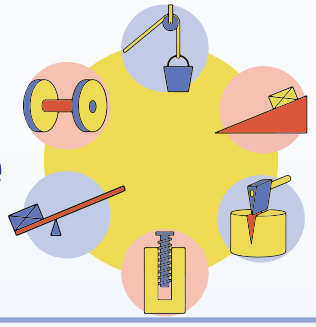
ACTIVITY *Light it up and smile with Pee Cee pocket.*



Machine Making



Simple Machine



It was a bright Sunday morning. Maan, Riya, and Kabir were playing near an old garage when they saw a big tractor old tire lying on the ground.



Before anyone could stop him, Maan jumped into the tire.



Kabir and Riya tried to push, but the tire was too heavy. Then, Riya saw a long wooden stick nearby.



She put one end of the stick under the tire and pushed down on the other end.

The tire lifted a little. Now, it was easier to roll.



The tire started rolling down the path, going faster and faster.



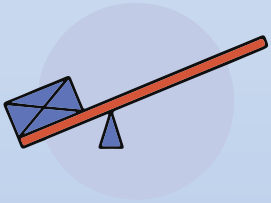


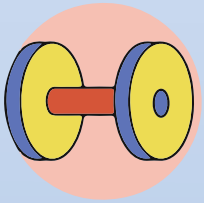


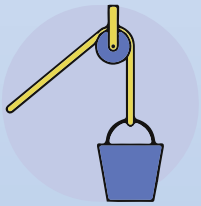
So students you know how simple machines concept originated " The idea of a simple machine originated with the Greek philosopher Archimedes around the 3rd century BC, who studied the Archimedean simple machines: lever, pulley, and screw. He discovered the principle of mechanical advantage in the lever".

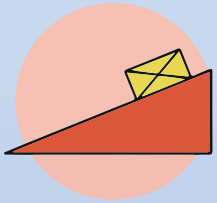
If we look stories of our friends Maan, Riya, and Kabir, We found that -

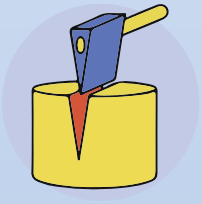
- ***Lever*** – "Like the stick we used! Also, scissors, crowbars, and bottle openers are levers."
- ***Wheel and Axle*** – "Like the tire, a car, a fan, or a chakla-belan!"
- ***Pulley*** – "It helps lift things! Cranes, well buckets, and flagpoles use pulleys."
- ***Inclined Plane*** – "A ramp that makes things easy to move. Like a slide or wheelchair ramp.
- ***Wedge*** – "A knife, an axe, or a chisel—anything that cuts is a wedge."
- ***Screw*** – "A bottle cap, a drill, or even the lid of a pickle jar!"

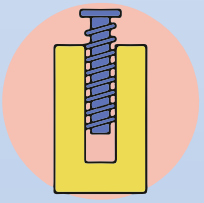

Lever


Wheel and Axle


Pully


Inclined Plane


Wedge


Screw



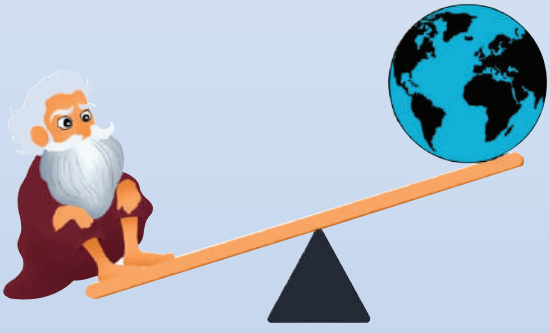
Lever





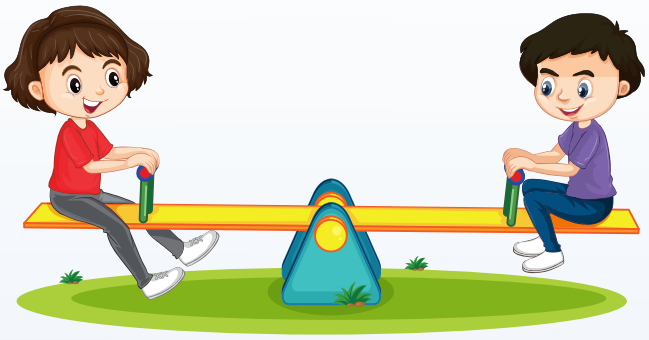
It was a bright Saturday morning. Maan, Riya, and Kabir were in the school playground, watching a cricket match.
"I love cricket!" Kabir said excitedly. "One day, I will hit the biggest six!"
Maan smiled. "You know, a cricket bat is a simple machine!"
Kabir and Riya looked at him in surprise. "What? No way!" Riya said.
"Yes! A cricket bat is a lever!" Maan said.

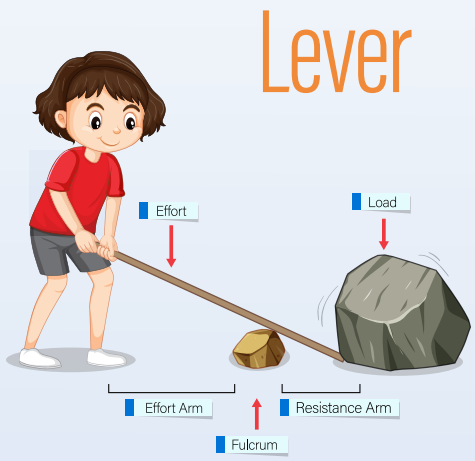
Maan explained about lever by saying if you apply a small force over a long distance, you can lift a heavy load with a short distance. That's why we use seesaws!"
Maan smiled, "Exactly! That's the Law of the Lever. It helps explain how levers work in everything, and a fun fact Archimedes once said, "Give me a lever long enough, and I can move the world!" Scientists later confirmed he was right, but no one gave him a lever that long.



Kabir still had a question. "So, if one side has more force, the distance has to be shorter to keep the lever balanced?"

Riya jumped in, “Yes! If we want to balance things, the side with more force should have less distance from the fulcrum. Like a strong person sitting closer to the middle of a seesaw, and a lighter person sitting farther away. These are just a few examples of the many levers that are used in our daily lives and in nature. The principles of levers are fundamental to many simple machines and are essential for understanding how force and motion interact. ”





Riya picked up a stick from the ground. "A lever is a simple machine that helps us lift or move heavy things easily. It has three parts:"

- **Fulcrum –** The fixed point where the lever moves.
- **Effort –** The force we apply to move the lever.
- **Load –** The thing we want to move.

Kabir thought for a moment. "And there are three types of levers, right?"

"Yes!" Maan nodded and drew in the dirt with his stick.

1. **First-Class Lever –** The fulcrum is in the middle (like a seesaw or a crowbar)
2. **Second-Class Lever –** The load is in the middle (like a wheelbarrow or a bottle opener)
3. **Third-Class Lever –** The effort is in the middle (like a cricket bat or a fishing rod)

Kabir clapped. "Got it! Now, let's see how levers help in sports!"

Just then, the school coach walked up to them. "Hey kids, want to try a fun challenge?"
"What challenge?" Riya asked.

"A weightlifting challenge," the coach said, pointing to a heavy sandbag on the ground. "You have to lift this without touching it directly."

Kabir groaned. "That looks impossible!"

Maan smiled. "Not if we use a lever!" He found a strong wooden rod and placed a small block under it as a fulcrum. Then, he slide one end of the rod under the sandbag and pushed down on the other end. "See? The fulcrum is in the middle, the effort is on one side, and the load is on the other side. This is a first-class lever!"

With little effort, the heavy sandbag lifted off the ground!

"Whoa! That was easy!" Kabir said.

The coach clapped. "Good job! First-class levers are used in sports like weightlifting and gymnastics!"

The High Jump Trick: Using a Third-Class Lever



It was sports period, “Next” the coach pointed at the high jump bar. "Who can jump the highest?"

Kabir stepped forward. "I'll try!" He ran and jumped but couldn’t reach the top.
ya thought for a moment. "What if we use a pole, like in pole vaulting?"

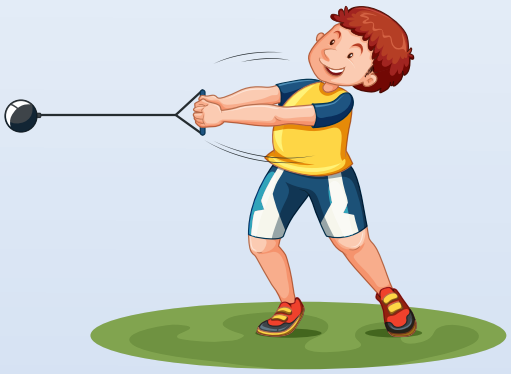
Maan picked up a long bamboo stick. "A pole is like a third-class lever! The effort is in the middle, the fulcrum is at the bottom, and the load is where the athlete lifts off!"

Kabir took the pole, ran, and planted it firmly on the ground. The pole bent and lifted him higher into the air!

"Whoa! I went much higher!" Kabir cheered.

The coach nodded. "That’s why athletes use poles for high jumps. Third-class levers give extra power!"

