A Guide For Schools Visiting DoScience

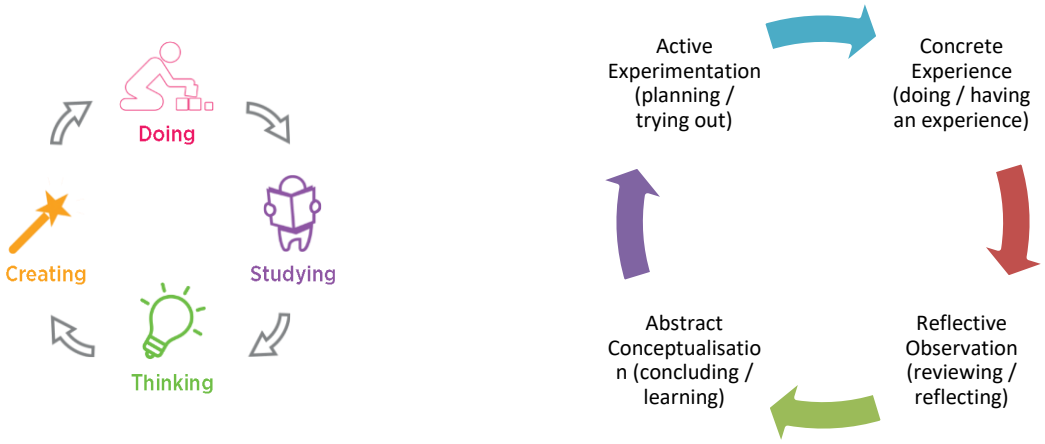
A Quick Introduction

DoScience is an outdoor, experiential science learning space. Operating since 2017, DoScience provides an informal, hands-on environment for learners to explore and discover concepts of Science and Maths.

DoScience is run by a non-profit, Bookmark Projects Trust. You can look us up at www.doscience.co.in and www.facebook.com/dosciencenow. We are located inside the Sanjeevaiah Park, on Necklace Road in Hyderabad and our google maps location is https://g.page/doscience-hyderabad?share.

"Doing" in the Experiential Learning Cycle

We draw considerably from David Kolb's Experiential Learning Cycle in our design and approach to learning. Here is a quick summary of the elements of the Learning Cycle.



Learning is the process where knowledge is created by the transformation of a concrete experience.

DoScience plays a concise role in the learning cycle – of providing opportunities for concrete experiences. This we hope will complement schools' efforts in providing a conceptual understanding, thus encouraging students to dwell deeper into their education.

There is considerable research to demonstrate that concrete experiences (hands-on learning) help learners to assimilate underlying concepts taught at school in a more holistic manner, and also enable retention in the long-term memories of the learners.

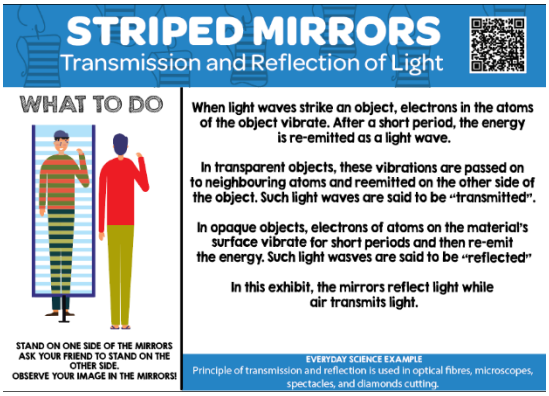
Learning Models at DoScience

Keeping with the spirit of experiential learning, nearly all the models at DoScience are hands-on. This ensures that the conversations between the learner and the teacher – during their visit to DoScience – have the subject matter at the centre.

We currently have over 70 learning / play models at DoScience. These encompass the areas of Physics (Mechanics, Sound, Light) and Mathematics, with a few play models (Scrabble, Chess) included. All our models are hands-on, mostly mechanical models; we do not use electronic gadgets.

Each DoScience model is supported by a detailed signage, which guides the user on how to interact with the model, the essential underlying principle behind the model, and some everyday applications of the principle. Many of the signages also have a QR code which will take the visitors to a relevant YouTube explanatory video.

For example,



We encourage learners to explore the models by themselves, with guidance from their teachers and parents. Depending on learners' past experiences and aptitude for the subject, the learning takeaways will differ for every individual. We hope that the exploration at DoScience will encourage learners to explore the concepts further, after they get back to their homes.

We urge schools to not worry about the students having to comprehend each single one of the principles during a short visit. We encourage you to provide a reasonable structure to the visit, guide the children appropriately and then allow them time and space to explore. This would be a good way to ensure valuable learning takeaways while also spending an enjoyable day.

Preparation before visiting DoScience

We have laid out the signages of our models as an annexure to this document. A playlist of the explanatory videos is available on DoScience channel on YouTube (https://tinyurl.com/DoSci-Exhibits). We urge teachers to review the information before their visit, so that they can guide the children suitably.

We also encourage teachers to plan the structure of the visit beforehand, so that children end the day with both a learning and a fun experience.

While our team will support the teachers in guiding the children during their visit to DoScience, we will not explain all the exhibits to all the visitors.

Facilities at DoScience

DoScience is located within Sanjeevaiah Park, which is one of the largest public parks in the city spread over a 99 acre area. The park has other interesting options to explore as well, including a cactus garden, a large national flag, a garden maze, a butterfly park, a bamboo garden, a nursery and a wide range of trees.

While the park has only a small pantry with basic food items available, its vast lawns present an opportunity for very pleasant picnics. Please note that while blankets and food are allowed to be brought inside the park, play equipment (balls, bats, bicycles etc) is not.

The washrooms in the park are the common amenities maintained by the park authorities.

Given the tropical weather conditions in Hyderabad and the vast spaces to be explored in the park, we urge children to carry hats and water bottles with them at all times of the year. DoScience will provide unlimited refills of mineral water into their water bottles.

Entry Fees, Group Sizes, Age-Groups, and Timings

Entry Fees

1. To Sanjeevaiah Park (as DoScience is located within the park, it is essential to enter the main park as well)
    - Rs. 10 per person per day.
    - Free for government school children
    - An introductory letter from the school is required by the park authorities (to be handed over at the ticket counter before entering.)
2. To DoScience
    - Rs. 50 per person per day
    - In case of school groups, free entry for the teachers and support staff accompanying the children
    - Free entry always for government school children. We request you to connect local government schools with us – we will be very happy to block dedicated time at DoScience for them.

We encourage you to make your payments digitally. We accept all digital payment channels (**not** credit cards), and will be happy to share the QR code or our NEFT details with you if you would like to pay in advance as well.

Group Sizes

1. DoScience can comfortably accommodate 150 students at any time. We usually find schools bringing larger groups of around 300 to the Park, and sending in batches of around 125-150 students to DoScience at intervals of 90-120 minutes. We encourage teachers to plan a schedule that works best for their school group.

Age-Groups

1. Most of the science and maths principles demonstrated at DoScience are a part of the middle and high school curricula in India. So, children from classes 3 upwards connect the experiences at DoScience directly with their school sessions.
2. We however believe that every learner is on their own unique learning journey and will garner knowledge appropriate for them at that point in time. So, we encourage children and grown-ups of all age-groups to visit DoScience.
3. In case of groups of children less than 8 years of age, we strongly advise schools to send adequate number of teachers and support staff to take care of the children. Most of our models are made of metal, so a bit of caution helps.

Timings

Our regular working hours for schools are –
Monday to Friday – 9.00 am to 5.30 pm
Saturday and Sunday – 7.00 am to 6.00 pm

(Please note that we are closed on Mondays for regular walk-in visitors)

Finally, a quick note on our pricing – DoScience is a non-profit initiative of Bookmark Projects. The entry fees paid by schools go towards subsidising government school visits and for covering our operating expenses to an extent. You will hence understand that we would not be able to provide a discount to your school group, even if it is a large one. We hope you will support us in our effort.

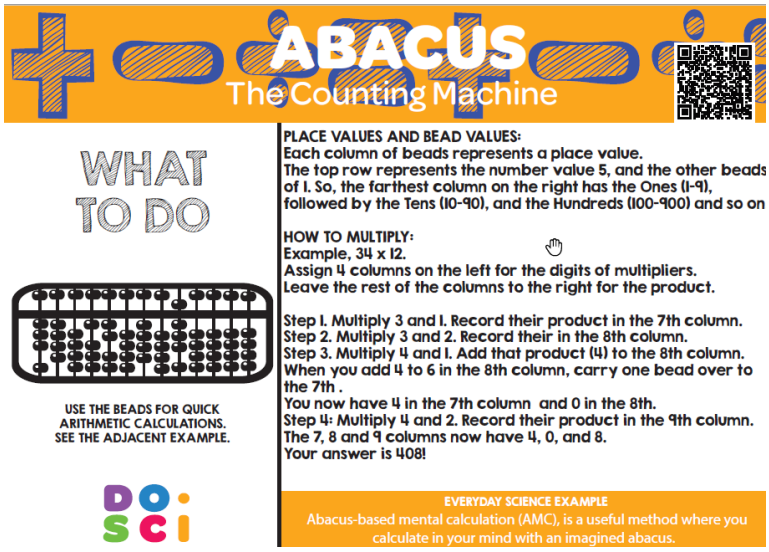
We hope this provides document adequate information for you to plan a visit to DoScience. We would be happy to have a detailed conversation with you to clarify any doubts or to schedule a visit. Please call +91 88972 04422 or write to us at aparna@doscience.co.in for any discussion or to check availability.

