

SCIENCE IN ACTION – OCTOBER 2006

Static Charges

ಸ್ಥಾಯಿ ವಿದ್ಯುತ್

Bernoulli's Principle

ಬರ್ನೋಲಿಯ ತತ್ವ

Water Rocket

ನೀರಿನ ರಾಕೆಟ್

Air Thermometer

ಗಾಳಿಯಿಂದ ಉಷ್ಣಮಾಪಿ

Magical Writing

ಅದೃಶ್ಯ ಬರಹ

Solar Energy

ಬಿಸಿಲಿನಿಂದ ವಿದ್ಯುತ್

Buoyancy

ಫ್ಲವನತೆ

Carbon-dioxide Fine Extinguisher

ಕಾರ್ಬನ್ ಡೈಆಕ್ಸೈಡ್‌ನಿಂದ

ಅನ್ವಿತಮನ

Explosions in a test tube

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ಆರ್ಕಿಮಿಡಿಸನ ತಿರುಗಣಿ

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ವರ್ಷಮಾಪಿ

Garden without plants

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Electromagnetic Induction

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ತರಂಗ ಯಂತ್ರ

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ಕಾಗದದ ಪಾತ್ರೆ

Electric Sparks

ಸ್ಥಾಯೀ ವಿದ್ಯುತ್ ಕಿಡಿಗಳು

Brightness of Stars

ನಕ್ಷತ್ರಗಳ ಕಾಂತಿ

Sound and Light Reflection

ಧ್ವನಿ ಮತ್ತು ಬೆಳಕು - ಪ್ರತಿಫಲನ

Flame Spectrum

ಜ್ವಾಲೆಯ ರೋಹಿತ

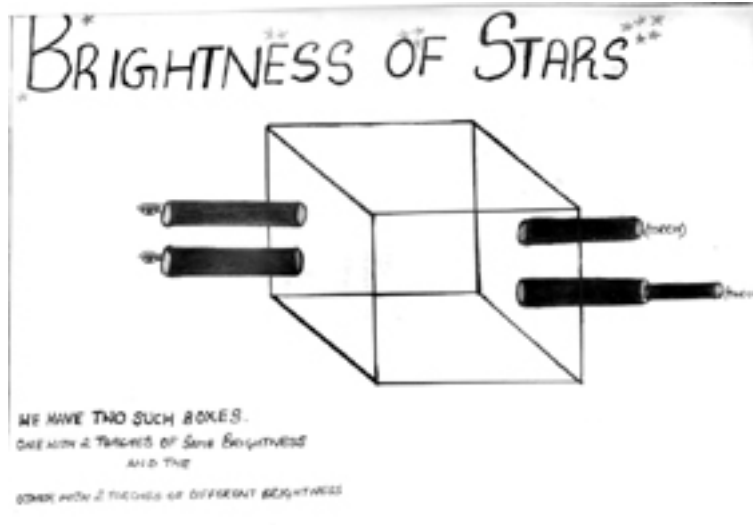
Infinite Well

ಪಾತಾಳ ಬಾವಿ

Boiling & Pressure

ಒತ್ತಡ ಮತ್ತು ನೀರಿನ ಕುದಿರ

BRIGHTNESS OF STARS



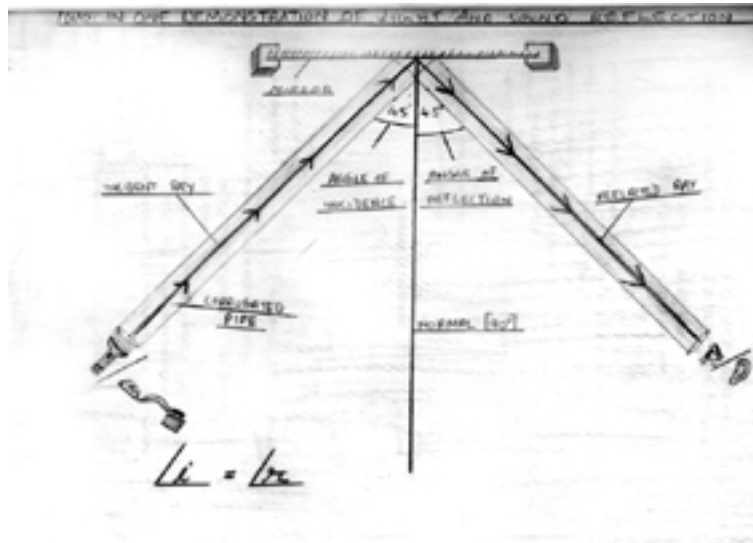
Objective: To demonstrate that the observed brightness of a luminous object depends on its intrinsic brightness as well as its distance from the observer

Procedure: Two bulbs of same brightness are housed inside a tube each as shown in the diagram. The pipes are fitted into a cardboard box. A similar arrangement is made with bulbs of different brightnesses. When the bulbs are viewed through

the tubes, they appear to be of different brightnesses in the first case. And, they appear to be of same brightness in the second.

