पुणा International School

Shree Swaminarayan Gurukul, Zundal

Class – X **Subject: Science** **Experiment (2020_21)**

Exp. No	Aim
1	To study the properties of acids and bases (dilute HCl and dilute NaOH) by their reaction with (a) Litmus solution (Blue/Red) (b) Zinc metal (c) Solid sodium carbonate
2	Performing and observing the following reactions and classifying them into: A. Combination reaction B. Decomposition reaction C. Displacement reaction D. Double displacement reaction (i) Action of water on quicklime (ii) Action of heat on ferrous sulphate crystals (iii) Iron nails kept in copper sulphate solution (iv) Reaction between sodium sulphate and barium chloride solutions
3	Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determining its resistance. Also plotting a graph between V and I
4	Experimentally show that carbon dioxide is given out during respiration.
5	Determination of the focal length of (i) Concave mirror and (ii) Convex lens by obtaining the image of a distant object.
6	Tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result.
7	Studying (a) binary fission in Amoeba, and (b) budding in yeast and Hydra with the help of prepared slides. Unit-II

Experiment - 1

AIM :

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Theory

Hydrochloric acid

> Chemical formula of hydrochloric acid is HCl.
> When it is dissolved in water; releases H^+(aq) ions, these H^+ ions cannot exist alone. Hence, it combines with water to form H_3O^+ (aq) ions.

$$\underset{\text{Hydrochloric acid}}{HCl\,(aq)} + \underset{\text{Water}}{H_2O\,(l)} \longrightarrow \underset{\text{Hydronium ion}}{H_3O^+\,(aq)} + \underset{\text{Chloride ion}}{Cl^-\,(aq)}$$

> The acidic property is seen due to this H^+(aq) ions/H_3O^+ ions.

Properties of hydrochloric acid

> It turns blue litmus solution red.
> Hydrochloric acid reacts with metals to release hydrogen gas.

$$\underset{\text{Zinc}}{Zn(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Zinc chloride}}{ZnCl_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

> **Test for H_2 gas:** When a burning splinter is brought near the mouth of test tube releasing H_2 gas, it bums with a 'pop sound'.
> Hydrochloric acid react with sodium carbonate to release CO_2 gas.

$$\underset{\text{Sodium carbonate}}{Na_2CO_3(s)} + \underset{\text{Hydrochloric acid}}{2HCl(aq)} \longrightarrow \underset{\text{Sodium chloride}}{2NaCl(aq)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

> **Test for CO_2 gas:** When CO_2 gas is allowed to pass through freshly prepared lime water, then the lime water turns milky or when a burning splinter is brought near the mouth of the test tube releasing CO_2 gas then the burning splinter extinguishes.
Sodium hydroxide
> Chemical formula of sodium hydroxide is NaOH.
> When it is dissolved in water releases OH^- ions.

Properties of Sodium hydroxide

> It turns red litmus solution blue.
> Not all bases react with zinc metal to release H_2 gas but sodium hydroxide solution reacts with zinc metal to release hydrogen gas.

$$\underset{\text{Sodium hydroxide}}{2NaOH(aq)} + \underset{\text{Zinc}}{Zn(s)} \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2(aq)} + \underset{\text{Hydrogen}}{H_2(g)}$$

> Sodium hydroxide do not react with solid sodium carbonate.

Materials Required
A test tube stand, test tubes, match box, test tube holder, droppers, a bent delivery tube, burner and cork.

Chemicals required: Dilute hydrochloric acid, dilute sodium hydroxide, blue litmus solution, red litmus solution, zinc metal granules or powdered zinc, solid sodium carbonate and freshly prepared lime water.

Procedure
(A) Properties of Hydrochloric Acid

	Experiment	Observation	Inference
1.	**Litmus Test** Take two clean test tubes. Pour 1 mL of dilute HCl solution in each test tube. Pour a drop of blue litmus in one test tube and a drop of red litmus solution in the second test tube.	Blue litmus solution turns red in first test tube. Red litmus solution shows no change in second test tube.	Dil. HCl shows acidic character.
2.	Reaction with Zinc Metal Take 1 mL of dilute HCl in a clean test tube. Add a small piece of zinc metal/ zinc powder in it. Light a matchstick and bring it near the mouth of the test tube, remove the thumb and observe.	Zinc metal reacts with the acid. Test tube becomes warm and pressure is exerted on thumb due to release of a gas. The matchstick bums with a pop sound.	Zinc + dil. HCl → Zinc chloride + Hydrogen gas $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$ Hydrogen gas always bums with a pop sound when lighted matchstick is introduced in it.

