

10

Measurement

We'll cover the following key points:

- Measurement in early ages and its need
- Standard and Non-Standard Units
- Measurement of Length and mass
- Measurement of Time and Temperature



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Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the concept of measurement and its importance in daily life.
- Explain the need for standard and non-standard units of measurement.
- Describe how to measure length and mass using appropriate tools and units.
- Identify and understand the measurement of time and temperature, and their significance in various contexts.

Guidelines for Teachers

The teacher can begin the chapter by explaining the importance of measurement in early human history and how it has evolved to meet practical needs. Use real-life examples like comparing objects' sizes using hands or feet as non-standard units, and then move on to explain the concept of standard units like meters and kilograms. Demonstrate the use of rulers, scales, and thermometers to measure length, mass, time, and temperature. Encourage students to perform hands-on activities, such as measuring the length of objects in the classroom or recording temperature at different times of the day. Simple experiments, like timing how long it takes for an object to fall or measuring temperature changes, can help students relate to the concept of measurement.



Warm Up

Experiential Learning

Match the following units:

Column A

1. 1000 milligram
2. 100 centimetres
3. 1000 litre
4. Degree Fahrenheit (°F)
5. 1000 gram
6. 1000 millilitre

Column B

- a. 1 kilogram
- b. 1 litre
- c. 1 gram
- d. 1 metre
- e. 1 kilolitre
- f. temperature

Fun Fact



A year on Venus is shorter than a day! Venus rotates so slowly that one full rotation (a day) takes 243 Earth days, while it only takes 225 Earth days to complete an orbit around the Sun (a year). It's the only planet in our solar system where a day is longer than a year!

Measurement in early ages and its need

Measurement and its need

In everyday life, measurements are often necessary. We need weights and measures for many other day-to-day activities. For instances,

- ✦ the amount of cloth required for a dress,
- ✦ the weight of grocery and vegetables to be bought,
- ✦ the amount of sugar needed for a cup of tea or the amount of petrol to fill in a car are all measured.

Measurement is the action of measuring something. We can measure time, weight, distance, height, temperature, length, speed and more. If we didn't have measurement, it would be very difficult to know when to go to school, how much you weigh, or how cold or warm it is outside.



Life is so much easier when we know how to measure things, and that is why measurement is so important. Every measurement involves a number and a unit. Assume that your classroom measures 10 metres in length. The number here is 10 and the unit is metre.

Measurement in early ages

In ancient times, people used to measure the length of an object using parts of the body or objects from surroundings.

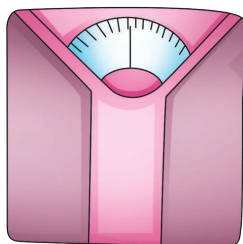
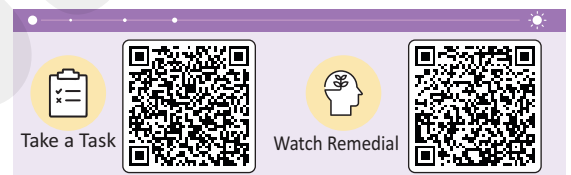
- ✦ **Hand span**, **cubit** or **foot** span were used to measure the length.
- ✦ Seeds, grains or stones were used for weights.
- ✦ Time was measured by looking at the Sun, Moon and other heavenly bodies.

These weights and measures did not give the correct measurements because of the difference in sizes of seeds, stones and people's hands and feet. So to avoid this, need to have a fixed **unit** for measuring different things was introduced.

Now let's learn about the units we use to measure things.

Standard and Non-Standard Units

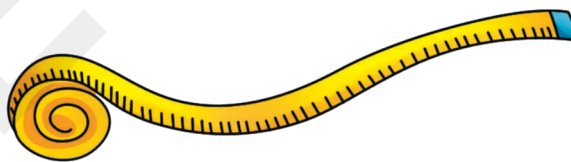
Standard units are the units everyone uses to measure something specific. We all need to speak the same language to understand each other, so we use hours, minutes and seconds to measure time, ounces and pounds to measure weight, degrees to measure temperature, and inches and feet to measure length or height.



