Do & Discover© Science Kit

Learn with Experiments!

Congratulations for getting this practical kit!! Before we begin, let's go through the safety instructions first!

SAFETY INSTRUCTIONS

1. Burning and heating should be done strictly in the presence of parents only. Keep all inflammable objects away while burning.
2. Chemicals should not be tasted or inhaled unless mentioned specifically.
3. Keep the science kit away from small children.
4. Always wash your hands with soap immediately after doing the experiments.
5. Never look at the sun directly through the convex lens or prism.
6. Magnesium wire burns very vigorously. Burn only a small piece at a time on the gas flame with long kitchen tongs or 'chimta'.
7. All experiments should be done under the observation of parents.

OTHER INSTRUCTIONS

1. Remove the metal seal of the phenolphthalein bottle very carefully. Put on the plastic dropper cap. Tilt the bottle and press the cap to get a drop of solution. Phenolphthalein may evaporate once the seal is broken.
2. Test tube can be heated directly on gas with low flame. Do not use it if it is cracked.
3. Take a paper underneath while handling chemicals so that they do not spoil the flooring.
4. Use only a small piece (1/2 or 1/3) of the pH paper and litmus papers at a time.
5. While using any chemical, use only a pinch (very small quantity) at a time.
6. Check the thermometer as soon as the kit is handed to you.
7. Whenever you take measurements, take 3-4 readings by repeating the procedure and take a reasonable average. This will reduce errors and improve accuracy.
8. Use a separate notebook to note down your readings, observations and conclusions.
9. Try to find out new experiments on your own and note down what you observed.
10. After completing each experiment, clean all the material and keep it back in place.

CONTACT US

Your feedback is very valuable to us. For feedback, suggestions and queries:

- Please call or whatsapp Rahul Ogale - 9892013836 or send an email at rahulogale@yahoo.com.
- Join our **whatsapp group** to discuss your experiments and share science posts and videos
- To see experiments done by other students and for guidance, watch our YouTube channels "young experimenters" and "ogalelearning".
- Visit our website **www.rahulogale.com** for more information about our **Mbooks** (multimedia mobile books), MGames, MPracts (for Homi Bhabha Practical Exam preparation using kit box), MTests (HomiBhabha Prelims on mobile), regular books, classes and activities.

YOUR KIT CONTAINS:

Experiment booklet	Candle	*Chemicals:*
Spring Balance	Match box	Calcium Carbonate
Thermometer	Dropper	Calcium Hydroxide
Prism	Beaker	Copper Sulphate
Bar Magnets	5 Marbles	Ammonium Chloride
2 Test tubes	Pendulum Bob	Alum
Test tube holder	Piece of Magnesium wire	Citric Acid
Convex lens	Magnetic compass	Sodium Carbonate
Concave mirror	Graph Paper	Sodium Bi Carbonate
2 plane mirrors	Filter paper	Potassium Permanganate
Measuring cylinder	Red & Blue Litmus Papers	Iron filings
Funnel	Ph Paper	Phenolphthalein

INTRODUCTION BY THE AUTHOR

What is an experiment?

The human brain can think. That is why it is curious to find out new things. Experiments are an outcome of this curiosity. Even a baby does experiments. It does some actions and checks how its mother reacts. From her response he learns whether the activity is good or bad. This urge to 'do something and check what happens' is our basic instinct. When modified into a systematic method, it is called an experiment.

Students often feel that 'experiment' means something exciting! They think, "Scientists do experiments. They take chemicals, mix them or heat them and see exciting changes." This is not quite true. Very few experiments are exciting in appearance. But for a science student, making your own observations and learning from them is always exciting.

As a student you may want to do experiments for many reasons -

- To verify the laws or rules which you have learnt
- To have a better understanding of the theory
- To remember the things easily by actually doing them
- To improve hand-skills and observation skills
- To increase accuracy in measurements and readings

In the future you might actually do a research-oriented job, and there might be a chance that you will actually do some new experiment which is useful for the development of science! Even in your routine work, experiments are essential for continuous improvements. But to reach that level, all the above points will be absolutely essential, and your practical kit will help you in that.

How to carry out the experiments?

1. First read the experiment. Think for a while, plan what you are going to do. Collect all the material required. Then start doing the experiment.
2. Observation – This is the most important step in all the experiments. Doing an experiment doesn't make any sense if you don't observe anything. Try to be a good observer and note down your observations systematically with units.
3. Writing the answers & conclusions – This is also an essential part of learning. If we do not write anything, we forget everything in no time! Writing is also very useful for the practical exam.

For any activity you do in life, 'Accuracy' and 'Quality' are most important. Force yourself to do the best quality job you can. Be your own judge and work for your own satisfaction. You will need determination and hard work to achieve this. But that is the only way to achieve true satisfaction.

LEVEL 1 – Know your Instruments

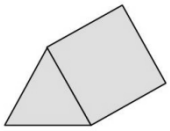
Let us begin with a few simple experiments to get familiar with our kit. ALWAYS note down your readings in a separate kit-notebook.

1. Spring Balance – It is used to measure weight. Use the spring balance to find out the weight of a tea cup in your house. (Always check and adjust the zero level first). Hold the handle as shown and note your reading. Weight of cup = _____ grams.
Also find out the weight of the pendulum bob in your kit = _____ grams.

2. Beaker – It is used to measure volume. Use the beaker to find out the volume of a stone:
Take some water in the beaker. Note initial water level = _____ ml.
Now put the stone in the beaker. Note new water level = _____ ml.
Increase in water level = _____ ml. So, volume of stone = _____ cc
Find the volume of other objects you can think of – e.g. a lemon, pendulum bob, etc.

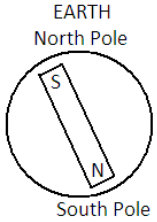
3. Measuring Cylinder – It is also used to measure volume. Follow the same procedure as above to find the volume of a stone using the measuring cylinder and note your readings of initial water level, new water level and volume of stone = _____ cc. (use a small stone that fits inside). Compare your answer with that using the beaker.
Q. Which one gives a more accurate reading – the beaker or the measuring cylinder?
Hint: The least count of the beaker is 5cc while that of the measuring cylinder is 1cc.

4. Thermometer – It is used to measure temperature. Use your thermometer to measure the temperature of the following objects (Note readings as _____ ^{o}C)
1) tea/coffee 2) bath water 3) tap water 4) boiling water
5) refrigerator main compartment 6) refrigerator freezer 7) your room
8) ice 9) crushed ice 10) salt + ice mixture 11) your body
Take water in a cup and measure its temperature. Now add glucose powder to it and stir. Quickly measure the temperature again. What change do you observe?



