PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement- It's importance

PERIOD-1

LEARNING OBJECTIVE

Students will be able to

- Understand the importance of measurement

- Explain the need of measurement

- Relate the types of measurements in our day today life.

- Understand the way in which measurement is expressed

WARM UP ACTIVITY

- Group students into pairs .Have each group discuss the different measurements they encounter on a daily basis, from the distance traveled to school in the morning to the number of windows in their school, ringing of bell after each period.

- Distribute <u>Class Activity Sheet</u> (at the end of this lesson) to each group and have students fill in the measurements in units which they know previously.

- Discuss whether or not students were surprised at how many measurements they use in daily life .

Definition of Measurement

- A measurement is the action of measuring something, or some amount of stuff. So it is important to measure certain things right. Distance, time, and accuracy are all great things to measure. By measuring these things or in other words, by taking these measurements we can better understand the world around us.

- **Measurement is a comparison of an unknown quantity with a known fixed quantity of the same kind.**

Why is measurement important in our lives?

- Time, size, distance, speed, direction, weight, volume, temperature, pressure, force, sound, light, energy—these are among the physical properties for which humans have developed accurate measures, without which we could not live our normal daily lives.

- Types of measurements we encounter in our day today life by showing a video.

- https://youtu.be/Z0CcUyFzeZ4

Need for measurement

The purposes of measurement can be categorized as measurement being in the service of quality, monitoring, safety, making something fit (design, assembly), and problem solving.

Measurement of weight, volume, length, and time has now become a part of our daily life.

A measurement needs to things the unit 'u' and the number 'n' which tells us how many times that the unit is contained in that quantity. Thus the measurement is expressed as

Measurement =n x u =nu
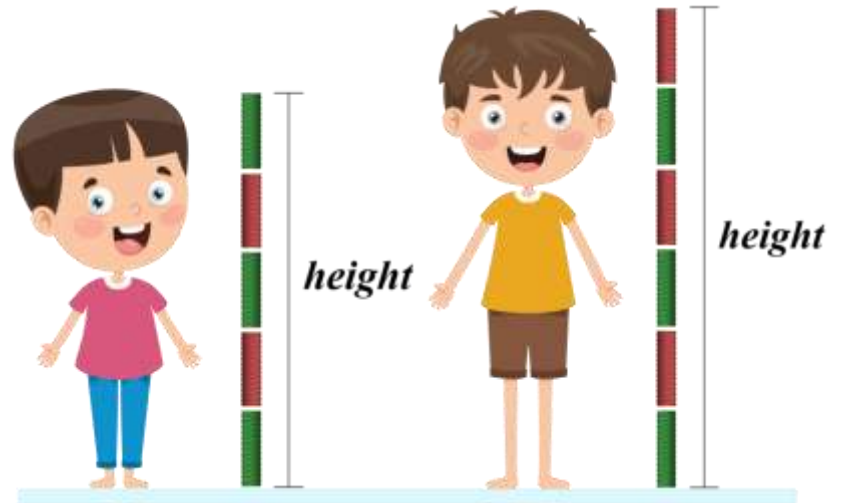
Why we need universally accepted unit for measurement?

- A **universal system** reduces the confusion when different **systems** of **measurement are** used and makes it easy to compare **measurements** taken by different persons.

- https://study.com/academy/lesson/why-do-scientists-need-a-common-system-of-measurement.html#lesson

HOME ASSIGNMENT

- Exercise- B 1,3
- Q. What is the need and importance of measurement?
- Q. How a measurement is expressed?

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Choice of Unit, basic physical quantities

PERIOD-2

LEARNING OBJECTIVE

Students will be

- familiarized with the properties of unit

- able understand the concept of magnitude

- Sensitized about the basic physical quantities,

- Able to Know how to use standard International unit

- Able to Know the convention while writing the SI units

WARM UP QUESTIONS

Recapitulation of previous topic by asking certain questions

- What is the need and importance of measurement?

- Define measurement

- What is the need for universally accepted unit for measurement?

Choice of units

TWO CHARACTERISTICS OF UNIT

- Two characteristics of a unit are

- It should be of convenient size.

- It must be universally accepted, i. e. its value must remain same at all places and at all times.