3.	Reaction with Sodium Carbonat Take a clean test tube. Add 2 mL of dilute HCl. Now add lg/pinch of sodium carbonate in it. Immediately close the mouth with cork containing delivery tube. Hold a test tube with lime water at the other end of the delivery tube.	Dilute HCl reacts with sodium carbonate to release a colourless gas. The gas turns lime water milky.	(i) $Na_2CO_3 + 2HCl \rightarrow$ $2NaCl + H_20 + CO_2$ (ii)$Ca(OH)_2+CO_2 \rightarrow$ Lime water$CaCO_3 + H_2O$ White insoluble ppt

(B) Properties of Sodium Hydroxide

	Experiment	Observation	Inference
1.	**Litmus Test** Take two clean test tubes. Pour 1 mL of dilute NaOH in each test tube. Add a drop of blue litmus solution in one test tube and a drop of red litmus solution in the second test tube.	Blue litmus solution shows no change. Red litmus solution changes to blue colour.	Dil. NaOH shows basic character.
2.	**Reaction with Zinc Metal** Take a clean test tube. Add zinc metal granules/zinc powder in it. Pour 2 mL of NaOH solution in the tube. Hold the test tube with a test tube holder and heat it. Bring a burning matchstick near the mouth of	On heating the mixture; reaction begins, colourless gas is evolved. The burning matchstick bums with a 'pop' sound.	$Zn(s) + 2NaOH(aq)$ $Na_2ZnO_2(aq) + H_2(g)$ Hydrogen gas always bums with a pop sound.

	the test tube.		
3.	**Reaction with Solid Sodium Carbonate** Take a clean test tube. Add 2 mL of NaOH solution in a tube and 1 g of sodium carbonate. Heat the mixture.	No change.	Dil. NaOH doesn't react with sodium carbonate.

Precaution

1. Use clean test tubes.
2. Use very small amount of chemicals.
3. Handle hydrochloric acid and sodium hydroxide solutions very carefully.
4. Shake the solutions and reaction mixtures carefully without spilling.
5. Always carry out the test for hydrogen with a very small volume of gas.
6. For H_2 gas test, be careful as H_2 catches fire. The flame on test tube can be seen due to H_2 gas.
7. For lime water test, allow the CO_2 gas to pass through lime water and shake the test tube by placing thumb on the mouth of the tube to get quick result.

Experiment - 2

AIM

To perform and observe the following reactions and classify them into:

(a) Combination reaction (b) Decomposition reaction

(c) Displacement reaction (d) Double displacement reaction.

1. Action of water on quick lime.
2. Action of heat on ferrous sulphate crystals.
3. Iron nails kept in copper sulphate solution.
4. Reaction between sodium sulphate and barium chloride solutions.

Materials Required

A beaker, four test tubes, test tube holder, tongs, test tube stand, a dropper, a piece of sand paper and bunsen burner. Chemicals required: A small piece of quick lime, ferrous sulphate crystals, iron nails (clean and unrusted), copper sulphate solution, sodium sulphate solution, barium chloride solution and distilled water.

Procedure

	Experiment	Observation	Inference
1.	*Combination Reaction:* Take a clean beaker, add a small piece of lime in it. Add water drop by drop into the beaker.	Reaction occurs with crackling sound and steamy vapours are released. The beaker becomes hot.	An exothermic and combination reaction occurs.
	Equation: $\underset{\text{Calcium oxide (Quick lime)}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Calcium hydroxide (Slaked lime)}}{Ca(OH)_2(aq)} + \text{Heat}$		
2.	*Decomposition Reaction:* Take a clean and dry test tube, add few crystals of ferrous sulphate. Fix it on a test tube holder. Heat the test tube on burner, keeping the mouth of test tube away from your face. Waft the gas released to smell and test it with acidified potassium dichromate paper.	The green crystals become reddish-brown, tiny droplets of water are settled near the neck of test tube and a colourless gas is evolved. The acidified potassium dichromate changes its colour from orange to green when held in gas.	Iron sulphate green crystals decomposes due to heat. Water of crystallisation is collected in the test tube. Sulphur dioxide gas has choking smell. It changes potassium dichromate paper green. Its a decomposition reaction.
	Equation: $\underset{\text{Ferrous sulphate Green crystals}}{2FeSO_4.7H_2O(s)} \xrightarrow{\text{Heat}} \underset{\text{Ferric oxide}}{Fe_2O_3(s)} + \underset{\text{Colourless gases}}{SO_2(g) + SO_3(g)} + \underset{\text{Water of crystallisation}}{14H_2O}$ $K_2Cr_2O_7(aq) + H_2SO_4(aq) + 3SO_2(g) \longrightarrow \underset{\text{Chromium Sulphate}}{Cr_2(SO_4)_3} + K_2SO_4(aq) + H_2O$		