Reason: The intensity of light is inversely proportional to the square of the distance from us. In the first case, bulbs of same brightness are placed at different distances from us. In the second, the brighter bulb is placed farther from us than the fainter one.

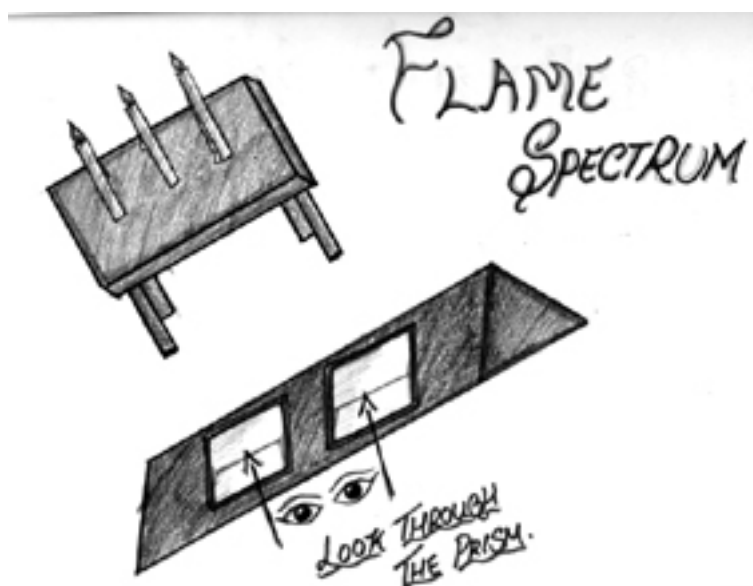
LIGHT AND SOUND REFLECTION



Principle: the laws of reflection of light hold for sound waves, too

Two hollow plastic tubes are arranged against a plane mirror as shown in the diagram. The intensity of sound from a buzzer placed at one of the tube is heard on reflection from the mirror through the other tube. As we vary the angle of the tube, the intensity of the sound varies. It is a maximum when the tubes make the same angle with the mirror.

FLAME SPECTRUM



Objective: To show the spectrum produced by a candle flame

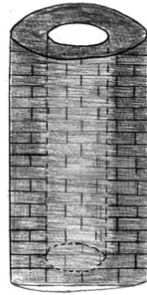
Procedure: Observe the flames of burning candles through the prisms provided to you. A continuous spectrum comprising various colour are vividly seen.

Reason: The flame of a candle appears orange to the naked eye. On examining closely, one can notice blue also. The spectrum, however, reveals all the colours of the visible part of the spectrum because hot objects radiate electromagnetic radiation at all wavelengths.

One will notice that all the colours are not equally bright.

INFINITE DEPTH WELL

*INFINITELY
DEEP WELL*

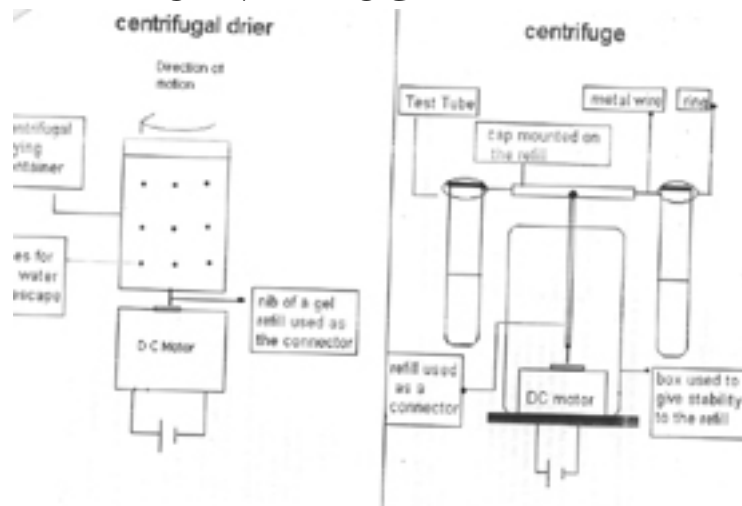


Objective: To demonstrate the image formation by parallel plane mirrors

Procedure: A well is fabricated with the help of thick cardboard. A circular plane mirror is placed at the bottom of the 'well'. Another circular mirror with a hole at the centre is placed at the top. When viewed from the top, the well appears to be a bottomless one!!!

Reason: The pattern along the inside of the well is reflected by the two parallel, plane mirrors. The number of images will be, in principle, infinite.

