CLASS 6 SCIENCE

CHAPTER 5 – MEASUREMENT OF LENGTH AND MOTION

1. Introduction

Measurement is an important part of our daily life. We measure the length of cloth, height of a person, distance between two places, size of objects, and many other things.

In the chapter, we learn:

- How length is measured
- Why standard units are needed
- Different units of length
- Correct use of a measuring scale
- How to measure curved lines
- Meaning of position and reference point
- Meaning of motion and rest
- Different types of motion

---

2. What is Measurement?

Measurement means finding the size or quantity of something by comparing it with a suitable standard unit.

For example:

If the length of a table is measured as **2 metres**, then:

- **2** → numerical value
- **metre** → unit

Thus, a measurement has two important parts:

Measurement = Number + Unit

Example

A pencil is **15 cm** long.

Here:

- 15 = number
- cm = unit

---

3. Measuring Length Using Body Parts

In earlier times, people often used body parts to measure length.

Some examples are:

- Handspan
- Foot
- Finger width
- Fist
- Arm length
- Stride

In the chapter, the students use their **handspan** to measure a table.

However, different people have different-sized hands, feet and fingers. Therefore, they may obtain different measurements for the same object.

Problem with Body-Based Units

Suppose five students measure the same table using their handspans.

They may get:

- 13 handspans
- Slightly more than 13
- Slightly less than 13
- Between 13 and 14
- 14 handspans

This happens because their handspans are not equal.

Therefore, we need **standard units of measurement**.

---

4. Traditional Indian Units

India has a long history of measurement.

Some traditional units mentioned in ancient Indian literature include:

- **Angula** – approximately the width of a finger
- Multiples of angula
- Dhanusa
- Yojana

Traditional craftspeople such as carpenters and tailors may still use some traditional measurements such as **angula**. Archaeological excavations have also found objects with markings that may have been used as scales.

---

5. Standard Units of Measurement

Different regions once used different systems of measurement. This created confusion when people travelled or traded.

To solve this problem, countries adopted a common system called the:

International System of Units

It is abbreviated as **SI**.

The SI unit of length is:

Metre (m)

A metre scale is divided into smaller units.

Important Units

Unit	Symbol
Kilometre	km
Metre	m
Centimetre	cm
Millimetre	mm

---

6. Units of Length

Kilometre

The **kilometre** is used for measuring large distances.

Examples:

- Distance between two cities
- Length of a long road
- Distance travelled by a vehicle

Conversion

1 km = 1000 m

Metre

The **metre** is the SI unit of length.

It can be used for measuring:

- Height of a person
- Length of a room
- Length of furniture
- Length of a playground

Conversion

1 m = 100 cm

Centimetre

The **centimetre** is useful for measuring smaller objects.

Examples:

- Pencil
- Eraser
- Book
- Notebook

Conversion

1 cm = 10 mm

Millimetre

The **millimetre** is used for very small lengths or thicknesses.

Examples:

- Thickness of a page
- Small dimensions of objects
- Small components

A millimetre is smaller than a centimetre.

1 mm = 0.1 cm

---

7. Important Unit Conversions

Remember these three basic relationships:

⭐ **Important**

1 km = 1000 m

1 m = 100 cm

1 cm = 10 mm

Therefore:

1 m = 1000 mm

---

8. Inch

Some measuring scales also contain markings in **inches**.

The relation given in the chapter is:

1 inch = 2.54 cm

Inches and feet were commonly used in earlier measurement systems and are still used in some situations.

---

9. Choosing the Correct Measuring Instrument

Different objects require different measuring instruments.

Examples

Object/Quantity	**Suitable instrument**
Pencil	15-cm scale
Book	Ruler/scale
Height of a room	Measuring tape/metre scale
Height of a person	Measuring tape
Girth of a tree	Flexible measuring tape
Chest size	Flexible measuring tape
Curved line	Flexible tape or thread

A flexible measuring tape is useful when the object or line is curved.

---

10. Correct Way of Measuring Length

While measuring an object, follow these rules.

Rule 1 – Place the Scale Correctly

The scale should be placed:

- Along the length of the object
- In contact with the object
- Without leaving unnecessary gaps

The scale should not be placed at an angle.

Rule 2 – Keep the Eye in the Correct Position

The eye should be positioned **directly above the point being read**.

This helps avoid an incorrect reading caused by viewing the scale from an angle.

Remember

Eye → directly above the marking being read

---

11. Measuring with a Broken Scale

Sometimes the zero end of a scale may be damaged or unclear.

The scale can still be used.

