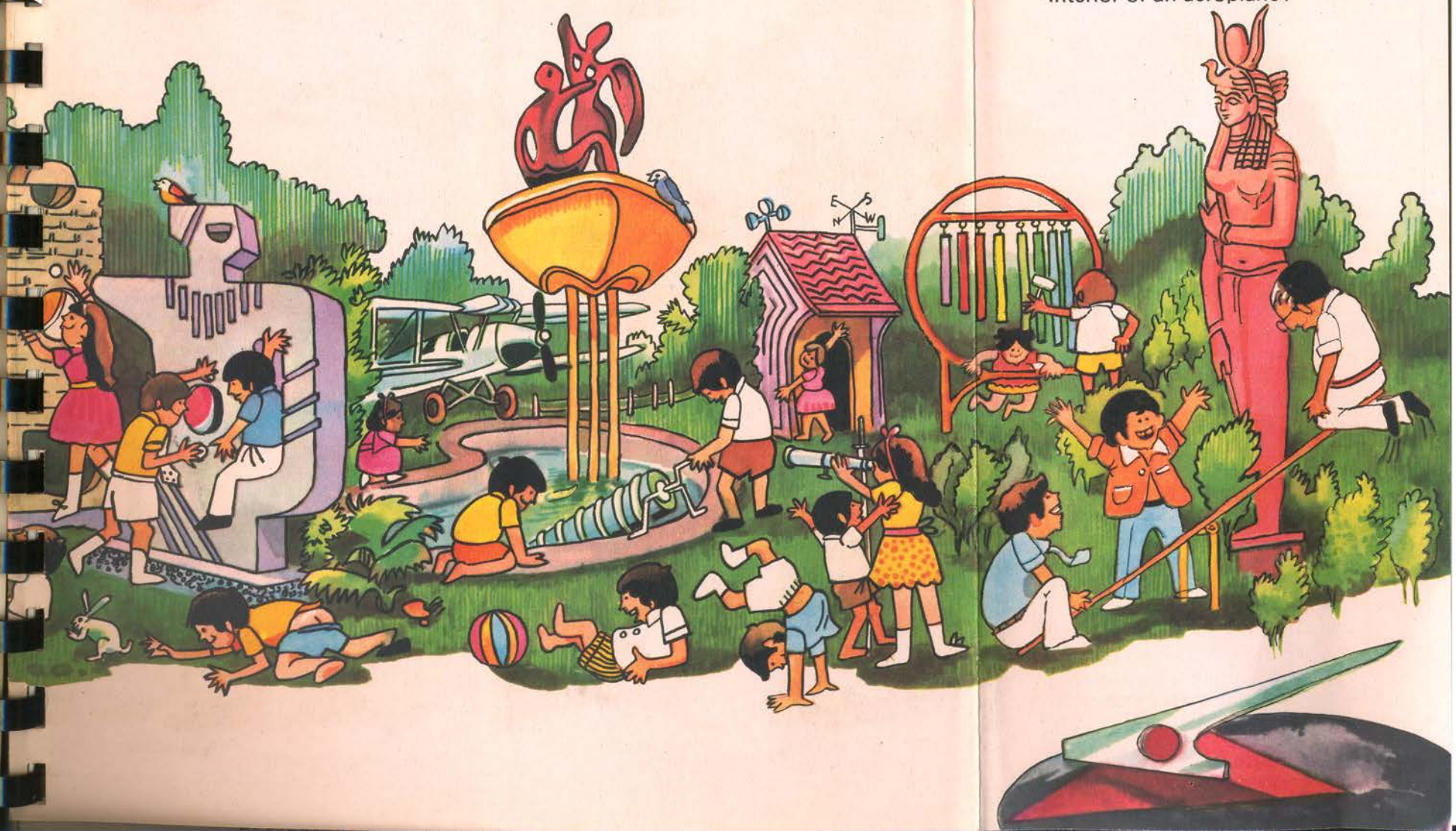
children science park

why science park?

Almost all our children have seen an aircraft flying in the sky. But how many have seen one from close quarters? And, not to speak of flying in it, how many have seen the interior of an aeroplane?



Similarly, although many children might have travelled by the railways, we are sure, not many have had the opportunity of examining a railway engine—be it an electric or a steam-driven one. Inquisitive by nature that they are, the children would have loved to do so!

But who allows them? And imagine how many railway engines or grounded aircrafts we are sending to scrap-yard each year!

Why talk about air-planes and engines? Swings and see-saws are so common in parks and play-grounds. Can we not tell children to experience for themselves that a longer swing oscillates slower or an off-centre see-saw fulcrum can balance lop-sided loads, instead of giving long lectures on laws of pendulum or principle of levers?

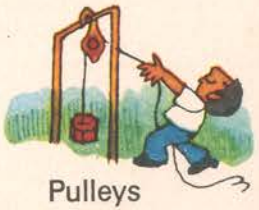
Let the children experience the growth of science and technology, or learn the elementary science, or grow a love for animals through fun—the Children's Science Park aims at this.

Accommodated in an open area of 4 hectares, the Science Park houses 64 exhibits covering various facets of science and technology.

The Nehru Science Centre is proud to present this gift, which is unique in this country, to children of Bombay in the International Year of the Child.

Exhibits in Science Park

Windmill

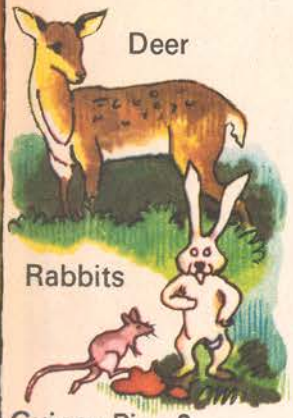

Pulleys


Birds


Inclined Planes


Sundial

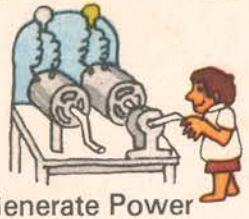

Screw Jack


Deer

Rabbits

Guinea Pigs & White Mice


Hydraulic Jack


Generate Power


Rain Gauge


Levers

Maximum & Minimum Thermometer

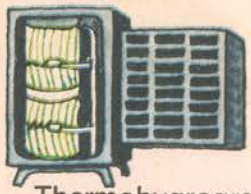
Anemometer

Windvane

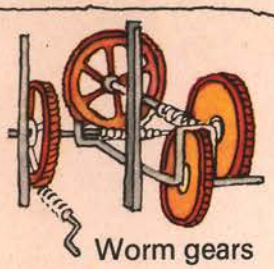
Sundial, another type

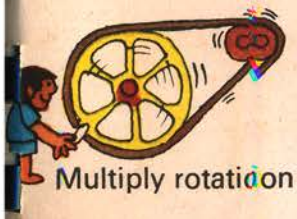
Sand hour-glass

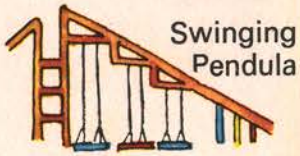

Microbarograph

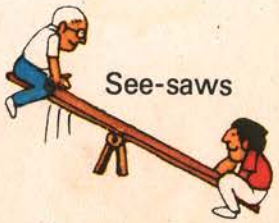

Thermohygrograph

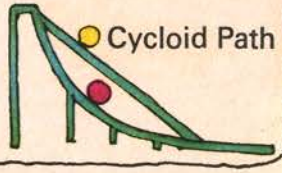

Musical Pipes

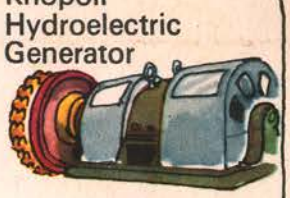


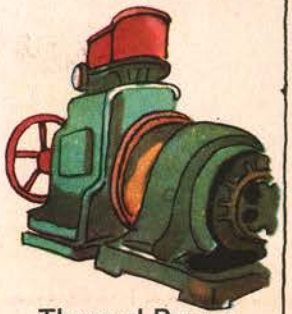






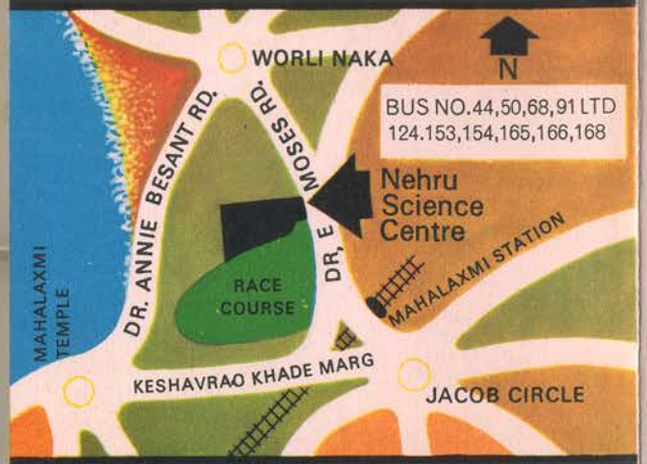






Designed & Published By Nehru Science Centre

how to come?



when to come?

Anyday between
12 noon and 7 pm.
Closed on Mondays and
Public Holidays

If it is a school group,
please book in advance
over telephone.

NATIONAL COUNCIL OF SCIENCE MUSEUMS · INDIA ·

NSC

nehru science centre

Dr. E. Moses Road, Worli
Bombay 400 018.
Telephones : 370822, 892667
Gram : POPSCIENCE

1. WHAT IS A SCIENCE PARK?

A science park offers children scope for exposure to the basic principles of science through fun. A set of robust all weather exhibits demonstrating basic scientific principles and concept is the main feature of a science park. The exhibits can cover subjects like motion, energy, sound, light, weather, mechanics, ecology, environment, solar energy and even natural history. Some tender live pet animals can also be kept while explaining the symbiotic relationship between man and animals. The exhibits are all essentially installed on idyllic natural settings with trees, shrubs and lawns. The hands-on experience which the children get in this Science Playground keeps a lasting impression on their tender minds and inculcates a spirit of inquiry in them. A science park is in effect a low cost outdoor science centre and can effectively assume the role of imparting non-formal science education to the community in general.

Calcutta, the great metropolis of Eastern India and a dwelling place for nearly 10 million people will complete 300 years of its existence in 1989-1990. It is less than two years from now that people of India particularly residents of Calcutta are going to witness this historic event. Everybody seems to be expecting a lot of things to happen as Calcutta steps on its 300th year. City planners, the intelligentia and the general public as well are all busy chalking out the programmes that should duly commemorate the event. The actual celebrations are being formulated and will gradually take shape during these two pregnant years.

Conforming to the progressive modern Indian outlook, it is felt necessary to plan celebration activities which would be fully justifiable in terms of resource spending, ultimate benefit to the mass and a face lift of our old beloved city. A proposal for setting up a large outdoor Science Park fits properly into all these considerations. An outdoor park is where children and general public get science education through fun and entertainment. It can very well be a classical value-added gift to the people of Calcutta on the tricentenary of the city and also for years to come. Many other programmes which are possibly being planned will have short life and they will probably create superficial impact on the city life as a whole. An outdoor Science Park, on the other hand, will be a permanent gift to the city and its suburbs with far reaching effects on the community in general.

At the same time, it is a low capital intensive and less time consuming project that gives the best values in terms of entertainment and fun.

Housed among lush green trees and shrubs there will be interesting outdoor exhibits for disseminating scientific knowledge through fun and frolic. A child's natural instinct to play, test his skill, compete and win will all be satisfied when he plays with the exhibit. The added benefit will be that while playing and manipulating with the exhibits he/she will learn about science. The exhibits are different from those in a common amusement park in that they are more thought-provoking and action oriented. Above all they are developed on basic concepts of science taking into consideration proper application of education psychology.

10. MAINTENANCE WORKSHOP

Covered area - 60 sq.mtr.

Machines to be installed:

i)	AC single phase arc welding set 250 Amp.	-	1 No.
ii)	Oxy-Acetylene Welding set	-	1 No.
iii)	Central Lathe 1 mtr. centre to centre distance, 14" swing with accessories	-	1 No.
iv)	Hand sharing machine 8" blade	-	1 No.
v)	Portable drill with stand 6mm and 13mm	-	1 No. each
vi)	Bench drilling machine 19mm capacity	-	1 No.
vii)	Hand tools	-	2 sets
viii)	Fitting bench equipments	-	2 sets
ix)	Workshop tables	-	2 Nos.
x)	Power Hacksaw machine	-	1 No.

11. FINANCE

A) Capital Expenditure

	Heads	Rs. in lakhs
i)	Exhibits	36.60
ii)	Service facilities	13.75
iii)	Maintenance enclosure	1.00
iv)	Machines, equipment and tools	2.25
v)	Water line, tubewell, pump	5.00
vi)	Park lighting	3.00
vii)	Garden path	2.50
viii)	Gate and fencing	10.00
ix)	Plantation and landscape	3.00
x)	Audio visual equipment, films	2.50
xi)	Office furniture	0.40
	Total:	80.00

B) Annual Recurring Expenditure

Heads	Rs. in lakhs
i) Staff salary	2.50
ii) T.A. and honorarium to guest lecturers and drama groups	1.30
iii) Security, gardening and conservancy	4.25
iv) Replenishment of animals	0.25
v) Animal food etc.	0.30
vi) Electricity	2.00
vii) Raw materials and consumables	1.00
viii) Miscellaneous office stationery	0.10
ix) Telephone bill	0.05
x) Publicity	1.00
ix) Miscellaneous	0.75
Total	13.50

12. **REVENUE EARNING**

Revenue earning has been calculated considering 300 working days per year and working hours from 10AM to 5 PM during October-March and 12 noon to 7 PM during April to September.

Expected number of visitors per day - 3000

Entry fee will be Rs.2/- per head for general adult visitors and Re.1/- per head for children below 10 years and members of school groups.

Total revenue earning in one year:

2 x 4,50,000 = Rs. 9,00,000

1 x 4,50,000 = Rs. 4,50,000

Total : Rs. 13,50,000

13. YEARWISE WORK SCHEDULE

Period	Extent of work proposed to be done
a) Till 31.3.89	i) Necessary land development
	ii) Award of contract for erection of boundary fencing
	iii) Finalisation of agreement with NCSM
	iv) Complete planning for exhibits and other park facilities by NCSM
	v) Arrangement for security
	vi) Recruitment of Executive Officer and Gardeners
b) 1.4.89 to 31.3.90	i) Fabrication and installation of 60% exhibits and park facilities
	ii) Completion of 70% work for open air theatre
	iii) Planting of trees, shrubs and landscaping
	iv) Recruitment of Education Assistant, Technicians and other administrative staff and arrangement for their training by NCSM
	v) Completion of garden path
	vi) Installation of water pumps and pipe lines
c) 1.4.90 to 30.9.90	i) Fabrication and installation of remaining 40% of exhibits and park facilities
	ii) Installation of all lighting fixtures inside the park and arrangement for power connection
	iii) Completion of water bodies
	iv) Acclimatisation for all live animals
	v) Installation of all workshop machines
	vi) Completion of planning for activities
d) October, 1990	Inauguration of park

14. FUTURE EXPANSION

The current project document presents a plan for development of a science park in two rectangular areas marked site 1 and site 2 in the plan. The area marked site 3, a narrow circular strip of land adjacent to the stadium super-structure may be utilised for adding a new series of outdoor exhibits in future. This area may depict a chronological storing of development of science and technology in Calcutta during last 300 years. It will be primarily a historic presentation, as authentic as possible, in the form of period enclaves offering the excitement and reminiscences of the past while visitors walk through them. The exhibition area may start with the early development of the city with its traditional transport, lighting and communication systems and gradually leading to 1900 century Calcutta scene depicting the changes of the city life with the advent of the products of industrial revolution. Steam navigation, Dry dock, Mint, Railways, Telegraph, advent of electricity, manufacturing industries and establishment of new educational institutions may form a major part of this area. The display will end up with scientific and technological advancement that have taken place in the post-independence era not only in Calcutta but in the surrounding industrial belt extending upto Asansol. This area will include heavy industries, modernised transport system, river valley system, power plants, electronic industries and other hallmarks of industrial process.

For this section active collaboration, both financial and organisational, may be sought for from different public sector and private industries, research institutes and other organisations. The total estimated expenditure for building up this area shall be about Rs.2 crore. Detailed planning for this section will take about six months. The National Council of Science Museums can undertake this responsibility on approval of the project and on assurance of grants.

15. RESEARCH AND TRAINING FACILITIES

The National Council of Science Museums has recently set up a Central Research & Training Laboratory (CRTL) in Salt Lake City for generation of new concepts and development of new techniques in areas of science communication and science popularisation. The Laboratory is well equipped not only for design of new exhibits and activities for science centres activities but also for development of prototypes which can be replicated in large numbers by different institutions in the country and abroad. The CRTL is equipped with modern equipment, instruments and facilities for imparting training to science museum professionals and science communicators. Such training programmes will be organised throughout the year for people coming from different parts of the country as well as persons coming from other countries under a programme sponsored by UNESCO.

Calcutta Science Park located within five minutes drive from the CRTL of National Council of Science Museums could draw on the resources of the CRTL and organise year-round training programmes for science communicators coming from different parts of West Bengal.

Annexure - I

Educational qualification, experience and job requirement for staff:

Executive Officer - M.Sc. in Physics/Chemistry/Zoology/Botany. At least two years working experience or research experience in his/her own discipline.

To supervise day-to-day work of Science Park, to liaison with scientists, guest lecturers and amateur groups for running regular shows, to execute policy decisions taken by governing body, to create new exhibits and modify existing ones if required. To prepare future plans and programmes in consultation with experts. To ensure proper upkeep and security of park. To maintain accounts of daily receipts and submit it to proper authority.

Education Assistant - 1) B.Sc. with Hons. in Physics/Chemistry or Diploma in Mech. Engineering.

One year experience will be preferable.

To explain to the visitors, scientific principles related to exhibits. To arrange lectures, dramas, film projection and other audio-visual shows in auditorium.

To supervise all maintenance work taken up in the workshop.

To supervise work of conservancy staff.

To ensure proper upkeep and exhibits on Physical Sciences.

2) B.Sc. with Hons. in Zoology/Botany.

One year experience will be preferable.

To explain to the visitors, scientific principles related to exhibits.

To arrange lectures, dramas, film projection and other audio-visual shows in auditorium.

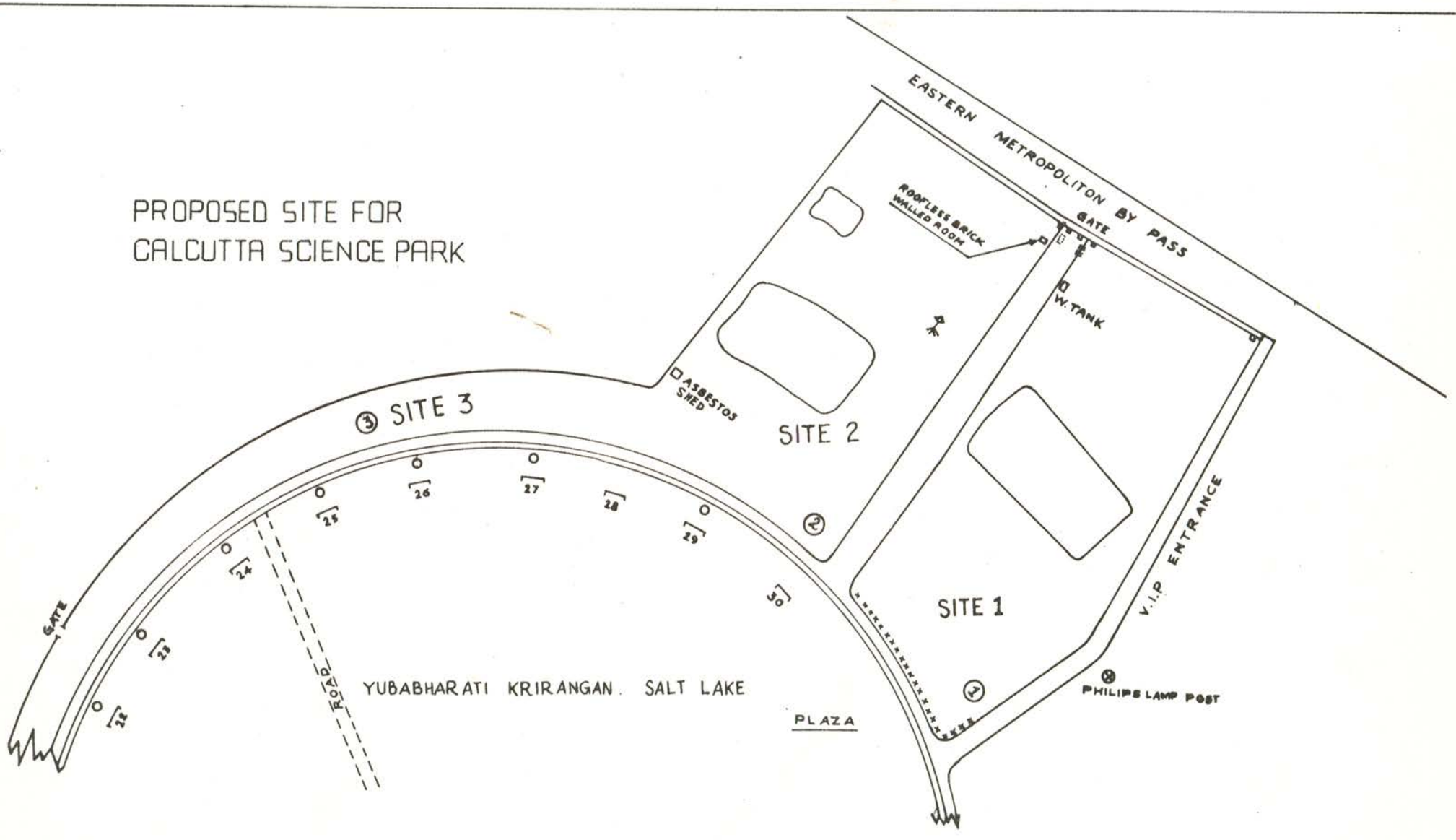
To supervise work of gardeners and animal keeper.

To ensure proper upkeep of all animals, cages, plantation and shrubs.

Technicians - Passed I.T.I course in fitting trade. Ability to do welding jobs will be an added advantage. One year experience necessary.

Animal Keeper - Minimum educational qualification for Class IV staff in W.B. Government.

Two years experience in similar work necessary.


PROPOSED SITE FOR
CALCUTTA SCIENCE PARK
EASTERN METROPOLITON BY PASS
GATE
ROOFLESS BRICK WALLED ROOM
W. TANK
ASBESTOS SHED
SITE 3
SITE 2
SITE 1
V.I.P ENTRANCE
PHILIPS LAMP POST
GATE
ROAD
YUBABHARATI KRIRANGAN. SALT LAKE
PLAZA
22
23
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28
29
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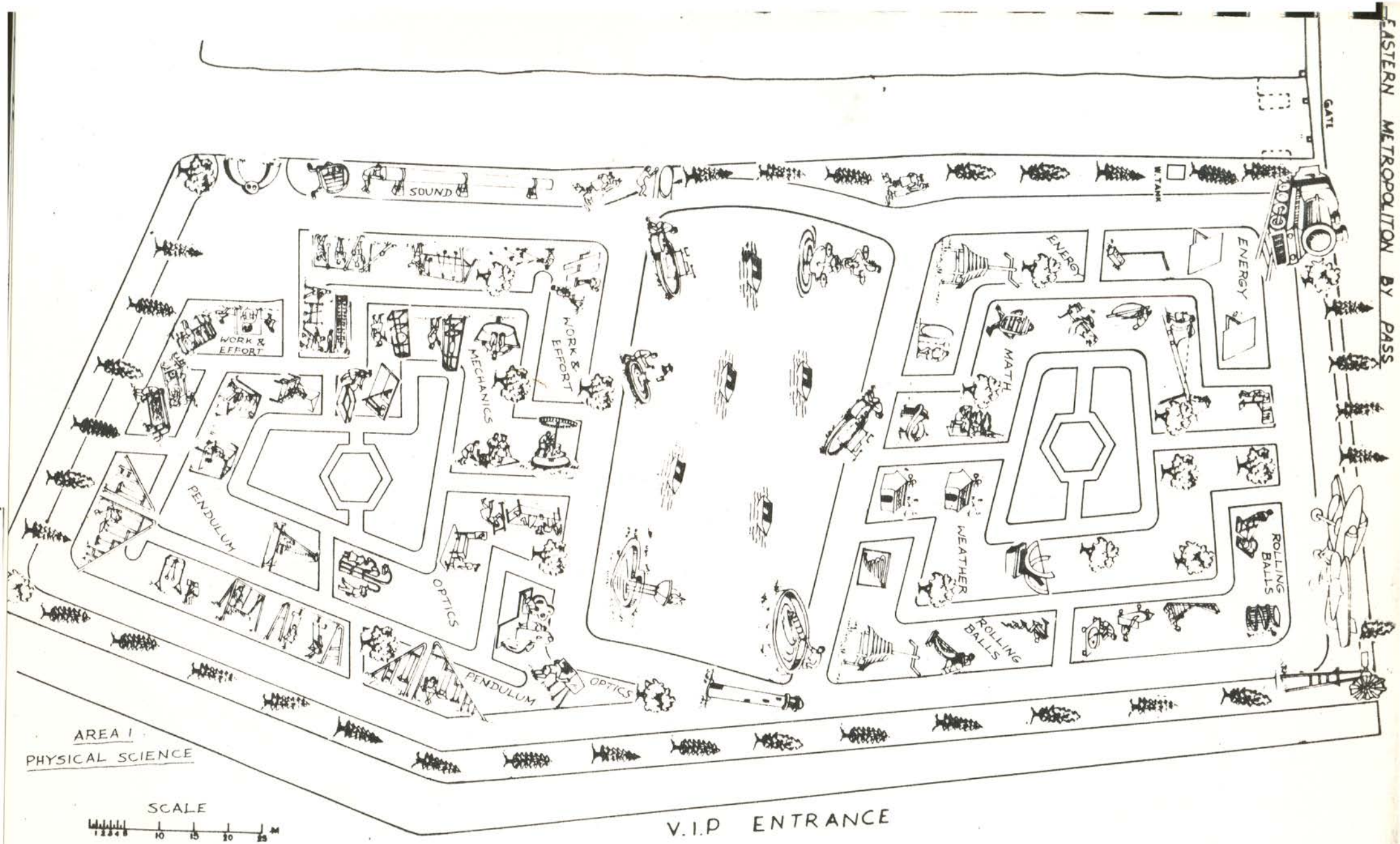
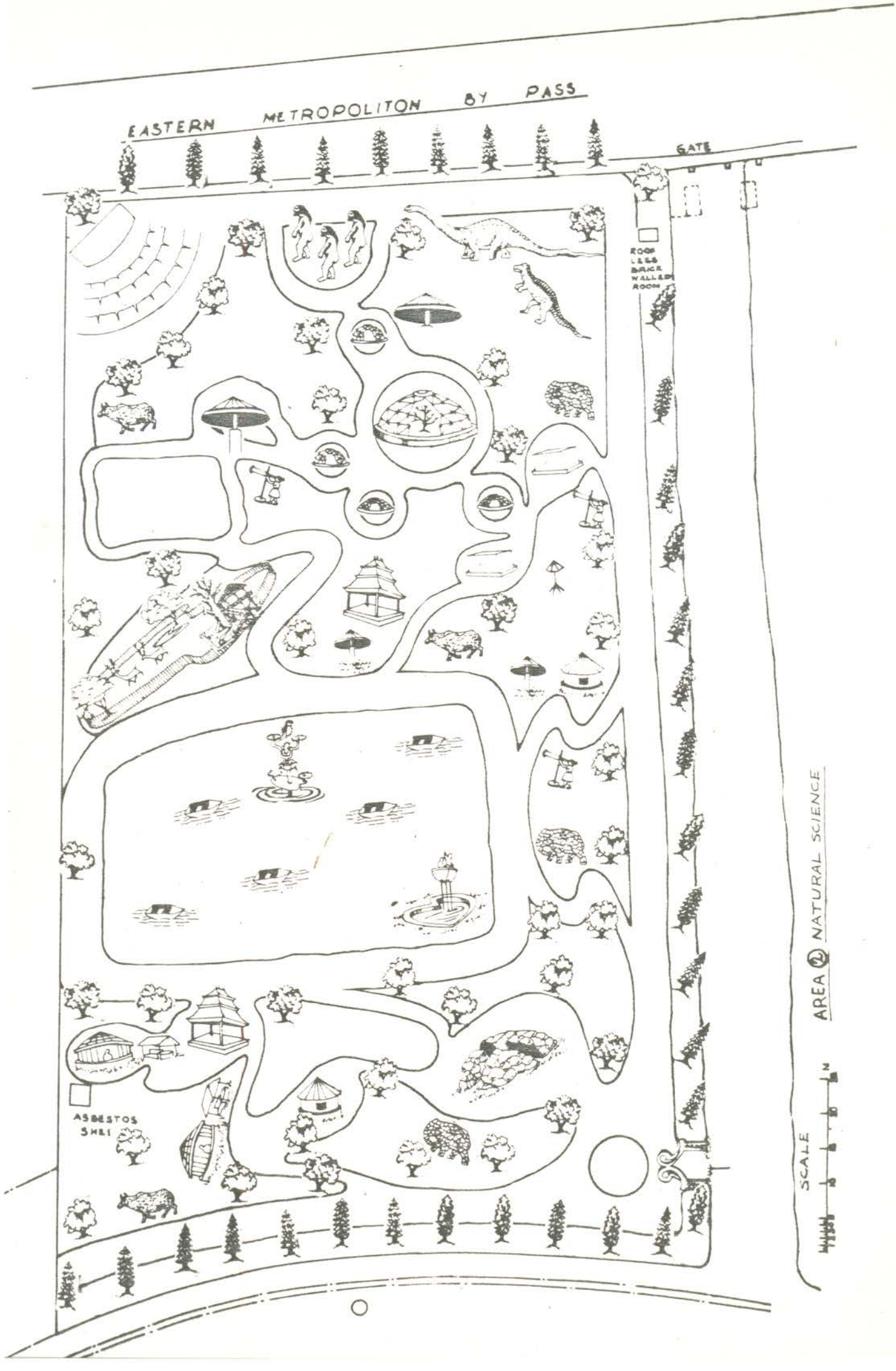
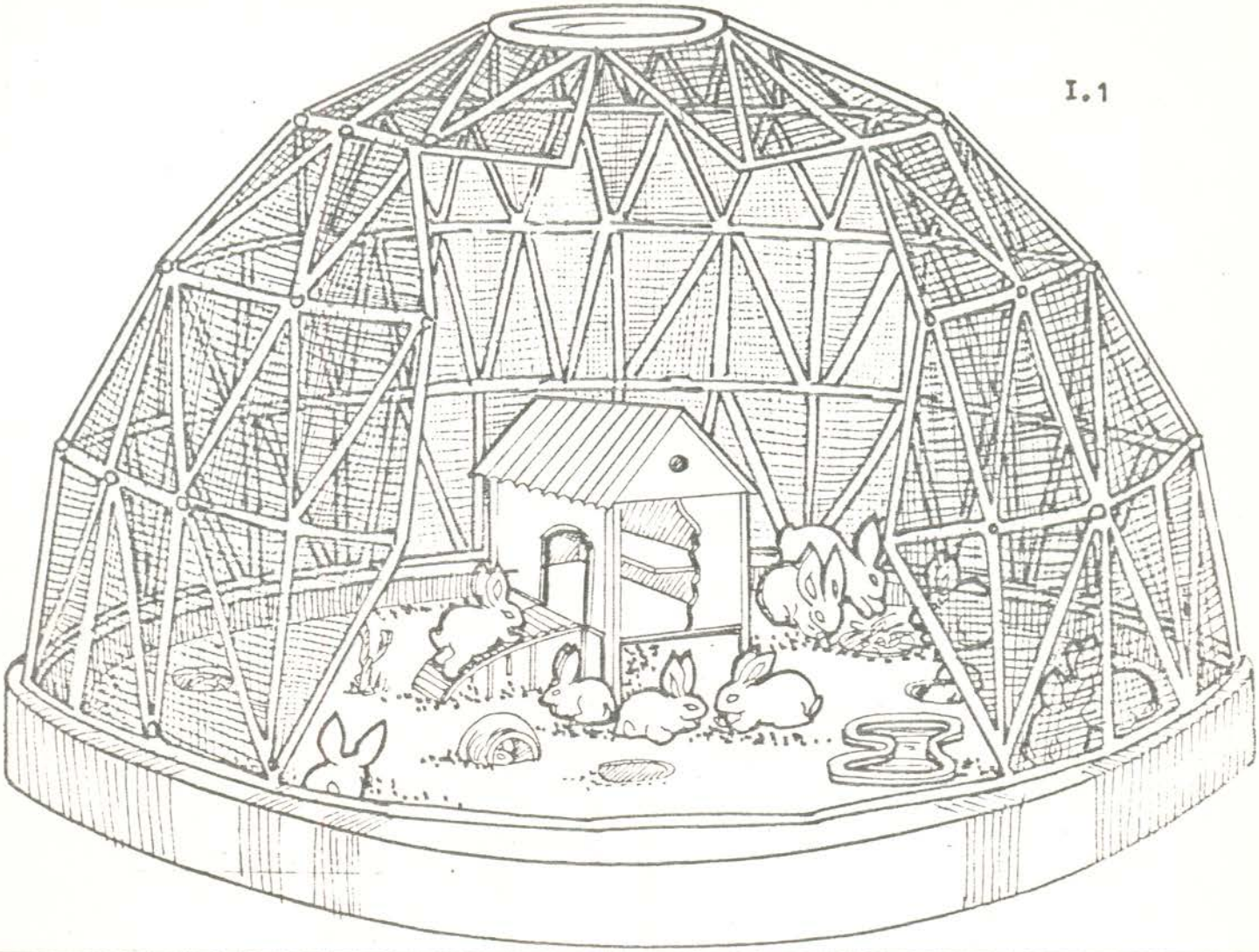
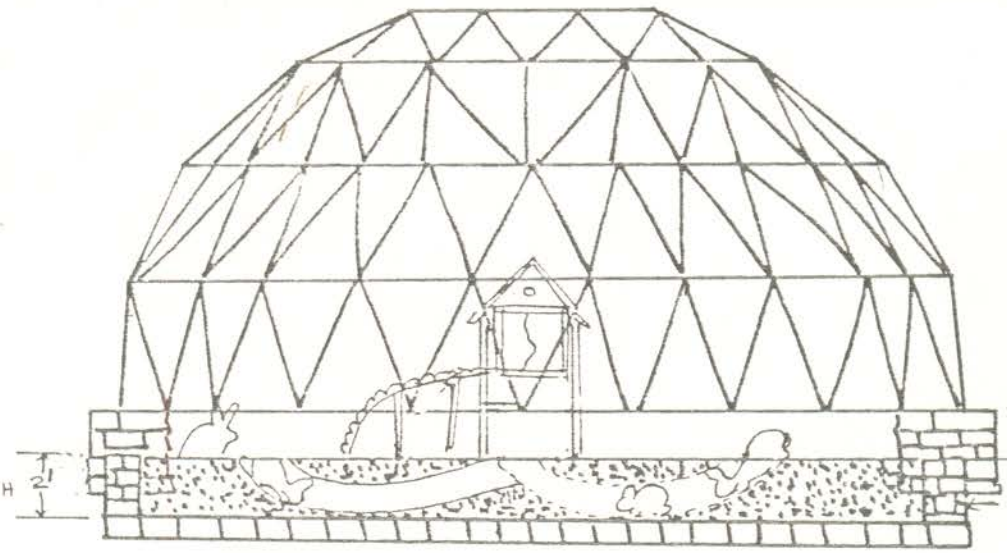

