Certificate

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Roll No. : [redacted] Exam No. :

Institution National Institute of open schooling

This is certified to be the bonafide work of the student in the Science *Laboratory during the academic year* 2024/2025 .

No. of practicals certified 10 *out of* 10 *in the subject of* Science and Technology

....

Teacher In-charge

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Examiner's Signature *Principal*

Date : .... *Institution Rubber Stamp*

(N.B.: The candidate is expected to retain his/her journal till he/she passes in the subject.)

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Date 2/9/2025

Expt. No. 1 Page No. 1

- Title

Determination of the density of the material of a given solid using a spring balance and a measuring cylinder.

- Aim

To determine the density of the material of a given solid by Measuring its mass with a spring balance and its volume by the displacment of water in a measuring cylinder.

- Apparatus / Materials

- Given solid (e.g., a metal/stone piece)
- Spring balance (suitable range, calibrated in grams)
- Measuring cylinder (suitable range, graduated in cm^3 or mL)
- Beaker with sufficient water (non-reactive)
- Thread (to lower the solid into water)
- Iron stand/nail or hook to hand the spring balance
- Pad and pen for observations
- Cloth/tissue for drying the solid

- Theory / Principle

Density $(d) = \frac{\text{mass (m)}}{\text{volume (V)}}$. Mass is measured using a spring balance Volume of an irregular solid is measured by immersing it in a liquid and nothing the rise in liquid level — the volume displaced equals the volume of the solid.

SI unit of density: $kg\ m^{-3}$. Common lab unit: $g\ cm^{-3}$

($1 g\ cm^{-3}$ =

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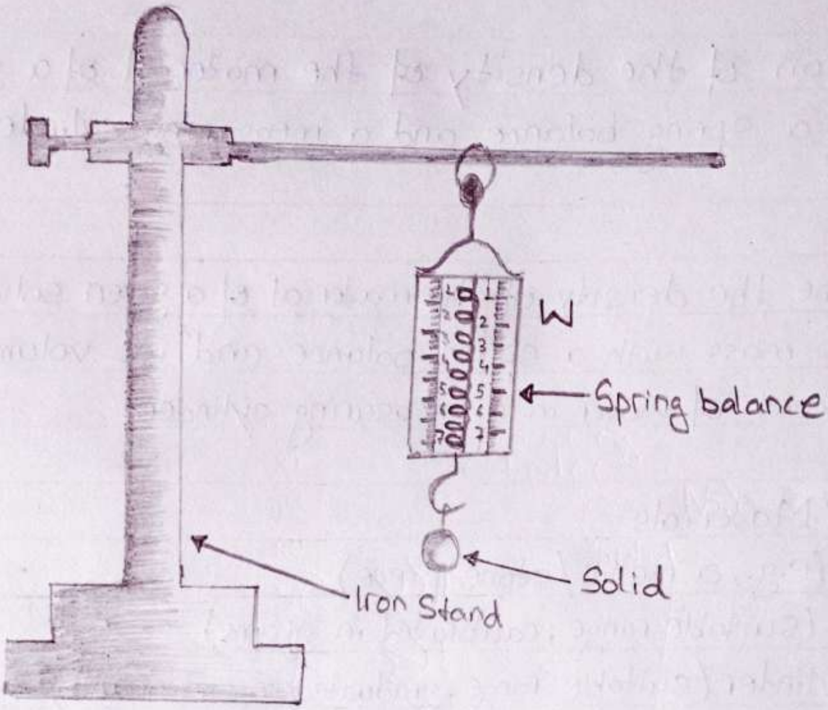

Fig 1.1: Determination of mass using spring balance

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• ~~Prod~~ Procedure

A. To find the mass of solid:

1) Hang the spring balance from the hook of the iron stand.
2) Note the least count of the spring balance. Adjust the pointer to the zero mark if necessary.
3) Tie the given solid object securely with a thread and suspend it from the hook of the spring balance.
4) Record the reading on the spring balance. This reading gives the mass of the solid.

B. To find the volume of the solid:

1) Place the measuring cylinder on a flat surface.
2) Note the least count of the measuring cylinder.
3) Pour enough water into the cylinder so that the solid can be fully submerged in it.
4) Record the initial volume of the water (V_1) by keeping your eye level with the lower meniscus of the water.
5) Gently lower the solid tied with the thread into the water, ensuring it is fully submerged and does not touch the walls or the bottom of the cylinder.
6) Record the new water level. This is the final volume (V_2).
7) The difference between the final and initial volumes ($V_2 - V_1$) gives the volume of the solid.

C. Calculation of Density:

Density of the material of solid $(d) = \frac{\text{Mass}(m)}{\text{Volume}(V)}$ (g/cm^3)

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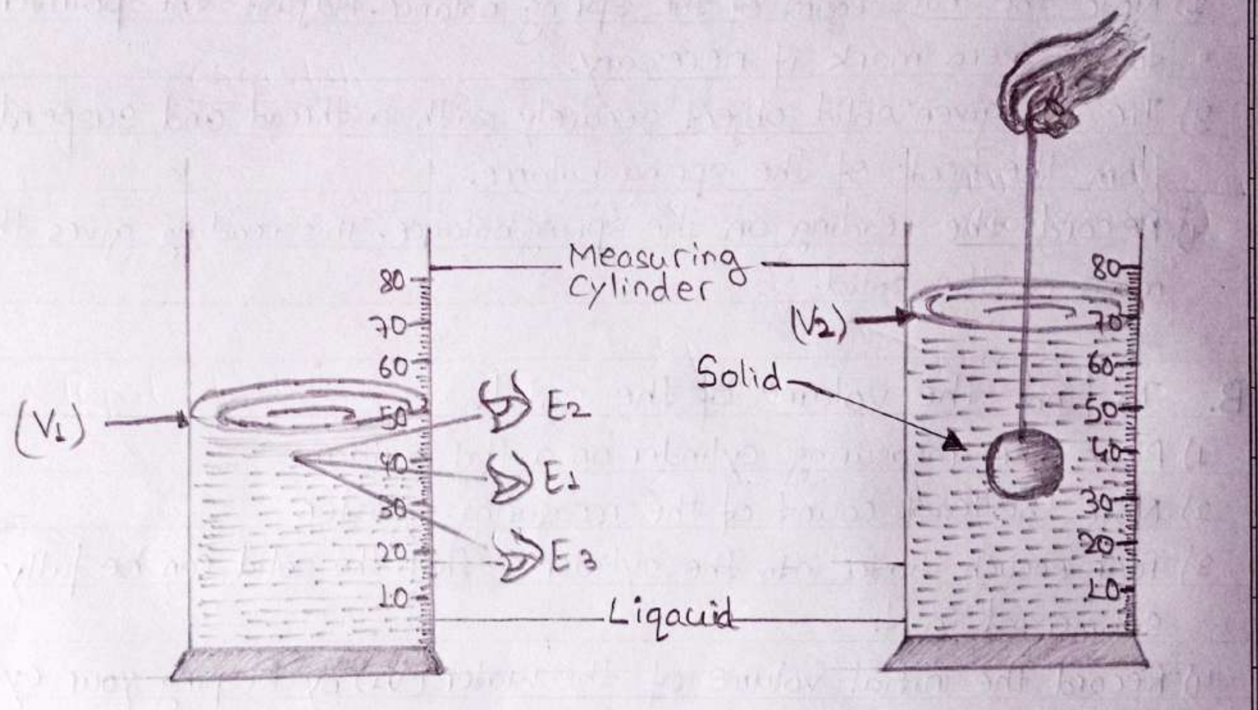

Reading level of liquid in a measuring cylinder

Level of liquid in a Cylinder after lowering Solid in it.

- Observation and Calculations

[A] Measurment of Mass:

(i) Least count of the spring balance = 5 g

(ii) Initial reading of the pointer of spring balance $(m_1) = 0g$

(iii) Final reading of the pointer of the spring balance $(m_2) = 80g$

(iv) Mass of the given solid, $(m) = (m_2 - m_1)g = 80g - 0g = 80g$

[B] Measurment of Volume of the solid

(i) Least count of the measuring cylinder $= 1 cm^3$ (mL)

(ii) Initial level of the liquid in the measuring cylinder $= [V_1] = 50 cm^3$ [ml]

(iii) Final level of the liquid in the measuring cylinder after lowering the solid in it, $[V_2] = 60 cm^3$ [mL]

(iv) Volume of the solid, $[V] = [V_2 - V_1] cm^3 = 60 - 50 = 10 cm^3$

[C] Calculation of Density of the material of the solid

$$d = \frac{m}{V} = \frac{80g}{10cm^3} = 8g/cm^3$$

- Conclusions

(i) Mass of the given solid = 80g

(ii) Volume of the given solid $= 10cm^3$

(iii) Density of the given solid $= 8g\ cm^{-3}$

- Precautions

- Ensure the spring balance is set to zero before taking readings
- Immerse the solid completely without it touching the cylinde's sides.