CENTRIFUGAL DRIER



Objective: To demonstrate the working principle behind a centrifuge and a centrifugal drier

Procedure: The Centrifuge: Arrange the set up as shown in the diagram. When the power supply to the DC motor is switched 'ON', the test tubes move upward and away from the axis of the motor. The smaller particles suspended in the solutions in the test tube precipitate out.

Reason: The particles in the solution experience a force directed toward the bottom of the test tube that is proportional to the square of the frequency of revolution of the tube.

BOILING AND PRESSURE

Objective: To demonstrate the relationship between pressure and boiling

Procedure: press the piston all the way down into the syringe. Now, slowly draw hot water, a couple of degrees below boiling point, into the syringe. When it is about half-filled, take the syringe out and quickly draw the piston outward.

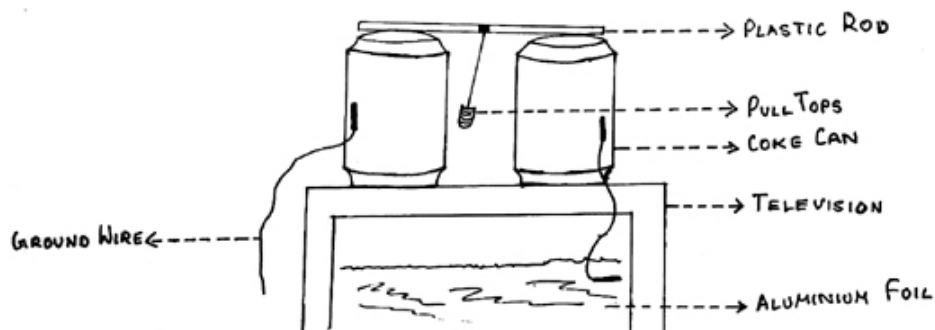
Observation:

The hot water inside the syringe begins to boil!

Reason:

The pressure inside the syringe falls when the piston is quickly drawn out. Under reduced pressure, water boils at a lower temperature

ELECTROSTATIC PENDULUM

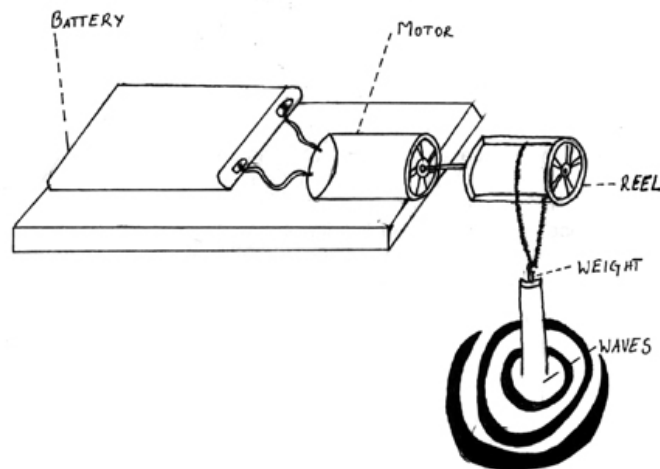


Objective: To show that a charged body attracts an uncharged body and that like charges repel.

Procedure: Arrange the set up as shown in the figure. One of the pull tops of the can serves as the pendulum. The two cans are about three-inch apart. A piece of wire attached to the left can is the ground wire which is connected to a water pipe (metal). An aluminium foil is pressed against the computer monitor/ TV screen. A wire connects the foil and the can on the right. Switch ON the television, the pull top gets pulled to one side of the can. After striking it, the pull top swings towards the other can! The process repeats.

Reason: To begin with, the pull top is uncharged and the right can is charged. This attracts the pull top towards it. When the pull top strikes the can, it acquires the same charge as the can and is thus repelled. On striking the can on the right, the pull top discharges and is now uncharged once again. The process repeats.

WAVE MACHINE



Objective: To produce surface waves on water

Procedure: Arrange the set up as shown in the diagram. Push the spindle of the motor into the opening of a spool such that the spindle spool does not wobbles easily while the rod attached to the spool executed up-down motion. Take water in a shallow tray and place it below the rod such that the rod just about touches the water surface. When the motor is turned on, the rod moves up-down and a series of surface waves are produced.

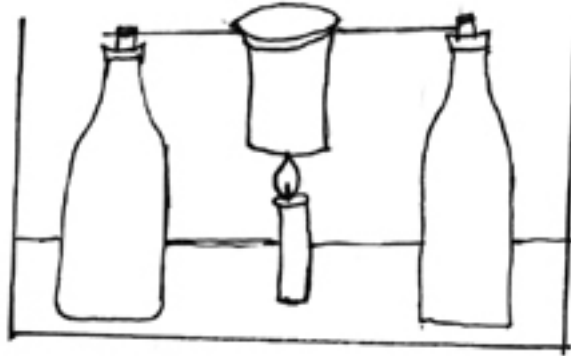
Reason: The rod touching the still surface of water constitutes a disturbance. It is the disturbance that propagates. Small pieces of paper on the surface indicate this.