The Hammer Throw Challenge: Using a First-Class



"One last challenge," the coach said, bringing out a heavy ball with a long handle. "This is like the hammer throw event in the Olympics. Try spinning it and throwing it far." Kabir picked it up and swung it around. "This is tough!"

Maan observed. "This is also a first-class lever! Your shoulder is the fulcrum, your hands give the effort, and the ball is the load!"

Riya took her turn, spinning faster before releasing the hammer. It flew far across the field!

"That’s because she used the lever correctly!" Maan said.

The coach smiled. "You kids are smart! Levers help in so many sports—golf, tennis, rowing, and even archery!"

As the sun set, the three friends sat under a tree, feeling happy.
"Sports are more fun when you know the science behind them!" Riya said.

Kabir laughed. "And now, I know how to hit the biggest six!"
Maan told. "All thanks to levers!"

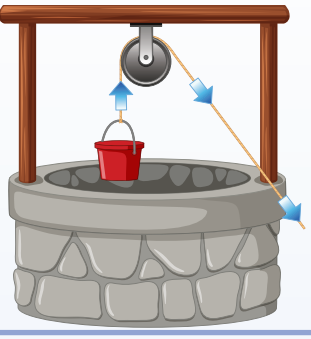
Their adventure with simple machines was just beginning. Where would they use them next?

ACTIVITY

Let’s do some activities that will help you understand better how lever works.



Pulley





It was a bright afternoon of Sunday, and Maan, Riya, and Kabir were going to the park through apartment lift, discussing random things as usual. Suddenly, Maan asked, “Hey, have you guys ever noticed how this lift is working?”

Kabir raised an eyebrow. “Pulleys are used in lifts, also known as elevators, to facilitate the movement of the elevator car up and down”

Maan said in excitement. “Think about it—pulleys are everywhere! Like flagpoles. Ever raised a flag at school? That’s a pulley at work.”

“Oh, and window blinds!” Riya added. “You pull the cord down, and the blinds go up.”

Kabir nodded. “That’s two. What else?”

Riya thought for a moment. “Cranes at construction sites! They lift heavy materials using pulleys.”

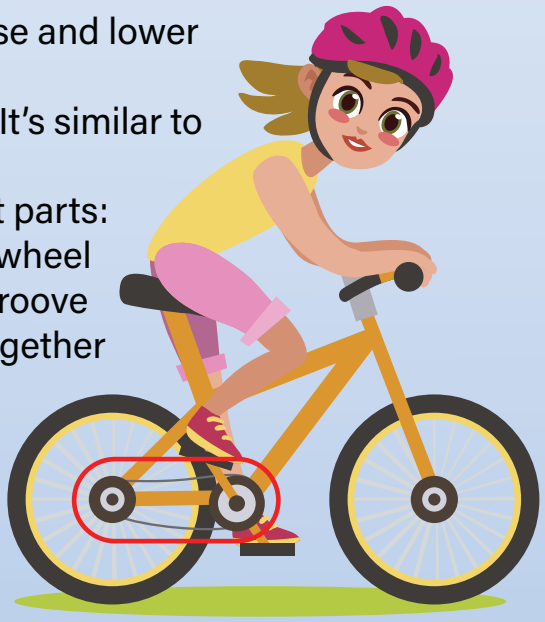
“Good one! What about gym equipment?” Maan pointed out. “Those machines where you pull a cable to lift weights.”

Kabir said. “Don’t forget wells! Buckets are pulled up using pulleys.”

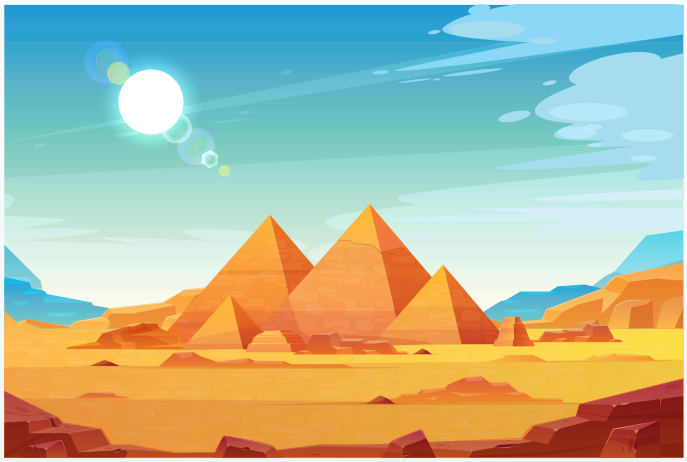
“Oh, sailboats too,” Riya added. “They use pulleys to raise and lower sails.”

“And what about a bicycle’s gear system?” Riya asked. “It’s similar to a pulley system.”

Maan said. "A pulley is a simple machine. It has different parts: the shell or frame holds everything together, the pulley wheel or sheave guides the rope, the axle lets it spin, and the groove keeps the rope from slipping. These small parts work together to make lifting heavy things easier."



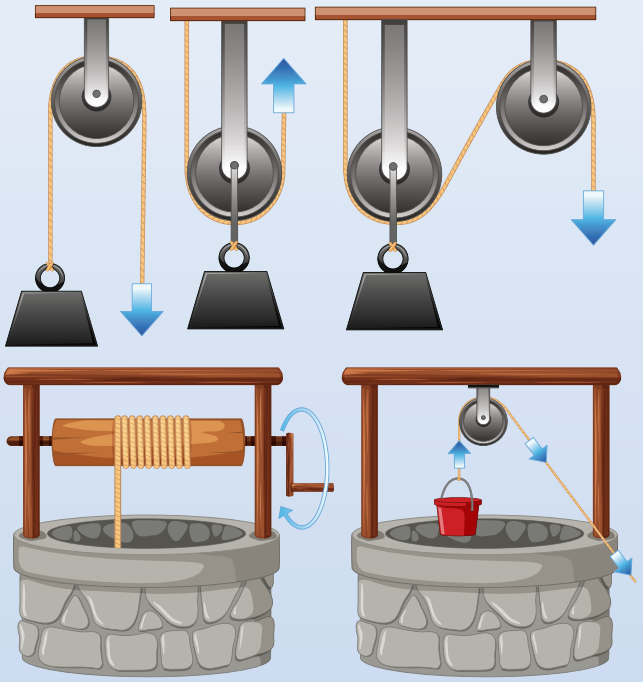
Kabir added “Indian temples also utilize pulleys and ropes for the assembly of temple elements, erecting carved parts into their precise positions using scaffolding and these systems.”



Maan told " I have studied about pyramids. No one knows for sure if pulleys were one of the simple machines that ancient cultures used to build pyramids. A few people believe that the beautiful and massive pyramids could not possibly have been built using something as simple as simple machines. Some people have wild theories about how the pyramids came to be — that perhaps aliens from another planet came to Earth and built them. Well, we do not know about that, but we do know that human beings are very creative and resourceful when they want to be. As long as we limit ourselves to materials and technologies that would have been available to the ancient Egyptians, it is acceptable for us to use our knowledge to construct pulley systems to build pyramid."

The real *mechanical advantage* of a pulley is in using many pulleys at once. Using multiple pulleys decreases the amount of force necessary to move an object by increasing the amount of rope used to raise the object.

Engineers combine many pulleys into a pulley system that significantly reduces the amount of force required to lift an object. They often use pulley system to move extremely heavy objects. A block and tackle are an example of a pulley system that can be attached to anything. It may take a lot of cable or rope, but a human using enough pulleys could lift several tons. Engineers use the block and tackle along with motors and electronics to create modern devices that operate with very low power requirements, such as cranes and elevators. At Disneyland, engineers even use a pulley system to move Tinkerbell across the sky.



ACTIVITY

Let's build our own pulley system and see what else they can do.



Wheel and Axle



The next simple machine we are going to learn about is the wheel-and-axle, which engineers primarily use to increase a turning or rotational force.

It was the final event of the school's Annual Sports Championship. Maan, Riya, and Kabir were excited but also nervous. The coach handed them a slip of paper.

"Strength, speed, and control will decide your victory. Choose the right wheels, and you'll win the race!"

Kabir scratched his head. "What does that mean?"

Riya smiled. "I think it's about the wheel and axle!"

Maan nodded. "Yes! But do you know what a wheel and axle is?"

Kabir shrugged. "Umm… car wheels?"

Maan laughed. "That's right! But we use the wheel and axle in many places. Let me ask you something. Where do we see it in daily life?"

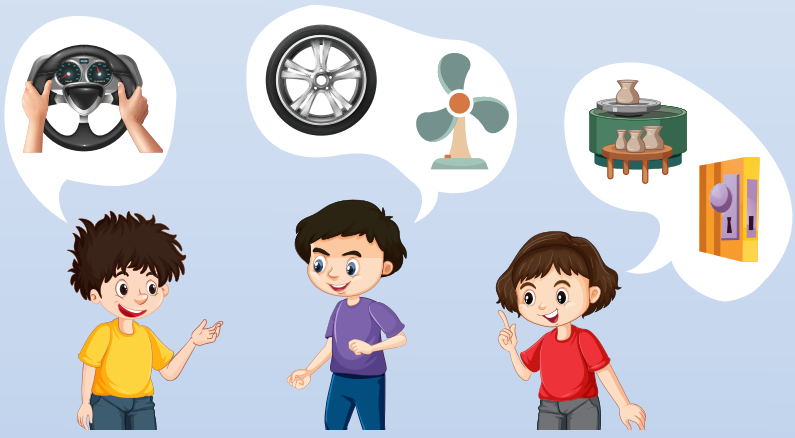
Riya thought for a moment. "A bicycle! The wheels turn around the axle!"