Magnitude

- The value obtained on measuring a quantity is called its magnitude.

- The magnitude of a quantity is expressed as numbers in its unit.

- for example to measure the length between two points we take a ruler of length one metre as unit and if the length of measuring is 15 times the unit metre , then we write the length is equal to 15 m.

In the past, different units were used to measure the length, mass and time in different countries. The following three systems of units were used :

    1. Centimetre-gram-second (C.G.S.) system
    2. Foot-pound-second (F.P.S.) system, and
    3. Metre-kilogram-second (M.K.S.) system or metric system.

    The units of length, mass and time in these systems are listed below:

System	Unit and symbol of length	Unit and symbol of mass	Unit and symbol of time
1. C.G.S.	centimetre (cm)	gram (g)	second (s)
2. F.P.S.	foot (ft)	pound (lb)	second (s)
3. M.KS.	metre (m)	kilogram (kg)	second (s)

Basic physical quantities

- A quantity that can be measured is called a physical quantity.

- In our daily life the measure the following four basic physical quantities

➢length

➢mass

➢time

➢ temperature

	Quantity	S.I. unit	Symbol of S.I. unit
(i)	Length	metre	m
(ii)	Mass	kilogram	kg
(iii)	Time	second	s.
(iv)	Temperature	kelvin	k

Use and need of Standard International Units for measurement.

In earlier times people across the world were using different systems of units for measurement. Without a widely accepted system of units of measurement, economies all over the world would collapse. Imagine the chaos if there were no standards for the measurement of mass, length and time.
There was a need, therefore, to end the confusion and bring in uniformity.

- The International System of Units (abbreviated as SI Units from its French name, Système International d'unités) is an internationally agreed metric system of units of measurement that has been in existence since 1960.

We use different units of measurement for length, weight, time, area, and volume.

- Distances are measured in miles and kilometres. Length is measured in inches, millimetres, centimetres, metres.

- Land is measured in feet, yard, acres, hectares, square yards, etc.

- Weight is measured in grams, kilograms, pounds, ounces etc.

- Time is measured in seconds, minutes and hours.

Conventions while writing the S.I. units

- https://youtu.be/mGOWxpaskys

HOME ASSIGNMENT

Exercise- B 2,4

- Q. Define magnitude

- Q. Define basic physical quantities

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement of length

PERIOD-3

LEARNING OBJECTIVE

Students will be

- familiarized with the definition of length

- Sensitized about the basic units of length

- Able to Know how to use of simple multiples and sub-multiples of metre

- Able to understand relationship between ft, inch and cm

- Knowing the devices used for measuring length- a metre ruler and a measuring tape.

WARM UP ACTIVITY

Activity
Show a chart on which a table of physical quantities, their respective S.I. units is shown like as:-

Physical Quantities	SI	Symbol
Length	meter	m
Mass	kilogram	Kg
Time	Second	S
Electric current	Ampere	A
Temperature	Kelvin	K
Volume	Liter	L

Ask some questions to assess the students' previous knowledge and write the expected responses on the board

Q1. In which units do you measure your height?
(Expected response: In feet or meters)

Q2: In which units do us show time?
(Expected response: In minutes hours or seconds)

Q3. How much do you weight?
(Expected response: 35-40Kg)

Q4: How far away is your school?
(Expected response: meters or kilometers)

Measurement of length

- The length and type of an object determine the kind of measuring tool that can be used.

- Large distances, e.g. distances between cities, are measured in kilometres.

- **Unit of Length**: The SI unit of length is the metre (m).

Multiples of Metre

- 1 decametre (dam) = 10 m
  1 hectometre (hm) = 100 m
  1 kilometre (km) = 1000 m

Sub- Multiples of Metre

1 m = 10 decimetre (dm)

1 m =100 centimetre (cm)

1 m = 1000 millimetre (mm)

1 m = 10^6 micron (μm)

1 m = 10^9 nanometre (nm)

Basic physical quantities

- A quantity that can be measured is called a physical quantity.