DESTRUCTIVE DISTILLATION OF WOOD

Objective: To demonstrate the destructive distillation of wood

Procedure: Take a small can with a push fit lid. Make a three millimetre diameter hole in the lid. Put some wood shavings into the can and close the lid tightly. Heat the can. A little while later you will notice a stream of gas coming out. This is wood gas - a mixture of hydrogen, methane and other gases. Now light the gas with a match. It burns with a sooty flame. Allow the can to cool. A black residue will be seen inside the can. This is charcoal. Destructive distillation involves heating something out of free contact with air.

PAPER SAUCEPAN

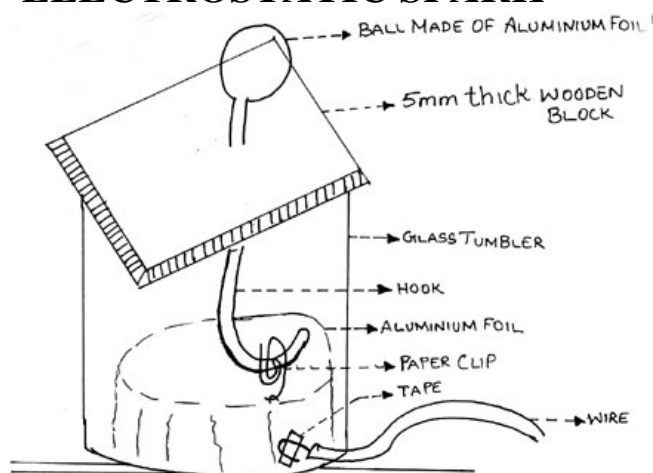


Objective: To demonstrate transport of heat

Procedure: Arrange the set up as shown in the diagram. Fill up three-fourths of the paper cup with water and place a burning candle or a bunsen burner underneath it. In a little while water begins to boil, but the paper cup would not have burnt at all!

Reason: The heat supplied to the papercup is quickly transported to water. Water consumes lot of heat energy while raising its temperature by a small amount. As a result, the paper cup never attains the temperature necessary for ignition.

ELECTROSTATIC SPARK



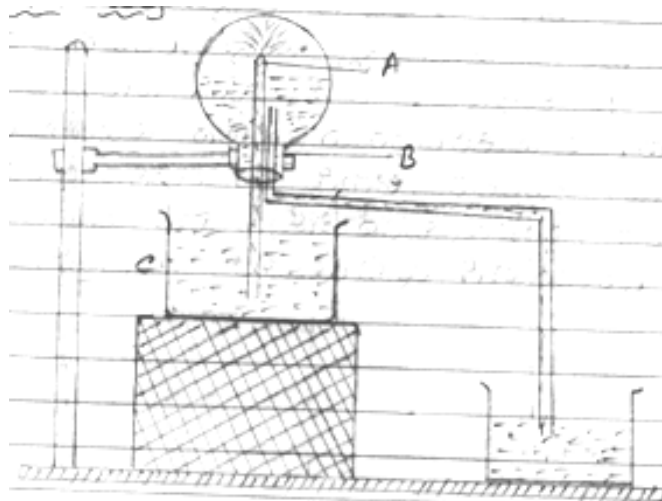
Objective: To show principle behind lightning

Procedure: Construct the set up as per the details provided in the diagram.

You may use the bent portion of coat hanger to make the hook. Stick the lower half of the glass tumbler with aluminium foils. The wire attached at the bottom of the glass tumbler must be grounded well by connecting the other end of the wire to a water pipe (metal). Now rub a plastic comb against a woollen cloth and charge the ball made of aluminium foil. Next, take a piece of wire and touch the ball and take the other end close to the aluminium foil at the bottom of the glass tumbler. A spark jumps from the wire to the foil.

Reason: A huge potential difference is created between the ball at the top (by charging) and the aluminium foil at the bottom that is grounded. Air, normally, a poor conductor of electricity, conducts due to high potential difference.

WATER FOUNTAIN



Objective: To demonstrate the principle of a siphon

Procedure: Fill up a half of a round bottom flask with water. Close the mouth of the flask with a two-holed rubber stopper. Insert a jet tube through one and a bent delivery tube through the other. Take some water in a container 'C' and place an empty container 'D'. Place container 'C' at a level higher than that of 'D'. Now invert the flask such that the end of the jet tube outside the flask is immersed in container 'C' and that of the bent tube in 'D'. In a while, water comes out of the jet tube as in a fountain.