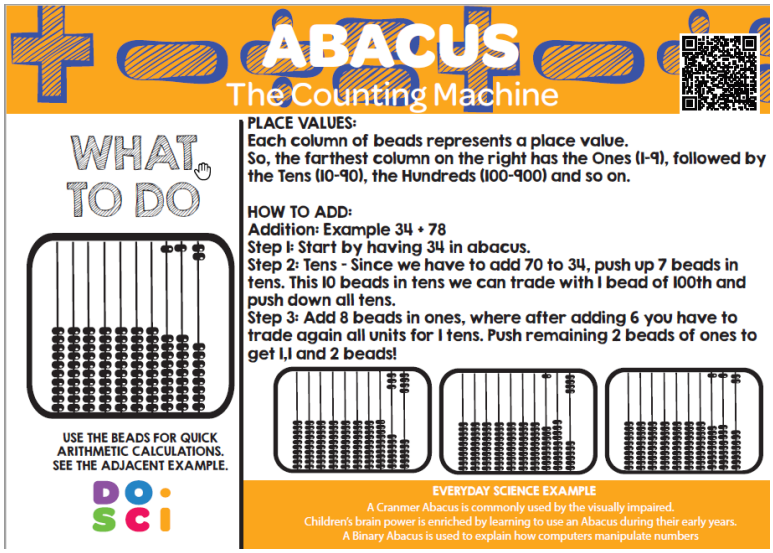
We look forward to hearing from you.

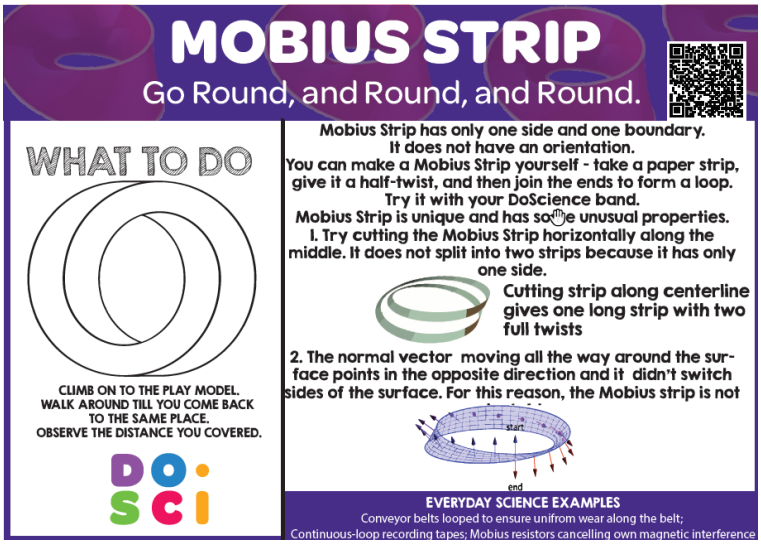
Annexure - Exhibit List, Signages, QR Codes to Videos

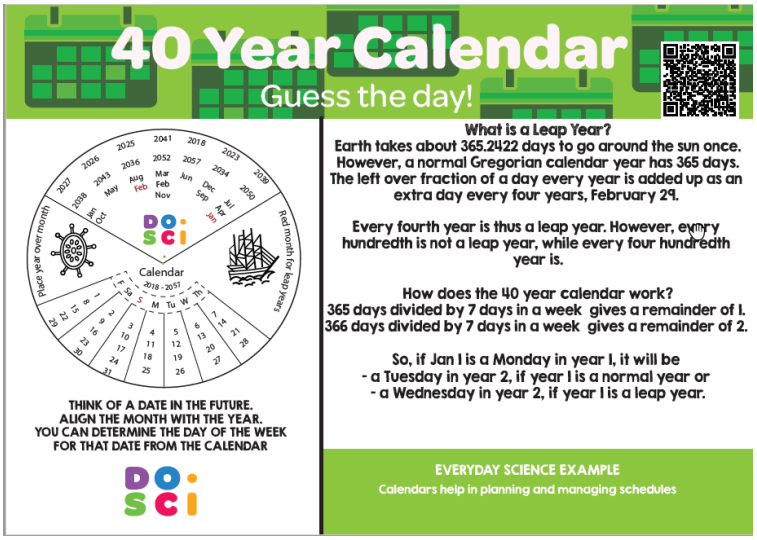
A Prep Guide for Teachers Accompanying School Groups

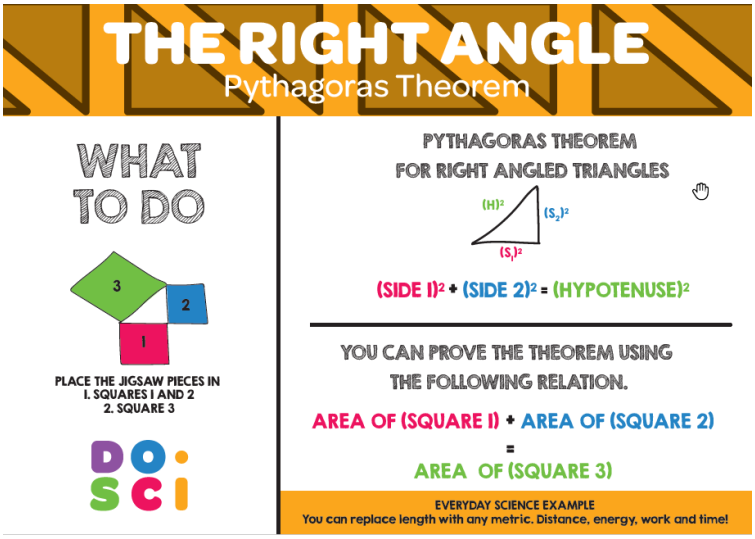
(A slide show of the exhibit signages is also available on YouTube at https://tinyurl.com/DoSci-Signages)

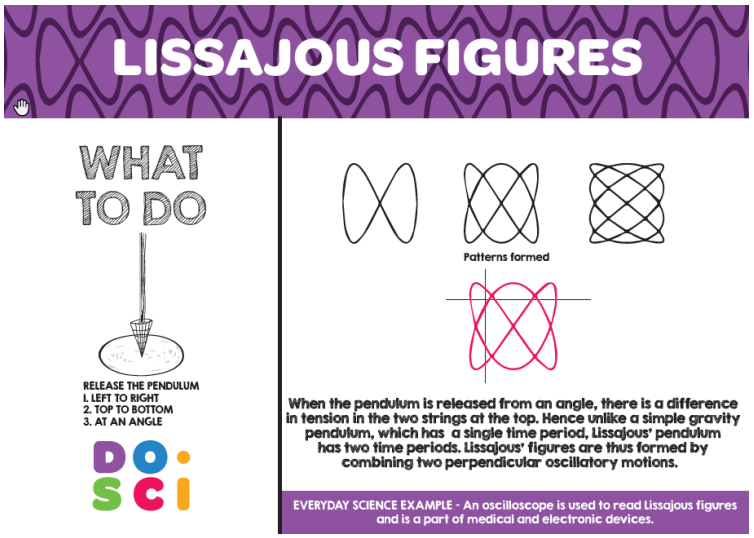








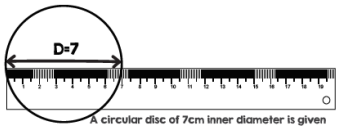




PI

Deriving the value of PI (π)

What To Do?



A circular disc of 7cm inner diameter is given

PLACE THE MARKER ON THE DISC AT POINT 0 ON THE SCALE. ROLL THE MARKER ALONG THE SCALE, AND NOTE THE POINT AT WHICH IT STOPS. THIS IS THE CIRCUMFERENCE.

PI is a mathematical constant, denoted by the Greek symbol π

π is defined as circumference of the circle divided by its diameter

The value of π is 22/7 or approximately 3.14. This value remains the same for all circles of all sizes

In this example, diameter = 7 cm

So, circumference should be 22 cm

EVERYDAY SCIENCE EXAMPLE

PI has uses in mathematics, science, trignometry, geometry, nature, thermodynamics, fractals, number theory, electromagnetism, computing & more.

ANTI-GRAVITY MIRRORS

Float in Air

WHAT TO DO

Human body is symmetrical. So, a mirror reflection of the right side of the body will appear exactly like the left side, to an observer.

Stand with the edge of the mirror bisecting your body. You will appear whole to a person observing from the front!

So just straddle the mirror, raise one leg, and fly!

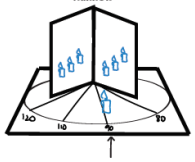
EVERYDAY SCIENCE EXAMPLE

SPECTACLES, TELESCOPES, MICROSCOPES, OPTICAL FIBRES

BETWEEN THE MIRRORS

Number of images depends on the angle between the mirrors

WHAT TO DO



1. PLACE AN OBJECT BETWEEN THE MIRRORS
2. ADJUST THE ANGLE BETWEEN THE MIRRORS
3. COUNT THE NUMBER OF IMAGES IN THE 2 MIRRORS

A MIRROR REFLECTS EVERYTHING IN FRONT OF IT, INCLUDING ANOTHER MIRROR. IF YOU PLACE TWO MIRRORS AT AN ANGLE, YOU INCREASE THE NUMBER OF REFLECTED IMAGES THAT YOU CAN SEE.

CALCULATE THE NUMBER OF IMAGES

IF θ IS THE ANGLE BETWEEN MIRRORS, AND IF $360/\theta$ IS EVEN

NUMBER OF IMAGES (n) = $360/\theta - 1$

EXAMPLE: $\theta = 60°$

$n = 360/60 - 1 = 6 - 1 = 5$

IF $360/\theta$ IS ODD, THEN NUMBER OF IMAGES (n) = $360/\theta$

EXAMPLE: $\theta = 120°$

$n = 360/120 = 3$

AS THE ANGLE BETWEEN MIRRORS INCREASES, THE NUMBER OF IMAGES DECREASES

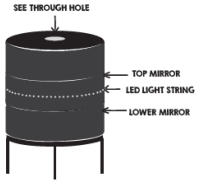
EVERYDAY SCIENCE EXAMPLE

In sweet shops, showrooms and temples, mirrors are mounted on walls and ceilings to create an illusion of more objects and to make it easier to see objects from all angles

INFINITY WELL

Multitude of images with parallel mirrors

WHAT TO DO



SEE THROUGH THE HOLE ON TOP OF THE INFINITY WELL. OBSERVE THE NUMBER OF ROWS OF LIGHTS.

