

Practical Notebook

Chemistry

Grade IX

Web Version of PCTB Textbook

giz



**Punjab Curriculum and
Textbook Board, Lahore**

Authors

1. **Prof. Dr. Abid Zia**
Professor of Chemistry, Vice Principal (Rtd.)
Govt. College of Science, Wahdat Road, Lahore.
2. **Mr. Zafar Mehdi Zafar**
Senior Science Teacher (Rtd.) D.P.S. Lahore.
3. **Dr. Saman Jameel**
Senior Subject Specialist (Chemistry),
Punjab Curriculum and Textbook Board, Lahore.
4. **Dr. Lubna Amer**
Lecturer (Chemistry), F.C. College, Lahore.
5. **Mrs. Shagufta Saeed**
Professor of Chemistry, Pak-Turk International Schools & Colleges, Girls Campus, Lahore.
Former Head of Chemistry Department, Lahore Grammar School
Former Lecturer (Chemistry), Aitchison College, Lahore.
6. **Syeda Tahera Anjum**
Senior Headmistress Govt. Girls High School, Governors House, Lahore.
7. **Malik Moazam Mehmood**
Head of Science Department International School of Choueifat, Lahore
8. **Mr. Makhdoom Sarfraz**
Lecturer (Chemistry), F.C. College, Lahore.
9. **Mr. Muhammad Saeed**
Principal, Govt. Higher Secondary School, Khudian Khas, District Kasur.
10. **Mr. Atta Dastgeer**
Subject Specialist (Chemistry/General Science),
Punjab Curriculum and Textbook Board, Lahore.

Editors

- **Prof. Dr. Abid Zia**
- **Atta Dastgeer**

Supervision

Atta Dastgeer

Director (Manuscripts)

Mrs. Nisar Qamar

Sr. Artist / Deputy Director (Graphics)

Aisha Waheed

Composing, Illustrations & Layout

• Zahid Ilyas • Hafiz Inam-ul-Haq • Niaz Muhammad

Published by: Punjab Curriculum and Textbook Board, Lahore **Printed by:** Malik House

Date of Printing	Quantity PMIU	Quantity PEF	Total
January 2020	424,924	13,896	438,820

CERTIFICATE

Certified that:

Student _____

Class _____ Roll No. _____

School _____

has completed the practical work of Chemistry IX for
session _____ as per syllabus.

Signature
Science Teacher

Signature
Head of the Department

Web Version of PCTB Textbook

Table of Contents

Introduction	1
Learning Outcomes of Practical Work	2
General Safety Procedures	3
Common Laboratory Apparatus	4
General Instructions	7
First Aid in Chemistry	7
Chapter 1	
Experiment 1.1	9
Separate the given mixture of iron filings and sand by physical method.	
Chapter 5	
Experiment 5.1	12
Determine the melting point of the given compound (Naphthalene).	
Experiment 5.2	15
Determine the melting point of the given compound (Biphenyl).	
Experiment 5.3	15
Determine the boiling point of the given liquid (Acetone).	
Experiment 5.4	18
Determine the boiling point of the given liquid (Toluene).	
Experiment 5.5	18
Determine the boiling point of the given liquid (Ethyl alcohol).	
Experiment 5.6	18
Demonstrate sublimation using ammonium chloride.	
Experiment 5.7	20
Separate naphthalene from the given mixture of sand and naphthalene by sublimation.	
Experiment 5.8	22
Separate the given mixture of alcohol and water by distillation.	
Experiment 5.9	24
Demonstrate that a chemical reaction releases energy in the form of heat.	
Chapter 6	
Experiment 6.1	26
Prepare 100cm ³ of 0.1M sodium hydroxide (NaOH) solution.	
Experiment 6.2	29
Prepare 100cm ³ of 0.1 M sodium carbonate (Na ₂ CO ₃) solution.	
Experiment 6.3	31
Prepare 250cm ³ of 0.1M HCl solution.	
Experiment 6.4	34
Prepare 250 cm ³ of 0.1 M oxalic acid (H ₂ C ₂ O ₄ .2H ₂ O) solution.	
Experiment 6.5	36
Prepare 100 cm ³ of 0.1 M sodium hydroxide (NaOH) solution from the given 1M solution.	

Experiment 6.6	Prepare 100 cm ³ of 0.01M Na ₂ CO ₃ solution from the given 0.1 M solution	38
Experiment 6.7	Prepare 100 cm ³ of 0.01M hydrochloric acid (HCl) solution from the given 0.1 M solution.	39
Experiment 6.8	Prepare 100 cm ³ of 0.01M oxalic acid solution from the given 0.1M solution.	40
Experiment 6.9	Prepare pure copper sulphate crystals from the given impure sample.	41
Experiment 6.10	Demonstrate that miscible liquids dissolve in each other and immiscible liquids do not.	43
Experiment 6.11	Demonstrate that temperature affects the solubility.	45

Chapter 7

Experiment 7.1	Demonstrate the conductivity of different given solutions.	47
Experiment 7.2	Demonstrate a metal displacement reaction in aqueous medium.	50

Chapter 8

Experiment 8.1	Demonstrate that two elements combine to form a binary compound.	52
Experiment 8.2	Demonstrate that compounds can be products of a decomposition reaction.	54
Experiment 8.3	Demonstrate that some processes absorb energy.	56

Web Version of PCTB Textbook

Introduction

A chemistry laboratory is a chemist's workshop. It is a room where a student is trained to observe the physical and chemical behaviour of the substances by following a definite procedure. Before starting the laboratory work, a student should be familiar with the layout of the laboratory and various fittings provided on the laboratory table.

Laboratory Fittings

Chemistry laboratory has the following fittings with which the student must familiarize himself on the first day of his entry in the laboratory.

1. Demonstration Table

It is the table where students assemble before starting the experiment. It is provided with a gas tap, a water tap and a sink. The class teacher gives detailed instructions and demonstration regarding the experiment to be performed on that day.

2. Student's Working Table

It is a large table designed to meet the requirements of work in a chemistry laboratory. It is slightly higher than the ordinary table and is divided into a number of seats, one for each student. Each seat is provided with the following fittings.

- i. Gas tap
- ii. Water taps and sinks
- iii. Waste box (for throwing solid waste material)
- iv. Reagent shelf (on which chemicals and reagents required more frequently are placed in reagent bottles arranged in a definite order)
- v. Side shelf: The chemicals or reagents which are not frequently used are provided in the side shelf in alphabetical order.
- vi. Drawers are provided on the side of the working table for placing books, note books and other articles.
- vii. Balance room (a small room is usually attached to the chemistry laboratory where a number of balances are placed.)
- viii. Fire extinguisher, fire blankets and buckets full of sand

Learning Outcomes of Practical Work

Students are required to carry out practical work as an integral part of the course. They are advised to maintain a laboratory record book in which they record all their practical work, the experimental arrangements used, the observations made and the analysis of these observations. Through experimental work the students are expected to acquire the skills as follows.

- Adopt safety procedures in Chemistry laboratory
- Handle chemical apparatus and use compounds and reagents etc.
- Keep and store poisonous compounds properly.
- Control explosive reactions.
- Determine melting point of organic solids.
- Determine boiling point of organic liquids.
- Carry out sublimation.
- Carry out distillation process.
- Prepare solutions of different strength.
- Carry out dilution of solutions.
- Determine which solutions conduct electricity from a set of different given solutions.
- Perform metal displacement reactions in aqueous medium.
- Perform a reaction for preparation of a binary compound from two elements.
- Perform a decomposition reaction which produces new compounds.
- Conduct exothermic and endothermic processes.

General Safety Procedures

Before you begin.....

1. Keep your work table neat and clean. Make sure that it is not full of unnecessary things such as school bag, files, clothes and books etc.
2. Read all the instructions in your practical manual / book before you do anything.
3. Look out for possible safety precautions.

While you are doing the experiment....

1. Follow the directions in the practical manual / book closely.
2. Do not wander around and do not endanger people around you.
3. Wear or use protective devices that are provided to you. These protective devices include goggles, gloves, apron and safety tongs.
4. Use wire gauze or sand bath for heating. Never leave heating apparatus unattended. Turn off Bunsen burner or spirit lamp when you have to leave your work table for a while or when you have finished your experiment.
5. Handle the apparatus and other instruments particularly sharp objects to avoid damage and loss.
6. If you have broken any glassware (beakers, test-tubes or thermometer etc.) or spilt anything, report to your teacher at once. You may have to help in cleaning up.
7. Be aware of where fire extinguishers, fire blankets and first aid box are located in the laboratory.

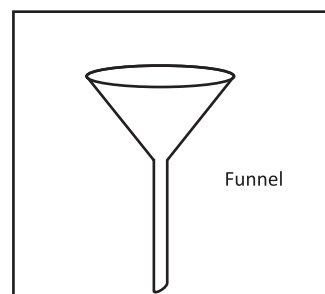
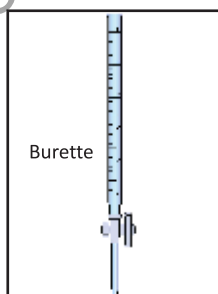
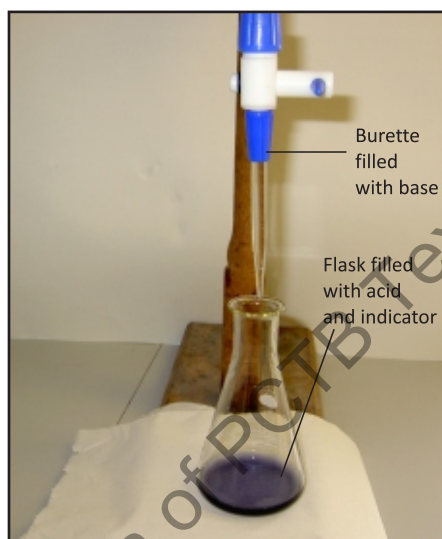
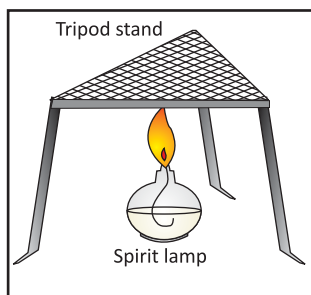
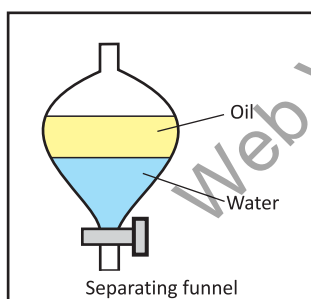
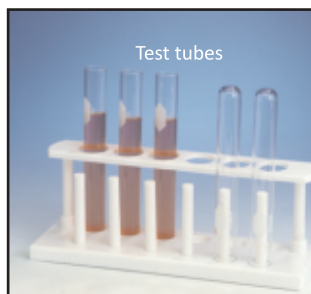
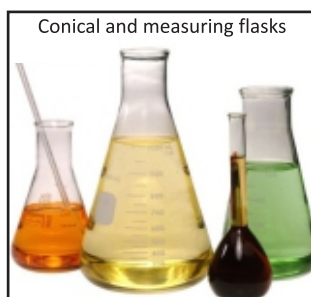
After you have finished....

1. Turn off water and gas taps, disconnect electrical connections and return your apparatus to Laboratory Staff.
2. Clean your work table.
3. Do not dispose of material in the sink unless you are instructed to do so.
4. Wash your hands thoroughly.

The best preventive measure is always to be careful and alert. Take care of yourself and your neighbours.