"Good one!" Maan said. "Anything else?"

Kabir snapped his fingers. "A fan! The blades rotate around an axle!"

"Yes! And what about a steering wheel in a car?" Maan asked. "It helps the driver turn the car smoothly."

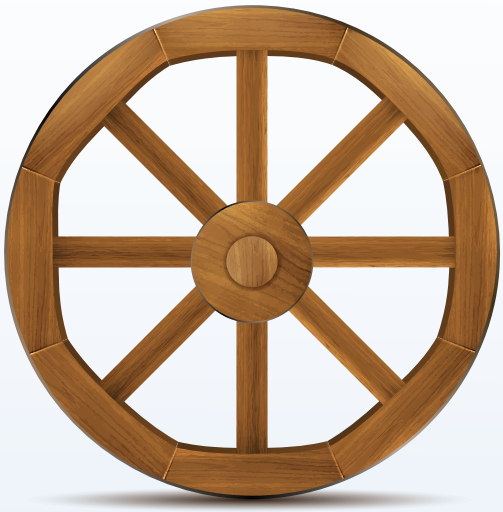
Riya smiled. "Even a potter's wheel! It spins to shape clay into pots!"



Maan nodded. "Exactly! The wheel and axle is a simple machine that makes work easier by reducing effort and increasing speed or force."

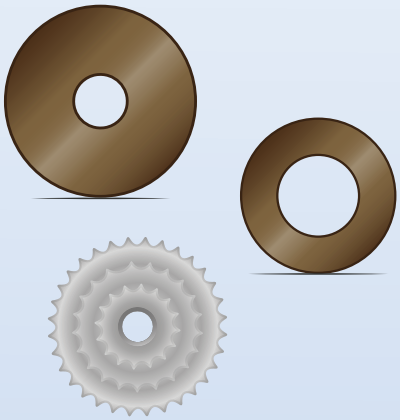
Maan then asked, "Can you tell me one example where the wheel and axle is used to increase force?"

Riya thought and said, "A doorknob! When we turn it, a small effort makes the whole lock move."


"Correct!" Maan said. "Now, what about something that uses the wheel and axle to increase speed?"
Kabir grinned. "A bicycle! A small push on the pedals makes the big wheel move fast!"
Maan clapped. "Good! Now, last one—where does the wheel and axle help with control?"
Riya answered, "A steering wheel in a car! It helps turn carefully!"
"Perfect!" Maan said. "Now let's use this knowledge to win the challenge!"

The Three Challenges: Strength, Speed & Control



Near the track, they saw three different wheel-and-axle setups:

1. **A big wheel with a small axle**
2. **A small wheel with a big axle**
3. **A set of gears connected to an axle**

Above them, a sign read:

"Choose wisely. One will give you power, one will give you speed, and one will give you control."

Round 1: The Strength Booster



For the first part of the race, they had to pull a heavy cart across the field.
Maan turned to his friends. "Which one should we pick for more strength?"
Riya pointed at the large wheel with a small axle. "This one! It helps move heavy things with less effort."
They fixed it to the cart. Kabir pushed, and the cart moved without much effort!
"This is like a doorknob or screwdriver," Riya said. "Small force, big effect!"

How It Works

A large wheel and small axle increase the mechanical advantage, meaning you apply less force to move heavy objects.

Examples:

- ***Doorknob (a small turn moves a big door)***
- ***Steering wheel (a small effort controls a big car)***
- ***Screwdriver (a small twist turns a big screw)***

"Great! But now we need speed!" Maan said.

Round 2: The Speed Booster



Next, they had to race on bicycles.
Maan asked, "Which setup should we use to increase speed?"
Kabir grinned. "The small wheel with a big axle! This will make the cart go faster."
They started pedaling. The wheels spun quickly, making them move fast!
"This is like a bicycle or a car's axle!" Riya said. "A small push makes the big wheels move faster!"

How It Works

A small wheel with a big axle reduces mechanical advantage but increases speed.

Examples:

- ***Bicycle pedals (small effort makes the wheels spin fast)***
- ***Car axles (small rotation moves the entire vehicle)***
- ***Hand drill (a small turn creates high-speed rotation)***

They overtook the other teams and reached the final round.

Round 3: The Control Master



For the last challenge, they had to steer a cart through a zigzag track.

Maan asked, "Now, which one will help us control movement?"

Kabir quickly attached the gears-and-axle system. "This one! It will help us move smoothly."

As he turned the gears, the cart moved slowly but with full control. "This is like a steering wheel!" Maan said. "It helps turn smoothly, just like a car!"

How It Works

Gears in a wheel-and-axle system control movements carefully, balancing speed and power.

Examples:

- ***Steering wheel (smooth turns)***
- ***Ferris wheel (slow, steady motion)***
- ***Clock gears (precise control)***

The cart reached the finish line, and the crowd cheered loudly!

Lessons Learned

A bicycle is a great example of several simple machines like the wheel-and-axle, lever, and pulley, integrated into one device. The front and back tires are wheel-and-axles, where the tyres rotate around the axle, in the center, where the gears are fixed. The gears and chain act as a pulley and help to drive the wheel on its axle. There are several levers on a bicycle, one of which is the pedal. All three of these simple machines are necessary for a bicycle to move! As you ride your bike, your leg transfers energy to the pedal (lever), which then gets tranferred from the pedal to the chain and gears (pulley system). This energy finally gets transferred to the wheel-and-axle system (tires) and then to the ground to make the bicycle move forward!

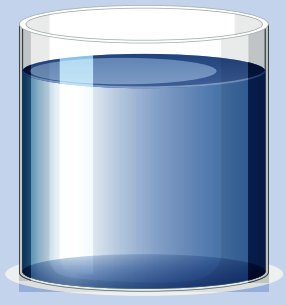
ACTIVITY

Let's use Wheel and Axle, and build some fun machines to understand their function better.

Out Of Box – Fun Facts

Ice takes up more space than water. An ice cube occupies about 9% more volume than the water used to make it.





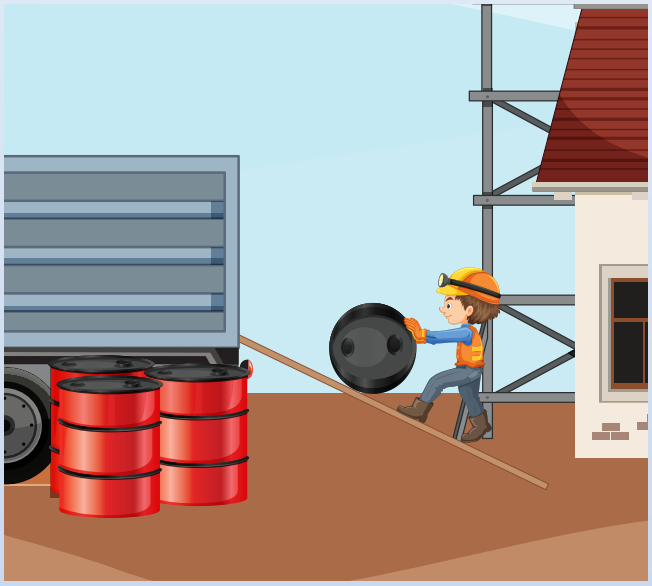


Inclined Plane





It was another bright afternoon, and Maan, Riya, and Kabir were walking in the park, talking and laughing. As they passed a construction site, they saw workers loading heavy barrels into a truck. Dhanak, a young apprentice, needed to move these heavy barrel from the ground level. Lifting it directly into truck was too difficult for him. His master, a wise craftsman, observed the situation and suggested using an inclined plane. The master said, "Instead of lifting, you can roll the barrel up a gently sloping ramp. The inclined plane makes the task much easier."



Dhanak, initially skeptical, followed his master's instructions and created a simple ramp using wooden planks. He rolled the barrel up the inclined plane with surprisingly little effort.

The kids were also watching this incidence from a distance. “Hey, look! That’s an inclined plane in action!” Maan pointed excitedly.

Kabir looked closely. “You mean that ramp?”

“Exactly! Inclined planes are everywhere,” Maan said.

Riya’s eyes lit up. “Like slides in the park! They make it easy to go down but hard to climb up.”

“And roads on hills,” Kabir added. “If roads went straight up, cars would struggle to climb.”

“What else?” Maan challenged.

“Escalators!” Riya said. “Moving inclined planes!”

“Slanted rooftops,” Kabir suggested. “They help rainwater slide off.”

“Wheelchair ramps,” Riya said. “They make it easier to go up instead of using stairs.”

“Conveyor belts in malls,” Kabir added. “They move luggage without lifting it.”

"Mailboxes! The inside is slanted so letters slide down," Riya said.
"Knife edges," Maan added. "They are inclined planes that make cutting easier."
"Screw threads!" Kabir said. "They are actually an inclined plane wrapped around."
Riya added. "They go up slowly so vehicles don't need to climb steeply."
"Stunt ramps for bike tricks," Kabir said. "They help riders jump high!"