5. Prism – Observe the shape of the prism carefully. Look through it and see how various objects look distorted. Keep it in sunlight and tilt it at various angles to observe coloured spectrum on the ground. (Do NOT look at the sun through the prism)

6. Bar Magnets –
Observe how the magnets attract and repel each other in different positions.
Remember: Like poles of magnets repel each other and opposite poles attract.
(a) Try to move one of the magnets without touching it (use the other magnet to repel it).
(b) Take some coins of 1Re, 2Rs, 5Rs, 10Rs (Also old ones like 50ps, 25ps etc. if possible). Find out which types of coins are attracted by the magnet. Why?
(c) Keep a card paper on a magnet. Keep a coin on it. Move the coin by moving the magnet.
(d) Make a train of coins touching each other and try to pull it by touching a magnet at one end. How many coins can you pull?

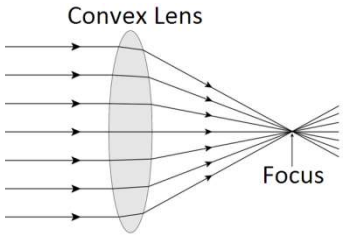


7. Magnetic compass – It is used to locate directions.
How does it work? – The earth has a magnetic field whose axis is nearly along the geographical north-south direction. Due to this, if a magnet is suspended, its north pole gets attracted towards the geographical north pole. Magnetic needle is a pivoted magnet. Its north pole (red mark)

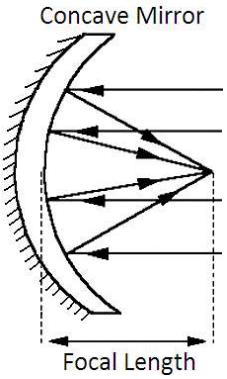
shows north direction.

a) Stand in the middle of the room. Locate all the directions with the magnetic needle. Which window faces east? Can you see the rising sun through that window? Which direction is your TV facing? Main door is facing which direction? In which direction do you sleep at night (north-south/ east-west/ any other)?
b) Bring a bar magnet near the compass and see how the magnetic needle behaves. Why does it deflect? Which pole of the magnet does the red mark get attracted to – north or south? Why?

8. Convex lens –



a) Touch and feel the convex lens bulging at the centre.
b) Read through the lens and see how the letters appear.
c) Try to obtain the image of a tubelight on the opposite wall using the convex lens (adjust the distance between the lens and the wall till you get a sharp image).
d) NEVER look at the sun directly through the lens.



9. Concave mirror –

a) Observe your face in the concave mirror. How does it appear?
b) Stand with your back towards a window. Get the image of the building/ view outside in the concave mirror. How does the image appear – nearer or farther than it actually is?

10. Test tubes, Test tube holder, Candle, Dropper –

Do this with the help of your parents only. Light the candle and fix it on a flat surface. Take some water in a test tube using the dropper. Fix the test tube in the test tube holder and hold it slightly inclined on the candle. Observe how the water boils. Put a 2-3 particles of potassium permanganate ($KMnO_4$) in the test tube. Now you will see **convection currents** in the water. Do similar currents flow in solids also?

11. Chemicals, Litmus Papers, pH paper -

a) Cut a lemon and touch a blue litmus paper to the wet part. What change in colour do you see? Why?
b) Wet your soap and touch a red litmus paper. What change in colour do you see? Why?
c) Take a pinch of citric acid from the chemical bottle. Dissolve it in a few drops of water and test it with small pieces of red and blue litmus paper. Which litmus changes colour in acid?
d) Take a pinch of sodium carbonate (washing soda - Na_2CO_3) from the chemical bottle. Add a few drops of water and test it with small pieces of red and blue litmus paper. Which litmus changes colour?
e) Test all the above (lemon, soap, citric acid and washing soda) with small pieces of pH paper. Each time, match the colour of pH paper with the colour strip provided.

Remember:

- 1 ml volume = 1 cc volume = Volume of a cube of size 1 cm x 1 cm x 1 cm = $1cm^3$
- Density = Mass per unit volume = Mass/Volume
- Density of water is 1 gm/cc. (i.e. 1 cc volume of water has mass = 1 gram)
- Units are very important in measurements. E.g. Length is measured in mm/cm/metre/etc., Area in square units (sq cm/sq metre/etc.), Volume in cubic units (cu cm = cc/ml/etc.)

LEVEL 2 – Conduct experiments in laboratory style.

Note:

- Before you begin any experiment, read the entire instructions (description & questions) carefully till the end. Try to understand the objective of the experiment.
- Note all your observations neatly in order to draw correct conclusions.
- Try to answer all the questions below. Do contact us if you have any difficulties (see first page).
- After completing each experiment, think of the exact logic behind it. Ask yourself why it could have happened. Try to make a new experiment of your own using similar logic.

PHYSICS

Experiment 1:

Name: Matter occupies space Material: Bottle, Funnel

Description: Take a 500 ml plastic bottle. Hold a funnel tightly on its mouth to make it airtight. You can use wax or plasticine clay to make it airtight. Now start pouring water into the funnel.

Questions:

1. Does water enter the bottle? Why?
2. What are the properties of matter? Which property is involved in this experiment?
3. Is air 'matter'? Write all the states of matter with 2 examples of each.
4. Molecules of solids are _____ (closely / loosely) packed as compared to those of gas.

Experiment 2:

Name: Finding the volume of a marble using measuring cylinder.

Material: 5 marbles, measuring cylinder, water

Description: Take 20cc of water in measuring cylinder. Add 5 marbles to it. Note down new volume.

Questions:

1. Initial level of water = _____ cc. 2. Final level of water = _____ cc
3. Volume of 5 marbles = _____ cc. 4. Volume of one marble = _____ cc
5. Will the volume change if we take some other liquid whose density is more than water (e.g. milk) in the measuring cylinder instead of water?

Experiment 3:

Name: Finding the volume of a single drop of water

Material: Dropper, Measuring Cylinder, water

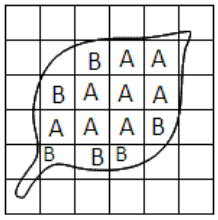
Description: Take some water in a dropper. Go on putting water drops in the measuring cylinder until you collect 10 ml water. Count how many drops are put.

1. How many drops make volume 10 ml? 2. Volume of each drop = _____ ml
3. Why is a drop of water spherical (round) in shape?

Experiment 4:

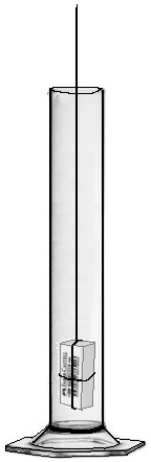
Name: Finding the area of a leaf using a graph paper

Material: Medium sized leaf, graph paper



Description: Keep the leaf on the graph paper and draw its outline. Remove the leaf. Count how many one cm squares are completely covered by the object. How many are partially covered. Use only dark (cm) lines of the graph paper for counting.