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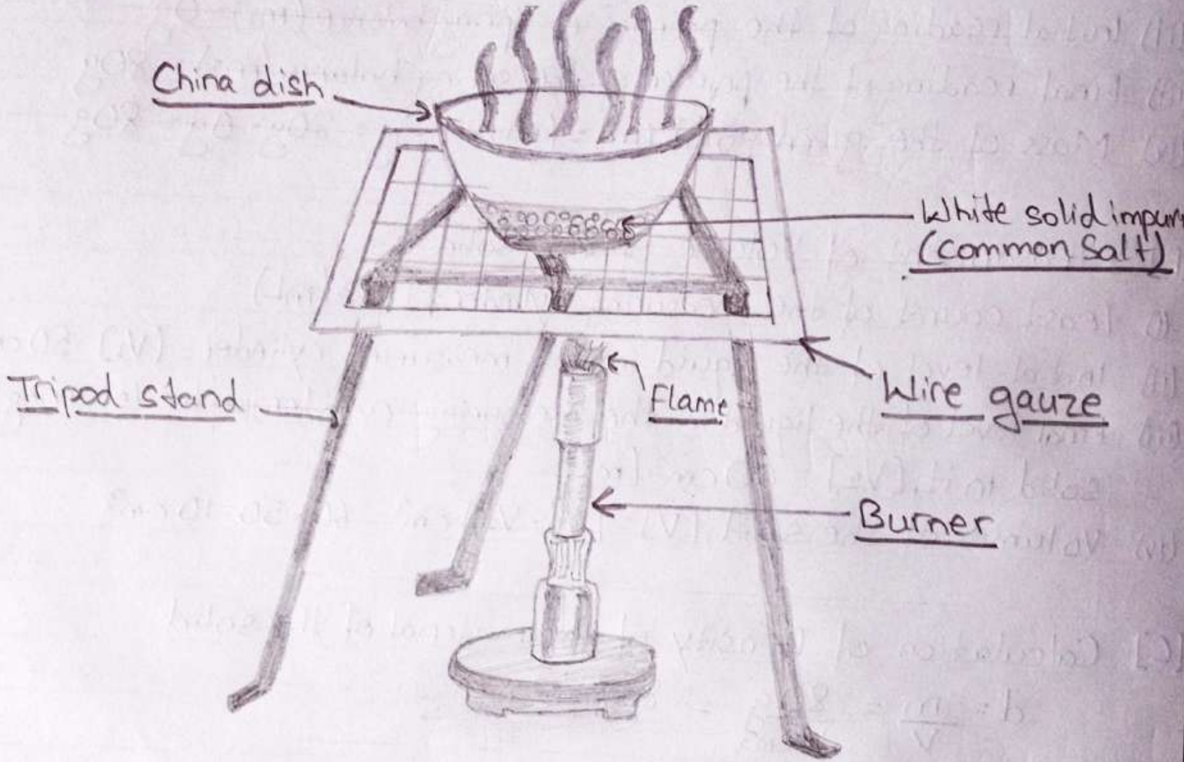

Evaporation

Date 3/9/2025

Expt. No. 2

- Title

Separation of Mixtures

- Aim

To separate the componends of given mixtures using appropriate dechniques:

(A) To separate common salt from its solution in water by evaporation.

(B) To sparate copper sulPhate from its aqueous solution by crystallization.

(C) To separate naphthalene from a mixture of sand and naphtalene by sublimation.

- Apparatus/Materials

- For Evaporation: Solution of common salt, china dish, burner or spirit lamp, tripod stand, wire gauze, glass rod

- For crystallization: Solution of copper sulphate in water, beaker, burner or spirit lamp, tripod stand, wire gauze, glass rod

- For Sublimation: Mixture of napthalene and sand, burner or spirit lamp tripod stand, wire gauze, clay pipe triangle, china dish cotton

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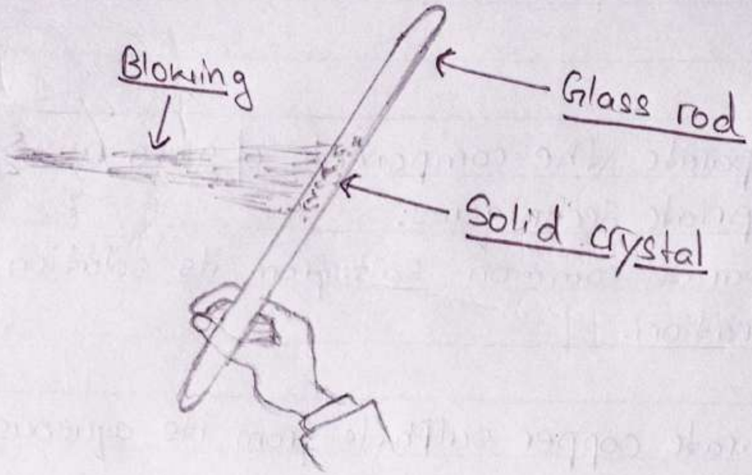
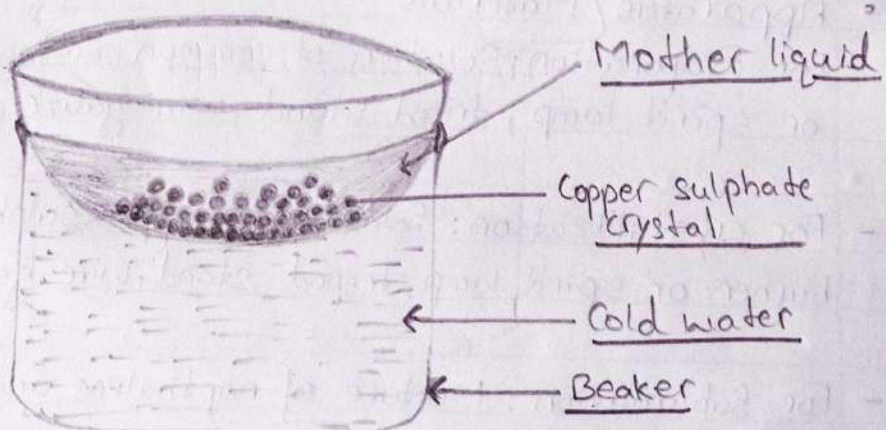


Testing of crystallization point



Coding the concentrated solution undisturbed for 4-5 hrs to obtain crystals

- Theory / Principle

1. Mixtures: When two or more substances are mixed in any ratio, they form a mixture. Mixtures can be homogeneous (like salt in water). or haterogeneous (like sand and water).

2. Evaporation: This is a process used separate a non-volatile soluble solid from its volatile liquid solven. The solution is heated until the liquid evaporates, leaving the solid behind.

3. Crystallization: This technique is used to purify solids, A concentrated solution of the substance is prepared and then allowed to cool slowly. The pure solid separates out in the form of crystals.

4. Sublimation: This is the process where a solid directly changes into its gaseous state upon heating, without passing through the liquid phase. It is used to separate a sublime substance (like napthlene, camphor) from a non-sublime substance (like salt).

(A) Separation of Common Salts from Water by Evaporation

- Procedure

1. Take about 25mL of salt solution in a clean china dish.
2. Place the china dish on a wire gauze kept over a tripod stand.
3. Heat the solution gently using a burner or spirit lamp.
4. Continue heating until all the water evaporates.

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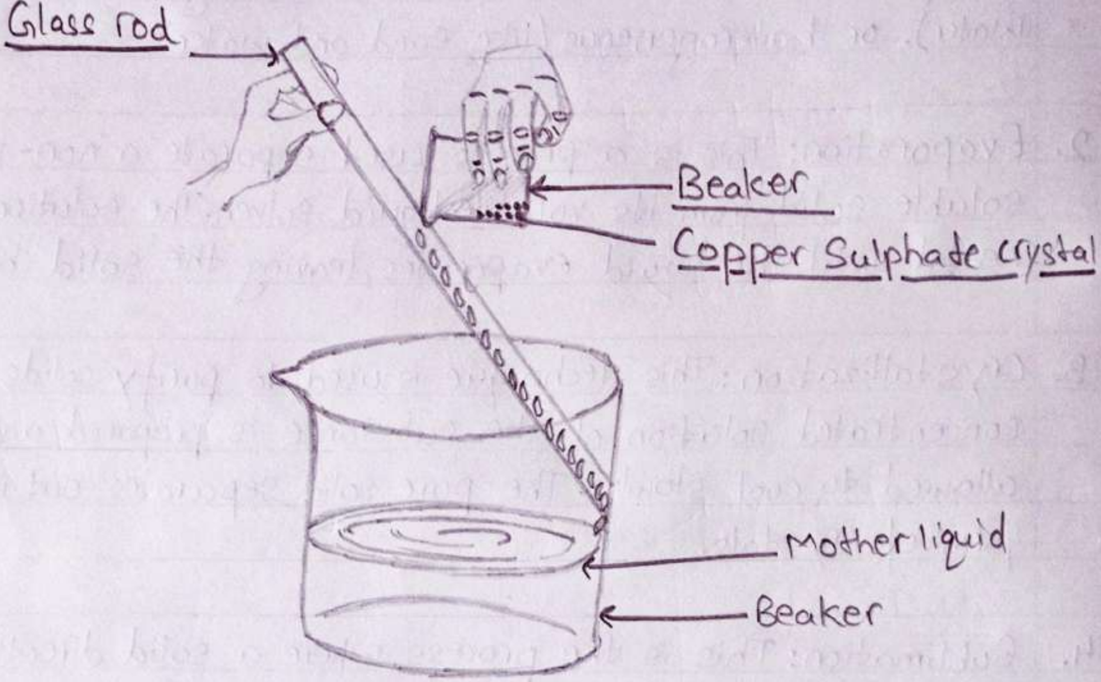


Deconting off the mother liquor

- Observation

Common salt was successfully separated from its salt soluti-on by the process of evaporation. and china dish left behind which a white solid residue.