Reason: As soon as the flask is inverted, water flows out of the bent tube into 'D' resulting in a reduced pressure inside the flask. As a result water rises into the jet tube.

Explosions In A Test Tube

Objective: To demonstrate an exothermic reaction

Procedure: Take a small quantity of sulphuric acid and ethanol into a test tube. Drop a few small crystals of potassium permanganate. In a few seconds you will hear crackling sound accompanied by mini explosions.

Reason: The reaction between the acid and the permanganate produces oxygen and sufficient amount of heat that ignites the alcohol vapours.

Caution: Use fine powder of permanganate. Larger crystals produce louder bangs and the reaction is more violent.

Silica Garden

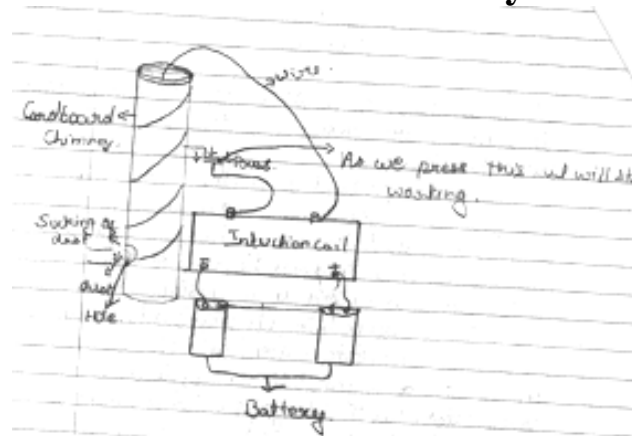
Objective: To grow crystals of different salts

Procedure: Powder a mixture of various salts. Place the mixture at the bottom of the glass tube. Slowly pour a dilute solution of silica gel (water glass) into the tube. Stand the tube without disturbing.

After a few minutes crystals grow in almost a vertical direction. However, one can see the crystals of different composition migrate at different rates.

Reason: The resistance offered by silica gel to the growth of different crystals is different. This, in essence is the principle behind chromatography.

Electrostatic Chimney



Objective: To show the working principle of an electrostatic chimney

Procedure: Take the cardboard covered with aluminium foil and drill a hole at one end. Hang a thick wire down the centre of the tube, so that it does not touch the sides. Connect the foil with the voltage terminal of the batteries through a switch and the hanging wire to the other terminal of the battery.

Reason: The chimney described in this project acts as an electric precipitation. When voltage is applied on the chimney or wire hanging at its centre, it acts as a precipitation. All the charged particle of some stick to the walls of the chimney and so smoke is prevented.

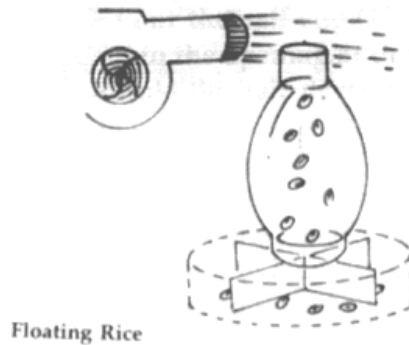
Positive and Negative Static charges

Principle: To demonstrate the creation of positive and negative static electric charges

Procedure : A dry silk cloth is first rubbed against the glass. It is now charged and is able to pick small pieces of tissue paper. These pieces are dropped into the glass tumbler. At first they stick to the glass but immediately fly apart.

Reason : The rubbing of silk cloth produces positive charges on the silk cloth. At the same time the glass is negatively charged. The silk cloth picks up tissues, which in turn acquire positive charges. However, as soon as they dropped into the glass they acquire negative charge on touching the glass and therefore repel each other.

Bernoulli's Principle

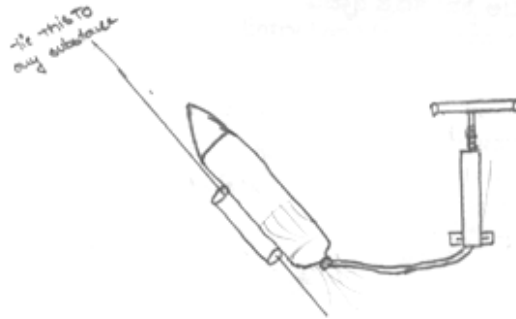


Principle : Demonstration of decrease in pressure in a direction perpendicular to the flow of gas.

Procedure : A chimney is placed on a suitable support so that air can flow freely into it from the bottom opening. Air is blown over the chimney using a hair drier. The puffed rice fly upward. Puffed rice cereals are poured into it.