1. Number of complete squares (A) = _____
2. Number of more than half complete squares (B) = _____
3. Total area of the object = A + B = _____ (Write units)
4. One square meter = _____ cm^2 = _____ mm^2
5. Can you find the area of this leaf using overflow vessel?



Experiment 5:
Name: Finding the volume of a rectangular parallelopiped object by two methods.
Material: Rectangular parallelopiped shaped object (preferably eraser with sharp edges), Measuring cylinder, scale, string, water
Description: Measure all the dimensions of the eraser.

a) Note your readings: length = _____ cm, breadth = _____ cm, height = _____ cm.
b) Find the volume = length x breadth x height = _____ cu cm.
c) Take around 15-20 cc water in the measuring cylinder. Note initial level = _____ cc.
d) Now tie a string to the eraser and dip it in the cylinder. Note final level = _____ cc.
e) Calculate volume by this method = final level – initial level = _____ cc.
f) Compare both your answers.

Some more questions:

1. How many surfaces has the object got?
2. Find out the area of the largest surface
3. How many right angles can you find on the object?
4. How many vertices (corners) are there?
5. Try to find total surface area. (Hint: There are 2 surfaces of each type)

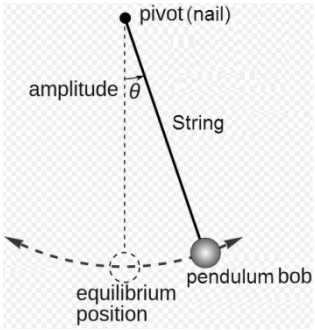
Experiment 6:
Name: Finding the capacity of your water bottle using measuring cylinder.
Description: Take an empty water bottle (or a cold drink bottle). Take 100 cc water in a measuring cylinder. Put the water in the bottle using funnel. Repeat. Count the number of times 100cc water was put into the bottle. When the bottle is nearly full, put 25 cc water at a time. Repeat this procedure till the bottle is full. Questions:

1. Number of times 100cc water was put = _____
2. Number of times 25cc water was put = _____
3. Capacity of given bottle = _____ cc
4. 1 litre = _____ cc
5. Density of water is 1 gm/cc. What is the mass of the water in the bottle?
6. Mercury is 13.6 times heavier than water. How many cc of mercury can the bottle contain?

Experiment 7:
Name: To observe effect of heat on air
Description: Tie a balloon to the mouth of a bottle. Keep the bottle in cold water and observe. Keep it in hot water and observe.

1. What happened when bottle was held in cold water? Why?
2. What happened when bottle was held in hot water? Why?

Experiment 8:
Name: To study oscillations of a pendulum
Description: Tie a non-elastic string to a pendulum. Make a small loop on the other side of the string and hang it to some small nail at a suitable height. The centre of the pendulum bob (metal ball) should be at a distance of 25cm from the nail from which the string is suspended. Now give a small displacement to the bob and let it oscillate freely. While oscillating the string or the pendulum should not touch any obstacle. Count the number of oscillations in one minute. (Start counting when pendulum is at one end. When it again comes back to the same position it is said to have completed one oscillation.)

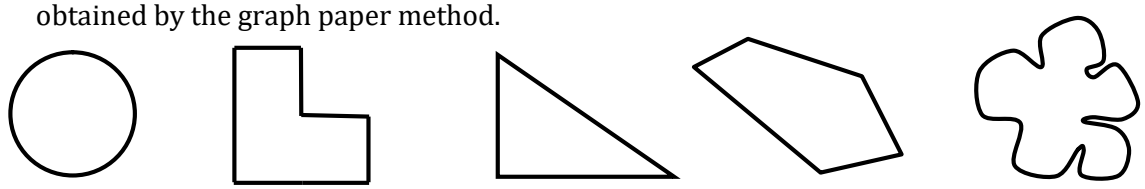


Questions:

1. Number of oscillations in 60 sec = _____
2. Time period for one oscillation = _____ sec
3. Repeat the experiment with 100cm long thread. Write the observations.
4. When length of the string is increased, oscillations become _____ (faster / slower)
5. If the weight of the pendulum is increased (with the length kept constant), will the frequency of oscillations change?

Experiment 9:
Name: Finding the area of various shapes using both graph paper and calculation methods
Material: A sheet of paper, scale, graph paper
Draw figures similar to those given below (but larger in size) on a sheet of paper and cut them out. You can also draw any more shapes you like.

a) Find the area of all the figures using graph paper method.
b) Find the area and perimeter of the L-shape by measuring dimensions and using your own ideas. Compare with the area obtained by graph paper method.
c) Find the area of the triangle and the circle using formulae and compare your answers with those obtained by the graph paper method.



Experiment 10:
Name: Testing the buoyancy of different objects
Description: Take objects of different materials given below (add more using your own imagination). For each object write your own prediction whether it will float or sink in water. Now put them into a bucket of water one by one and write your actual observation in each case.
a) rubber erasers, wax candle, iron nails, wooden piece, shells, copper wire, marbles, coins, sponge
b) empty plastic bottle, plastic bottle completely filled with water, plastic bottle filled with iron nails
c) piece of paper, paper boat, ball of crumpled aluminium foil, boat made of aluminium foil
Questions:

1. Why does aluminium ball sink but boat of same material float?
2. What can you conclude about density of wax – is it more or less than 1gm/cc?
3. What about density of glass, plastic, rubber, copper, wood, aluminium?

Experiment 11:
Name: Testing the magnetic properties of different materials
Material: Objects of different materials such as iron, copper, aluminium , steel, wax, rubber, glass, plastic, gold & silver (Try to borrow from your parents for a while but handle very carefully)
Description:
a) Find which materials get attracted to a magnet. (Return the gold & silver immediately!)
b) Put iron nails in water and test whether magnetism acts under water.
c) Rub one of the poles of a bar magnet on an iron nail in the same direction for a minute. Check that the nail is now able to attract another iron nail. (The nail is magnetized – it has become a magnet itself!)
d) **Temporary magnet**: Keep a bar magnet in contact with an iron nail. You can stick it using a cellotape. Now bring this nail in contact with another nail (the magnet should not touch the new nail). See that the nail attracts the other nail. Note: This magnetism is temporary. The nail is not magnetised as in (3) above. This magnetism will disappear as soon as the bar magnet is removed.

Experiment 12:
Name: Friction
Description: Give a slight hit to a coin on different surfaces like glass, granite, sand paper, sunmica, metal plates, cloth bedsheet, rough carpet, etc. and observe. Hit with the same force every time.

1. On which surface did the coin move maximum distance?
2. Now roll the coin with the same force. It will move much more distance. What can you conclude from this? Try the same with a marble.
3. Why do we put boric powder on carrom board or oil in moving machine parts?
4. Give two examples where friction is increased purposely.
5. Why is it more difficult to skate than to walk? Will we be able to walk on a frictionless road?

Experiment 13:

Name: To find the poles of the bar magnet using magnetic compass.