INFINITY WELL HAS TWO MIRRORS.

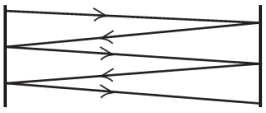
- THE TOP MIRROR IS A TWO-WAY MIRROR. WHILE IT REFLECTS THE IMAGE, YOU CAN ALSO SEE THROUGH IT FROM THE OTHER END.
- THE LOWER MIRROR IS A REGULAR ONE-SIDE MIRROR.

THE TWO MIRRORS ARE PLACED PARALLEL TO EACH OTHER. AND A STRING OF LEDS IS PLACED BETWEEN THE TWO.

THE ANGLE BETWEEN THE MIRRORS IS 0 DEGREES.

HENCE, THE NUMBER OF REFLECTIONS IS (360 / 0), WHICH IS INFINITY.

THAT IS, LIGHT BOUNCES OFF THE TWO SURFACES MULTIPLE TIMES RESULTING IN A NUMBER OF IMAGES.



EVERYDAY SCIENCE EXAMPLE

As room accents and in artwork

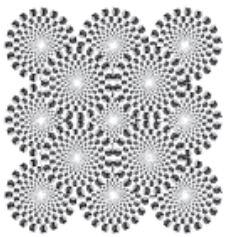
SCIENCE WITH A SPIN

Types of Optical Illusions

LITERAL ILLUSION

Here the brain interprets an image differently from individual elements of the image.
In this painting, a young girl sits in front of a mirror that appears to be a skull. There isn't actually a skull there - the objects in the painting come together to create that effect.

PHYSIOLOGICAL ILLUSION



This is the result of the brain and eyes being exposed to an external stimulus for a certain period. Exposure to the external stimulus often produces an after-image.

COGNITIVE ILLUSION

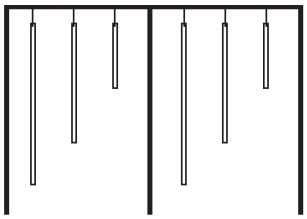
Here the brain perceives an object based on prior knowledge or assumptions.
In the above image, the brain was looking for something familiar to it - in this case, either two faces or a vase.

MUSICAL PIPES

Frequency of sound waves in hollow pipes

WHAT TO DO

STAINLESS STEEL COPPER



HIT THE DIFFERENT PIPES AND OBSERVE THE SOUNDS

When a pipe is hit, the air column inside vibrates. These vibrations are the sound waves that are picked up by our ears.

The sound waves depend on the length and width of the air column and the material of the pipe. Observe the difference in the sounds produced by the copper and steel pipes.

The frequency of the sound waves varies with the length of the pipe. Shorter tubes generate higher pitch sounds while longer tubes generate lower pitch sounds.

$F = V/\lambda$

V ⟶ Speed of sound
λ ⟶ Wavelength
F ⟶ Frequency

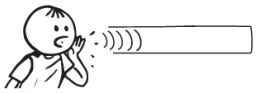
Here λ is the wavelength and is a factor of the length of the pipe. Speed of sound in air is around 340 metres per second. These factors determine the frequency of sound generated in each pipe.

EVERYDAY SCIENCE EXAMPLE
Wind instruments like trumpets, trombones and flutes

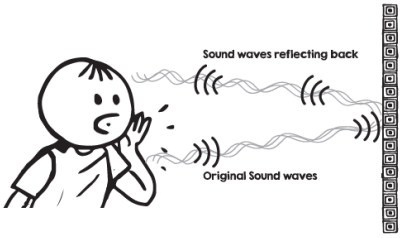
HELLO... HELLO... HELLO

Echo tube

WHAT TO DO



GO AHEAD AND SCREAM INTO THE TUBE.



Echo is a reflection of sound that comes back to the speaker with a delay when it bounces off a surface.

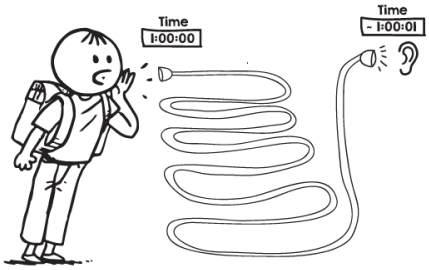
EVERYDAY SCIENCE EXAMPLE
Clapping at the Golconda main portico;
Medical devices such as ECG, 2D and 3D echo; SONAR

SPEED OF SOUND

Delayed Sound

WHAT TO DO

SPEAK INTO THE MOUTH PIECE AND HEAR YOUR VOICE THROUGH THE EAR PIECE.



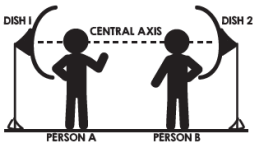
In air, sound travels at the speed of approximately 340 m/sec. This exhibit has a pipe length of around 300 metres. So, when you speak through the mounth piece, you hear yourself from the mouth piece after a lag of around 1 sec.

EVERYDAY SCIENCE EXAMPLE
Make a string telephone and see for yourself.

PARABOLIC SOUND REFLECTORS

Whisper Dishes

What To Do?



1. PERSON 'A' STANDING CLOSE TO DISH '1' SPEAKS SPEAKS SOFTLY INTO IT
2. PERSON 'B' STANDING CLOSE TO DISH '2' HEARS THESE SOUNDS CLEARLY

GUESS HOW THIS HAPPENS?
NOTICE THE SHAPE OF THE DISH?
ITS A PARABOLA.

A parabolic dish is a good device for reflecting and collecting sound waves.

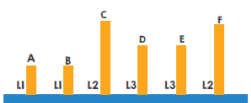
Because of the shape of the dish, sound waves that travel parallel to its central axis and strike the dish, get reflected to its focal point.

Initial sound gets reflected from the "acoustic mirror", propogates to the other dish and gets concentrated at its focal point. This conservation of sound allows us to hear low whispers also, as if the sound is being originated right next to us.

EVERYDAY SCIENCE EXAMPLE
TV signals, radio signals, light waves are transmitted and received using parabolic dishes. Large telescopes use parabolic dishes to gather light from distant stars, allowing us to study them.

RESONANCE BARS

WHAT TO DO



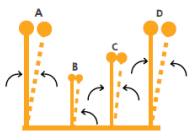
SET BAR 'A' VIBRATING.
WHAT DO YOU NOTICE?
BAR 'B' OF SAME LENGTH IS ALSO SET INTO VIBRATION.
TRY WITH C, D, E & F BARS

Natural Frequency: Frequency at which a system oscillates when not subjected to a continuous external force.

Resonance: When an external stimulus - with a frequency close to the natural frequency of the object - is applied, then abnormally large vibrations are produced.

In this exhibit, one object vibrating at the natural frequency of the second object forces the second object also to vibrate.

RESONANCE TRIGGERED IN SIMILAR BARS



The vibrations in bar A trigger vibrations in the base and surrounding air particles. These trigger vibrations in bars B, C and D.

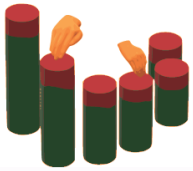
The amplitude of vibration is highest in bar D which has the same length and natural frequency as bar A.

EVERYDAY SCIENCE EXAMPLES
Musical instruments like guitar and veena use resonance to generate loud sounds. When the strings are pulled, air particles inside the instruments vibrate to generate louder sounds.
Resonance in machinery, buildings and vehicles may however cause their breakdown or collapse.

PERCUSSION DRUMS

Sounds generated by vibrating air columns

WHAT TO DO



PLAY THE DRUMS.
OBSERVE THE SOUNDS GENERATED BY EACH DRUM.

Sounds produced by a drum depend on -
1. the drum head and 2. the drum shell.

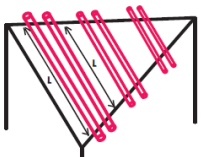
Drum Head - determines the the dominant frequencies produced. While a heavier drum head dampens higher frequencies, a lighter drum head enables them.

Drum Shell - shape and size of the shell determines the air column. The larger the volume of the resonating body, the easier it is to resonate in the lower frequency band, while the smaller the volume, the easier it is to resonate in the higher frequency band. The larger the diameter, or the deeper the shell, the thicker and heavier the tone, and the smaller or shallower the shell, the brighter and lighter the tone

EVERYDAY SCIENCE EXAMPLE
Sounds generated by air columns are used for communication over large distances
Drums are used in music art; for setting a marching pace; or for announcements.

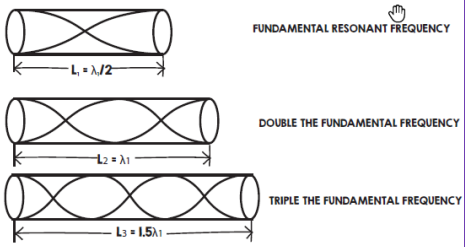
NATURAL FREQUENCY OF OBJECTS
Resonance Pipes

WHAT TO DO



1. PLACE YOUR EAR AT THE OPENING OF A PIPE AND LISTEN TO THE SOUNDS
2. REPEAT WITH THE OTHER PIPES. OBSERVE THE DIFFERENCE IN THE SOUNDS

WHEN THE FREQUENCY OF A BODY MATCHES THE FREQUENCY OF AN EXTERNAL SOURCE, RESONANCE OCCURS. RESONANCE CAUSES A SHARP INCREASE IN THE AMPLITUDE OF VIBRATION

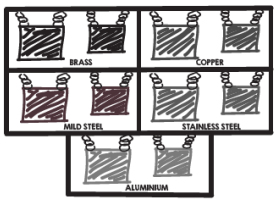


Observe that the resonance varies with the length of the pipe

EVERYDAY SCIENCE EXAMPLE
Musical instruments like the flute, trumpet and saxaphone use resonance in open pipes to generate beautiful music

METAL GONGS
Transmission and Dampening of Sound

What To Do?