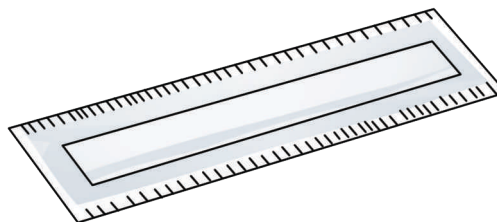
Scale
(Pounds)



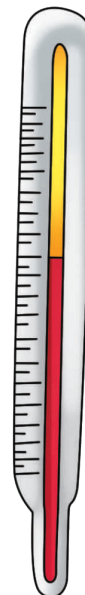
Scale
(Ounces)



Measuring tape
(inches)



Ruler
(inches)



Thermometer
(degree)

Standard Units of Measurement

Non-standard units are random things that people choose to measure with. For example, I can use a paper clip to measure my notebook or yarn to measure my brother's height. I can use my hands to know if something is heavier or lighter, and I can use my fingers to measure my friend's arm.

The units for the following are:

1. Finding out temperature of a patient having fever – Celsius (degree C).
2. Water in a big tank – Kilolitres (kl)/l.
3. Distance between your school and house – Kilometres (km).
4. Water in a water bottle – Millilitres (ml).
5. Mass of the earth – Kilograms (kg).

Measurement of Length and mass

Measurement of Length

Length measures the distance between two points. It is the size or the measure of how long something is. It is measured with a metric ruler, or an inch ruler.

Some units for measuring length are: millimetre (mm), centimetre (cm), metre (m) and kilometre (km). Small lengths are measured in centimetres whereas long lengths are measured in metres. Longer lengths or distances are measured in kilometres (km).

- ✦ 10 millimetres(mm) = 1 centimetre(cm)
- ✦ 100 centimetres(cm) = 1 metre (m)
- ✦ 1000 metres (m) = 1 kilometre (km)

Using a Ruler, Measuring Tape and Metre Scale

A ruler is a tool used to measure lengths and draw straight lines. In schools and colleges we use meter-scales of one meter length, 30 cm scales and 15 cm scales.

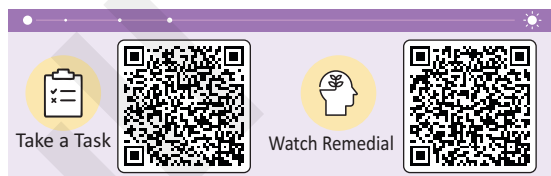
We use 30 cm scale and 15 cm scale in our daily routine work, to draw line-segments of given measure and to measure the line-segments.

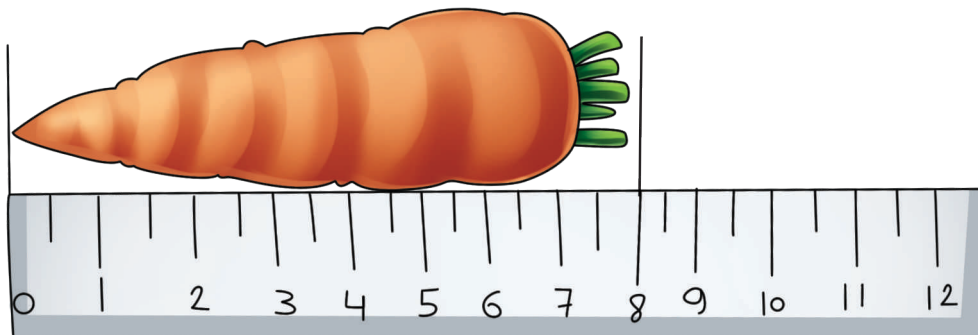
The small scales of measure 30 cm or 15 cm are used to measure the lengths of line-segments, chalk-pieces, the length of a pencil etc.

Objects on a ruler are measured by putting one end of the object on 0 and aligning the object straight along the edges of the ruler. The mark where the other end of the object ends is the length of the object.