Reason : The air blown with a greater speed at the top of the chimney reduces the pressure. The air now rushes from the bottom to the low pressure area. Puffed rice being very light are moved up by this movement of air. The decrease in pressure in a direction perpendicular to the flow is called Bernoulli's Principle.

Water Rocket

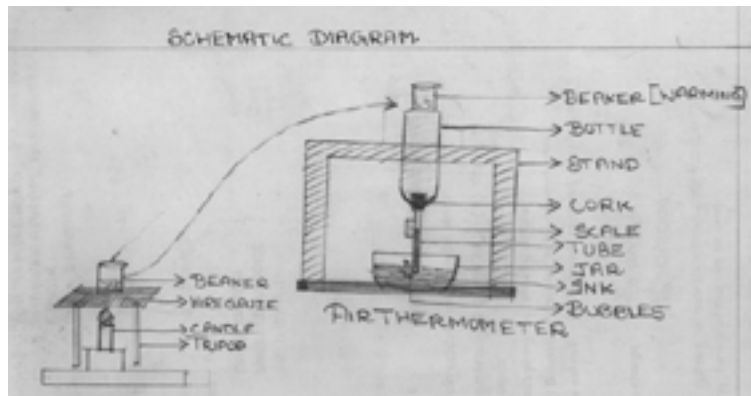


Principle : Firing a rocket with water using Newton's third law of motion

Procedure : Fill a bottle with water to about $1/4^{\text{th}}$. Replace the lid with a valve inside a cork. Attach a straw to the bottle and let thread pass through the straw to a convenient height. Use a bicycle pump and blow air into the valve. The pressure builds up inside the bottle. At one point, the cork, with valve is pushed out. As the water rushes out, the rocket raises up along the thread.

Reason : As per the third law, the action of water rushing out produces a reaction of the bottle itself moving up.

Air Thermometer



Principle : The expansion of a gas with heat is used to measure the temperature

Procedure : An empty bottle is fitted with a small glass tube. When the bottle is exposed to heat it expands and the air escapes in the only outlet the tube. To observe this the tube is kept immersed in water which is coloured with ink. The expansion of the air pushes the water in the tube so that the temperature can be read out. To estimate this reading water at different known temperatures is kept in a beaker above the bottle, the expansion is marked on a scale behind the tube each time.

Reason : Gases expand much more rapidly than liquids. Therefore, for meaning small changes in temperature this is ideally suited.

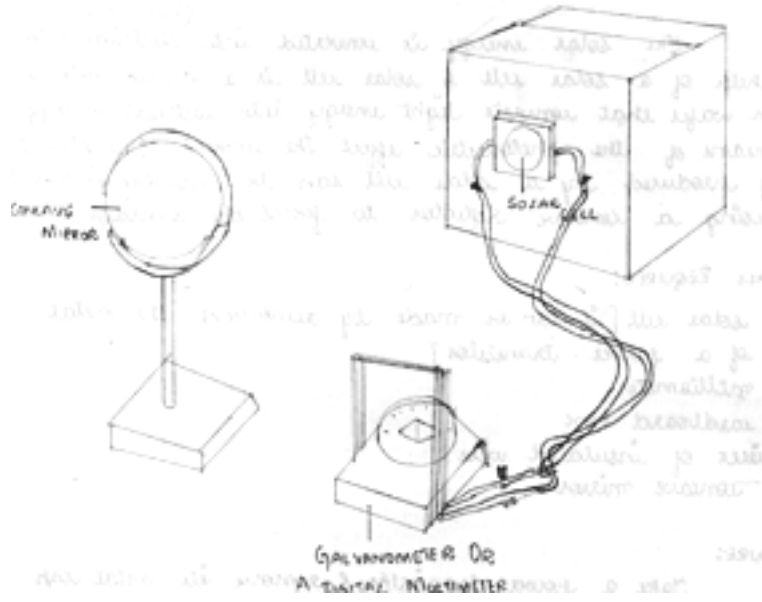
Magical Writing

Principle : Using the reaction of starch with iodine to produce unseen messages.

Procedure : Make solutions of tincture (iodine) and lemon. A writing on the pages with lemon juice will be generally not seen. But when it is inserted in iodine solution the message becomes visible.

Reason : The starch molecules in a paper react with iodine to yield a purple coloured molecule. When the paper is coated with lemon juice the reaction produces colourless molecule. Therefore, the message becomes visible.