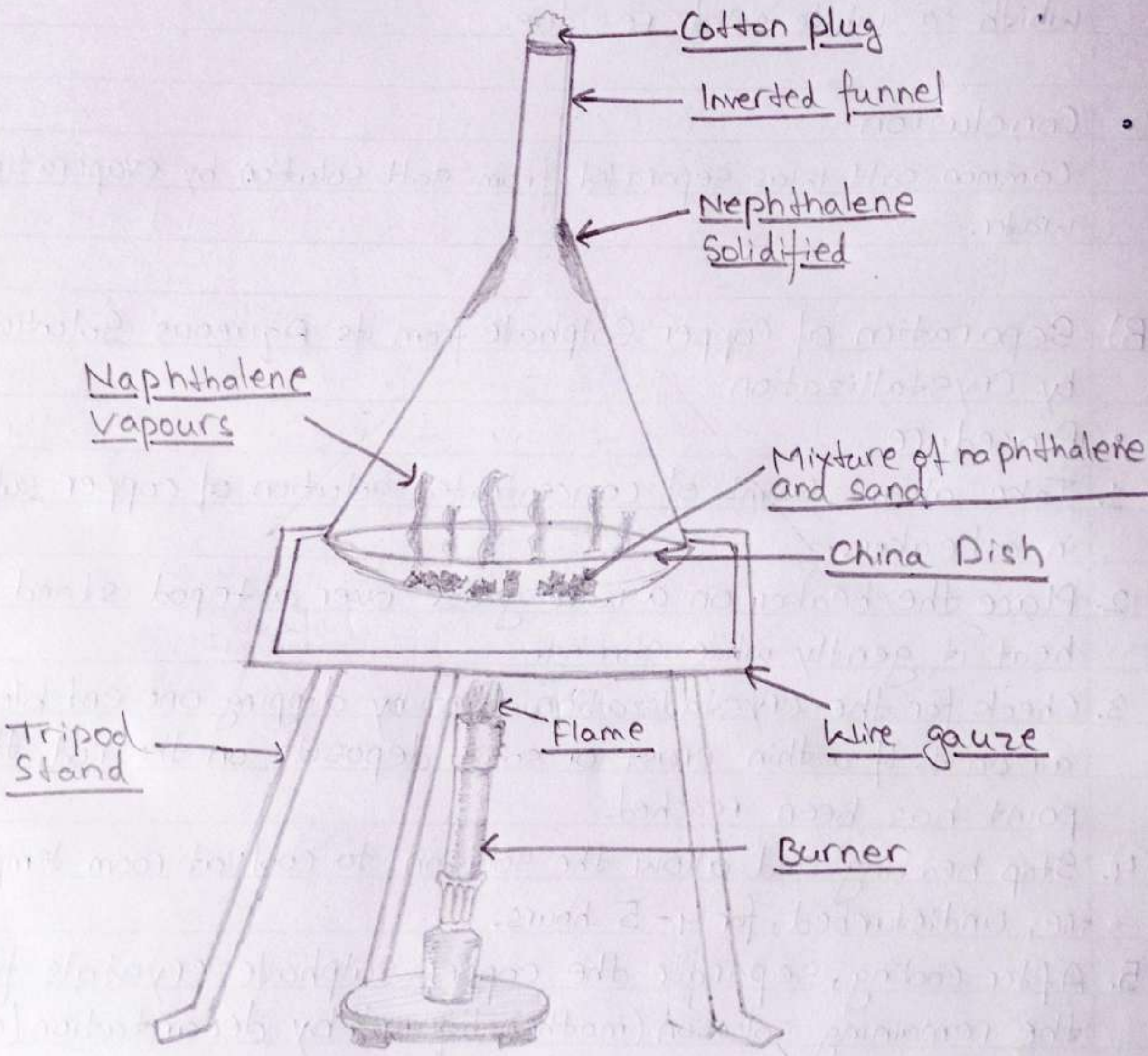
- Conclusion

Common salt was separated from salt solution by evaporating water.

(B) Separation of Copper Sulphate from its Aqueous Solution by Crystallization

- Procedure

1. Take about 50mL of concentrated solution of copper sulphate in a beaker.
2. Place the beaker on a wire gauze over a tripod stand and heat it gently while stirring.
3. Check for the crystallization point by dipping one end blowing air on it. If a thin crust or solid deposits on the rod, the point has been reached.
4. Stop heating and allow the solution to cool at room temperatu-re, undisturbed, for 4-5 hours.
5. After cooling, separate the copper sulphate crystals from the remaining solution (mother liquor) by decantation (carefu-lly pouring the liquid out).



Sublimation

- Observation

As the concentrated solution cools, pure, blue-colored, well-defined crystals of copper sulphate are formed at the bottom of beaker.

- Conclusion

Pure copper sulphate crystals were separated from the aqueous solution by the process of crystallization.

(c) Separation of Naphthalene and Sand by Sublimation

- Procedure

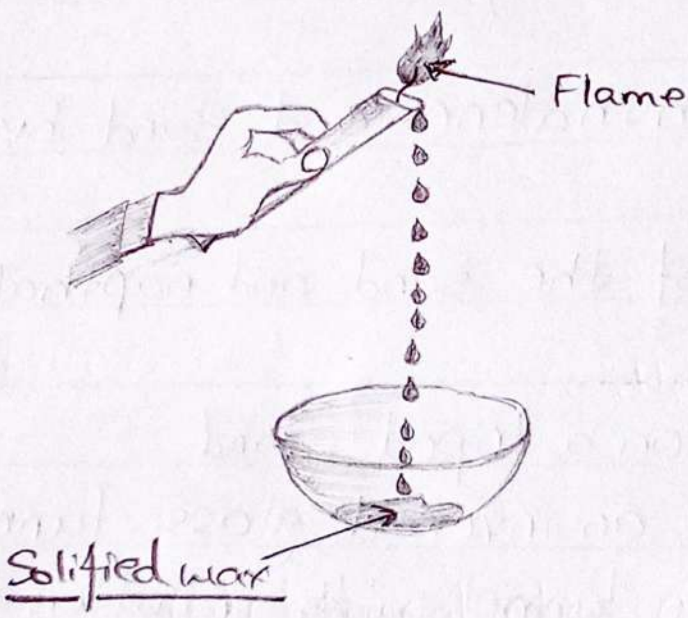
1. Take about 5-10g of the sand and napthalene mixture in a china dish.
2. Place the china dish on a tripod stand
3. Cover the dish with an inverted glass funnel.
4. Plug the stem of the funnel with a cotton ball to prevent vapors from escaping
5. Heat the china dish gentely with a burner.
6. Observe the changes.

- Observation

On heating, naphthalene sublimes into white vapours, which Which condense as solid on the cooler funnel walls, sand remain in dish

- Conclusion

Napthalene was separated from mixture by sublimation.



(a) Physical change

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Expt. No. 3 Page No. 7

- Aim

To differentiate between a chemical and a physical change by observing the burning of a candle.

- Apparatus / Material

- candle
- Match box
- Glass slide
- China dish
- Glass rod

- Theory / Principle

Physical Change: A change in which only the physical properties of a substance (like state, shape, or size) are altered, and no new substance is formed. These changes are often reversible. For example, melting of ice.

Chemical Change: A change in which a new substance with entirely diffrent chemical composition and properties is formed. These changes are generally irreversible. For example, burning of wood.

When a candle burns, both physical and chemical changes occur simultaneously.

- Procedure

1. Place a candle on a flat surface and light it with a burning matchstick.

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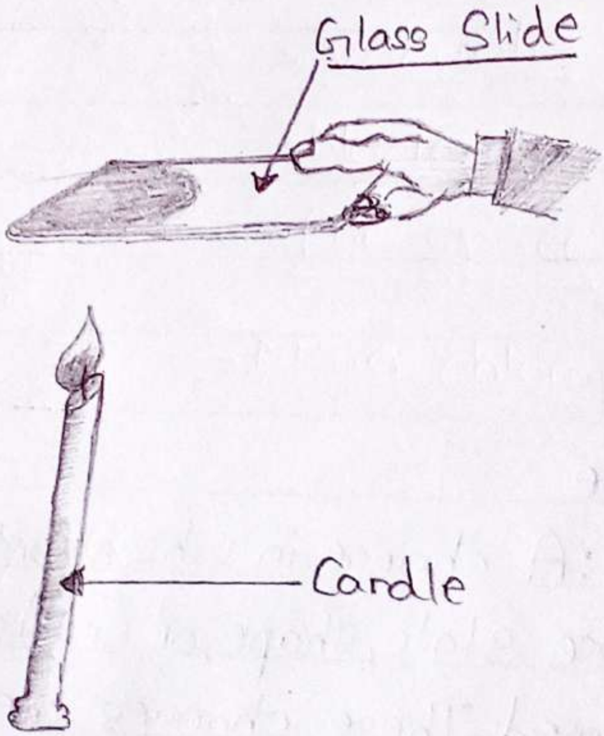

(b) chemical change

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2. Allow some of the wax to melt and fall into a china dish. Observe the molten wax as it cools down
3. Once the wax in the china dish solidifies, scratch a small portion of it with a glass rod. Compare its color and texture with the orignal candle wax.
4. Bring a clean glass slide and hold it about 5cm above the candle flame for 2-3 minutes.
5. Observe the black deposit formed on the slide
6. Put out the candle and examine the properties of this black deposit.
7. Record all your observations in the table.

- Observations

1. When the candle is lit, the wax melts. This molten wax, upon cooling, turns back into solid wax. The properties of this solidified wax are the same as the orignal wax. This shows melting is a physical change.

2. When the candle burns, it produces flame, light, heat and smoke. A black sooty deposit (carbon) forms on the glass slide, showing the formation of a new substance. Hence, burning is a chemical change.

S.No	Process	New substance(s) is formed or not	Type of change
1.	Melting of Wax	Not Formed	Physical change
2.	Burning of Wax	Yes (Soot/Carbon, CO_2, Water vapour)	Chemical change

- Conclusion: Melting of wax is a physical, and burning of wax is a chemical change.