"Ploughs for farming," Maan said. "They dig soil by sliding through it like an inclined plane."

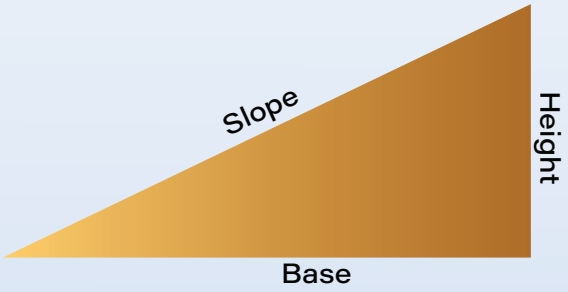
Maan took a deep breath and smiled. "Before we go, let me explain what an inclined plane is!"

"There are three main parts of an inclined plane," Maan said.

1. The Slope – The slanted surface that helps move objects up or down.

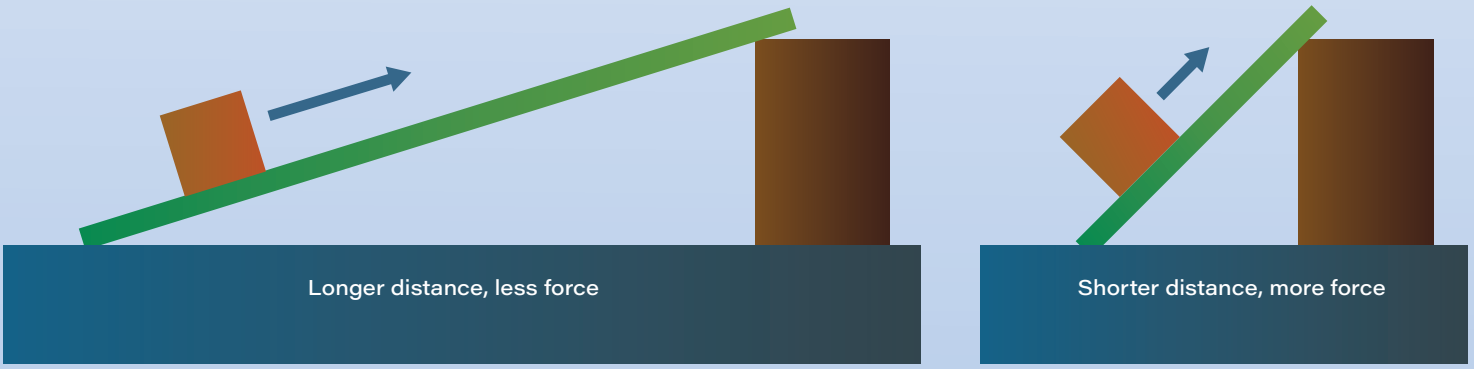
2. The Base – The bottom part where the inclined plane starts.

3. The Height – The difference in height from the base to the top of the slope.



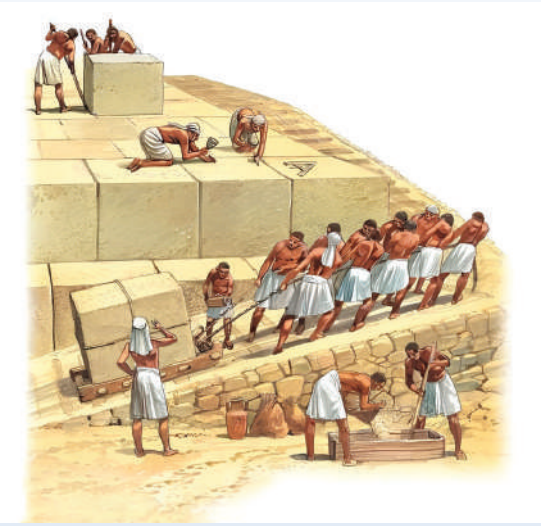
The Science Behind Inclined Planes

"An inclined plane reduces the force needed to move things by spreading the work over a longer distance," Maan explained. "Instead of lifting something straight up, you slide it up slowly, making the job easier."
"The longer the plane, the less force you need," he continued. "That's why ramps are so useful!"



History of Inclined Planes

"Inclined planes have been used for thousands of years," Maan continued. "The Egyptians used them to build the pyramids, and ancient people used ramps to move heavy stones and logs."
Riya's eyes widened. "So, we're using the same science as the Egyptians? That's amazing!"





ACTIVITY *Let's explore different type of Incline Plane.*



Out Of Box – Fun Facts

The Great Wall of China is the world's largest ancient monument, spanning over 13,000 miles and built over centuries.





Screw and Wedge



Screw

Today, the students went to STEAM lab, where their teacher gave them a challenge.

"Make something useful using simple machines — and gift it to your father. On the occasion of father's day.

Aryan, a class 3 boy, wanted to make a photo frame with a special picture of his father smiling at their Diwali celebration.

Aryan collected four smooth wooden sticks. To join them, he picked up tiny screws and a manual screwdriver.



As he started screwing the corners, Meena Ma'am, the STEAM teacher, noticed and walked over.

"Aryan, great choice! Do you know what you're using?"

He nodded and smiled, "Screw, ma'am! It's a simple machine!"

She clapped gently, "Exactly! A screw is actually an inclined plane wrapped around a cylinder."



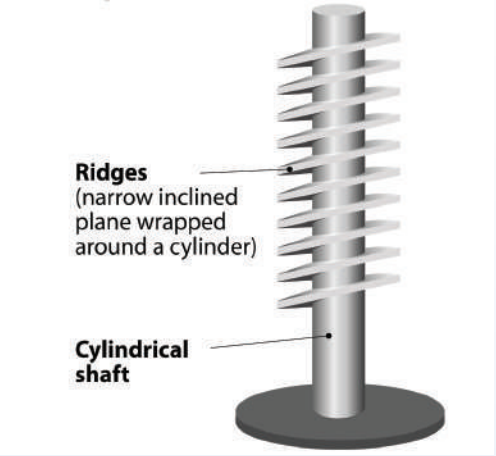
"The smaller the pitch, the more tightly the screw holds. That's why we use screws in so many places!"

She pointed to nearby examples of screw in the lab:

Bulb, Jar lids, Bolts and nuts, Corkscrews, Spiral staircases, hand drills, etc.

Aryan was amazed, "Even a bulb has a screw!"

"Aryan, you know a screw is used to tighten things and hold them firmly in place," the teacher explained. "It helps us do work faster and with less effort. Have you ever noticed how a car jack works? It uses a screw mechanism to lift the heavy car slowly and safely. That's the power of simple machines like the screw!"

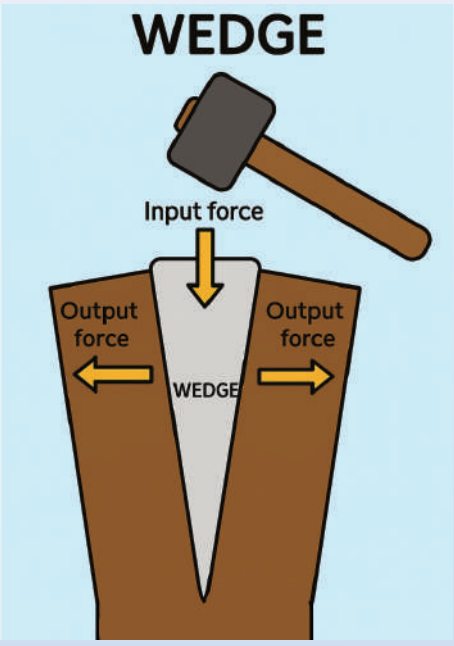


Wedge

Next, Aryan wanted to carve a slight groove to fit the photo inside the frame. He picked up a chisel and gently tapped it with a wooden hammer.
"Be careful," said Meena Ma'am. "Chisel is a type of wedge, another simple machine."

"Since the chisel tip is sharp and thin, the area is small. So even small force gives high pressure, making cutting easy."

The thinner and longer the wedge, the more it helps us cut with less force."
She also pointed out other wedge-based tools:
Knife, axe etc



Aryan looked at his pencil sharpener, smiled and said,
"Ma'am, this sharpener uses both screw and wedge!"
She replied, "Perfect observation
Aryan decorated the frame with stickers, small mirrors, and a paper rose. He added a stand using another small screw at the back.
On Father's Day, Aryan handed the gift to his dad.