Common Laboratory Apparatus

1. Some of the items of apparatus commonly used in the laboratory are shown below.



2. Names and functions of the apparatus used in the laboratory are:
- i. **Bunsen burner:** It is used to heat substances.
 - ii. **Tripod stand:** It is made of iron having three supporting legs. Apparatus to be heated is placed on the tripod stand.
 - iii. **Wire gauze:** It is the iron wire gauze piece pasted with asbestos in the centre. It is placed on the tripod stand so that the flame does not touch the glass apparatus directly, reducing danger of its breaking.
 - iv. **Sand Bath:** It is used to supply slow and uniform heat to the system when required.
 - v. **Test tube:** These are small tubes made of glass used for handling small amounts of reagents.
 - vi. **Test tube holder:** It is used to hold a test tube.
 - vii. **Test tube stand:** It is made of wood, polythene or steel on which test tubes can be placed in upright position.
 - viii. **Beakers:** These are glass containers used for taking liquids. Beakers are of various sizes such as 50cm^3 , 100cm^3 , 250cm^3 or 500cm^3 are available.
 - ix. **Conical or Titration flask:** It is a flask of conical shape used for titration during volumetric estimation.
 - x. **Funnel:** These are used for transferring liquids from one container to another or for filtration. Funnels are of different sizes 3cm, 5cm, 8cm etc.
 - xi. **Evaporating dish (china dish):** It is a small dish made of porcelain used for evaporating and concentrating the dilute solutions. It is available in different sizes.
 - xii. **Measuring cylinders:** These are graduated cylinders for approximate measurements. They are available in different sizes 5cm^3 , 10cm^3 , 20cm^3 , 50cm^3 , 100cm^3 and 1000cm^3 .
 - xiii. **Measuring flasks:** These are flasks made of glass having long neck used for measuring exact volume of liquids in volumetric analysis. There is a mark on the neck (stem) of the flask indicating the point up to which it is to be filled to take the exact volume of the liquid. These are used to prepare solutions of exact molarity. These are available in different sizes i.e., 100cm^3 , 250cm^3 , 500cm^3 and 1000cm^3 .
 - xiv. **Burette:** These are used to deliver very accurate but variable volumes of a liquid. These are usually of 50cm^3 capacity.

- xv. **Pipette:** It is used to measure fixed and accurate volume of a liquid. Generally available sizes are 10cm^3 , 20cm^3 and 25cm^3 .
- xvi. **Thermometer:** The temperature of a substance is measured using a thermometer. Temperature in laboratory is usually measured in units of degree Celsius ($^{\circ}\text{C}$).
- xvii. **Watch Glass:** It is used to weigh solid chemicals on the balance.
- xviii. **Iron stand:** It is used for hanging (thermometer), clamping / holding (burette, round bottom flask etc.)
- xix. **Glass rod:** It is used to stir solutions.
- xx. **Wash Bottle:** Now-a-days polythene wash bottles are used in the laboratory for storing distilled water for various operations such as transferring of precipitates from a container to the filter paper or washing the precipitates. When the bottle is pressed with hand, water comes out through the jet in the form of a fine stream.
- xxi. **Desiccator:** It is used to absorb the moisture present in a substance and to render it dry.
- xxii. **Spatula:** It is a metallic or glass spoon used to transfer the solid chemicals.

General Instructions

1. Conduct yourself in a responsible manner at all times in the laboratory.
2. Always wear a lab coat and safety goggles in the lab.
3. Girls must tie up their duppata and lose hair when working in the laboratory.
4. Never work alone in the laboratory.
5. Don't bring eatables in the laboratory.
6. Never taste or smell any compound or a gas, to smell gases always waft the fumes or gas towards your nose.
7. You must report immediately about an accident or breakage.
8. Develop habit to put things back at their proper place after use.
9. Don't mix the chemicals.
10. Always take care of yourself and your class fellows while working in the laboratory.
11. Don't work on chemicals for which you don't have instructions.
12. Read the FIRST AID instructions.

First Aid in laboratory

Every laboratory must have a first aid box. The first aid box usually contains a fire extinguisher, fire blanket, bandages and medicines etc. An accident may occur in the laboratory due to carelessness or by chance. In any case, take necessary steps with the help of first aid box. Common accidents and their first aid treatments are given in the table below.

Accidents and their First Aid Treatment

	Type of Accident	First Aid Treatment
1.	Cuts (i) Minor cuts (ii) Serious cuts	(i) Remove the glass piece if any, apply a little methylated spirit or tincture iodine with a piece of cotton. Both act as disinfectant. (ii) Apply pressure on the cut for about 10 minutes to stop bleeding. Consult a doctor.
2.	Eye injuries (i) Acid in the eye (ii) Alkali in the eye (iii) Foreign particle in the eye (iv) Soreness in the eye	(i) Wash thoroughly with water and then with 1% sodium bicarbonate solution. (ii) Wash with water followed by 1% boric acid solution. (iii) Do not rub the eyes. Remove the particle carefully with soft handkerchief then wash with water. (iv) Put a drop of olive oil in the eyes and keep them closed for some time.
3.	Burns (i) Burns with dry heat (flame, hot object) (ii) Burns causing blisters (iii) Acid burns	(i) Apply burnol or mustard oil. (ii) Apply burnol at once. Caution: Heat burns should never be washed. (iii) Wash freely with ice cold water. Then wash with a saturated solution of sodium bicarbonate and again with water.

	(iv) Alkali burns (v) Bromine burns	Caution: If sulphuric acid falls on the skin wipe it before washing with water. (iv) Wash freely with water and then with 1% acetic acid solution and again with water, dry the skin and apply the burnol. (v) Wash liberally with 2% ammonia solution and apply glycerine. Wipe off glycerine after sometime and apply burnol.
4.	Poisons (i) Poisons swallowed (ii) Acid swallowed (iii) Caustic alkalies swallowed (iv) Salt of heavy metals swallowed.	(i) Spit immediately, wash mouth with water repeatedly. (ii) Drink a lot of water or lime water or milk of magnesia. (iii) Drink a lot of water; drink a glass of lemon or orange juice. (iv) Take milk or white part of the egg.
5.	Fire (i) Clothes catch fire (ii) Beaker containing inflammable liquid catches fire. (iii) Spirit or oil catches fire. (iv) Electric parts catch fire.	(i) Do not run. Wrap with blanket or with dry cotton cloth. Lie down on the floor. (ii) Cover the beaker with a duster or damp cloth. This will cut off the supply of oxygen. (iii) Throw a mixture of sand and sodium bicarbonate. Do not throw water. It will simply spread the fire. (iv) Switch off the electric supply immediately and throw sand. Do not throw water in such cases to extinguish fire.

CHAPTER Fundamentals of Chemistry

1



Separate the given mixture of iron filings and sand by physical method

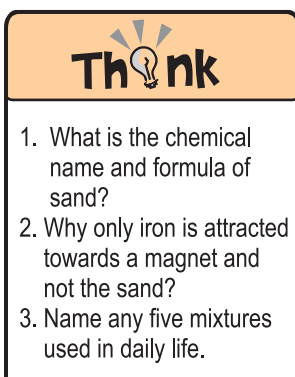
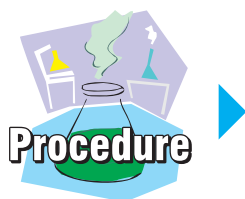
Date _____



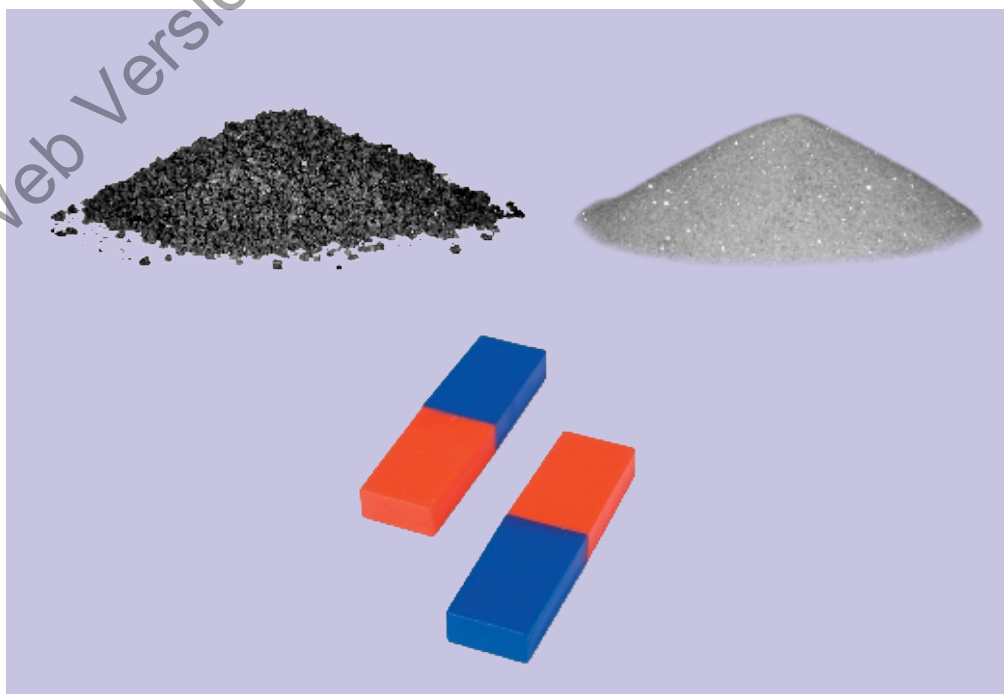
Separation of a given mixture is based upon the differences in physical properties of the component substances. For example, iron is attracted towards magnet whereas sand is not. Therefore, a mixture of these two substances is separated by using a bar magnet.



Bar magnet, mixture of sand and iron filings, piece of plastic sheet, two watch glasses/china dishes



- 1 Take a small amount of the given mixture of iron filings and sand in a watch glass/china dish.
- 2 Wrap the bar magnet in a piece of plastic sheet.
- 3 Spread the mixture on the watch glass and move the wrapped magnet over the mixture until the bar magnet is covered with iron filings.
- 4 Remove the iron filings from the magnet (by lowering down the plastic cover from the magnet) and collect them on the other watch glass/china dish.
- 5 Repeat this procedure till all the iron filings are removed from the mixture.





- a. Common salt and aluminium filings

b. Ammonium chloride and common salt

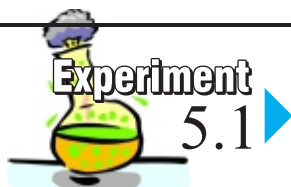
c. Common salt, sand and iron filings

a. Sublimation
b. Filtration after shaking with water
c. With the help of bar magnet
d. With separating funnel



CHAPTER Physical States of Matter

5



Experiment 5.1

Determine the melting point of the given compound (Naphthalene)

Date _____



Background Information

There are three states of matter which may be inter-converted either by heating or cooling. Melting point is a temperature at which the solid changes into liquid. At this temperature solid and liquid states coexist. It is a measure of the strength of intermolecular forces. Covalent compounds have low melting points but ionic compounds show higher melting points. Crystalline compounds show fixed and sharp melting points.



Materials Required

Thermometer, beaker (250 cm³), thread, capillary tube, tripod stand, wire gauze, stirrer, iron stand with clamp, water and given organic compound (Naphthalene).



