GOVERNMENT OF TAMILNADU

# STANDARD EIGHT

## TERM - I

## VOLUME 3

# SCIENCE

# SOCIAL SCIENCE

A publication under Free Textbook Programme of Government of Tamil Nadu

Department of School Education

**Untouchability is Inhuman and a Crime**

# Table of Contents



AA17RG

E - book

KGSICP

Assessment

R3S9_8_SCIENCE_EM

DIGI links

# Career Guidance





## Engineering Courses B.E. / B.Tech 4 years

- Aeronautical Engineering
- Aerospace Engineering
- Architecture Engineering
- Automobile Engineering
- Automation & Robotics Engineering
- Avionics Engineering
- Bio Medical Engineering
- Bio Technology Engineering
- Civil Engineering
- Chemical Engineering
- Ceramic Engineering
- Computer Science Engineering Construction Management & Technology Engineering
- Electronics and Communication Engineering
- Electrical and Electronics Engineering
- Environmental Science Engineering
- Information Science Engineering
- Industrial Engineering
- Industrial Production Engineering
- Instrumentation Technology
- Marine Engineering
- Medical Electronics Engineering
- Mechanical Engineering
- Mining Engineering
- Manufacturing Science Engineering
- Naval Architecture
- Polymer Technology
- Silk Technology Engineering
- Carpet Technology Engineering
- Textile Engineering

## Medical Course 5 years

- MBBS – Allopathy
- BSMS – Siddha
- BAMS - Ayurveda
- BUMS – Unani
- BHMS – Homeopathy
- BNYS – Naturopathy & Yoga
- BDS – Dental
- BVSc – Veterinary

## Paramedical Diploma / UG 2/3 years

- Nursing
- Pharmacy
- Anaesthesia Technician
- Cardiac Technician
- Dental Mechanic
- Health Inspector
- Medical imaging & tech
- Medical Lab Tech
- Medical X-ray Tech
- Nuclear Medicine Tech
- Occupational therapist
- Operation Theatre Tech
- Ophthalmic Assistant
- Physiotherapy
- Radiographic Assistant
- Radiotherapy Tech
- Rehabilitation Tech
- Respiratory Therapy Tech
- Blood Transfusion Tech

## Agriculture Courses| (4 years)

- B.Sc. Agriculture Science
- B.Sc. Horticulture
- B.Sc. Forestry
- B.Tech Agricultural Engineering

## Humanities 3 years

- Advertising
- BA-General Criminology
- Economics
- Fine Arts
- Foreign Languages
- Home Science
- Interior Design
- Journalism
- Library Sciences
- Physical Education
- Political Science
- Psychology
- Social Work
- Sociology
- Travel & Tourism

# Road ahead after 12th...

## B.Sc., Courses
## 3 years

- B.Sc. Physics
- B.Sc. Chemistry
- B.Sc. Botany
- B.Sc. Zoology
- B.Sc. Mathematics
- B.Sc. Computer Science
- B.Sc. PCM
- B.Sc. CBZ
- B.Sc. Dietician & Nutritionist
- B.Sc. Sericulture
- B.Sc. Oceanography
- B.Sc. Meteorology
- B.Sc. Anthropology
- B.Sc. Forensic Sciences
- B.Sc. Food Technology
- B.Sc. Dairy Technology
- B.Sc. Hotel Management
- B.Sc. Fashion Design
- B.Sc. Mass Communication
- B.Sc. Electronic Media
- B.Sc. Multimedia
- B.Sc. 3D Animation
- B.Sc. Home Science


## Management Courses
## (3 years)

- Business Management
- Bank Management
- Event Management
- Hospital Management
- Hotel Management
- Human Resources Management
- Logistics & Management

## Commerce Courses
## 3 years

- CA – Chartered Accountant
- CMA Cost Management Accountant
- CS Company Secretary (Foundation)
- B.com – Regular
- B.com – Taxation & Tax Procedure
- B.com – Travel & Tourism
- B.com – Bank Management
- B.com – Professional
- BBA/BBM – Regular
- BFM – Bachelors in Financial Markets
- BMS – Bachelors in Management Studies
- BAF – Bachelors in Accounting & Finance
- Certified Stock Broker & Investment Analysis
- Certified Financial Analyst
- Certified Financial Planner
- Certified Investment Banker

## C.A

CPT
↓
ATC IPCC
↓
ITT
(100 Hours)
↓
Articleship
(Work under in CA)
↓
Clear Final Exam
Become a C.A.