EASTERN METROPOLITON BY PASS
GATE
W. TANK
SOUND
WORK & EFFORT
MECHANICS
WORK & EFFORT
ENERGY
ENERGY
MATH
PENDULUM
OPTICS
WEATHER
ROLLING BALLS
ROLLING BALLS
PENDULUM
OPTICS
AREA I
PHYSICAL SCIENCE
SCALE
1 2 3 4 5 10 15 20 25 M
V.I.P ENTRANCE
PHILIPS LAMP POST

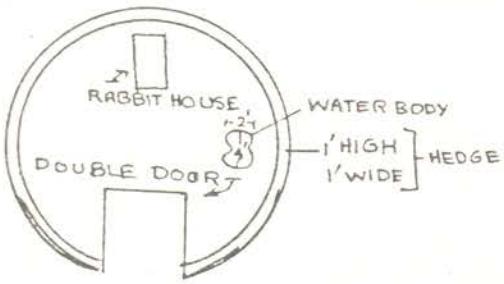

EASTERN METROPOLITON BY PASS
GATE
ROOM LESS BRICK WALLED ROOM
ASBESTOS SHED
SCALE
AREA (2) NATURAL SCIENCE

RABBIT 20' ø DOME

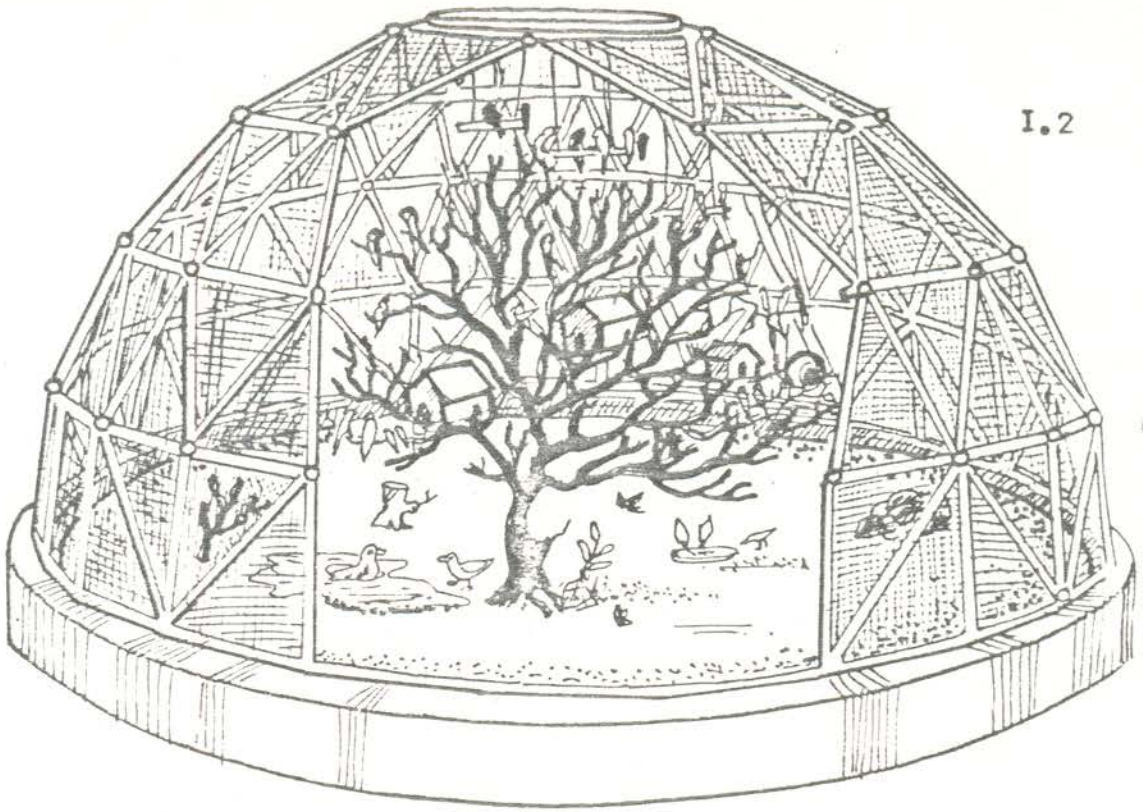
I.1







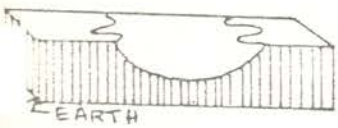
SMALL BIRDS 12'ø DOME

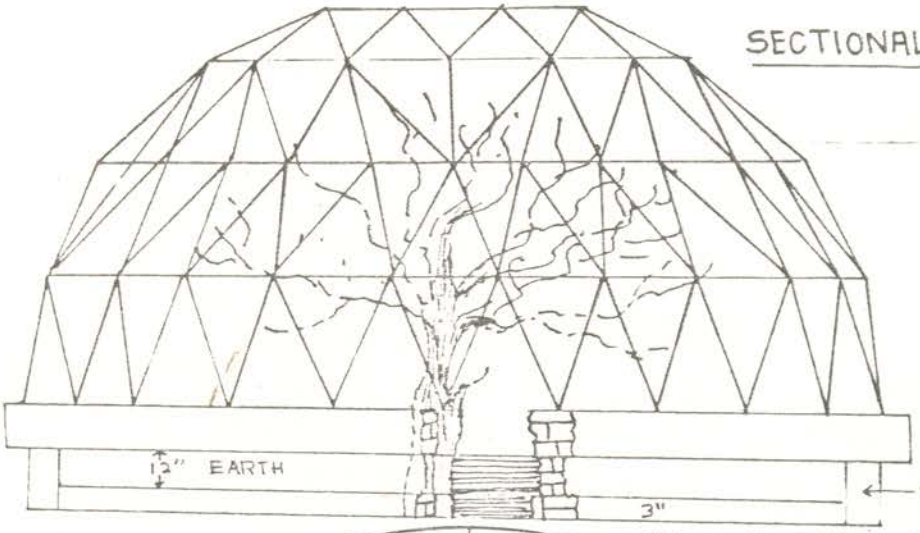


I.2

SECTIONAL VIEW

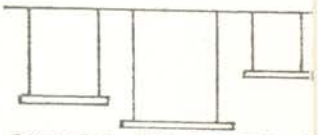
SECTIONAL VIEW OF WATER IN THE POND





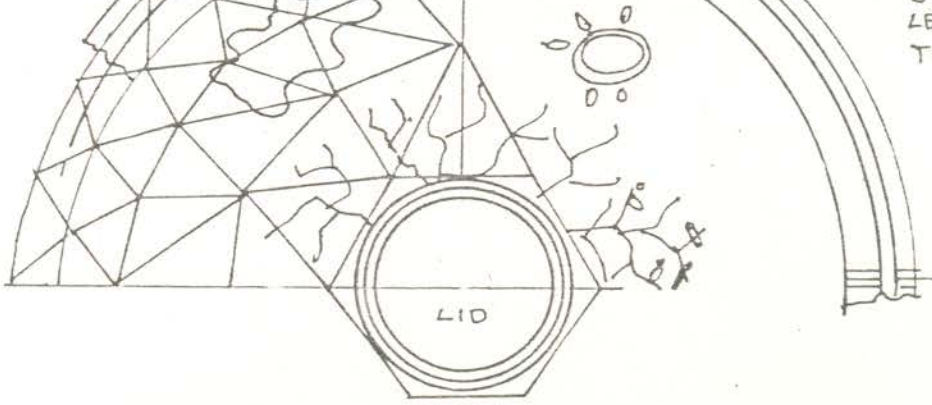
FOOD TRAY

5" BRICK WITH CEMENT



SWINGS OF DIFFERENT LENGTHS HUNGED FROM THE TOP

DRY TREE IN THE CENTRE 8' OUT & 4' UNDEREARTH



PLAN

The simpler exhibits are scientific versions of common place park fixtures. A series of swings of varying lengths urge visitors to note the basic law of the pendulum: the longer the swing the slower its movement. A slightly off-centred fulcrum in a see-saw demonstrates the principles of the lever - a small child derives enormous pleasure and confidence in lifting up his parents on the other side.

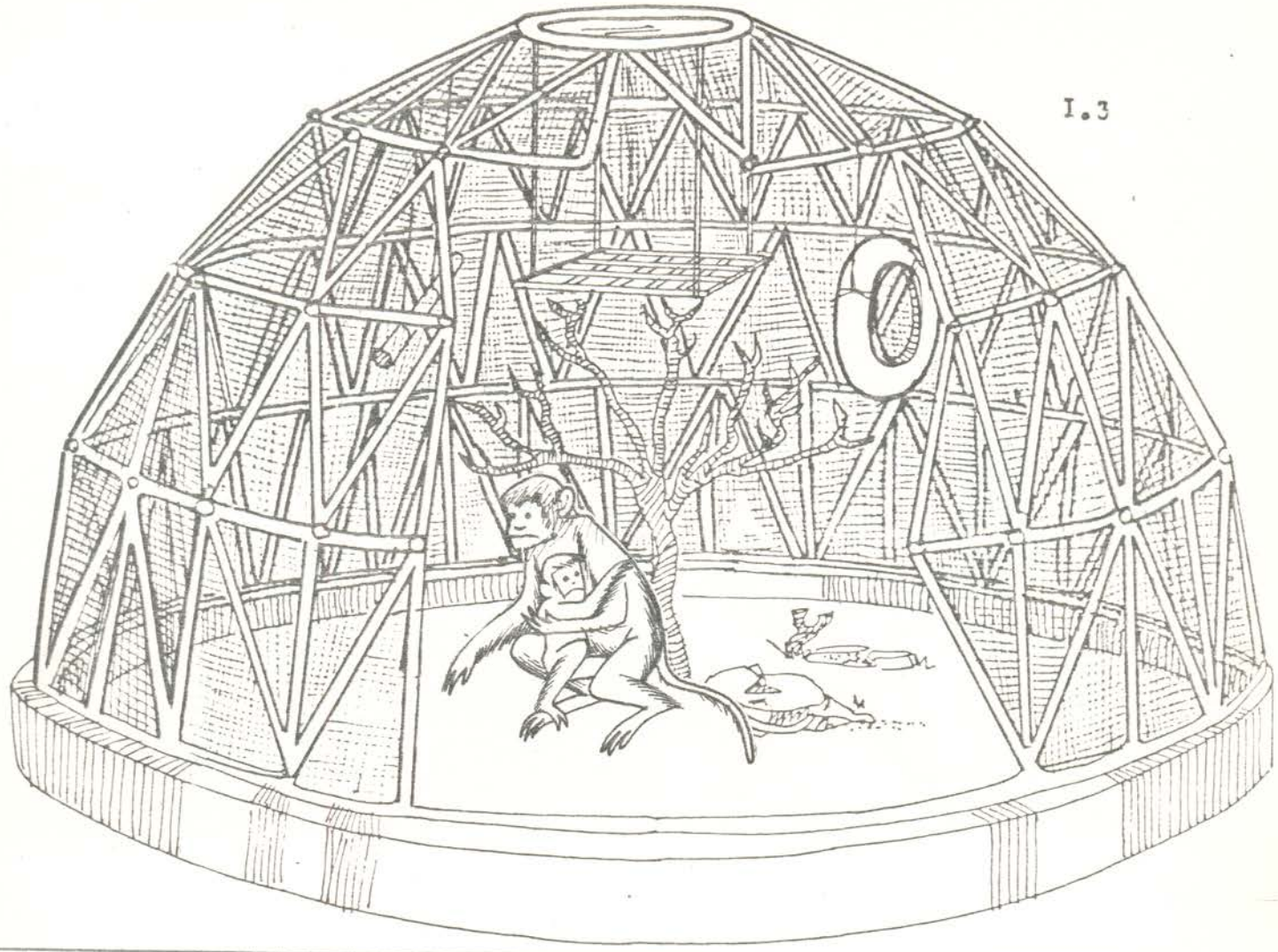
Other exhibits, however, are designed to go beyond such commonplace park games. A swing has been developed to demonstrate coupled oscillation or sympathetic vibration. Two people sit on two swings hanging from an oscillating plank. If one starts swinging, the other visitor, though sitting still, swings automatically. The second visitor attains a maximum swing when the first one, who initiated the swing, almost stops. But that is for a moment only. The first visitor again gains momentum while the second visitor almost comes to a halt. This process goes on alternately.

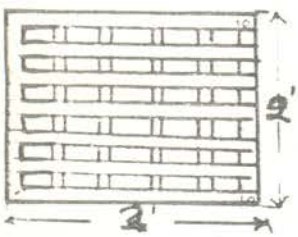
Excitement is everywhere. Roll a ball through three successive loops to demonstrate the effect of centrifugal force or along three different channels to show it travels fastest on a cycloidal path. Stand on a turn-table and turn a large umbrella, you start turning in the opposite direction. Again, turn on a turn-table slowly with both hands outstretched with a dumb-bell in each hand. Now move your hands closer together and you turn faster. Watch how the colour of the landscape changes when you look through changing and overlapping colour filters. Make pipes chime, take readings from a sundial and note the maximum-minimum temperatures, humidity, atmospheric pressure and rainfall of the day from weather station instruments. Most exciting is to observe how an object becomes weightless in a free fall. You may see this in a science park without travelling into outer space. Amidst the plants and trees stand large artefacts such as windmill, a railway engine, an early horse-drawn or electric tramcar, a hydroelectric turbine, a supersonic jet fighter and other aircraft, a huge sundial or simply a garden sculpture. Somewhere in the park stands an aviary full of local as well as rare birds. Elsewhere you find a pet area designed to evoke a symbiotic relationship between children and animals. A pool maintaining a natural eco-system or pits infested with snakes and reptiles are designed to present a well-knit story on ecological balance and the protection of the environment.

In a science park, exhibits are displayed among trees, shrubs, flower beds, ponds and garden pathways, all picturesquely landscaped, which is what makes the exhibits so interesting. The entire area is surrounded by lofty trees. Large bushy trees which flower at different seasons give shade to rest and recreational areas. Fruit-bearing trees attract birds. A large variety of smaller ornamental plants, shrubs and seasonal flower beds add colour to the green. Planting is done systematically at the initial stage after consulting landscape architects and horticulturists. Rare specimens of plants, not growing in the locality, find a special place in a science park. They include strange fruits, flowers, medicinal and aromatic plants, spices, economic crops such as tea, coffee, cocoa, rubber, cotton, jute, etc. Greenhouses with cactii, succulents and bonsai are places of special attraction. Sensitive plants and

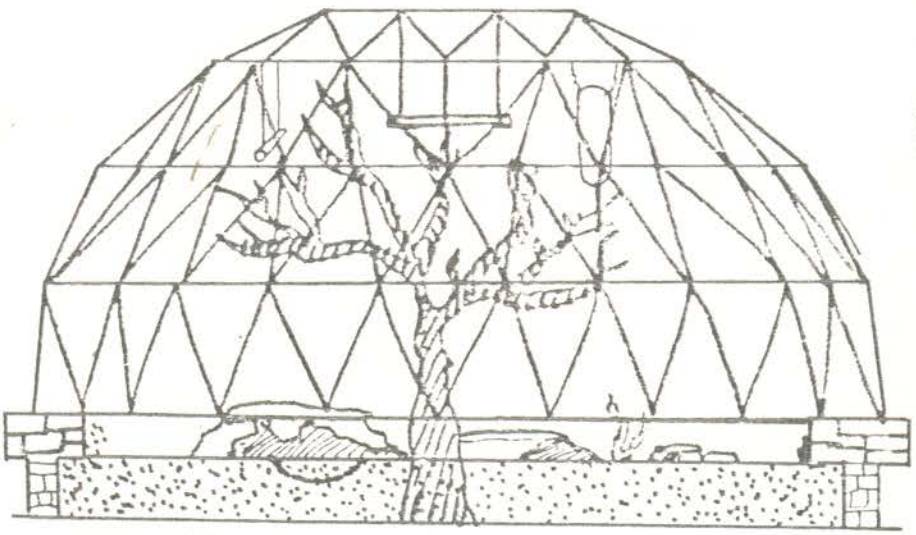
MONKEY 20' Ø DOME

I.3

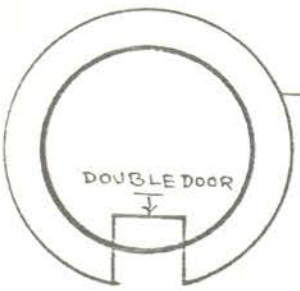




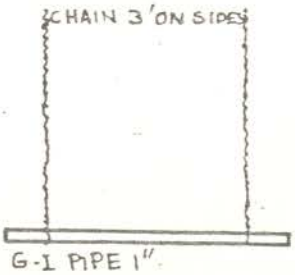
TO BE HUNG FROM THE DOME WITH CHAIN ON THE FOUR CORNERS.



USE TRUCK TYRE TO HUNG



2½' HIGH
2' WIDE
HEDGE



G-I PIPE 1"

STONE BOWLS OR ANY OTHER HEAVY BOWL LIKE THING FOR KEEPING FOOD & WATER FOR THE MONKEY

A.1 A SWING IS A PENDULUM

* Hold the seat of the longest swing with both hands and set it in motion without anybody sitting on it.

* Do this experiment with other swings.

* Observe that the longer is the swing the slower is its oscillation.

* Sit on any swing and enjoy swinging.

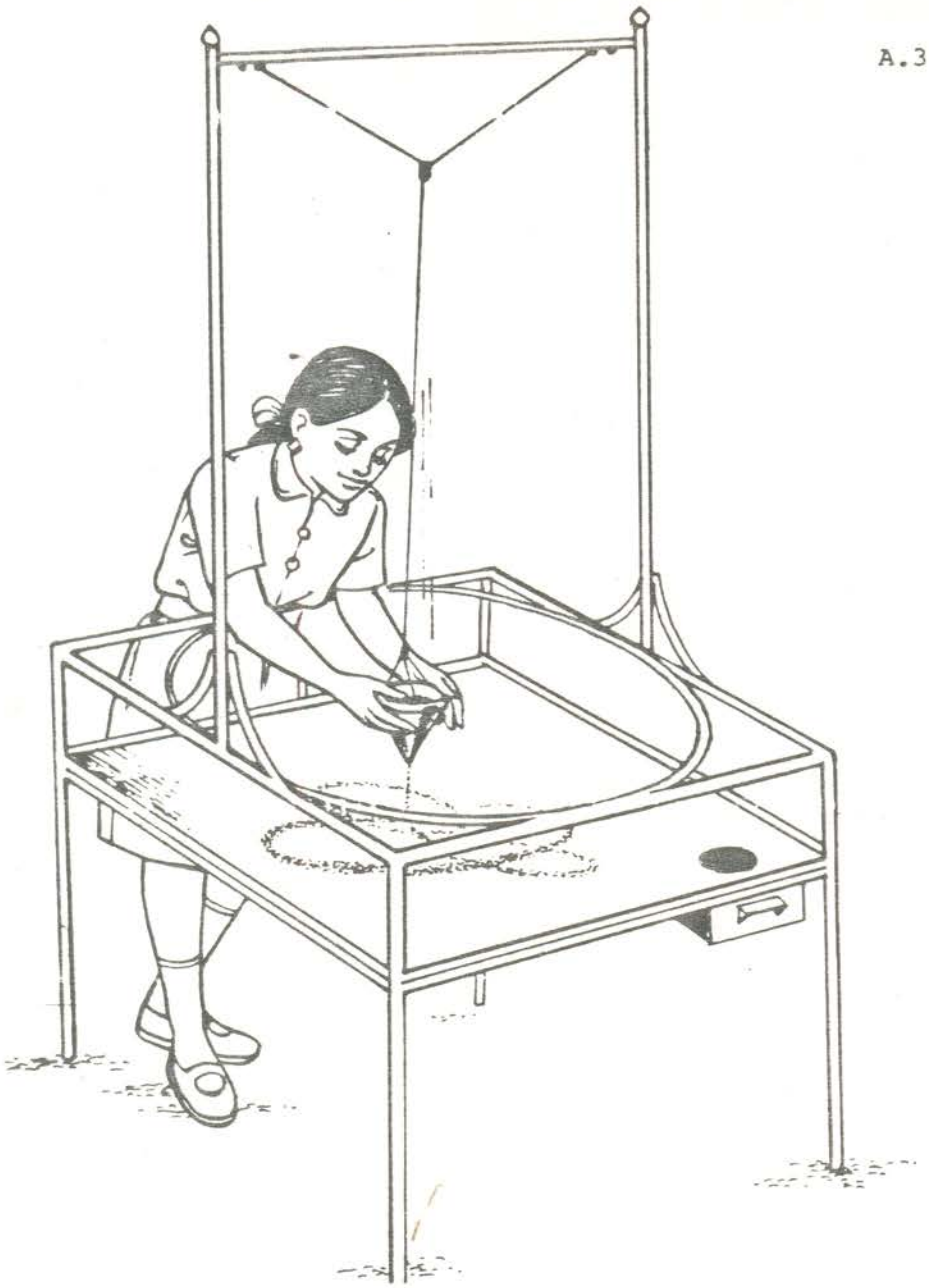
The longer is the pendulum the slower is its motion and vice-versa.

A.2 SYMPATHETIC SWING

* Sit on a swing and ask your friend to sit on the other.
* Swing gently and keep your feet off the ground.
* After a few oscillations your friend starts swinging automatically and you come to a stop.
* Sit still, your friend gradually stops and you start swinging again.
* This goes on and on if there is no friction.

The large wooden plank at the top transfers your oscillation to the other swing. When oscillations of your swing go in opposite phase to that of the plank, you stop. Your friend stays in full swing because his oscillations are in same phase with that of the plank.

