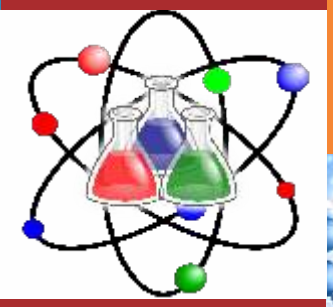

SCIENCE LAB MANUAL

IX

9 SCIENCE LAB MANUAL

Name .....

School .....

Class ..... Section .....

Address .....

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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

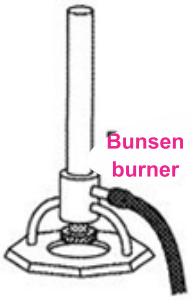
1924. This formed the basis of the Bose-Einstein Statistics. In 1937, Rabindranath Tagore dedicated his only book on science, Visva–Parichay, to Satyendra Nath Bose. The Government of India awarded him India's second highest civilian award,

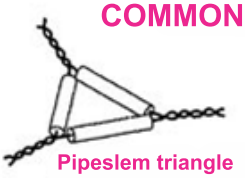

Jagdish Chandra Bose

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.

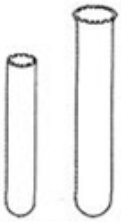
Another of his well known inventions is the crescograph, through which he measured plant response to various stimuli and hypothesized that plants can feel pain, understand affection etc. While most of us are aware of his scientific prowess, we might not be aware of his talent as an early writer of science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

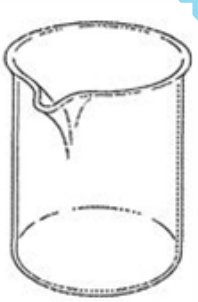
COMMON LABORATORY EQUIPMENT


Bunsen burner


Pipeslem triangle


Evaporating dish

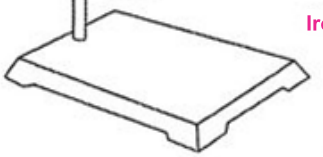

Test tubes


Beaker


Utility clamp

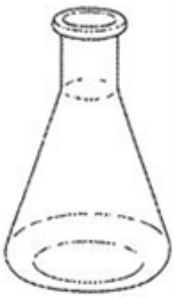

Mortar and pestle


Gas bottle


Ring stand


Iron ring

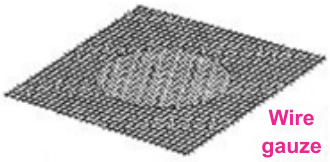

Crucible and cover


Erlenmeyer flask

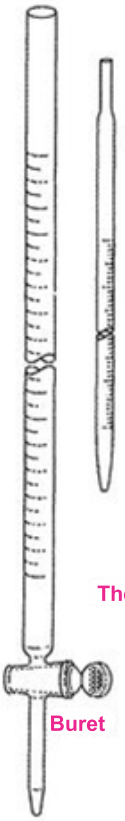

Safety goggles


Corks


Watch glass


Wire gauze

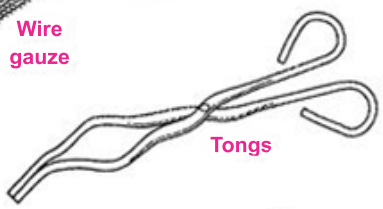

Assorted rubber stoppers


Buret

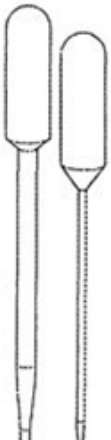
Pipet

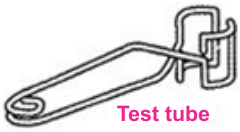

Thermometer

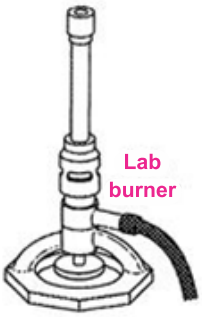

Graduated cylinder


Tongs


Wash bottle


Micropipets (standard and narrow stem)