HIT THE DIFFERENT GONGS
OBSEVE THE DIFFERENCE IN SOUNDS GENERATED

Sounds generated by objects depend on two key factors:
I. elasticity and 2. shape of the object

ELASTICITY
Elasticity is the object's ability to retain its shape after impact. For example, steel has greater elasticity than air. So, sound is transmitted better through steel than through air.

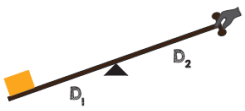
In other words, steel trasmits sounds while air dampens sound.

SHAPE
On impact with a mallet, gongs can generate a range of sounds. The sounds depend on -
I. Area - bigger, usually lower frequency and deeper sound
II Thickness - thicker, usually higher frequency and sharper sound

EVERYDAY SCIENCE EXAMPLE
As different materials transmit sound differently, we use some materials to transmit sound and some others to dampen sound.

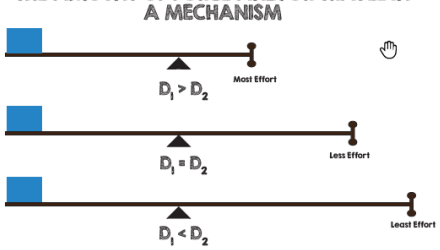
FIRST ORDER LEVER
See Saw

WHAT TO DO



LIFT THE WEIGHTS BY PUSHING DOWN EACH LEVER.

LEVERS ARE MECHANICAL DEVICES USED TO SCALE THE AMOUNT OF FORCE AND/OR TRAVEL IN A MECHANISM



COMMONLY USED TO CREATE MECHANICAL ADVANTAGE, THE PRINCIPLE OF TURNING EFFECT OF FORCE OR MOMENT IS USED HERE

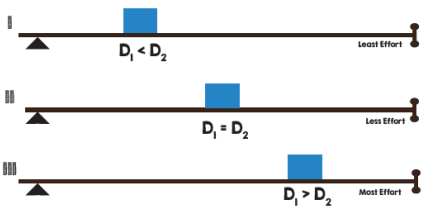
EVERYDAY SCIENCE EXAMPLE
See saw, Construction sites, Crow bar, Scissors, Bottle opener, Row boat.

SECOND ORDER LEVER
Wheel-barrow

WHAT TO DO

LIFT THE WEIGHTS BY PULLING UP THE LEVERS.

SECOND ORDER LEVERS ARE SIMPLE MACHINES USED TO MULTIPLY THE AMOUNT OF FORCE IN A MECHANISM

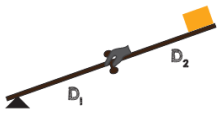


DISTANCE BETWEEN FIRST WEIGHT AND FULCRUM IS THE LEAST. SO IT IS THE EASIEST TO LIFT. DISTANCE OF THE THIRD WEIGHT IS HIGHEST. SO, IT IS MOST DIFFICULT TO LIFT.

EVERYDAY SCIENCE EXAMPLE
Wheelbarrow, Nut crackers, Staplers and Nail clippers.

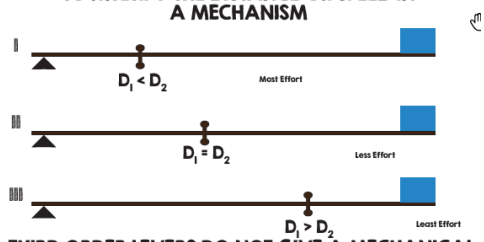
THIRD ORDER LEVER
Fishing Rod

WHAT TO DO



LIFT THE WEIGHTS BY PULLING UP THE LEVERS.

THIRD ORDER LEVERS ARE SIMPLE MACHINES USED TO MULTIPY THE DISTANCE OR SPEED IN A MECHANISM



THIRD ORDER LEVERS DO NOT GIVE A MECHANICAL ADVANTAGE. THEY INCREASE THE TRAVEL OR SPEED.

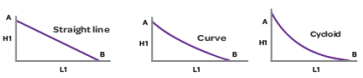
TURNING EFFECT OF THE FORCE IS HIGHEST IN THE THIRD CASE ABOVE.

EVERYDAY SCIENCE EXAMPLE
Shovels, fishing rods, human arms and legs, tweezers, and ice tongs.

Distance, Curvature and Speed
Cycloidal Path

WHAT TO DO?

- DROP THE BALLS ALONG THE THREE PATHS. OBSERVE THE TIME TAKEN BY THE BALLS TO REACH THE END POINT
- SHORTEST PATH BETWEEN POINTS A AND B IS A STRAIGHT LINE
- A CYCLOID IS THE PATH TAKEN BY CIRCLE AS IT ROLLS DOWN A STRAIGHT LINE.
- FASTEST PATH BETWEEN POINTS A AND B IS ALONG A CYCLOID
- AS THE BALL ROLLS DOWN THE CYCLOID, IT PICKS UP SPEED. AVERAGE SPEED ALONG THE CYCLOID IS THE HIGHEST, COM PARED WITH ALL PATHS CONNECTING A AND B



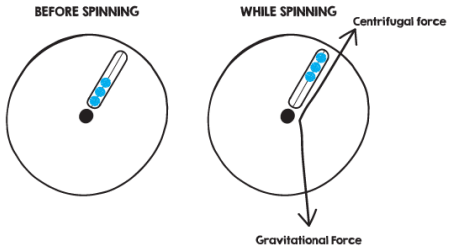
EVERYDAY EXAMPLES
DESIGN OF GEARS, CONVEYOR BELTS, PENDULUMS

DEFYING GRAVITY
Centrifugal Force

WHAT TO DO

SPIN THE DISC TO SEE THE BALLS MOVE AWAY FROM THE CENTRE.

Due to inertia, a body tries to move in a straight line.
Centrifugal force is the result of this inertial force when in curcular motion.
Centrifugal force makes the balls to slide radially outwards.



CENTRIFUGAL FORCE > GRAVITATIONAL FORCE

The steel balls defy gravity as the centrifugal force acting on them is greater than the gravitational force.

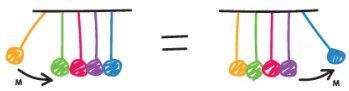
EVERYDAY SCIENCE EXAMPLE
Washing Machine, Centrifuges, Governors for throttle control, Turbine blade design.

ART IN MOTION
Newton's Cradle

WHAT TO DO

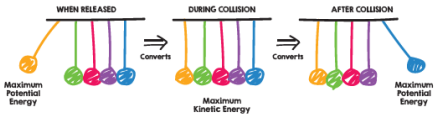
LIFT A SPHERE AND RELEASE IT. NOW, LIFT TWO SPHERES AND RELEASE THEM.

CONSERVATION OF MOMENTUM (M)



WITH THE COLLISIONS BEING ELASTIC, TOTAL MOMENTUM REMAINS CONSTANT

CONSERVATION OF ENERGY



ENERGY CAN NEITHER BE CREATED NOR DESTROYED

EVERYDAY SCIENCE EXAMPLE
Snooker balls colliding, cars in a crash.

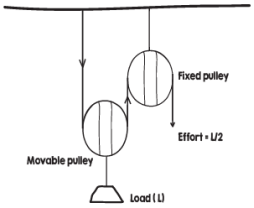
THE CLIMBING CHAIR
Lift yourself Pulley

WHAT TO DO

Sit on the chair and try hoisting yourself up.

PULLEYS REDUCE EFFORT REQUIRED TO LIFT LOADS

In a 2-pulley system, effort required to lift a weight is half the load.
This effort decreases with an increase in the number of pulleys.
Simultaneously, the length of rope pulled increases with the decrease in effort.
Hence, total work done to lift a given weight to a given height, remains constant.

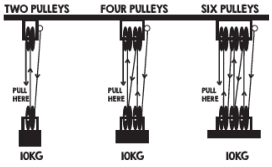


In this exhibit, we use a 6-pulley system which means that you need to apply an effort equal to 1/6th of your weight to lift yourself up.
Try lifting yourself up.

EVERYDAY SCIENCE EXAMPLE
Bosun's Chairs used in construction work.

LIFTING WITH PULLEYS
Mechanical advantage of using pulleys

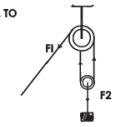
WHAT TO DO



1. LIFT THE 10 KG WEIGHTS USING THE TWO-PULLEY SYSTEM, AND THEN THE FOUR-PULLEY AND SIX-PULLEY SYSTEMS
2. OBSERVE THE EFFORT REQUIRED IN EACH OF THE PULLEY SYSTEMS FOR LIFTING A SIMILAR WEIGHT

IN A TWO-PULLEY SYSTEM, FORCE NEEDED TO LIFT A BODY IS EQUAL TO 1/2 OF ITS WEIGHT.

WORK DONE = FORCE X DISTANCE
F1 X S1 = F2 X S2
5 NEWTON X 20 CM = 10 NEWTON X 10 CM
= 100 NEWTON-CM



IN A FOUR-PULLEY SYSTEM, FORCE NEEDED TO LIFT THE SAME BODY IS 1/4TH OF ITS WEIGHT BUT THE DISTANCE IS DOUBLE THAT IN THE TWO-PULLEY SYSTEM.

WORK DONE = 10/4 NEWTON X 40 CM
= 100 NEWTON-CM

IN A SIX-PULLEY SYSTEM, FORCE NEEDED TO LIFT THE SAME BODY IS 1/6TH OF ITS WEIGHT BUT THE DISTANCE IS THRICE THAT IN THE TWO-PULLEY SYSTEM.