## Law Courses
## 3.5 years

- LLB
- BA+LLB
- B.Com + LLB
- BBM+LLB
- BBA+LLB

**JOB / Post Graduation**

## PREFACE

This book is developed in a holistic approach which inculcates comprehending and analytical skills. It will be helpfull for the students to understand higher secondary science in a better way and to prepare for competitive exams in future. This textbook is designed in a learner centric way to trigger the thought process of students through activities and to make them excel in learning science.

## HOW TO USE THE BOOK

- This term-I science book has 9 units.
- Each unit has simple activities that can be demonstrated by the teacher and also few group activities are given for students to do under the guidance of the teacher.
- Infographics and info-bits are added to enrich the learner's scientific perception.
- The "Do you know?" and "More to know" placed in the units will be an eye opener.
- Glossary has been introduced to learn scientific terms.
- ICT corner and QR code are introduced in each unit for the digital native generation.

### How to get connected to QR Code?

- Download the QR code scanner from the google play store/
  apple app store into your smartphone
- Open the QR code scanner application
- Once the scanner button in the application is clicked, camera opens and then bring it closer to the QR code in the textbook.
- Once the camera detects the QR code, a URL appears in the screen. Click the URL and go to the content page.

UNIT 1

# MEASUREMENT

## Learning Objectives

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At the end of this lesson, students will be able to:

- Understand SI units, base quantities and base units.
- Explain the system of units and measurements.
- Analyze the different system of units.
- Know about temperature, amount of substance, electric current and luminous intensity.
- Explore the knowledge of accuracy in measurements.
- Difference between the plane angle and solid angle, different clocks.
- Solve the numerical problems.

## Introduction

Physics is the study of nature and natural phenomena. Physics is considered as the base of all science subjects. Physics is based on experimental observations. The principles and observations allow us to develop a deeper understanding of nature. Scientific theories are valid, only if they are confirmed through various experiments.

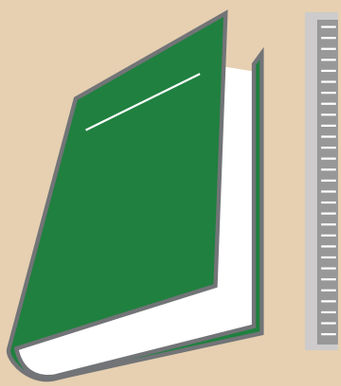
Theories in physics use many physical quantities that have to be measured.

Measurement is the base of all scientific studies and experimentations. It plays a vital role in our daily life. Measurement is the process of finding an unknown physical quantity by using a standard quantity.

We need three things for a perfect measurement. They are (i) an instrument, (ii) a standard quantity and (iii) an acceptable unit.

### Activity 1

Students are asked to measure the length and breadth of their science book using a ruler (scale) and compare their measurement with those of their friends.



In this activity, let the length of the book be 15 cm, the length is the physical quantity, ruler is the 'instrument', 15 is the 'magnitude' and 'cm' is the unit. This process is called "Measurement".

Here, all the students will not get the same value. Thus, one can infer that there may be an error while taking the measurement. This lesson helps us to get a better understanding of measurements.

## 1.1 System of Units

People in various part of the world are using different systems of units for measurement. Some common systems of units are :

1. FPS - System (Foot for length, Pound for mass and Second for time)
2. CGS -System (Centimetre for length, Gram for mass and Second for time)
3. MKS - System (Metre for length, Kilogram for mass and Second for time)


The 'CGS', 'MKS' and SI units are metric systems of units and 'FPS' is not an metric system. It is a British system of units.

### 1.1.1 International System of Units

In earlier days, scientists performed their experiments and recorded their results in their own system. Due to lack of communication, they couldn't organize other's experimental results. So, the scientists planned to follow a uniform system for taking the measurements.

As you studied in the lower classes, in 1960, in the 11th General Conference on Weights and Measures at Paris in France, the scientists recognized the need of using standard units for physical quantities. That was called as "International System of Units" and is popularly known as SI System (abbreviated from the French name 'Systeme International'). The scientists chose seven physical quantities as 'Base Quantities' and defined a 'Standard Unit' to measure each one. They are known as Base Units or Fundamental Units (Table 1.1)

### 1.1.2 SI Base Units

**Table: 1.1** Base Quantities and Units

| Quantity | Unit | Symbol |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Temperature | kelvin | K |
| Electric Current | ampere | A |
| Amount of Substance | mole | mol |
| Luminous Intensity | candela | cd |

You have already studied about Length, Mass and Time in the lower classes. So, now you are going to study about the other base quantities such as temperature, current, amount of substance and luminous intensity.