Description: Cover a bar magnet with a piece of newspaper and cellotape so that you cannot see which pole is the north pole. Now bring the bar magnet near the compass (with one of its poles towards the compass). Observe how the needle gets deflected. Now bring the other pole towards the compass and observe. Can you now identify which pole of the bar magnet is the north pole? (Hint: You know which end of the compass needle is the north pole.) Remove the paper cover and check your answer.

a) Identify north and the south poles of the bar magnet. Explain your answer.

b) Tie a string to the bar magnet at its midpoint and suspend it freely. Which is the direction shown by the north pole of your bar magnet? Is the result consistent with that of the magnetic needle?

Questions:

1. What are magnetic substances?
2. What will happen if we heat a magnet?
3. Which is a sure test of magnetism?
4. Which equipment in your house contains a magnet?
5. What is the difference in temporary and permanent magnet?

Experiment 14:

Name: Finding the thickness of a one rupee coin

Material: 10 coins of one rupee, scale

Description: a) Measure the thickness of one coin using a scale. Note down the reading.

b) Now make a stack of 10 coins. Keep them on edge of the table, measure the thickness of 10 coins. Note your reading and calculate the thickness of one coin.

Questions:

1. Thickness by method (a) i.e. by measuring only one coin = _____
2. Thickness of 10 coins = _____
3. Thickness of one coin by method (b) = _____
4. Which method gives a more accurate answer - (a) or (b)? Why?
5. Will the accuracy increase further if we use 50 coins instead of 10? Why?
6. One meter = _____ cm
7. One meter = _____ mm
8. What is the least count of your plastic scale?

Experiment 15:

Name: Finding the density of metal (pendulum)

Material: Pendulum, Spring Balance, Beaker, Water

Note: Density of a material = $\frac{mass}{volume}$. Density tells us how closely packed its atoms or molecules are.

Description: Take some water in the beaker (water should be enough for the pendulum to get completely immersed). Note the initial level of water = _____ Now put the pendulum into the beaker. Note the new water level = _____. Using this, find the volume of the pendulum.

Now find the mass of the pendulum using the spring balance.

Questions:

1. Volume of the pendulum = Initial level – Final level of water = _____ cc
2. Mass of pendulum = _____ grams
3. Density of metal = $\frac{mass}{volume}$ = _____ gm/cc
4. Will the pedulum bob float or sink in mercury?
5. What will be the volume of the pendulum on the moon?
6. What will be the mass of the pendulum on the moon?

Experiment 16:
Name: To study the magnetic field of bar magnets
Description:

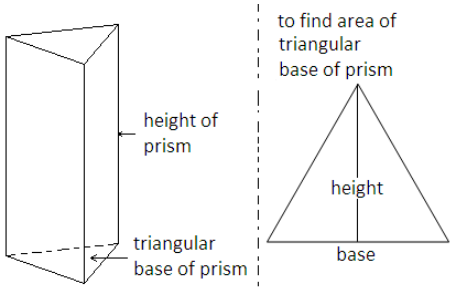
a) Put a card paper on one of the magnets. On the top of the paper put some iron filings (provided in the chemical bottles packet). Tap the paper gently till you see a clear arrangement of the particles. Draw a diagram of the arrangement of iron filings.
b) Put the two magnets in attracting position (with small gap in between). Keep the card paper with iron filings on top of the two magnets and tap it. What arrangement do you observe now? Draw a diagram.
c) Repeat the procedure keeping the magnets in repelling position. Draw a diagram.

What difference do you observe in the arrangement in attracting and repelling positions?
Note: The alignment of iron filings shows the magnetic lines of force

Experiment 17:
Name: To find the volume of a prism
Material: Prism, Beaker, Measuring Cylinder, water, scale
Description: Try to think of a method to find the volume of the prism. Try it out. Then try the methods below and compare your answers.

Method 1: Keep the prism inside the beaker. Pour water slowly into the beaker till it reaches 100ml level. Transfer all the water into the measuring cylinder (hold a finger at the end so that the prism does not fall). Note the water level in the measuring cylinder = _____(x)_____ ml.
Volume of prism = 100 – x = _____ ml.

Method 2: Keep the prism (triangular face down) on a paper. Draw an outline of its base. It is an equilateral triangle. Measure its base and height. Measure the height of the prism.



1. Length of triangular base = _____ cm
2. Height of triangular base = _____ cm
3. Area of the triangular base = ½ x base x height = _____ sq. cm.
4. Height of prism = _____ cm
5. Volume of prism = Area of base x Height = _____ cu.cm.
6. Compare the answer with that obtained by method 1.
7. How many right angles does the prism have?
8. How many surfaces does the prism have?
9. Find the total surface area. (Hint: How many surfaces of each type are there?)

Experiment 18:
Name: To find the density of glass
Description: You have 2 glass objects in your kit – prism and marbles. Let us compare the density of glass in both. You have already found the volume of the prism in expt. 17 and the volume of marbles in expt. 2. We will use this data. Now we need to find the mass of both. Take 5 marbles in a plastic bag and weigh it. Then keep the prism in a plastic bag and weigh it.

1. Volume of 5 marbles (found in expt.) = _____ cc
2. Mass of 5 marbles (found using spring balance) = _____ gm
3. Density of glass (of marbles) = $\frac{mass}{volume}$ = _____ gm/cc
4. Volume of prism (found in expt.) = _____ cc
5. Mass of prism (found using spring balance) = _____ cc
6. Density of glass (of prism) = $\frac{mass}{volume}$ = _____ gm/cc
7. Is the density of glass same in both cases?

Experiment 19:

Name: To study the apparent loss of weight in water

Material: Stone, Spring Balance, Beaker, water

Description: Take a stone that will fit inside the beaker. Tie a string to it and make a loop at the other end of the string. Weigh the stone with the spring balance. Note the reading. Initial weight of stone = _____ gm.

Take water in the beaker. Note: The amount of water should be such that the stone will get completely immersed in it but water will not spill. Note the initial water level = _____ cc.

Holding the spring balance, dip the stone into the water. Now observe the reading on the spring balance. (The weight has changed!). New weight = _____ gm.

Also note the new water level = _____ cc

Questions:

1. Apparent loss of weight in water = Initial weight – New weight = _____ gm
2. Volume of stone = New water level – Initial water level = _____ cc
3. Do you see any relation between the volume of stone and apparent loss of weight?
4. Why does the weight of the stone seem to reduce in water?
5. (For 9th Std students) State the Archimedes Principle of Floating.

Experiment 20:

Name: Observe action-reaction forces.

Description: Action and reaction forces are always equal and opposite to each other. They act on different objects. E.g. While walking, we push the ground backwards (action force acting on ground) and so the ground pushes us forward (reaction force acting on us).