3.	*Displacement Reaction:* Take a clean test tube, add 2-3 mL of copper sulphate solution in it. Place a clean iron nail in it. Keep it on the test tube stand and observe the changes for 30 minutes.	The blue colour copper sulphate slowly changes its colour. The iron nail gets the deposit of reddish copper ions. The blue colour of copper sulphate solution changes to green.	Iron metal is reactive than copper, displaces it to form iron sulphate solution. Its a displacement reaction and red deposit of copper is formed on the nail.
	Equation: $\underset{\text{(Blue)}}{CuSO_4(aq)} + \underset{\text{(Grey)}}{Fe(s)} \longrightarrow \underset{\text{(Light green)}}{FeSO_4(aq)} + \underset{\text{(Brick red)}}{Cu(s)}$		
4.	*Double Displacement Reaction:* In a clean test tube, take sodium sulphate solution, to this add barium chloride solution. Shake the contents and observe.	Both sodium sulphate and barium chloride solutions are colourless, on mixing together a white precipitate is formed.	The white insoluble precipitate of barium sulphate is formed. It is a double displacement reaction.
	Equation: $\underset{\text{(Colourless)}}{Na_2SO_4(aq)} + \underset{\text{(Colourless)}}{BaCl_2(aq)} \longrightarrow \underset{\text{(White ppt.)}}{BaSO_4(s)} + 2NaCl(aq)$		

Precautions

Do not touch quick lime with hands, use tongs.

Mixing of quick lime and water releases large amount of heat, so add water drop by drop and use borosil beaker.

For heating, use hard glass tubes.

Never inhale any gas, just waft the gas.

Do not touch any chemical with hands.

Keep the mouth of the test tube away from your face while heating.

The iron nails must be cleaned properly by using sand paper before dipping them in copper sulphate solution.

Video link

https://youtu.be/oRNuhlDW3k0

Experiment - 3

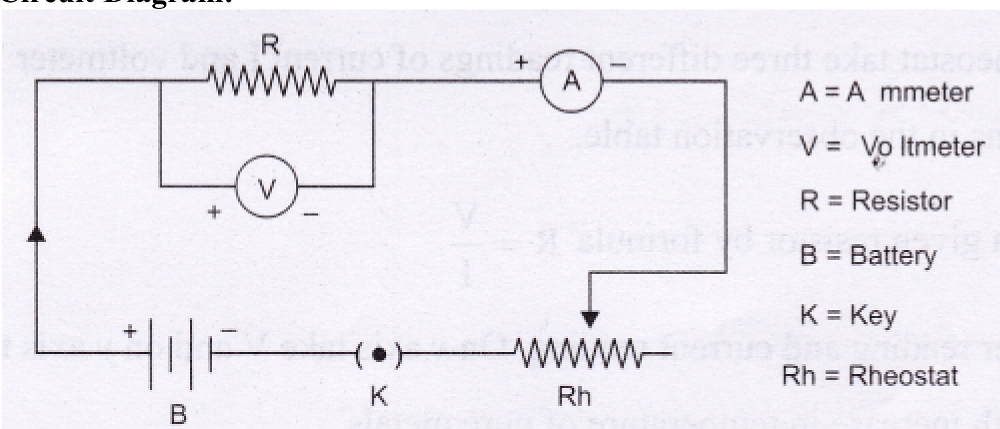
Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determining its resistance. Also plotting a graph between V and I

Aim

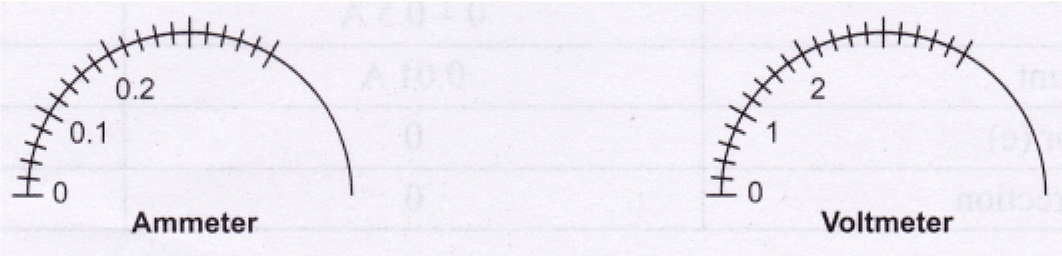
To study the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plot a graph between V and I.