Did you know ?

Height can be defined as the distance between the lowest and highest points of a person or an object.





To measure long distances like length and breadth of a park or field we use measuring tapes. It is 50 m or 100 m or 250 m or more in length.

Tailors have a small measuring tape to measure the length of cloth. They also have a metre rod which is one metre long. It is also used to measure the length of cloth.

The tapes and meter-rod or meter-scale are used to measure the length and breadth of a room, table, blackboard etc. and also the length of a piece of string or a piece of cloth.

Check 'N' Mate

Critical Thinking

Write 'T' for true and 'F' for false statements.

1. Hand span cannot be used to measure length all over the world. ☐
2. Every measurement involves a number and a unit. ☐
3. The distance between Delhi and Mumbai is expressed in kilometers. ☐
4. Tailors have a small measuring tape to measure the length of the cloth. ☐

Measurement of Mass

Mass is defined as the amount of matter in an object. Some units of mass are : milligrams (mg), grams (g) and kilograms (kg).

✦ 1000 milligrams (mg) = 1 gram (g)

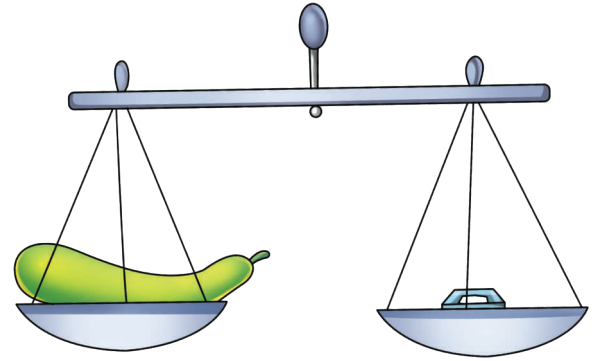
✦ 1000 grams (g) = 1 kilogram (kg)

Small masses are measured in grams while large masses are measured in kilograms. The mass of an object is measured using a weighing balance or weighing machine.

Weight is different from mass. Weight is the measure of the force of gravity on an object. The mass of an object will never change, but the weight of an item can change based on its location. For example, you may weigh 50 kg on Earth, but in outer space you would be weightless as there is no gravity. However, you will always have the same mass on Earth as you have in outer space.

Use of weighing balance

The things are weighed with the help of a balance. Generally this balance is called a **common balance**. We place the weight in one pan and the objects or commodities in the other pan. Vegetable vendors place the vegetables on one plate and put the weights on another plate of the balance to measure the mass of the vegetables in kg or grams.



Balance

Measurement of Capacity

Capacity is defined as the amount of liquid that a container can hold. For instance, the amount of water in a bucket or a bottle is its capacity.

Some units for measuring capacity are litre (L), millilitre (mL), kilolitre (kL)

- ✦ 1000 millilitres (mL) = 1 litre (L)
- ✦ 1000 litres (L) = 1 kilolitre (kL)

Thus, for smaller capacities we use millilitre and litre and for larger capacities we use kilolitre (kL)

A measuring cylinder is used to measure capacity.



Measuring Cylinder

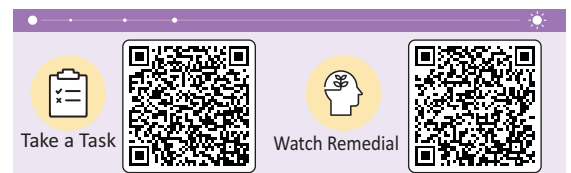
Measurement of Time and Temperature

Measurement of Time

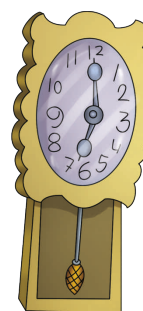
Time is the measurement of period between two actions of events. It is measured using a clock or a watch. Some units to measure time are seconds (s), minute (min) and hour (h) respectively.