Do the following simple experiments and explain the action and reaction forces:

1. Blow up a balloon. Hold the mouth downwards and let go. Why does the balloon go up?
2. Try sending the balloon in different directions.
3. Roll a ball towards a wall. Why does the ball come back after hitting the wall?
4. Take a big ball (heavier) and a small ball (lighter). Make them collide. Explain what happens.
5. How do birds fly? 6. How does a rocket go up?

Experiment 21:

Name: Study the effect of dissolving salt in water

Material: Measuring cylinder, salt, water, bottle cap

Description:

a) Take 30cc water in the measuring cylinder. Fill the bottle cap with water upto to the brim and add it to the measuring cylinder. Note the new water level = _____ cc.
   Increase in water level on adding capful of <u>water</u> = new level – 30cc = _____ cc

b) Empty the measuring cylinder. Make the bottle cap completely dry. Again take 30cc water in the cylinder. Fill the bottle cap with salt upto to the brim and add it to the measuring cylinder. Use a stick/spoon to stir and completely dissolve the salt. Note the new water level = _____ cc.
   Increase in water level on adding capful of <u>salt</u> = new level – 30cc = _____ cc

1. What is difference in your observation in case (a) and (b)?
2. Why did water level rise less when salt was added? 3. What is saturation level?

Experiment 22:

Name: Filtration of water

Description: Take some muddy water. Make a cone out of filter paper. Make it wet and fit it in the funnel. Now pour the muddy water in the funnel. And collect the filtered water in a beaker.

1. Are all the impurities removed by filtering with filter paper? Which of the impurities can still remain in it? Suggest methods to remove them.
2. Is this filtered water safe for drinking? 3. What is distilled water? What are its properties?
3. Which substances are used for purification of water?

CHEMISTRY

Note:

- Phenolphthalein evaporates very fast. Keep the bottle tightly closed. Do the experiments which require phenolphthalein within 15-20 days from purchasing the kit.
- SAFETY should be the first priority while doing any of the experiments.
- Some experiments require household chemical substances (e.g. salt, sugar, turmeric, lemon, etc). Clean your hands before taking them so that other chemicals do not mix with them.

Acid-Base Indicators: Litmus paper, Ph-Paper and Phenolphthalein are used to identify acids and bases. They are called "indicators". They behave as follows:

1. Red litmus turns blue in base. (It does not change colour in acid)
2. Blue litmus turns red in acid. (It does not change colour in base)
3. Phenolphthalein turns pink in base. (It remains colourless in acid)
4. Turmeric (haldi) solution turns red in base. (It does not change colour in acid)
5. Ph paper changes colour in both acids and bases (see colour chart on the strip). That is why it is called a universal indicator
6. Indicators do not change colour in neutral substances

Experiment 1:

Name: Litmus Test

To find the nature of substances – acidic/ basic (alkaline)/ neutral – using litmus paper

Material: milk, butter milk, vinegar, pickle, tomato sauce, fresh tomato, jam, sugar solution, sea water, soap water, tap water, orange, lemon, fizzy cold drink

Description: Take a small quantity of each substance and test it with both red and blue litmus papers. Make a table of your observations with name of substance and its nature

Questions:

1. Which substances were acidic? Which were basic? Which were neutral?
2. Do you know the nature of blood?
3. What is the nature of muddy water?
4. Do acids and bases react with each other? What is the outcome of such a reaction?

Experiment 2:

Name: To study some chemicals

Description: Take small samples (pinch) of sodium carbonate (Na_2CO_3), sodium bi carbonate ($NaHCO_3$), alum, copper sulphate ($CuSO_4$), sugar, common salt. Observe the samples. Make a solution of each sample and test it with litmus papers and turmeric solution. For each substance answer the questions (make a table for better understanding).

Questions:

1. What is its colour?
2. Is it crystalline or amorphous?
3. Does it dissolve in water?
4. Is its solution soapy or oily to touch?
5. What is its nature (acid / basic / neutral)?
6. Name one of its uses.
7. Put some iron pieces (or nails) in the copper sulphate solution. Leave it undisturbed for 3-4 hours. What change do you observe in the iron pieces? What is the change in the colour of the solution? (9^{th} Std students should write the chemical reaction also.)

Experiment 3:

Name: To study the effect of heat on some chemical substances.

Description: Take small samples of alum, copper sulphate, common salt, sugar. Heat them in a clean and dry steel spoon (on a candle) one by one. Observe.

1. Write your observations of each substance before heating the next one.
2. Write the chemical formula of each substance

Experiment 4:
Name: Sublimation
Description: Take a pinch of ammonium chloride in a test tube. Put a cotton plug at the mouth of the test tube. Heat the test tube till you observe some vapours.
Questions:

1. Explain your observation. What kind of change is this? (physical / chemical)
2. What kind of substance is ammonium chloride? Name 3 other substances showing this property.

Experiment 5:
Name: To find out adulteration in powdered sugar sample
Description: Sodium Bicarbonate (soda-bi-carb – $NaHCO_3$) powder looks similar to powdered sugar. Take two samples of powdered sugar – A and B. Tell your parents or friends to add some soda-bi-carb to one of the samples secretly. Now your task is to find out the adulterated sample. For this use citric acid solution in water. Take a small quantity of powders from both A and B and add the acid solution to it.
Questions:

1. What did you observe when acid was added?
2. How did you identify the adulterated sample?
3. Is Soda-bi-carb acidic or basic (alkaline)?
4. Write uses of soda-bi-carb. Give its chemical formula.
5. Write the reaction of soda-bi-carb with dilute HCl. (For 9th Std students only)

Experiment 6:
Name: To study ammonia gas
Description: In a test tube take a pinch of calcium hydroxide and ammonium chloride. Shake it slightly to mix the chemicals. Now heat the test tube. Observe the gas coming from the test tube. Hold <u>moist</u> blue and red litmus papers at the mouth of the test tube.
Questions:

1. What is the change in the colour of the litmus papers?
2. What is the nature of the gas that evolved? (conclude from litmus test)
3. Write one use each of calcium hydroxide and ammonium chloride
4. What kind of substance is ammonium chloride?
5. Write the chemical reaction that took place on heating (For 9th Std students only)

Experiment 7:
Name: To observe effect of heat on copper sulphate
Description: Take a pinch of copper sulphate in a spoon and heat it. Observe the change.
Questions

1. What was the nature and colour before heating?
2. What is the nature and colour after heating?
3. Cool the crucible and add a drop of water. Does the substance regain its original state?
4. Is this a physical change or chemical change?
5. What is the chemical formula of copper sulphate? What are its uses?