WORK DONE = 10/6 NEWTON X 60 CM
= 100 NEWTON-CM

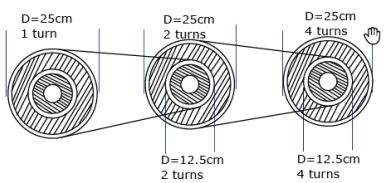
EVERYDAY SCIENCE EXAMPLES
To lift heavy weights conveniently. Such as, lift water from well using a pulley, rescue people using a winch or in the lift (elevator) systems in buildings

BELTS AND PULLEYS
Change Torque, Speed, and Direction

WHAT TO DO

ROTATE THE SHAFT
OBSERVE THE DIRECTION AND SPEED OF THE MOVING PULLEYS.

Here, energy is transferred from a larger wheel to a smaller wheel, and then again to a larger wheel. Hence, overall speed is increased while maintaining the size of the wheel.



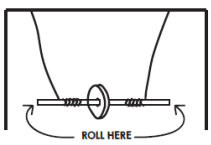
Cross belts between the pulleys will enable a change in the direction of rotation.

Pulley work better than when we need to transfer torque over a longer distance. However, there is a greater loss in energy transfer in pulley systems as compared with gears.

EVERYDAY SCIENCE EXAMPLE
USED IN MILL INDUSTRY, CONVEYOR BELTS

SCIENCE OF YO-YOS
Conservation of energy

WHAT TO DO



1. ROLL THE ENDS OF THE YO-YO STUB UPWARDS AND LET IT GO
2. WATCH IT SPIN, COME DOWN THE ROPE AND CLIMB UP AGAIN

Energy can neither be created nor be destroyed.
It can only be converted from one form to another.

A Yo-Yo demonstrates the conservation principle effectively.

P.E ⇌ Translational K.E + Rotational K.E

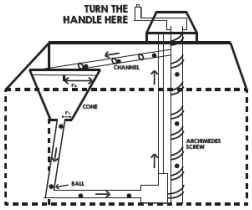
At the top	While moving
Potential energy	Translational + Rotational kinetic energy

Energy gets continously converted from one form to another. The kinetic energy in the system cannot get destroyed when the yo-yo reaches the bottom. So it gets converted to potential energy and the yo-yo rises back.

EVERYDAY SCIENCE EXAMPLES
Wheels going down the hill, water gushing down a dam.

BLACK HOLE

WHAT TO DO



TURN THE HANDLE ON TOP, AND OBSERVE THE MOVEMENT OF THE BALL

THERE ARE A NUMBER OF INTERESTING THINGS TO OBSERVE HERE

I. MOMENTUM OF THE BALL ON RELEASE MAKES IT SLIDE ALONG THE SIDES OF THE CONE INSTEAD OF FALLING STRAIGHT DOWN

2. VELOCITY OF THE BALL INCREASES AS THE RADIUS OF THE CONE DECREASES, TO MAINTAIN A CONSTANT ANGULAR MOMENTUM

3. ARCHIMEDES SCREW ON THE SIDE USES ROTATORY MOTION TO MOVE THE BALL VERTICALLY

EVERYDAY SCIENCE EXAMPLES
I. CELESTIAL OBJECTS INFLUENCED BY GRAVITATIONAL PULL (INCL IN A BLACK HOLE)
2 . RACING IN A VELODROME OR DEATHWELL
2. CAR JACK AND WATER SCREWS IN AGRI FIELDS

Reverse Bicycle

Turn left or turn right?

What to do?

RIDE THE CYCLE
- TURN LEFT. TURN RIGHT
- OBSERVE THE TWO GEARS CONNECTING THE HANDLE TO THE FRONT WHEEL

- WHEN TWO GEARS MESH TOGETHER, THE SECOND GEAR ALWAYS MOVES IN THE OPPOSITE DIRECTION

- IN THIS CYCLE, THE HANDLE AND FRONT WHEEL ARE CONNECTED THROUGH TWO SIMPLE GEARS. HENCE, THEY MOVE IN OPPOSITE DIRECTIONS

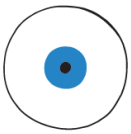
- IF YOU CAN RIDE A NORMAL CYCLE, IT WILL TAKE YOUR BRAIN AROUND 8 MONTHS TO LEARN TO RIDE THIS REVERSE CYCLE! FURTHER, BY THEN, YOUR BRAIN WILL FORGET HOW TO RIDE A NORMAL CYCLE!! THIS IS CALLED NEUROPLASTICITY.

EVERYDAY EXAMPLES:
REVERSE GEARS IN VEHICLES, MECHANISMS FOR TURNING OBJECTS (LIKE TELESCOPES, GUNS, POINTING DEVICES)

RACE THE ROLLERS

Distribution of Mass

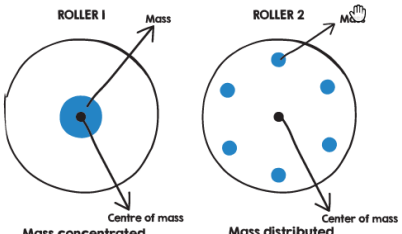
WHAT TO DO



PLACE BOTH THE ROLLERS ON TOP OF THE INCLINE.
GIVE THEM BOTH A SIMILAR PUSH AND SEE WHICH ONE WINS THE RACE.

Moment of inertia (MOI) in rotational motion is analogous to mass in linear motion.

MOI of a rigid body is a measure of its resistance to angular acceleration when a torque is applied. MOI depends on distribution of mass - when mass is distributed away from the axis of rotation, it resists motion more than when the mass is distributed closer to the axis,



Roller I wins the race

EVERYDAY SCIENCE EXAMPLE
Formation and movement of stars and planets.
Flywheels of engines are designed to have high MOI.

ROTATING IN YOUR ORBIT

Spinning Chair

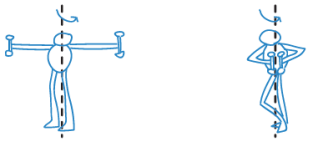
WHAT TO DO

SIT IN THE CHAIR.
SPIN YOURSELF SLIGHTLY.
NOW MOVE WEIGHTS INWARD & OUTWARD.

LAW OF CONSERVATION OF ANGULAR MOMENTUM

ANGULAR MOMENTUM (L) IS A FUNCTION OF ANGULAR VELOCITY (ω) AND MOMENT OF INERTIA (I). IN THE ABSENCE OF AN EXTERNAL TORQUE, ANGULAR MOMENTUM IS CONSERVED.

NOTE: MOMENT OF INERTIA IN ANGULAR FRAMEWORK IS AKIN TO MASS IN LINEAR FRAMEWORK.



BODY MASS IS DISTRIBUTED AWAY FROM THE ROTATION AXIS, SO I IS MORE AND ω IS LOW.

BODY MASS IS DISTRIBUTED CLOSE TO THE ROTATION AXIS, SO I IS LESS AND ω IS HIGH.

EVERYDAY SCIENCE EXAMPLE
Skating on ice; distribution of mass in automobile wheels

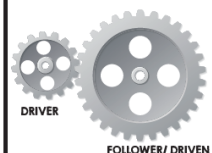
Spur Gears

Change in Torque, Speed and Direction

WHAT TO DO

ROTATE THE SHAFT
OBSERVE THE DIRECTION AND SPEED OF THE MOVING GEARWHEELS.

Gears are rotating machine parts with teeth, which mesh together to transmit torque from one point to another.



NUMBER OF TEETH IN DRIVER IS I6
NUMBER OF TEETH IN FOLLOWER IS 30

THE GEAR TRAIN HAS A GEAR RATIO OF 30/I6. HENCE IF AN INPUT TORQUE OF I6ON IS GIVEN, THE OUTPUT TORQUE WILL BE (30/I6)XI60, i.e. 300N. HERE MECHANICAL ADVANTAGE OF I.875 IS GAINED.

Gears enable devices to change torque, speed and direction. Two gears in direct contact exert equal and opposite forces on each other. They create a mechanical advantge in the process, depending on their gear ratio.

There are different types of gears - such as helical, bevel, worm, and rack and pinion.

Apart from changing direction of rotation, gears (such as bevel gears) can be used to change the axis of rotation.

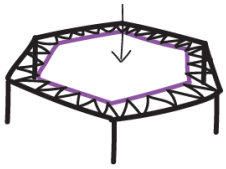
EVERYDAY SCIENCE EXAMPLE
Automotives, clocks, bicycles, conveyer belts.

TRAMPOLINE

For every action there is an equal and opposite reaction

WHAT TO DO

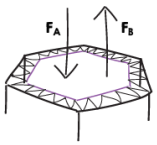
JUMP ON THE TRAMPOLINE



THE TRAMPOLINE PUSHES YOU AND YOU BOUNCE BACK

WHEN YOU (OBJECT A) EXERT A FORCE (F_A) ON THE TRAMPOLINE (OBJECT B) BY JUMPING ON IT, YOU ARE PUSHED BACK BY AN EQUAL FORCE IN THE OPPOSITE DIRECTION

$F_A = - F_B$



NEWTON'S THIRD LAW OF MOTION

FOR EVERY ACTION, THERE IS AN EQUAL AND OPPOSITE REACTION

WHEN YOU SWIM ⟶ YOU PUSH THE WATER BACK AND THE WATER PUSHES YOU FORWARD

WHEN YOU SIT ⟶ YOUR BODY EXERTS A DOWNWARD FORCE ON CHAIR WHILE CHAIR EXERTS AN UPWARD FORCE ON YOUR BODY

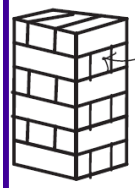
CAN YOU THINK OF OTHER EXAMPLES?