- In our daily life the measure the following four basic physical quantities

➢length

➢mass

➢time

➢ temperature

Converting from Standard to Metric

Convert from:	To:	Multiply by:
mile	kilometer (km)	1.609347
inch	millimeter (mm)	25.4
inch	centimeter (cm)	2.54
foot	meter (m)	0.3048
yard	meter (m)	0.9144
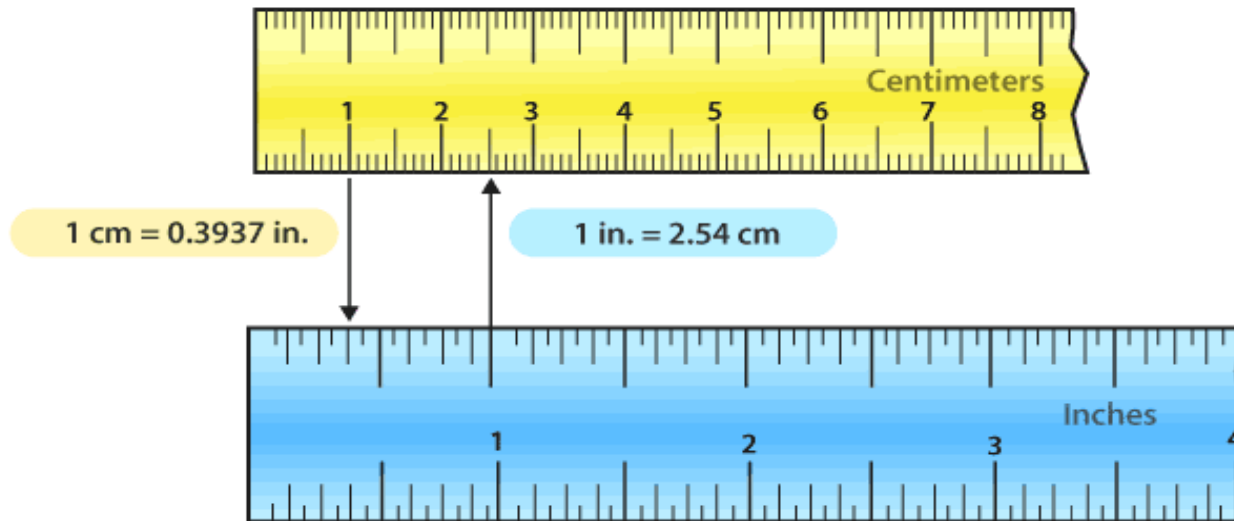
Devices for measuring length-

use of a meter ruler to measure length by the help of a video

- https://youtu.be/lHmjeL6w0yw

Devices for measuring length-

- Explain the use of measuring tape to measure length

- https://youtu.be/-0p2RD0VnR0

Avoiding Parallax Error

- When noting the reading on a ruler, you should look at it with the eyes directly above the reading, and not in an oblique way.

- Otherwise, you will not be able to note the reading accurately.

- In case the ruler has a damaged edge, place the broken or damaged ruler along the edge of the object whose length is to be measured in such a way that any visible mark coincides with one end of the object.

- Now note the reading on the ruler at the other end of the object. The difference between the two readings gives the length of the object.

Fig - I

4.8 cm

4.6 cm

5.0 cm

3   4   5   6
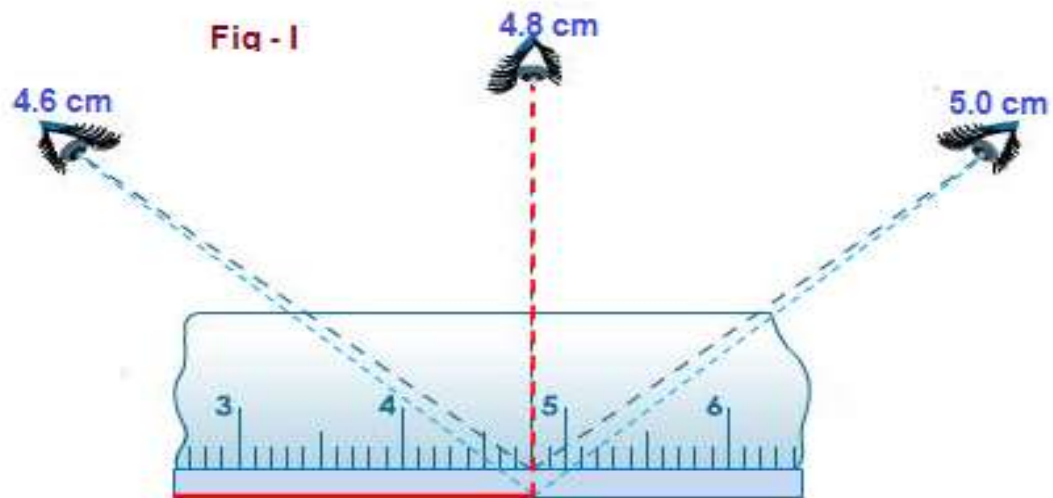
Parallax error arises due to thickness of the ruler used