Method

1. Choose another clear marking, such as **1.0 cm**.
2. Place that marking at one end of the object.
3. Note the reading at the other end.
4. Subtract the starting reading from the final reading.

Example

Starting reading = **1.0 cm**

Ending reading = **10.4 cm**

Therefore:

Length = 10.4 – 1.0

Length = 9.4 cm

Formula

Length of object = Final reading − Initial reading

---

12. Measuring Length for Visually Challenged Students

Students with visual challenges can use scales with **raised markings**.

These markings can be felt by touching them.

This makes measurement possible through touch.

---

13. Measuring a Curved Line

A straight scale cannot easily measure a curved line.

For example:

- Curved edge
- Arch
- Curved part of an object

Two useful methods are:

Method 1 – Flexible Measuring Tape

Place the flexible tape along the curved line and read its length.

Method 2 – Thread

1. Place a thread carefully along the curved line.
2. Mark the two ends.
3. Remove the thread.
4. Straighten it.
5. Measure the thread using a scale.

Thus, the curved length can be determined.

---

14. How to Write a Measurement

Whenever writing a measurement, write:

Number + Unit

For example:

15 cm

2 m

5 km

8 mm

There should be a **space between the number and the unit**.

Correct

15 cm

Incorrect

15cm

Unit symbols such as **km, m, cm and mm** are written in lowercase letters and are not followed by **s** for plural.

---

15. What is a Reference Point?

To describe the position of an object, we need a fixed point for comparison.

This fixed point is called a:

Reference Point

Definition

A fixed object or point with respect to which the distance or position of an object is described is called a **reference point**.

Example

Suppose a person is travelling towards Delhi.

If the distance is described as:

Delhi – 70 km

then **Delhi is the reference point**.

When the person reaches a place where the sign says:

Delhi – 60 km

the distance from Delhi has changed.

---

16. Position

The location of an object with respect to a reference point can be described using distance.

Example

If a kilometre stone says:

Delhi 70 km

the position of the traveller is **70 km from Delhi**.

If the next stone says:

Delhi 60 km

the position is now **60 km from Delhi**.

Therefore, the position changes as the traveller moves.

---

17. What is Motion?

An object is said to be in **motion** when its position changes with time with respect to a reference point.

Definition

An object is in motion if its position changes with respect to a reference point with time.

---

18. What is Rest?

An object is said to be **at rest** when its position does not change with time with respect to a reference point.

Definition

If an object's position does not change with respect to a reference point with time, the object is said to be at rest.

---

19. Motion Depends on the Reference Point

The same object can appear to be at rest with respect to one reference point and in motion with respect to another.

Example: Passenger in a Bus

A passenger sitting inside a moving bus:

- Is **at rest with respect to the bus**
- Is **in motion with respect to a building outside**

Therefore:

Reference point is important when deciding whether an object is moving or at rest.

---

20. Types of Motion

Objects can move in different ways.

The important types discussed in this chapter are:

1. **Linear motion**

2. **Circular motion**
3. **Oscillatory motion**
4. **Periodic motion**

---

21. Linear Motion

When an object moves along a **straight line**, its motion is called:

Linear Motion

Definition

Motion along a straight-line path is called linear motion.

Examples

- A car moving along a straight road
- A box pushed along a straight path
- A person marching in a straight line
- An object falling approximately along a straight path

---

22. Circular Motion

When an object moves along a **circular path**, its motion is called:

Circular Motion

Definition

Motion of an object along a circular path is called circular motion.

Examples

- Merry-go-round
- Rotating wheel
- An object whirled using a thread
- Circular movement of a rotating part

---

23. Oscillatory Motion

When an object moves **to and fro about a fixed position**, its motion is called:

Oscillatory Motion

Definition

To-and-fro motion of an object about a fixed position is called oscillatory motion.

Examples

- Swing
- Vibrating metal strip
- To-and-fro movement of a pendulum-like object

---

24. Periodic Motion

If an object repeats its path or motion after a **fixed interval of time**, its motion is called:

Periodic Motion

Definition

Motion that repeats after a fixed interval of time is called periodic motion.

Circular and oscillatory motions can be periodic when they repeat regularly.