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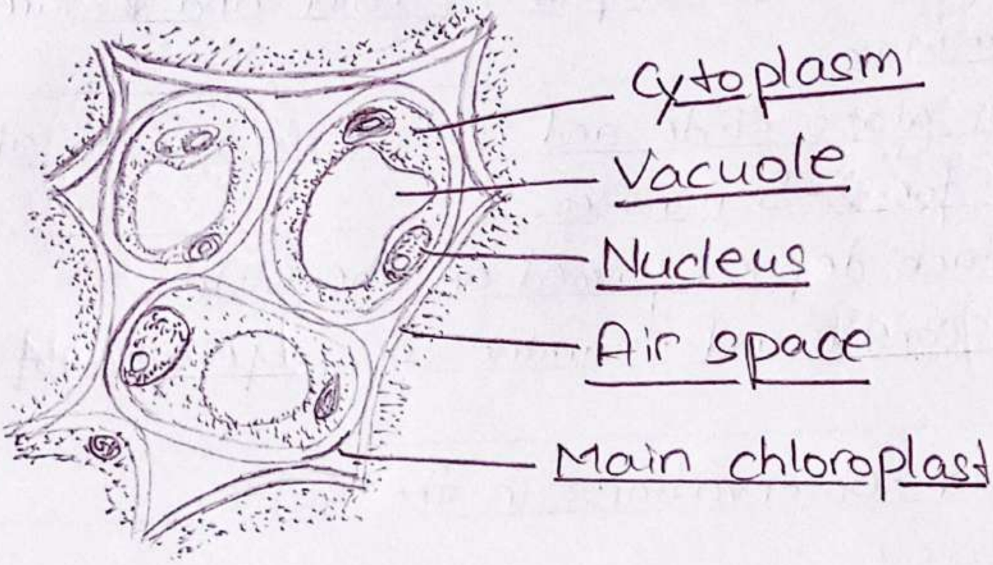
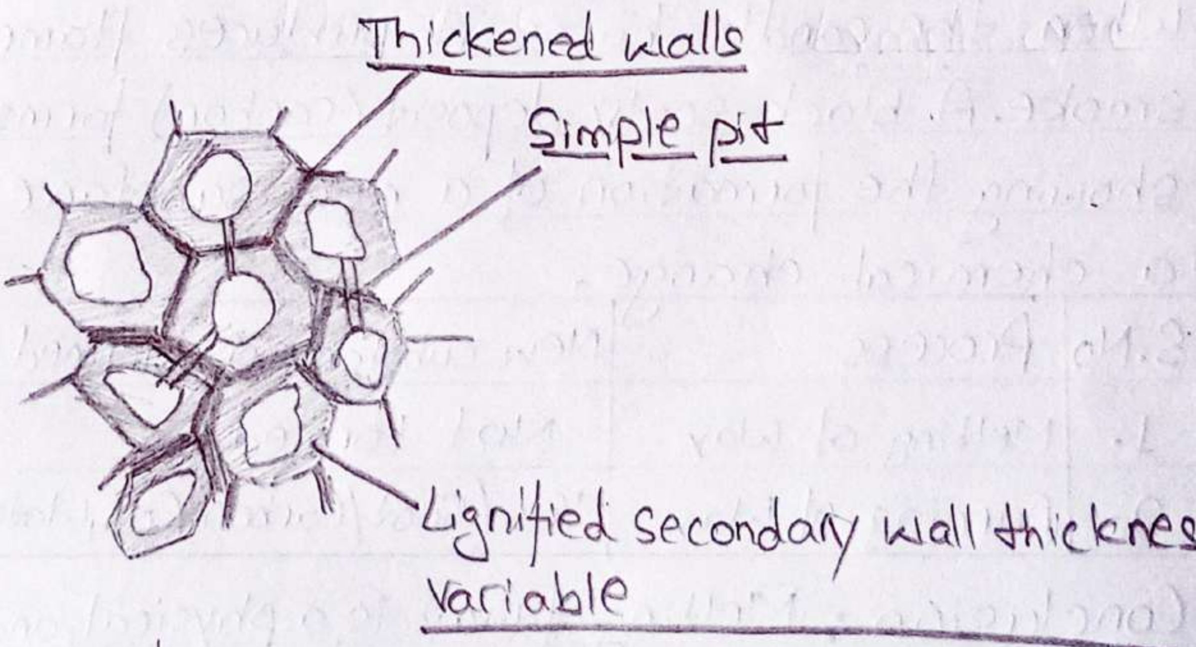


Parenchyma



Sclerenchyma

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Expt. No. 4 Page No. 9

- Title

To Study and Draw Diffrent Types of Plant and Animal Tissues with the Help of Permanent Slides :- Plant tissue

- Plant tissues: Parenchyma and Sclerenchyma;
- Animal tissues: Blood, Striped muscle fibres and Nerve cells.

- Aim

Study and draw diffrent types of plant and animal tissues using permanent slider

- Apparatus / Material

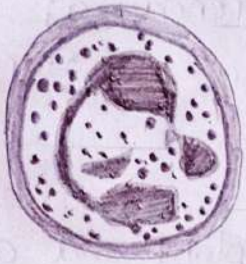
- Permanent slides of the given tissues,
- Compound microscope
- glass slide
- Coverslip
- drawing pencil, eraser, and observation sheed

- Theory

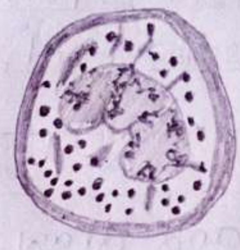
Plant and animals have many types of tissues with specialized functions:

- Plant tissue can be simple (parenchyma) or complex (sclerenchyma)
- Animal tissue include connective tissue (blood), muscle tissue (striped muscle fibres), and nervous tissue (nerve cells). By examining their structure under a microscope, they can be identified and differentiated.

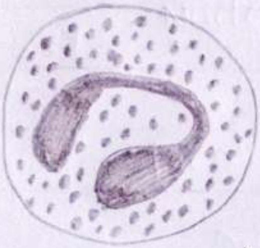
White Blood Corpules



Neutrophil



Basophil



Eosinophil

Monocyte

Lymphocyte

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- Procedure

1. Wipe each permanent slide with soft tissue paper to clean it before use.
2. Place the slide under the low power of the microscope and focus to get a general view.
3. Switch to high power if needed to observe finer details.
4. Record and draw all observed structures for each slide.
5. Repeat for each tissue sample.

- Observations

[A] Plant Tissues

1. Parenchyma
   - Cells are relatively large, thin-walled, and have a globular or oval shape with prominent nuclei.
   - Arranged loosely, leaving intercellular spaces.
   - Main function: storage, photosynthesis, and gas exchange.

2. Sclerenchyma
   - Cells are thick-walled due to lignin deposition, rigid and somewhat brittle.
   - Usually dead cells, no intercellular air spaces.
   - Provides mechanical strength and support.

[B] Animal Tissues

1 Blood (as seen in human blood slides)
   - Large number of small, circular, biconcave disc-like cells (RBCs) with no nucleus.

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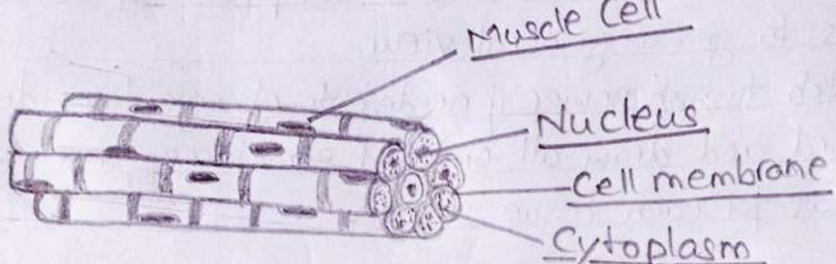
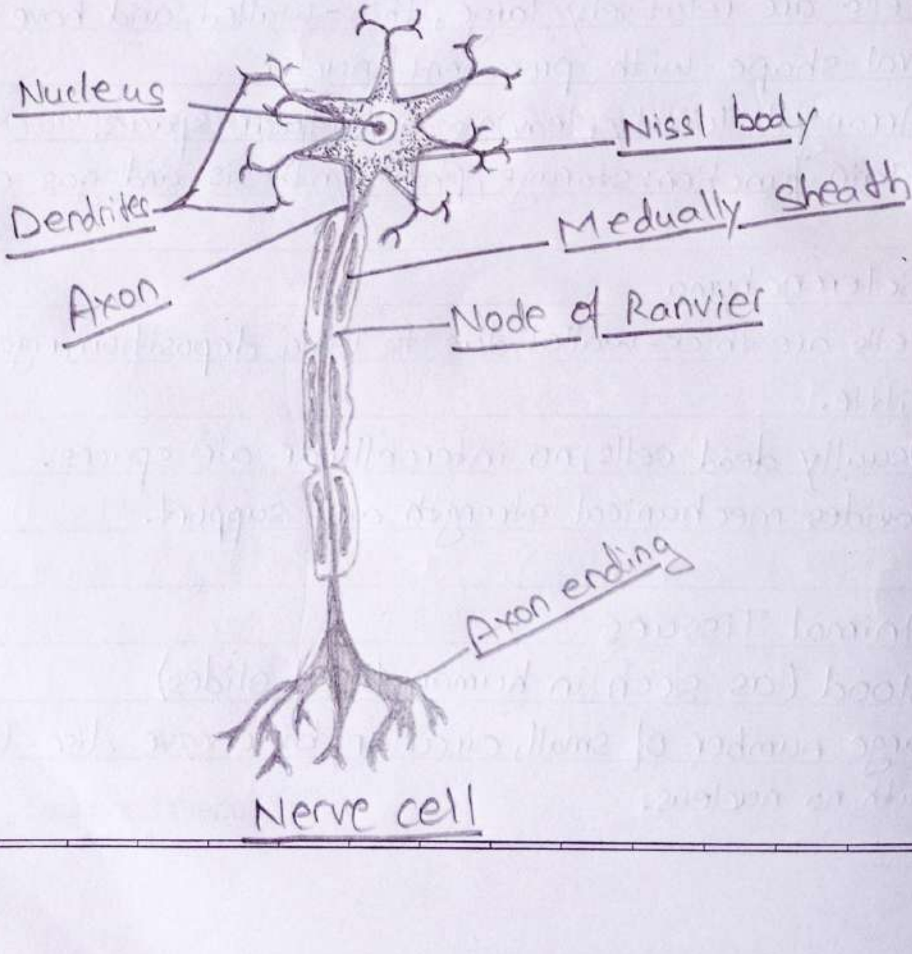


Muscle fibre



Nerve cell

- Fewer, larger, irregularly shaped cells (WBCs), each with a prominent nucleus.
- Five type of WBCs: Neutrophils, Basophils, Eosinophils, Lymphocytes, Monocytes.
- Platelets seen as very small fragments.