A.3 TRACE A PATTERN

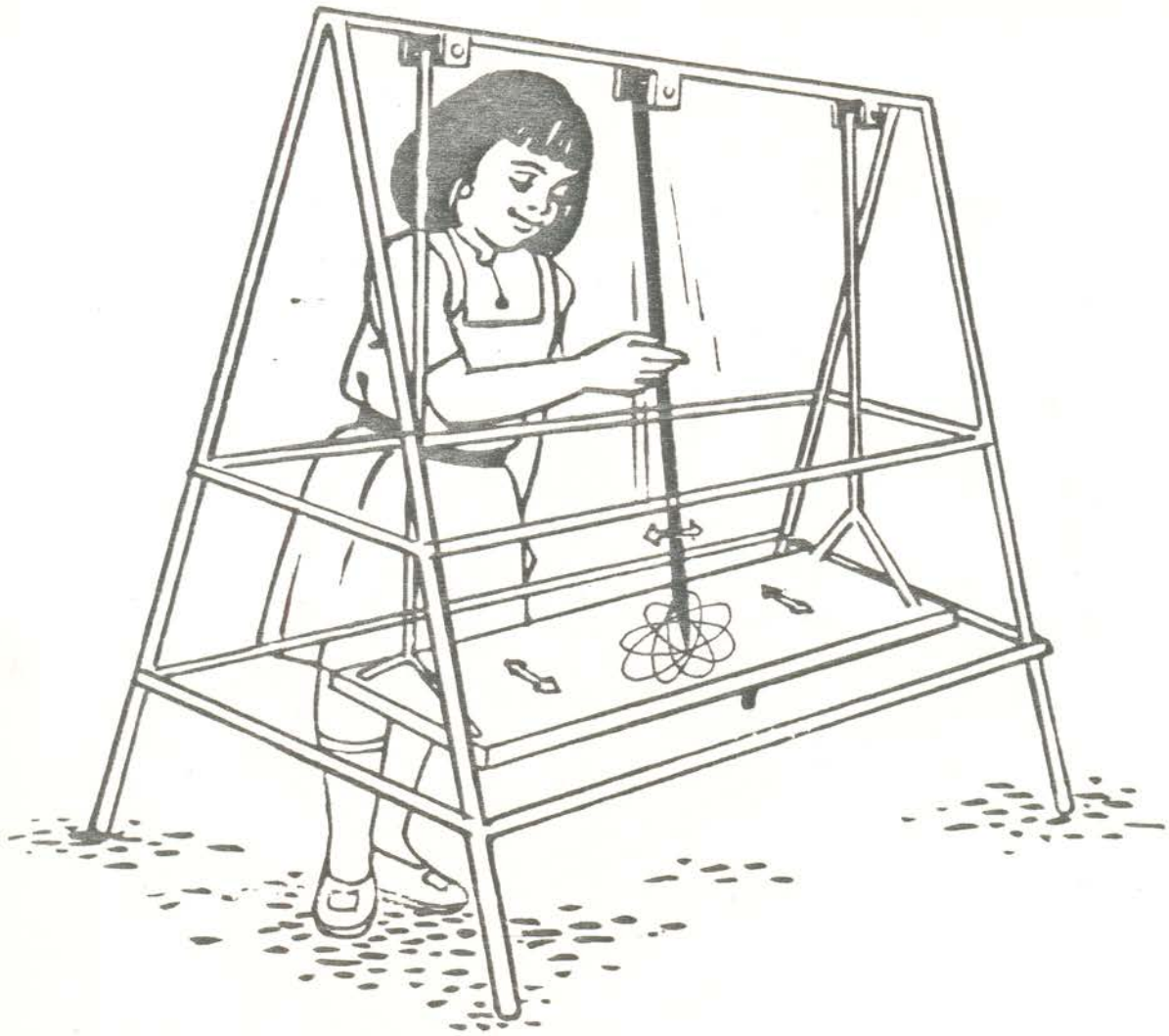


* Fill the conical vessel with sand by closing the hole at the bottom of the vessel with one finger.

* Draw the sand filled vessel at an angle and release gently. Observe the beautiful patterns produced by the dripping sand.

These patterns are called lissajous figures or bowditch curves. Such curves are traced by a point which combined two simple harmonic motions in perpendicular directions.

A.4 COMPOUND PENDULUM



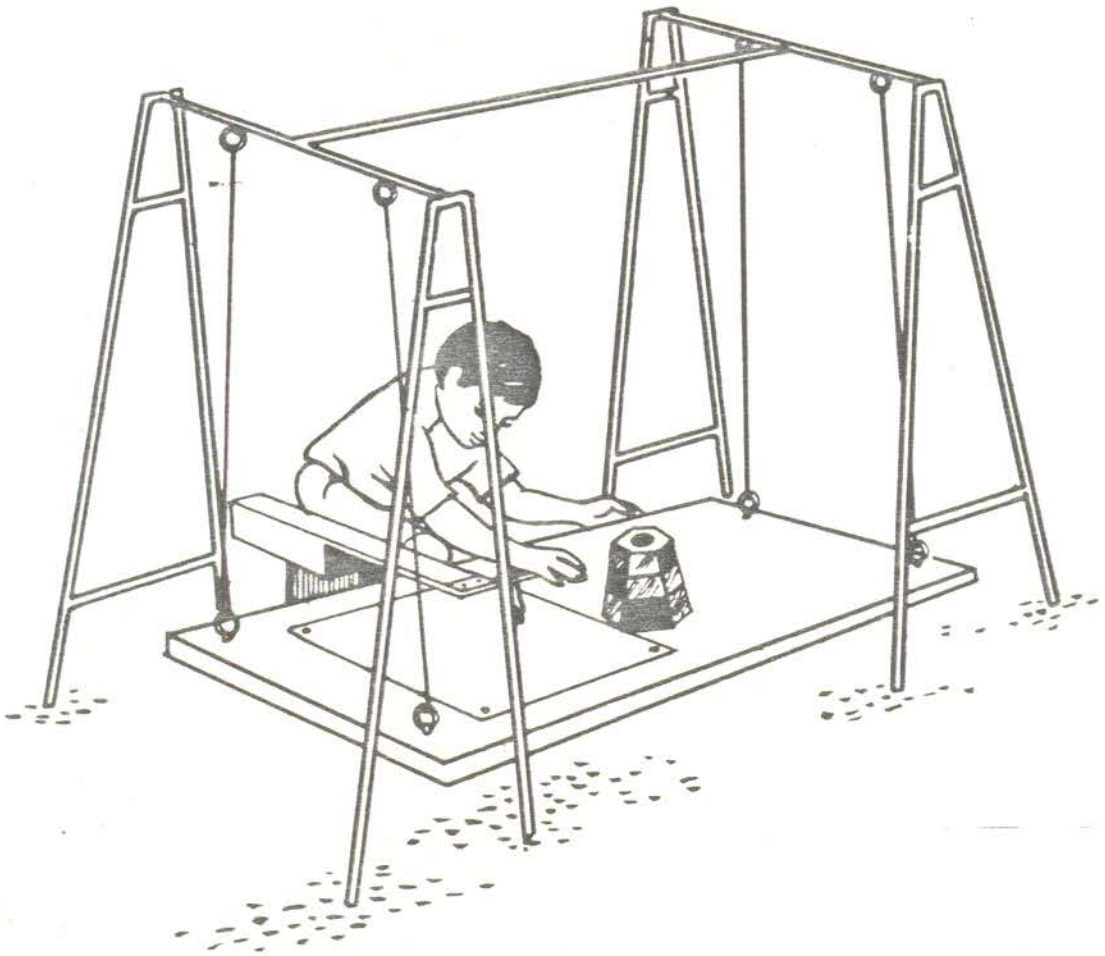
* Swing only the central pendulum gently.

* Observe that its pointed end traces a straight line.

* Then swing the outer platform. Watch that the pointed end starts tracing elliptical paths.

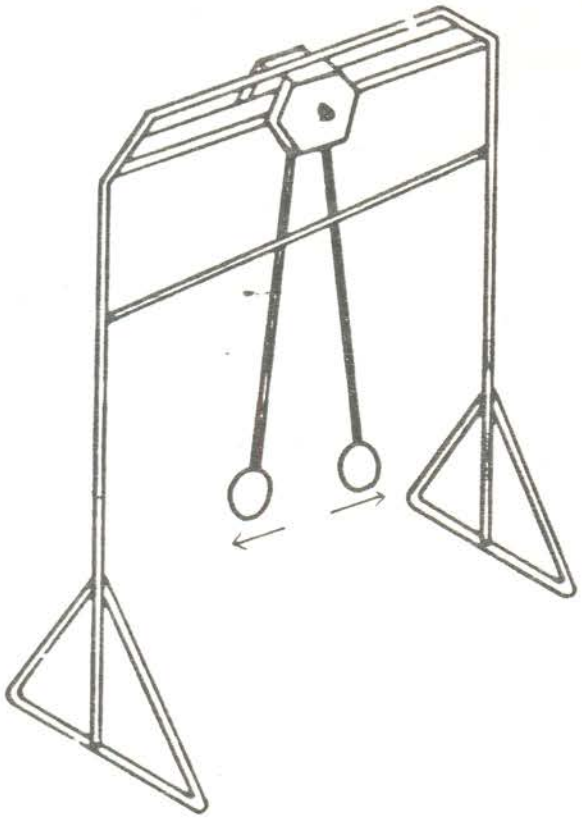
The elliptical paths are generated by combining two simple harmonic motions in perpendicular directions.

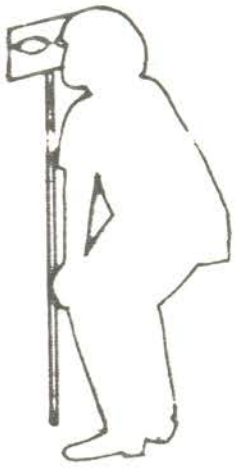
A.5 HARMONOGRAPH



* Set the paper in the space marked for.
* Insert the marker pen into its holder.
* Give gentle swing to the platform.
* Slowly lower the pen holder arm on the paper.
* Observe various patterns generated on the paper.

A.6 STRAIGHT LINE OR CIRCLE ?

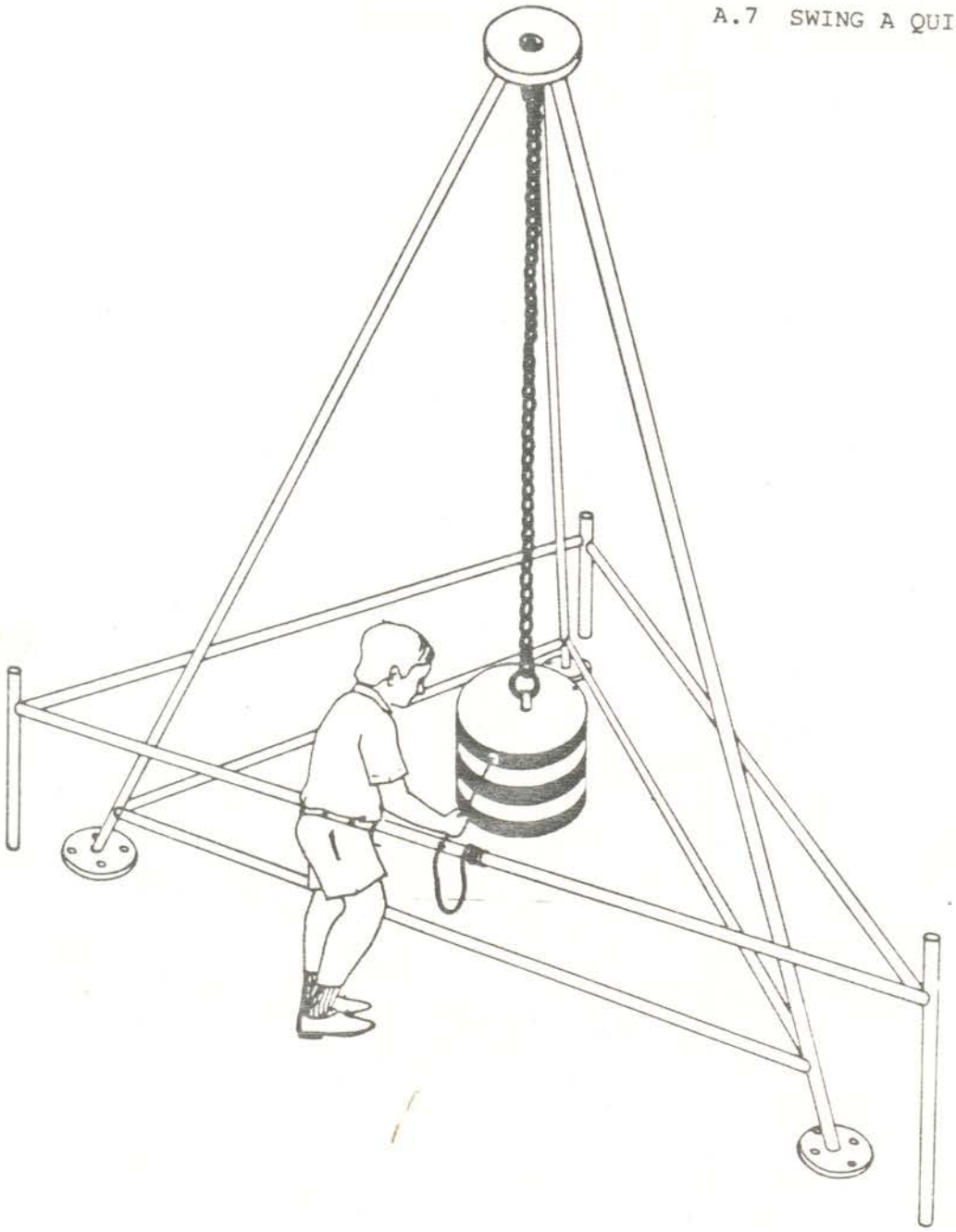




* Swing both pendulums simultaneously in opposite directions.
* They appear to oscillate in parallel planes.
* Look at them through coloured spectacles.
* You will see the pendulums revolving around each other.

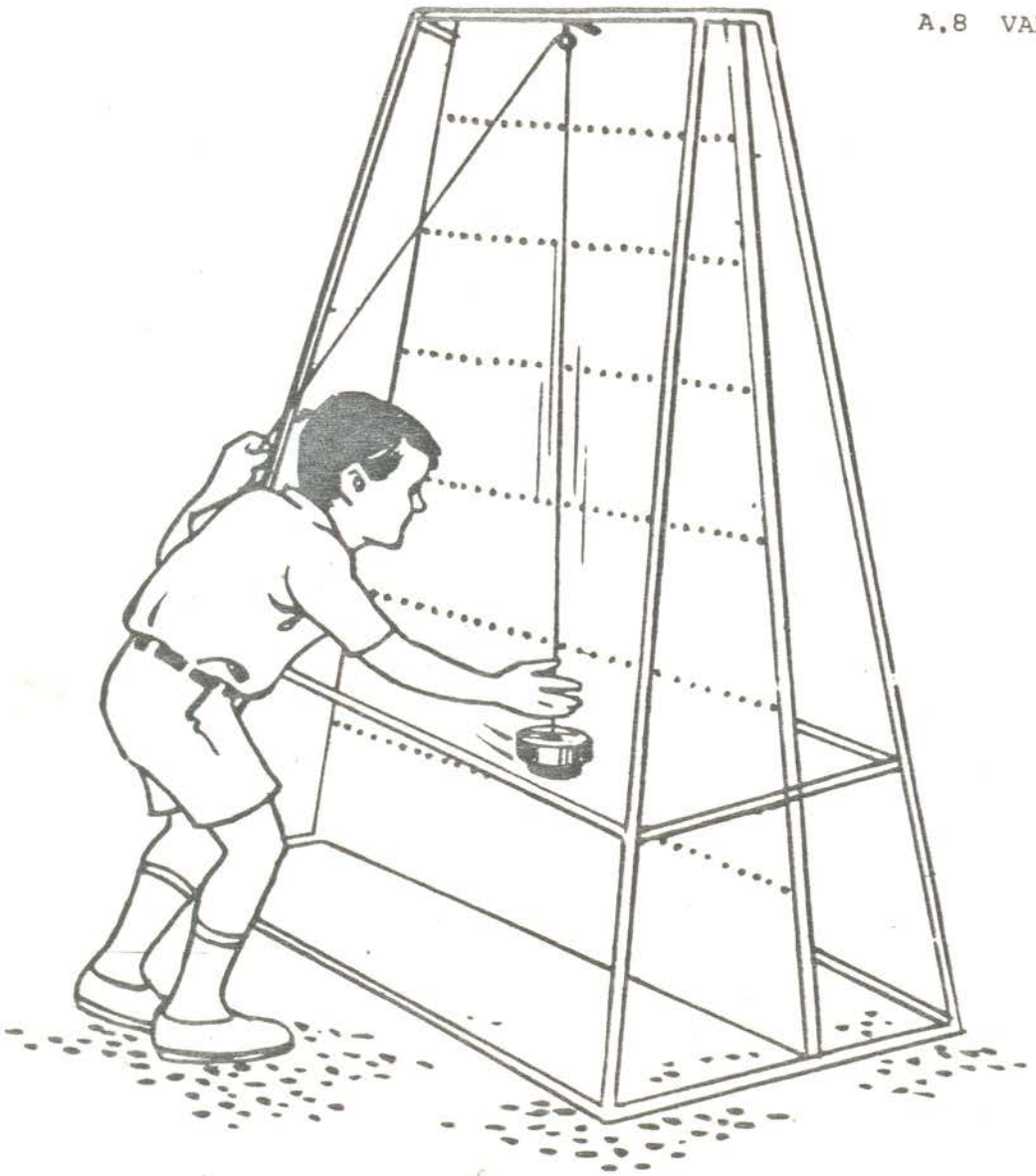
As your eyes see the pendulums through two different colours, they send messages to your brain at slightly different times and this results in the illusion.

A.7 SWING A QUINTAL



* Can you swing the 100 kg weight with the help of a small magnet ?
* Toss the magnet on the weight so that it sticks to iron bands.
* Pull the string gently to start a swing of the weight.
* Give a small tug to the string every time the weight starts moving towards you and loosen your grip as it swings away.
* Watch how the amplitude of the swing increases gradually.

A.8 VARIABLE PENDULUM



* Hold the string by one hand to keep the pendulum bob at a particular height and set the pendulum in motion by the other hand. Observe the time period of its oscillation.

* Pull the string or release it to set the pendulum bob at some other height and swing the pendulum with the other hand. Observe its time period of oscillation again.

* Do this experiment by hanging the bob at different heights and noting the period of oscillation everytime.

You will understand that the longer is the pendulum the slower is its oscillation

B.1 INCLINED PLANES

* Observe that equal weights are hung by different ropes.

* Pull the left hand side rope gently and lift the weight vertically.

* Then pull other ropes gently one by one and lift the weights along the inclined planes.

* Observe that maximum effort is needed to lift the weight vertically up and lesser and lesser effort is required to lift equal weights as the slope of the incline reduces.

Inclined plane is a simple machine used for lifting heavy weights.

delicate exhibits are guarded not by fence but by multicoloured hedges. Serpentine pathways layered with pebbles or red brick dust lead visitors from one exhibition area to another.

What appears encouraging and rewarding is the behaviours of the adults. Entering the park as a casual visitor with the sole purpose of keeping an eye on their children so that they do not get lost, parents do not realise that they become fully engrossed and absorbed and literally lose themselves in the exhibits.

2. WHY A SCIENCE PARK?

a) An outdoor science park is an entertainment cum non-formal educational facility unique in character. Users derive extra benefit from the didactic values of the exhibits.

b) The strong and rugged exhibits are low cost long lasting capital investments. They fully justify their use in long term output.

c) An outdoor science park is an ideal platform for conducting community programmes where people from spectrum of life can meet together and take part.

d) The exhibits and facilities provided in the science park are immensely attractive. The park and the surrounding area should get vibrant with activities within a short time and attract tourists in large numbers.

e) This will be a very important addition to the already dwindly greenery and open area in this over-crowded city.

3. LOCATION AND LAND AREA

a) The Calcutta Science Park is proposed to be set up adjacent to one of the most important land marks on the face of the city - The Yuba Bharati Krirangan.

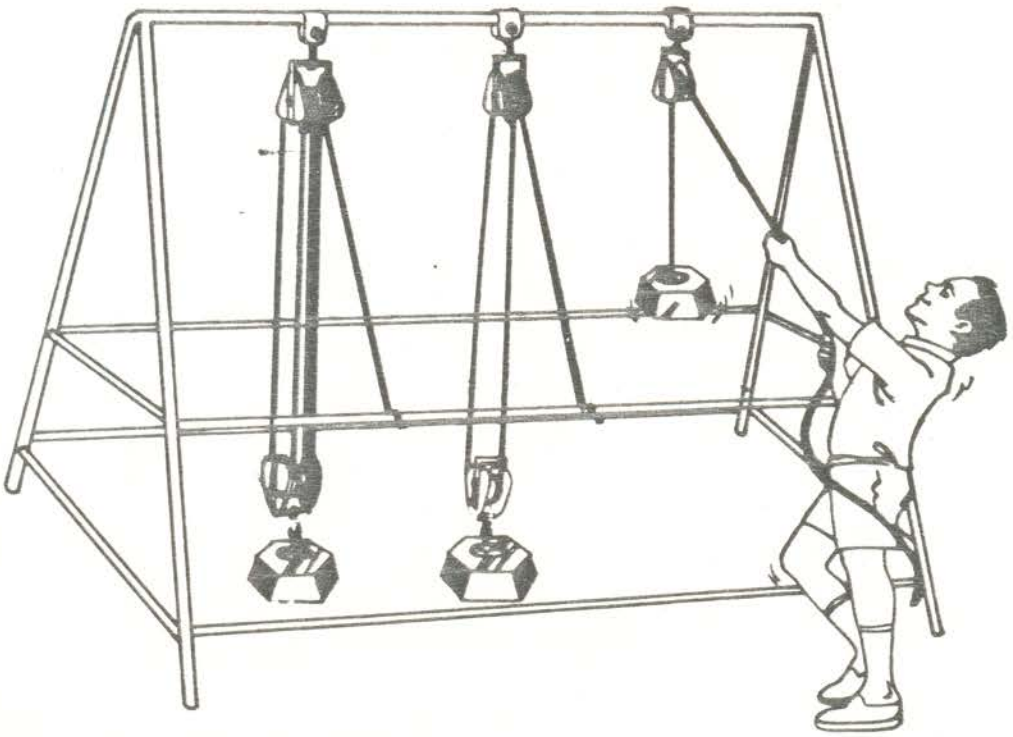
b) The addition of the science park, in effect, will enhance the utilisation factor of the area adjacent to the stadium.

c) This particular location will conveniently utilise the systems of transport, car parking and other related service facilities that are already existing. This will help create a perennial flow of visitors to the park and the stadium complex without further investment towards such facilities.

d) The stadium complex will be full of activities all along the year and not only during the programmes that are held in the stadium occasionally.

Proposed land area for the park	-	25100	meter square
Area of water body	-	4300	meter square

B.2 PULLEYS LIFT LOADS

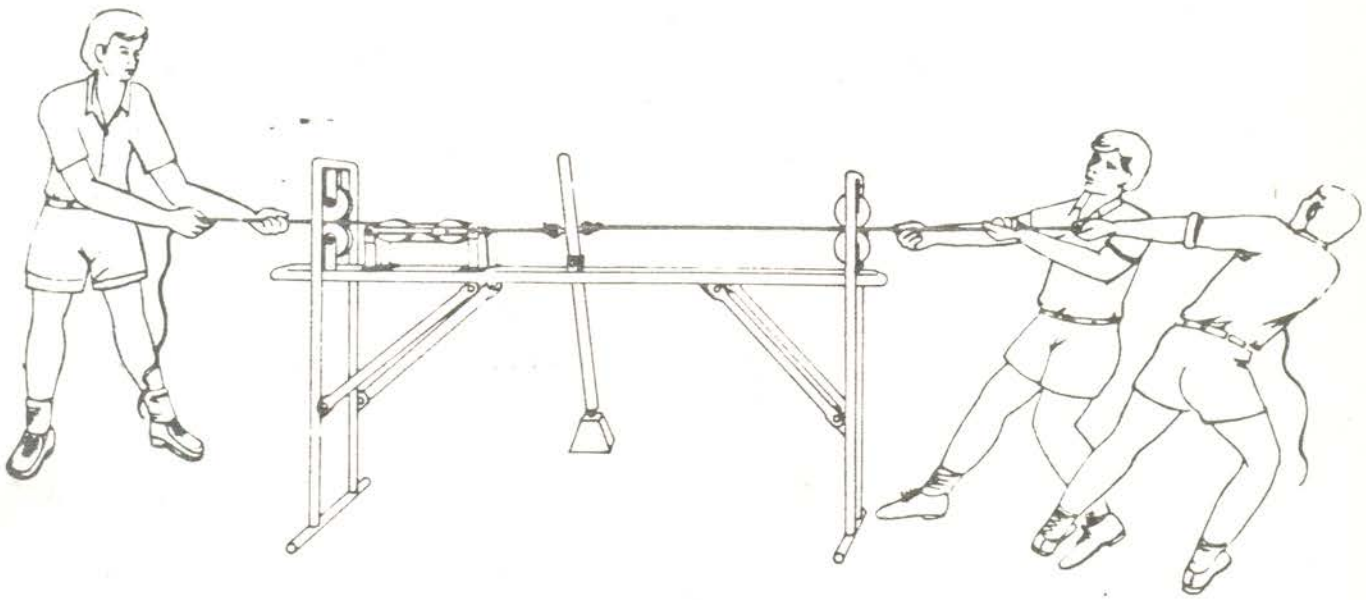


* Observe that equal weights are hung from three different pulley systems.

* Lift three weights individually and feel the difference in pull.

By increasing number of pulleys suitably, heavy weights can be lifted with lesser and lesser efforts. Pulley is a simple machine which is used in cranes.

B.3 TUG OF WAR

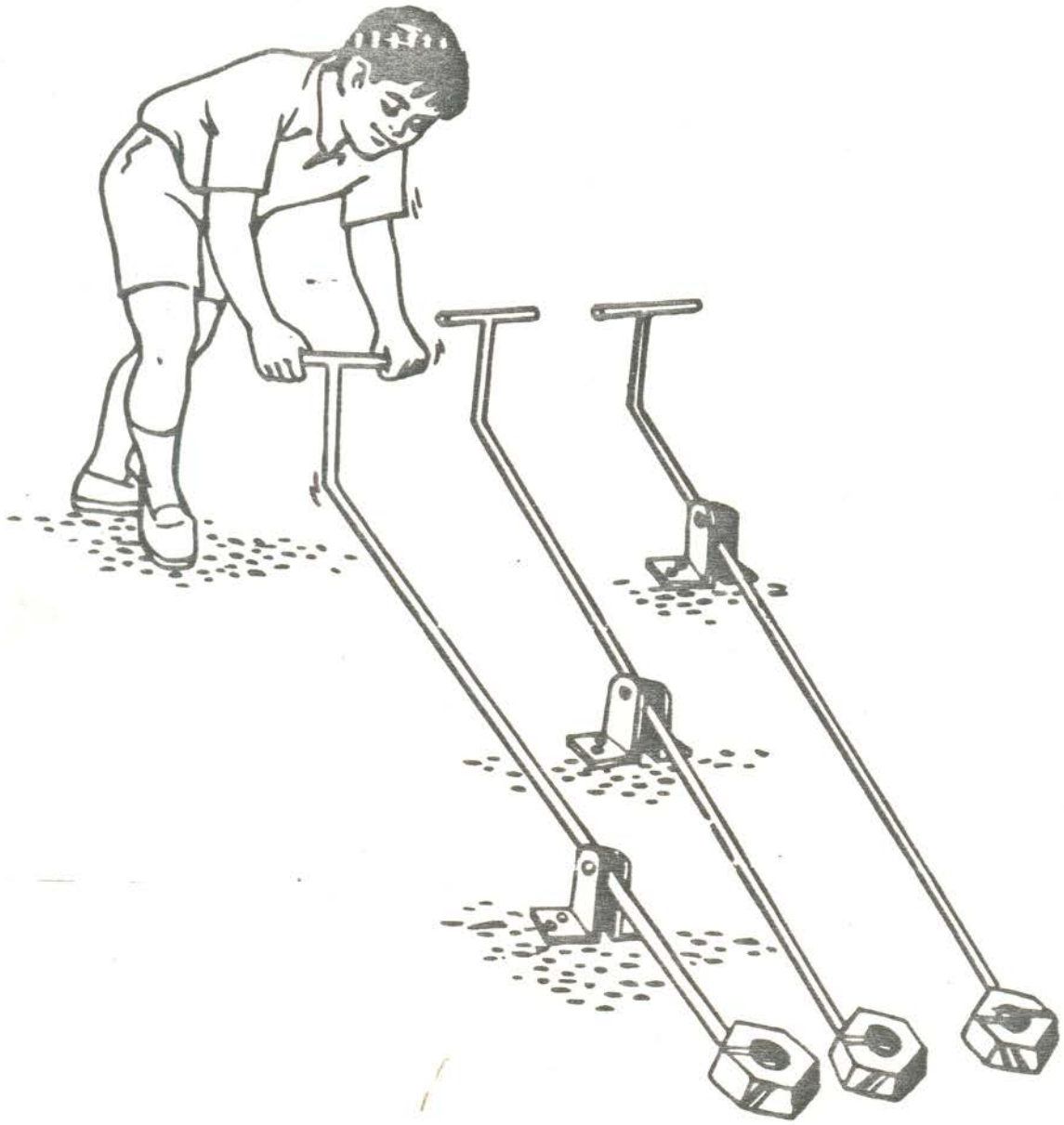


* Stand on the pulley block side and ask your friends to stand on the other side.

* Start a tug of war. You will always win.

The pulley block gives you a mechanical advantage. You need less effort to pull. But notice that you have to move back much further than your friends move forward.

