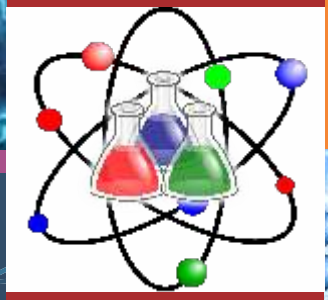

SCIENCE LAB MANUAL

X

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Sumit Kumar

10 SCIENCE LAB MANUAL

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Preface

The quality of practical work varies considerably but there is strong evidence, from this country and elsewhere, that: When well-planned and effectively implemented, science education laboratory and simulation experiences situate students' learning in varying levels of inquiry requiring students to be both mentally and physically engaged in ways that are not possible in other science education experiences. (Lunetta et al. 2007, p.405).

The importance and relevance of exercising practical work in science is widely accepted. The qualitative practical work not only promotes the engagement and interest of students but also enriches skills, experiences, knowledge and conceptual understanding of the students. In this book, we have focused on core activities, directly related activities and complementary activities.

Furthermore, to make optimum use of this practical book, Teacher should strive for making students

1. To find problems and their solutions;
2. To develop analytical and critical attitude;
3. To find new facts and arriving at new principles.

This book is designed for to provide practical knowledge as much as possible. Through the development of the project we had a great experience of various strategies that can be applied in the development of the project. This project will prove stepping stone for our carrier.

To provide proper and essential information has been guiding principle for us, As a teacher, we endeavored to achieve this important objective. We are pleased to present this project.

Salient features of this book are: --

1. A special care has been taken to present the subject matter in simple language so that student may understand it with ease.
2. Great efforts have been made to make the book free of mistakes.
3. Original diagrams are used to clarify the experiments.
4. Multiple choice question and viva voce questions have been given in experiments.

We are greatly thankful to Shri RAVI JI (SAH Sangathanmantri, Vidya bharti, Haryana) who inspired us to write this book.

AUTHORS

Contents

INDIAN SCIENTIST

Science is an important part of our everyday life, even more so than we notice. From our fancy gadgets to the technologies we can't live without, from our humble light bulb to the space explorations, it is all gift of science and technology.

I wonder what would we be doing if none of these things were invented? How often do we take out the time to think about those extra ordinary minds who made life easier for us?

C. V. Raman

Chandrasekhara Venkata Raman won the Nobel Prize for Physics in 1930 for his pioneering work on scattering of light. Born in Tiruchirapalli on November 7, 1888, he was the first Asian and first non-White to receive any Nobel Prize in the sciences. Raman also worked on the acoustics of musical instruments. He was the first to investigate the harmonic nature of the sound of the Indian drums such as the tabla and the mridangam.

He discovered that, when light traverses a transparent material, some of the deflected light changes in wavelength. This phenomenon is now called the Raman scattering and is the result of the Raman effect.

In October 1970, he collapsed in his laboratory. He was moved to a hospital and the doctors gave him four hours to live. He survived and after a few days refused to stay in the hospital as he preferred to die in the gardens of his Institute (the Raman Research Institute in Bangalore) surrounded by his flowers. He died of natural causes on 21 November 1970.


Homi Jahangir Bhabha

Born on October 30, 1909 in Bombay, **Homi Jehangir Bhabha** played an important role in the Quantum Theory.

He was the first person to become the Chairman of the Atomic Energy Commission of India. Having started his scientific career in nuclear physics from Great Britain, Bhabha returned to India and played a key role in convincing the Congress Party's senior leaders, most notably Jawaharlal Nehru, to start the ambitious nuclear programme.

Bhabha is generally acknowledged as the father of Indian nuclear power. But few people know that he was absolutely against India manufacturing atomic bombs, even if the country had enough resources to do so. Instead he suggested that the production of an atomic reactor should be used to lessen India's misery and poverty.

He died when Air India Flight 101 crashed near Mont Blanc on 24 January 1966. Many possible theories of the crash came up including a conspiracy theory in which the Central Intelligence Agency (CIA) is involved in order to paralyze India's nuclear program.


Satyendra Nath Bose

Born on January 1, 1894 in Calcutta, **SN Bose** was an Indian physicist specialising in quantum mechanics. He is of course most remembered for his role played in the class of particles 'bosons', which were named after him by Paul Dirac to commemorate his work in the field.