Electricity From Light

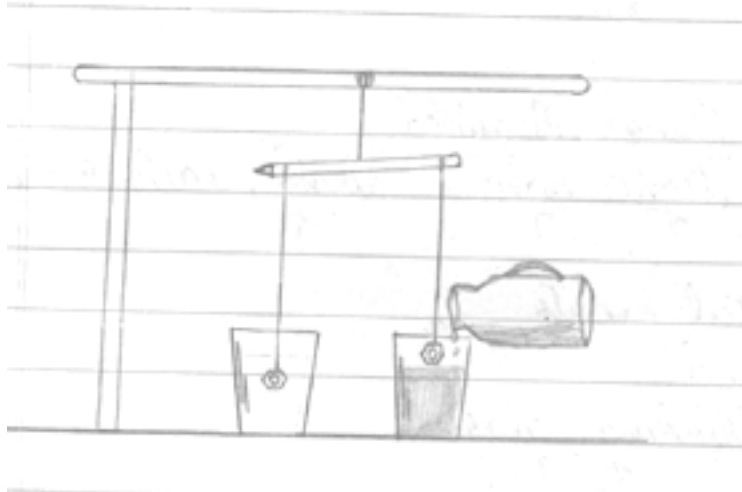


Principle : The conversion of light energy into electricity can be enhanced using a concave reflector.

Procedure : A solar cell is obtained by removing the cap of a power transistor. This is connected to a voltmeter or galvanometer to measure the output. When the solar cell is exposed to sunlight the voltage can be read out. By focusing the light using a concave mirror, it is seen that the output increases.

Reason : The concave mirror collects more sunlight and concentrates it onto the solar cell.

Buoyancy

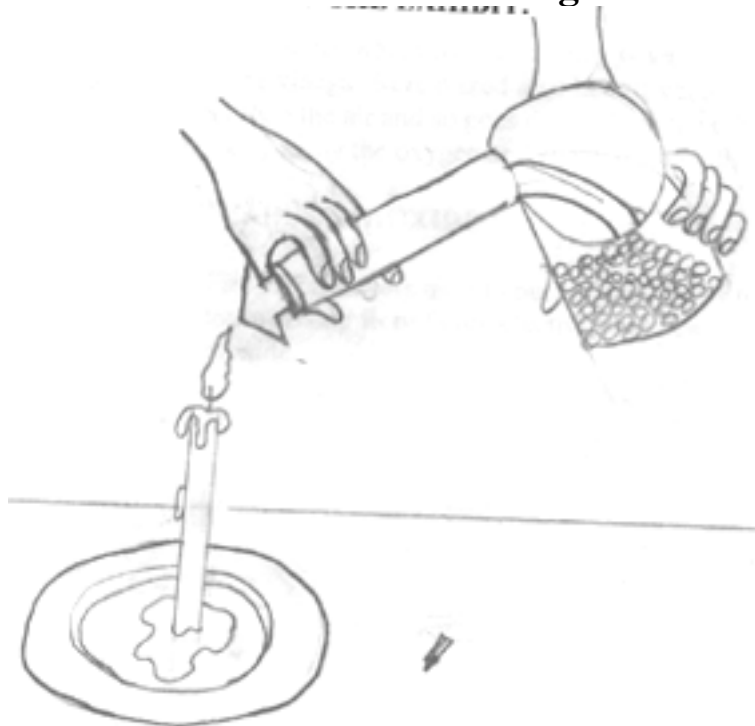


Principle : Buoyancy, the upward force in any liquid reduces the weight of an object.

Procedure : A simple balance is constructed with a pencil, stand and two nuts as weights. The distances are adjusted so that pencil is horizontal. An empty tumbler is placed beneath one of the nuts and water poured into it till the nut is below the water level. Immediately, the balance is disturbed. The nut appears to have lost weight.

Reason : Water exerts force in all directions. The upward force is called buoyancy. This is against the force of gravity. Therefore, it appears as though the nut has lost weight.

Carbon dioxide Fire Extinguisher



Principle : Carbon dioxide is heavier and it extinguishes fire

Procedure : When sodium bi carbonate and vinegar are mixed, bubbles are seen. We have to tilt the beaker and let the gas out through a pipe towards a burning candle. The candle is put off.

Reason : Carbon dioxide is produced when vinegar reacts with sodium bi carbonate. This comes out as bubbles. But it is heavier than air and therefore will not come out. When we put the tube and tilt it, it flows like a liquid towards the flame.

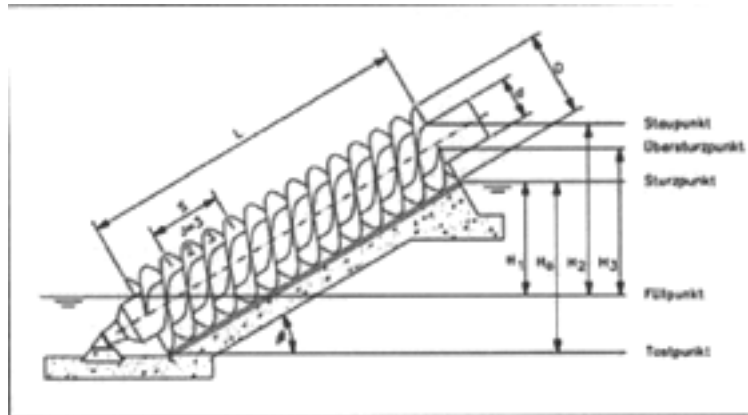
Polymerization

Principle : Production of polymers

Procedure : Urea, formalin and concentrated sulphuric acid are mixed in the ratio 2:1:3. A pale white coloured solid is formed.