Theory

- **Ohm's Law:** The potential difference, V across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature is the same. This is Ohm's law.
  $V \propto I$
  .'. $V = IR$, (Here R = Constant for the given metallic wire)
- The SI unit of resistance is Ohm (Ω).
  $R = \frac{V}{I}$
- **One Ohm:** If the potential difference across the ends of a conductor is 1 volt and the current flowing through it is 1 ampere, then the resistance of the conductor R is 1 ohm.
  $$1 \text{ Ohm} = \frac{1 \text{ Volt}}{1 \text{ Ampere}}$$
- •
- • **Factors affecting resistance:**
- • The nature of resistor (a conductor having some resistance.)
- • The length of the resistance. ($R \propto l$)
  (Resistance increases as the length of the wire is increased)
- • The area of cross-section of the resistor. $R \propto \frac{1}{A}$
- (Resistance decreases with the increase in the cross-section area of the wire)
- **Circuit Diagram:**



- In a circuit ammeter is always connected in series and voltmeter is connected in parallel across the points between which potential difference is to be measured.
- A straight line graph obtained between V and I verifies the Ohm's law.
- **Least Count:** It is very important to find the least count of ammeter and voltmeter before using them.



If in the ammeter, there are 10 divisions from 0 to 0.1 A then each division indicates 0.01 A.

A. To calculate the least count of ammeter.

Range of ammeter = A_R.........................

Number of divisions in ammeter = A_N...............................

.'. Least count of ammeter = $\frac{A_R}{A_N}$= …………….. ampere.

B. To calculate the least count of voltmeter.

Range of voltmeter = V_R……………………

Number of divisions in voltmeter = V_N

.'. Least count of voltmeter = $\frac{V_R}{V_N}$= ………………. volt.

Materials Required

A battery, an insulated copper wire (cut into 10 pieces), a key, an ammeter, a voltmeter, a rheostat, a resistor and a piece of sand paper.

Procedure

1. Keep the devices as shown in the circuit diagram.
2. Connect them with the connecting wires and keep the key open.
3. Positive terminal of the battery is connected to the positive terminal of the ammeter.
4. Check the +ve and -ve terminals of voltmeter before connecting it in the circuit.
5. Once the circuit is connected, insert the key and check the rheostat, adjust its slider and see whether the ammeter and voltmeter readings are shown.
6. By using the slider of rheostat take three different readings of current 1 and voltmeter V.
7. Record your observations in the observation table.
8. Calculate resistance of a given resistor by formula $R = \frac{V}{I}$.
9. Plot a graph of voltmeter reading and current reading. On x axis take V and on y axis take I.
10. Resistance increases with increase in temperature of pure metals.

Observation Table

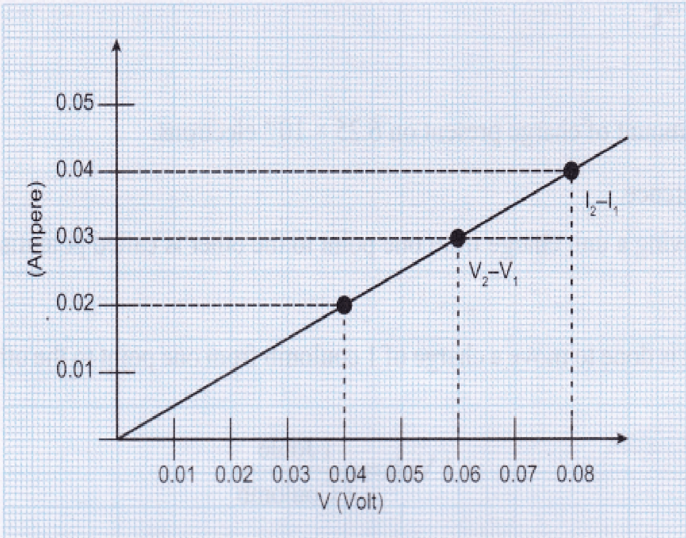
A. Least count of ammeter and voltmeter

S. No.		Ammeter (A)	Voltmeter (V)
1.	Range	0 – 0.5 A	0-0.1 V
2.	Least Count	0.01 A	0.01 V
3.	Zero Error (e)	0	0
4.	Zero Correction	0	0