Procedure

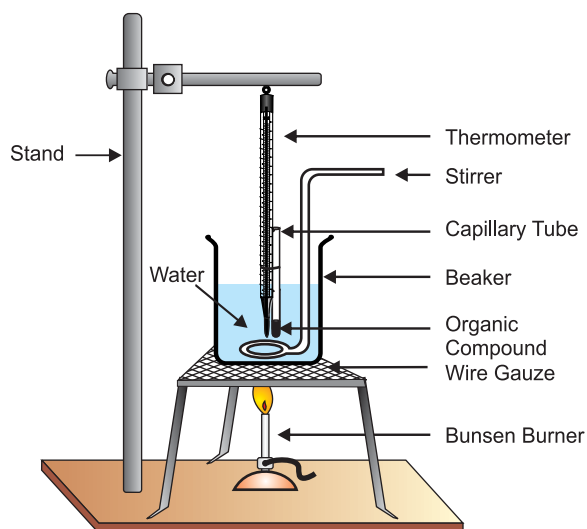
CAUTION

The bulb of the thermometer should not touch the walls or base of the beaker.

Think

1. What do you conclude from your observations about the nature and purity of the given compound?
2. Which other liquid you may use for heating instead of water when the melting point of substance is close to 100°C .
3. Why two different compounds have different melting points?
4. What is the effect of impurity on the melting point of a solid?
5. For the purpose of melting point determination, is it possible to heat the compound directly instead of using a water bath?

1. Close one end of the capillary tube by heating it on the flame of Bunsen burner.
2. Crush the organic compound (Naphthalene) to make its powder.
3. Fill one centimetre length of the capillary tube with the organic compound.



Determination of Melting Point

4. Attach the capillary tube with thermometer with the help of a piece of thread. Keeping in view that the base of the capillary tube and the bulb of the thermometer must be at the same level.
5. Hang the thermometer with the clamp of iron stand using thread as shown in the figure.
6. Take 250 cm^3 beaker and add approximately 100 cm^3 of water in it. Place this beaker over the tripod stand with the wire gauze in between them.
7. Now dip the thermometer along with the capillary tube into the beaker containing water as shown in the diagram.
8. The upper end of the capillary tube must remain 1 to 2cm above the water level. Bulb of thermometer must be completely immersed into water.
9. Heat with continuous stirring.
10. Note down the temperature at which the solid starts melting.
11. Repeat the experiment and note the melting point again.
12. Calculate the average temperature and compare it with the standard melting point of the organic compound.



DO YOU KNOW?

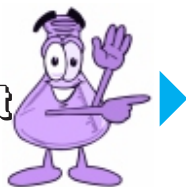
1. A mixture of scrambled egg placed in cold vacuum chamber, slowly turns to a powdery solid.
2. When carbon dioxide gas under pressure is allowed to pass through a very small hole, it is converted into a white solid. This solid is called dry ice.



No. of obs.	Melting point (°C)
1.	t ₁°C
2.	t ₂°C

$$\text{Mean value} = \frac{t_1 + t_2}{2}$$
$$= \text{-----}^{\circ}\text{C}.$$

Result



Melting point of the given organic compound is -----°C.

Post Lab Activities



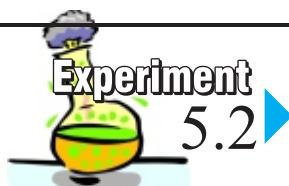
1. When the observed melting point is less than the standard value what inference will you get?

2. If equal amounts of sodium chloride and benzoic acid are taken separately and heated under similar conditions which one will melt earlier and why?



BRAIN TEASERS

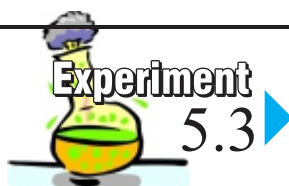
1. Huge glaciers of ice remain in sun for years but do not melt whereas ice cubes taken out from refrigerator melt within a few minutes. Explain.
2. When roads are blocked by snow during winter season, powdered salt is thrown on the snow which makes it melt quickly and roads become available for traffic. Explain the action.



Determine the melting point of the given compound (Biphenyl)

Date _____

Proceed as in experiment 5.1



Determine the boiling point of a given liquid (Acetone)

Date _____



Boiling point is defined as the temperature at which the vapour pressure of a liquid becomes equal to the external pressure.

Boiling point of a liquid depends upon external pressure, nature of intermolecular forces, molecular mass and purity of the substance. Impurities increase the boiling point of the liquids. Higher the external pressure higher is the boiling point and vice versa.



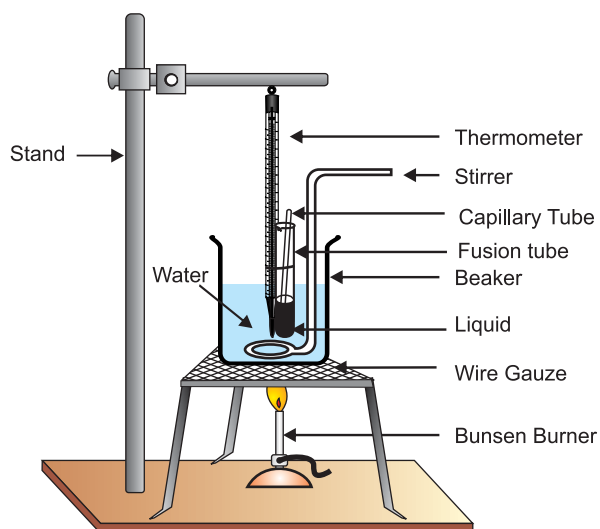
250 cm³ beaker, thermometer, Bunsen burner, tripod stand, wire gauze, glass stirrer, fusion tube, capillary tube, iron stand with clamp, dropper, thread/ rubber band, match box, water, given organic compound (acetone).



1 Close one end of the capillary tube by gentle heating in the blue oxidizing flame.

2 Attach the fusion tube with thermometer with the help of thread or rubber band in such a way that the bulb of the thermometer and the base of the fusion tube are at the same level.

3 Hang the thermometer along with fusion tube using thread with the clamp of the iron stand.



Determination of Boiling Point

- ④ Take 250cm³ beaker and add approximately 100cm³ water in it, place this beaker on the tripod stand over the wire gauze.
- ⑤ Now dip the thermometer and the fusion tube into the beaker containing water as shown in the diagram.
- ⑥ Fill one third of the fusion tube with acetone with the help of a dropper and place the capillary tube in it with its closed end upward.
- ⑦ Heat the beaker gently with continuous stirring to keep the temperature of water uniform.
- ⑧ Note down the temperature at a which continuous stream of bubbles starts coming out from the open end of the capillary tube. Repeat the experiment twice and take the mean value.

CAUTIONS

1. Thermometer and the fusion tube should not touch the walls and the base of the beaker.
2. Base of fusion tube and the bulb of the thermometer should be at the same level.
3. The open end of the fusion tube must remain above the surface of water level in the beaker.



No. of obs.	Boiling point (°C)
1.	t ₁°C
2.	t ₂°C



$$\text{Mean value} = \frac{t_1 + t_2}{2} \text{}^{\circ}\text{C}.$$

The boiling point of the given organic compound is°C.

Think

1. Why do we determine the boiling point of a liquid?
2. Why does ethyl alcohol show higher boiling point than acetone?
3. If the boiling point of a given liquid is greater than 100°C then which liquid is used in the water bath?
4. Why does sea water boil at higher temperature than distilled water?



DO YOU KNOW?

Liquid carbon dioxide exists, but only at a pressure greater than 5 atmosphere. Infact carbon dioxide is usually transported in the liquid state at room temperature in steel tanks. It cools others, but does not leave a residue as ordinary ice does.

1. **Why boiling point of water at hilly areas is lower than that at sea level?**

2. **The boiling point of water on a mountain location is found to be less than 100°C . Suggest a way to raise the boiling point of water.**

3. **On the basis of which property, fractions of the mixture of petroleum are separated from each other during petroleum refining?**

4. **Alcohol is a colourless liquid but red coloured alcohol is used in thermometers.**

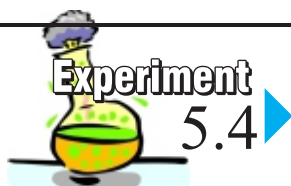
a) What is the purpose of using coloured alcohol instead of using any other compound?

b) Why use of alcohol is preferred over mercury in thermometers?



BRAIN TEASERS

1. Why food is cooked quickly in a pressure cooker?
2. Very often salt is added to water when boiling an egg? Can you think of a reason to do so?

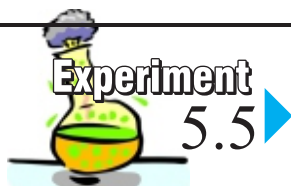


Experiment 5.4

Determine the boiling point of a given liquid (Toluene)

Date _____

Proceed as in experiment 5.3.

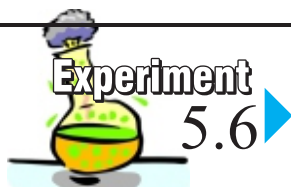


Experiment 5.5

Determine the boiling point of a given liquid (Ethyl alcohol)

Date _____

Proceed as in experiment 5.3.



Experiment 5.6

Demonstrate sublimation using ammonium chloride

Date _____



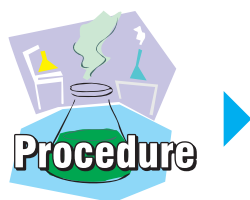
Background Information

Sublimation is a process in which a solid changes directly into vapours without passing through liquid state. Common substances which can sublime are ammonium chloride, naphthalene, iodine, camphor and menthol. Only those solids sublime which have an appreciable vapour pressure in the solid state at room temperature.



Materials Required

Test tube, test tube holder, Bunsen burner, ammonium chloride.



Procedure

- 1 Take approximately 1.0 g ammonium chloride in a dry and clean test tube and hold the test tube with test tube holder as shown in the diagram. Always keep the mouth of the test tube away from you and your lab fellows during heating. It should normally be along the length of the table.



- ② ☐ Wrap a wet filter paper along the sides of the test tube.
- ③ Heat the test tube as gently as possible on the blue flame of the Bunsen burner. Heat the test tube with to and fro motion.

CAUTION

It is important to heat the solid gently for it to sublime.





Think

1. Is sublimation a physical change or a chemical?
2. Can this property of a substance be utilized to separate it from other substances?
3. Can vaporization of water be also called sublimation?



1. Name five more substances which have the tendency to sublime.

- i.
- ii.
- iii.
- iv.
- v.

2. Elaborate the difference between dew and frost.



BRAIN TEASER

A pile of snow slowly disappears in water though the temperature of atmosphere is too low for it to melt. Explain How?



DO YOU KNOW?

1. Freeze-drying of foods is a commercial application of sublimation. Brewed coffee is frozen and placed in vacuum to remove water vapours. The ice continues to sublime until it is all gone, leaving freeze dried coffee. Most freeze dried foods are easily reconstituted by adding water.
2. Common metals like zinc and tin are obtained in the pure state by the method of sublimation.