2. Striped Muscle Fibres (skeletal muscle)
- Elongated, cylindrical cells with alternating bands/striations and multiple nuclei at the periphery.
- Responsible for voluntary movements.

3. Nerve Cell
- Large star-shaped cell body with a prominent nucleus and several thread-like extensions (dendrites and long axon)
- Cytoplasm contains Nissl granules.

- Conclusion

Diffrent plant and animal tissues can be identified and deff--rentiated based on their structural details - such as cell, shape, arrangment, presence of walls, nuclei and unique features - by observing permanent slides under the microscope.

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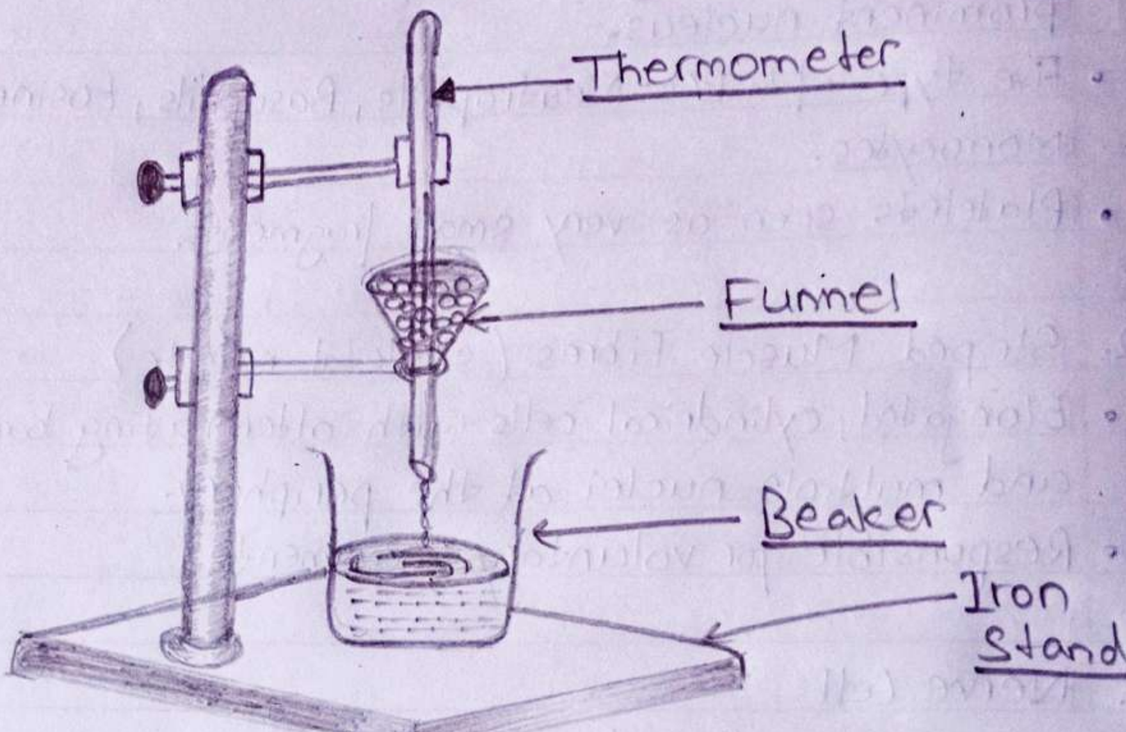


Experiment set up for finding melting point of ice

- Aim

To determine the melting point of ice.

- Apparatur / Material

Large funnel (about 15 cm diameter at top), laboratory thermometer beaker, iron stand with funnel holder and clamp, broken ice.

- Theory

- A solid melts to its liquid state at a fixed temperature called its melting point.
- For any pure substance, melting point and freezing point are the same.
- When a solid melts at its melting point, the temperature remains constant until all of it has liquefied.

- Procedure

1. Arrange the funnel, beaker, and thermometer on the iron stand as shown in the diagram, ensuring the thermometer is vertical.
2. Fill the funnel with broken ice so the thermometer bulb is fully surrounded by ice.
3. At 30-second intervals, note the thermometer reading without removing it from the ice.
4. Record the temperature as soon as it stops changing and becomes constant; this is the melting point of ice.

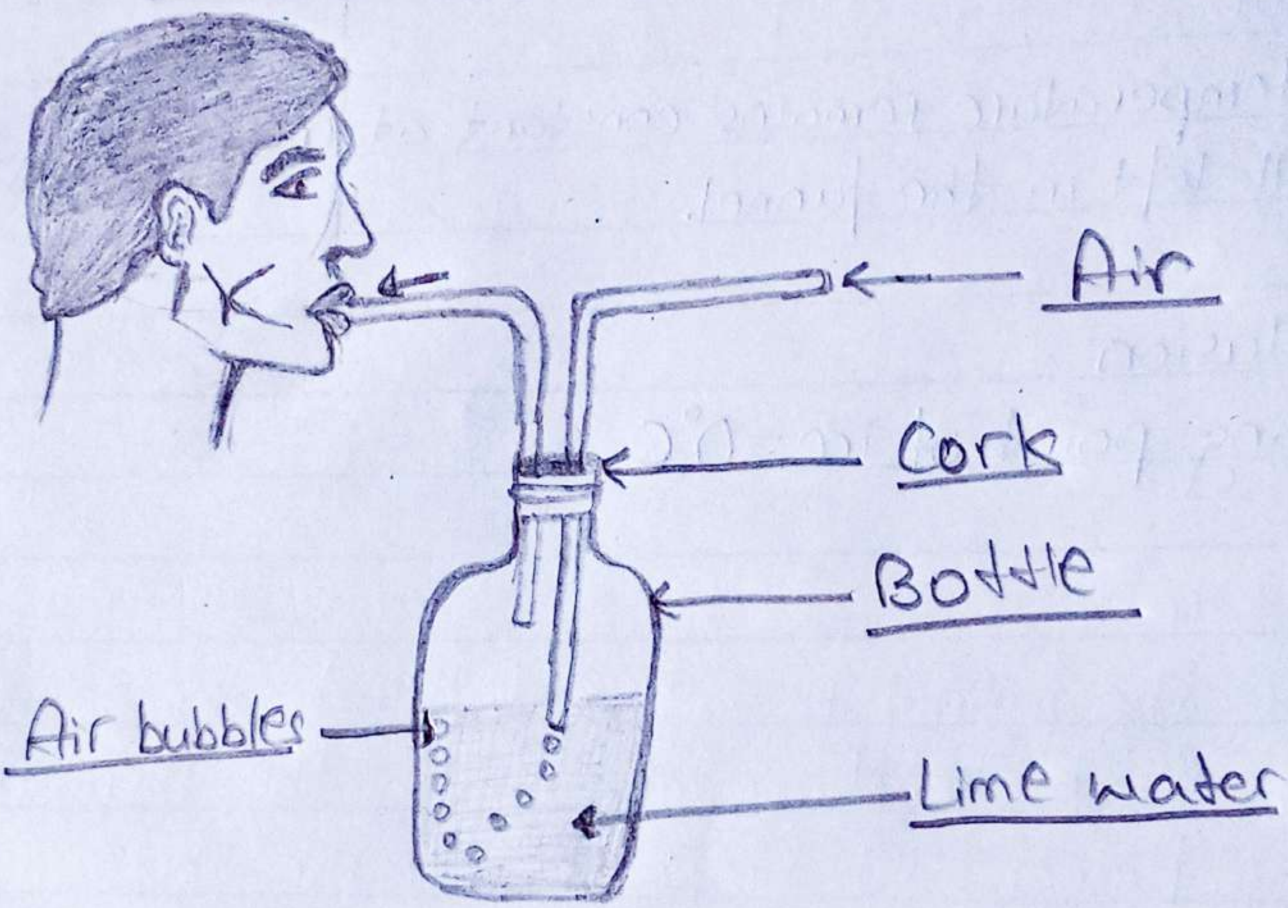
- Observation

S.No.	Time (min)	Temperature (C°)
1	0.5	0°
2	1.0	0°
3	1.5	0°
4	2.0	0°
5	2.5	0°

The temperature remains constant at 0°C as long as some ice is still left in the funnel.

- Conclusion

Melting point of ice = 0°C



Testing presence of CO_2 in air

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- Aim

To test the presence of carbon dioxide (CO_2) in air using lime water.