Experiment 8:
Name: Burning of magnesium wire
Description: Take a small piece of magnesium wire. Hold it in a test tube holder and ignite it on gas. It might not burn on a candle. <u>Do this experiment in the presence of parents only.</u> It burns with a bright flame. Collect the white powder (magnesium oxide - MgO) formed after burning. Dissolve it in some water in a dish. Test the solution with red and blue litmus and identify its nature.
Questions:

1. What is the nature of the magnesium oxide solution?
2. Name one use of the magnesium wire

Experiment 9:
Name: Identify acid, alkali and neutral solutions and study the behaviour of all indicators
Material: Litmus papers, pH paper, phenolphthalein, turmeric, sodium carbonate (Na_2CO_3), citric acid
Description:
Take 3 identical containers. In the 1st container dissolve a pinch of citric acid in water.
In the 2nd container dissolve a pinch of sodium carbonate (base) in water. In the 3rd container take some water (neutral). Ask your friend/parent to label the 3 containers as A, B, C (you should not know which is which). Your task is to identify which container contains acid, base and neutral solutions.
Take some of the solution from 'A', 'B', 'C' and test it with red and blue litmus papers and pH paper. Similarly test them with turmeric solution (haldi powder mixed in water). Test the solutions with phenolphthalein (add one drop of phenolphthalein).

Questions:
1. Write your observations in the table shown alongside:
2. Which ions are present in acid?
3. Which basic substance do we use daily?
4. Name any two acidic substances which we can eat.

No	Indicator	Colour in A	Colour in B	Colour in C
1	Red litmus			
2	Blue litmus			
3	pH Paper			
4	Turmeric solution			
5	Phenolphthalein			
	Conclusion	A is _____	B is _____	C is _____

Experiment 10:
Name: To study the chemical properties of carbon dioxide gas
Description:
Take a pinch of sodium bicarbonate ($NaHCO_3$) in a dry test tube. Add some citric acid crystals to it. Shake the test tube to mix the chemicals keeping a finger at its mouth. Observe that no reaction take place.
Keep moist litmus papers ready. Burn a candle and keep it ready. Now add a few drops of water to the test tube. Hold the moist blue and red litmus papers at the mouth of the test tube (Don't dip it inside). Observe the change. Now hold the burning candle near the mouth of the test tube. Observe the change.
Questions:
1. What happened when water was added?
2. From litmus test, find the nature of the evolved gas (CO_2).
3. What happened when you brought the burning candle near the test tube? Explain why.
4. Write 2 physical and chemical properties of the evolved gas. Also write 2 uses of the gas

Experiment 11:
Name: Neutralization
Description: In one test tube, dissolve a pinch of sodium carbonate or sodium bicarbonate (alkali) in water (about 1/3 of the test tube). Add a drop of phenolphthalein to it. In another test tube dissolve a pinch of citric acid in water and make acid solution. Add the acid solution drop by drop to the 1st test tube containing base (alkali). Observe the colour change.
Questions:
1. What was the colour of the solution after adding phenolphthalein?
2. What change has taken place after adding acid? Why?
3. What is the colour of phenolphthalein in acid and in alkali (base)?
4. What is the meaning of neutralization?

Experiment 12:
Name: Curdling of milk
Description: Take some milk in a test tube and add some lemon juice/ vinegar to it. Observe the change. What kind of change is this (physical/chemical, reversible/irreversible)?

Experiment 13:
Name: To study the nature of germinating seeds.
Description: Take germinating seeds with radicals. Take a plastic dish. Keep red and blue litmus pieces on some moist cotton on the dish. Keep the seeds on the litmus. Observe after every 6-8 hours. Observe the change. (Blue litmus will turn red).

Experiment 14:
Name: Fungus
Description: Take a piece of bread and put it in a dish. Sprinkle some water on it. Keep it for 2-3 days. Cover it with some plastic container. Observe daily.

1. What has grown on the bread? 2. Observe it with a convex lens and write your observations.

Experiment 15:
Name: Rusting of iron
Description: Take a few iron pieces. If they are oily, wash them to remove the oil. Take water in a dish and put the pieces into the water. Observe after 3-4 days. Every day add water to the dish if required.
Questions:

1. What was colour of the iron before and after the experiment?
2. What is rust? 3. How to prevent rusting of iron?

Experiment 16:
Name: Hard water and soft water
Description: Take some sea water and tap water in two test tubes. Add a few drops of soap solution in each test tube. Shake both the test tubes gently.
Questions:

1. Write the difference observed. Which water sample is hard water?
2. Which salts are present in hard water?
3. Take some hard water in a test tube. Add sodium carbonate (Na_2CO_3) to it and shake it. Now add soap solution and again shake it gently. Do you get lather now?
4. How to make hard water soft?

Experiment 17:
Name: Effect of Bordeaux mixture on fungus
Description:
To make Bordeaux mixture: Take calcium hydroxide and copper sulphate in a test tube (in the ratio 1:1 by volume) and add water to it. Dissolve the chemicals in the water. This is called Bordeaux mixture.
Take a piece of bread and cut it into 2 parts. Keep them into two different containers. Add Bordeaux mixture to one of the containers. Add a few drops of sugar solution to the other container. Observe every day for next 3-4 days. What difference do you observe in both the samples of bread?

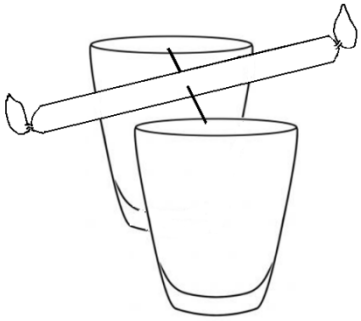
Some useful answers (physics Level 2)

Expt 2: Volume will not change if we take some other liquid instead of water because marbles will displace volume of liquid equal to their own volume even if we put them into any other liquid. The only condition is that the marbles should sink into the liquid.
Expt 6: Even if mercury is heavy, same volume of mercury will fit in the bottle (its mass will be different)
Expt 8- Frequency of pendulum will not change if weight is increased (it depends only on the length).
Expt 14: Accuracy will increase if we use 50 coins instead of 10 because the inaccuracy in the measurement will get divided over 50 coins instead of 10. This will lead to less error per coin.
Expt 15: The volume and mass of the pendulum will remain the same on the moon. Only weight changes on moon as gravitational force changes.
Expt 19: Weight appears to reduce in water because water applies upward buoyancy force on the stone.
Expt 21: Salt occupies intermolecular spaces in the water and so the water level rises lesser.

LEVEL 3 – For keen experimenters and science lovers!

- If you are able to do Level 3 experiments, do post your photos and videos on our whatsapp group. Experiments are more fun if you do them together and share your experiences!
- Do contact us (Rahul Ogale – 9892013836) or post on the group if you face any difficulties.
- Students selected for Homi Bhabha Practical Exam should try to do all these experiments.

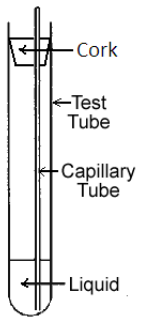
Experiment 1:
Name: Make a see-saw with a burning candle.
Description: Remove some portion of wax from the ends of the candle so that the wick is exposed at both ends (so that you can light the candle from both ends). Find the midpoint of the candle. Insert a long metal pin through the midpoint. The pin should be perpendicular to the candle and wick. The candle should freely rotate on the pin. Support both the extended ends of the pin. Light both the ends of the candle. You will find that the candle moves like a see-saw.