Test tube holder

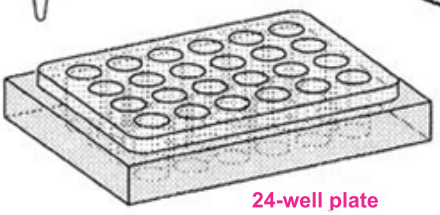

Lab burner

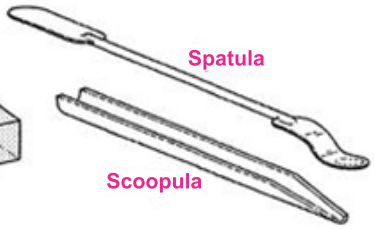

Dropper


Forceps


File

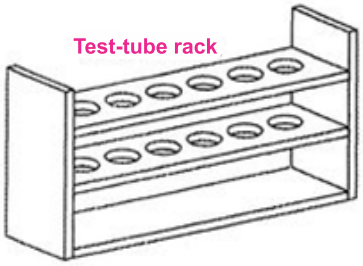

Wire brush


24-well plate


Spatula

Scoopula


Funnel


Test-tube rack

LABORATORY EQUIPMENT

PHYSICS

Density of Solid

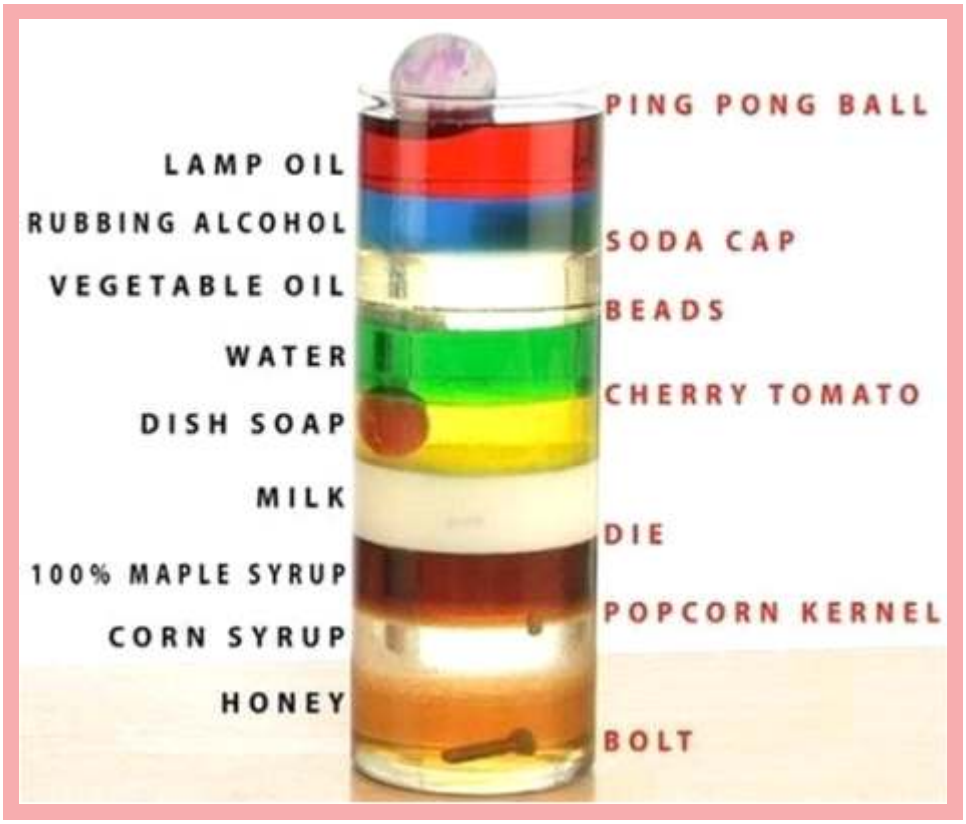
EXPERIMENT 1

Aim

To determine the density of solid (denser than water) by using a spring balance and a measuring cylinder.

Theory

1. Density: The density of a substance is defined as the mass per unit volume, [P = $\frac{M}{V}$]
   Here, D → P (rho) = Density of the body
   M = Mass of the body
   V = Volume of the body.
2. S.I. unit of density = Kgm^{-3} or kg/m^3
   C.G.S. unit of density = g/cm^{-3} or g/cm^3