Fig - II

4.8 cm

4.8 cm

4.8 cm

3   4   5   6
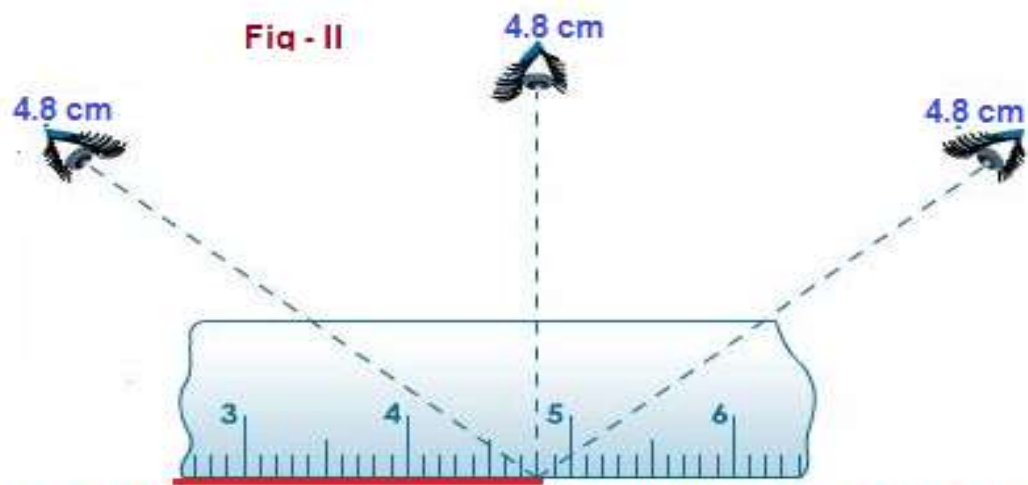
Parallax error vanishes if there is negligible thickness of the ruler or if the scale is placed vertically on the surface.

Exercise- B 5,6

Q. What do you mean by error of parallax

Q. Explain stepwise how to take measurement of length of an object with a meter scale

Q. Explain stepwise how to take measurement of length of an object with a measuring tape.

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement of mass

PERIOD-4

LEARNING OBJECTIVE

Students will be

- familiarized with the concept of mass

- Sensitized about the unit of mass

- able to know how to use multiple and sub multiple units of mass

- able to know the relationship between gram, kilogram and pound

- familiarized with the devices used for measuring mass

WARM UP QUESTIONS

Recapitulation of previous topic by asking certain questions

- What do you mean by error of parallax

- How can you measure length of an object with a meter scale?

- How can you measure length of an object with a measuring tape?

Measurement of mass

The mass of a body is the quantity of matter contained in it.

UNIT OF MASS-

SI unit of mass is kilogram in short form it is written as kg.

Multiple and Sub multiple unit of mass

A bigger unit of mass is **quintal**

1 quintal = 100 kg

A still bigger unit of mass is **metric ton**

1 metric ton = 10 quintal = 1000 kg

The mass of a light body is expressed in a smaller unit of mass called **gram** the short form of it is 'g'

1 gram is the 1000 part of kilogram or 1000 gram make 1 kilo gram that is

1 Kg = 1000 gm or

1 gm= 1 / 1000 kg

A still smaller unit of mass is milligram in short form it is written as 'mg'

1 milligram is the 1000 part of a gram or 1000 milligrams make one gram that is

1 gm = 1000 mg

1 mg = 1 / 1000 g

In F.P.S. system, the unit of mass is pound (*lb*)