1. Why does the candle keep changing its position?
2. Will the see-saw work if the candle is lighted only from one end? Why?

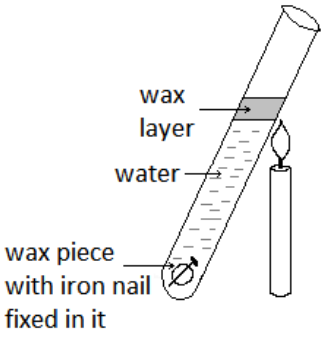
Note: *If you are successfully able to do this experiment, do post your video on our whatsapp group!! This will help to guide and encourage your fellow science experimenters (contact Rahul Ogale – 9892013836).*

Experiment 2:
Name: To study the effect of heat on air and water.
Description: Take a test tube. Make a cork/rubber lid which fits tightly on the test tube. Make a small hole and insert a small capillary into it. (A capillary is a hollow tube of small diameter. You can use an empty ball pen refill as a capillary tube. Or remove the cotton from both ends of the ear bud and use it as a capillary.) Put a drop of ink into the capillary and fit the lid on the test tube. Now heat the test tube. Observe the changes. Repeat the same experiment with a test tube filled with coloured water.



1. Write the observation in first and second case. Explain both the observations
2. Expansion of gases is _____ (faster/slower) than those of liquid

Experiment 3:
Name: Studying heat transfer by convection
Material: test tube, wax, iron nail, test tube holder, candle
Description: Fill upto ¾ of the test tube with water. Scrape out some small pieces of wax from a wax candle or wax crayons. Insert an iron nail into one of the pieces. Put in in the test tube (it will sink). Now put some more pieces of wax in the test tube (they will float). Heat only the upper layer of water till it boils. Do NOT heat the bottom of the test tube (Hold the test tube in a slanting manner).

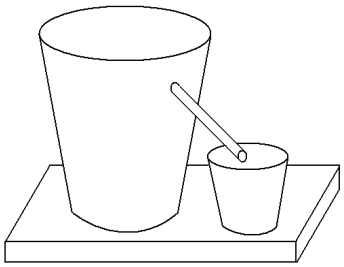


1. What did you observe? 2. Why does the wax at the bottom not melt?
3. What are the three types of heat transfer mechanisms? Give one example of each.

Experiment 4:
Name: To burn paper by focussing light by convex lens.
Description: ***Do this in the presence of your parents only.***
Keep a piece of paper or match stick on the ground in sunlight (AWAY FROM ANYTHING ELSE WHICH CAN CATCH FIRE). Hold the convex lens in sun light such that the sunlight gets focused at a point on the paper. (NEVER LOOK TOWARDS THE SUN THROUGH THE LENS. Also avoid staring at the bright spot created by focusing). The paper will catch fire. (Keep some water ready at your hand, for safety.)

1. Why does the paper burn? 2. Write two uses of convex lens.

Experiment 5:
Name: To make and use an overflow vessel
Material: Empty can, stiff straw, M-seal, Beaker/ Measuring Cylinder
How to make it:
Take a clean empty plastic container (e.g. Amul Shrikhand Can). Make an inclined hole in it of the size of a straw using a red hot nail. Put the straw in the hole but don't let it protrude inside. Remove protrusions with sand paper. Fix the straw in that position using M-seal from outside.
How to use it:
An overflow vessel is used to find the volume of a solid object.



Keep the overflow vessel in a tub/ tray (so that water does not spill on the ground). Fill water into the overflow vessel till it overflows through the tube/straw. Wait till the water stops overflowing. Now keep a small container ready to collect water coming through the straw. Then put the object inside slowly without dipping your fingers (tie the object to a thread if necessary). Collect all the water that overflows through the straw till the last drop. Measure the volume of this water using a beaker or measuring cylinder.
Volume of the object = Volume of water displaced by it = Volume of collected water.
Use your overflow vessel to find the volume of a stone, pendulum bob, a lemon, etc.

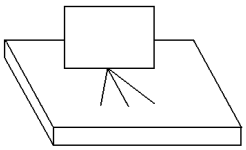
Note: *If you are successfully able to make a working overflow vessel, do post your photos on our whatsapp group!! (contact Udita Ogale – 9892108541 / Rahul Ogale – 9892013836).*

Experiment 6:
Name: Finding the porosity of sand
Material: Dry sand/ soil, beaker, measuring cylinder, water, dropper
Description: Procure some dry sand from a beach. If not possible, bring some dry soil from a garden.
Note: *Porosity of a material is the volume of pores (holes) present in a unit volume of the material.*
I.e. Porosity is the ratio = $\frac{\text{Volume of holes}}{\text{Volume of material}}$. Before you read further, try to think of a method to find this ratio for your sand. Try out your method. Then read and try the method below:

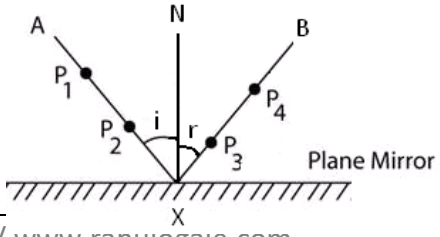
Put the sand into the beaker with a spoon till it reaches the 50cc mark. Take 50cc water in the measuring cylinder. Pour water very slowly from the measuring cylinder into the beaker till it attains exactly the same level as the sand. (Use a dropper when the level is close so that you do not exceed the level of the sand). Note the new water level in the measuring cylinder = _____ cc.

1. Quantity of water that entered the sand in the beaker = New level – 50 cc = ____(v)____ cc.
2. So 50cc of sand is able to accommodate ___(v)___ cc of water. So porosity of sand = $v/50$ = _____.
3. Percentage porosity of your sand = $\frac{v}{50} \times 100$ = _____ %

Experiment 7:
Name: Verifying the law of reflection: Angle of Incidence = Angle of Reflection

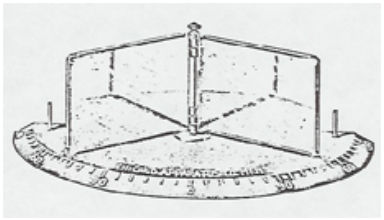


Material: Plane mirror, thermocol sheet, paper, 4-6 pins, scale
Description: Fix a plane mirror parallel to one side of a rectangular thermocol sheet. Use pins to fix a paper on the thermocol sheet. Put two pins P_1, and P_2 on the sheet at a suitable angle. Observe their image in the mirror from the other side. Put two more pins P_3 and P_4 such that you can see all the four pins in one straight line. Then mark the positions of the pins and remove them.
On the paper join P_1 and P_2 and draw line AX. Draw a perpendicular NX to the mirror surface at X. Join P_3 and P_4 and draw line BX.