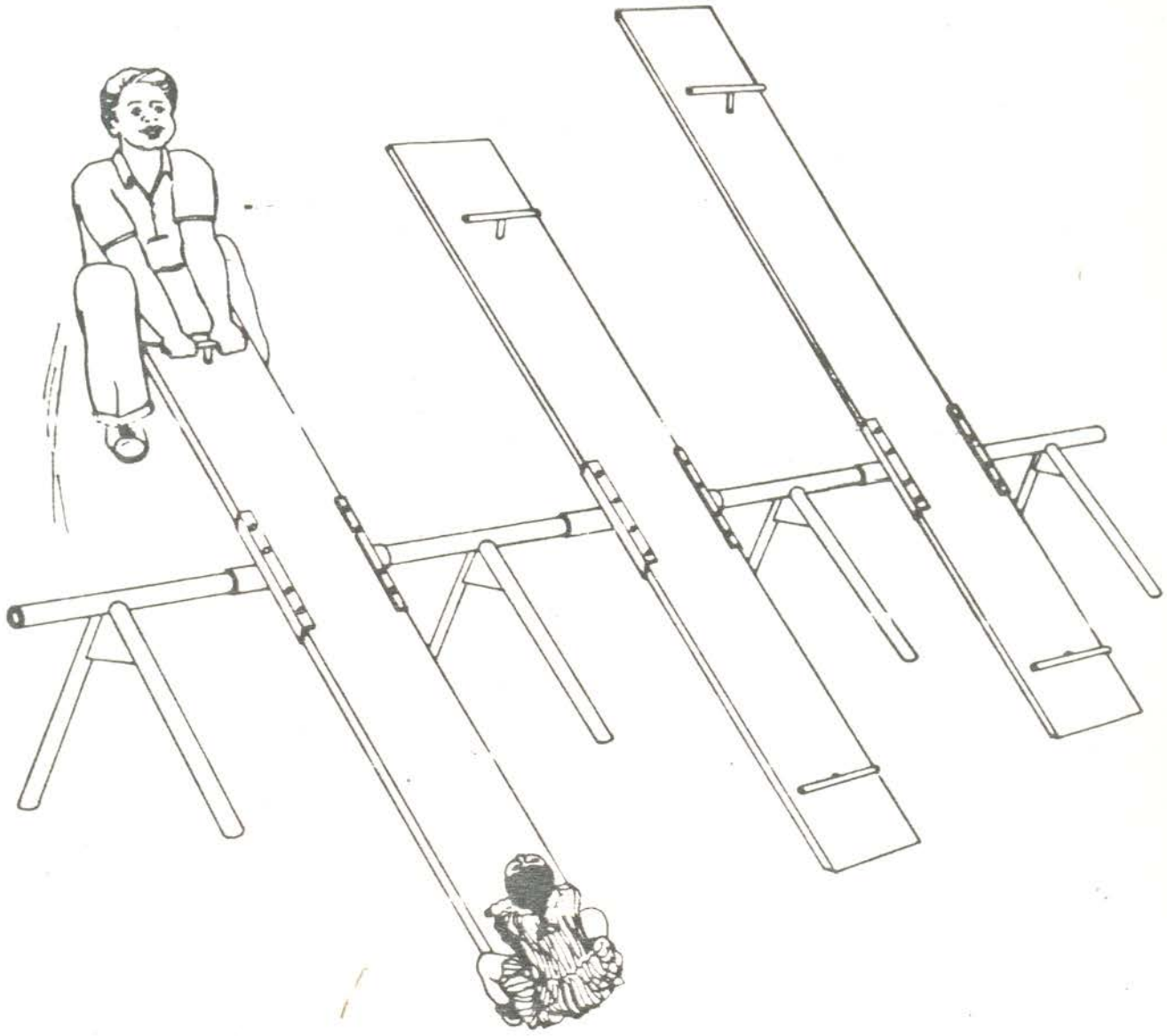
B.4 LEVER REDUCES EFFORT



* Observe that equal weights are placed at the end of three levers.
* Press the lever handles one by one and lift the weights.
* Note that it is easier to lift the weight when the arm of lever on your side gets longer.

Levers help in lifting large load with less effort.

B.5 A SEA-SAW IS A LEVER



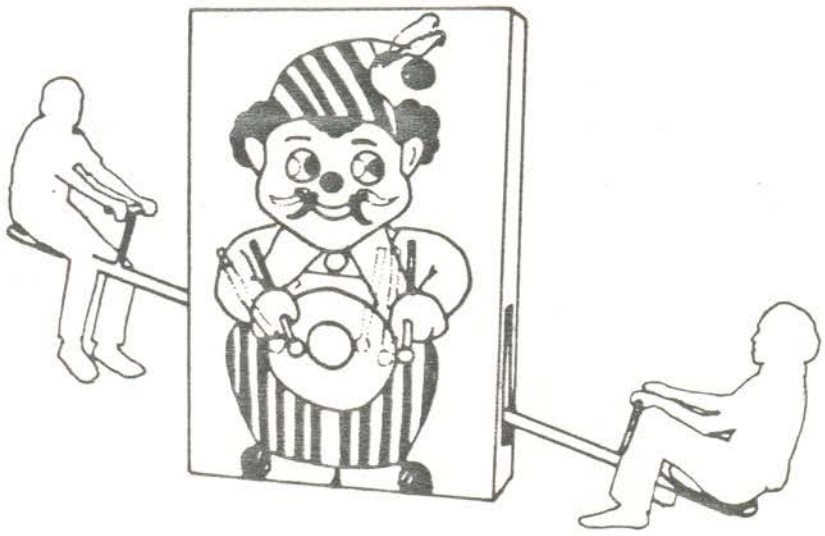
* Observe that some of the sea-saws are supported at the centre while some others are off-centered.

* Choose a sea-saw having its fulcrum (support) at the centre and enjoy the sea-saw along with one of your friends.

* Choose another sea-saw with off-centered fulcrum and ask two persons to sit on the shorter side and you sit on the longer side to operate the sea-saw.

A sea-saw is a lever. A small child on the longer side can lift his parent on the short side in an off-centered sea-saw.

B.6 AMUSING SEA-SAW

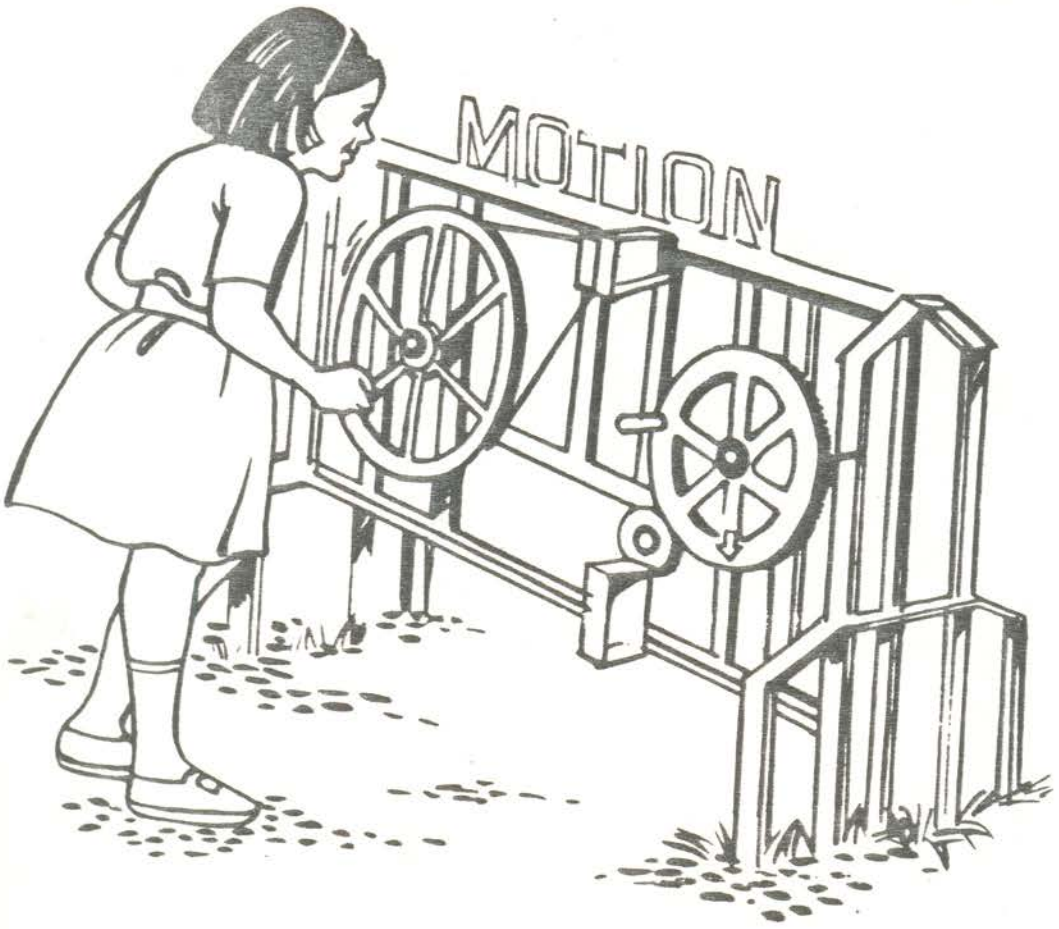


* Sit on one side of the sea-saw and ask your friend to sit on the other side.

* Operate the sea-saw and observe various movements and hear different sounds.

This sea-saw operates a series of levers and cams and moves different parts and creates sound.

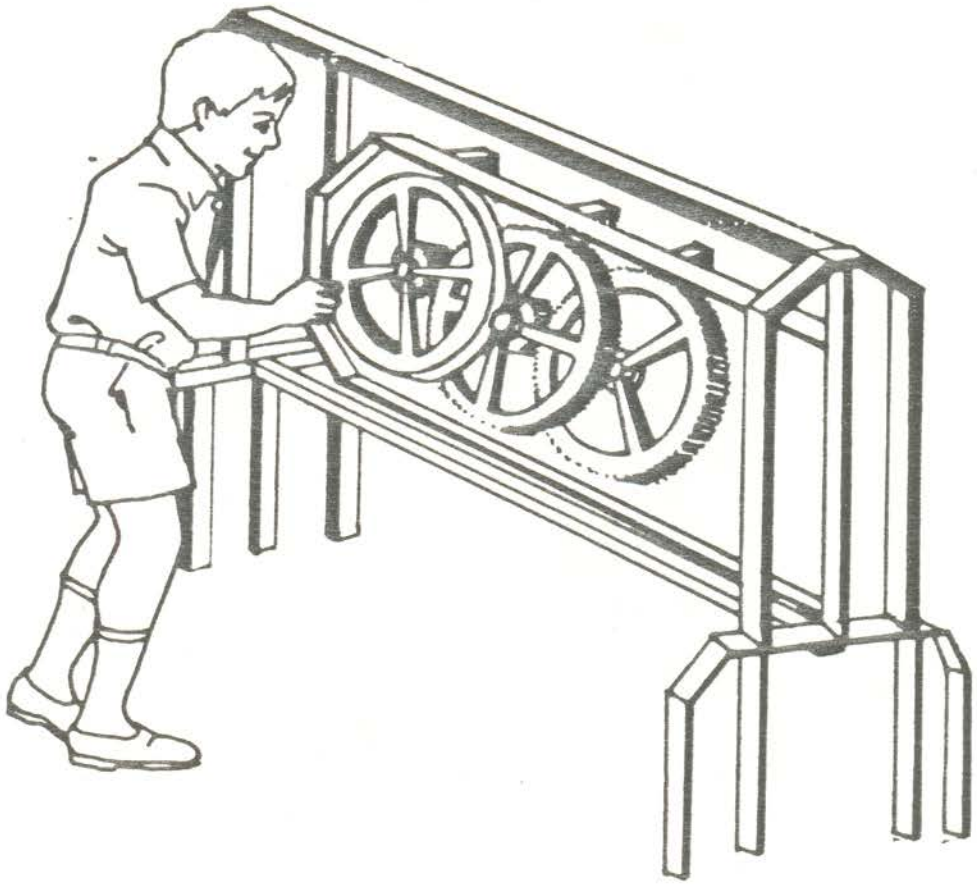
B.7 PULLEY DRIVE



* Give a full turn to the large pulley with the help of the handle.
* Observe number of turns of the small pulley.
* Measure the diameters of two pulleys.
* Observe that the ratio of the diameters is the same as the ratio of the numbers of turn of the pulleys.

Pulleys are used to transmit power from one shaft to the other. By changing pulley diameters, rotational speed can be increased or reduced. Smaller pulleys turn faster than larger pulleys.

B.8 GEAR TRAIN

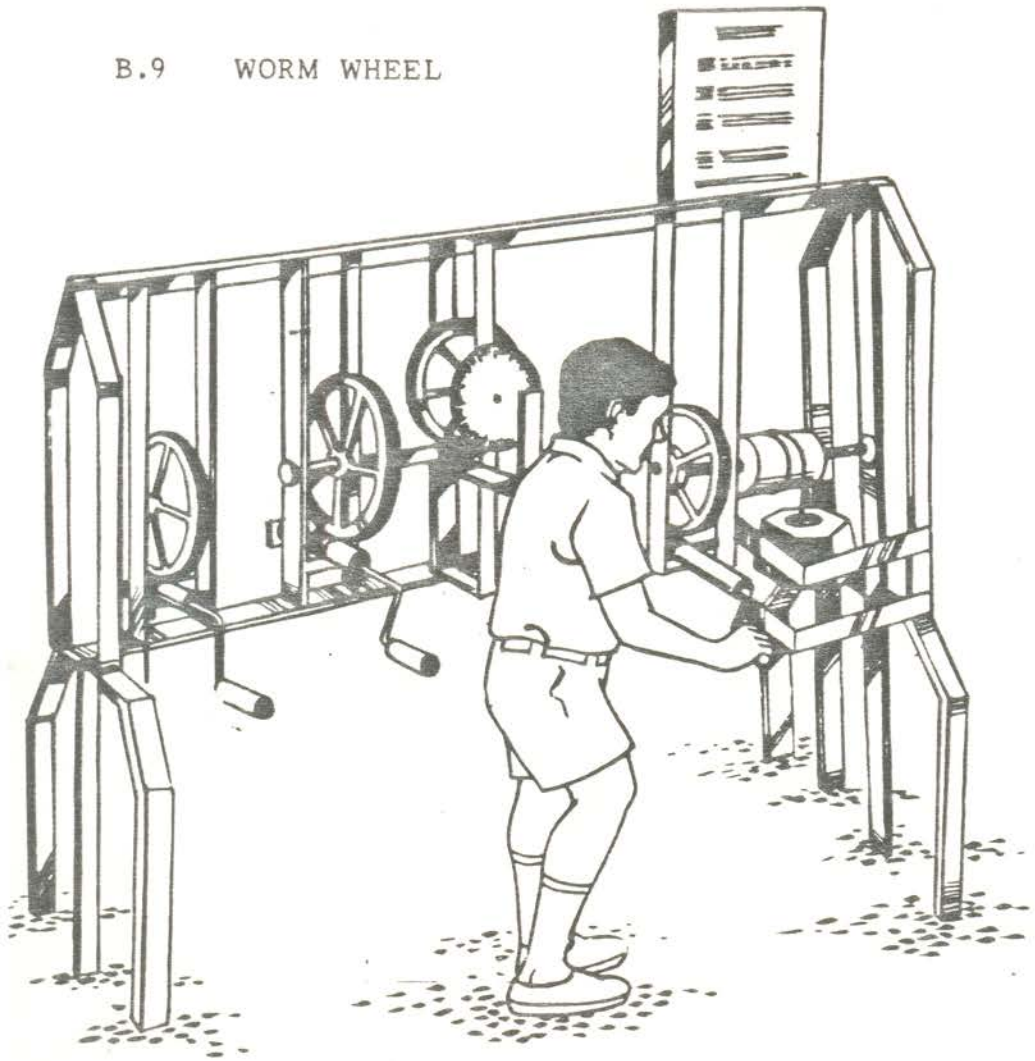


* Turn the small gear by handle and count number of turns required to give a full turn to the adjacent large gear.

* Go on turning and counting until the large gear at the other end makes a full turn.

Gears are used to reduce or increase rotational speed. When you turn a small gear, rotational speed is reduced at large gear. If you turn the large gear, the small gear will turn more.

B.9 WORM WHEEL



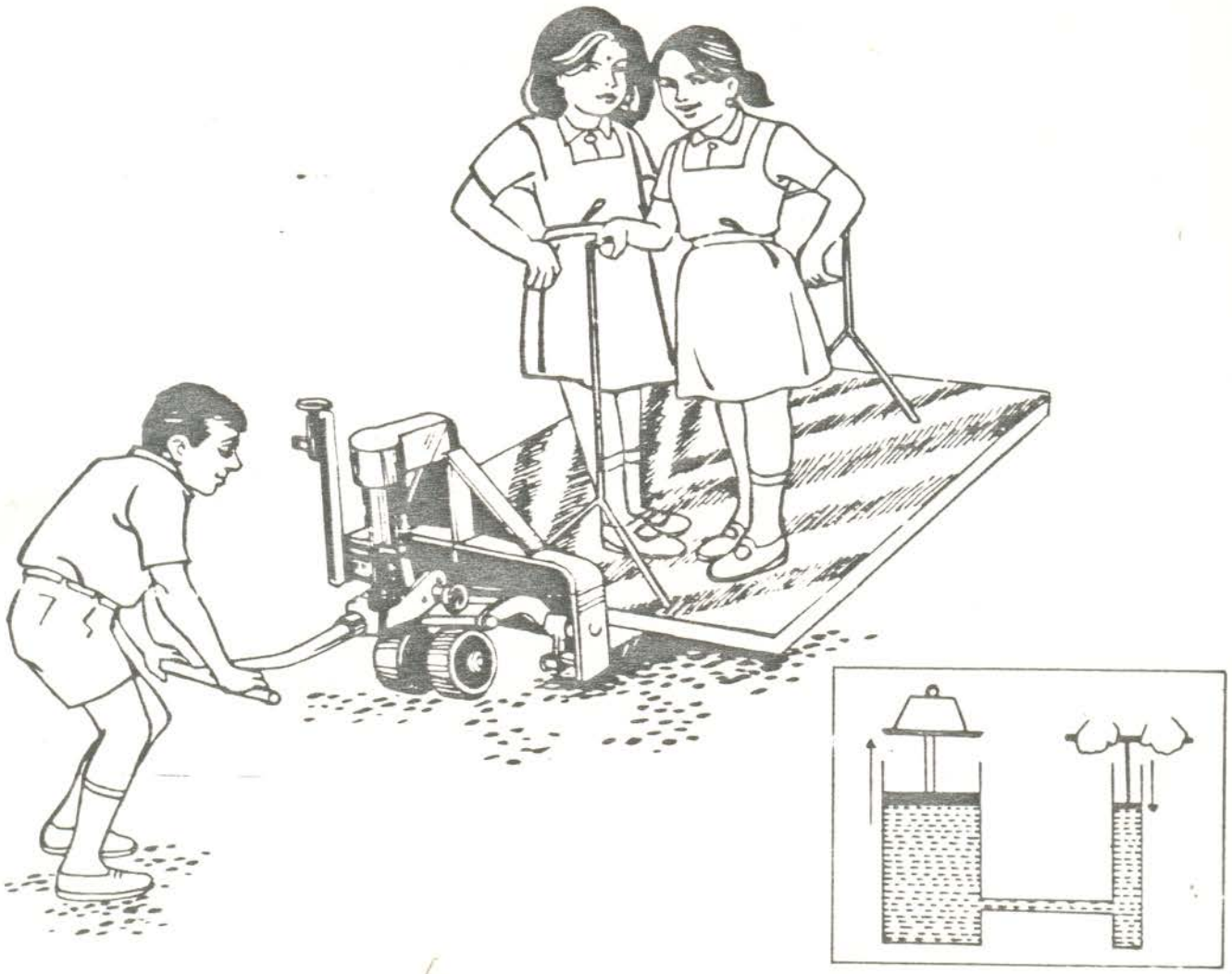
* Continue to turn the handle until the weight is raised to some appreciable height. Then turn handle other way round to lower the weight.

* Feel how easy it is to lift the load with this worm wheel arrangement.

* Also note that you require to give a large number of turns to the handle to turn the gear only once.

Worm wheel combination gives a very large reduction ratio in rotational speed and a very large torque to lift a load.

B.10 HYDRAULIC JACK



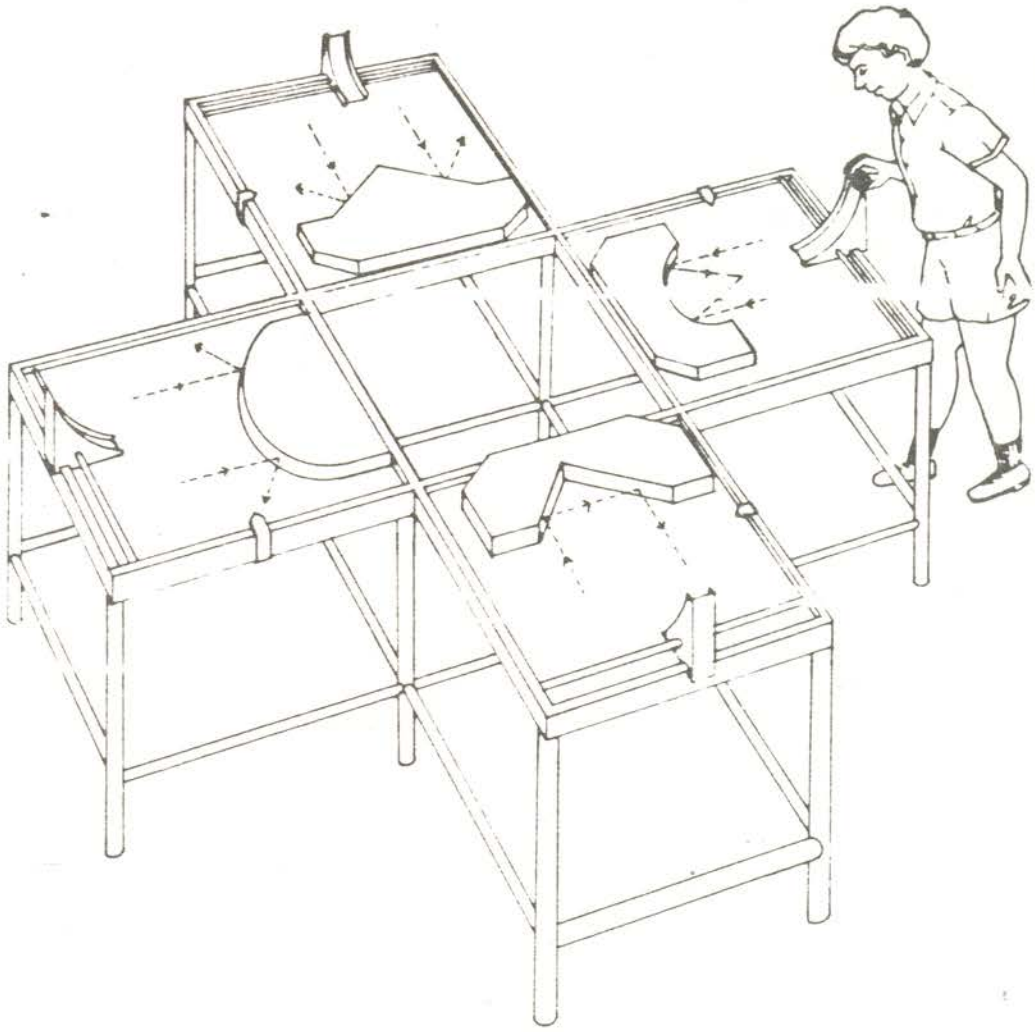
* Ask your friends to stand on the platform.

* Pump the handle of the hydraulic jack to raise the platform along with all your friends.

* Observe how easy it is to lift so many people with so little effort.

* Hydraulic Jack is used to lift a motor-car in a service station. It is also used for pressing things in a hydraulic press.

C.1 BOUNCING BALL GAME



* Roll the ball along the channel and watch its path after bouncing off the wooden surface.
* Slide the channel to other positions and repeat the operation.
* Compare the rebound paths of the ball for four different surfaces given.

By observing the rebound paths of the ball exact shape of deflecting surfaces can be predicted.

4. EXHIBITS

Most of the exhibits in the proposed science park will be hands-on type. All of them will be three dimensional and will offer a number of options for manipulation and prediction to the user. They will be made attractive displaywise and will be fully compatible with the surroundings. The exhibits are proposed to be arranged according to the general groups given below

Group	Area covered in sq. mtr.
a) Evolution of life	1000
b) Earth sciences	2000
c) Life sciences	5000
d) Physical sciences	5000
e) Water body exhibits	4300
f) Weather forecasting	1000
g) Energy corner	1000
h) Original artefacts	1000
i) Supplementary exhibits	2000
j) Open air theatre	1000
k) Picinic area	1000
l) Visitors facilities	1000
m) Pathways	4100
Total:	29400

5. ACTIVITIES

The proposed Science Park will not be a passive fairground. Visitors will themselves generate and take part in a number of activities related to science education. In fact, it is expected that everyday there will be one or other participatory activities conducted inside the science park by visitors themselves. The following are the suggested activities:

a) Science Drama

School children and amateur groups will stage science dramas and science jatras in the open air theatre. There may be annual competition among the school and amateur groups and suitable prizes may be distributed.

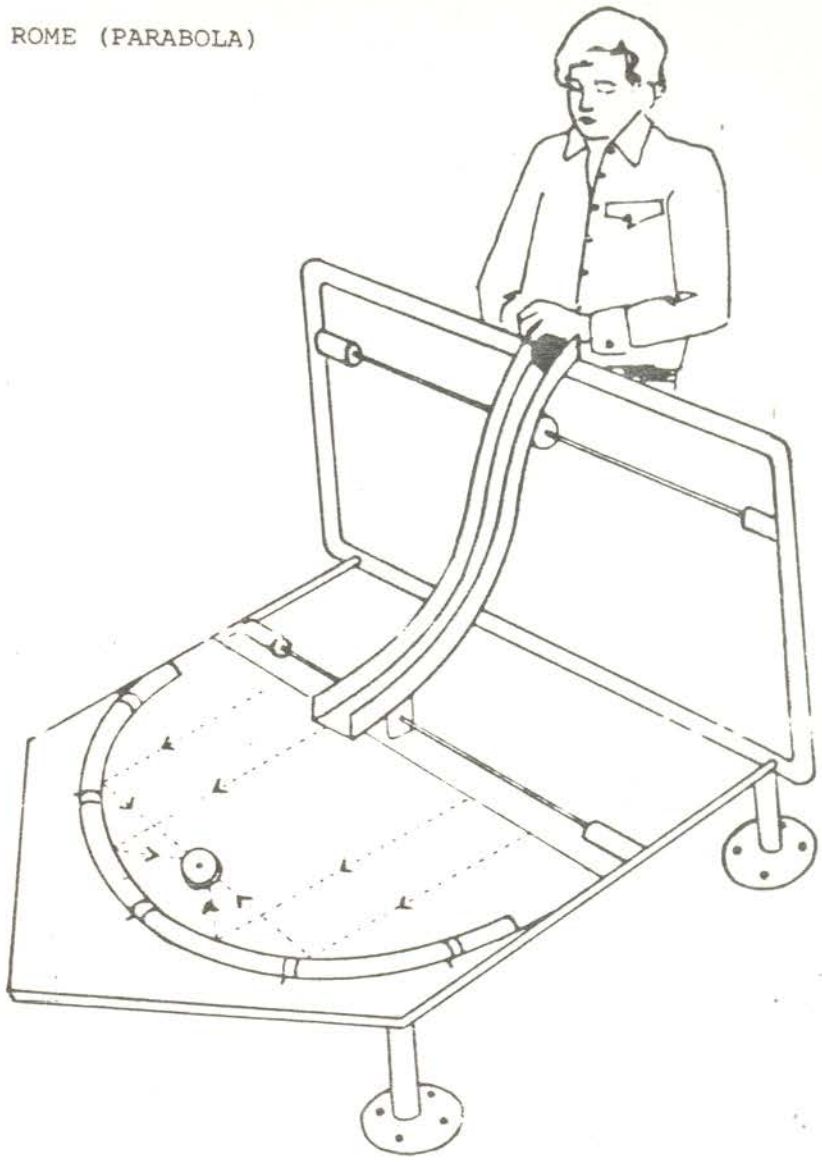
b) Popular Lectures

Eminent persons in S&T fields may be invited to deliver popular lectures on various topics.

c) Science Clinic

A small laboratory may be set up where the visitors may perform some testing and simple experiments under suitable guidance

C.2 ALL ROADS LEAD TO ROME (PARABOLA)

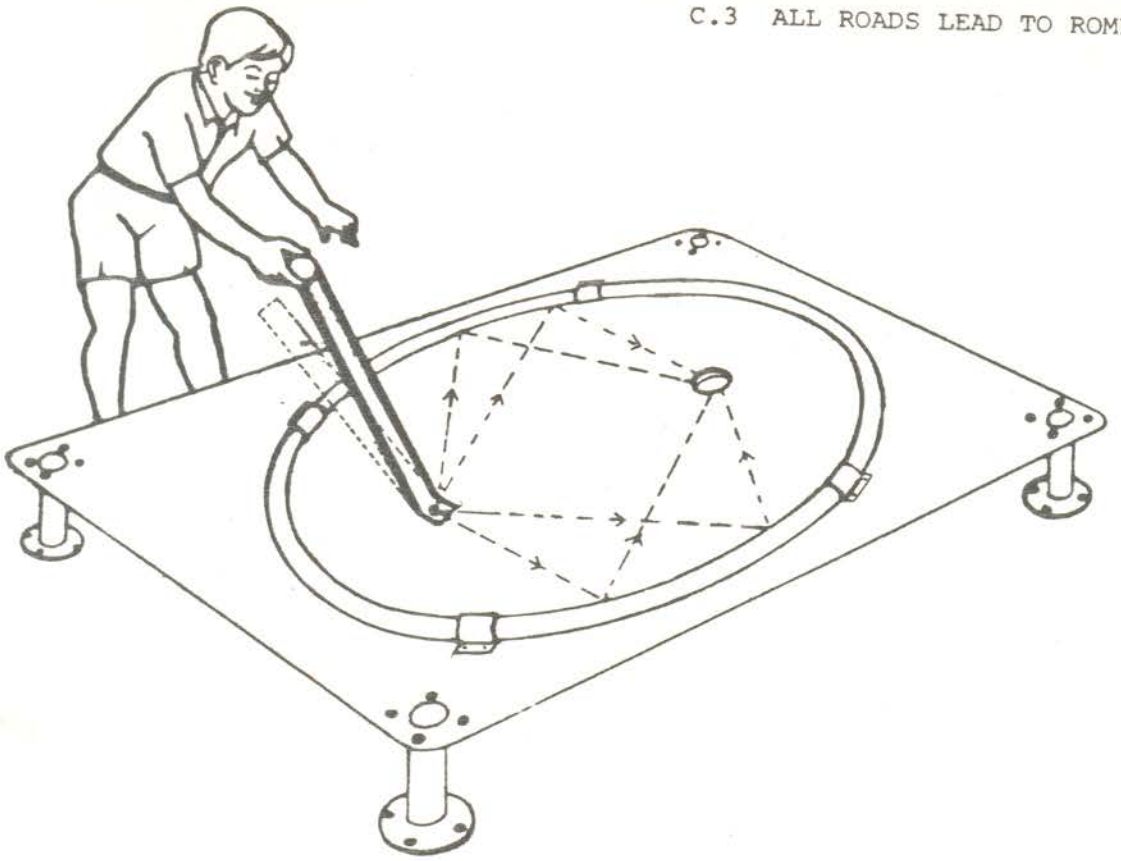


* Roll the ball along the channel at different positions.