- In C.G.S. system, the unit of mass is gram (g)

- **Relationship between gram, kilogram and pound**

- 1 g = 1/1000 kg

- 1 *lb* = 453.59 g

Devices for measuring mass

- Explain the use of a beam balance to measure mass of a body by the help of a video

- https://youtu.be/qnMyHvYRoPM

- https://youtu.be/5q9wy7G2v5U

- https://youtu.be/nEslpsH87zs

Standard weights

To measure the mass of an object standard weights are used. Standard weights are of 20 kg, 10 kg ,5 kg ,2 kg and 1kg however smaller weights of 500 gram 200 gram 150 gram 20 gram 10 gram and 5 gram are also available.

Devices for measuring mass

Explain the use of an electronic balance to measure mass of a body by the help of a video

- https://youtu.be/0UymyTJATLc

HOME ASSIGNMENT

Exercise- A 1,2

Q. Define mass

Q. Convert 80 gm to kg

Q. explain the relationship between gram, kilogram and pound

Q. Explain the process in which you can measure the mass of a body using beam balance

Q. Describe the parts of electronic balance

Q. What are standard weights? Give some examples

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement of time

PERIOD-5

LEARNING OBJECTIVE

Students will be

- familiarized with the concept of time

- able to define mean solar day

- Sensitized about the units of time

- familiarized with the devices used for measuring time

- familiarized with the devices used for measuring short time interval.

WARM UP QUESTIONS

- Recapitulation of previous topic by asking certain questions
- Define mass
- explain the relationship between gram, kilogram and pound
- Explain the process in which you can measure the mass of a body using beam balance
- Describe the parts of electronic balance
- What are standard weights? Give some examples

Measurement of time-

- The interval between two instances or events is called time.

- We measure time in terms of the mean solar day. A solar day is the time taken by the earth to complete one rotation about its own axis. The mean of 365 days in a year is called the mean solar day.

# Units of time

The SI unit of time is second (s).

- 1 second is defined as 1/ 86400 part of a mean solar day that is

- 1 s = 1 / 86400 x one mean solar day.

1 second is the time interval between two consecutive ticks that we hear from a Pendulum wall clock.

- In case of metric system F.P.S. system as well as in C.G.S. system , the unit of time is second (s) Second is a smaller unit of time.
- Bigger unit of time is **minute**.
- **1 minute = 60 second or 1 min = 60 s**
- Still a bigger unit of time is **hour**
- 1 hour = 60 minutes
- **1 hour = 60 x 60 seconds = 3600 s**
- Another big unit of the time is day.
- 24-hour makes 1 day. 1 day is the time taken by the earth to rotate once on its own axis.
- **Thus 1 day = 24 hour = 24 X 60 minutes = 1440 minutes = 24 X 60 X60 = 86400 seconds.**
- A year is another bigger unit of time.
- 365 days makes one year. 1 year is the time taken by the earth to complete one Revolution around the sun.
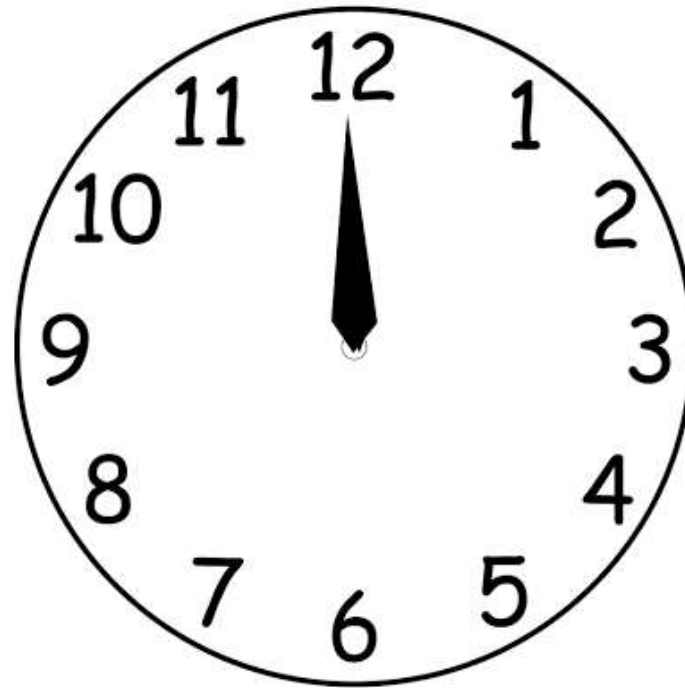- **1 year = 365 days = 365 x 86400 s = 3.15x 10^7.**