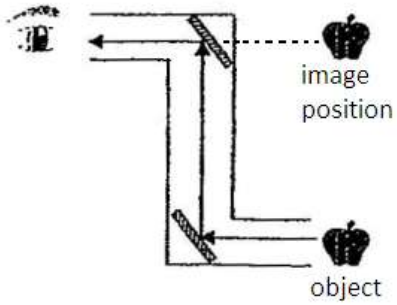
1. Measure angle AXN = angle of incidence (i) = _____
2. Measure angle BXN = angle of reflection (r) = _____
3. Verify that i = r, i.e. Angle of Incidence = Angle of Reflection

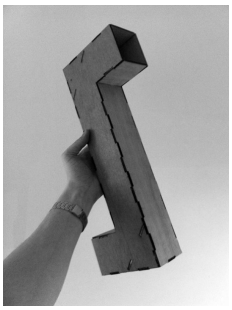
Experiment 8:
Name: Study the number of images formed by two plane mirrors kept at an angle.
Description:
a) Keep the mirrors on a protractor as shown. Set the angle between them as 90^0. Fix them with a cellotape. Now keep an object between them (at the centre) and count the number of images (don't count the object).

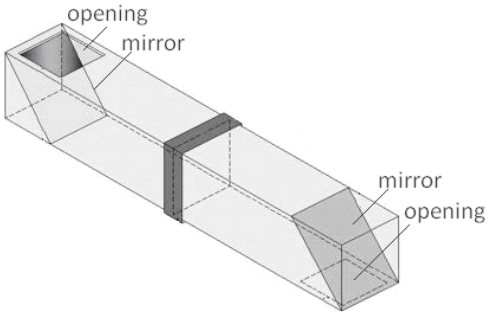


b) Repeat the experiment for angles = 30^o, 45^o, 60^o, 90^o, 120^o. Note the number of images in each case.
c) Verify the formula: Number of images = $\frac{360}{angle\ between\ mirrors} - 1$
d) Keep the two mirrors parallel to each other. Place a small object between them. Observe. Why do you get infinite images?

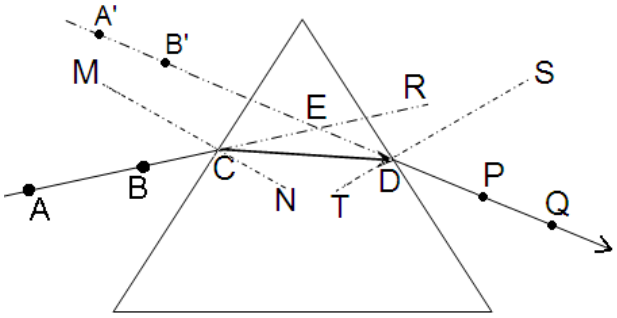
Experiment 9:
Name: Making a periscope
Description: Make a 'Z' shaped hollow card board box as shown. Fix two mirrors inside it at 45^o angle as shown. If you find it difficult, you can make a simple rectangular box like the one shown on the right. Enjoy the view through your periscope.







Experiment 10:
Name: To study refraction of light in a prism and find out the angle of deviation (For 9th Std students)
Description:
Fix a paper on a rectangular thermocol piece. Put the prism at the centre of the paper and draw the outline of the prism. Mount two pins A and B at any suitable angle of incidence (angle ACM). Observe these pins from the other side of the prism and put two more pins P and Q such that all the four pins appear to be in the straight line. Remove the prism and complete the ray diagram as shown.



Note:
i) MN and ST are perpendicular (normal) to the surface of the prism at C and D.
ii) A-B-C-D-P-Q is the path of light.
iii) Refraction takes place twice – air to glass (AB to CD) and again from glass to air (CD to PQ)
iv) A' and B' show the apparent position of the pins (as seen through prism)

Questions:

1. For refraction from air to glass measure the angle of incidence (ACM) and angle of refraction (DCN)
2. For refraction from glass to air measure the angle of incidence (CDT) and angle of refraction (SDQ)
3. Measure the angle of deflection/ deviation for the prism (REP)
4. If we pass sunlight through prism it splits in 7 colours (try it). Name the colours from top to bottom
5. If red light is passed through prism, how it will split? Explain your answer.

BIOLOGY EXPERIMENTS

1. Observe the pupil of human eye, cat's eye, cow's eye and the way they look at objects
2. Observe insects, cockroaches, ant, snail, mosquito, housefly, earthworm, lizard. Observe the tiny animals using convex lens.
3. Observe leaves of different trees. E.g. Mango, coconut, banana, lotus, arum (*alu*)
4. Observe the walking mechanism of spider on its net and the construction of the net
5. Observe dogs and their puppies. Why do they put their tongue out?
6. Observe birds and their habitat, their nests
7. Observe difference in the flying style of crow, sparrow, kite, pigeon
8. Observe food grains in the house. Note their similarities and differences
9. Observe how food gets cooked. E.g. Put rice in a steel vessel with water and put it on gas & observe
10. Observe wheat, matki, moong soaked on a moist cloth. See how they germinate.
11. Go to a fish market and identify different fish. Observe their fins, gills, eyes, tail (Don't do this if you have a nausea for it)
12. Sow some 'dhania' seeds in soil and observe their growth
13. Watch informative programmes on Animal Planet. Write down what you learnt
14. Cut different fruits and vegetables and see their internal structure. E.g. Apple, chiku, orange, papaya, guava, watermelon, pomegranate, banana, mango, tomato, cucumber, lady's finger, brinjal, gourd, tendli, cauliflower, cabbage, coconut. Identify which part of the plant they are.
15. See the position and arrangement of seeds in the above fruits.
16. Observe flowers like chapha, hibiscus, lotus, etc.
17. Observe root structure of trees growing on walls. Find out how they get water.
18. Observe avicinia trees growing in marshy areas. Observe their roots coming out.
19. Take wheat flour. Add some dry yeast & sugar. Add some water and keep it for a day. Observe the change after one day.
20. Take dilute sugar solution (1 cup water + 1 spoon sugar) Add yeast and keep it for 1 day. Test with blue litmus paper. (Throw it away after the experiment)
21. Find out which of the following float on water: lemon, tomato, lady's finger, mango, onion, potato, brinjal, amla, coconut

CONTACT US

- For queries, feedback, joining our whatsapp science group: send whatsapp with your details to Rahul Ogale – 9892013836
- Check out our app **MPracts** on google play store to become a good experimenter!
- Our **MBooks** (multimedia mobile books) and **MGames** are available for free on google play store. To avail them, search for 'rahul ogale mbooks' on Play Store (for android phones)
- Visit our youtube channels "young experimenters" and "ogalelearning" for kit videos.
- Visit our website **www.rahulogale.com** for more information about our MBooks, Mtests, MGames, MPracts, regular books, classes and activities.