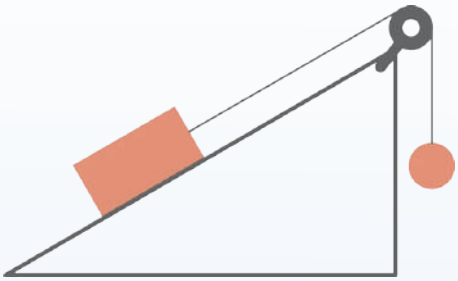
ACTIVITY *Let's create a fun mechanism using Screw and Wedge.*



STEAM-Compound Machine



Compound Machine

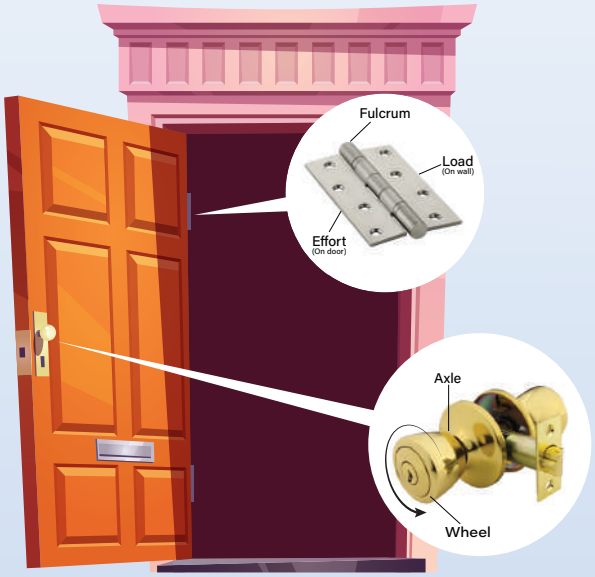


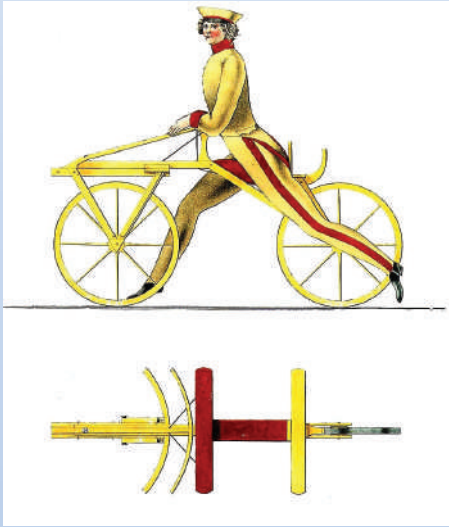
There was a theory class in the STEAM lab. The teacher asked, "If we combine two or more simple machines, what do we get?"
A student answered, "A compound machine. It's when two or more simple machines work together." These machines help us to do work more easily, quickly, and efficiently.

When we use a compound machine, we often want to know:

- How much less force is needed?
- How much faster or easier the work becomes?

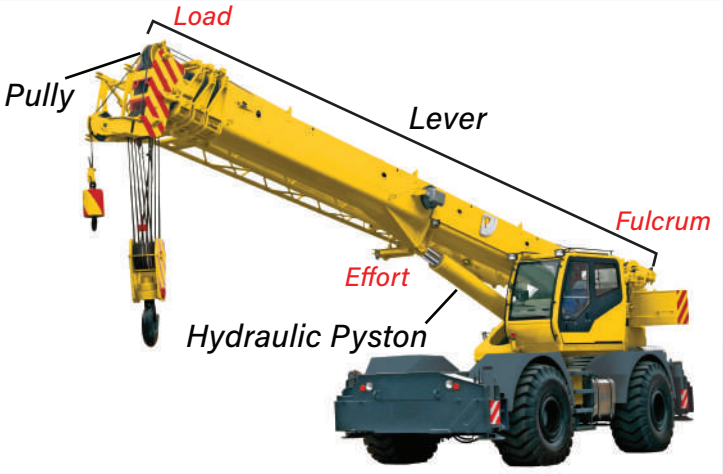
The teacher asked the next question, Can you give me an example of compound machine. Another student pointed to the door and said, "This door is a compound machine. It has hinges (levers) and a door knob (wheel and axle)."
The teacher said "Imagine if the door had no hinges, how would you open it?" The children said, "It would be very hard!"
"If the door had no doorknob?" asked the teacher. "Also very hard to open," said a student.
The teacher explained that a door's mechanical advantage is the product of its simple machines. Removing one makes it much harder to use.





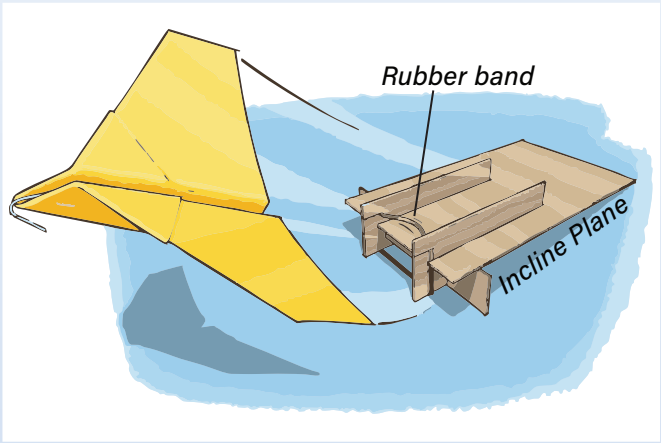
Then, the teacher talked about bicycles — another compound machine with wheels and axles, levers, and gears. The first bicycle, invented in 1817, was simple and hard to use, but engineers improved it over time.
The teacher also mentioned Rube Goldberg, who drew funny, overcomplicated machines doing simple tasks.
Finally, the teacher told the students to observe machines at home and think about the inventors behind them.
After discussing doors and bicycles, the teacher introduced more examples:
Marble Run – A playful setup where marbles travel across tracks, ramps (inclined planes), levers, pulleys, and even

rotating wheels. Though it looks like a toy, it's actually a brilliant example of combining simple machines to move an object using gravity and momentum. It helps children understand cause and effect, motion, and energy transfer.



Hydraulic Crane **–** Used at construction sites, this compound machine combines levers (for lifting), hydraulic pistons (for power), pulleys (for direction), and a base with wheels and axles (for movement). It multiplies force and makes lifting very heavy loads easier.

Balloon-Powered Cone Car **–** A lightweight cone with wheels (wheel and axle) is powered by air escaping from a balloon. This simple-looking toy demonstrates air pressure, propulsion, and how energy can be used to move a vehicle — all powered by combined machine elements.



Airplane Launcher **–** Made using a rubber band (elastic energy), inclined ramps, and a guiding rod (acting like a lever), the airplane launcher shoots paper planes into the air. This is a perfect example of how compound machines can store and release energy to do mechanical work — flying an object

Let us take another example of compound machine, which you all have seen at your home. A needle is a simple machine called a wedge. It helps us to pierce cloth or material. But when this needle is fixed inside a sewing machine, it becomes part of a compound machine. A sewing machine has a wheel and axle, lever, and wedge working together. It can stitch clothes faster, better, and with less effort than doing it by hand. This is how compound machines make our tasks simple, less tiring, and more effective.

ACTIVITY

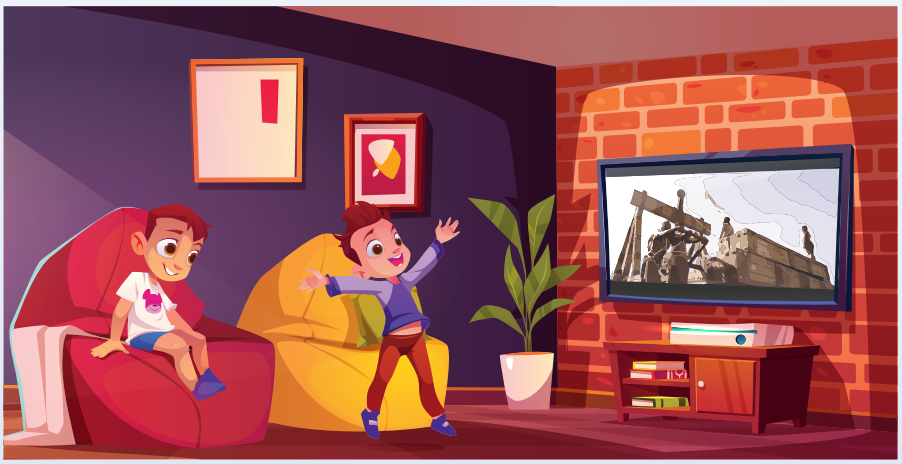
Let's build our own catapult and see who is the last one standing in the battlefield.



Catapult

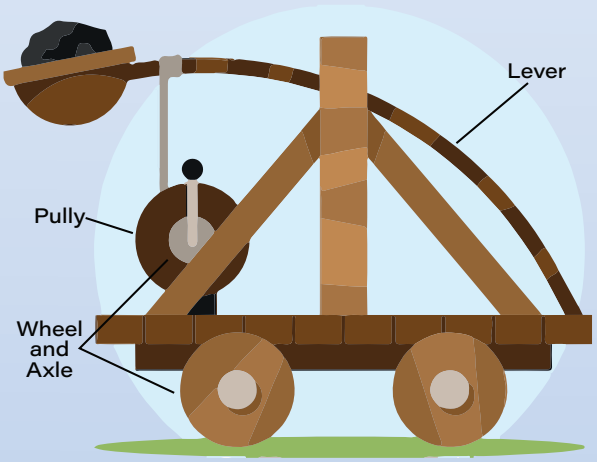


It was a Sunday afternoon. Rudra and Veer were watching the movie Bahubali on TV. Suddenly, Rudra pointed at the screen, "Look! That soldier is using a bow and arrow."
"Yes!" said Veer. "And look there! Someone is fighting with a sword. So cool!"
They both watched quietly as a huge wooden machine threw a big stone high into the sky—it flew and smashed a wall!