B. For reading of ammeter and voltmeter

S. No.	Current in Ampere (I) (Ammeter Reading)		Potential difference in Volts (V) (Voltmeter Reading)		Resistance in Ohms R = V/I(Ω)
	Observed	Corrected	Observed	Corrected	
1.	0	0.02	0	0.04	$R_1 = 2\ \Omega$
2.	0	0.03	0	0.06	$R_2 = 2\ \Omega$
3.	0	0.04	0	0.08	$R_3 = 2\Omega$

$$\therefore \text{ Mean value of R } = \frac{R_1 + R_2 + R_3}{3} = \frac{2+2+2}{3} = 2\,\Omega$$



Graph between current and voltage

Conclusions

1. The value of R is found to be same and constant in all three readings.
2. The resistance of a resistor is ratio of potential difference V and current I.
3. The graph of V and I is a straight line. This shows that $V \propto I$. This verifies Ohm's law.

Precautions

1. The connecting wires should be thick copper wires and the insulation of their ends should be removed using the sand paper.
2. Connections should be tight otherwise some external resistance may introduce in the circuit.
3. Connections should be made as per the circuit. Before closing the circuit show the connections to the teacher to take the readings.
4. The ammeter should be connected in series with the resister such that the current enters at the positive terminal and leaves at the negative terminal of the ammeter.
5. Voltmeter should always be connected in parallel to resistor.
6. Calculate the least count of voltmeter and ammeter correctly.
7. The pointers of the ammeter and voltmeter should be at zero mark when no current flows through the circuit.
8. Current should be passed through the circuit for a short time while taking observations; otherwise current would cause unnecessary heating in the circuit. Heating may change the resistance of resisters.

Experiment - 4

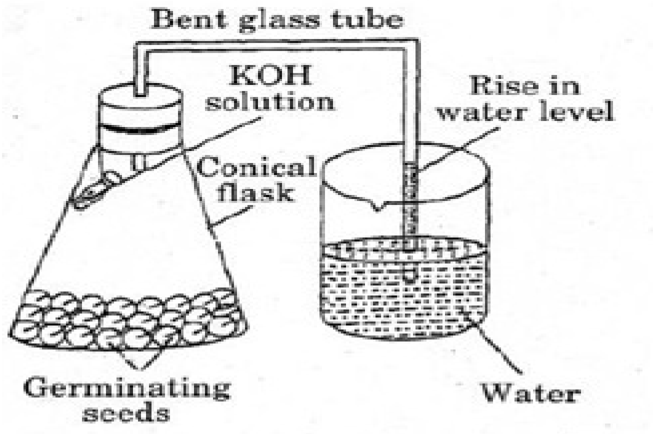
Aim : Experimentally show that carbon dioxide is given out during respiration.

Principle/Theory

The process of respiration is biochemically carried out wherein food, glucose to be precise is oxidized and energy is released. In this experiment, gram seeds (moistened) are used. The purpose of using these seeds is that they release carbon dioxide and are respiring actively. The released carbon dioxide is consumed by the solution of KOH.

Material Required

- Soaked gram seeds



- U-shaped delivery tube
- Conical flask
- Blotting paper (moist) /cotton wool
- Thread
- Water
- Beaker
- Test tube
- Rubber cork with a single hole
- Freshly prepared KOH solution (20%)
- Vaseline

Procedure

- Germinate close to 25 seeds. This can be done by wrapping them in moist blotting paper or cotton wool for around 3 to 4 days
- Set up the germinated or sprouted seeds in the conical flask. Spray some water into the flask to dampen the seeds
- With the help of a thread, suspend the conical flask containing the test tube having a freshly prepared 20% KOH solution.
- Use the rubber cork to seal the opening of the conical flask.
- One edge of the U-shaped glass delivery tube present in the conical flask should be inserted through the hole in the rubber cork. The other edge should be placed into a beaker that is saturated with water
- All attachments of the set-up should be sealed. This can be done using Vaseline to create an air-tight environment
- The initial water level present in the U-shaped delivery tube needs to be marked.
- Leave the experimental set-up uninterrupted for 1 to 2 hours. Observe the fluctuations in the water level in the tube.

Observation

Careful observation after a certain period of time reveals that the water level in the U-shaped delivery tube has risen in the beaker.

Conclusions

The rise in level water indicates that carbon dioxide is released as a result of germinating gram seeds during the process of respiration in the conical flask. The carbon dioxide that is released in the process is absorbed or consumed by the KOH solution that is suspended in the test tube in the conical flask, creating a vacuum or a void in the flask resulting in the upward water movement in the tube. Hence, the water level in the tube changes.