* Watch that it strikes the bell everytime after bouncing of the curved pipe.

The pipe is bent in the form of a parabola with the bell at its focus. The experiment shows that parallel beams incident on a parabolic surface converge at its focus.

C.3 ALL ROADS LEAD TO ROME (ELLIPSE)

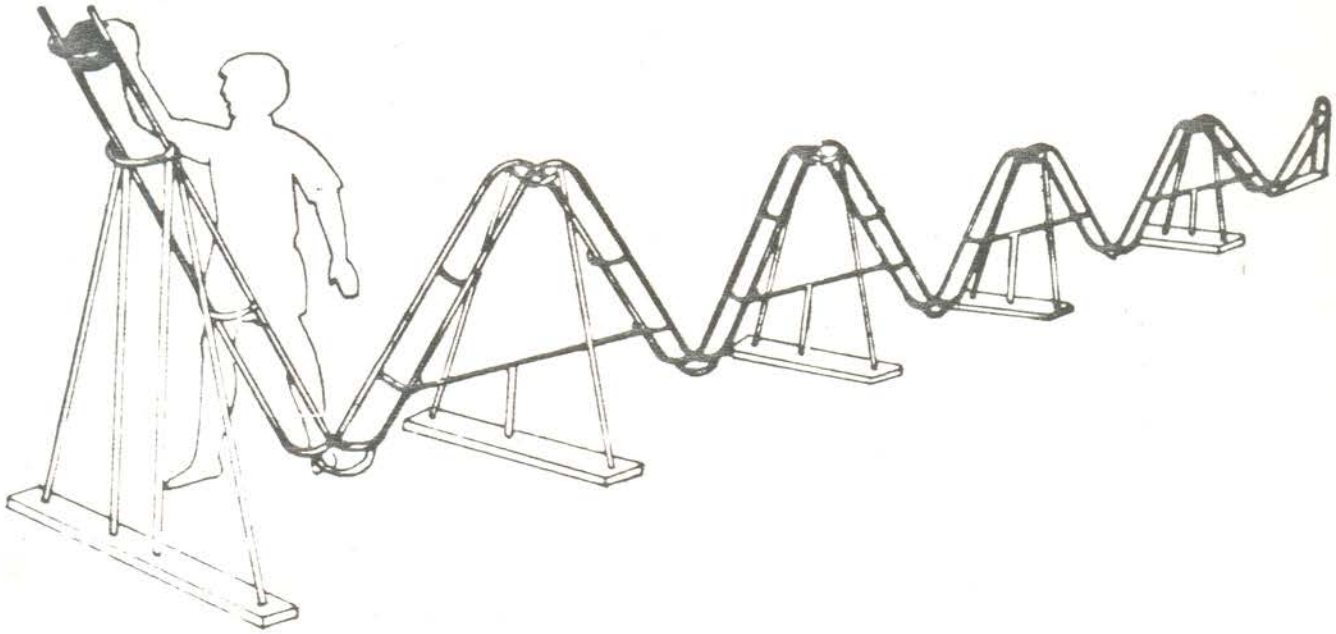


* Roll the ball down the channel at different directions.

* Observe that it falls into the pocket at the other end everytime after bouncing off the curved pipe.

The pipe is bent in the form of an ellipse. It has two focil - one at the point where the ball leaves the channel and the other at the pocket. This experiment shows that beams originating from one focus of an ellipse and incident on its surface converge at the other focus.

C.4 ROLLER COASTER



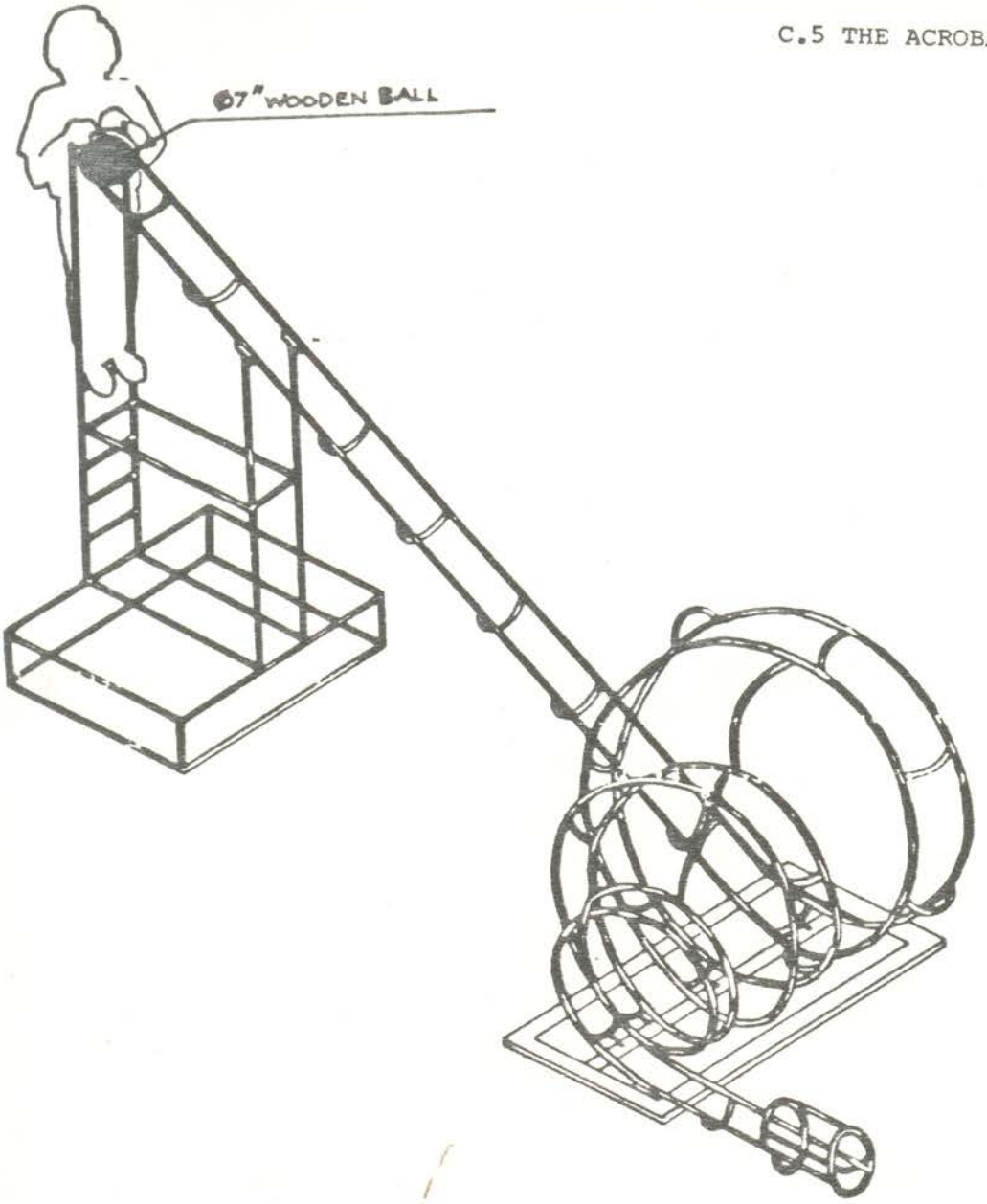
* Release the ball from the highest point. It may bounce off the track.

* Release it from some lower point until it passes over all humps.

* Release it from a further lower point. It fails to cross the first hump.

The ball needs an optimum velocity which gives it kinetic energy to glide over humps. Velocity depends on the height from where it is released. While moving, the ball loses energy due to friction. Hence heights of humps are gradually diminished to allow the ball to roll.

C.5 THE ACROBATIC BALL



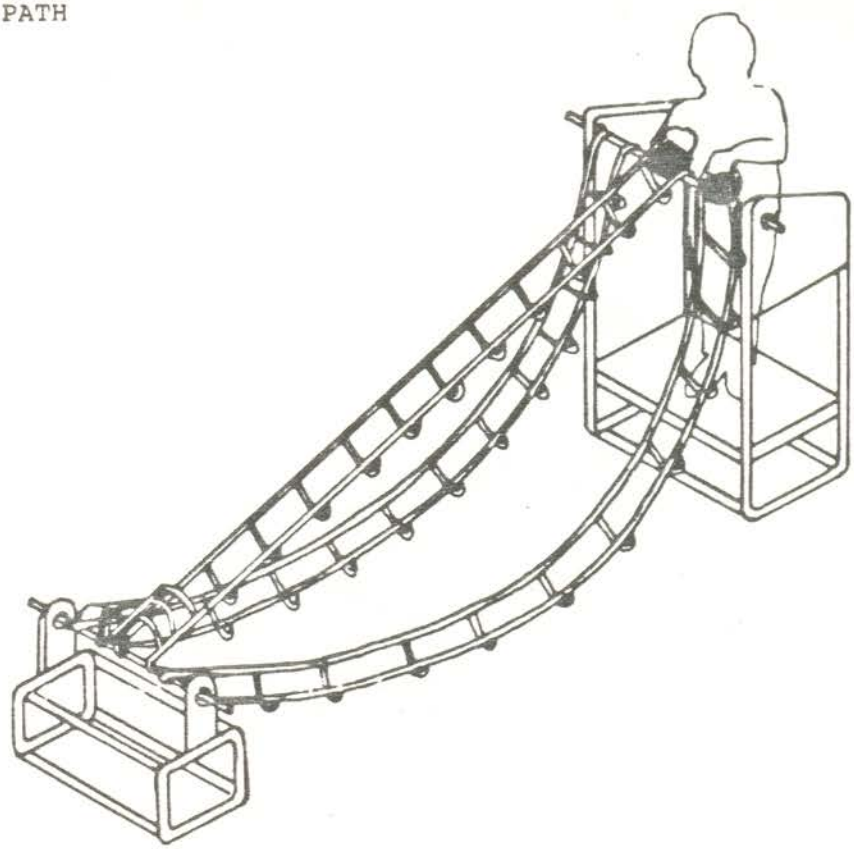
* Release the ball from the topmost point. It rolls through all the loops.

* Release the ball from a lower point. It falls down in the loop.

* Push the ball down from the top point. It may fall down in the loop.

The ball released from top acquires a velocity which gives it a centrifugal force. This force tends to push it outward in a curve. Hence it does not fall. When released from a lower point, the velocity and the centrifugal force is insufficient to push it out. When pushed from top, the ball does not roll, but slides down and falls to attain required velocity.

C.6 MINIMUM TIME PATH



* Take two balls on top of any two paths.

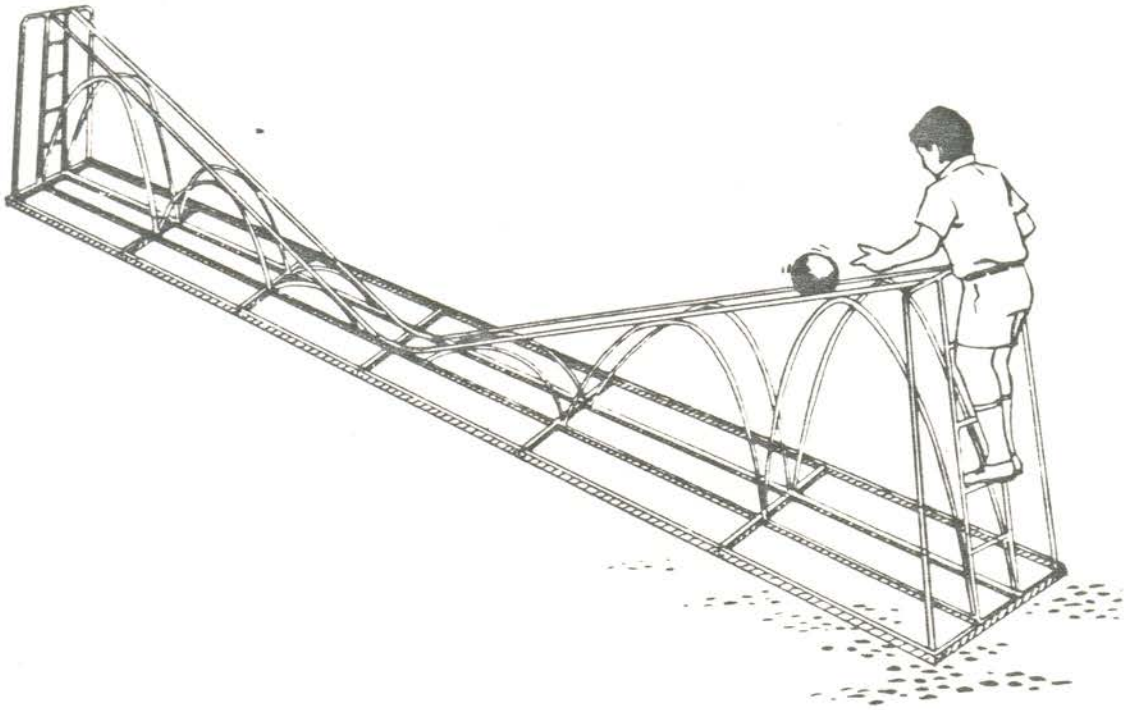
* Release two balls at the same time and observe that one ball comes down faster than the other.

* Repeat this with other pairs of paths.

* Observe that in all cases the ball rolls down faster along a particular curved path.

  This particular path is called a cycloid. All objects come down fastest under gravitational pull through a cycloid even though the shortest path is a straight line.

C.7 ROLLING AND SLIDING



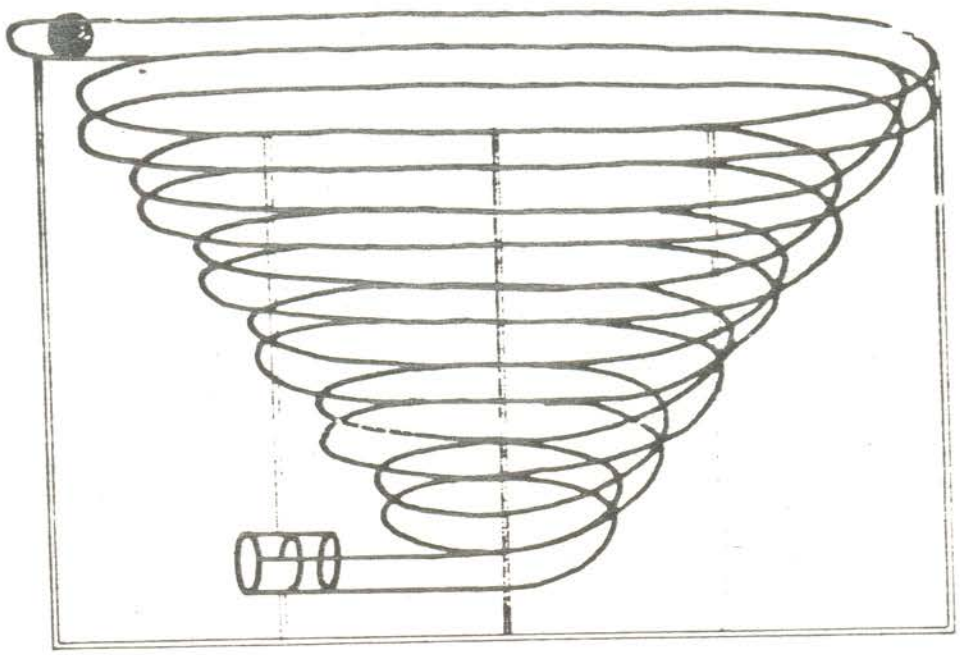
* Take any ball from the basket, place it on the top position of the channel and release it.

* Note whether the ball rolls or slides or hops on the channel. Guess why?

* Identify which ball rolls down with constant velocity. Can you find out the reason?

All balls are partially filled either with grains, sand, water or solidified wax. The ball with an optimum quantity of sand makes it travel with constant velocity. With more sand or grain the ball tends to slide. The ball partially filled with wax either slides or hops depending on how you roll it. The ball filled partially with water behaves like a normal ball.

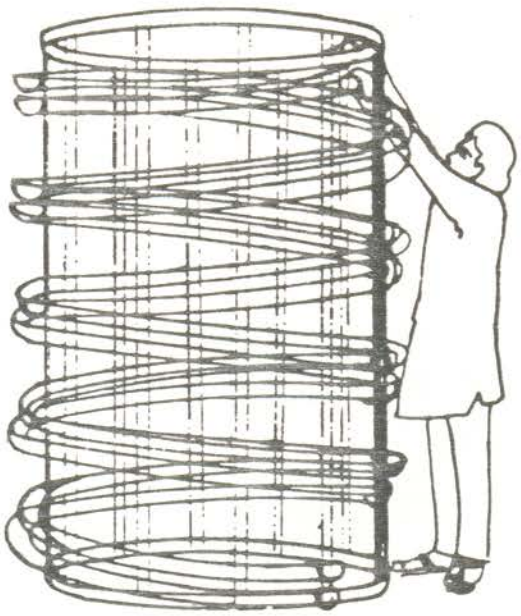
C.8 GRAVITY WELL



* Release the ball from the top position of the spiral channel.

* Observe that the ball travels faster when it comes closer to the centre.

Planets round the Sun or satellites round the earth moves faster when it comes closer to the earth.



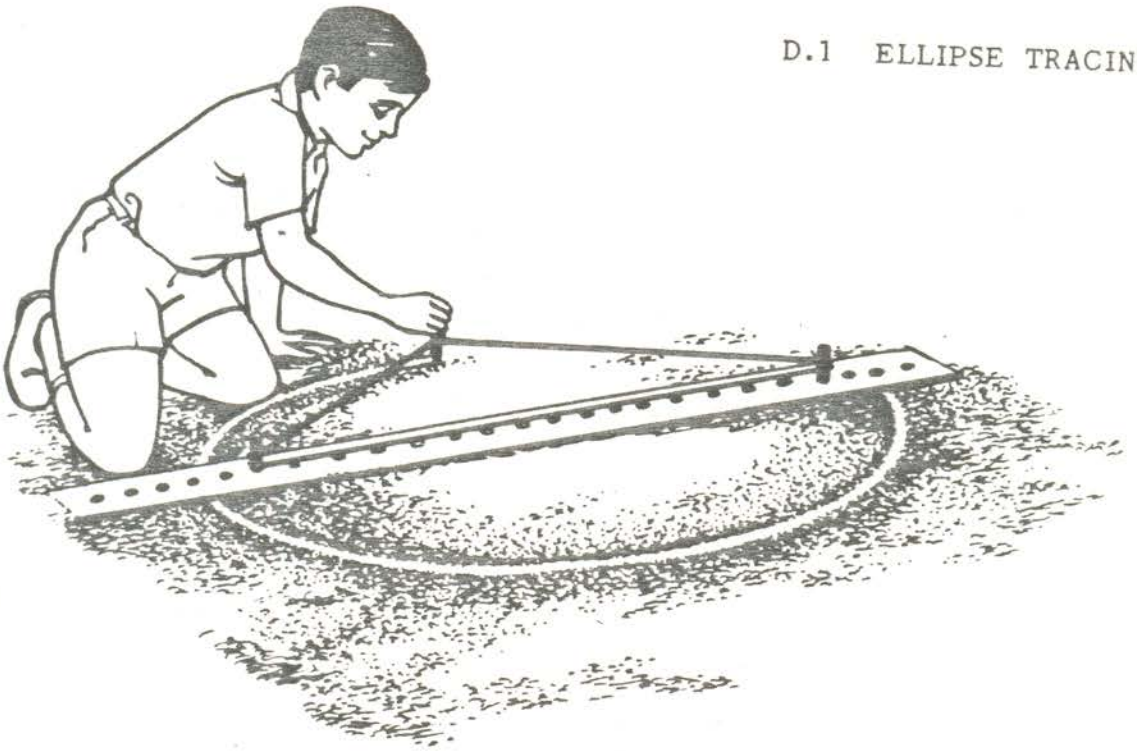
* Take two balls to the top of the channels and release them simultaneously.

* Observe that one ball rolls down faster and faster, accelerated by the gravitational force.

* Also note that the other ball rolls down at a constant velocity. Can you guess why?

In a free fall all bodies will accelerate under gravitational force. The ball moving with constant velocity is partially filled with sand. The quantity of sand is controlled in such a manner that the friction compensates acceleration.

D.1 ELLIPSE TRACING



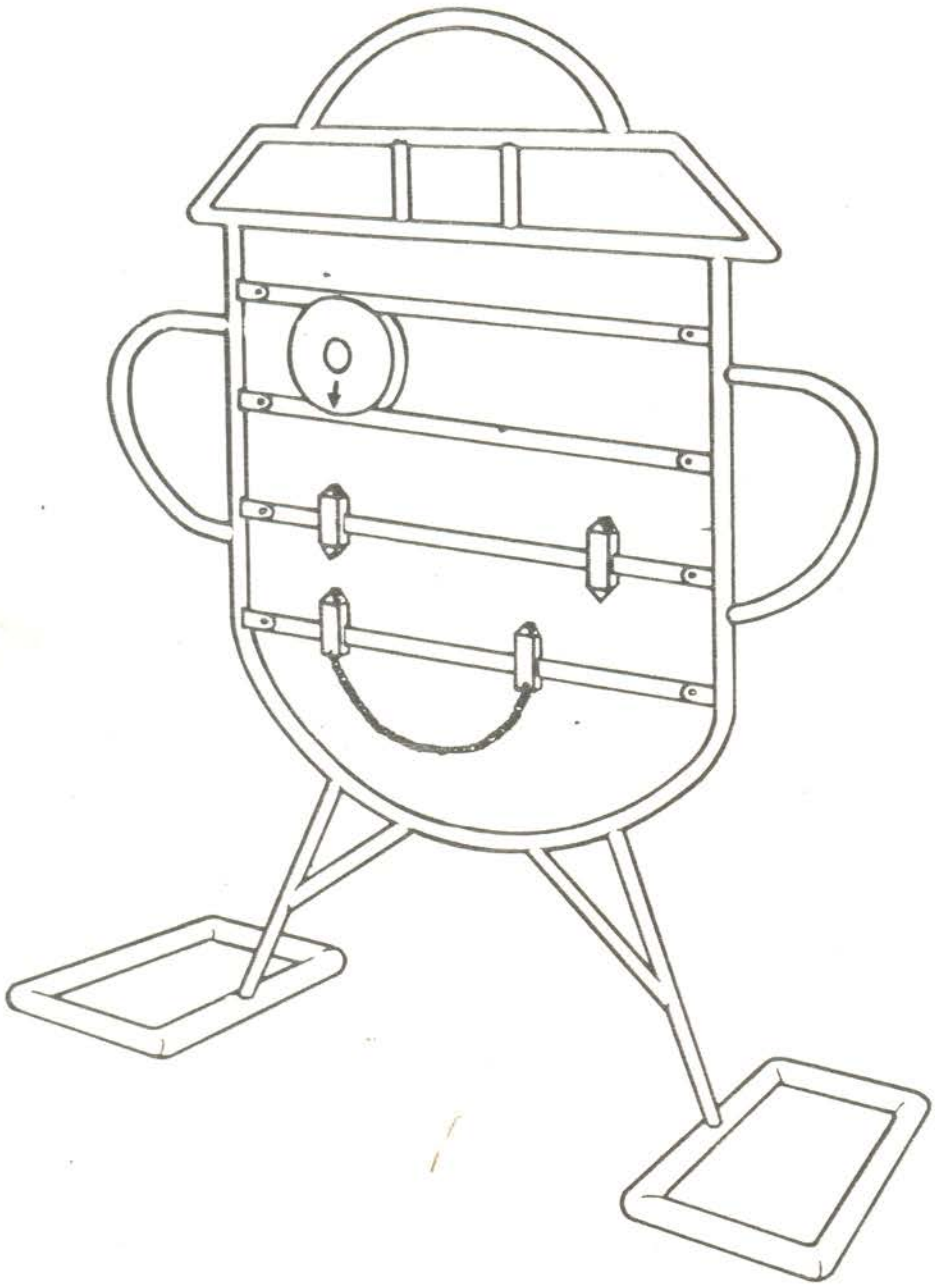
* Insert two pins fixed with two ends of a rope into any two holes.

* Hold the stylus in your hand so that its bottom end gets embedded in sand.

* Move the stylus around the flat plate and observe that an ellipse is being traced.

* Insert the two pins in two other holes and repeat the tracing. An ellipse of different size will be drawn.

D.2 GUESS THE LENGTH



* Guess the length of the hanging chain and set this length by moving the righthand pointer.

* Verify your guess by straightening the chain.

* Similarly guess the perimeter of the disc and set it between pointers.

* To verify your guess bring the arrow mark on the disc just over the left pointer and roll the disc till the arrow points downward again.

The curve made by a hanging chain is called a catenary. You see it in hanging bridges. The curve traced by the arrow point when the disc is rolled is called a cycloid.

d) **Science Film Show**

This may be a regular feature in the open air theatre during evening hours.

e) **Pet Club**

A pet club may be introduced so that exchange of pet animals and observation of their behaviour may be ecouraged.

f) **Reference Library - Popular Science books, journal and kits**

A reading library for science enthusiasts may be added.

g) **Training programmes**

Regular training programmes may be held for school children, teachers and interested public on different science and technology fields.

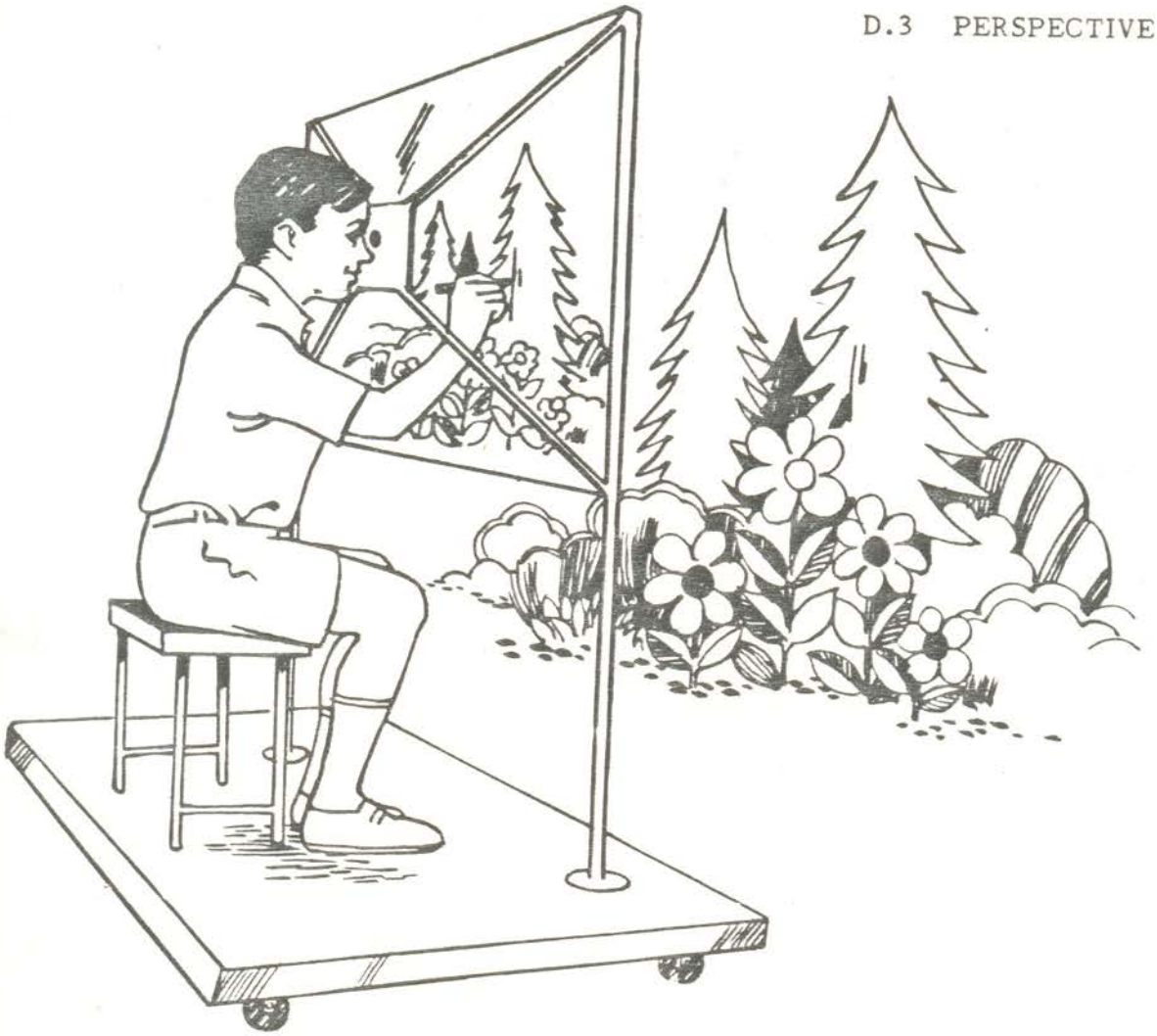
6. PERMANENT STRUCTURES

The proposed science park will have no massive structures at all. For housing live animals, putting up service facilities and for administrative offices, artistically designed huts, kiosks and architecturally interesting structures will be built so that they become fully compatible with the landscape.