Experiment 5.7

Separate naphthalene from the given mixture of sand and naphthalene by sublimation

Date _____

Background Information

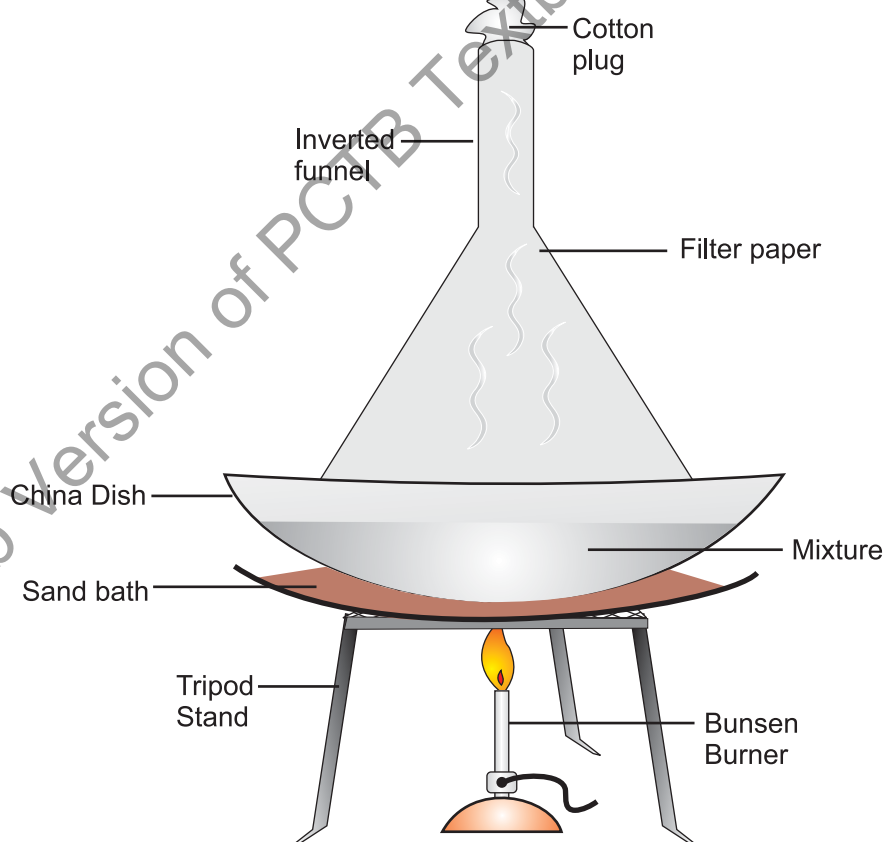
Separation of a given mixture is based upon the difference in the physical properties of the component substances. The mixture of naphthalene and sand is separated using the property of naphthalene to undergo sublimation on gentle heating. Sand, on the other hand, does not sublime on heating.

Materials Required

Evaporating dish (china dish), Bunsen burner, funnel, filter paper, cotton, tripod stand, sand bath, mixture of naphthalene and sand.

CAUTION

Heat the mixture of naphthalene and sand very gently to avoid the melting of naphthalene.



Procedure

- 1 Take about 5.0 g of the given mixture in the china dish and place it on the sand bath, resting over a tripod stand as shown in the figure.
- 2 Fold a filter paper in a cone shape. Moisten the inner side of the funnel with a little water and place the filter paper cone inside it, so that it is fixed firmly with the sides of the funnel. Place the inverted funnel along with filter paper on the china dish as shown in the figure.

Think

1. Suggest two methods to separate a mixture of naphthalene and potassium sulphate.
2. Can we purify NaCl by this method?
3. What are volatile solids?



BRAIN TEASERS

1. Why mosquito mats become inactive after one or two days?
2. Why do solid air fresheners disappear after a few days?

3. Close open end of the stem of the funnel with the help of cotton as shown in figure on page 20.
4. Heat the sand bath gently by a Bunsen burner.
5. Stop heating after 5-10 minutes and let the china dish cool at room temperature.
6. Carefully lift the funnel, remove the filter paper out of the funnel and observe the crystals stuck on it.

The given mixture of sand and naphthalene has been separated. The crystals of naphthalene are on the filter paper whereas the sand is left behind in the china dish.

1. Which one of the following mixtures can be separated by sublimation?

- i. Iodine and naphthalene _____
- ii. Potassium chloride and sodium chloride _____
- iii. Camphor and sodium chloride _____

2. The insecticidal and fungicidal tablets contain substances that prevent the attack of insects and fungus on the grains and wheat for months. On the basis of which property these are used for such a long time?



DO YOU KNOW?

1. The crystals of intense smelling camphor are used for crematorium. It suppresses the smell which may come out of the dead body.
2. A solid sublimates rather than melts because the combination of intermolecular attraction and pressure is not great enough to keep the particles near one another once they leave the solid state.

Experiment 5.8

Separate the given mixture of alcohol and water by distillation

Date _____

Background Information

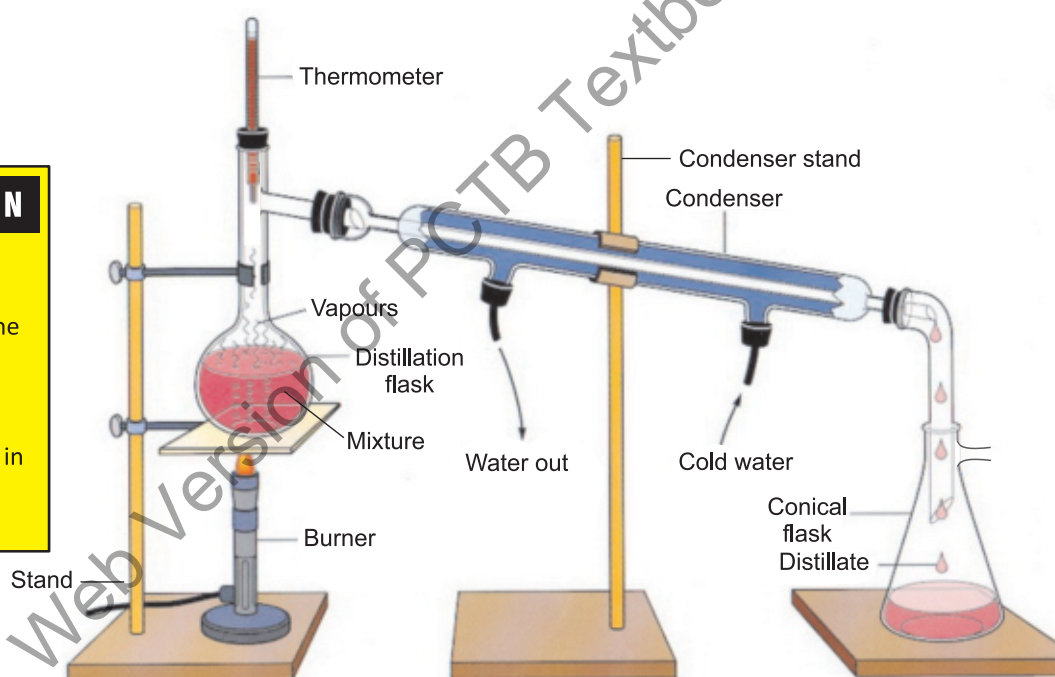
Alcohol and water on mixing form a miscible mixture. A miscible mixture of liquids is separated by first boiling the mixture and then condensing the vapours thus obtained. This process is called distillation. The separation depends upon the difference in the boiling points of the two liquids.

Materials Required

Round bottom distillation flask, thermometer, cork, water condenser with rubber pipes, receiving flask, burner, iron stand, wire gauze, mixture of alcohol and water and plaster of Paris.

CAUTION

1. The bulb of the thermometer should be near the outlet of the distillation flask.
2. Do not forget to add boiling chips in the distillation flask.



Procedure

1. Take 100cm^3 of the given mixture in the round bottom flask with the help of a measuring cylinder.
2. Set up the apparatus as shown in the diagram.
3. Make sure that the bulb of the thermometer comes in front of the side arm of the distillation flask.
4. Add a few pieces of boiling chips (to prevent bumping) in the distillation flask.

Think

1. During distillation, how do we know that alcohol is being distilled?
2. Why the temperature remains constant during the boiling of alcohol?
3. Why is cold water from the tap supplied to the condenser from the lower inlet instead of the upper inlet?
4. What is the reason for placing the thermometer with its bulb near the outlet of the distillation flask?

5. Seal the cork with the help of plaster of Paris so that the vapours may not escape.
6. Heat the flask gradually with the help of a Bunsen burner. Turn on the tap to allow cold water to circulate around the condenser.
7. Alcohol will evaporate first at 78°C and its vapours will pass through the condenser. The water circulating around the condenser will condense these vapours back into the liquid form. The distillate will be collected in the receiving flask.
8. As long as the alcohol distills over, the temperature on the thermometer will remain at 78°C .
9. As soon as the temperature starts exceeding 78°C replace the receiving flask with a new flask. Start heating again. Now the temperature on the thermometer will rise to 100°C at which water starts boiling and is collected in the receiving flask after condensation.

Result



Post Lab Activities



1. **Sea water is a mixture of many compounds in water. How does nature purify the sea water?**

2. **Petroleum in natural form is a mixture of many compounds which are commonly used as fuels. Examples of such fuels are petrol, diesel, kerosene oil and furnace oil. How can these components of petroleum be separated?**

3. **Vapour pressure of which liquid, alcohol and water, will be higher at room temperature?**

BRAIN TEASERS

1. The process of distillation is used to separate two liquids which are soluble or miscible with each other. How would the mixture of two immiscible liquids be separated?
2. Suggest a method for separating fat from milk.
3. What happens in the process involving dialysis?

DO YOU KNOW?

In sugar industry, sugar cane juice is concentrated to get crystals of sugar. The residue which is obtained in this process is called molasses. This residue is subjected to the process of fermentation to get a mixture containing alcohol. Alcohol can be separated from the rest of the mixture by distillation.

Experiment 5.9

Demonstrate that a chemical reaction releases energy in the form of heat

Date _____

Background Information

All chemical reactions take place with the evolution or absorption of energy in the form of heat. Reactions which are accompanied by the evolution of heat are called exothermic reactions, while those which absorb heat are called endothermic reactions. As a result, the vessel in which the reaction is being carried out, may become hot or cold. The temperature of the contents may be measured with the help of a thermometer.

Materials Required

Beaker (250 cm³), thermometer, calcium oxide, water.

Chemical Equation



CAUTION

Students should keep themselves away from the beaker, to avoid any mishap.

Procedure

- Take 50 cm³ of water in a beaker and note down its temperature (T₁°C) with the help of a thermometer.
- Add about 10 g calcium oxide in the above beaker and wait for a few minutes till the maximum temperature is attained.
- Note down the temperature of the mixture (T₂°C).

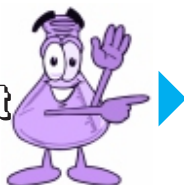
Think

- Is the reaction involving burning of natural gas exothermic or endothermic?
- Explain how steam is produced when calcium oxide is added to water?
- Can you suggest any commercial application of this reaction?

Observations

Temperature before adding Calcium Oxide (T ₁ °C)	Temperature after adding Calcium Oxide (T ₂ °C)	Difference in Temperature (T ₂ - T ₁)°C

Result



Post Lab Activities



1. Why a piece of iron may be cut by oxy-acetylene flame and not by flame obtained from burning natural gas?

2. Write down the name of fuel used by jet air craft?

3. How heat and light are produced in the sun?

4. What type of fuels space vehicles use?

5. How the energy is produced in a nuclear reactor?

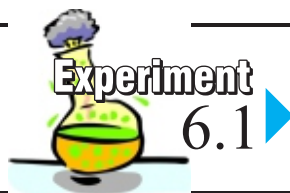
6. What happens when a bomb blast occurs?

BRAIN TEASERS

1. Which fuel in your opinion is environment friendly?
2. Which reaction is responsible to generate energy with which our body works?

DO YOU KNOW?