Precautions

- The seeds that are to be germinated needs to be moistened
- Air-tight environment for all the connections in the experimental set-up
- The KOH solution that is used needs to be freshly prepared
- Care needs to be taken to ensure that one end of the delivery tube is placed in the conical flask. The other edge is submerged in the water of the beaker
- The tube that contains the KOH solution needs to be suspended carefully

https://youtu.be/V5t4YJwpGMs

Experiment - 5

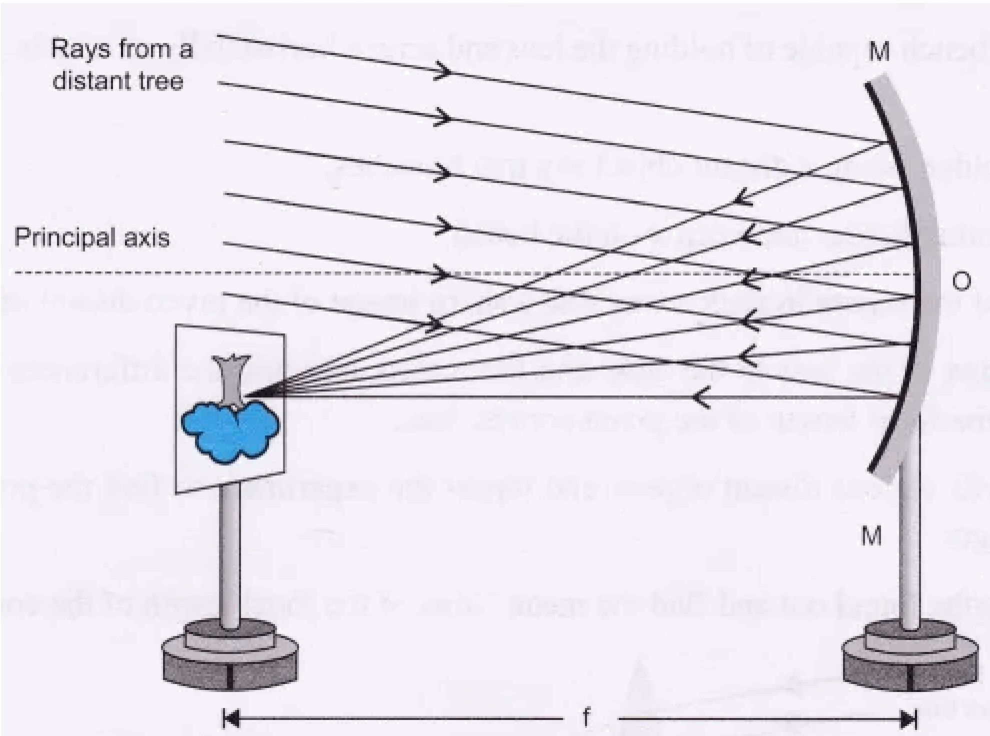
Determination of the focal length of (i) Concave mirror and (ii) Convex lens by obtaining the image of a distant object. Unit-III

(i) To determine focal length of a given concave mirror:

Materials Required
A concave mirror, a measuring scale, a screen a mirror holder and mirror stand.

Procedure

1. Select a distant object from the laboratory window (distance should be more than 50 ft).
2. Fix the concave mirror on the mirror stand placed on the table, facing the distant object.
3. Place the screen in front of the reflecting surface of the mirror. Move the screen back and forth until a clear, sharp image of the distant object is obtained on the screen.
4. Measure the distance between the concave mirror and the screen with a metre scale. This distance is the focal length of the given concave mirror. Record the focal length.
5. Repeat the above procedure twice and record the readings. Take three readings and calculate the average focal length.



Determination of focal length of a concave mirror

Observation Table

S.No.	Position of concave mirror (M)	Position of screen (S)	Focal length/ = (M – S) cm

1.	60 cm	50 cm	10 cm
2.	60 cm	50 cm	10 cm
3.	60 cm	50 cm	10 cm

Calculation

Mean value of focal length of concave mirror =

$$\frac{f_1+f_2+f_3}{3} \text{ cm} = 10 \text{ cm}$$

Result

The focal length of the given concave mirror = 10 cm

Precautions

1. The distant object must be well illuminated to produce a well illuminated and distinct image.
2. Always place the concave mirror near an open window.
3. The polished surface of the concave mirror must face the distant object.
4. There should be no obstacle or hurdle in the path of rays of light from the distant object, incident on the concave mirror.
5. The base of the stands of the concave mirror and screen should be parallel to the measuring scale.
6. The mirror holder along with the mirror should be kept perpendicular to the measuring scale for precise measurements.