7. EXHIBIT DETAILS AND THEIR COST (including cost towards land development)

		No Off	Cost (Rs. in lakh)
a)	**Evolution of Life**		
i)	Evolution of life tree	1	0.50
ii)	2 Dinosaurs placed in a Paleozoic forest 12Mx12M	1	4.00
iii)	Fibreglass models of early man	1 set	2.00
b)	**Earth Sciences**		
i)	Large Rock garden showing mineral strata in large rocks - 8Mx8M		3.00
c)	**Life Sciences**		
i)	Large aviary with 15M diameter Geodesic dome with 150 birds	1	2.00

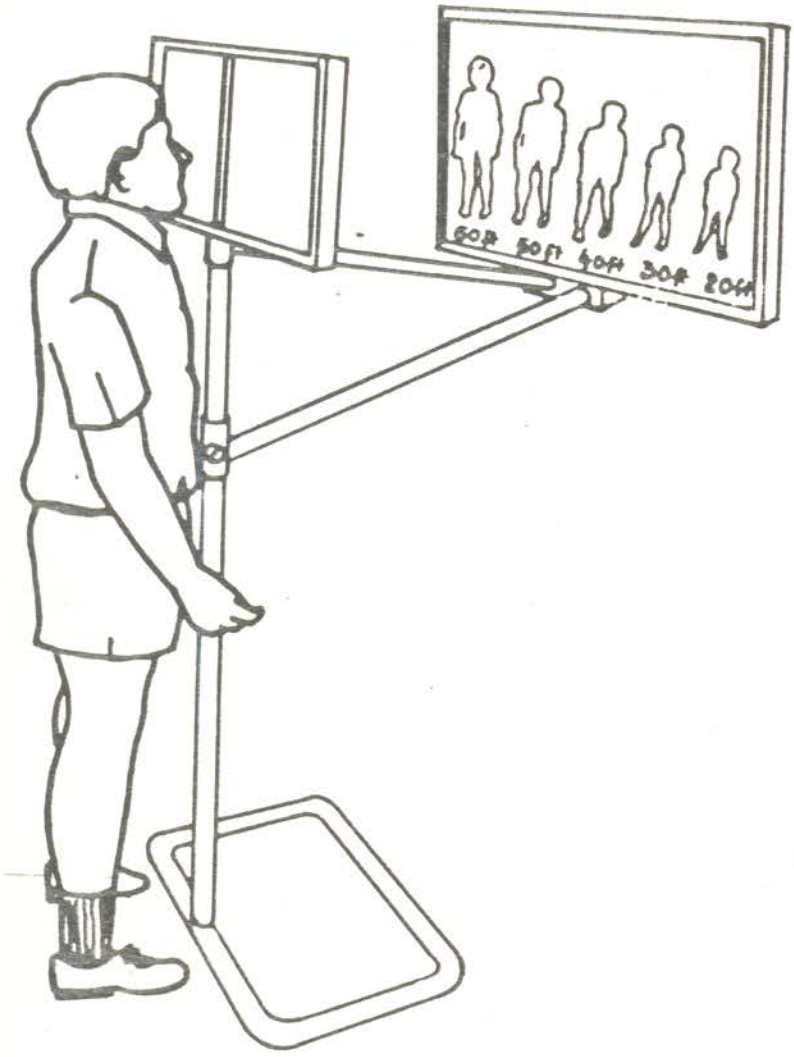
D.3 PERSPECTIVE DRAWING

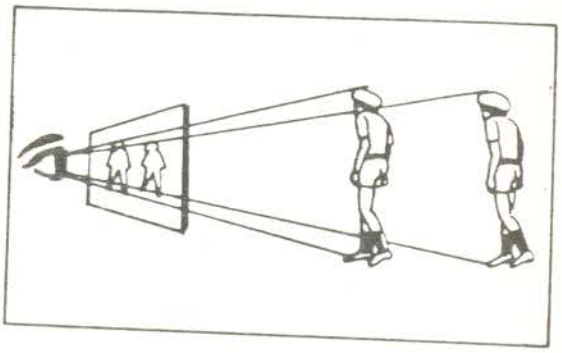


* Look through the central hole, hold a chalk in your hand and place it on the glass coinciding with a particular point of a tree or any other object.

* Move the chalk on the glass tracing the outline of your selected object. You get a nice drawing.

D.4 SIZE AND DISTANCE





* Ask your friend to stand at a distance facing you.

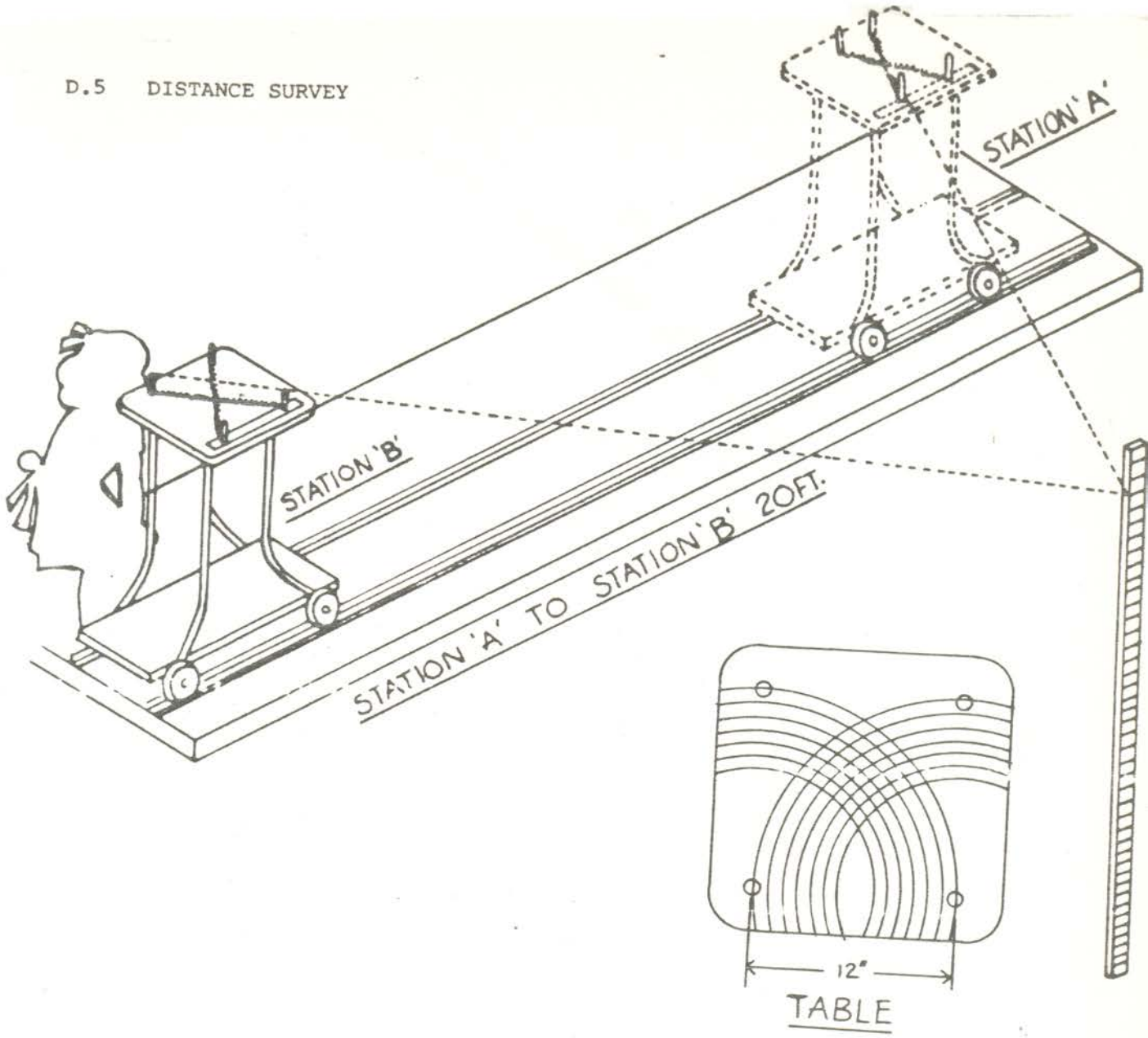
* Look through the narrow slit cut on the front plate of the exhibit.

* Rotate the extended arm slowly till your friend appears to just completely fill up one of the openings in the shape of human figures.

* The number below this particular opening gives you the distance in feet of your friend from you.

The distance is related to the size of the opening by the laws of similar triangles. The further is your friend, the smaller is the opening.

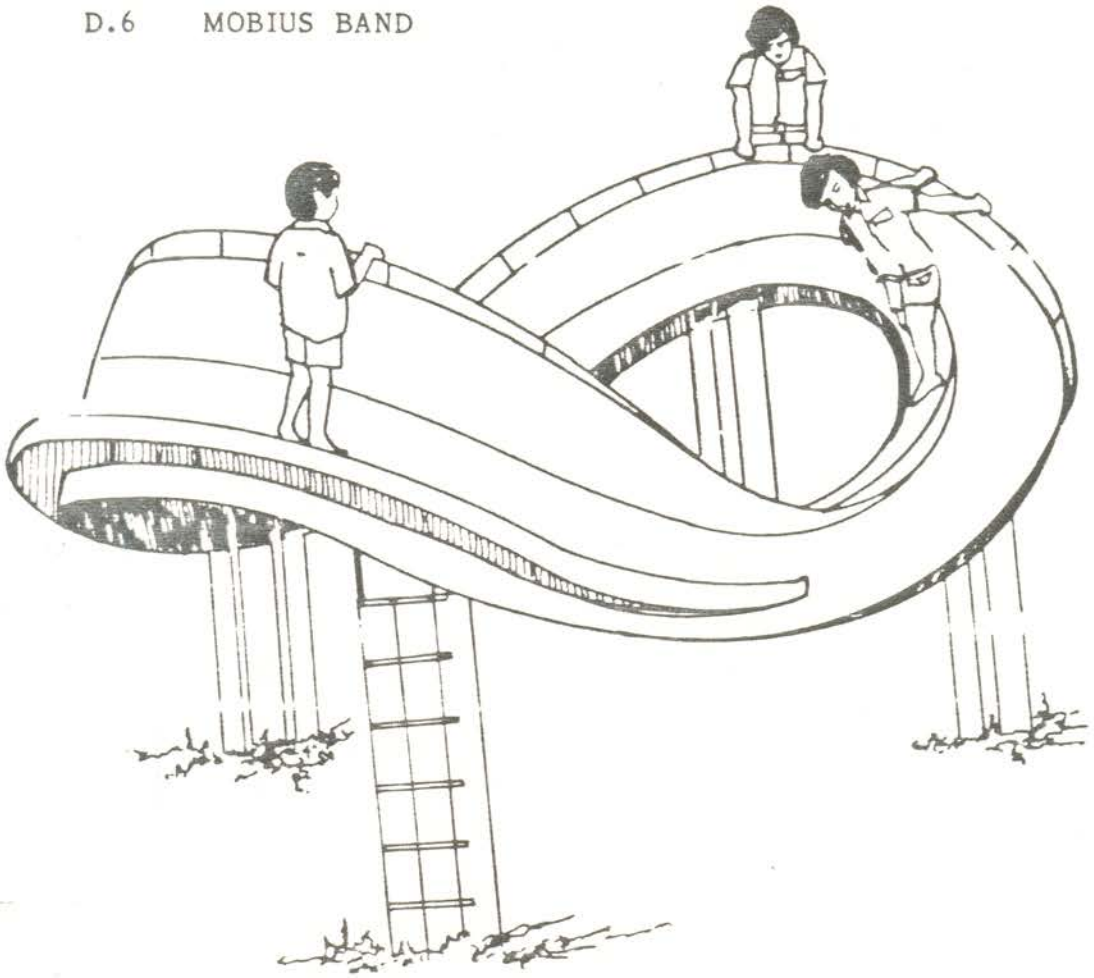
D.5 DISTANCE SURVEY



* Take the trolley to station 'A' on your left.
* Place one eye close to the fixed pin on left of the top plate.
* Move the sliding pin to bring your eye, both pins and the distant object in a straight line.
* Keep the sliding pin in this position.
* Move the trolley to station 'B' on your right.
* Place one eye close to the fixed pin on right of the top plate.
* Move the other sliding pin to bring your eye, both pins and the distant object in a straight line.

The point of intersection of the two springs gives you the distances of object from the stations A & B.

D.6 MOBIUS BAND



* Walk along this band by holding the rails.

* Observe that you will come back to the same spot after traversing both sides of the band.

In a normal band you can walk along either the inner side or the outer side. Mobius band is a very special figure in which you can walk along both sides at a stretch.

D.7 WORLD CLOCK

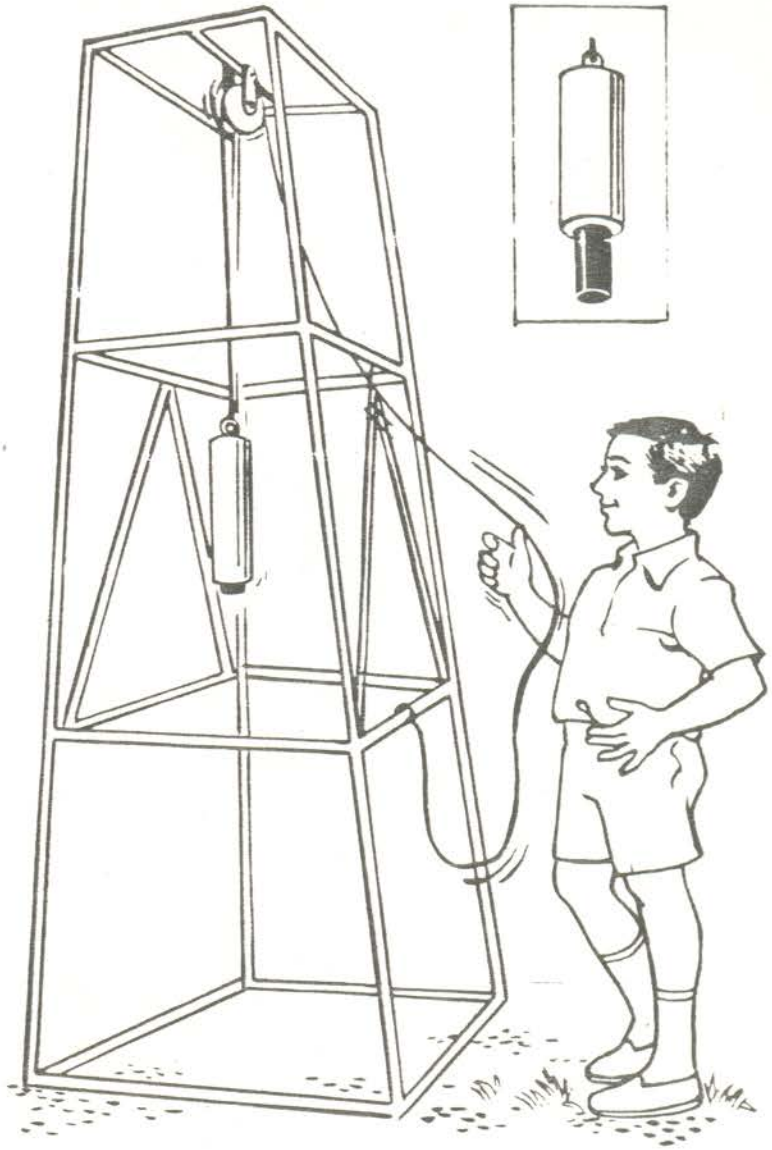
* Turn the horizontal plate to a position where one of the hour marks coincides with a vertical line on the world map passing through an important city. The particular hour mark shows the time in this city.

* Walk around the map and read the local time of any other city or place.

* Repeat the experiment with another time set for the first city chosen by you.

The map is divided into 24 equal parts by the vertical lines. The time difference between two successive lines is one hour. As the earth rotates on its axis once in approximately 24 hours, different parts of earth have different times of the day.

E.1 WEIGHTLESSNESS



* Pull the rope and raise load to the top.

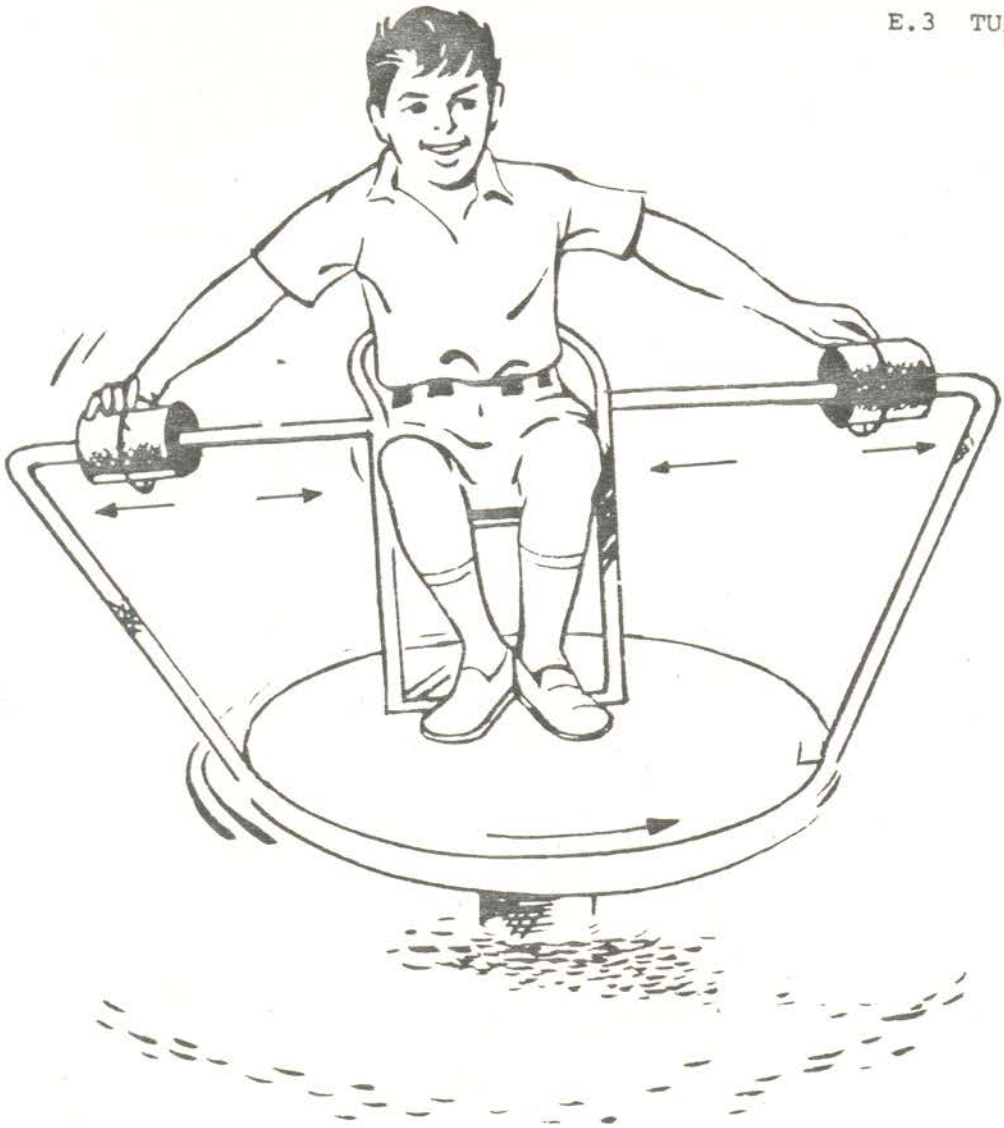
* Observe that the load is hanging from a tubular body upto a red mark on it.

* Release the rope suddenly.

* The load partially moves into the tubular body and the red mark disappears. Why?

The load is hung inside the tubular body by a spring. When you suddenly release the rope the load falls freely and becomes weightless. The spring pulls it into the tube.

E.3 TURN FASTER



* Sit on the chair.

* Push the weights away at your full arm lengths and hold them by your hands.

* Ask your friend to give you a gentle turn.

* While rotating bring both weights close to you - you will turn faster.

* Again push away the weights and you turn slower. Do this several times.

Angular momentum depends on mass, angular velocity and radius. If the radius is decreased by pulling the weights closer to the centre, the angular velocity will increase.

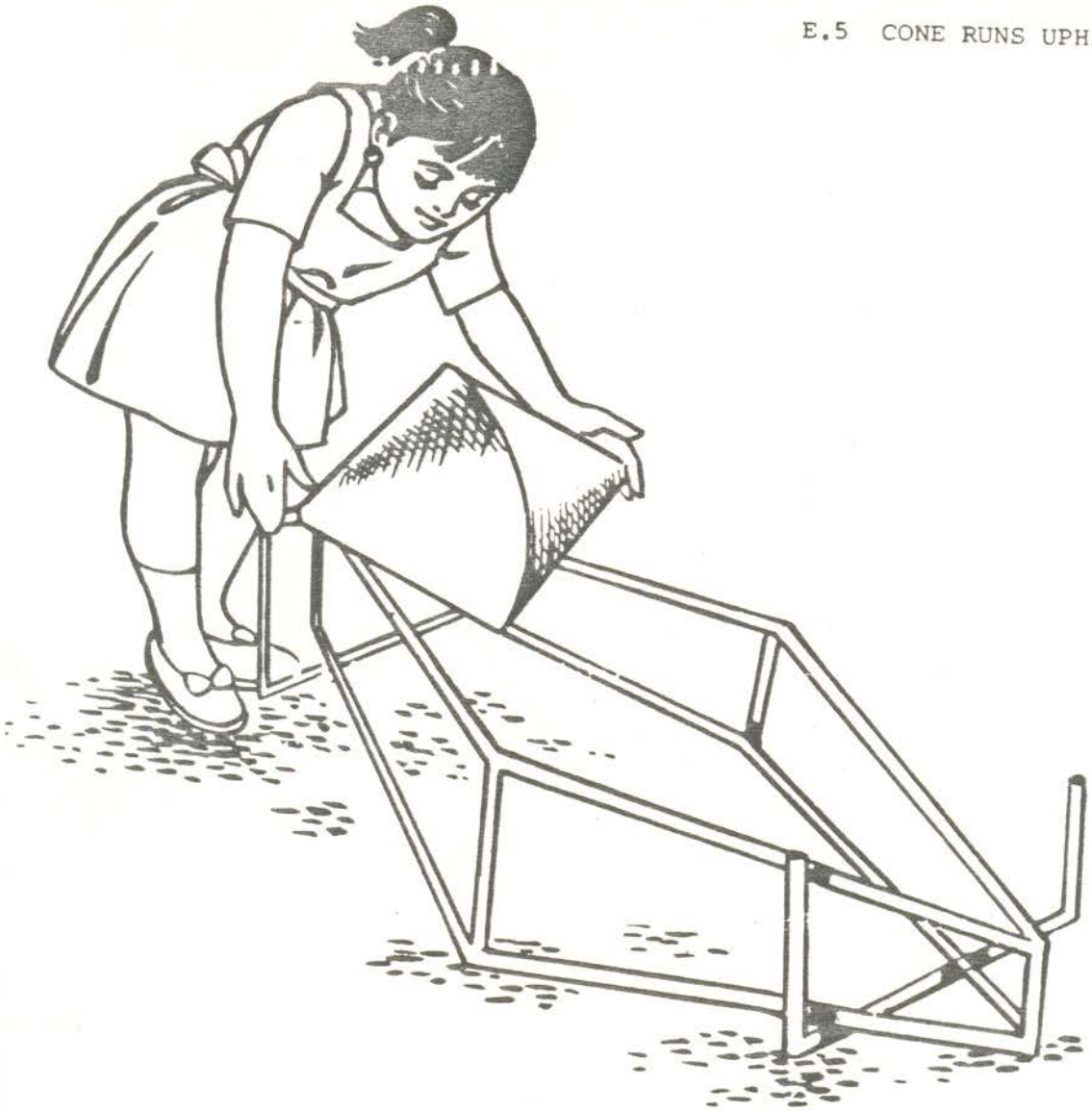
E.4 ACTION AND REACTION

* Sit on the bench and turn the umbrella slowly by turning the central pole.

* Observe that your platform turns in the opposite direction.

Every action has an equal and opposite reaction - says Newton's third law of motion.

E.5 CONE RUNS UPHILL



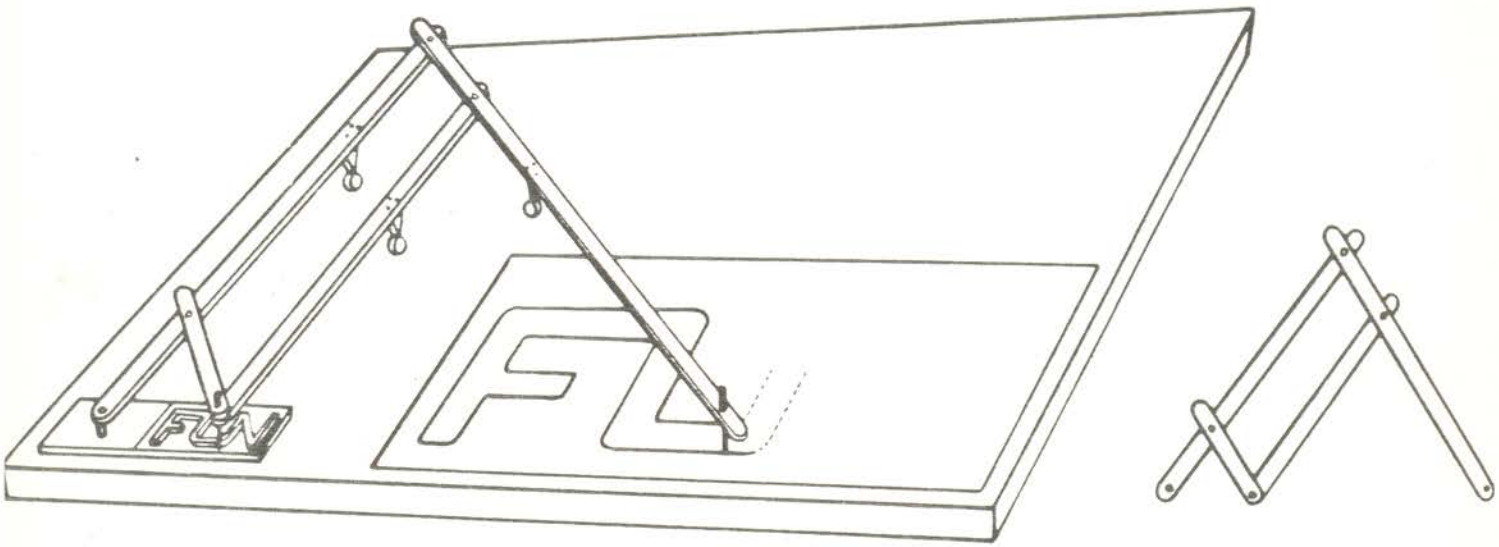
* Place the double-ended cone at the lowest point on inclined rails and release it.

* It goes up, makes a few oscillations and finally rests at the highest point on rails.

* Does it defy laws of gravity ?

A free body always seeks a position when its centre of gravity goes down. From the diagram it is obvious that the centre of gravity of the double ended cone, which is on its rotational axis, assumes the lowest position at the uppermost point on the rails.