1. The photosynthesis is an overall endothermic reaction which uses solar energy to produce glucose.
2. Our body generates energy from food by the same overall process as combustion. One gram of fat yields twice as much energy as one gram of carbohydrate. Thus, by storing its fuel as fat, the body can store more fuel for a given mass of the tissues.



Experiment 6.1

Prepare 100 cm³ of 0.1 M sodium hydroxide (NaOH) solution

Date _____



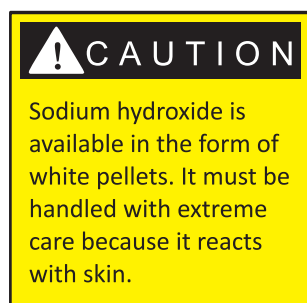
Background Information

The solution whose concentration is known is called a standard solution. The concentration of a solution is expressed in moles per dm³. When one mole of a solute is dissolved per dm³ of the solution, it is called one molar (1M) solution. Similarly when 0.1 mole of a solute is dissolved per dm³ of solution, it is called 0.1 M solution.



Materials Required

Top loading balance, solid NaOH, distilled water, watch glass, measuring flask (100 cm³) with stopper, spatula, funnel, beaker (100 cm³).



CAUTION

Sodium hydroxide is available in the form of white pellets. It must be handled with extreme care because it reacts with skin.



Procedure

1 First calculate the mass of NaOH required to make 100 cm³ 0.1M solution.

- (a) Molar mass of NaOH = 23 + 16 + 1 = 40 g mol⁻¹
- (b) Volume of NaOH required in dm³ = 100/1000 = 0.1 dm³
- (c) No. of moles of NaOH required = Molarity of NaOH required × Volume of solution required in dm³
= 0.1 × 0.1 = 0.01 mole
- (d) Mass of NaOH required (Xg) = Moles of NaOH × Molar mass NaOH = 0.01 × 40 = 0.4g

- 2 Set the top loading electronic balance at 0.00 g.
- 3 Place dry watch glass on top loading balance and tare the reading.
- 4 Now weigh 0.4 g of NaOH on the watch glass using a spatula.

- 5 Transfer NaOH into the beaker, wash the watch glass with small amount of distilled water and transfer the washings to the same beaker.
- 6 Now add about 20 cm^3 distilled water in the beaker and stir the solution so that all NaOH is dissolved.
- 7 Transfer the solution to measuring flask (100 cm^3) with the help of a funnel, wash the beaker with distilled water and transfer the washings to the measuring flask.
- 8 Add more distilled water to raise the level of solution below the etched mark of measuring flask.
- 9 Now add distilled water carefully with the help of dropper till the lower meniscus of the solution touches the calibrated mark.
- 10 Stopper the measuring flask and turn it upside down to ensure that solution is thoroughly mixed.



Think

1. What is the difference between solution and standard solution?
2. What will be the molarity of the solution if 0.80 g of NaOH is dissolved per dm^3 of the solution?
3. How much KOH will be required to prepare 0.02 M of its 500 cm^3 solution?
4. Is dissolution of sodium hydroxide in water an exothermic or endothermic process?
5. What are the commercial names of sodium hydroxide and potassium hydroxide?

1. Calcium is necessary for healthy teeth and strong bones. The mineral water bottles contain approximately $55 \text{ mg/dm}^3 \text{ Ca}^{2+}$ ions. Calculate the molarity of calcium ions in the mineral water?

2. Using a pH paper check whether the following commercially used substances are alkaline or acidic in nature?

	Substance	pH
a.	Tooth paste	
b.	Milk	
c.	Soap solution	
d.	Shampoo solution	
e.	Cooking oil	



DO YOU KNOW?

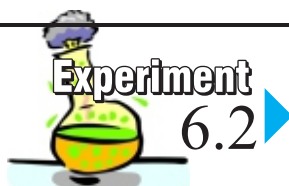
1. Honey bee sting is acidic in nature. So calamine lotion or ammonia solution is rubbed on the place to neutralize the effect of the sting. Contrary to this a wasp sting is basic in nature and vinegar solution is used to treat it.
2. Sodium hydroxide is also called lye. It can be found in drain cleaners and oven cleaners. Other major uses of sodium hydroxide include the preparation of soaps and other detergents, paper making and petroleum refining.



BRAIN TEASERS

1. Vinegar, a dilute solution of acetic acid, is extensively used in pickles. Which property of this acid makes it suitable for this use?
2. Why the solution of sodium hydroxide should not be stored in an aluminium can?

Web Version of PCTB Textbook



Experiment 6.2

Prepare 100 cm³ of 0.1M sodium carbonate (Na₂CO₃) solution

Date _____



Materials Required

Top loading balance, solid sodium carbonate Na₂CO₃, distilled water, watch glass, measuring flask (100 cm³) with stopper, spatula, funnel, beaker (100 cm³).



Procedure

- 1 First calculate the mass of Na₂CO₃ required for preparing 100 cm³ 0.1 M solution.

(a) Molar mass of Na₂CO₃ = (23)2 + 12 + (16)3 = 106 g mol⁻¹

(b) Volume of solution required in dm³ = $\frac{100}{1000}$ = 0.1 dm³

(c) No. of moles of Na₂CO₃ required = $\frac{\text{Molarity of Na}_2\text{CO}_3 \text{ required} \times \text{Volume of solution required in dm}^3}{1}$
= 0.1 × 0.1 = 0.01 mole

(d) Mass of Na₂CO₃ required (Xg) = Moles of Na₂CO₃ × Molar mass of Na₂CO₃ = 0.01 × 106 = 1.06g

- 2 Weigh 1.06g of sodium carbonate on the watch glass and prepare its solution in a measuring flask (100 cm³) as described in Experiment No. 6.1.

Result



Post Lab. Activities



1. Why Na₂CO₃ is called washing soda while NaHCO₃ is called baking soda?

2. What do you observe when Na₂CO₃ is added in vinegar?

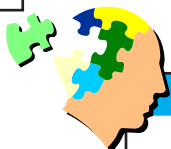
Think

1. Is Na_2CO_3 an acid or a base?
2. What is the colour of an aqueous solution of Na_2CO_3 in the presence of a drop of phenolphthalein indicator?



DO YOU KNOW?

1. An antacid tablet or syrup contains a weak base like $\text{Mg}(\text{OH})_2$ and it is used to treat hyperacidity in stomach.
2. Sodium carbonate is an important compound of sodium. The anhydrous compound, Na_2CO_3 is called soda ash. Large quantities of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$, called washing soda is used as a water softener and is added to detergent preparation.



BRAIN TEASERS

1. An aqueous solution of fruit salt is used to treat indigestion. Can you guess the composition of fruit salt?
2. What is carbonated water. What is the source of its acidity?

Web Version of PCTB Textbook

Experiment 6.3

Prepare 250 cm³ of 0.1M HCl solution

Date _____

Background Information

Usually compounds are available in the crystalline state. It is easy to prepare solution of such compounds by weighing known mass and dissolving it in water. The compounds such as mineral acids are not solid rather they are available in aqueous solution of known molarity or percentage. Hydrochloric acid is commercially available as 12.0 M or 37% aqueous solution. This solution is then diluted to prepare solutions of desired concentration (molarity).

Materials Required

Distilled water, 12.0M HCl (stock solution), measuring flask (250 cm³), beaker, glass rod, burette, funnel, wash bottle or dropper.

(a) Measuring volume of the given HCl solution



(b) Dilution in measuring flask





Think

1. Do you know in which state hydrogen chloride exists at normal temperature and pressure?
2. Why HCl is called a mineral acid?
3. Can you name some other mineral acids?

Result



1. In order to calculate the volume of the concentrated HCl solution (stock solution) needed to prepare the required solution, let us apply the following molarity equation,

<u>12 M HCl solution (given)</u>		<u>0.1 M HCl solution (required)</u>
$M_1 V_1$	=	$M_2 V_2$
$12 \times V_1$	=	0.1×250
V_1	=	$\frac{0.1 \times 250}{12}$
V_1	=	2.00 cm^3

2. Fix the burette in the burette stand and fill it with the given concentrated HCl solution carefully using a funnel.
3. Take 100 cm^3 distilled water in the measuring flask (250 cm^3).
4. From the burette add 2.00 cm^3 of HCl solution into the measuring flask.
5. Further dilute this solution with distilled water and make up the volume up to the etched mark with the help of wash bottle or dropper containing distilled water and stopper it.
6. Turn the flask upside down to thoroughly mix the solution.

1. In a lead accumulator or a car battery 6 M sulphuric acid solution is used. Sulphuric acid which is available in the market is 18M. How will you prepare 1000 cm^3 of 6M sulphuric acid to be used in the battery?

2. HCl is secreted by the walls of our stomach for the proper digestion of protein food in our diet. Why is it not safe to use HCl in our diet?

3. Which chemical is used to remove scales in an electric kettle?

4. Which common ions are present in aqueous solutions of HCl and common salt?



DO YOU KNOW?

Hydrochloric acid is used to clean mortar from bricks. Mortar is calcium hydroxide which reacts with HCl to give a solution of calcium chloride. Hydrochloric acid is also used in the pickling of steel. It consists of dipping steel into an acid bath to remove rust from its surface.



BRAIN TEASERS

1. To save human life, saline glucose is injected. Do you think its concentration is important?
2. What makes lemon juice a good house hold cleansing agent?



Experiment 6.4

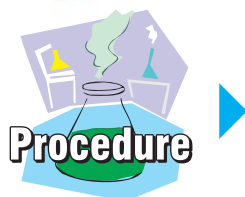
Prepare 250 cm³ of 0.1 M oxalic acid (H₂C₂O₄·2H₂O) solution

Date _____



Materials Required

Top loading balance, solid oxalic acid (H₂C₂O₄·2H₂O), distilled water, watch glass, measuring flask (250 cm³) with stopper, spatula, funnel, beaker (100 cm³).



Procedure

- ❶ First calculate the mass of oxalic acid (H₂C₂O₄·2H₂O) required to make 100 cm³ 0.1 M solution.

(a) Molar mass of oxalic acid (H₂C₂O₄·2H₂O) = (1)2 + (12)2 + (16)4 + 2(18) = 126 g mol⁻¹

$$\frac{250}{1000} = 0.25 \text{ dm}^3$$

(b) Volume of oxalic solution required =

(c) No. of moles of oxalic acid (H₂C₂O₄·2H₂O) required = Molarity of oxalic acid required × Volume of solution required

$$= 0.1 \times 0.25 = 0.025 \text{ mole}$$

(d) Mass of oxalic acid required (Xg) = Moles of oxalic acid × Molar mass of

❷ oxalic acid

$$= 0.025 \times 126 = 3.150 \text{ g}$$

Think

1. Is oxalic acid a weak or a strong acid?
2. What is the name of the anion obtained when oxalic acid is ionized in water?
3. Oxalic acid is a covalent compound. Why does it then ionize in water like an ionic compound?

Result



CAUTION

1. Weigh the solute accurately.
2. Wash the beaker and measuring flask thoroughly with water before use.



Post Lab Activities

1. Which one of the following acids is not used as part of our food?
a. Tartaric acid b. Citric acid c. Lactic acid d. Benzoic acid

2. Which acid is present in milk?



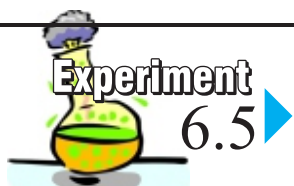
DO YOU KNOW?