Bose adapted a lecture at the University of Dhaka on the theory of radiation and the ultraviolet catastrophe into a short article called “Planck's Law and the Hypothesis of Light Quanta” and sent it to Albert Einstein. Einstein agreed with him, translated Bose's paper “Planck's Law and Hypothesis of Light Quanta” into German, and had it published in Zeitschrift für Physik under Bose's name, in

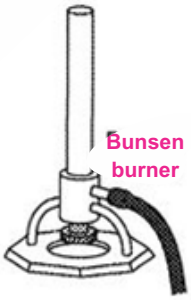
1924. This formed the basis of the Bose-Einstein Statistics. In 1937, Rabindranath Tagore dedicated his only book on science, Visva–Parichay, to Satyendra Nath Bose. The Government of India awarded him India's second highest civilian award,

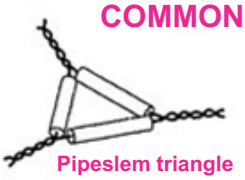

Jagdish Chandra Bose

Acharya J.C. Bose was a man of many talents. Born on 30 November, 1858 in Bikrampur, West Bengal, he was a polymath, physicist, biologist, botanist and archaeologist. He pioneered the study of radio and microwave optics, made important contributions to the study of plants and laid the foundation of experimental science in the Indian sub-continent. He was the first person to use semiconductor junctions to detect radio signals, thus demonstrating wireless communication for the first time.
What's more, he is also probably the father of open technology, as he made his inventions and work freely available for others to further develop. His reluctance for patenting his work is legendary.

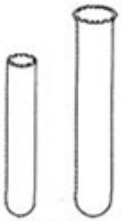
Another of his well known inventions is the crescograph, through which he measured plant response to various stimuli and hypothesized that plants can feel pain, understand affection etc. While most of us are aware of his scientific prowess, we might not be aware of his talent as an early writer of science fiction! He is in fact considered the father of Bengali science fiction.

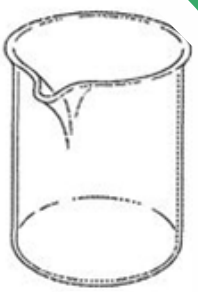
COMMON LABORATORY EQUIPMENT


Bunsen burner


Pipeslem triangle


Evaporating dish

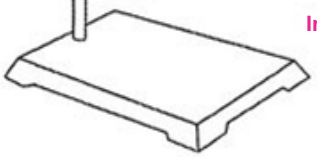

Test tubes


Beaker


Utility clamp

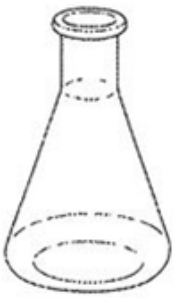

Mortar and pestle


Gas bottle


Ring stand


Iron ring

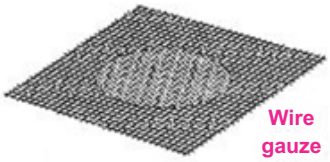

Crucible and cover


Erlenmeyer flask

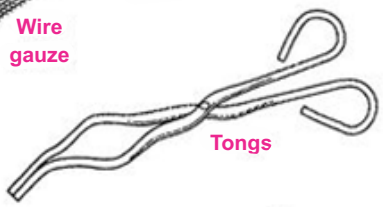

Safety goggles

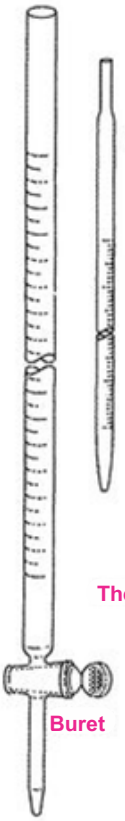

Corks


Watch glass


Wire gauze


Assorted rubber stoppers


Tongs

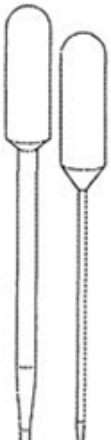

Buret

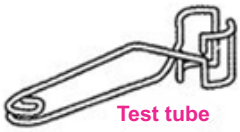
Pipet

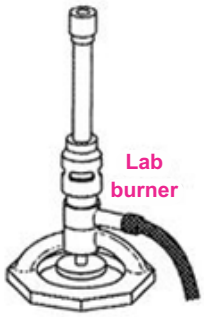

Thermometer


Graduated cylinder


Wash bottle


Micropipets (standard and narrow stem)


Test tube holder

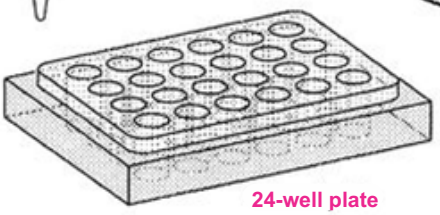

Lab burner

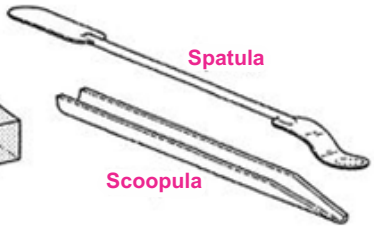

Dropper


Forceps


File

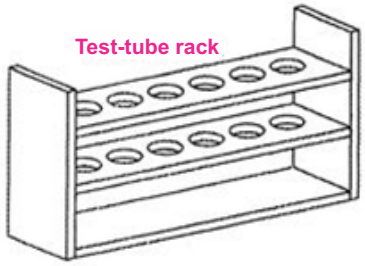

Wire brush


24-well plate


Spatula

Scoopula


Funnel


Test-tube rack

LABORATORY EQUIPMENT

08

CHEMISTRY

pH of Samples

EXPERIMENT 1

Aim

To find the pH of the following samples by using pH paper/universal indicator.