In December 1998, the National Aeronautics and Space Administration (NASA), USA launched the Mars Climate Orbiter to collect the data of the Martian climate. Nine months later, on September 23, 1999, the Orbiter disappeared while approaching Mars at an unexpectedly low altitude. An investigation revealed that the orbital calculations were incorrect due to an error in the transfer of information between the spacecraft's team in Colorado and the mission navigation team in California. One team was using the English FPS system of units for calculation, while the other group was using the MKS system of units. This misunderstanding caused a loss of approximately 125 million dollars.

## 1.2 Temperature

Identify, which of these objects are hot or cold? (Fig 1.1)

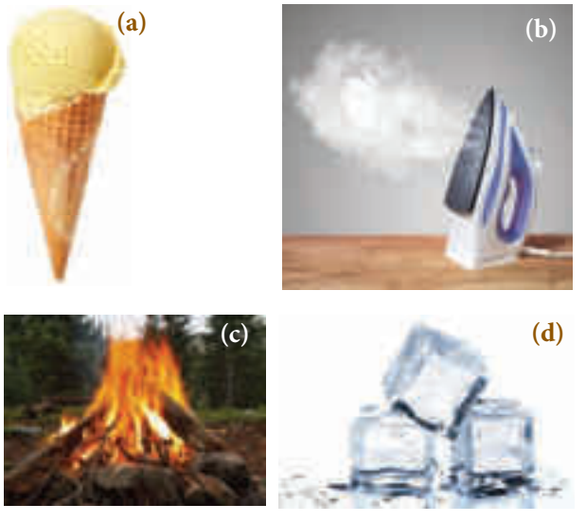



**Fig 1.1 - Various Hot and Cold Objects**

You can see that some objects are cold, and some are hot. You also know that, some objects are hotter than others while some of them are colder than others.

How do you decide, which is hotter and which is colder? So, you need a reliable quantity to decide the degree of hotness or coldness of an object. That quantity is 'temperature'.

Temperature is a physical quantity that expresses the degree of hotness or coldness of a substance. Heat given to a substance will increase its temperature. Heat removed from a substance will lower its temperature.

### 1.2.1 Definition

Temperature is a measure of the average kinetic energy of the particles in a system.

The SI unit of Temperature is kelvin. 'Thermometers' are used to measure temperature directly.

Usually, thermometers are calibrated with some standard scales. Celsius, Fahrenheit, Kelvin are the most commonly used scales to measure Temperature.

In these thermometers, melting point of pure ice (0°C) is taken as Lower Fixed Point (LFP) and Boiling point of water (100°C) is taken as Upper Fixed Point (UFP).

**Table : 1.2** Various Scales to measure Temperature

| Types of Scale | Lower Fixed Point (LFP) | Upper Fixed Point (UFP) | No. of divisions in thermometer |
|---|---|---|---|
| Celsius | 0° C | 100° C | 100 |
| Fahrenheit | 32° F | 212° F | 180 |
| Kelvin | 273 K | 373 K | 100 |

### Activity 2

Measure the room temperature inside the class room and outside the class room by using a thermometer and tabulate it with different time intervals for a week. Do you find any differences in these values? Discuss your observations.

| Day | 10:00 a.m. | | 12:00 p.m. | | 2:00 p.m. | | 4:00 p.m. | |
|---|---|---|---|---|---|---|---|---|
| | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside |
| Day-1 | | | | | | | | |
| Day-2 | | | | | | | | |
| Day-3 | | | | | | | | |
| Day-4 | | | | | | | | |
| Day-5 | | | | | | | | |

### 1.2.2 Conversion of Scales of Temperatures

The general formula for the conversion of scales of temperature is:

$$\frac{C-0}{100} = \frac{F-32}{180} = \frac{K-273}{100}$$

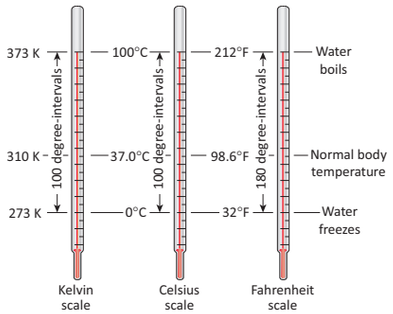



**Fig: 1.2 - Various Thermometers**

### 1.2.3 Application of various thermometric scales

1. Physicians use 'clinical thermometers'. It is graduated in 'Fahrenheit Scale'
2. Scientists are using thermometers with kelvin scale.
3. Common temperature measurements are made in celsius scale. (Example: Weather reports are given in celsius scale.)