1. Oxalic acid is used to remove the stain of rust on cotton fabrics. For this purpose moisten a few crystals of oxalic acid and rub them with the affected portion of the cotton fabric. After some time rinse the fabric with water.
2. Oxalic acid is poisonous in nature, if it is accidentally ingested, the oxalate ion concentration in the blood may increase sufficiently to precipitate calcium oxalate. Calcium ions, which are needed for proper muscle control, are then removed from the blood and it results into a sudden involuntary contraction of a muscle.



BRAIN TEASER

Some people drink light coffee some strong. Same is true for tea. What is the difference in these two types as their concentration is concerned?



Experiment 6.5

Prepare 100 cm³ of 0.1M sodium hydroxide (NaOH) solution from the given 1M solution

Date _____



Background Information

If a concentrated solution with a known molarity is given, it is possible to dilute it with distilled water and prepare a solution with lesser molarity and greater volume.



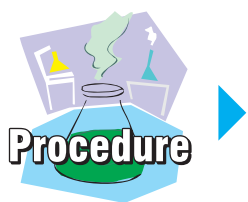
Materials Required

Distilled water, 1.0 M sodium hydroxide solution, measuring flask (100cm³), beaker, glass rod, pipette, funnel and dropper

Think

1. Is it possible to prepare 0.1M solution from 0.01 M solution?
2. Why is it necessary to use distilled water while preparing solution?





CAUTION

Pour the solution into the burette with the help of a funnel. The funnel should be removed immediately after the burette has been filled.

Result



Post Lab. Activities



BRAIN TEASER

What is the difference between soap and synthetic detergent?

- ① In order to calculate the volume of the concentrated solution needed to prepare the required solution, let us apply the following molarity equation,

1M NaOH solution (given) 0.1 M NaOH solution (required)

$$\begin{aligned} M_1 V_1 &= M_2 V_2 \\ 1 \times V_1 &= 0.1 \times 100 \end{aligned}$$

$$V_1 = \frac{0.1 \times 100}{1}$$

$$V_1 = 10 \text{ cm}^3$$

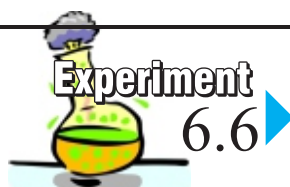
- ② Pipette out 10 cm^3 (or use burette for this purpose) of the given 1M NaOH solution and add in the measuring flask (100 cm^3).
- ③ Add distilled water and make up the volume of the solution up to the etched mark with the help of a dropper. Stopper the measuring flask.
- ④ Shake the flask well to thoroughly mix the solution.

1. How soap is prepared?

2. Caustic soda is known to be extremely deliquescent compound. What does the word deliquescent mean?

3. What happens to the concentration of sodium hydroxide solution when it is left in an open beaker?

4. Which chemical is used to clean sinks in the bath room?



Experiment 6.6

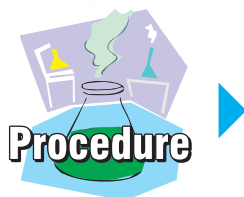
Prepare 100 cm³ of 0.01 M Na₂CO₃ solution from the given 0.1M solution

Date _____



Materials Required

Distilled water, 0.1 M Na₂CO₃, measuring flask (100cm³), beaker, glass rod,



Procedure

- 1 In order to calculate the volume of the concentrated solution needed to prepare the required solution, let us apply the following molarity equation,

0.1 M Na ₂ CO ₃ solution (given)		0.01 M Na ₂ CO ₃ solution (required)
$M_1 V_1$	=	$M_2 V_2$
$0.1 \times V_1$	=	0.01×100
V_1	=	$\frac{0.01 \times 100}{0.1}$
V_1	=	10 cm^3

- 2 Pipette out 10 cm³ (or use burette for this purpose) of the given 0.1 M Na₂CO₃ solution and add in the measuring flask (100cm³).
- 3 Prepare the required solution as described in Experiment No. 6.5.

CAUTION

1. Run down some of the solution to fill the jet of burette.
2. Keep the eye in level of the lower meniscus to note down the reading of the burette.

Result



Post Lab Activities

1. What is soda glass?

2. Raw material used for the commercial preparation of soda ash (Na₂CO₃) is abundantly available in Pakistan. Name that raw material.

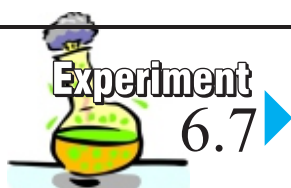
BRAIN TEASER

A bottle of sweet drink can make 30 glasses of drinks. If we make 20 or 40 glasses with the same bottle, what change of the taste you will feel?



DO YOU KNOW?

Sodium carbonate is used in fire extinguishers. In case of fire it reacts with hydrochloric acid to produce carbon dioxide gas which being a non-supporter of fire helps to put it off.



Experiment 6.7

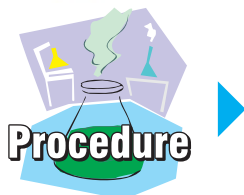
Prepare 100 cm³ of 0.01 M hydrochloric acid (HCl) solution from the given 0.1M solution

Date _____



Materials Required

Distilled water, 0.1M HCl, measuring flask (100cm³), beaker, glass rod, pipette, funnel, and dropper.



Procedure

- 1 In order to calculate the volume of the concentrated solution needed to prepare the required solution, let us apply the following molarity equation,

<u>0.1 M HCl solution (given)</u>		<u>0.01 M HCl solution (required)</u>
$M_1 V_1$	=	$M_2 V_2$
$0.1 \times V_1$	=	0.01×100
V_1	=	$\frac{0.01 \times 100}{0.1}$
V_1	=	10 cm ³

CAUTION

1. Anti parallax card may be used for taking the reading in burette.
2. While diluting the acid, it is advisable to add mineral acid into water.

- 2 Add about 20 cm³ distilled water in the measuring flask (100 cm³).
- 3 Measure 10 cm³ of the given 0.1M HCl solution with the help of burette and add in the same measuring flask (100 cm³).
- 4 Prepare the required solution as described in Experiment No. 6.5.

Result



Post Lab Activities



1. Identify all the ions which are present in 0.01M HCl solution.

2. What is the final volume of a solution of sulphuric acid if you dilute 48 cm³ of 1.5M H₂SO₄ to produce a solution of 0.18M H₂SO₄?

BRAIN TEASERS

You have a solution that is 14.8M HCl. How many cubic centimeters of this solution are required to give 50.0 cm³ of 1M HCl when diluted?

Experiment 6.8

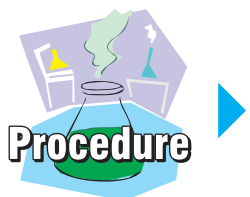
Prepare 100 cm³ of 0.01 M oxalic acid solution from the given 0.1M solution

Date _____



Materials Required

Distilled water, 0.1M oxalic acid ($\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$), measuring flask (100cm³), beaker, glass rod, pipette, funnel, and dropper.



Procedure

- In order to calculate the volume of the concentrated solution needed to prepare the required solution, let us apply the following molarity equation,

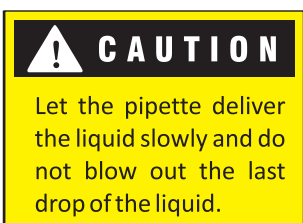
0.1 M oxalic acid solution (given) = 0.01 M oxalic acid solution (required)

$$\frac{M_1 V_1}{0.1 \times V_1} = \frac{M_2 V_2}{0.01 \times 100}$$

$$V_1 = \frac{0.1 \times 100}{0.1}$$

$$V_1 = 10 \text{ cm}^3$$

- Pipette out 10cm³ (or use burette for this purpose) of the given 0.1 M oxalic acid solution and add in the measuring flask (100cm³).
- Prepare the required solution as described in Experiment No. 6.5



CAUTION

Let the pipette deliver the liquid slowly and do not blow out the last drop of the liquid.



Result



Post Lab Activities

- How will you prepare 250 cm³ 0.001M oxalic acid solution from the given 0.2 M solution.

- Hydrogen peroxide is available in the market as 3.0% solution in water. How will you prepare 2.0 % solution from this?



DO YOU KNOW?

Hydrogen peroxide is used as a disinfectant or a bleaching agent due to its strong oxidizing nature.

Experiment 6.9

Prepare pure copper sulphate crystals from the given impure sample

Date _____

Background Information

Substances found in nature are usually impure as they contain other substances mixed with them. The purification of a substance means its separation from all other unwanted substances. One method to purify a solid substance is crystallization. Copper sulphate is highly soluble in water at high temperature and its solubility decreases appreciably at low temperature. This difference in solubility is used to get pure crystals of copper sulphate.

Materials Required

250 cm³ beaker, stirrer, china dish, tripod stand, Bunsen burner, wire gauze, iron stand, filter paper, funnel, impure copper sulphate, distilled water.

CAUTION

Copper sulphate is a poisonous substance. Use it carefully.



Procedure

- ❶ Take distilled water (50cm³) in a 250cm³ beaker and add enough quantity of impure copper sulphate with continuous stirring, until some of it settles down.
- ❷ Filter the above solution and collect the filtrate in a china dish.
- ❸ Heat the solution to get concentrated solution of copper sulphate. Dip a glass rod in this solution and blow it. If blue coloured crystals of copper sulphate appear on the rod, this shows crystallization point has reached. If crystals do not appear, continue heating.

- ④ Let the contents of the china dish cool slowly without disturbing it.
- ⑤ After some time when crystals are large enough to be seen, decant off the mother liquor and transfer the crystals from the china dish to a dry filter paper.
- ⑥ Dry these crystals by pressing them gently in the folds of the filter paper.

Think

1. Why is the solution in the china dish not evaporated to dryness?
2. What substances may be present in mother liquor?
3. Commercially important compounds like sugar, urea and alums are crystallized by this method. Name any two substances other than these that are purified by crystallization.



Observations

The crystals of pure copper sulphate have

Colour

Shape



Result



Post Lab Activities

1. How common salt is obtained from sea water?

2. We observe the deposition of salt over the surface of soil. Can you explain the reason of this deposition? Is it crystallization or not?



DO YOU KNOW?

Copper sulphate is used to preserve wood. It is also used to disinfect swimming pools. Both of these uses represent the fungicidal action of copper sulphate.



BRAIN TEASER

Why sugar settles down at the bottom of the container when we place concentrated sugar syrup in the refrigerator?

Experiment 6.10

Demonstrate that miscible liquids dissolve in each other and immiscible liquids do not

Date _____

Background Information

Miscible liquids can mix in all proportions and make a single phase of a homogeneous mixture e.g. ethanol and water. Immiscible liquids on mixing form two layers and there exists a boundary between the two liquids. Molecules of miscible liquids attract each other while those of immiscible liquids repel each other.

Materials Required

Two beakers (250 cm³), organic waste bottle, safety goggles, water, sunflower oil, ethanol

CAUTION
Wash the beakers thoroughly with water and then dry them



1) Mixture of water and oil



2) Mixture of water and Ethanol

Procedure

- 1 Take about 25cm³ water in a beaker and add about 25cm³ sunflower oil in it.
- 2 Mix the two liquids well with the help of a glass rod.
- 3 Leave the beaker undisturbed for sometimes.
- 4 Repeat the experiment for water and ethanol.