E.6 BLOW IT UP (PANTOGRAPH)

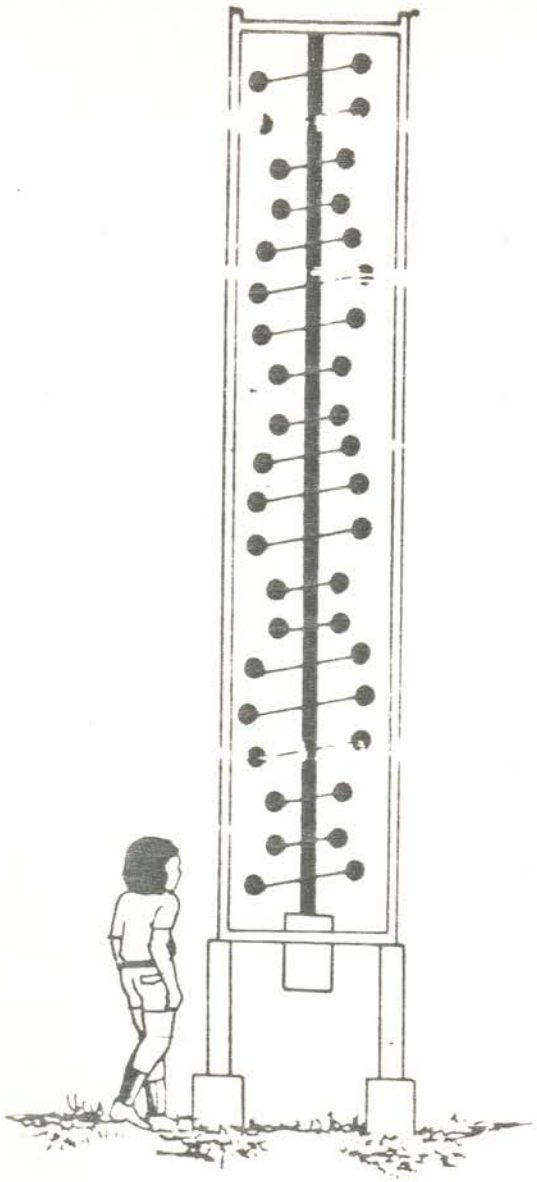


* Move the stylus on the word 'fun'.

* Observe that the pointer at free end traces the same word in a larger scale.

Pantograph linkage mechanism is extensively used in copying figures in a reduced or magnified scale.

		No Off	Cost (Rs. in lakh)
ii)	Small Aviary with 3.6M diameter dome with 20 birds	2	0.60
iii)	Monkey cage 6M diameter dome with 3 monkeys	1	0.60
iv)	Rabbit enclosure 6M diameter dome with 40 rabbits guinea-pigs	1	0.60
v)	Deer enclosure with 2M high	1	2.00
vi)	Insect Corner 4Mx4M	1	0.50
vii)	Cactus and bonsai Corner 4Mx4M	1	0.30
viii)	Terrestrial telescopes for bird watching	5	0.20
ix)	Pet Corner	1	1.50
d)	**Physical Sciences**		
i)	On Mathematics	10	1.50
ii)	Pendulum	8	1.20
iii)	Rolling balls	10	1.50
iv)	Work & effort	10	1.50
v)	Mechanics	8	1.20
vi)	Sound	5	0.75
vii)	Optics	5	0.75
e)	**Water body exhibits**		
i)	Shallow water bodies $25M^2$ each	6	1.20
ii)	Paddle boats in large water bodies	6	1.20
iii)	Musical fountain	1	1.00
iv)	Water wheels	1 set	0.15
v)	Water jet games	2	0.30
vi)	Remote control boat	2	0.20
vii)	Water raising devices	6	0.60



E.7 WAVE MOTION

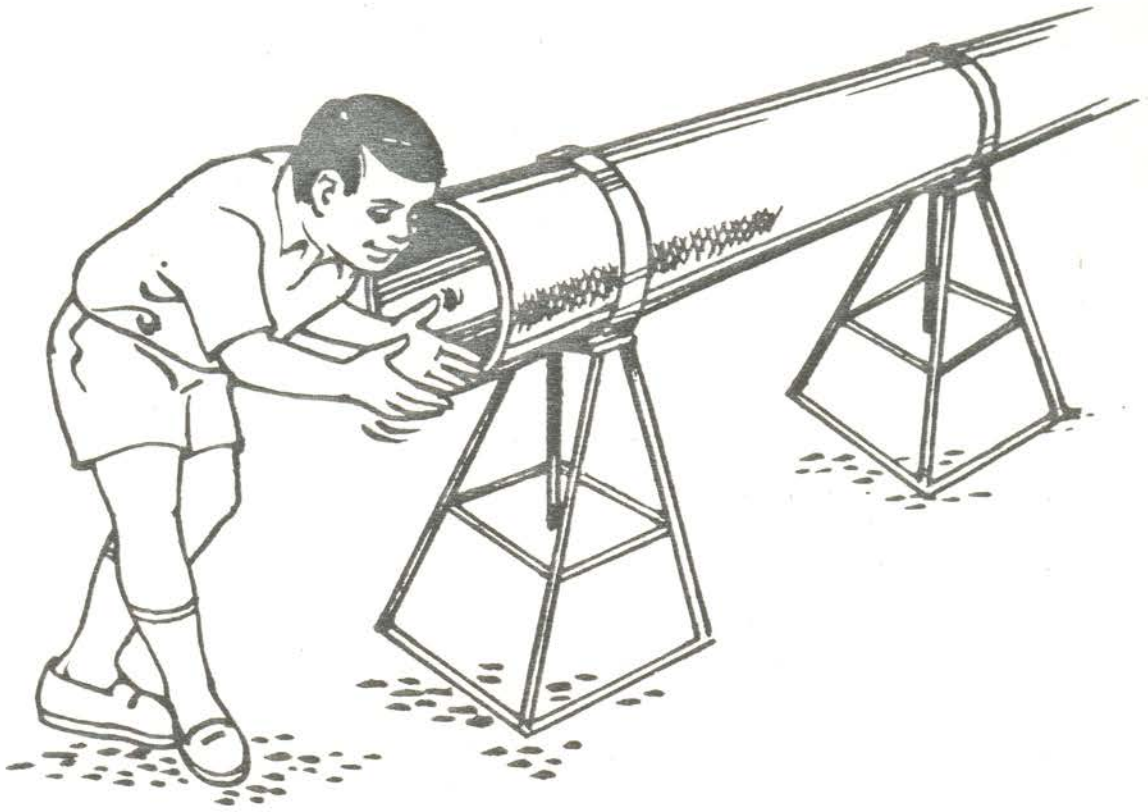
* Rotate one of the lowermost balls partly and release it.

* Watch the wave form as it rises up and reaches the top.

* Observe how the rising wave from the bottom interacts with the bounced-back wave from the top thus changing the wave form.

The central strip is made of a flexible material with its top end fixed. It is twisted back and forth as you rotate the lowermost ball and release it. This gives torsion in the strip which is manifested into a wave form by the movement of balls.

F.1 ECHO TUBE



* Bring your mouth inside the tube and say Hello !

* You will hear a distinct echo.

* Similarly clap once and hear several echoes.

Sound waves travel through the tube at about 330 mt per second and come back reflected from the other end. You can distinguish an echo if the reflected sound arrives at your ears at least one-tenth of a second after the original sound.

F.2 WHO SPEAKS

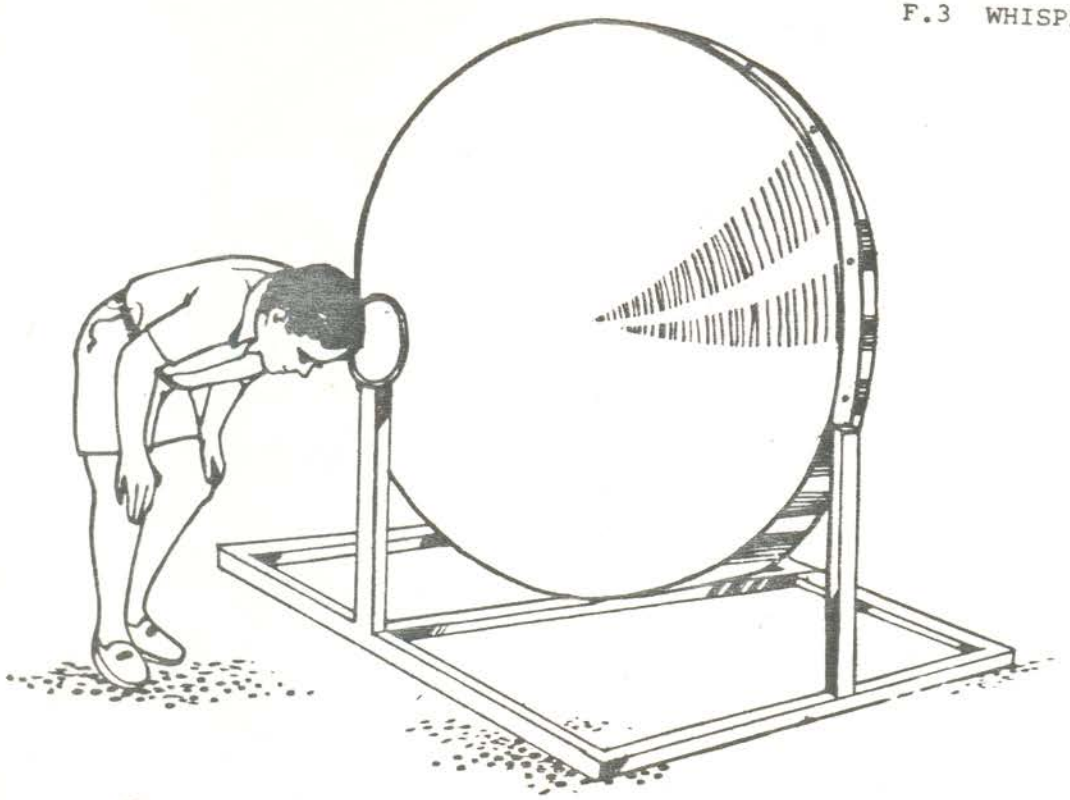
* Stand in front of one figure and ask your friend to go to the other one and put his/her ear close to the mouth of it.

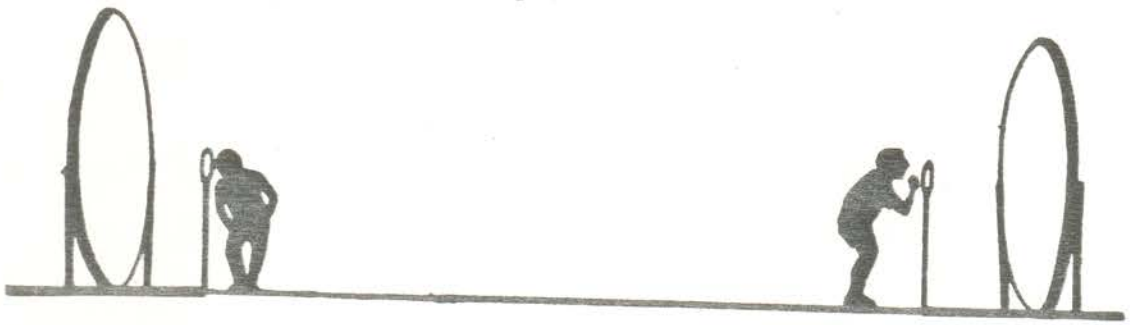
* Bring your mouth close to the mouth of the figure and talk to your friend normally. Ask him/her to reply to you in the same manner.

* Now put your ear close to mouth of the figure and listen to your friend.

* Mouths of both the figures are connected by an underground tube. Sound waves travel through the tube.

F.3 WHISPERING GARDEN





* Ask your friend to face a parabolic reflector with his/her ear close to the central ring.

* Go to the other reflector and put your mouth close to the central ring.

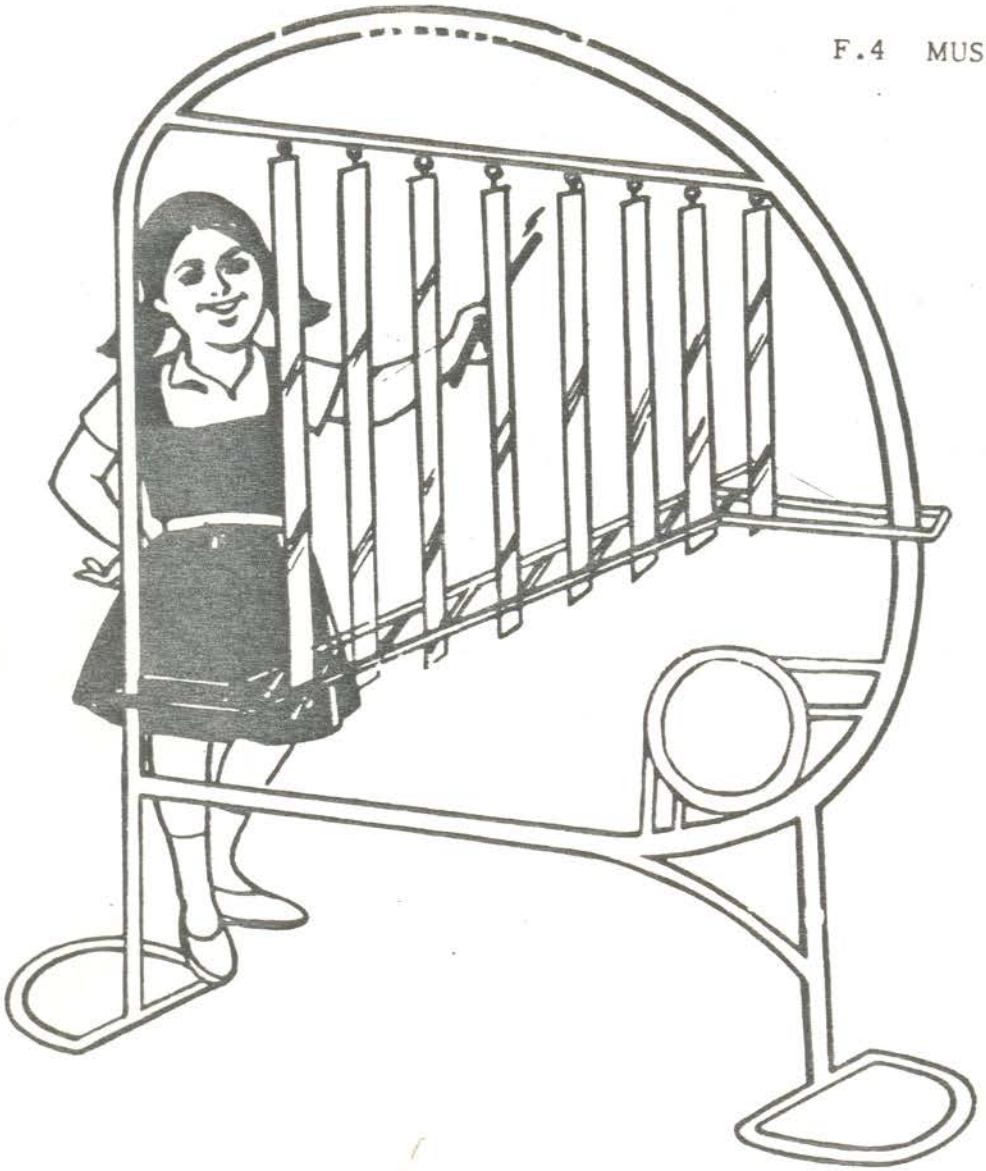
* Talk to your friend with normal voice.

* Ask your friend to put his/her mouth close to the ring and talk.

* Now put your ear close to the ring and listen.

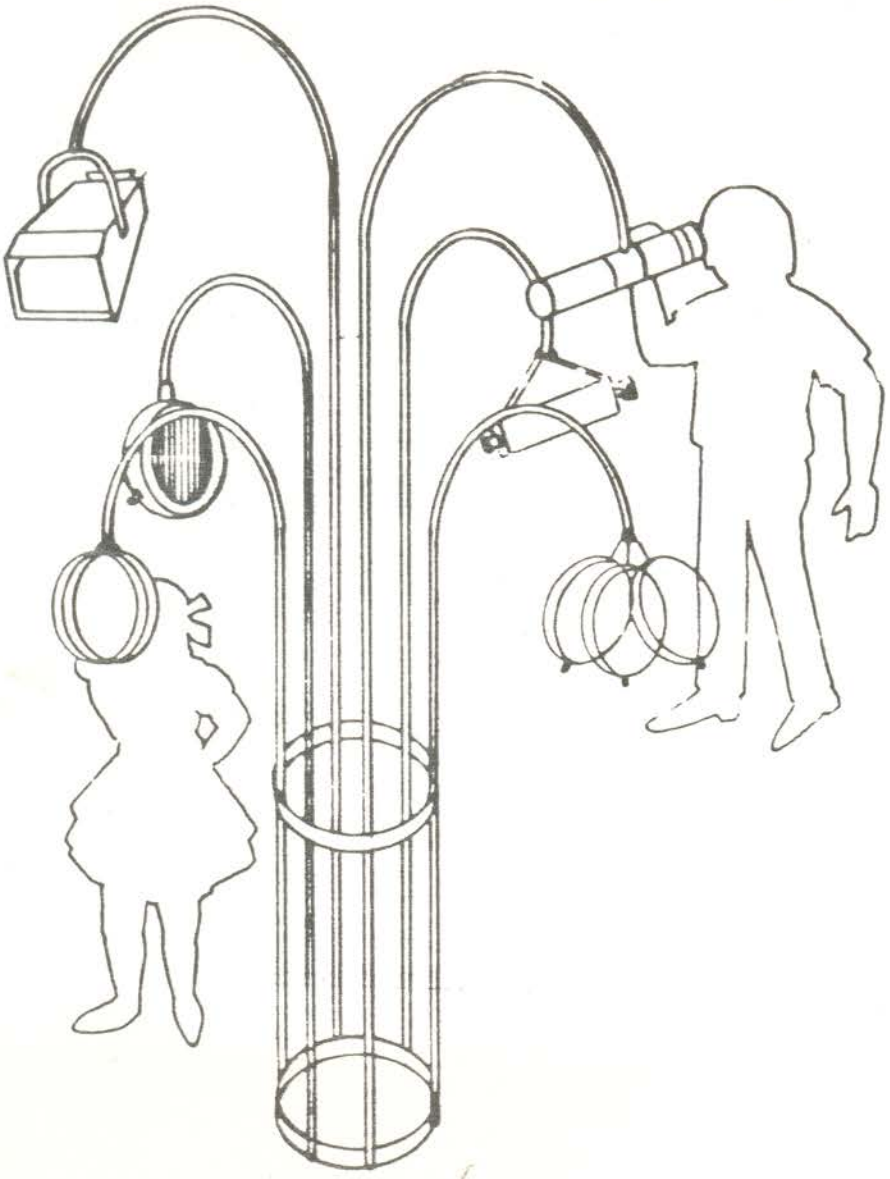
The central ring is placed at the focus of the parabolic reflector. Sound originating at one focus gets reflected by the surface and travels in parallel lines to the other reflector. There sound is converged to the focus of the reflector. Without such reflectors sound energy gets lost in air.

F.4 MUSICAL BARS



* Hit the bars of different lengths gently with the small striking hammer.

* Observe that different bars emit sound of different pitch. The pitch of sound of a freely hung bar depends on its length. The shorter is the bar the higher is the pitch.



G.1 OPTIC TREE

Camera

Light from an object passes through the lens at the front and falls on a screen. The image is inverted.

Kaleidoscope

Look through the peep-hole and rotate the cylinder. Observe coloured patterns that change shape as you turn the cylinder. Multiple images of coloured beads, formed by mirrors kept at an angle with each other, generate the patterns.

Prism

Hold the triangular prism in sunlight and see how the sunlight is split into a spectrum containing seven colours.

G.1 OPTIC TREE

Filters

Look through three primary colour filters and watch your surroundings. Use two filters together and observe change in colour.

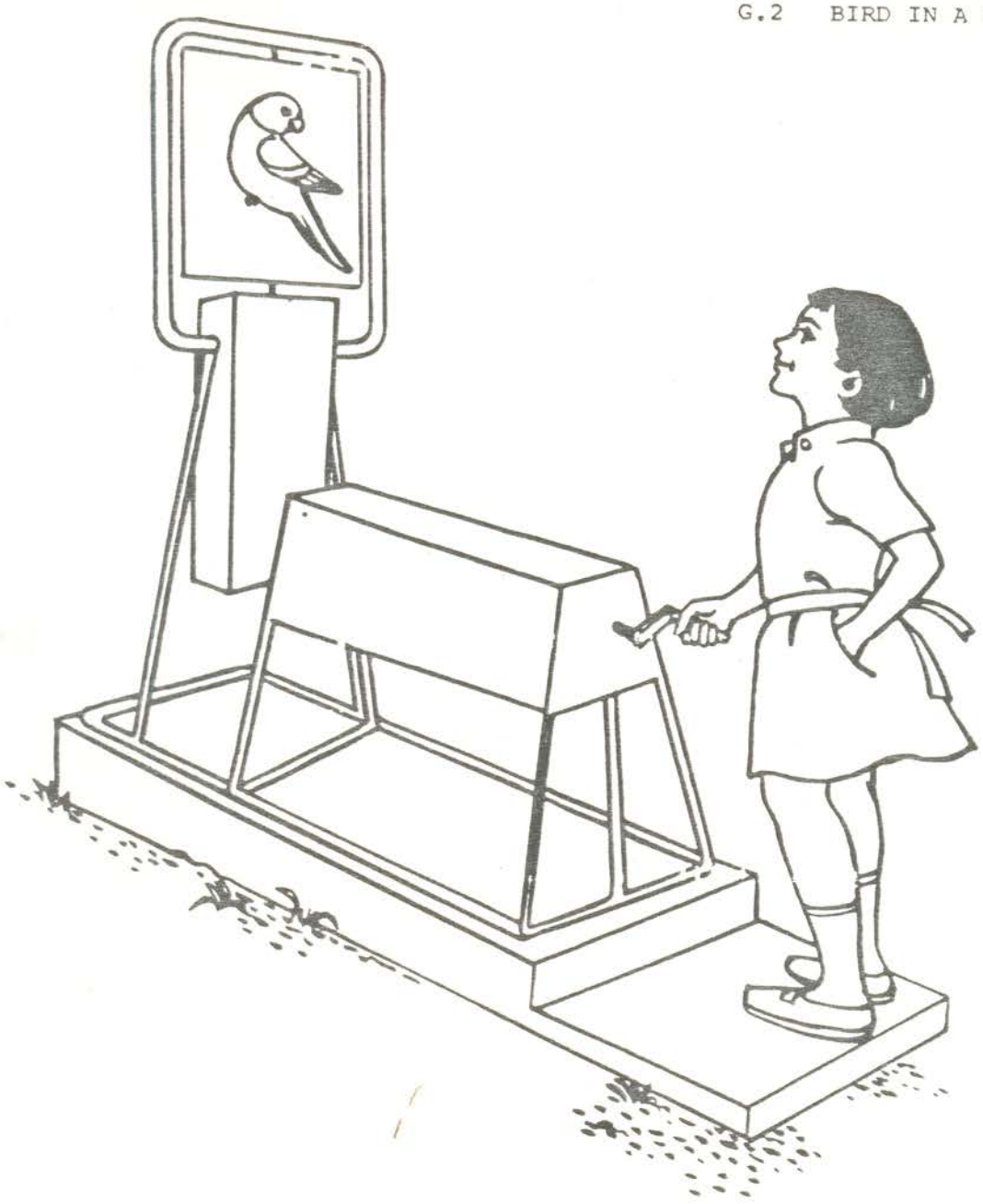
Polarised light

The discs fixed inside the drum contains polarising filters. If you rotate the knob, the light passing through the filters will be gradually shut off.

Moire patterns

Rotate one of the discs slowly and watch the moving patterns generated. These patterns are called Moire patterns.

G.2 BIRD IN A CAGE



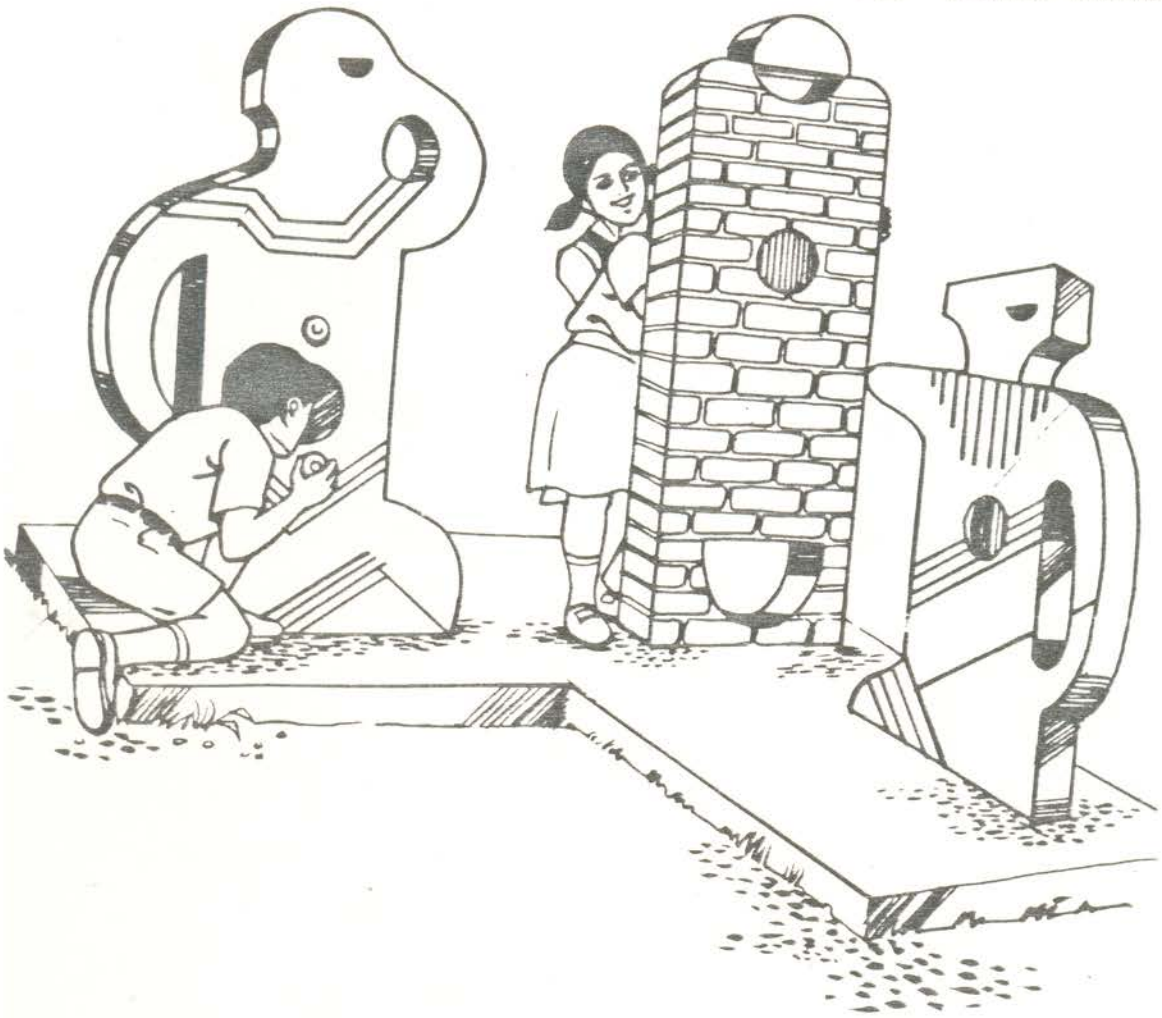
* Turn handle slowly. You will find picture of a bird printed one one face and picture of an empty cage on the other face of the board.

* Turn the handle very fast.

* You will now see only one picture - the bird sitting inside the cage.

The retina of our eye holds an image for about one sixteenth of a second. If another image is cast on the retina within this period, both images get mixed up and we see the combined image of the two. The same technique is utilised in motion pictures.

G.3 WORLD MINUS COLOURS

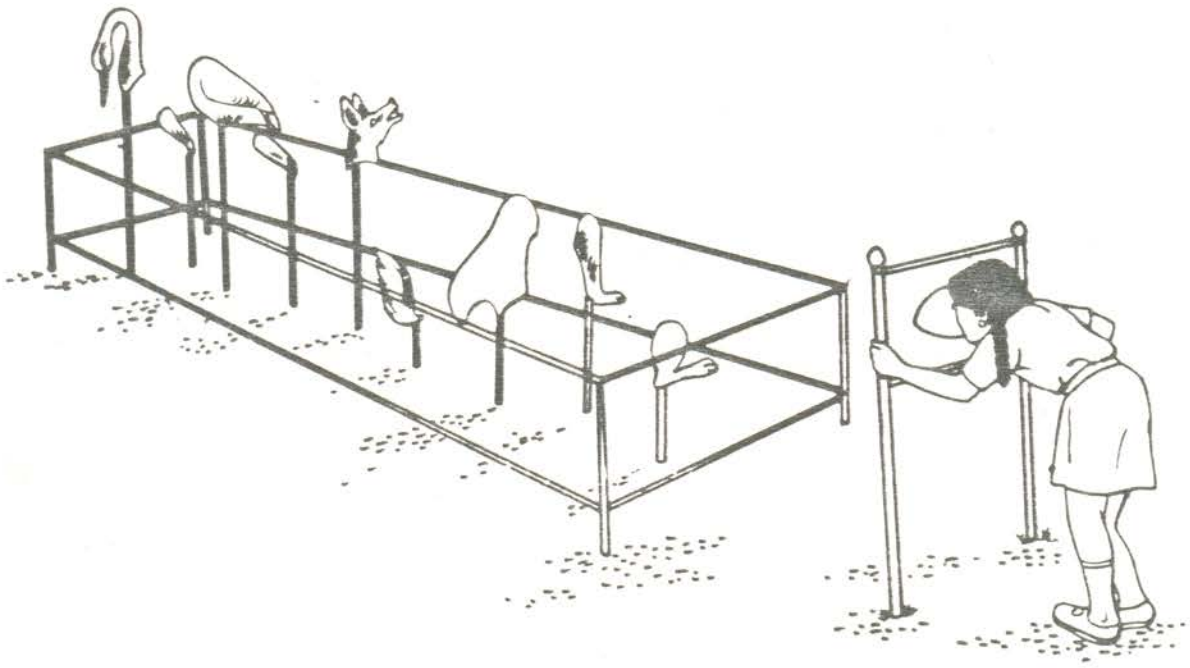


* Look through coloured filters.