(ii) To determine focal length of a given convex mirror:

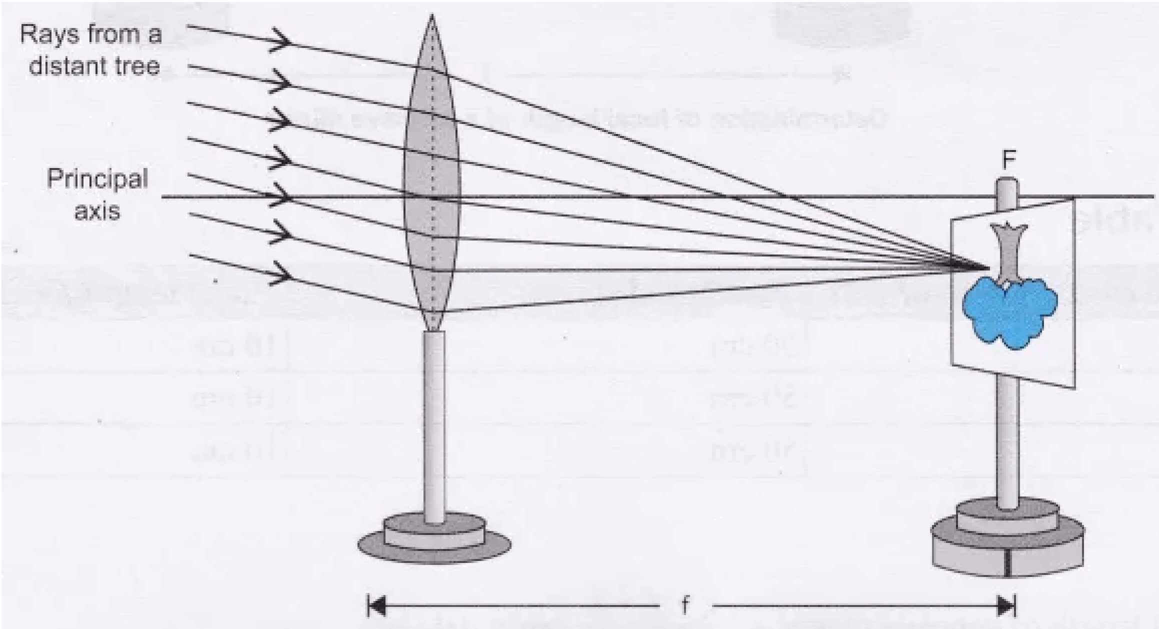
Materials Required

Wooden bench, convex lens, a lens holder, a screen fixed to a stand, a measuring scale; etc.

Procedure

1. Arrange the wooden bench capable of holding the lens and screen horizontally on a table, so that the lens and screen are not disturbed.
2. Keep the lens in a holder facing a distant object say tree branches.
3. Fix the screen on another holder and keep it on the bench.
4. Adjust the position of the screen in such a way that a sharp image of the given distant object falls on it.
5. Note down the position of the lens in the table and the screen, and find the differences and record the same. The difference will give the focal length of the given convex lens.
6. Focus the lens towards various distant objects and repeat the experiment to find the position of sharp image and thereby the focal length.

7. Add all the focal lengths found out and find the mean value of the focal length of the convex lens.



Determination of focal length of a thin convex lens

Observation Table

S.No.	Position of convex lens (L)	Position of screen (S)	Focal length/= (L – S) cm
1.	60 cm	50 cm	f_1 = 10 cm
2.	60 cm	50 cm	f_2 = 10 cm
3.	60 cm	50 cm	f_3 = 10 cm

Calculation

Mean value of focal length of convex lens =

$$\frac{f_1+f_2+f_3}{3}\ \text{cm} = 10\ \text{cm}$$

Result

The focal length of the given convex lens = 10 cm

Precautions

1. Convex lens should be placed vertically.
2. There should be no obstacle or hurdle in the path of rays of light from the distant object incident on the common lens.
3. In order to get a well illuminated and distinct image, it must be ensured that the distanct object is well illuminated.
4. The base of the stands of the convex lens and screen should be parallel to the measuring scale.

Experiment 7

Aim :Studying (a) binary fission in Amoeba, and (b) budding in yeast and Hydra with the help of prepared slides.

Principle/Theory

Budding and binary fission are types of asexual reproduction observed in lower organisms such as bacteria, unicellular protozoans and some other entities.

What is binary fission?