EVERYDAY SCIENCE EXAMPLES
WALKING, SWIMMING, BIRDS FLYING, CARS MOVING ON ROADS ARE ALL EXAMPLES FOR NETWON'S THIRD LAW OF MOTION

HOW TALL A TOWER CAN YOU BUILD
Jenga Blocks

Lower CG and centered line of gravity is important for stability of objects

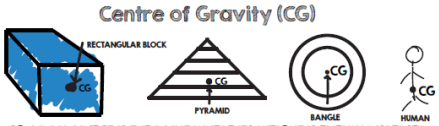
WHAT TO DO



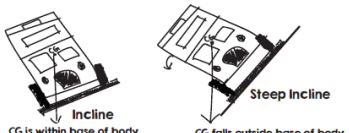
REMOVE BLOCKS ONE AT A TIME

1. REMOVE A BLOCK AND STACK IT ON TOP OF THE EXISTING TOWER. ENSURE YOUR TOWER REMAINS STABLE.
2. REPEAT.

Centre of Gravity (CG)



CG OF AN OBJECT IS THE POINT WHERE ITS WEIGHT IS EVENLY DISPERSED AND ALL SIDES ARE IN BALANCE



CG is within base of body. Hence, bus remains stable.

CG falls outside base of body. Hence, bus topples over.

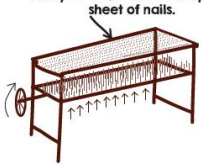
EVERYDAY SCIENCE EXAMPLE

1. A well-trimmed tree may remain stable during fierce winds, while a top-heavy tree topples over.
2. A short stocky man cannot be easily pushed down because his CG is lower.

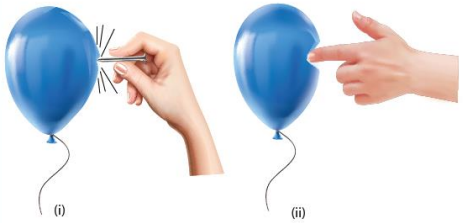
BED OF NAILS
Distribution of Force

WHAT TO DO

Lie on the bed distibuting your weight evenly.
Ask your friend to crank up the sheet of nails.



Pressure is Force acting upon a unit Area.
For the same force applied, pressure is lower if the contact area is more.



Force applied by the hand is same in both the balloons above.
But pressure is more in case (i) as force is concentrated at a single point, i.e. the nail tip.
In case (ii), pressure is less and hence the balloon does not burst.

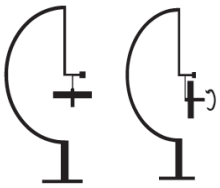
Similarly, when you sit on a single nail, it will likely pierce through your skin.
However, when you lie on a bed of nails, your weight is distributed over a wider area and it does not hurt.

EVERYDAY SCIENCE EXAMPLE

A sharp knife cuts through easily while a blunt one may not.

GYRO WHEEL
Conservation of Angular Momentum

WHAT TO DO



Rotating objects tend to maintain their orientation of rotation.

Principle of conservation of angular momentum entails that angular velocity of a rotating object remains constant and also its axis of rotation remains the same.

To change the axis, you need a torque (force with a direction). Or in converse, you will experience torque, if you change the axis.

You will experience considerable resistence, when you try to change the axis of rotation of the spinning wheel.

EVERYDAY SCIENCE EXAMPLE

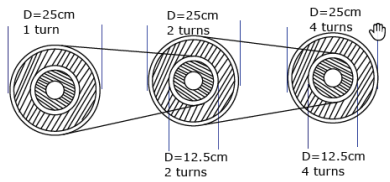
Gyro Compass used in Aircrafts, Steadicam

BELTS AND PULLEYS
Change Torque, Speed, and Direction

WHAT TO DO

ROTATE THE SHAFT
OBSERVE THE DIRECTION AND SPEED OF THE MOVING PULLEYS.

Here, energy is transferred from a larger wheel to a smaller wheel, and then again to a larger wheel. Hence, overall speed is increased while maintaining the size of the wheel.



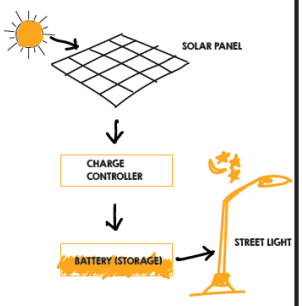
Cross belts between the pulleys will enable a change in the direction of rotation.

Pulley work better than when we need to transfer torque over a longer distance. However, there is a greater loss in energy transfer in pulley systems as compared with gears.

EVERYDAY SCIENCE EXAMPLE

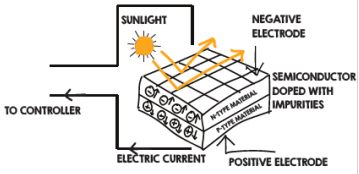
USED IN MILL INDUSTRY, CONVEYOR BELTS

SOLAR POWER
The free and renewable energy source



SOLAR PANELS CONTAIN PHOTOVOLTAIC (PV) CELLS WHICH CONVERT SOLAR ENERGY TO ELECTRICAL ENERGY.

THIS HAPPENS WHEN THE ELECTRONS IN THE SILICON CELLS OF THE PV PANELS ARE EXCITED BY THE PHOTONS IN THE SUNLIGHT. THIS IS CALLED THE PHOTOELECTRIC EFFECT.

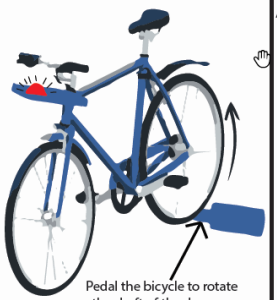


SOLAR ENERGY
- IS RENEWABLE
- IS ENVIRONMENT-FRIENDLY AS IT IS NON-POLLUTING
- IS FREELY AVAILABLE YEAR-ROUND IN COUNTRIES LIKE INDIA

EVERY DAY EXAMPLES

STREET LIGHTS, IN HOMES, FOR VEHICLES, SATELLITES IN SPACE. MANY VILLAGES ARE POWERED ENTIRELY BY SOLAR POWER.

DYNAMO
Bicycle Generator



Pedal the bicycle to rotate the shaft of the dynamo
Observe the LEDs glowing

A dynamo converts mechanical energy to electrical energy.

Faraday's Law of Electromagnetic Induction
Move a wire back and forth in a magnetic field.
The field pushes electrons in the metal.
This movement of electrons is electric current.

A dynamo has a magnetic stator and a coil rotator.
Following Faraday's principle, the rotating coil inside the magnetic field results in electricity being generated.

Here, when you pedal and the wheel rotates, it turns the shaft of the dynamo and generates electric current. This current in our case averages to 13 Amps.

This current is used to light up the LEDs.

EVERYDAY SCIENCE EXAMPLE

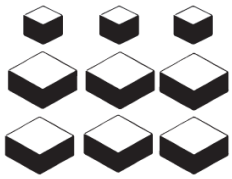
Hand cranked dynamos are used in clockwork radios, hand powered flashlights and other human powered equipment to recharge batteries.

Slothouber–Graatsma Puzzle

Form a uniform cube using the pieces

WHAT TO DO

Form a cube like this using all the 9 pieces



Given:
3 pieces of small cubes of 1x1x1 units dimenion
6 pieces of 2x2x1 units dimension.

Key to the solution:
1. Total volume of the 9 smaller cubes is 27 units. Hence, the side length of the final cube has to be 3 units.
2. Each of the 3 x 3 layers in various directions needs to contain a unit block of 1x1. Hence, the 1x1x1 blocks line up diagonally.

Now, try solving the puzzle!

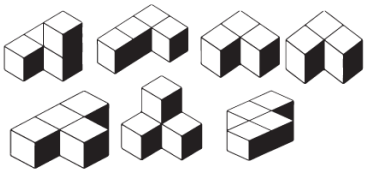
EVERYDAY SCIENCE EXAMPLE
The blocks may be used as recreational puzzles, educational tools, or for aesthetic purposes.

SOMA CUBE

Form a uniform cube using the pieces

WHAT TO DO

Form a cube like this using all the 7 pieces



Key to solving the puzzle:
This puzzle has 240 unique solutions.
In each of these solutions, one particular piece is always in the same position.

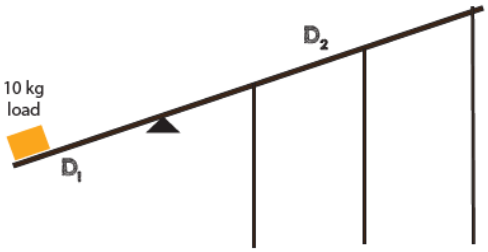
Here are some pointers to help:
1. The "T" piece will always fill either 2 or 0 corners of the large cube.
2. The "L" piece can either fill 2, 1 or 0 corners.
3. The other five pieces can each fill either 1 or 0 corners.

Now, try solving the puzzle!

EVERYDAY SCIENCE EXAMPLE
The Soma Cube was a precursor to the famous Rubik cube.
The cube is famous for its use in psychological and intellectual experiments

GIANT LEVER

WHAT TO DO



LIFT THE WEIGHT BY PULLING DOWN THE ROPES, INDIVIDUALLY.

LEVERS ARE MECHANICAL DEVICES USED TO SCALE THE AMOUNT OF FORCE AND/OR TRAVEL IN A MECHANISM

THE PRINCIPLE OF TURNING EFFECT OF FORCE OR MOMENT IS USED HERE TO CREATE MECHANICAL ADVANTAGE

EVERYDAY SCIENCE EXAMPLE - Pliers, scissors, a crow bar, a claw hammer, a see-saw and a weighing balance

INVISIBLE BATMAN!

The Dark Knight disappears when viewed from a specific position.