- Apparatus/Material

Bottle, freshly prepared lime water, cork with two holes, two glass tubes bent at right angles (one long and one short/delivery tube)

- Theory

- When carbon is passed through freshly prepared lime water, it turns the lime water milky due to the formation of insoluble calcium carbonate:

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3(s) + H_2O$

- If CO_2 is passed for a long time, the milkiness disappears as calcium carbonate reacts to form soluble calcium bicarbonate

$CaCO3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$

- Lime water turning milky is a test for the presence of CO_2 in air.

- Procedure

1. Take lime water (freshly prepared) in a boiling tube or bott-el.
2. Fix the cork (having two holes) tightly into the bottle mouth.
3. Insert a long bent glass tube through one hole, so its end dips in the lime water.

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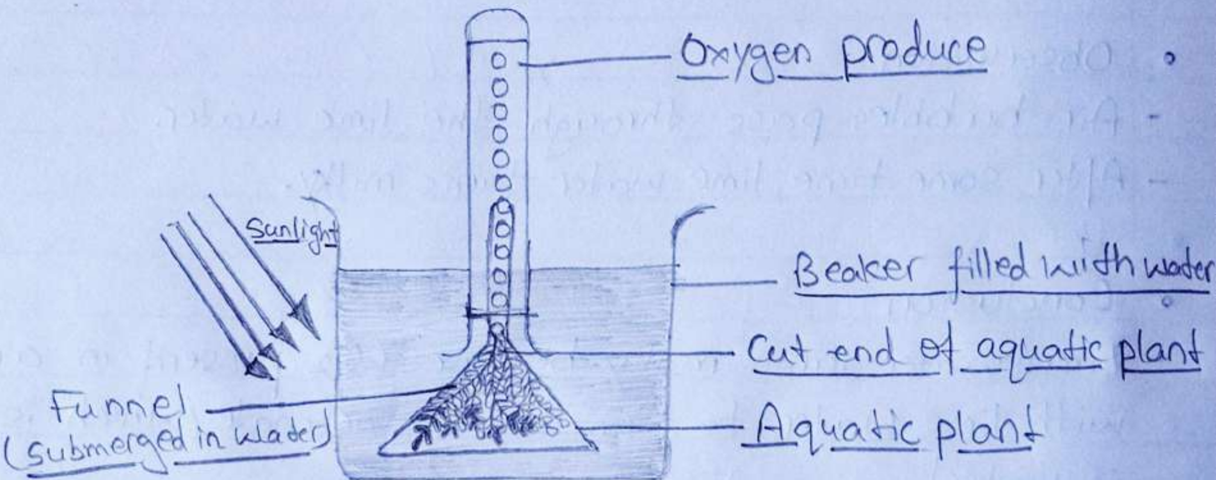

Set-up to observe that oxygen is liberated during the process of photosynthesis

4. Insert a short delivery tube through the other hole.
5. Slowly suck air through the small delivery tube with the mouth (as shown in the diagram).
6. Observe as the outside air bubbles through the long tube into the lime water.

- Observation

- Air bubbles pass through the lime water.
- After some time, lime water turns milky.

- Conclusion

- Lime water turns milky because CO_2 present in air reacts with lime water to form calcium carbonate (which is insoluble in water)
- This confirms that carbon dioxide is present in air

- Precautions

1. Use freshly prepared lime water for better results.
2. Ensure all apparatus are clean before use.
3. Suck air gently to avoid lime water entering the mouth

- Aim

To observe that oxygen is released during the process of photosythesis.

- Apparatus / Material

Beaker, funnel, Match box, test tube, Aquatic plant, thread. Water, Baking soda

- Theory

Photosynthesis is the process by which green plants use sunlight to synthesize food from carbon dioxide and water, releasing oxygen as a by-product. The chemical equation is:

$$6CO_2 + 12H_2O \xrightarrow{\text{Sunlight, chlorophyll}} C_6H_{12}O_6$$

Oxygen (O_2) release during photosynthesis can be observed as bubbles given off from the leaves of an aquatic plant kept under water in sunlight.

- Procedure

1. Fill a beaker with pond or tap water and add a pinch of baking soda.
2. Tie a few twigs of aquatic plant with a thread.
3. Place the plant under an inverted funnel, with the cut ends facing the funnel stem.

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4. Fill a test tube with water and invert it over the stem of the funnel, ensuring no air bubbles.
5. Keep the entire apparatus in sunlight or under a lamp for 30-40 minutes.
6. Observe the bubbles formed at the tip of the plant and collect in the test tube.

- Observations

S.No.	Time	No. of bubble liberated	No. of bubbles liberated per min (total ÷ time)
1	1st min	8	8
2	2nd min	9	9
3	3rd min	10	10
4	4th min	9	9

Average number of bubble liberated per minute $= \frac{(8+9+10+9)}{4} = \frac{36}{4} = 9$

After 5 minutes, the level of water in the test tube falls due to displacement by oxygen gas.
If a glowing matchstick is brought to the mouth of the test tube, the matchstick glow brighter, indicating the presence of oxygen.

- Conclusion

Oxygen is released during photosynthesis, as confirmed by the collection of gas bubbles and their effect on a glowing matchstick.

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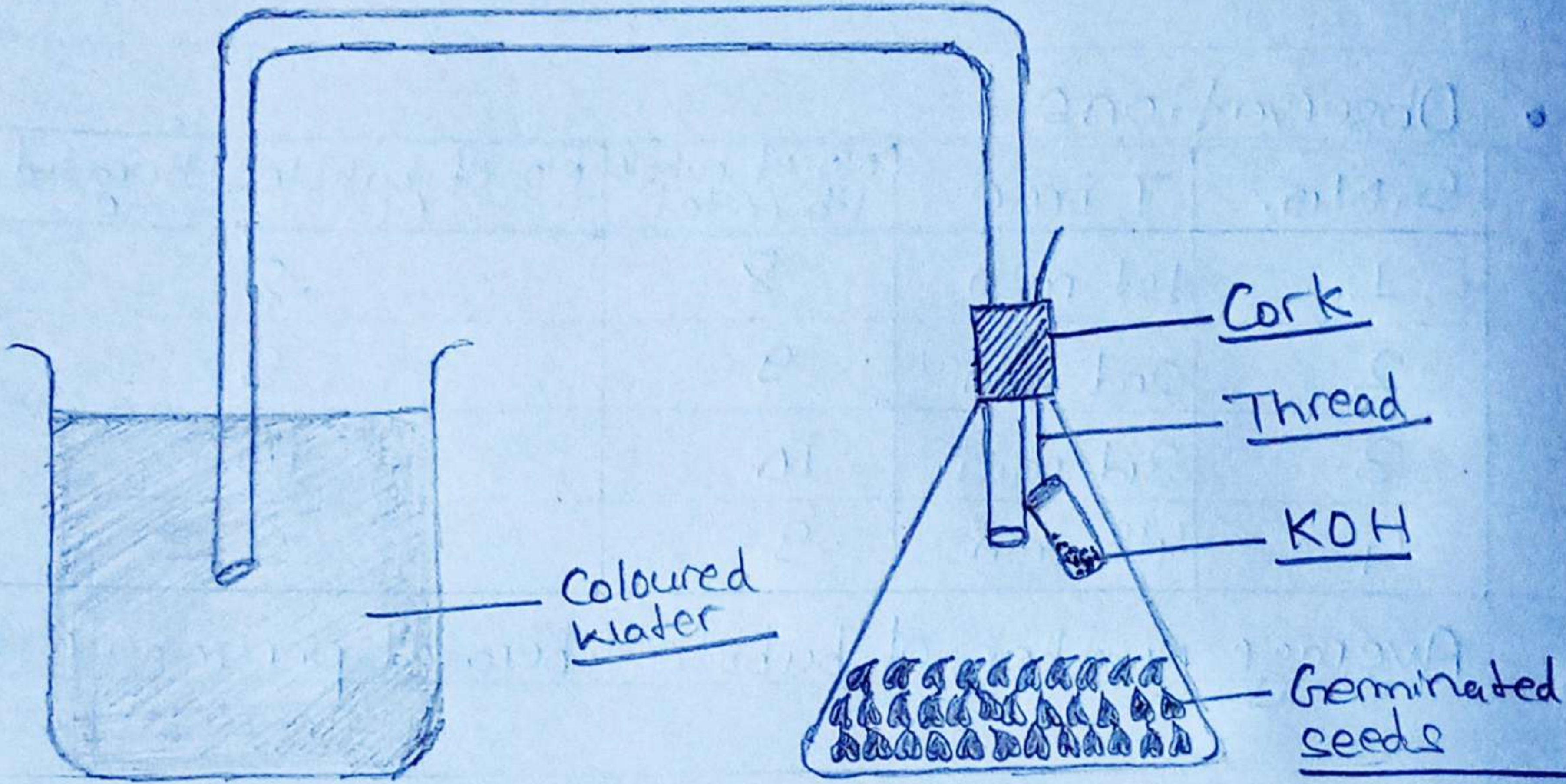

Experiment set-up to show CO2

Date 4/9/2025

Expt. No. 8

• Aim

To show that carbon dioxide (CO_2) is given out during respiration

• Apparatus / Material

Conical flask (250 ml), Beaker, Thread, one-holed rubber cork, Glass tube bent at right angles, small bottle/test tube, germinating seeds (gram, moong or wheat), KOH pellets (caustic/potassium hydroxide)

• Theory

Respiration occurs in all living organisms. During respiration, oxygen is taken in and carbon dioxide is released. Germinating seeds respire more actively than dry or boiled seeds.