In this type of reproduction, the parent cell divides or is split into two daughter cells through mitosis wherein each daughter cell develops into an adult. Amitosis is the division of the nucleus.

Define budding?

It is a kind of asexual reproduction wherein a new organism develops from a bud or an outgrowth due to the process of cell division at a particular site.

Can you give an example of an organism that carries out budding?

A freshwater entity such as hydra.

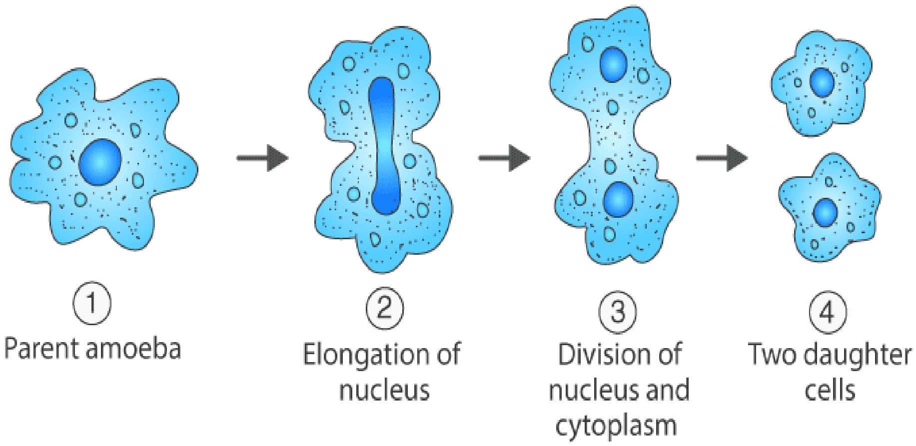
Material Required

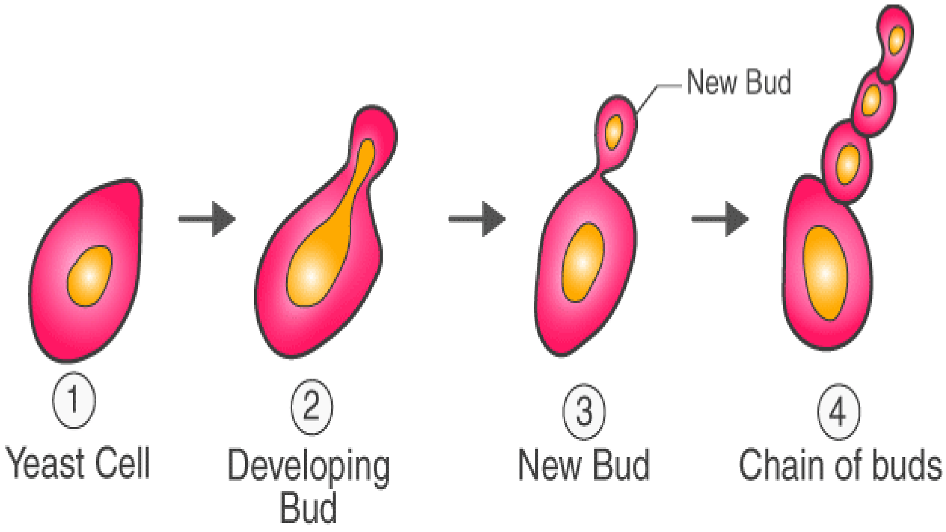
- Compound microscope
- Permanent slides of budding in yeast and binary fission in amoeba

Procedure

- Place the slide under a compound microscope
- Focus the slide, first under low power and later under high power of the compound microscope
- Various stages of budding and binary fission can be carefully examined

Diagram





Observation

(a) Binary fission in Amoeba

- Initially, the pseudopodia are retrieved. The body of amoeba is coiled and becomes round
- Amitosis is observed, the division of the nucleus takes places which are followed by splitting of cytoplasm
- At the point of fission in the body of the amoeba, a constriction starts to develop.
- The constriction or furrow turns deeper resulting in the formation of two daughter cells

(b) Budding in yeast

- Protuberance or a tiny outgrowth is observed on the parent cell
- Division of the nucleus is observed which is later seen in the bud
- Repetitive budding leads to the formation of a chain of cells

Conclusions

The prepared slides display asexual reproduction. One individual is involved to produce a new offspring of its own kind.

Precautions

- Slides need to be aligned and focused accurately
- Sketch out your observation that is observed under a microscope
- The slides first need to be examined under a low-power magnification of the compound microscope and then under high-power magnification.

https://youtu.be/lwS5HHNdsKY