- ✦ 60 seconds (s) = 1 minute (min)
- ✦ 60 minutes (min) = 1 hour (h)

Very short durations or periods of time, such as the time taken to blink your eyes or your pulse rate, are measured in seconds. Longer duration such as the time taken to have breakfast or to take bath, are measured in minutes. Even longer durations, such as the duration of a school day or duration of a movie, are measured in hours.



Watch



Wall clock

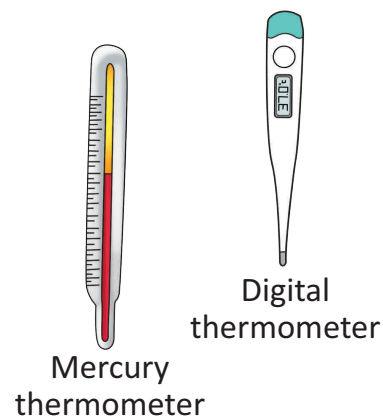


Stop watch

Watches, wall clocks, stopwatches etc. are used to measure time. A clock has three hands – hour, minute and second.

Measurement of Temperature

Temperature tells us how hot or cold an object is. A clinical thermometer is used to measure the temperature of our body when we have fever. The mercury column inside the thermometer moves along the scale printed on the thermometer and indicates the body temperature.



A digital thermometer displays the temperature in digits in a small screen. Normal body temperature is 98.6 degrees Fahrenheit or 37 degrees Celsius.

Check 'N' Mate

Critical Thinking

Fill in the blanks.

1. Weight measures the _____ (force/mass) of gravity on an object.
2. _____ (Time/Temperature) tells us how hot or cold an object is.
3. Time is measured using a _____ (clock/plate).

In a Nutshell

- ✦ Length measures the distance between two points. The units that are used for the measurement of length are kilometre (km), metre (m) and centimetre (cm)
- ✦ Length is measured with a metric ruler, or an inch ruler.
- ✦ Mass is defined as the amount of matter in an object. The standard International System of Units (SI), unit of mass is the kilogram (kg) and grams (g).
- ✦ A beam balance is used to measure mass.
- ✦ Capacity is defined as the amount of liquid that a container can hold. The units for measuring capacity are litre (L), millilitre (mL), kilolitre (kL).
- ✦ A measuring cylinder is used to measure capacity.
- ✦ Time is the measurement of period between two actions of events. It is measured using a clock or a watch. Some units to measure time are second (s), minute (min) and hour (h)
- ✦ Temperature tells us how hot or cold an object is. It is measured in degree Celsius ($^{\circ}\text{C}$) and degree Fahrenheit ($^{\circ}\text{F}$)
- ✦ A thermometer is used to measure temperature.

- Hand span : The measure from the tip of your thumb to the tip of the little finger of a fully opened palm.
- Foot span : The measure from the big toe to the end of the heel.
- Cubit : The measure from your elbow to the tip of your fingers.
- Unit : A fixed quantity used for measuring an unknown quantity.



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EXERCISE

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A. Objective Type Questions

- The amount of matter contained in a body is its:
 - Capacity
 - Mass
 - Length
- Fixed quantity that is used as a standard of measurement :
 - Forearm
 - Unit
 - Stones
- Small masses are measured using:
 - Litre and millilitre
 - Milligram and gram
 - Kilogram and gram
- This is an example of a larger length:
 - A pencil
 - A walking stick
 - Distance from your home to school
- Normal temperature of a human body is:
 - 39°C
 - 98.6 °F
 - 102°F

B Match the following :

Column A

- Length
- Mass
- Capacity
- Time

Column B

- gram/kilogram
- metre/kilometre
- sec/min/hour
- litre/kilolitre

C. Fill in the blanks :

- _____ are the units everyone uses to measure something specific.
- Water in a swimming pool is measured in _____.
- Tailors use _____ to measure the length of cloth.

4. Your _____ remains constant but your weight varies based on its location.
5. Time is the measurement of _____ between two actions or events.