(a) Dilute hydrochloric acid
(b) Dilute NaOH solution
(c) Dilute ethanoic acid solution
(d) Lemon juice
(e) Distilled water
(f) Dilute sodium bicarbonate solution

Theory

- pH is the measure of the hydrogen ion concentration H^+ of a solution. $pH = -\log_{10}[H^+]$
- Acids release H^+ ions when dissolved in water.
- Bases release OH^- ions when dissolved in water.

pH scale:

If pH < 7 then it is acidic solution.
If pH > 7 then it is basic solution.
If pH = 7 then it is neutral solution.

- Acids convert blue litmus paper to red. For example : HCl, CH_3COOH etc.
- Bases convert red litmus paper to blue. For example : NaOH, $NaHCO_3$ etc.
- Neutral solutions have no affect neither on blue nor on red litmus paper.

Materials Required

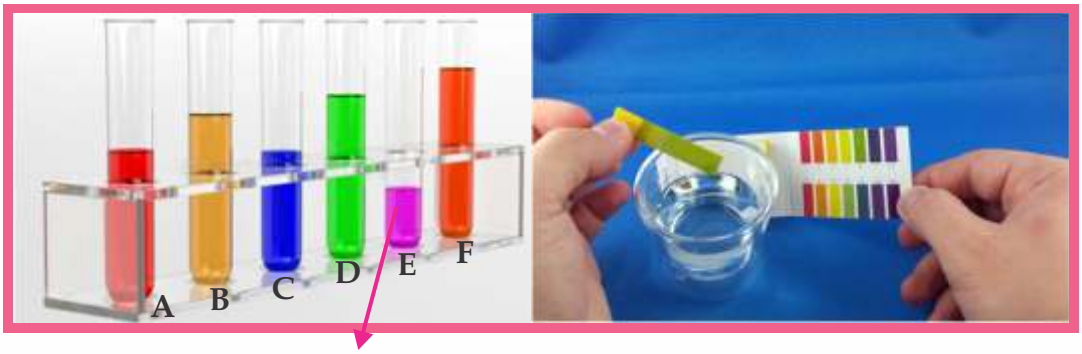
Six test tubes, six droppers, white tile, pH paper (with coloured chart strip of pH scale) and test tube stand.

Chemicals required:

Dilute hydrochloric acid, dilute solution of sodium hydroxide, dilute ethanoic acid, lemon juice, distilled water and dilute solution of sodium bicarbonate.

Procedure

1. Take six test tubes, wash them with distilled water and place them on test tube stand.
2. Mark these test tubes as A, B, C, D, E and F.



3. Take 2 *mℓ* each of the above chemicals and add them to the marked test tubes.
   Test tube A – add 2 *mℓ* of dil. HCℓ acid, Test tube B – add 2 ml of dil. NaOH solution, Test tube C – add 2 *mℓ* of dil- ethanoic acid, Test tube D – add 2 *mℓ* of lemon juice, Test tube E – add 2 *mℓ* of distilled water, Test tube F – add 2 *mℓ* of dil. sodium bicarbonate solution
4. Take a white tile and place small strips of pH paper on it, mark them as A to F.
5. Take clean droppers rinsed with distilled water.
6. Use each dropper to suck the contents present in the test tubes A to F and pour a drop of each content on marked pH paper respectively. E.g. : the contents of test tube A to be dropped on the pH paper with label A.
7. Observe the colour change in the pH paper and match it with the colour pH chart as shown in diagram. Record your observations.

Observations

Test tube	Sample	Colour of pH Paper	Approximate pH	Nature
A	Dil. HCℓ			
B	Dil. NaOH			
C	Dil. CH_3 COOH			
D	Lemon juice			
E	Distilled Water			
F	Dil. $NaHCO_3$			

Precautions

1. The test sample solutions should be freshly prepared .
2. Use clean and rinsed droppers, test tube rinsed with distilled water only.
3. Use clean test tubes and mark them carefully.
4. Use clean tile.

Sources of Error

1. Be careful while using the dropper, ensure that everytime you use a clean dropper.
2. Do not use tap water for rinsing, the pH may go wrong.

VIVA VOCE

Q. 1. What does "pH of a solution" mean?
Ans pH is defined as negative logarithm of the hydrogen ions concentration in a solution.

Q. 2. Name the scientist who introduced pH.
Ans Sorensen.

Q. 3. What is the pH of human blood?
Ans pH of human blood is 7.35 – 7.45.