Position 1
Side View

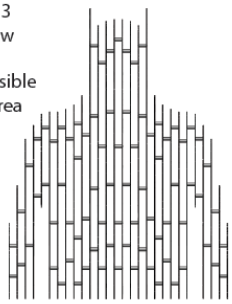
Very High Visible Surface Area

Position 2
View at an Angle

Medium Visible Surface Area

Position 3
Front View

Very Low Visible Surface Area

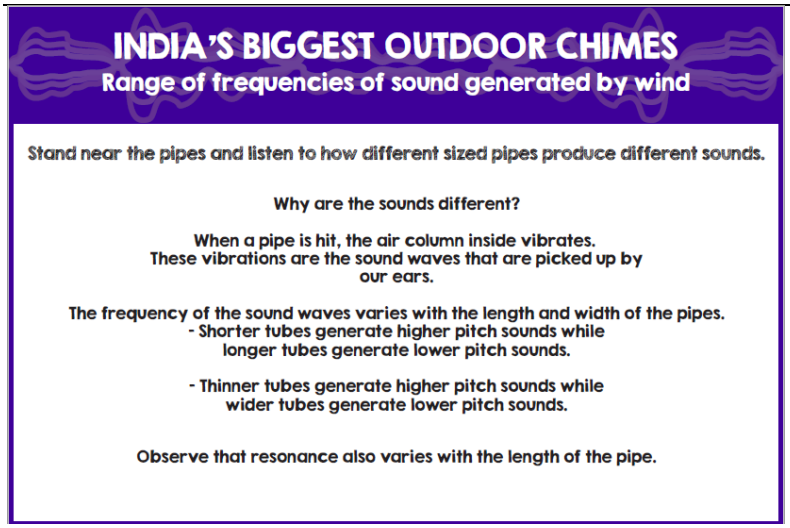


The visible surface area of the metal sheets varies depending on the position they are viewed from.

In position 1, the sculpture is viewed from the flat side of the metal sheets. The surface area of the sheet from this position is very high.

In position 3, the sculpture is viewed along the edge of the metal sheets. The surface area of the sheet from this position is very low.

This is a reason for the sculpture turning nearly "invisible" in the front view.



The above cover a large share (but not all) of the installations at the centre.

GOVERNMENT DEGREE COLLEGE FOR WOMEN , BEGUMPET

PASSIONATE PHYSICS CLUB

ACTIVITIES PERFORMED :

Workshop on sensor models;

On 11th February 2023(Saturday), Government Degree college for women's Begumpet students participated in sensor based activities of different models which are applicable in our daily life . The work shop organizer clearly explained the process of sensor models like (how to connect the sensor , circuit diagrams of different sensors etc). So, students actively participated in this workshop. Students understand the importance and applications in our daily life.

There are many models based on topic sensor like **fire detector sprinkler, street light controller liquid level sensor, pollution detector, gas detector, vehicle based street light, public tap water controller, portable metal detector etc..**

These are the models applicable in our daily life activities. For instance, water level sensor: when the tank reaches the maximum water, the water level detector will give us a sound and it indicates that water reached at top.

National science day **(**FEB-28):

On the birthday of C .V RAMAN we are celebrating national science day . on that day we the committee members organized a science exhibition . Students from different streams participated in this exhibition and we invited our honourable principal madam k. Padmavathi garu as a chief guest . all the faculty members along with principal madam went around to observe the model designed by students .

Students from begumpet government school attended this exhibition. Principal Madam assessed the description given by the students. children from primary

and upper primary schools learn more information rather than books .different models presented in exhibition are ; sonometer, solar charger , clap switch etc..

Finally, principal madam congratulate the students who took part in this show .

National science day

Committee members

President:

B. Sai priya (1085-20-468-009)

Vice-president:

Naheed begum (1085-20-468-089)

General Secretary:

i-Maheen begum (1085-20-468-073)

ii S. Bhargavi (1085-21-468-092)

Joint secretary:

i-J.varsha (1085-20-468-049)

ii-J.sruthi (1085-21-468-030)

Treasurer:

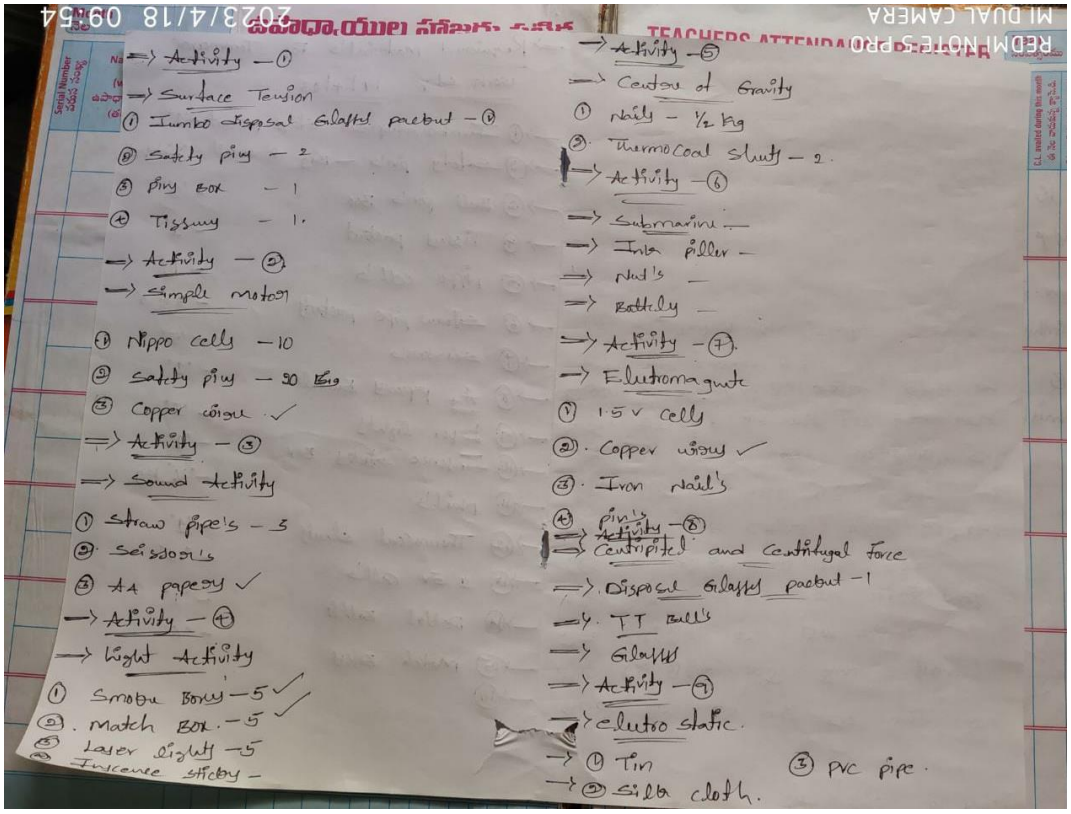
i-Ch. Ruchitha(1085-20-468-023)

ii-K. Akhila(1085-21-468-044)

Student co-ordinator:

i-M. poojitha (1085-21-468-055)

ii- B.Siri chandana (1085-22-468-007)



Certificate course in

LOW COST AND NO COST ON CONCEPTS IN PHYSICS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DEPARTMENT
OF
JOURNALISM
REDMI NOTE 5 PRO
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REDMI NOTE 5 PRO
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2023/4/19 11:45


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PRIZE WINNERS IN PASSIONATE PHYSICS CLUB ON ANNUAL DAY CELEBRATIONS (20-4-2023)…0

डॉ. टी. एस. सुनील कुमार
अपर निदेशक (अ. एवं. वि.)
Dr. T. S. Sunil Kumar
Additional Director (R&D)

सत्यमेव जयते

भारत सरकार
परमाणु ऊर्जा विभाग
परमाणु खनिज अन्वेषण एवं अनुसंधान निदेशालय

Government of India
Department of Atomic Energy
Atomic Minerals Directorate for Exploration and Research

No. AMD/NSD/2023/1

Date: 17.02.2023

Dear Sir / Madam,

On the occasion of celebration of National Science Day 2023 on February 28, I have great pleasure in inviting you to join the Science day celebrations at Atomic Minerals Directorate for Exploration and Research, Begumpet, Hyderabad from 9:30 AM to 2:30 PM. (land mark: Opp. Hyderabad Public School, Begumpet). On this occasion, a popular science lecture will be delivered by the Chief Guest Padma Shri M.Y.S. Prasad, Former Director, Satish Dhawan Space Centre, Sriharikota. On the occasion, the students will have the opportunity to visit state-of-the art AMD laboratories.

It will be highly appreciated if you can identify and send ten students for an organized visit to AMD. One faculty member may accompany the students to assist them during this programme.

All the visiting students and accompanying teacher are advised to carry their identity cards while visiting the AMD complex. Kindly provide a list of students along with accompanying official for enabling their entry passes in AMD premises. Students may also be advised not to carry any mobile / electronic gadgets which are not permitted in AMD premises due to security reasons.

Your kind cooperation in organizing the events would be of great help and go a long way in realizing the objectives of the programme to increase the awareness in science and technology and also inculcating the scientific spirit among the students.

Thanking you,

17/02/2023

[डॉ. टी.एस .सुनील कुमार / Dr. T.S. Sunil Kumar]

To,

The Principal

Govt. Degree college for Women
Begumpet, Hyderabad.

1-10-153-156, बेगमपेट Begumpet
हैदराबाद Hyderabad - 500 016

☎ दूरभाष / Telephone : 040-27766324 (O) / 040-23759339 (R) फैक्स / Fax: 040-27766324
ई-मेल / E-MAIL : addldir-rnd.amd@gov.in

इंटरनेशनल एडवांस्ड रिसर्च सेंटर फॉर
पाउडर मेटलर्जी एंड न्यू मटेरियल्स (एआरसीआई)

INTERNATIONAL ADVANCED RESEARCH CENTRE
FOR POWDER METALLURGY AND NEW MATERIALS (ARCI)

(An autonomous Research & Development Centre of Department of Science & Technology, Govt. of India)

बालापुर, हैदराबाद / Balapur, Hyderabad - 500 005

ए आर सी आई
ARCI

Azadi Ka Amrit Mahotsav

G20

PARTICIPATION CERTIFICATE

This is to certify that Dr. P.H. Kanchana Latha, Government Degree College for woman(A), Begumpet. has participated in the One-Day **Orientation Programme for Promoting Science as Career** organized for science faculty on the occasion of National Science Day celebrations as part of Azadi Ka Amrit Mahotsav (AKAM), by International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad on February 23, 2023.