• Procedure

1. Soak and germinate ~25 g gram seeds in water for about 24 hours.
2. Wrap the germinated seeds in wet cloth for a day, then select those with visible sprouts.
3. Put germinated seeds into a dry conical flask to cover the base.
4. Hang a small test tube with 5-6 KOH pellets inside the flask using a thread (so KOH does NOT touch the seeds)
5. Insert a one-holed cork with a bent glass tube passing through.

Teacher's Signature :

6. Dip the free end of the glass tube in a beaker of colored water (dyed with saffranin)
7. Mark the initial water level in the tube.
8. Leave setup for several hours and observe water level changes.

- Observations (i to ix)

(i) Germinating seeds actively respire and give out CO_2, while dry seeds do not respire and hence release negligible CO_2.

(ii) Yes, we can take floral buds.

(iii) Floral buds should be healthy and not in the process of wilting or decay. KOH pellets should not touch the buds directly as this may interfere with the experiment.

(iv) KOH absorbs the CO_2 released by the seeds during respiration facilitating observation of gas exchange and creating a vaccum that causes colored water to rise in the tube.

(v) To visibly detect movement (rise) in water level, which confirms gas changes and vacuum creation inside the flask due to CO_2 absorption.

(vi) (B) Rise, the water level in the tube.

(vii) Water rises because CO_2 released by the respiring seeds is absorbed by KOH, creating a partial vacuum inside the flask, Atomospheric pressure then pushes colored water up the tube to balance the pressure difference.

(ix) No. Boiled seeds are not capable of respiration because boiling kills the enzymes necessary for the process, so they do not release CO_2.

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- Conclusion

The experiment confirms that CO_2 is produced during respiration in germinating seeds, as indicated by the observed rise in colored water level caused by the absorption of CO_2 by KOH.

- Precautions

1. Cork must be air-tight
2. KOH pellets must not touch seeds

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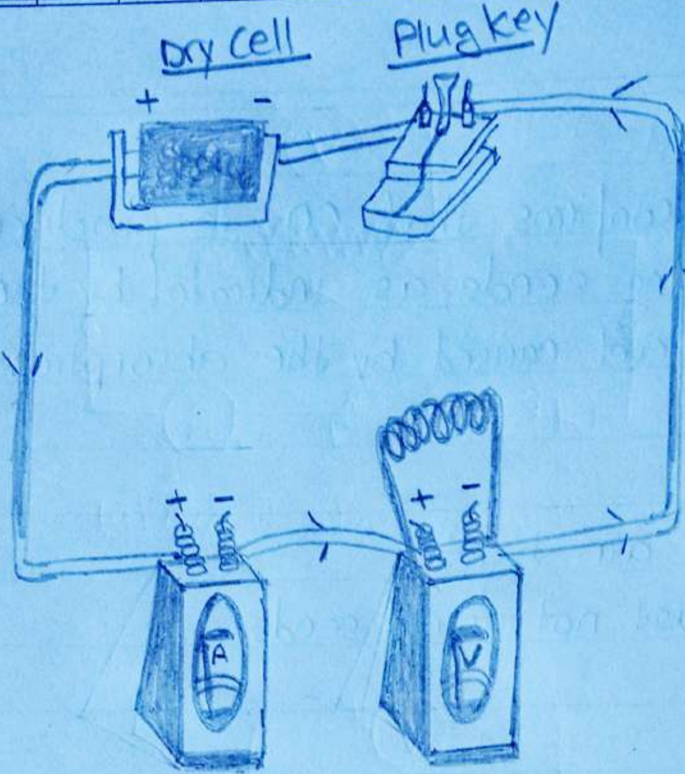
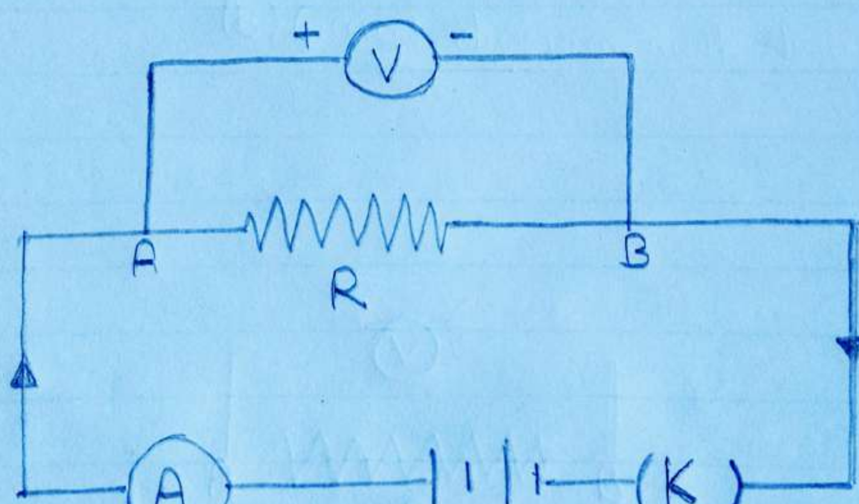


(a) Experiment setup



(b) The circuit diagram

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Expt. No. 9

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- Aim

To study the change in current through a resistor by changing potential diffrence across it, and to determine the resistance by plotting a graph between potential diffrence (v) and current (I)

- Apparatus / Materials

Four fresh cells (each 1.5V), resistor (wire), ammeter, voltmeter, connecting wires, key (plug), sand paper.

- Theory

- According to Ohm's Law: $V = IR$
- Therefore, $R = \frac{V}{I}$ (where R is resistance in ohms, V is potential diffrence in volts, I is current in amperes).
- If the temperature remains constant, $\frac{V}{I}$ will be a constant, showing direct proportionality.

- Procedure

1. Note the range and least count of the ammeter and voltmeter.
2. Make circuit connections as shown in the diagram, keeping the key open.
3. Connect the voltmeter across the resistor in parallel; connect the positive terminals correctly.
4. Clean the ends of wires with sand paper.
5. Check ammeter pointer is at zero when key is open; adjust if needed.

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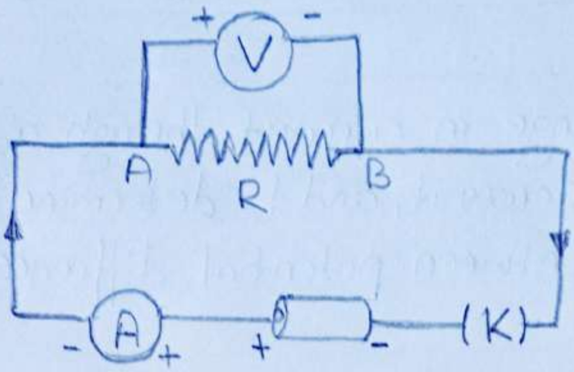
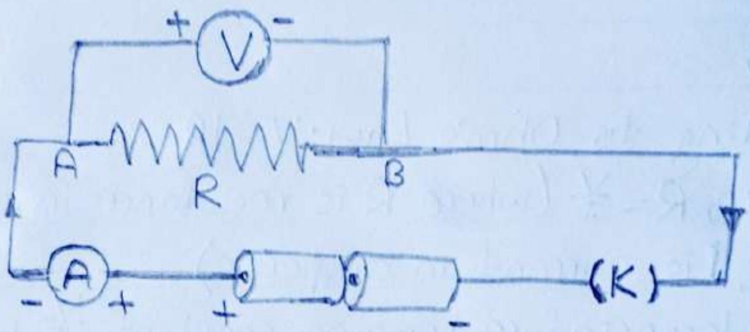
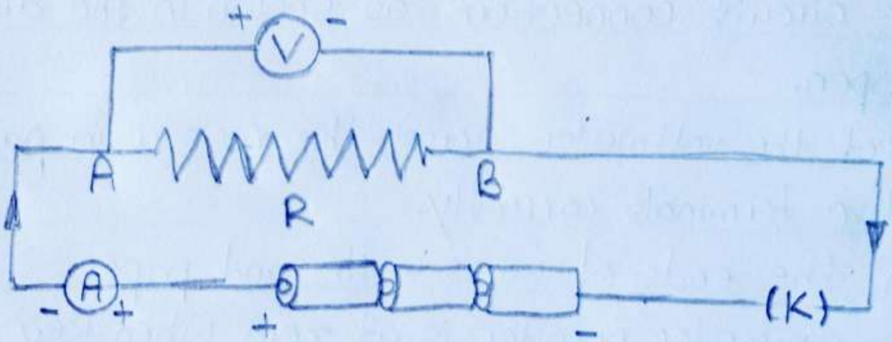


(a) Circuit diagram with single cell



(b) Circuit diagram with two cell



(c) Circuit Diagram with three cells

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6. Close the key and note readings of voltmeter and ammeter for 1, 2 and 3 cells (1.5V, 3.0V, 4.5V).
7. Repeat observations, then plot a graph between V (X-axis) and I (Y-axis).
8. Calculate resistance for each set and the mean value.