Reason : The solid is a polymer which has extensive applications. This is the simplest method of forming a polymer.

Archimedes' Screw

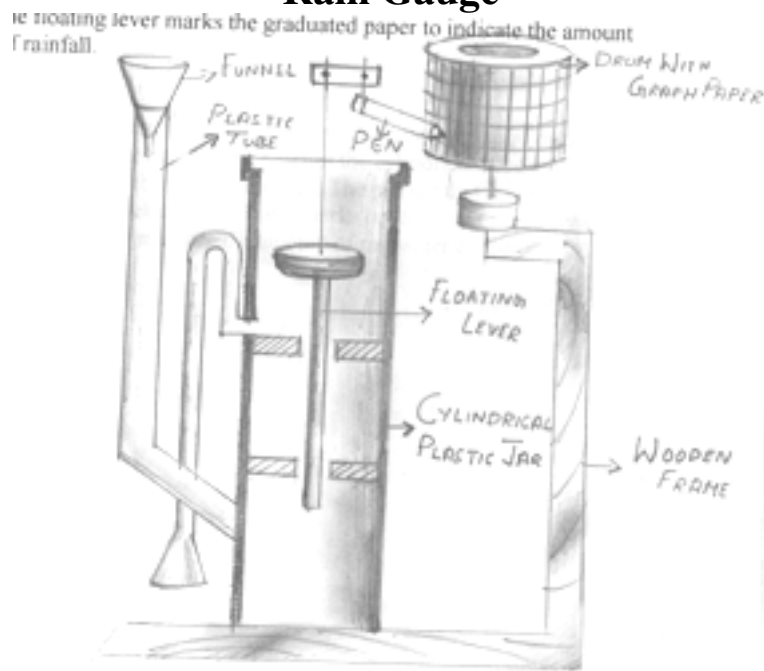


Principle : The principle of rotation and inclined plane are used to lift water from a lower level to higher level.

Procedure : The model is a design of Archimedes. The height difference between the levels, the distance between them decides the energy output. The angle of inclination, the diameter of blade, the pitch of the screw all have to be calculated for the desired efficiency.

Reason : The water flows into the lower most groove and rotation lifts it higher and higher countering the gravitational effect.

Rain Gauge



Principle : Measurement of rain water by using flotation.

Procedure : Rain water is collected and allowed to flow into a cylinder which has a floating lever. A pen is attached to the lever and it is arranged to mark on a rotating drum. As the water level increase leaves a mark on the graph paper.

Reason : The rise of the floating lever is dictated by the amount of water. Therefore, the amount of water collected can be calculated.

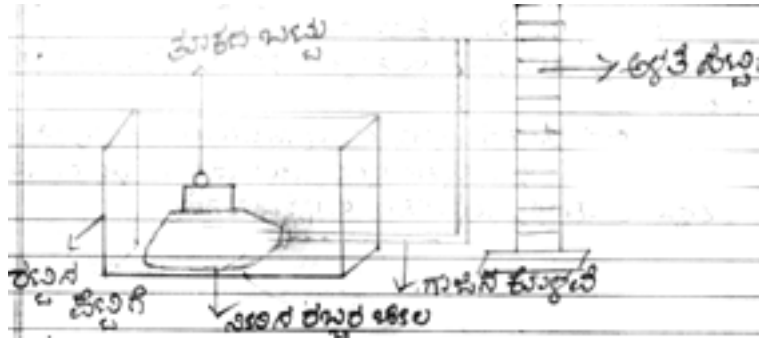
Electromagnetic Induction

Principle : Rotating magnet induces electric current

Procedure : A magnet is rotated with the help of a bobbin manually. The coil which is wound around it will have a current induced. This is indicated by a bulb which glows brighter as the magnet's rotation speed increases.

Reason : This is the principle of electromagnetic induction discovered by Michael Faraday, used in dynamos and motors.

Water Balance



Principle : Measuring weight using water pressure

Procedure : When a weight is placed on the rubber bag as shown in the figure, water pushes out into the L shaped tube. The height to which water raises is decided by the weight kept on the bag. Therefore, a scale on a graph paper can be prepared to indicate the weights.

Reason : The weight exerts pressure on the water inside the bag. This increase in pressure pushes the water out into the tube.