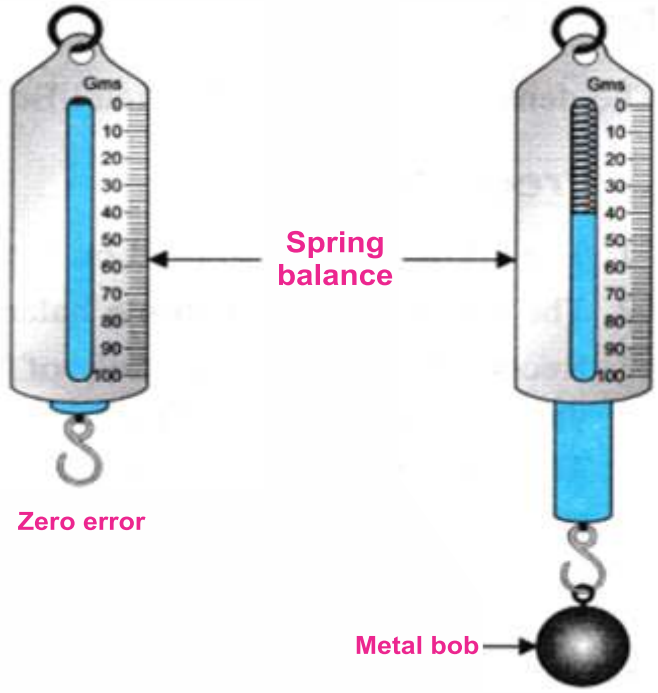
Materials Required

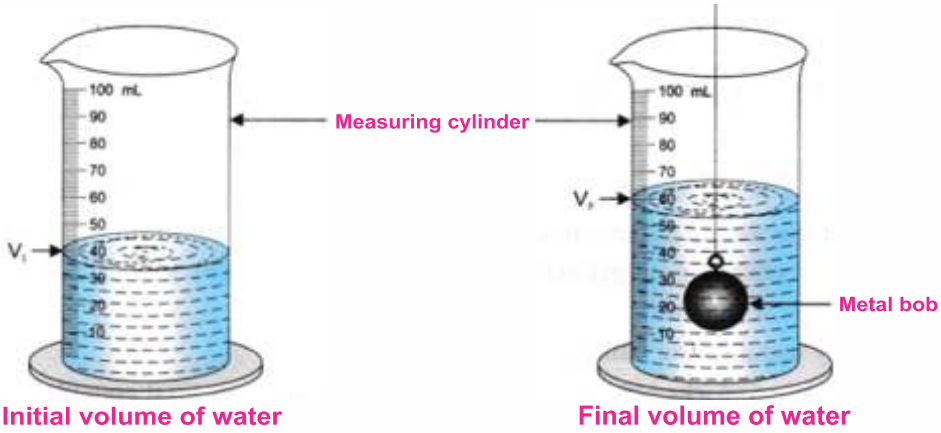
A spring balance, a measuring cylinder, a beaker with water, a metal bob (or any body that is heavier than water and does not dissolve in water), a cotton string, a stand (optional).

Procedure

1. The spring balance should be checked for any error. Let the zero error be 'x'.
2. Tie a metal bob (or any solid) with the string of cotton to the hook of the spring balance.
3. Hold the spring balance (or tie it to the stand), suspended with the metal bob in air. Measure the weight of the bob. Let its weight be 'Wf'

4. Pour the water in the measuring cylinder and record the initial volume of water, let it be 'Vi'
5. Suspend the metal bob into the measuring cylinder with water. The bob should not touch the base, nor the sides of the cylinder.
   The water level rises, note the water level, let this volume be 'Vf'
6. Record all your observations in the observation table and do the calculation to find the density of a given solid metal bob.





Observations

WEIGHT OF THE SOLID (METAL BOB (M)

Initial Reading of Spring balance, x	Final Reading of spring balance with Metal Bob (W_f)	Weight of the Metal Bob $W = W_F - x$

1. Weight of the given Metal Bob = ... N
2. Mass of the Metal Bob = ... g (By using formula W = mg where g = 9.8 m/s^2)

VOLUME OF THE SOLID (METAL BOB) (V)

Initial Volume of water in cylinder V_i (mL)	Final volume of water when Metal Bob is immersed V_f (mL)	Volume of the Metal Bob $V = V_f - V_i$

1. Volume of water displaced by solid (metal bob) = ...
2. Density of a solid (metal bob) = ...
3. mL of water = 1 cm^3

Result

The density of given solid (Metal Bob) is g/cm3

Precautionss

1. The spring balance should be sensitive.
2. The zero error in the spring balance should be recorded before it is used to find the weight of solid.
3. Record the readings carefully of both spring balance and measuring cylinder by keeping the level of eye and the mark of reading same/parallel.
4. The solid/metal bob should not touch the bottom, or sides of the measuring cylinder.
5. Note the zero error of spring balance and subtract this zero error from the final reading of the weight of solid/ metal bob.

VIVA VOCE

Q. 1. Define density.
Ans Density is defined as the mass per unit volume.

Q. 2. State the S.I. unit of density.
Ans kg/m^3.

Q. 3. At what temperature the density of water is maximum?
Ans At 4°C.

Q. 4. How can you measure 1 N weight?
Ans It can be measured by using spring balance.

Q. 5. The density of a solid is 2.5 g/cm^3. What does it mean?
Ans It means that 2.5 g of solid has a volume of 1 cm^3

Multiple Choice Questions (MCQs)

1. To find the density 'P' of a body with mass 'M' and volume 'V', the correct formula is

(a) $M = \frac{P}{V}$ (b) $P = \frac{M}{V}$ (c) $V = \frac{P}{M}$ (d) $P = M \times V$.