**Info bits**

"Normal temperature of the human body is between 98.4° F and 98.6° F"


Infra red thermometer, measures the temperature of an object without any physical contact.

**Activity 3**

Collect the highest and lowest temperature details of your nearest town or city from the news paper or television for a week and record the values in a tabular column. Does this data remain same throughout the year?

## 1.3 Electric Current ( I )

Flow of electric charges, in a particular direction is known as 'electric current'.

The magnitude of an electric current is the amount of electric charges flowing through a conductor in one second.

$$\text{Total capitalised value of the business} = \frac{\text{Average profit}}{\text{Normal rate of return}} \times 100$$

$$I = \frac{q}{t}$$

SI unit of Electric Current is 'ampere' and it is denoted as A. Unit of charge is coulomb.

**Fig 1.3 - Ammeter**

**One ampere** is defined as one 'coulomb' of charge moving in a conductor in one second. Ammeter is a device used to measure 'electric current'. (Fig 1.3)

**More to Know**

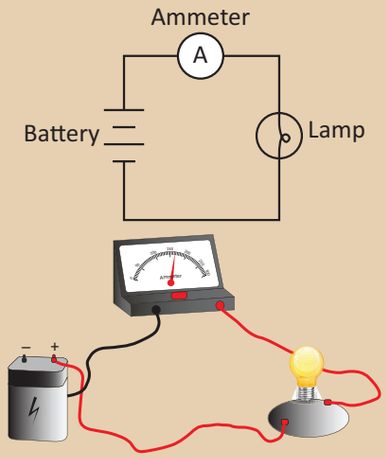
At very low temperature, around 30 K (-243.2° C), some conductors conduct electric current without any loss. These conductors are known as 'SUPER CONDUCTORS'.

The super conductors are used to levitate trains from the track.

Super conductors can be used as memory or storage element in the computers.

### Activity 4

Measure the current in an electric circuit.




**Components Required:**

Battery, Ammeter, Lamp (Bulb)

**Procedure:**

1. Connect the battery, ammeter and the lamp in series as shown in the figure.
2. Note the ammeter reading
3. It is the current in the circuit

## 1.4 Amount of substance

Can you count the number of copper coins in the picture? (Fig 1.4)

Can you count the number of copper atoms in a coin? (Fig 1.4)

It is very difficult to count the number of atoms because the atoms are not visible. There is an indirect method to count the number of atoms or molecules in a substance in multiples of mole. Let us see in detail.

**Fig 1.4 - Copper Coins**

Amount of substance is a measure of the number of entities (particles) present in a substance. The entity may be an atom, molecule, ion, electron or proton etc.

Generally, the amount of substance is directly proportional to the number of atoms or molecules.

The SI unit of amount of substance is mole and it is denoted as 'mol'.

Mole is defined as the amount of substance, which contains $6.023 \times 10^{23}$ entities.

### More to Know

The number $6.023 \times 10^{23}$ is also known as Avogadro Number.

## 1.5 Luminous Intensity


**Fig 1.5 (a & b)** - Photometer in day to day life

Have you seen these scenes on the television? (Fig 1.5)

What is the umpire doing? Is he taking a 'selfie' ? (Fig 1.5)

No, he is checking the intensity of light, as perceived by the human eye, by using an instrument called 'Photometer'.

### 1.5.1 Definition

The measure of the power of the emitted light, by a light source in a particular direction, per unit solid angle is called as Luminous Intensity.

The SI unit of luminous intensity is candela and is denoted as 'cd'.


Fig 1.6 - **Photometer**

The light emitted from a common wax candle is approximately equal to one candela

Luminous intensity is measured by a 'photometer' (Fig 1.6) (Luminous Intensity Meter) which gives the luminous intensity in terms of candela directly.

**Info bits**

Luminous Flux or luminous power is the measure of the perceived power of light. Its SI unit is 'lumen'.

One lumen is defined as the luminous flux of the light produced by the light source that emits one candela of luminous intensity over a solid angle of one steradian.