---

25. Difference Between Types of Motion

Type	Meaning	Example
Linear	Motion along a straight line	Car on a straight road
Circular	Motion along a circular path	Merry-go-round
Oscillatory	To-and-fro motion about a fixed position	Swing
Periodic	Motion repeating after a fixed time interval	Repeated swing motion

---

26. Important Difference: Motion and Rest

Motion	Rest
Position changes with time	Position does not change with time
Depends on a reference point	Depends on a reference point
Example: moving car	Example: parked car

---

27. Important Difference: Standard and Non-Standard Units

Standard Unit	Non-standard Unit
Metre	Handspan
Centimetre	Foot
Millimetre	Finger width
Kilometre	Arm length
Same value for the same length	May vary from person to person

---

28. Why Are Standard Units Necessary?

Standard units are necessary because:

1. Different people may have different body measurements.
2. Non-standard units can produce different results.
3. Standard units give consistent measurements.
4. They make communication easier.
5. They reduce confusion between different regions.

---

29. Important Formulae and Conversions

Length conversions

1 km = 1000 m

1 m = 100 cm

1 cm = 10 mm

Therefore:

1 m = 1000 mm

Broken scale

Object length = Final reading − Initial reading

Example

Final reading = 15 cm
Initial reading = 2 cm

Length:

15 − 2 = 13 cm

---

30. Key Terms

Measurement

Finding the size or quantity of something by comparing it with a unit.

Unit

A fixed standard used for expressing a measurement.

SI Unit

An internationally accepted standard unit in the International System of Units.

Metre

The SI unit of length.

Reference Point

A fixed point used to describe the position of an object.

Motion

Change in position with respect to a reference point with time.

Rest

No change in position with respect to a reference point with time.

Linear Motion

Motion along a straight line.

Circular Motion

Motion along a circular path.

Oscillatory Motion

To-and-fro motion about a fixed position.

Periodic Motion

Motion that repeats after a fixed interval of time.

---

31. Important Points for Revision ⭐

- Measurement consists of a **number and a unit**.
- Body parts such as handspan and foot are not reliable standard units.
- The SI unit of length is **metre (m)**.
- **1 km = 1000 m**.

- **1 m = 100 cm**.
- **1 cm = 10 mm**.
- **1 inch = 2.54 cm**.
- A suitable measuring instrument should be selected according to the object.
- A scale should be placed along the length of the object.
- The eye should be directly above the marking being read.
- A broken scale can still be used by taking the difference between two readings.
- Curved lines can be measured using flexible tape or thread.
- Always write the unit with the numerical value.
- A fixed point used to describe position is called a **reference point**.
- Motion is determined with respect to a reference point.
- Straight-line motion is **linear motion**.
- Circular-path motion is **circular motion**.
- To-and-fro motion is **oscillatory motion**.
- Repeated motion after a fixed time interval is **periodic motion**.

---

32. Important Questions and Answers

Q1. Why are standard units required?

Answer: Standard units are required because measurements using body parts such as handspan, foot or finger width can differ from person to person. Standard units provide consistent measurements.

Q2. What is the SI unit of length?

Answer: The SI unit of length is **metre (m)**.

Q3. Write three important conversions of length.

Answer:

- 1 km = 1000 m
- 1 m = 100 cm
- 1 cm = 10 mm

Q4. What is a reference point?

Answer: A fixed object or point with respect to which the position or distance of another object is described is called a reference point.

Q5. What is motion?

Answer: An object is said to be in motion when its position changes with respect to a reference point with time.

Q6. What is rest?

Answer: An object is said to be at rest when its position does not change with respect to a reference point with time.

Q7. What is linear motion?

Answer: Motion along a straight line is called linear motion.

Q8. What is circular motion?

Answer: Motion along a circular path is called circular motion.

Q9. What is oscillatory motion?

Answer: To-and-fro motion of an object about a fixed position is called oscillatory motion.

Q10. What is periodic motion?

Answer: Motion that repeats after a fixed interval of time is called periodic motion.

---

33. Exercise-Based Answers

Q1. Match the suitable units

Length	Suitable unit
Distance between Delhi and Lucknow	Kilometre
Thickness of a coin	Millimetre
Length of an eraser	Centimetre
Length of school ground	Metre

Q2. True or False

(i) The motion of a car moving on a straight road is an example of linear motion.

✅ **True**

(ii) An object changing its position with respect to a reference point with time is in motion.

✅ **True**

(iii) 1 km = 100 cm.

❌ **False**

Correct relation:

1 km = 1000 m

Q3. Which is NOT a standard unit?

Options:

- millimetre
- centimetre
- kilometre
- handspan

Answer: Handspan

Handspan is a non-standard body-based unit.

Q4. School-to-home distance = 1.5 km

Convert into metres.