- **Observations**

Range of the voltmeter = 0V to 5.0V
Least count of the voltmeter = 0.1V
Range of the ammeter = 0A to 1.0A
Least count of the ammeter = 0.1A

- **Values of Current and Voltage table**

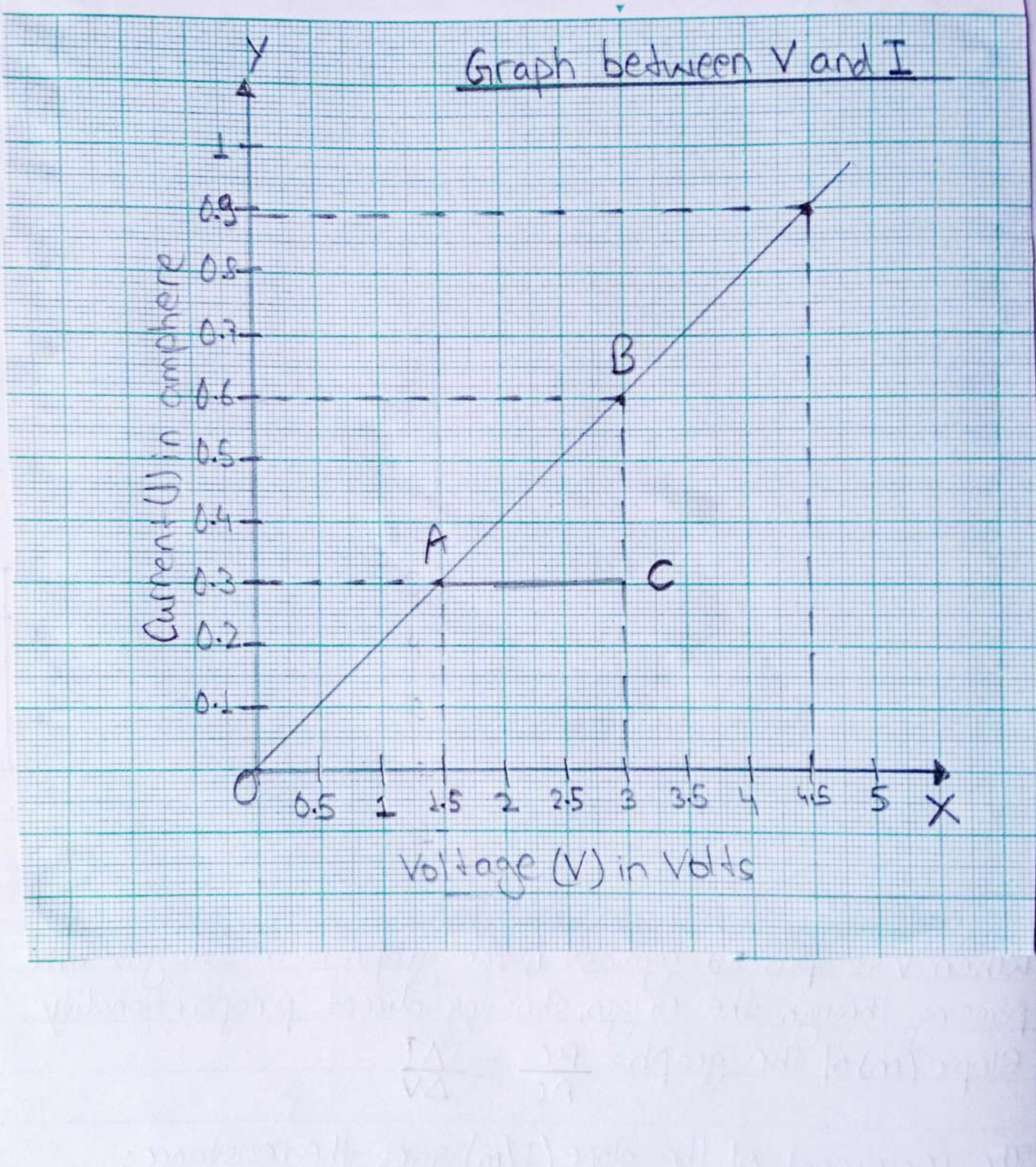
S.No.	Voltage in volt (V)	Current in ampere (I)	V/I (Ω)
1	1.5	0.3	5.0
2	3.0	0.6	5.0
3	4.5	0.9	5.0

Mean value of resistance $R = \frac{5.0+5.0+5.0}{3} = \frac{15}{3} = 5\Omega$

- **Analysis of Data**

- When V is plotted against I, the graph is a straight line passing through the origin, showing direct proportionality
- Slope (m) of the graph $= \frac{BC}{AC} = \frac{\Delta I}{\Delta V}$
- The reciprocal of the slope (1/m) gives the resistance:
$R = \frac{1}{m} = \frac{1}{0.2} = 5.0\Omega$ (Since V increases by 1.5 when I increase by 0.3: $\frac{0.3}{1.5} = 0.2$, so $R = 1/0.2 = 5.0\Omega$).

Teacher's Signature :



Graph between V and I
Y
X
O
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
A
B
C
Current (I) in ampere
Voltage (V) in Volts

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- Conclusion

1. The value of resistance of the conductor $R = 5.0\,\Omega$
2. The straight-line graph indicates the ratio V/I is constant, confirming the circuit obeys Ohm's law.

- Precautions

1. All connections should be tight and clean.
2. Use fresh cells.
3. Ammeter and voltmeter pointers must be at zero before starting.

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• Aim

1. To compare the amount of particulate matter (carbon soot) deposited on leaves from different localities.
2. To compare particulate matter emitted by the exhausts of diffrent type of vehicles (petrol car, disel truck/bus, CNG bus, scooter/auto) using cloth/filter paper imprints.

• Apparatus/Materials

- Leaf samples from different areas (e.g., park, busy road, industry side)
- Old white cotton cloth piece (≈4"×4") or filter paper/coarse paper.
- Vaseline/petroleum jelly or grease.
- Long thread
- Scissors, marker, clipboard (for lab record)
- Hand lens (optional)
- Glue/tape to stick samples in record book
- Pen and observation table

• Theory

Air contains particulate pollutants like dust and carbon soot. Soot is produced by incomplete combustion (Vehicle exhausts, burning). Particulate matter settles on leaf sufaces and on sticky cloths. More dark deposit → higher particulate pollution CNG usually produces less soot than petrol/disel. Deposited soot can block leaf stomata and reduce photosythesis; in human it can cause respiratory problems.

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- Procedure

[A] Compare carbon soot on leaves

1. Collect fresh leaf samples from diffrent areas like a well-maintained park, a residential area away from traffic, a busy road, and near a construction/industry site. Lable each sample (A, B, C, D) with area, date, time.

2. Spread each leaf (dark green side down) on a clean white cloth or plain paper. Gently press the leaf with an outward motion of fingres so any soot on the leaf transfers as an imprint.

~~3. Obser~~

3. Observe the shade and darkness of the imprint. Record impressions (light, moderate, dark).

4. Paste small pieces of impring or the leaf in you record book and write observations.

[B] Compare particulate emission from vehicle exhausts.

1. Cut 4-6 pieces of white cotton cloth or filder paper. One piece will be the control (kept at a safe distance from exhausts).

2. Smear a thin, even layer of vaseline/petroleum jelly on each cloth piece. This will trap particulate matter. Label each cloth with vehicle type (disel truck, petrol car, CNG bus, scooter).

3. With permission from the vehicle owner, tie a cloth piece with thread to the exhaust pipe of each vehicle. The cloth should hang close to pipe ~~to the~~ but not touch the road Let it remain tied while the vehicle runs on its normal route for a day (or place on vehicles parked in busy area for ~24 hr) — follow teacher/instruction (safety). The control piece is left in same area but away from direct exhaust.

4. After 24 hour remove the cloths carefully. Observe and compare the greasy areas, color, and amount of particulate deposition. Stick small piece of cloth in record book and write observations.

5. Write your answers below based on observations

- Observations

- Table 1 – Leaf imprints (Part A)

Sample no.	Area of leaf collection	Shade of imprint	Pollution level
A	Well-maintained Park	very light/almost no dark deposit	Low particulate pollution
B	Residendal area	Light	Low-moderate pollution
C	Busy road crossing	Dark/heavy deposit	High particulate pollution
D	Near construction	Moderate/dark	Moderate-high pollution

• Table 2 - Cloth/filder-paper imprinds from vehicle exhausts (B)

Sample No.	Vehicle type	Appearance after 24 h (greasy area)	Comments
1 (control)	Control	Clean/no deposit	Baseline
2	Disel truck	Very dark black deposit over greasy area	High particulate emission
3	Diesel bus	Dark black deposit	High emission
4	Petrol car (well-serviced)	Light grey deposit	Moderate emission
5	CNG bus	Almost no/very light	Lowest particulate emission
6	Scooter/auto	Moderate deposit (grey-black)	Moderate emission

• What to observe

1- Do these piece look diffrent from what was tied to the exhaust pipes 24 hours ago?
Yes - pices tied to exhausts show visible dark/black deposits and greasy areas after 24 hours, diffrent from clean cloths tied 24 hours earlier

2- What has deposited on the greasy area of the cloth/fider paper/coarse paper?
Carbon soot, dust and other particulate matter (tiny black carbon particles from incomplete combustion) have deposited on the greasy area.

3- Do these pices look diffrent from each other on the basis of particulate matter deposited?
Yes - pices from disel vehicles exhausts are darker (more soot)

than those from petrol vehicles; CNG shows the least deposition. Differences reflect diffrent emission levels.

4- Are there any samples that do not have any deposition? What does that indicate?
The control sample (kept away from direct exhaust) often has no deposition. This indicates that deposition is due to exhaust emission and not from general background dust in that specific placement.

5- Which vehicle does not emit any particulate pollutant? As per your observation, which fuel is the cleanest one - petrol, disel or CNG?
In practice, CNG emits the least particulate matter (appears cleanest). Petrol emits some particulate but less than disel; diesel emits the most soot. So CNG is the cleanest among the three for particulate emissions.

- Conclusion
Disel vehicles and busy traffic areas show maximum soot (particulate matter). Petrol shows less, and CNG is the cleanest fuel. Particulate pollution is harmful to both plants and humans.

- Precautions
Take permission before tying cloths to exhausts. Use equal size cloths with same amount of vaseline. Keep a control sample away from exhaus. Perform in open air.

Teacher's Signature :