D. Very Short Answer Questions.

Give two examples for each of the following :

1. Measurement used in ancient times _____
2. Devices used to measure length _____
3. Devices used to measure mass _____
4. Devices used to measure capacity _____
5. Devices used to measure time _____

E. Short Answer Questions.

1. How is measurement important in our day to day life?
2. How were things measured and weighed in ancient times?
3. Why do we need to have standard units to measure things?
4. How is weight different from mass?
5. What is temperature? What is used to measure temperature?



F. Long Answer Questions.

1. Define length. What is the relationship between the different units of length?
2. Define mass. What are the different units used to measure mass?
3. What is capacity? Write the different units needed to measure capacity.
4. Define time. What is the relationship between the different units of time?
5. What is temperature? Write the different units used to measure temperature.



Time to Discuss

Pondering and Communicating

Michael and Lily both measure the width of their desk using a straw. Michael found the width of the desk is 4 straw. Lily found that the width of the desk is 6 straw. Explain why Michael and Lily got different measurement.



Time to Create

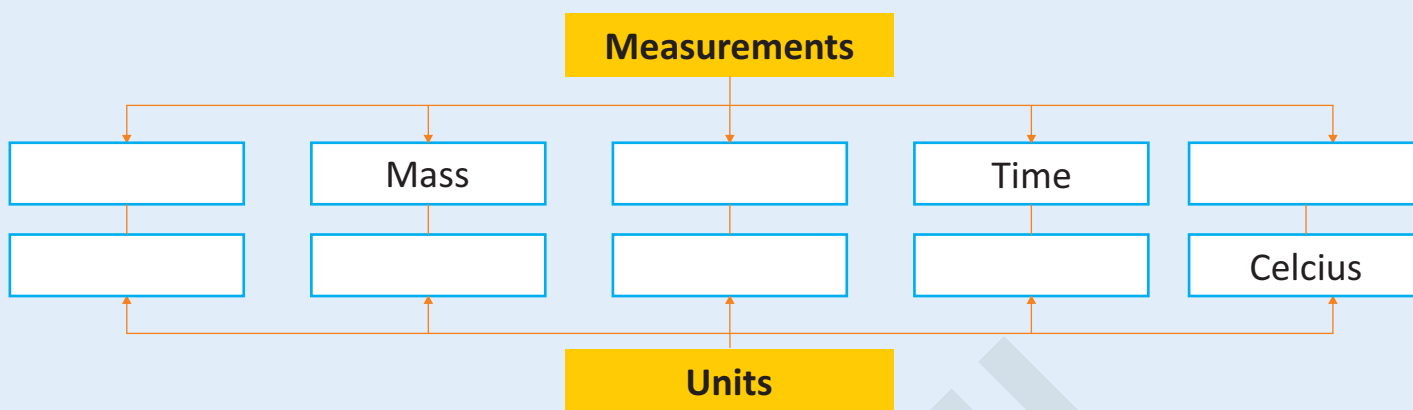
Creating and Collaborating

Tabulate the maximum and minimum temperatures of your city for a month. Now find the hottest and the coldest days in the month.

Time to Recall

Remembering and Analysing

Recall and complete the concept map given below.



Time to Apply

Applying and Creating

1. Alisha has been advised to take a small amount of medicine every day. She needs to measure the syrup with the help of a dropper. Which measure do you think she would use: 5 L, 5 mL, 5 km or 5 m?
2. Manisha asked the shopkeeper for $\frac{1}{2}$ kg of sugar. What could be written for this in grams: 1000g, 550g, 750g or 500g?
3. Four children measured the length of a table which was about 2 m. Each of them used different ways to measure it.
 - a. Reema used her hand span.
 - b. Rishab used his 15 cm long scale from his geometry box.
 - c. Seema used a 5 m long measuring tape.
 - d. Sameer used a half metre long thread.

Which one of them would get the most accurate length? Give reason for your answer.



Time to Observe

Observing, Critical Thinking, Analysing

Karina looks at the thermometer below to see what temperature it is outside.
What temperature is it outside?