No.	Liquid	Liquid	Observation
1.	Water	Oil	
2.	Water	Ethanol	

Result



Water and oil are liquids while water and ethanol are

Think

1. What is the difference between miscible and immiscible liquids?
2. Why ethanol is miscible with water?
3. Why oil is immiscible with water?
4. Which pair of the following liquids are miscible?
 - (i) Water and olive oil
 - (ii) Mustard oil and olive oil
 - (iii) Water and chloroform

Post Lab Activities



1. How will you remove grease stains from the cotton fabrics?

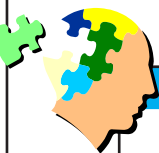
2. Water insoluble lubricants are used to run machines. What types of soaps are used to clean these machines?

3. Why is it generally easy to remove stains from synthetic fabrics than from the cotton fabrics?



DO YOU KNOW?

It is sometimes possible to make a liquid solution by mixing two solids together. Potassium-sodium alloy is an example of this. Potassium and sodium are solid metals at room temperature, but a liquid solution is formed when the mixture contains 10% to 50% sodium.



BRAIN TEASER

Household polish and paint workers often use kerosene oil during their work. Being insoluble in water, kerosene oil cannot be completely removed by washing hands with soap. Think of a method to wash hands so that they are free from the smell of kerosene oil.

Experiment 6.11

Demonstrate that temperature affects the solubility

Date _____

Background Information

Solubility is defined as the maximum amount of a substance in grams which can dissolve in 100g of the solvent at a particular temperature.

Unit of solubility = ____ g/100g

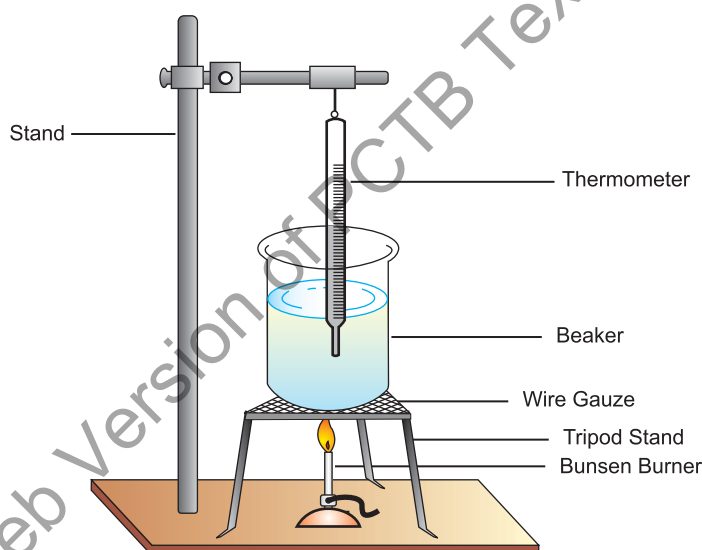
Following factors affect the solubility of a substance:

1. Temperature
2. Nature of solvent
3. Nature of solute
4. Pressure in case of a gas as solute

In most cases the solubility of a solid increases with increase in temperature.

Materials Required

Beaker (250cm³), Bunsen burner, iron stand, tripod stand, wire gauze, glass rod, safety goggles, sucrose (sugar) and water.



Procedure

- ① Add about 50cm³ distilled water in the beaker.
- ② Start adding sugar crystals little by little while stirring the solution with glass rod. When sugar crystals start settling down at the bottom of the beaker, stop adding sugar.
- ③ Heat the beaker on a Bunsen burner as shown in the figure.
- ④ After heating for a few minutes the settled crystals of sugar will also dissolve.
- ⑤ Now add more sugar crystals and heat the solution again, this will also dissolve.

Think

1. While making lemonade why do we add sugar to normal tap water instead of adding it in cold water?
2. Will you perform the same experiment to show that the solubility of a substance decreases with the increase in temperature?



1. Change of solubility with temperature leads us to crystallize a given compound. Choose a compound from the following which will be crystallized by this method using water as a solvent. Explain why other compounds cannot be crystallized by this method?

i. BaCO_3 ii. NaCl iii. KNO_3

2. Which compound will show decrease in its solubility in water by increasing temperature?
- a) Which evolve heat when dissolved in water
 - b) Which absorb heat when dissolved in water
 - c) Which ionize in water completely
 - d) Which react with water

3. Is the solubility of hydrogen chloride gas in water a physical phenomenon or a chemical reaction?

4. Heating a soda water bottle will increase the solubility of CO_2 or decrease it.



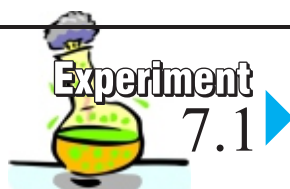
BRAIN TEASER

Is it possible to obtain drinking water from sea water by freezing?



DO YOU KNOW?

The solubility of gases in liquids always increases with increasing pressure. When a deep-sea diver or a tunnel worker comes to the surface too quickly, nitrogen and oxygen that have dissolved in the blood at high pressure are suddenly released in the form of bubbles in the blood vessels. This is very painful and in extreme cases can even cause death. Astronauts have to worry about their space suits tearing for the same reason. Now a days a mixture of helium and oxygen is used for this purpose.



Experiment 7.1

Demonstrate the conductivity of different given solutions

Date _____



Background Information

An electrolyte is a compound, the solution of which contains ions when dissolved in water. Due to the presence of ions, a solution conducts electricity. Conductivity of electricity through the solution can be checked by dipping the electrodes of a battery into the solution.

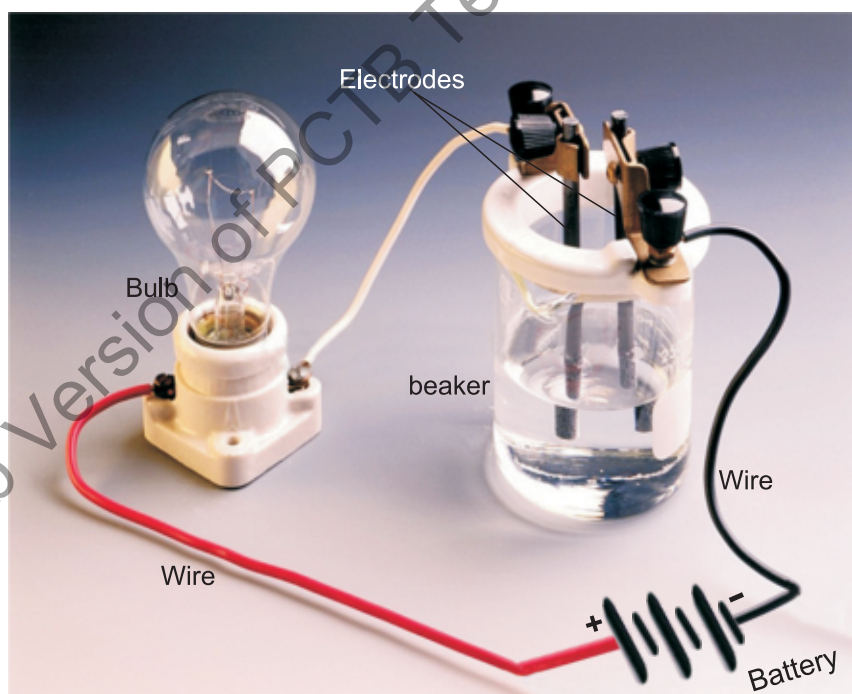


Materials Required

Battery, electrodes, key, connecting wires, bulb, 5 beakers (250cm³), distilled water, NaCl, HCl, NaOH, sugar and vinegar.

! CAUTIONS

1. The beakers should be properly cleaned before starting the experiment.
2. Rinse the electrodes with distilled water when changing the liquid during the experiment.
3. All connections should be tight.
4. The electrodes should not touch each other.



Procedure

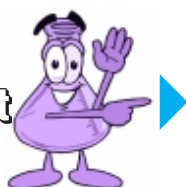
1. Take five beakers each containing 100cm³ distilled water.
2. Dissolve 2.5g each of NaCl, NaOH and sugar in separate beakers and stir well to make homogeneous solutions.
3. Similarly in the remaining beakers add in each 2.5 cm³ HCl and 2.5cm³ vinegar solution. Stir the solutions well.
4. Connect the electrodes in the circuit as shown in the diagram.
5. Dip the electrodes one by one in each beaker and note whether the bulb glows or not.



Observations

Observation No.	Name of the compound dissolved in water	Bulb glows / Bulb does not glow	Result
1.	Distilled water		
2.	Table sugar		
3.	NaCl		
4.	NaOH		
5.	HCl		
6.	Vinegar		

Result



Solutions ofconduct electricity.

Solutions ofdo not conduct electricity.



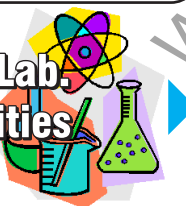
DO YOU KNOW?

Hydrogen chloride gas in the gaseous state does not conduct electricity. It also does not conduct electricity when dissolved in organic solvent. It conducts electricity when dissolved in water because it ionizes in water to give hydrogen ions and chloride ions. These ions cause solution to conduct electricity.

Think

- Does the glowing of the bulb depend upon the nature of the electrolyte?
- How does conductance take place in electrolytes?
- Can conductivity be measured in aqueous solutions only?
- Why conductivity of various solutions is different?
- If the concentration of an aqueous solution of a strong electrolyte decreases, will the conductivity increase or decrease?

Post Lab Activities



- Why people get electric current shocks from the electric pole when it is raining?

- Are human blood, tears, urine and sweat electrolyte or non-electrolyte?

- Arrange the followings in increasing order of their electrolytic strength.
sea water, river water and rain water

4. Which of the following are conductors, electrolytes and non-electrolytes?

Iron, solid sodium chloride, copper sulphate solution, aqueous solution of glucose, sodium carbonate solution, copper, aqueous solution of urea, hydrogen chloride gas dissolved in toluene.

Conductor	Electrolyte	Non electrolyte

5. Which metals are extracted by electrolysis of their molten salts?

6. How zinc metal is deposited over iron sheets to prevent rusting?



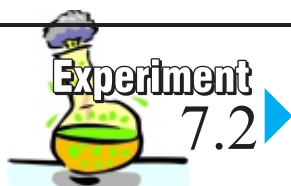
INTERESTING INFORMATION

The process of electrolysis is used to make many important chemicals that find their way into our lives. Examples are lye (NaOH) and chlorine gas. For years now dry cells and batteries have powered our flashlights, radios, calculators, wrist-watches, cameras, toys and mobile telephones.



BRAIN TEASERS

1. From the studies in the lab now we know that the pure water is a very weak electrolyte. However it is always advised to avoid use of hair dryer, electric shaver or an iron with wet hands and feet, do you know any reason for this advice?
2. Why a solid electrolyte does not conduct electricity while its aqueous solution can?



Experiment 7.2

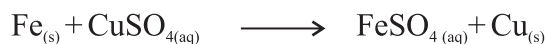
Demonstrate a metal displacement reaction in an aqueous medium

Date _____



Background Information

A metal higher in the reactivity series can displace a metal below it from its aqueous salt solution. For example, iron can displace copper from copper sulphate solution.



Materials Required

250cm³ beaker, stirrer, distilled water, copper sulphate, three iron nails.



Procedure

- 1 Take 100cm³ distilled water in a beaker. Add to it 2-3g copper sulphate crystals.
- 2 Stir it well to prepare the solution.
- 3 Add to it three iron nails.
- 4 Allow the solution to stand for sometime.



Observations



Result

Think

1. Can iodine be separated from potassium iodide solution using chlorine water?
2. What do you expect to observe if zinc is added in an aqueous solution of copper sulphate?
3. Can you obtain hydrogen gas by reacting sodium with water?



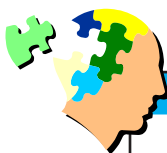
1. Which metals can displace copper from copper sulphate solution?