Veer jumped up. "Brother! What is that weapon? It looks so powerful!"
Rudra smiled, "That is called a catapult! It throws stones very far and breaks big things."
Veer wants to know more about it so they decided to discuss it with Science teacher.
Next day, they asked their question to their science teacher Ms Kiran.
Ms. Kiran smiled. "A very good question, boys! A catapult is indeed strong, because it can throw big stones over long distances. But more than a weapon, it's a compound machine!" That means it is made of more than one simple machine." in catapult mainly we see three simple machine lever, pulley and axle. They play significant role in pulley

- Lever helps throw the object.
- Axle allows smooth turning of the throwing arm.
- Pulley helps lift and release the arm or weight with less effort.

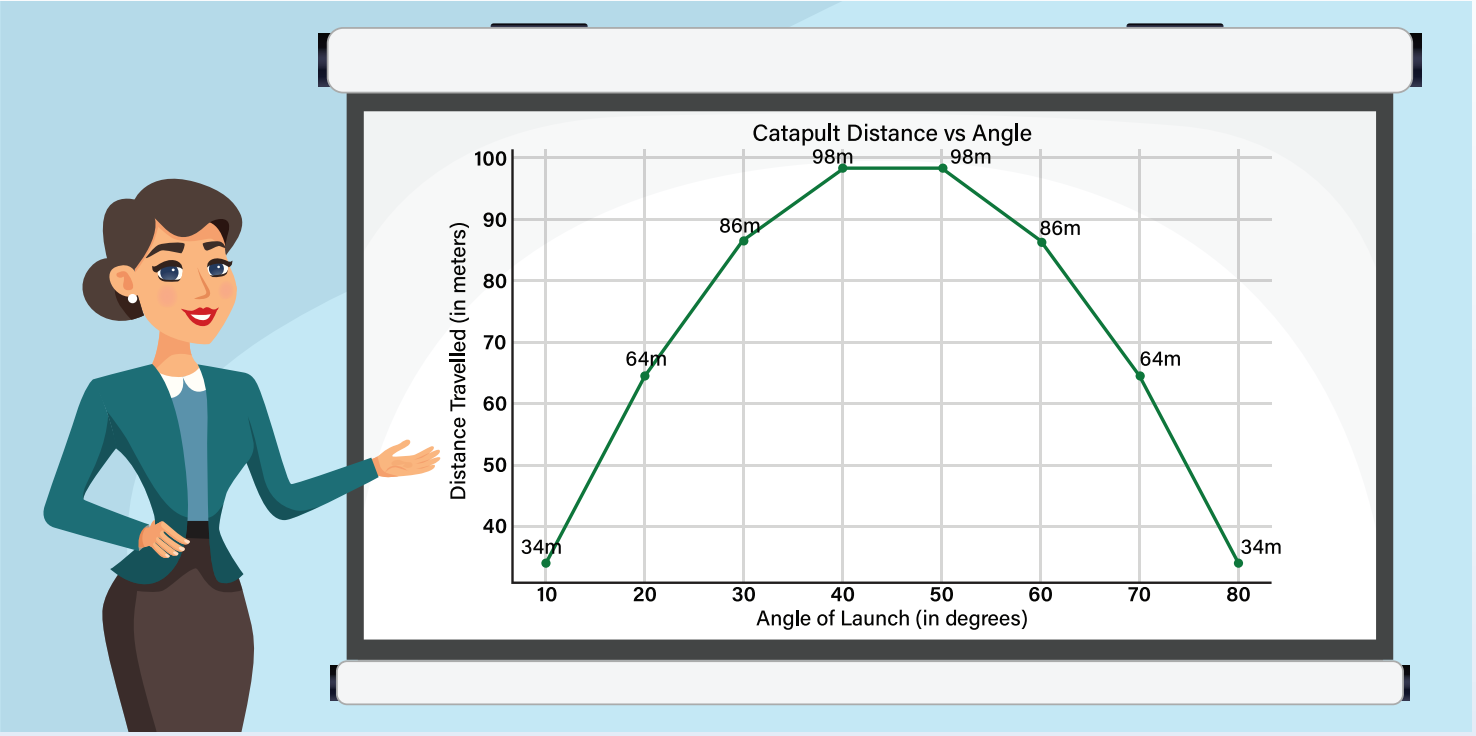


She continued when you stretch a rubber band, it stores energy, and when you release it, it snaps back and throws the loaded stone forward. This is called elasticity.

Ms. Kiran said:

- When we pull back the arm, it *stores energy(potential energy).*
- When we release, it changes into *moving energy (kinetic energy).*
- The stone goes up and down in the air this kind of motion is known as *projectile motion.*

She added, "The farther you pull, the more energy it stores—and the farther it throws!". But it also depends on angle. She then shows a graph on digital board as you can see:



- At small angles (like 10°), the stone doesn't go very far.
- The distance increases as the angle increases, reaching a peak around 45°.
- After that, the distance starts to decrease again.

Ms. Kiran continued, "Catapults have been designed by engineers for a variety of purposes — from lifting boulders into the air for warfare to human beings for entertainment; the projectiles in this activity are grapes for a magic act. To make a projectile cover the most horizontal distance possible, it should be launched from a 45° angle. Remember this fact because you will need to apply it to the construction of your catapults in the upcoming activity.

- If a projectile is launched from an angle greater than 45°, where will it go?
- If the same projectile is launched from an angle less than 45°, where will it go?

ACTIVITY

Let's build our own catapult and see who is the last one standing in the battlefield.



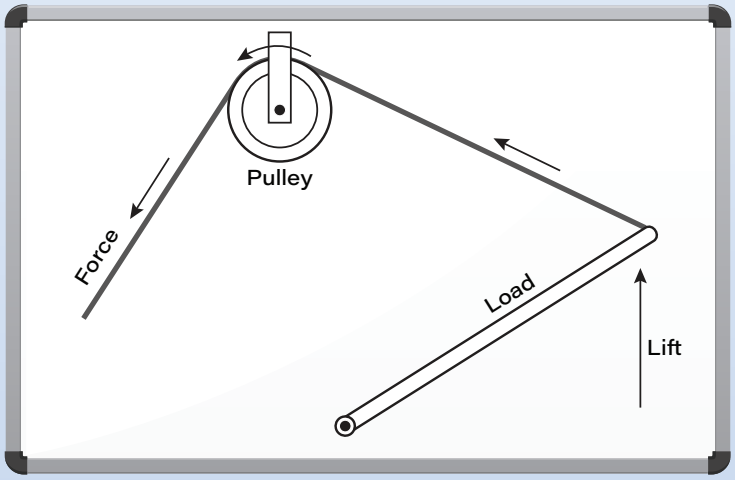
Lifting Bridge



It was a bright Monday morning. In their science class, Ms. Kiran showed a video of the Pamban Bridge in Rameshwaram. The students watched closely as the middle part of the bridge slowly lifted upwards to allow a big ship to pass underneath. Rudra raised his hand and asked, "Ma'am, how does this big bridge lift like that? It must be so heavy!"

Ms. Kiran smiled, "Good question, Rudra. The Pamban Bridge uses a special lifting mechanism, have you heard about old wooden bridges in ancient forts they can also move they are not stationary at one place. Even though the material is different—steel now and wood earlier—the science behind it is the same. It is a compound machine made of simple machines like pulleys, levers, and axles."

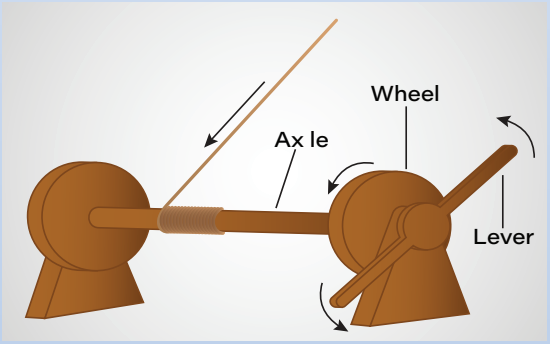




She drew a simple diagram on the board and explained, "A pulley is used to change the direction of force. When you pull down on a rope, the gate or bridge goes up. This makes lifting easier. The rope is wound around an axle, which is connected to a big wheel. When the wheel is turned—either by a motor in modern bridges or by soldiers using wooden bars in ancient times—it pulls the rope and lifts the bridge."

She said, "more pulleys make lifting easier."

Then she explained the role of axle and lever. "The rope is wound around a thick rod called an axle, which is connected to a big circular wheel. In olden days, soldiers turned this wheel using wooden bars—like a lever. This gives more turning force with less effort. Today, a motor turns the axle instead."



Rudra asked, “Ma’am, how does the bridge stay up?”
She replied, “Good question! Gravity is always trying to pull it down, so we use locks or brakes to hold it in place. When we want to lower the bridge, the lock is released, and gravity brings it back down safely.”

Finally, Ms. Kiran talked about the importance of angle. She explained, “If the rope goes at a wrong angle, more force is wasted. But at the right angle, like 45°, the lifting becomes smooth and efficient.”