Devices for measuring time

1. A pendulum clock
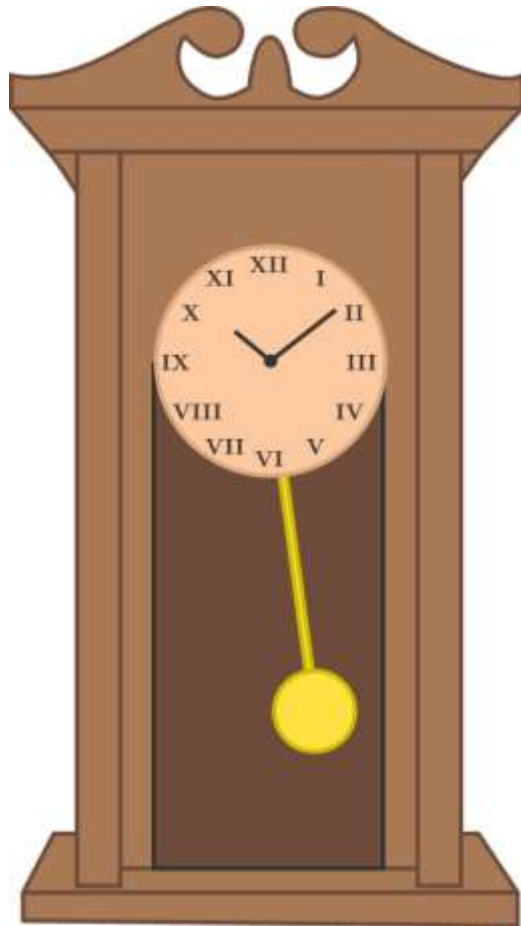
Devices for measuring time
2. Watch

Measuring devices for a short time interval

- The short time interval of an event is measured with the help of a stop clock or a stopwatch.

- Stopwatch has arrangements **to start**, **to stop** and to **reset** at 0.

- An electronic stop watch is more accurate than a mechanical stopwatch.

- It can measure time intervals accurately up to 0.01 second

- It does not have a minute or a second arm.

- On the other hand it has the digital display screen.

- Such watches are used for measuring the timings of Athletic activities such as the time taken by the athletes to complete a hundred metre race.

Exercise- B 15, 16

Q. what do you mean by mean solar day

Q. The unit of time in MKS and CGS system is_____

Q. How can you measure short time interval? Explain

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement of temperature

PERIOD-6

LEARNING OBJECTIVE

Students will be

- familiarized with the concept of temperature

- Sensitized about the units of temperature

- familiarized with the devices used for measuring temperature of an object

- familiarized with the process of measuring temperature using a laboratory thermometer

- Familiarized with the process of measuring temperature of a patient's body using a clinical thermometer.

WARM UP QUESTIONS

Recapitulation of previous topic by asking certain questions

- How can you define time?

- what do you mean by mean solar day

- How can you measure short time interval? Explain

- What is the basic unit of time?

- How many seconds are there in an hour?

Measurement of temperature-

Temperature is how hot or how cold an object is.

What the thermometer reads is the temperature.

Temperature can, therefore, be defined as the reading on a thermometer.

There are a variety of thermometers about which we will learn in this chapter and also about approximation.

Scales of Temperature:

- The different units to measure temperature are represented by different scales of temperature.

- A temperature scale is defined by choosing two reference temperatures and dividing the difference between these two temperatures into a certain number of divisions.

- Each division is called one degree.

- The reference temperatures usually used are the melting point of pure ice, called the lower fixed point, and the boiling point of water called the upper fixed point.

- The two commonly used temperature scales are the Celsius and the Fahrenheit scales. In scientific calculations, Kelvin scale is used.