We know:

1 km = 1000 m

Therefore:

1.5 × 1000 = 1500 m

Answer: 1500 m

---

34. Examples of Different Types of Motion

Linear Motion

1. Car moving on a straight road
2. Box pushed along a straight path

Circular Motion

1. Merry-go-round
2. Rotating wheel

Oscillatory Motion

1. Swing

2. Vibrating strip

---

35. Activities – What We Learn

Activity 1: Measuring with a Handspan

Observation: Different students get different measurements.

Reason: Their handspans have different lengths.

Conclusion: Standard units are needed.

Activity 2: Observing Motion

Observe objects around you and classify them as moving or at rest.

Conclusion: Motion or rest is determined by observing whether the object's position changes with respect to a reference point.

Activity 3: Dropping an Object

Drop an eraser and observe its path.

Purpose: To investigate whether its motion follows a straight path.

Activity 4: Whirling an Object

Tie an object to a thread and whirl it.

Conclusion: The object follows a circular path, showing circular motion.

Activity 5: Swinging an Object

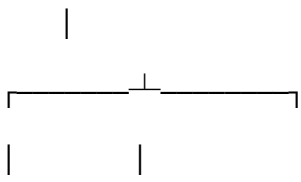
Move a hanging object to one side and release it.

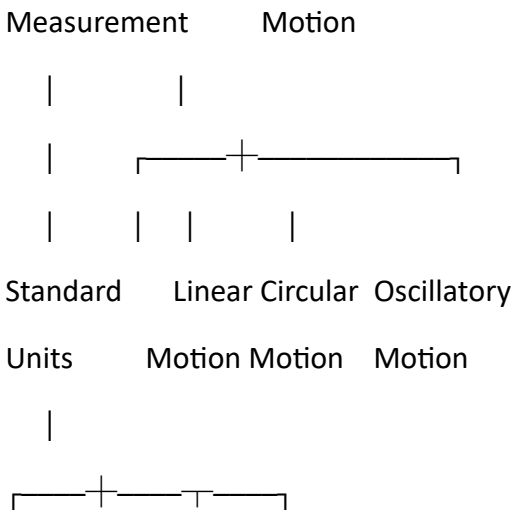
Conclusion: Its to-and-fro movement is oscillatory motion.

---

36. Quick Revision Chart

MEASUREMENT OF LENGTH AND MOTION





---

37. One-Minute Revision

Remember:

SI unit of length → metre (m)

Large distance → kilometre (km)

Small length → centimetre (cm)

Very small length → millimetre (mm)

1 km → 1000 m

1 m → 100 cm

1 cm → 10 mm

Fixed point → Reference point

Straight path → Linear motion

Circular path → Circular motion

To-and-fro → Oscillatory motion

Repeats after fixed time → Periodic motion

---

38. Exam Practice Questions

Very Short Answer

1. What is the SI unit of length?
2. What is a reference point?
3. Define motion.

4. Define rest.
5. What is linear motion?
6. What is circular motion?
7. What is oscillatory motion?
8. What is periodic motion?
9. How many metres are there in 1 km?
10. How many millimetres are there in 1 cm?

Short Answer

1. Why can handspan not be used as a standard unit?
2. Why are standard units important?
3. Explain the correct method of measuring length.
4. How can a broken scale be used?
5. How can the length of a curved line be measured?
6. Explain the importance of a reference point.
7. Explain motion and rest with an example.
8. Differentiate between linear and circular motion.
9. Differentiate between circular and oscillatory motion.
10. Why does a passenger inside a moving bus appear to be at rest?

Numerical Practice

1. Convert 3 km into metres.
2. Convert 250 cm into metres.
3. Convert 5 m into centimetres.
4. Convert 7 cm into millimetres.
5. A scale reading changes from 2.5 cm to 14.5 cm. Find the length of the object.
6. Convert 1.5 km into metres.

---

39. Chapter Summary

This chapter teaches us how to **measure length accurately** and how to understand **motion**.

We learned that body-based measurements such as handspan can differ from person to person, so standard units are necessary. The SI unit of length is **metre**. Other commonly used units are kilometre, centimetre and millimetre.

We also learned the correct method of using a scale, how to measure using a broken scale, and how to measure curved lines using a flexible tape or thread.

For describing the position of an object, we use a **reference point**. An object's motion or rest depends on whether its position changes with respect to that reference point.

Finally, we studied **linear, circular, oscillatory and periodic motion**.

⭐ **MOST IMPORTANT FORMULAS**

1 km = 1000 m

1 m = 100 cm

1 cm = 10 mm

1 inch = 2.54 cm

Length = Final reading − Initial reading

These are the key points to remember from **Chapter 5 – Measurement of Length and Motion**.