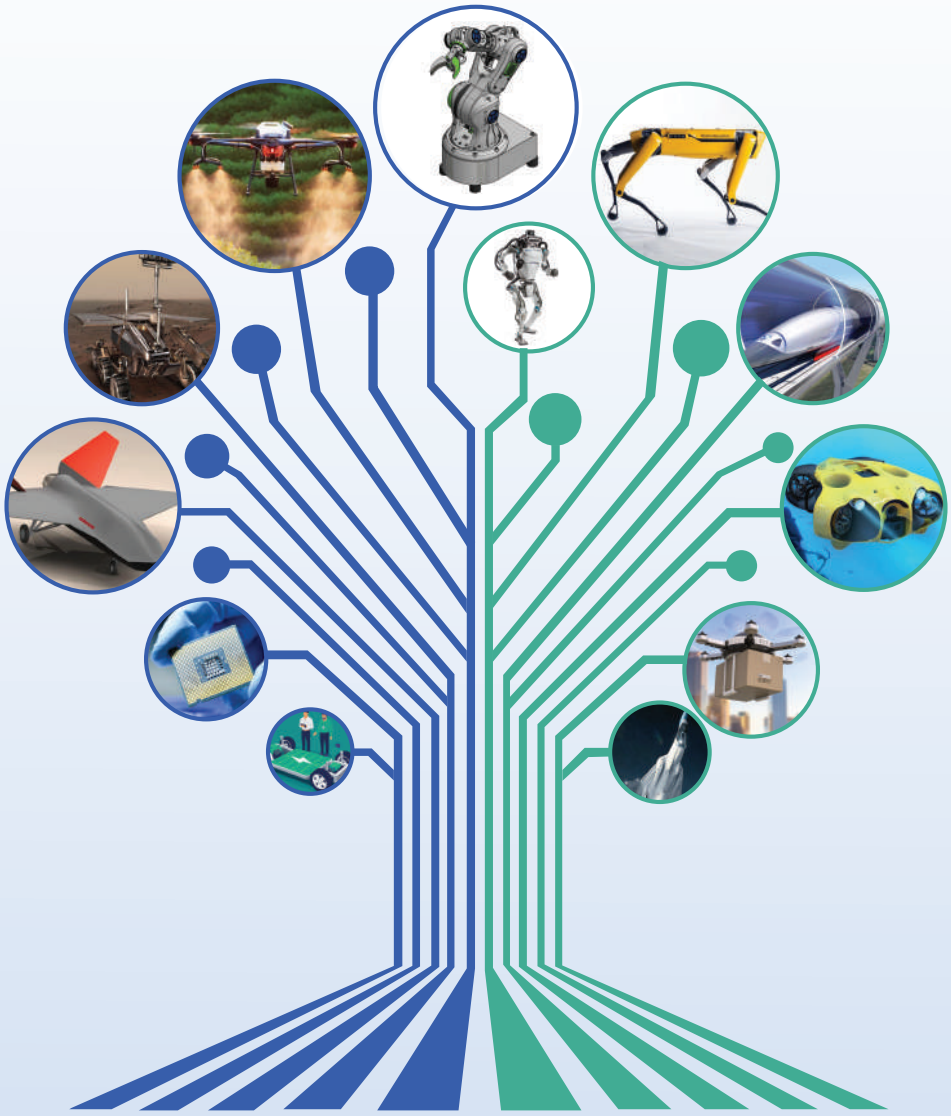
Angle	Lifting	Efficiency
10°	Too flat	force wasted
45°	Best angle	efficient
80°	Too steep	hard to pull

She said, “whether it is an ancient wooden bridge or the modern Pamban Bridge, the machines inside are doing the same smart work. They help us lift heavy things using science and clever design.”

At the end of the class, Rudra and Veer were excited. “Ma’am, can we build a model of a lifting bridge using pulleys and motors?”
Ms. Kiran smiled. “Of course! You’ve already made catapults, now it’s time to build bridges!”
And with that, the students started planning their next science project—learning real-world engineering inspired by India's own Pamban Bridge.

ACTIVITY *Let’s build a lifting bridge.*

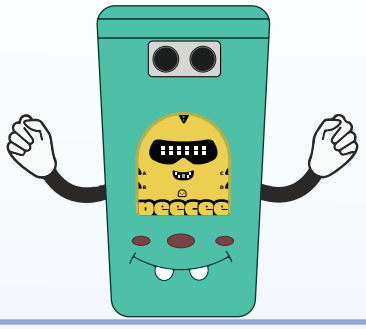




Mechatonics-Project Based Learning



Smart Dustbin



On a sunny afternoon, Rakshit and his cousin Riya were visiting their Grandma's house. Grandma loved to keep everything neat and clean. She had a big garden, shiny floors, and even a tiny dustbin near the kitchen for food waste.



Every time Grandma cooked something, she had to touch the dustbin lid to throw away the peels and wrappers.

"Ugh, this lid is always dirty!" she would say, wiping her hands right after.

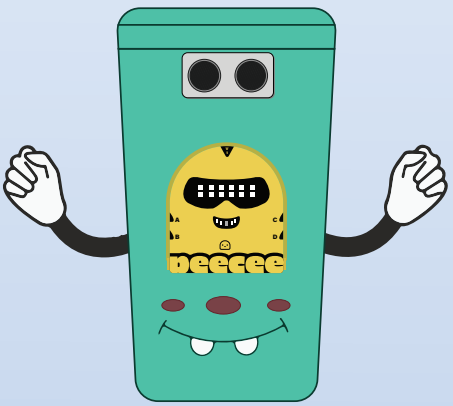
Rakshit noticed this and got an idea.

"What if the dustbin could open all by itself, Grandma?" he asked one day.

Grandma laughed, "That would be amazing, but dustbins don't have magic, dear."

Riya grinned. "Maybe not magic… but maybe science?"

Just then, their mentor and friendly instructor, Ms. Shruti, who taught science projects at their school, came to visit with some extra kits.



Ms. Shruti smiled. "That's a brilliant idea. Let's use the Pocket PeeCee and Play-Dynamex kit. I'll guide you."

That evening, the three of them sat down to work. Rakshit opened the special kit — it had a tiny computer called Pocket PeeCee and a box of mechanical blocks called Play-Dynamex.

"Let's build something cool," he said.

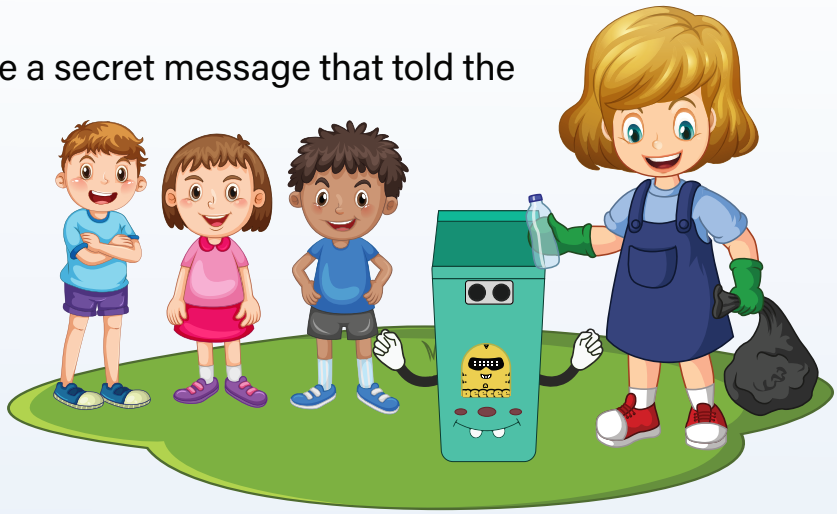
"Step one: sensing," Ms. Shruti said. "Let's attach an ultrasonic sensor that acts like the dustbin's eyes."

Rakshit connected the sensor. "This will help the dustbin 'see' Grandma's hand when she comes close."

Riya helped fix the motor and gears inside a cardboard dustbin. "The motor is like the dustbin's muscles," she said. "And these gears will help move the lid smoothly, like a team!"

Ms. Shruti encouraged, "Perfect! Now let's code it with Pocket PeeCee — give it some brains!"

Together, they wrote a simple code, like a secret message that told the motor what to do when the sensor saw a hand.



After two hours of teamwork and guidance, the smart dustbin was ready!

They placed it in Grandma's kitchen and waited.

The next morning, Grandma walked in with a banana peel. As she got close to the dustbin — swoosh! — the lid opened on its own!

Grandma jumped in surprise and then burst out laughing. "Is this your magic?"

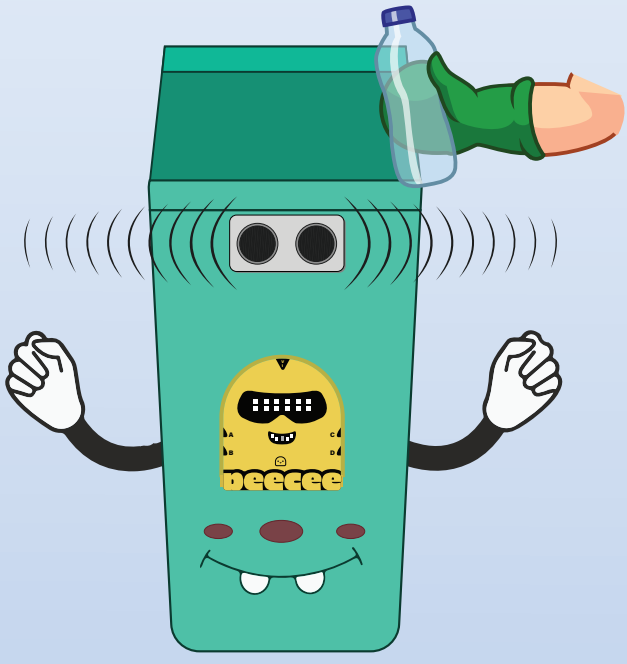
"No," Rakshit smiled. "It's science — sensors, motors, and gears!"