Celsius scale and Fahrenheit scale:

- **In Celsius scale**, the melting point of ice is taken as 0 °C and the boiling point of water as 100 °C. The difference between the two points is divided into 100 degrees.

- **In Fahrenheit scale**, the lower fixed point or the melting point of ice is 32 °F and the upper fixed point or the boiling point of water is 212 °F. The difference between these two points is divided into 180 degrees.

- **In Kelvin scale**, 0 °C corresponds to 273 K and 100 °C corresponds to 373 K.

Conversion between Celsius and Fahrenheit Temperatures

- The Celsius and Fahrenheit scales are related as follows, where C and F are the temperatures measured in Celsius and Fahrenheit scales, respectively.

- If K is the Kelvin temperature, then K = C + 273.

Devices for measuring temperature

There are different types of thermometers for measuring the temperatures of different things like air, our bodies, food, and many other things.

There **are clinical thermometers, laboratory thermometers, Galileo thermometers, maximum-minimum thermometers and digital remote thermometers.**

Among these, the commonly used thermometers are clinical thermometers and laboratory thermometers.

Description of a laboratory thermometer

https://youtu.be/QB_n3xpFcUM

- Description of a clinical thermometer
- https://youtu.be/O-h6fi4_vQU

Exercise- B 19,20,21

Define temperature

Explain the units of temperature.

Q. What do you mean by ice point and steam point?

Q. One degree on Celsius scale is equal to ------------- ---degree on Fahrenheit scale.

Q. Differentiate between laboratory thermometer and clinical thermometer.

THANKING YOU

ODM EDUCATIONAL GROUP

PHYSICAL QUANTITIES AND MEASUREMENT

SUBJECT-PHYSICS

CHAPTER NO- 2

Measurement of area

PERIOD-7

LEARNING OBJECTIVE

Students will be

- familiarized with the concept of area

- Sensitized about the area of regular shapes

- familiarized with the use of graph paper to find the area of a regular or irregular surface

- Familiarized with the units of area

- Able to understand multiple and sub multiple units of area.

WARM UP QUESTIONS

Recapitulation of previous topic by asking certain questions

- Define temperature

- Explain the units of temperature.

- What do you mean by ice point and steam point?

- One degree on Celsius scale is equal to ------------degree on Fahrenheit scale.

- Differentiate between laboratory thermometer and clinical thermometer.

Measurement of area-

The total surface occupied by an object is called its surface area or simply the area.

Measurement of Area of a Regular Surface

- We can find the area of regular surfaces by measuring their linear dimensions like length, breadth, etc. and calculating the area using appropriate formulae. The formulae used to find the area of some regular shapes are given below:

- **Area of a square = side x side**
- **Area of a rectangle = length x breadth**
- **Area of a triangle = ½ x base x height**
- **Area of a circle = π x radius x radius**
- We can find the area of a small regular surface using a centimetre graph sheet also.

- **Measurement of Area of an Irregular Flat Surface**
- We can find the area of an irregular flat surface, for example, a leaf, using a graph sheet.
- For doing this, the leaf is placed on a centimeter graph sheet and its outline is drawn.
- Then the number of complete and incomplete squares is counted separately.
- Assuming the area of an incomplete square to be equal to half the area of a complete square, the approximate area of the leaf is the sum of the number of complete squares and half of the number of incomplete squares. This area is in cm square.

Area of an

Multiple and Sub-multiple Units of Area

1 hectare = 100 m x 100 m = 10,000 m^2

1 m^2 = (1/10,000) hectare = 10^{-4} hectare

1 km^2 = 1000 m x 1000 m = 1,000,000 m^2

1 km^2 = 100 hectares

- Demonstration of use of graph paper to find area of irregular surface

- https://youtu.be/x0NHC0cmKfU

- Demonstration of use of graph paper to find area of regular surface

- https://youtu.be/5fyXxFSE6qk

Exercise- B 19,20,21

- Define surface area

- Explain the units of area.

- 1 yard =_____m

- 1 square ft=_____meter square

- 1 acre= _____meter square

THANKING YOU

ODM EDUCATIONAL GROUP