2. If W is the weight of the body, 'm' is the mass of the body and 'g' is the force of gravity acting on a body

then

(a) $W = \frac{m}{g}$ (b) $W = m \times \frac{g}{2}$ (c) $W = m \times g$ (d) $W = \frac{m}{2} \times m$

3. The S.I. unit of density is

(a) g/Cm^3 (b) $kg\ cm^{-3}$ (c) $g\ m^{-3}$ (d) $kg\ m^{-3}$

4. To measure the mass of a body the right device is

(a) spring balance (b) beam balance (c) weighing machine (d) none of these.

5. To find the weight of a body we should use

(a) spring balance (b) beam balance (c) both (a) and (b) (d) none of these.

6. The density of water is maximum at temperature

(a) 0°C (b) 100°C (c) 40°C (d) 4°C.

7. Four cylinders are given with different least counts. Pick the one you will choose to find the density

(a) 1 cc (b) 0.2 cc (c) 5 cc (d) 0.1 cc.

8. One kgf is equal to

(a) 1 N (b) 98 N (c) 9.8 N (d) 100 N.

9. The S.I. unit of mass is

(a) g (b) kg (c) Newtons (d) mg.

10. The S.I. unit of weight is

(a) g (b) kg (c) Newton (d) kgf.

11. The S.I. unit of volume is

(a) cc (b) cm^3 (c) m^3 (d) kg^3.

12. In an experiment to find the density of a solid, the device by which the volume of a solid can be measured by taking water in it is

(a) beaker (b) conical flask
(c) measuring cylinder (d) round bottom flask.

13. The density of which of the following cannot be measured accurately using a spring balance and a measuring cylinder?

(a) A ball filled with a liquid having a leakage
(b) A block of ice at 0°C (c) A small porous solid
(d) All of these.

14. If we want to determine the volume of a solid by immersing it in water, the solid should be

(a) lighter than and soluble in water
(b) heavier than and soluble in water
(c) lighter than and insoluble in water
(d) heavier than water and insoluble in it.

15. In a spring balance the space between 0 and 25 g marks is divided into 10 equal parts. The least count of the spring balance is

(a) 2.5 (b) 25 (c) 0.25 gwt (d) 15

16. To determine the density of a solid, the solid should be

(a) lighter than water
(b) heavier than water
(c) insoluble in water
(d) heavier than water and insoluble in it.

17. The relative density of water at 4°C is

(a) 1 (b) 10 (c) 1000 (d) 100.

18. While determining the density of a copper piece using a spring balance and a measuring cylinder, the following procedure is followed:

(I) Note the water level in the measuring cylinder without the copper piece.
(ii) Immerse the copper piece in water.
(iii) Note the water level in the measuring cylinder with copper piece.
(iv) Remove the copper piece from the water and immediately weigh it using a spring balance.

The wrong step in the procedure is

(a) (i) (b) (ii) (c) (iii) (d) (iv)

Scoring Key With Explanation

1. (b) It is the relationship between P, M and V $(P = \frac{M}{V})$
2. (c) W = mg, is how the weight of the body calculated.
3. (d) $P = \frac{M}{V}$, S.I. unit of M = kg and V = m^3
4. (b) Mass is the quantity of matter, it is measured best by beam balance.
5. (a) The mass is acted by gravitational force hence spring balance measures the weight of the body.
6. (d) The water is heavier at 4°C, unique property of water.
7. (d) Smaller the least count better are the results.
8. (c) kgf is kilogram force, which means m x g = 9.8 N.
9. (b) kg is the S.I. unit of mass.
10. (c) Weight = m x g, the value is given in Newton, S.I. unit of weight.
11. (c) It is the SI unit of volume.
12. (c) Measuring cylinder measures the liquid.
13. (d) The solid that is non-porous, denser than water, insoluble and is stable can be used to determine its density using water.
14. (d) The solid that is non-porous, denser than water, insoluble and is stable can be used to determine its density using water.
15. (a) 25 ÷ 10 = 2.5
16. (d) The solid that is non-porous, denser than water, insoluble and is stable can be used to determine its density using water.
17. (a) The relative density is compared with the density of water.
18. (d) Weight of the solid is taken first by using spring balance.