2. Metals like Zn, Mg, and Fe react with hydrochloric acid to liberate hydrogen gas. Why copper metal is unable to liberate hydrogen gas from hydrochloric acid?



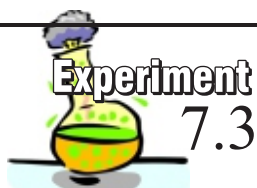
DO YOU KNOW?

1. By using the concept of reactivity of metals many other metals are extracted, titanium is obtained by reacting titanium (IV) chloride with magnesium
$$2\text{Mg (s)} + \text{TiCl}_4(\text{aq}) \longrightarrow 2\text{MgCl}_2(\text{aq}) + \text{Ti (s)}$$
2. Molten iron is obtained when iron oxide is made to react with aluminium powder. The reaction is called thermite process and it was used for welding broken railway tracks before the discovery of electric welding.



BRAIN TEASER

Can you displace silver from silver nitrate using the concept of reactivity of metals? How will you design this experiment?



Demonstrate that an element and a compound can react to form a different element and a different compound.

Repeat the above experiment using copper chloride solution and aluminium strips



Clean the aluminium strips well using sand paper.

CHAPTER Chemical Reactivity

8



Experiment 8.1

Demonstrate that two elements combine to form a binary compound

Date _____



Background Information

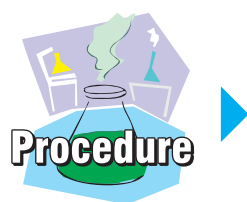
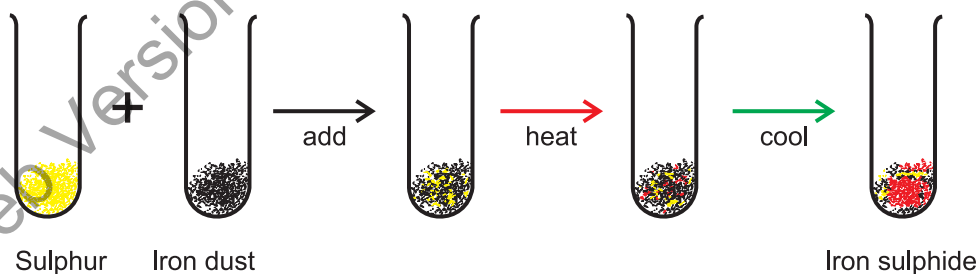
A binary compound is a chemical compound that contains two different elements. A binary compound may be either molecular or ionic. Molecular compounds contain only non-metals like H_2O , H_2S , HCl , etc., while ionic compounds contain at least one metal and one non-metal e.g. NaCl , KBr , FeS etc. When two elements combine chemically a new compound is formed. The compound so formed has a new set of properties which are entirely different from the elements of which it is formed.



Materials Required

Test tubes, test tube stand, test tube holder, Bunsen burner, pestle and mortar, balance with weight box, bar magnet, powdered sulphur, iron dust, distilled water and dilute HCl .

CHEMICAL EQUATION



Procedure

- 1 Weigh 5.6g of iron dust and 3.2g of powdered sulphur separately.
- 2 Mix iron and sulphur. Then grind the mixture thoroughly in a mortar.
- 3 Take the mixture in a test tube. Heat the test tube first gently and then strongly till the mixture glows red hot.
- 4 Allow the test tube to cool.
- 5 Then break the test tube on a piece of paper.

CAUTIONS

1. Weigh sulphur and iron carefully and accurately.
2. Heating should be gentle



- Comparison of the properties before and after the reaction.

No.	Test	Before heating	After heating
1	Action of magnet		
2	Add water (H ₂ O) and shake.		
3	Add dilute HCl and shake.		

Think

1. In photosynthesis which binary compounds are used?
2. What is the difference between binary ionic and binary molecular compounds?
3. Which binary compound will be obtained when magnesium is heated in the air?

Result



Post Lab Activities



1. Where do in daily life processes you observe the formation of binary compounds such as AgS, CO, CO₂ and SO₂?

2. Carbon dioxide is a gas used in soft drinks, in fire extinguishers and for refining sugar in sugar industry etc. How will you prepare this gas in laboratory?

BRAIN TEASERS

1. Name any two binary compounds extensively used in daily life?
2. Which binary compound helps digest food in our stomach?

Experiment 8.2

Demonstrate that compounds can be products of a decomposition reaction

Date _____

Background Information

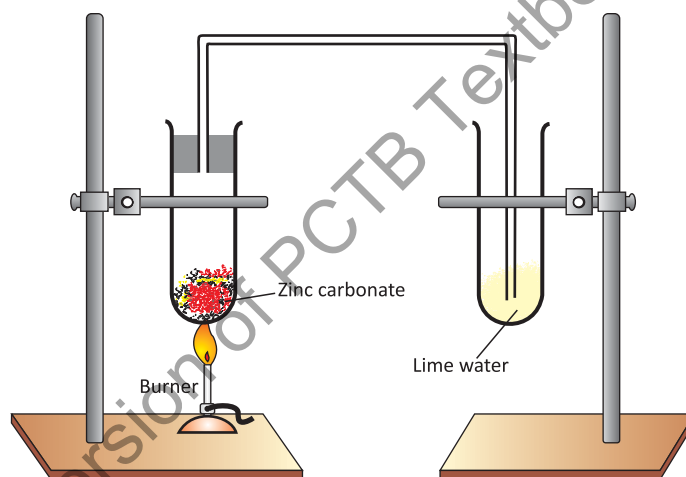
A reaction in which one substance breaks down into two or more simpler substances is known as decomposition reaction. A decomposition reaction always involves breaking of one or more chemical bonds and therefore occurs only when the required amount of energy is supplied. The energy may be supplied in any form. When a compound is heated, it decomposes into different fragments. These fragments may be elements or compounds.

Materials Required

Test tubes, a rubber cork with one hole, delivery tube, Bunsen burner, matches, test tube holders, safety goggles, pestle and mortar, zinc carbonate (ZnCO_3), lime water (saturated solution of Ca(OH)_2).

Think

1. What will be the reverse of decomposition reaction?
2. Why lime water is turned milky?
3. How does plaster of Paris seal the cork?
4. What will happen if Na_2CO_3 and NaHCO_3 are heated strongly?



Procedure

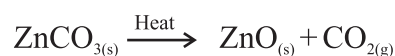
1. Take a small lump of zinc carbonate. Grind it into a fine powder with the help of pestle and mortar.
2. Put about 5g of ZnCO_3 in a test tube.
3. Fix a cork with the delivery tube on the mouth of the test tube as shown in the figure. Seal the cork with plaster of Paris to make it air tight.
4. Fix the test tube in a clamp of the iron stand.
5. Dip the open end of the delivery tube in lime water taken in another test tube.
6. Heat the test tube with a Bunsen burner.



CAUTION

The cork alongwith delivery tube must be sealed completely to prevent carbon dioxide gas to escape.

EQUATION





Observations



Result



Post Lab Activities

1. Take a few sugar crystals on a spoon and first heat them gently and then strongly. Record your observations in the table below.

	Before heating	After gentle heating	After strong heating
Physical state of sugar			
Colour of sugar			

2. Green copper carbonate turns black when heated. Can you explain the reason for this colour change?

3. Name two other metallic carbonates which decompose on heating.



DO YOU KNOW?

Millions of tons of lime are produced annually by heating lime stone. This is then used to prepare cement, glass and steel.



BRAIN TEASER

The soft cola drinks contain carbonic acid. It decomposes to carbon dioxide and another compound when pressure is decreased by opening the bottle. Write down the balanced chemical equation for the decomposition of carbonic acid.

Experiment 8.3

Demonstrate that some processes absorb energy

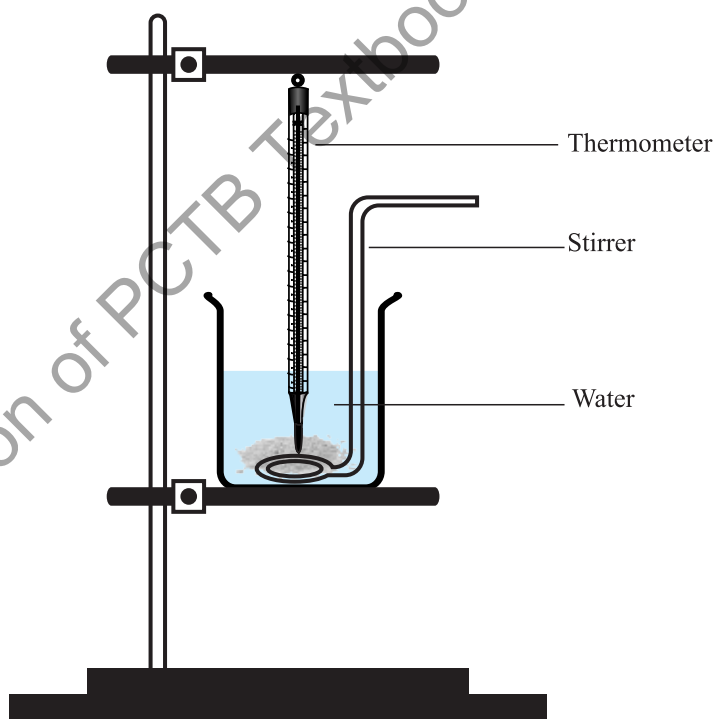
Date _____

Background Information

Processes in chemistry may evolve or absorb energy in the form of heat. Those processes which evolve heat are called exothermic while those which absorb heat are called endothermic. The evolution or absorption of heat may be noted by increase or decrease in the temperature respectively. Processes may involve physical or chemical change. Dissolution of a compound in water is a physical process which may be exothermic or endothermic.

Materials Required

Ammonium chloride, 250 cm³ beaker, thermometer, stirrer, distilled water.



Procedure

- 1 Fill half of the beaker (100 cm³) with distilled water.
- 2 Note down the initial temperature of water (T_1 °C).
- 3 Add about 5g ammonium chloride and stir the solution with glass rod.
- 4 The temperature of the solution will decrease slowly. Note down the temperature when it stops decreasing (T_2 °C).
- 5 Repeat the experiment twice.



CAUTION

Thermometer should not touch the sides and bottom of the beaker.



No. of Obs.	Initial temp. (T_1 °C)	Final temp. (T_2 °C)	Decrease in temp. ($T_2 - T_1$) °C
1.			
2.			
3.			



Think

1. Can you name another compound whose dissolution will be endothermic?
2. In this experiment what did you feel when you touch the sides of the beaker?
3. What happens to ammonium chloride when it is dissolved in water?
4. In which way the heat energy travels in this process?
5. Is evaporation of water an exothermic or endothermic process?



1. For heating a substance we burn natural gas, wood or kerosene oil. Can you suggest two methods to cool down a substance?

(i) _____

(ii) _____

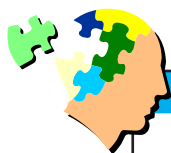
2. How low temperature is attained in a refrigerator?

3. Steam is used to generate electricity. What happens to the steam after it has generated electricity?



DO YOU KNOW?

Nitrogen present in the atmosphere is an inert gas. It does not react with oxygen under normal conditions. In the presence of lightening, however, it reacts with oxygen in an endothermic reaction to produce nitric oxide gas.



BRAIN TEASER

A mixture of ammonium nitrate, ammonium chloride and ice is used to prepare ice cream. What is the purpose of using this mixture?

Web Version of PCTB Textbook