## 1.6 Plane angle

It is the angle between the intersection of two straight lines or intersection of two planes. (Fig 1.7)

The SI unit of Plane Angle is 'radian' and is denoted as 'rad'.

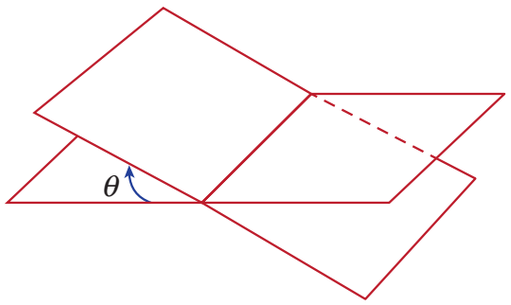



Fig 1.7 - **Plane Angle**

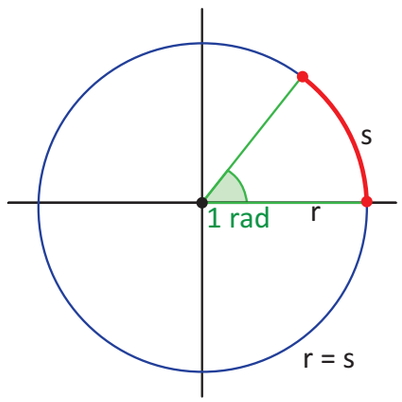



Fig 1.8 - **Radian**

Radian is the angle subtended at the centre of a circle by an arc whose length is equal to the radius of the circle. (Fig 1.8)

$\pi$ radian = 180°

1 radian = $\frac{180°}{\pi}$

## 1.7 Solid Angle

It is the angle formed by three or more planes intersecting at a common point.

It can also be defined as 'angle formed at the vertex of the cone'

The SI unit of solid angle is 'steradian' and is denoted as 'sr'.

### 1.7.1 Definition

Steradian is the solid angle at the centre of a sphere subtended by a portion whose surface area is equal to the square of its radius of the sphere. (Fig 1.9)

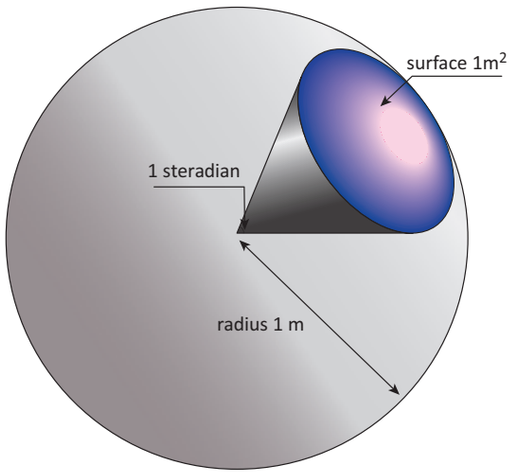



**Fig 1.9 - Steradian**


Until 1995, Plane Angle and Solid Angle were classified under supplementary quantities. In 1995, they were shifted to derived quantities.

**Table: 1.3** Difference between Plane Angle and Solid Angle

| Plane Angle | Solid Angle |
|---|---|
| Angle between the intersection of two lines or planes | Angle between the intersection of three or more planes at a common point |
| It is two dimensional | It is three dimensional |
| Unit is radian | Unit is steradian |

## 1.8 Clocks

Clocks are used to measure time intervals. So, many clocks were used from the ancient time. Scientists modified the clock's mechanism to obtain accuracy.

**Fig 1.10 - Ancient Clock**

### 1.8.1 Types of clocks based on display:

1. Analog clocks; 2. Digital clocks

### 1. Analog clocks

**Fig 1.11 - Analog Clock**

It looks like a classic clock. It has three hands to show the time. (Fig 1.11)

**Hours Hand:** It is short and thick. It shows 'hour'.

**Minutes Hand:** It is long and thin. It shows 'minute'.

**Seconds Hand:** It is long and very thin. It shows 'second'. It makes one rotation in one minute and 60 rotations in one hour.

Analog clocks can be driven either mechanically or electronically.

**Activity 5**

Students must make a model of an Analog clock using a cardboard.

### 2. Digital clocks

A **digital clock** displays the time directly. It shows the time in numerals or other symbols. It may have a 12 hours or 24 hours display. (Fig 1.12)

Recent clocks are showing Date, Day, Month, Year, Temperature etc.

Digital clocks are often called as Electronic Clocks.