Dr. PK Jain
Associate Director &
Chairman (AKAM), ARCI

Dr. Tata Narasinga Rao
Director, ARCI

ए आर सी आई
ARCI

NATIONAL SCIENCE DAY CELEBRATIONS

Azadi Ka Amrit Mahotsav

G20

Orientation Programme for Promoting Science as Career

February 23, 2023

A nation's self-reliance very much depends on its strength of science and technology output. Innovation through science and technology open a completely new exciting world to students. School/college teachers play an influential role in igniting the passion for scientific discovery and critical thinking in young minds during the process of learning. On the lines of Azadi Ka Amrit Mahotsav and the National Science Day celebrations, a one-day 'Orientation Programme for Promoting Science as Career' is being organized for science teachers and lecturers on February 23, 2023 at ARCI, Hyderabad.

The objective of the programme is to inspire the teachers and lectures to become science ambassadors for inculcating scientific temper among students by pursuing scientific careers and to strengthen the nation's self-reliance through its strength in science and technology.

The Orientation Programme will cover talks by expert scientists on recent advances in areas of materials physics and chemistry, followed by a visit to the state-of-the-art facilities at ARCI. This will help teachers stay up-to-date with the latest advancements and be able to incorporate that information into their lessons. The overall experience will be highly beneficial for science faculty and will help them inspire the next generation of scientists.

Programme

10.00 hrs	Inaugural Address by Dr. R. Subasri, Scientist 'G' and Co-Chairman, AKAM Welcome Address by Dr. P. K. Jain, Associate Director and Chairman, AKAM Address by Dr. Tata Narasinga Rao, Director, ARCI Dr. Roy Johnson, Associate Director, ARCI Mr. D. Srinivasa Rao, Associate Director, ARCI Introduction of the **Chief Guest - Shri Naveen Mittal, IAS**
10.45 hrs	Address by **Shri Naveen Mittal, IAS, Commissioner, Collegiate Education & Technical Education at Government of Telangana**
11.00 hrs	Hi-Tea and Group Photo
11.15 hrs	**Lectures by ARCI Senior Scientists**
13.30 hrs	Lunch
14.30 hrs	Lab Visit
16.30 hrs	Tea Break
16.45 hrs	Panel Discussion
17.00 hrs	Distribution of Participation Certificates
17.30 hrs	Vote of Thanks by Dr. Sanjay R Dhage, Scientist-E & Member, AKAM

Lectures

- **"Nano and Advanced Materials for Various Applications"** by Dr. R. Vijay, Head, Centre for Nanomaterials
- **"Role of Advanced Ceramics for Future Technologies"** by Dr. M. Buchi Suresh, Scientist-E, Centre for Advanced Ceramic Materials
- **"Using Nanotechnology to Generate Surfaces that Mimic Nature"** by Dr. R. Subasri, Head, Centre for Sol-Gel Coatings
- **"Solar Energy for a Brighter Future"** by Dr. R. Easwaramoorthi, Scientist-E Centre for Solar Energy Materials, ARCI
- **"A Career as a Materials Scientist"** by Dr. G. Ravichandra, Head, Centre for Materials Characterization and Testing

इंटरनेशनल एडवांस्ड रिसर्च सेंटर फॉर पाउडर मेटलर्जी एंड न्यू मटेरियल्स (एआरसीआई)
INTERNATIONAL ADVANCED RESEARCH CENTRE FOR POWDER METALLURGY AND NEW MATERIALS (ARCI)
(An autonomous Research & Development Centre of Department of Science & Technology, Government of India)
बालापुर, हैदराबाद / Balapur, Hyderabad - 500 005 www.arci.res.in @arci.res.in @arci_res_in

Career Opportunities at ARCI

Training:

- ❑ Fresh M.E./M.Tech./M.S. degrees: Post Graduate Training Programme (PGTP); Stipend: Rs. 15,000/- pm
- ❑ Fresh B.E./B.Tech./M.Sc. Degrees: Graduate Training Programme (GTP); Stipend: Rs. 12,000/- pm
- ❑ Fresh Polytechnic diploma or B.Sc. : Diploma Training Programme (DTP); Stipend: Rs. 8,000/- pm
- ❑ Candidates with degrees relevant to ARCI's core areas of research only are considered under this programme

Summer Internship:

- ❑ Every year from May to June. Min 45 and Max 60 days
- ❑ First year of M.Tech./M.E./M.Sc. or 2nd/3rd year of B.Tech./B.E. or equivalent are eligible to apply
- ❑ Online application. Advertised during Feb-March
- ❑ Candidates with degrees relevant to ARCI's core areas of research only are considered under this programme

Student Projects:

- ❑ B.E./B.Tech./M.Sc. or M.E./M.Tech./M.S. students can carry-out final year project work
- ❑ Duration: Min 3 months to Max 12 months, Full time project
- ❑ No stipend. Students have to make their own accommodation and transport arrangements
- ❑ Candidates with degrees relevant to ARCI's core areas of research only are considered under this programme

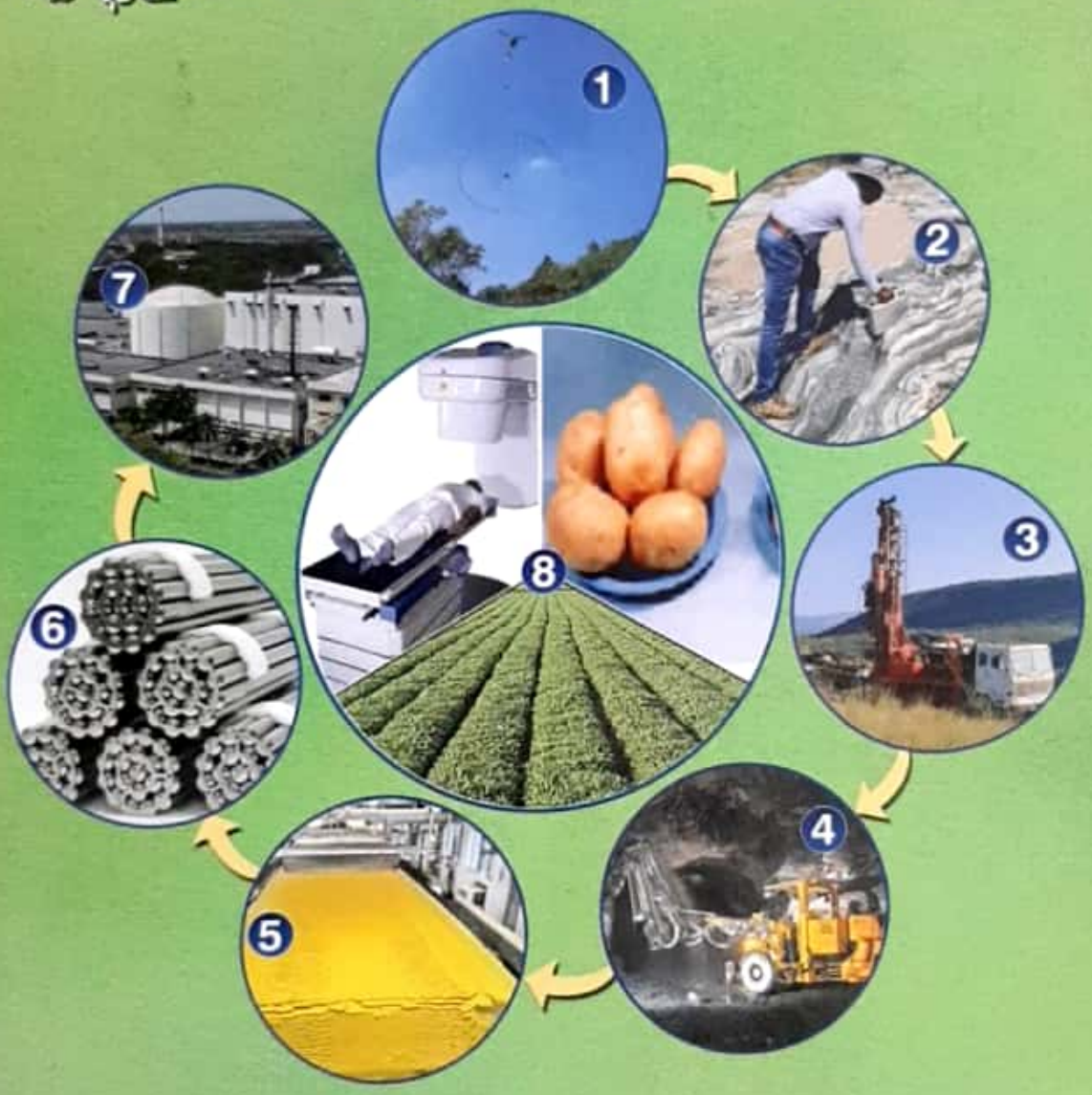
Research Fellows:

- ❑ Research Fellowship Programme @ IITs. IITM, IITB and IITH
- ❑ Senior/Junior Research Fellows. M.E./ M.Tech./M.S. degrees: SRF; B.E./ B.Tech./ M.Sc. : JRF
- ❑ Post Doctoral Fellows / National Post Doctoral Fellowship (SERB-NPDF)

Azadi Ka Amrit Mahotsav

అణు శక్తి

స్వచ్ఛమైన పరిత శక్తికి ఒక విశ్వసనీయమైన ఎంపిక



ముఖ్య సంపాదకుడు

డా. దీపక్ కుమార్ సిన్హా

డైరెక్టర్, ఎ.ఎం.డి

అణు ఖనిజ అన్వేషణ మరియు పరిశోధన సంచాలక కార్యాలయము

అణు శక్తి విభాగము

నవంబరు, 2022