Grandma clapped her hands. "This is the smartest dustbin I've ever seen!"

That night, Riya wrote in her diary:

"Today, we learned how machines can be smart with the help of sensors, motors, and gears. And we used our science to solve a real problem for someone we love."

After Grandma's smart dustbin opened by itself, she was amazed. "This is truly magic!" she said again and again.



But Rakshit smiled and said, "It's not magic, Grandma… it's science!"

"Really?" Grandma asked, curious now. "Then you must tell me how it works!"

Rakshit nodded. "Okay, let me explain it like a story!"

He pointed to the top of the dustbin. "See this little black box? That's called an ultrasonic sensor. It's like the dustbin's eyes."

Riya added, "These eyes don't see like ours. They send invisible sound waves—like tiny shouts—and wait for them to bounce back."

Rakshit continued, "If something, like a hand, comes close, the waves bounce back quickly. The sensor then tells the PeeCee computer, 'Hey! Someone's here!'"

Ms. Shruti chimed in, "That's called echo-based sensing, just like how bats fly using sound!"

"Exactly!" Rakshit grinned. "The sensor is like a bat's sonar. It helps the dustbin know when a hand is nearby."

HAND COMES NEAR ⟶ SENSOR DETECTS ⟶ PEECEE DECIDES ⟶ MOTOR TURNS ⟶ GEARS MOVE ⟶ LID OPENS

Then he said, "And when your hand goes away, the sensor sees nothing — so it tells the brain, and the lid closes again."
That night, before bed, Grandma sat beside Rakshit, Riya, and Ms. Shruti and asked, "Can I ask some questions too?"
"Of course!" they said together.

Grandma asked:

- ***"What if I stand far away from the dustbin? Will it still open?"***
- ***"Can I make a smart cupboard like this?"***
- ***"What happens if the motor stops working?"***
- ***"Can we make it talk too — like saying 'Thank you!'?"***

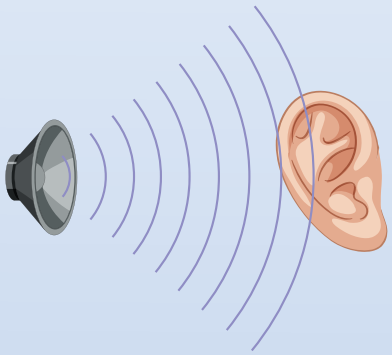
Ms. Shruti chuckled. "Those are wonderful questions! And they're all possible. That's what your next project could explore!"
Rakshit grinned. "Yes, yes, and yes — but let's explore that in our next adventure!"
As Grandma hugged them all, Riya whispered,

"Science makes life better — one lid at a time."

STEAM Behind Smart Dustbin

What is Sound?

Sound is a type of energy that we hear. It is made when something vibrates — like a guitar string, your vocal cords, or a speaker cone.
When an object vibrates, it moves the air particles around it. These air particles bump into each other and carry the sound to our ears. This movement of air is called a sound wave.



What is Vibration?

Vibration is a quick back-and-forth movement. It is how sound is created.



Example:

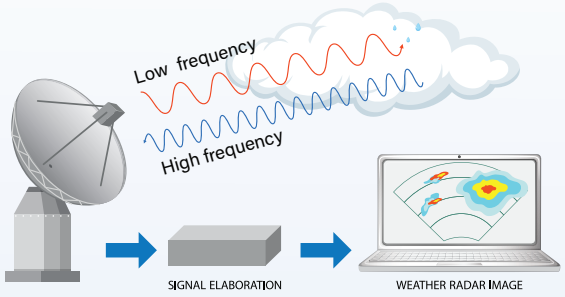
- When you pluck a rubber band, it vibrates and makes a sound.
- When you speak, your throat (vocal cords) vibrates.

What is Frequency?

Frequency means how fast something vibrates, or how many times it vibrates in one second. It is measured in Hertz (Hz).

High frequency = high-pitched sound (like a whistle)
Low frequency = low-pitched sound (like a drum)

Formula: Frequency(f) = 1÷Time of one vibration(T)



What is Frequency?

Amplitude is how big the vibration is — or how strong the sound wave is. It tells us how loud or soft a sound is.

- **Big amplitude** = loud sound
- **Small amplitude** = soft sound

Amplitude is measured in decibels (dB).

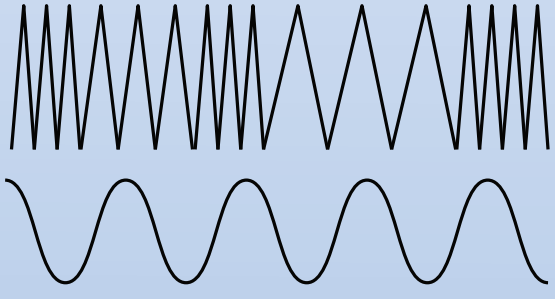
Types of Sound

Here are some different types of sounds based on how we hear them:

Type	Description	Example
Audible Sound	Sounds we can hear (20 Hz to 20,000 Hz)	Talking, music, clapping
Infrasonic Sound	Sounds below 20 Hz (too low to hear)	Earthquake vibrations
Ultrasonic Sound	Sounds above 20,000 Hz (too high to hear)	Bat sounds, dog whistles

What is a Wave?

A wave is a pattern that carries energy. Sound travels in waves — like ripples in water.



There are two main types of waves:

1. **Longitudinal waves:** Sound waves in air (particles move back and forth)
2. **Transverse waves:** Light waves or water waves (particles move up and down)

What are Ultrasonic Waves?

Ultrasonic waves are sound waves with frequencies higher than 20,000 Hz — too high for humans to hear.



Used in:

- Bats for navigation
- Medical ultrasound machines
- Sensors in smart dustbins

They work by sending waves that bounce back when they hit something (called echo), just like bats use echo to fly in the dark.

What is Gear Ratio?

A gear is a wheel with teeth that connects to another gear to transmit motion.Gear ratio tells us how the rotation of one gear affects another.

$$\textit{Gear Ratio} = \frac{\textit{Number of teeth on driver gear}}{\textit{Number of teeth on driven gear}}$$

Some basic formula:

1. Distance=Speed×Time
2. Detection Distance Formula (for ultrasonic sensor)= (Speed of Sound x Time) ÷ 2

ACTIVITY

Let's make a SMART Dustbin to keep our environment clean and hygienic.



Obstacle Avoiding Car





One afternoon, Rakshit's toy car rammed into the wall — bonk! The front wheel rolled away.
Riya frowned. "Your car keeps crashing."
"I wish it could see where it's going," Rakshit sighed.
Suddenly, Riya had a spark. "What if we build a car that avoids obstacles on its own?"
At school the next day, they pitched the idea to Shruti Ma'am during science lab.
That evening, their table turned into a mini workshop. They pulled out:

- **Two motors for movement,**
- **A Play-Dynamex box for the body,**
- **An ultrasonic sensor to see object.**
- **The Pocket PeeCee as the brain.**



Rakshit fixed the sensor to the front. "This will spot anything in the way."
Riya connected wires. "And when it does, the PeeCee will change the car's direction."
When the motors didn't respond, they asked Shruti Ma'am for help.
"Any clues why it's not working?" she asked.
Riya spotted it. "The ground pin! It's not connected!"
"Good catch!" Shruti Ma'am nodded. "That's what real inventors do — test and fix."
Soon, the car was ready. In the living room, it rolled forward, paused at a block, turned, and kept going!



"It's working!" Rakshit said, amazed.
"Look at it go!" Riya laughed.
Grandma, watching from the sofa, clapped. "A car without a driver — how clever!"
"It's not magic," Rakshit said. "It's science. Want to see how it works?"
He held the car while Riya opened her science notebook.
"This is an ultrasonic sensor," Rakshit explained. "Like a bat's eyes."
"Bats don't bump into things in the dark," Riya added. "They make sounds that bounce back, just like our sensor does."
Rakshit continued, "When the sensor sends out sound waves, they bounce off objects. The Pocket PeeCee calculates how far they are and tells the motors what to do."
Riya showed the parts inside the car:

- **Ultrasonic Sensor –** the eyes
- **Pocket PeeCee –** the brain
- **Motors and Wheels –** the legs
- **Battery –** the energy source

She drew arrows in her notebook:

1. Sensor sends sound waves.
2. Waves bounce back if there's something ahead.
3. PeeCee tells the car to stop.
4. Then, it turns left or right.
5. The car moves forward again.



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STEAM Behind Obstacle Avoiding Car:

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When an object vibrates, it moves the air particles around it. These air particles bump into each other and carry the sound to our ears. This movement of air is called a sound wave.

ACTIVITY *Let’s build an Obstacle Avoiding Car.*

Out Of Box – Fun Facts

Leonardo Da Vinci visualised and sketched plans for a robot in 1495