* Turn knobs slowly to make and change a combination of filters. Look through them.

A coloured filter blocks other colours except its own. Blue objects through a red filter will appear black. Red objects through a blue filter will also appear black. Intermediate colours come through different filters with different colours.

G.4 PERCEPTION OF DEPTH



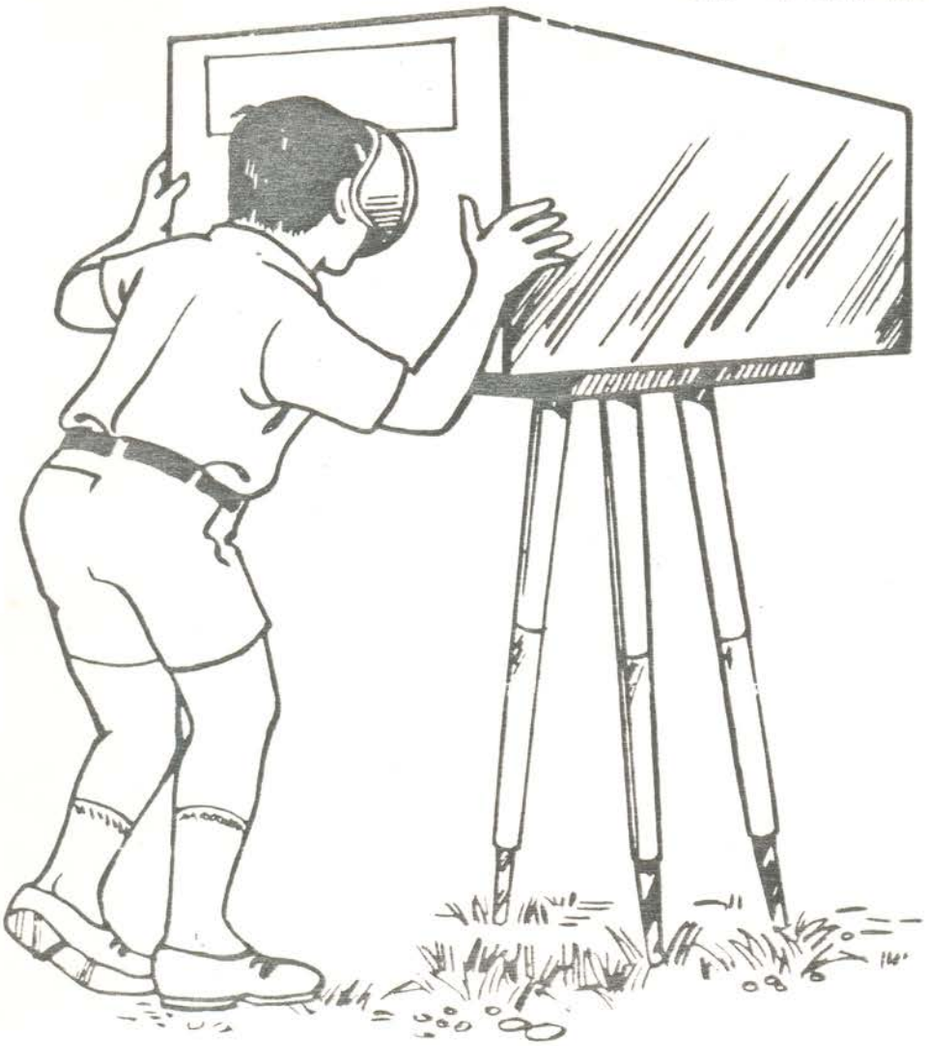
* Look at dismembered parts of a crane and a jackal.

* Look through the peep hole through one eye. What do you see?

When the distance of an object changes, the relative positions of two images on two retinas also change. This makes us feel what is far and what is near. With one image on one retina we lose the feeling of distance and everything appears in the same place.

		No Off	Cost (Rs. in lakh)
f)	**Weather Station**		
	i) Anemometer	1	
	ii) Wind vane	1	
	iii) Dry bulb and wet bulb thermometers	1 set	
	iv) Sun shine recorder	1	1.00 complete set
	v) Hygrometer	1	
	vi) Microbarograph	1	
	vii) Rain gauge	1	
	viii) Instrument hut	1	
g)	**Energy Corner**		
	i) Wind mill	1	
	ii) Biogas plant	1	
	iii) Solar water heaters	2	2.00 complete set
	iv) Solar cookers	6	
	v) Solar still	1	
	vi) Solar tubelight	1	
	vii) Solar pump	1	
h)	**Original Artefacts**		
	i) Aeroplane	1	
	ii) Steam locomotive	1	0.25 transport cost only
i)	**Supplementary Exhibits**		
	i) Sun dial large	1	
	ii) Semaphor towers	1 pair	2.50 complete set
	iii) Shrubs in the shape of animals	50	
	iv) Animals made of waste material	25	
		Total	36.60

G.5 A SIMPLE CAMERA

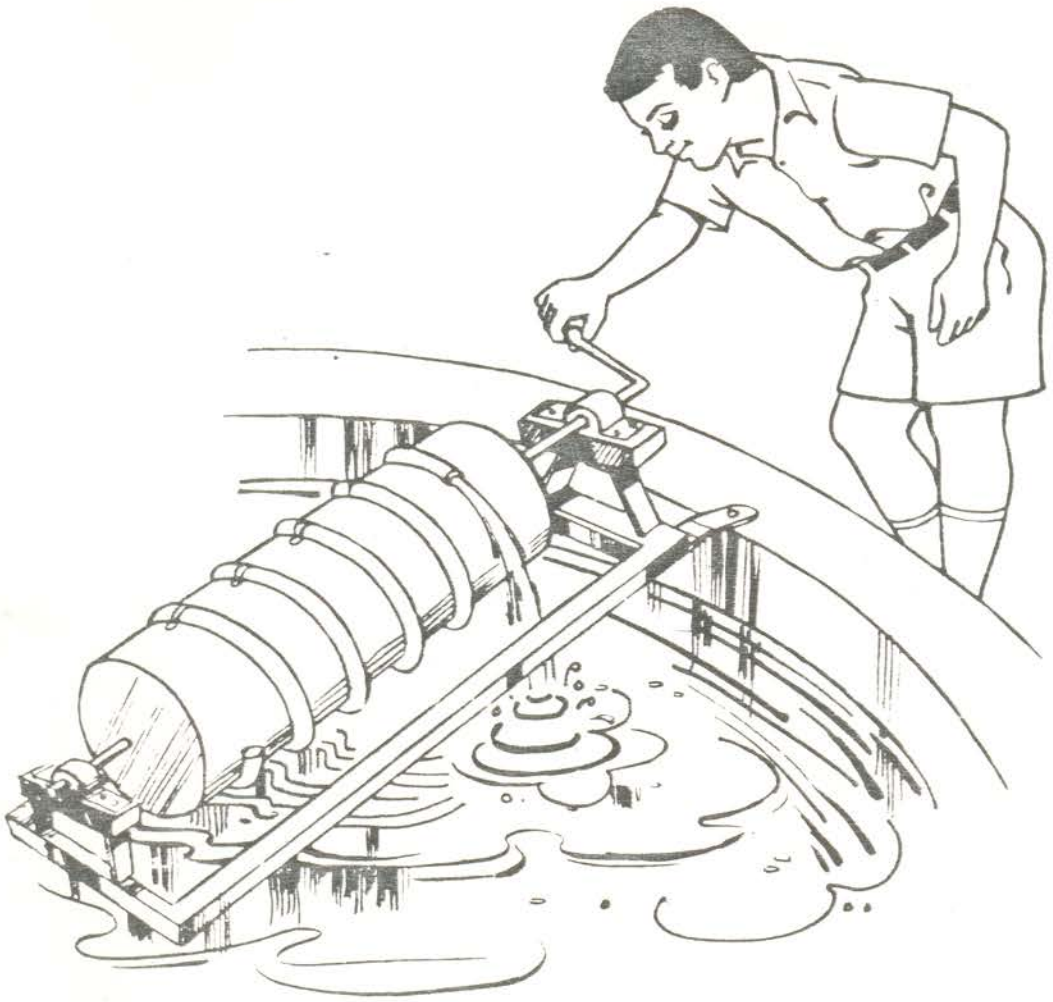


* Look into the box through the circular opening at one end and see the beautifully coloured image.

* Rotate the box slowly and watch the image changing. Observe that the image is always inverted.

Light from outside objects falls on a frosted screen through a lens and forms an inverted image. In a simple camera a photographic film is kept in place of the frosted screen.

H.1 ARCHIMEDES SCREW

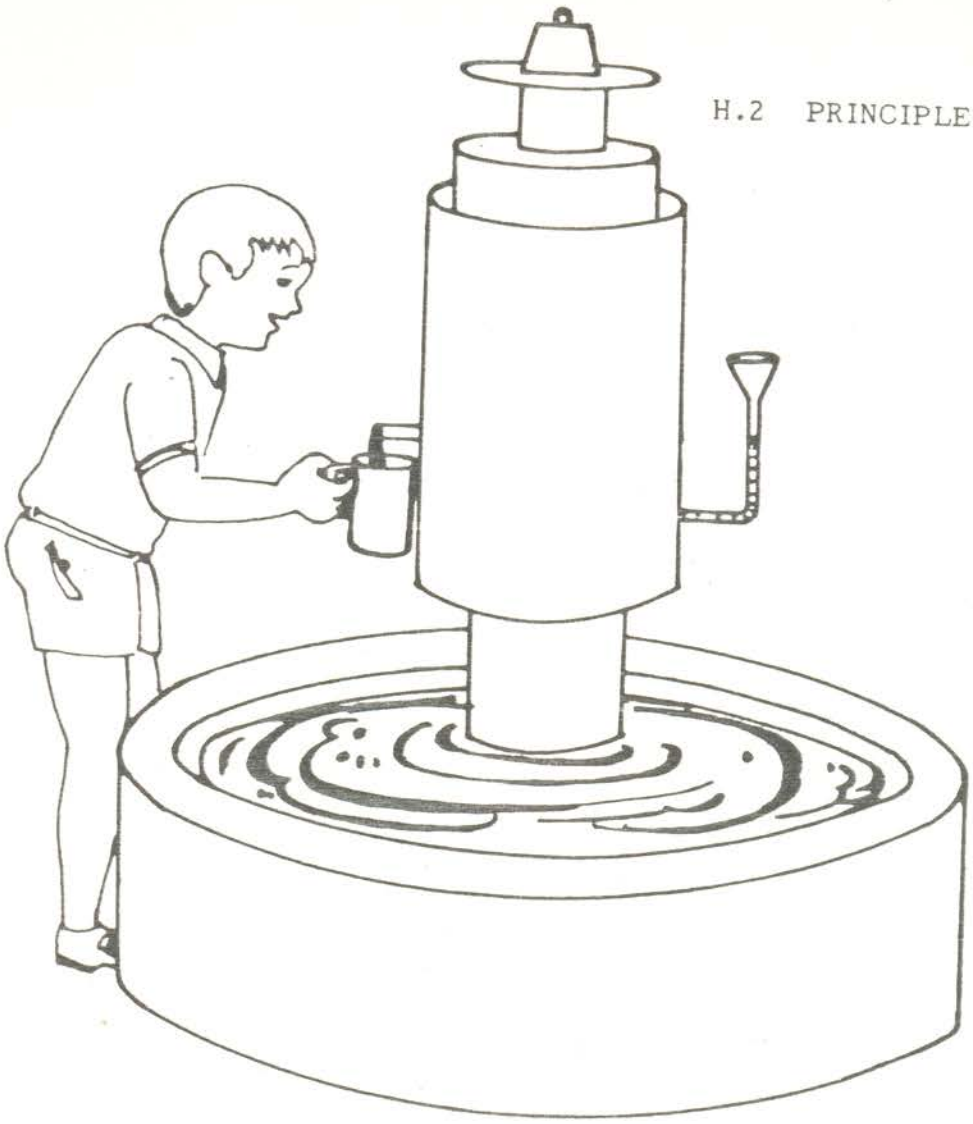


* Rotate the handle fitted at the top end of the drum.

* Observe that water comes out intermittently through the top end of the tube wrapped around the drum.

This device for raising water to a height was conceived by Archimedes - the celebrated Greek inventor.

H.2 PRINCIPLE OF FLOATATION



* Before you start the experiment make sure that there is no weight on the top floating pan.

* Now pour water into the funnel till the water level reaches the given mark.

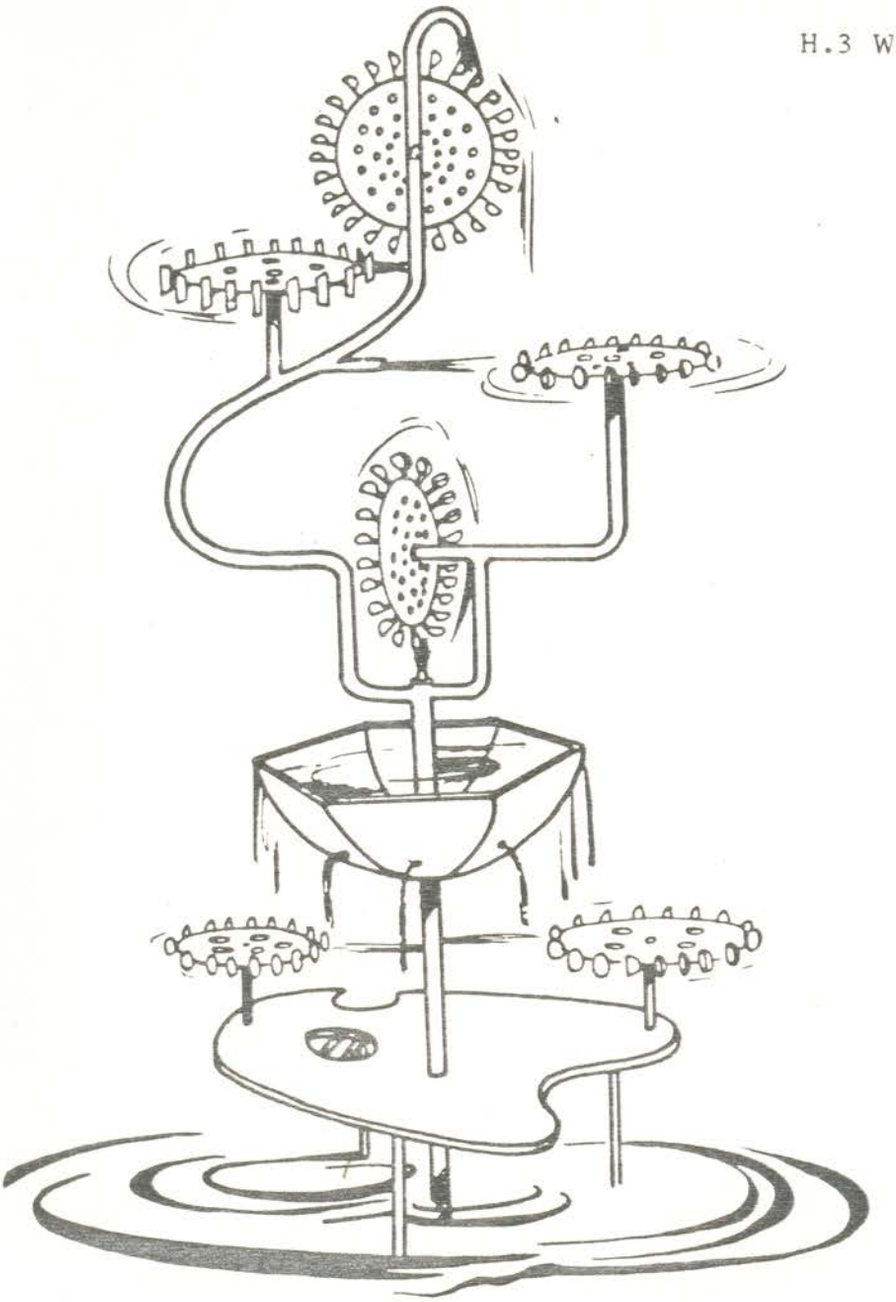
* Put a half kilogram weight on the top floating pan and collect the water coming out of the outlet in a calibrated jug.

* Watch that the volume of collected water is half litre.

* Repeat the experiment with one kilogram weight on the pan and the volume of collected water will be one litre.

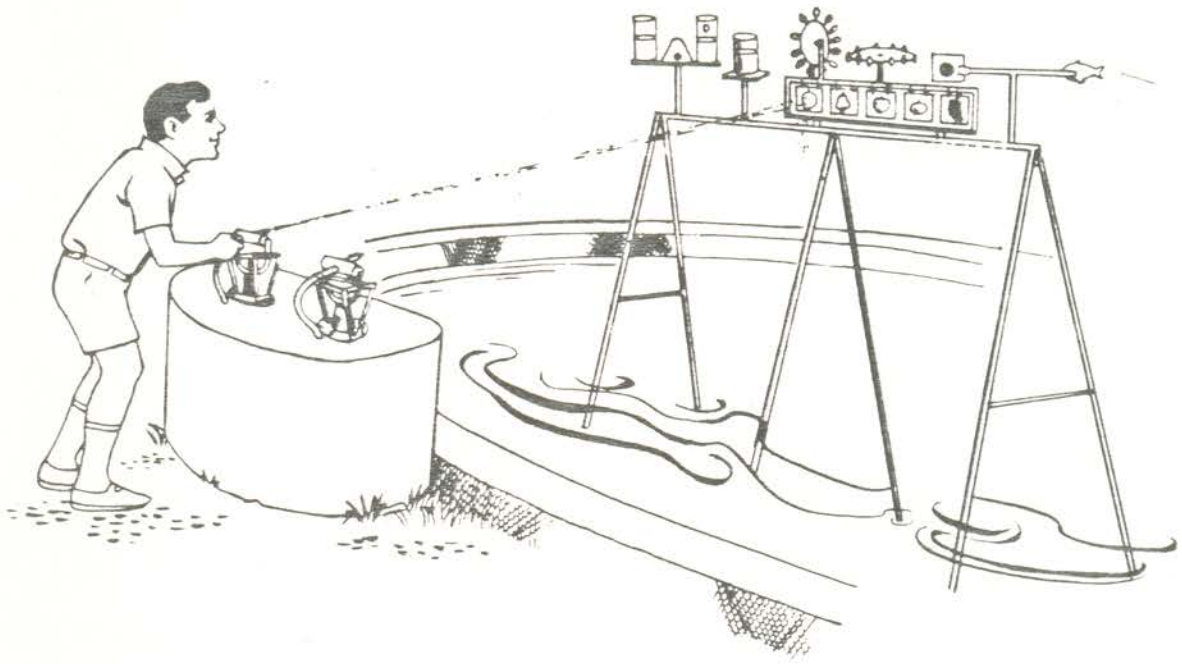
According to the law of floatation the weight of a floating body in water is equal to the weight of water it displaces. One litre of water weighs one kilogram.

H.3 WATER WHEELS



Water jets drive wheels of different types on different axes. Such wheels are used for grinding wheat and corns by water coming from streams in hilly areas. Big water turbines are used for driving hydro-electric generators.

H.4 PLAY WITH WATER



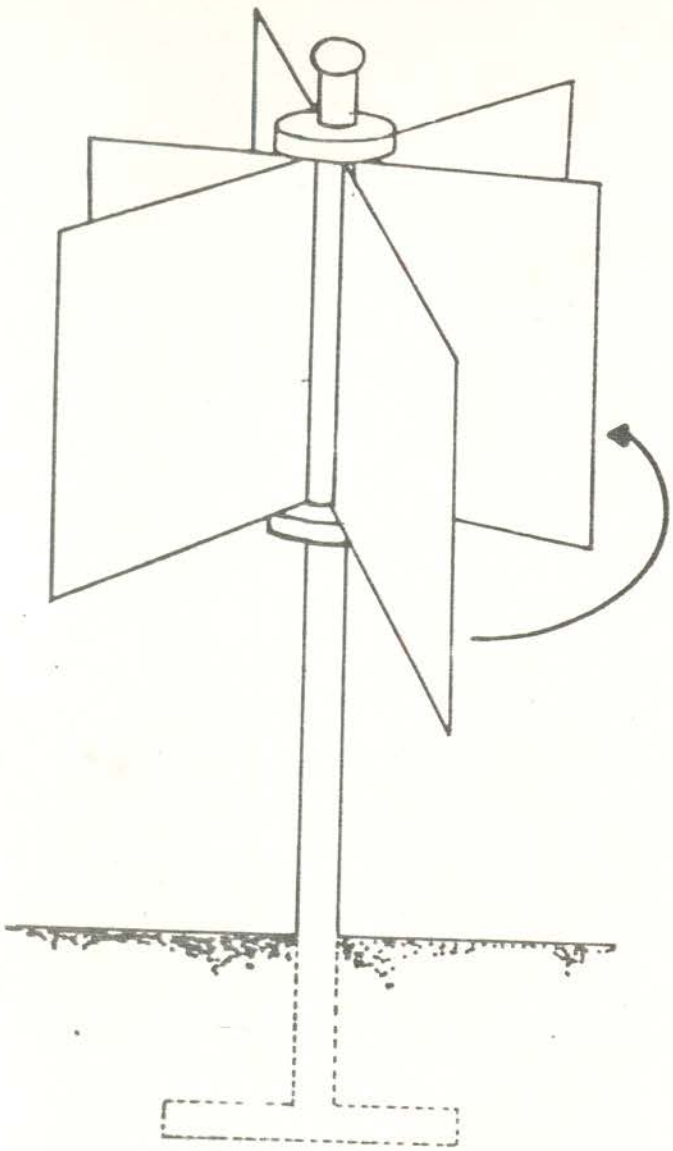
* Take up the nozzle in your hand and pull the trigger for water jet.

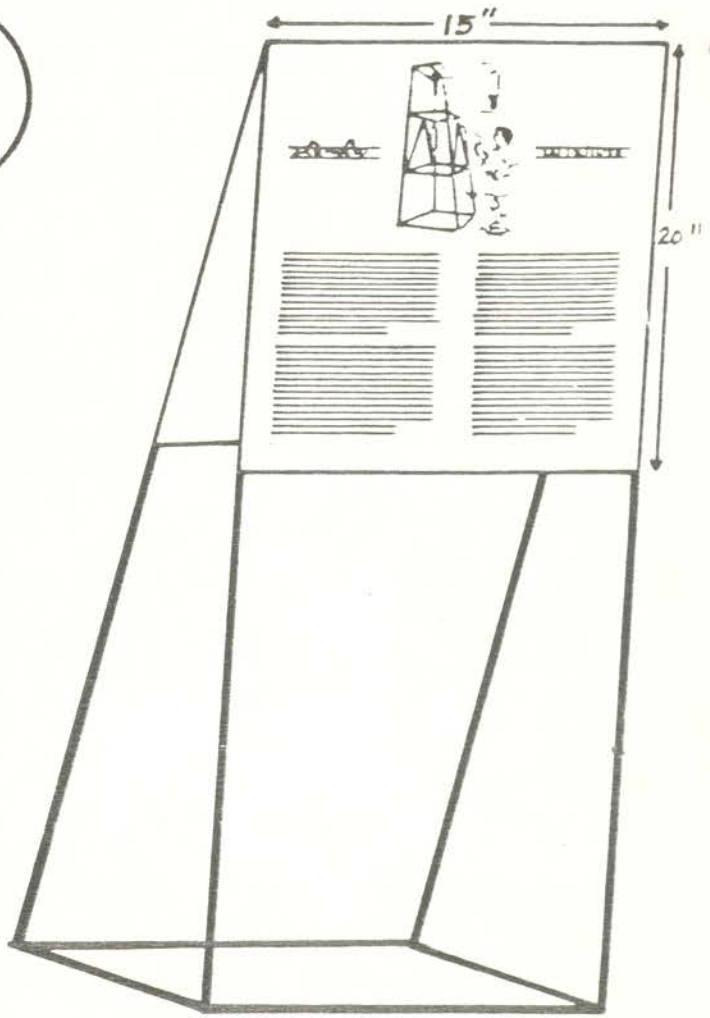
* Aim the jet at different bodies placed in front of you.

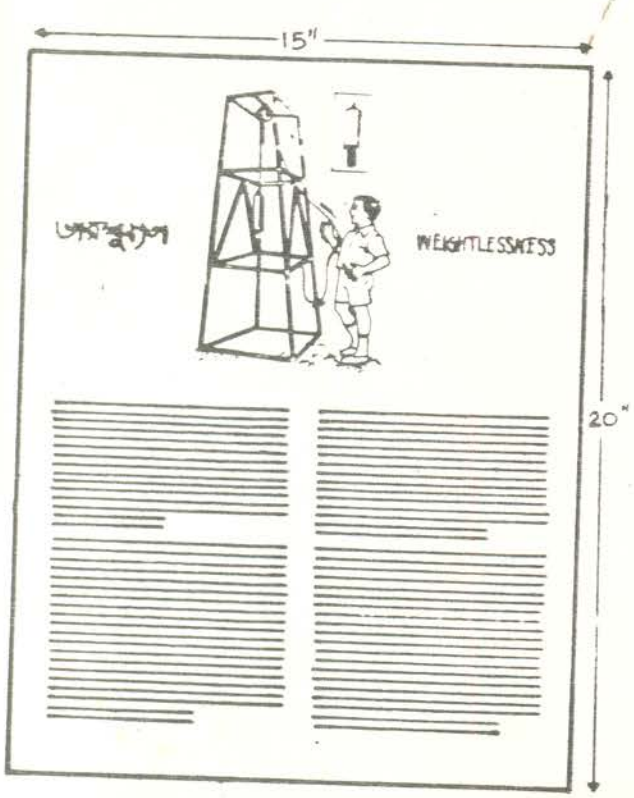
* Try to rotate the wheels and fill up the empty containers.

The high speed jet hits the water wheels tangentially and rotates them.

J. LABELS







		No off	Cost (Rs in lakh)
J)	**Visitors facilities**		
i)	Open air theatre	1	5.00
ii)	Picnic area with thatched roof huts, snack bar, drinking water and waste disposal facilities	2	2.00
iii)	Bridge, island and observation platform on water body		3.00
iv)	Fibreglass umbrellas	100	0.75
v)	Small structures for enquiry and ticket counter watchpost, cloak room, rest rooms	10	3.00
		Total	13.75

8. PROPOSED AGENCY FOR BUILDING THE PARK

During the last decade a number of Science Parks have come up alongwith science centres being built by the National Council of Science Museums, an autonomous body functioning under the aegis of the Ministry of Human Resources Development, Government of India. They are the pioneers in setting up Science Parks in India and they have the widest experience and expertise in the country for setting up Science Parks. Parks built by the National Council of Science Museums are already existing in Bombay, Patna, Delhi, Purulia, Tirunelveli, Bhubaneswar, Dharampur and Nagpur. Some more parks are in the process of construction in places like Guwahati, Bhopal and Lucknow. Since this expertise is readily available with them, it is proposed to offer the work of planning, designing and fabrication of exhibits and other park facilities to the National Council of Science Museums, 19A, Gurusaday Road, Calcutta - 700019.

NCSM may be entrusted with the one-time job of setting up the park. For regular maintenance, conducting activities and day-to-day administrative work in connection with proper functioning of the park, a committee may be formed by the Government of West Bengal, for this purpose. A suitable infrastructure including trained personnel and maintenance facilities may be built up right from the initial stage.

9. STAFF REQUIREMENT FOR MAINTENANCE, ACTIVITIES AND ADMINISTRATION OF SCIENCE PARK

Staff Designation	Job requirement	Number	Gross emoluments per head
a) Executive Officer (M.Sc. in Physics/ Bio-Sciences)	Day-to-day administration, keeping accounts and submitting the same to proper authorities, overall responsibility for exhibit maintenance, activities and administration, liaison with managing committee, publicity.	1	Rs.4,500/- per month
b) Education Assistant (B.Sc. in Physical Science-1 and B.Sc. in Bio-Science - 1)	To assist Executive Officer in conducting programmes, general keep up of exhibits, garden and other facilities, demonstration of exhibits, guidance to visitors, overviewing activities of technicians and conducting regular participatory activities in the park.	2	Rs.3,000/- per month
c) Technician (ITI certificate in fitting/welding trade)	Maintenance of exhibits, workshop equipments, repair of park facilities.	2	Rs.2,000/- per month
d) Animal Keeper	Proper upkeep of all animals including feeding and cleaning of cages.	1	Rs.1,500/- per month
e) Stenographer (Higher Secondary)	Standard followed by Govt. of West Bengal	1	Rs.2,000/- per month
f) Ticket seller	Selling tcikets, maintain visitors figure register and handle cash properly	2	Rs.1,500/- per month