Chapter 5: Measurement of Length and Motion

Exercises — Let Us Enhance Our Learning

Q1 Some lengths are given in Column I of Table 5.5. Some units are given in Column II. Match the lengths with the units suitable for measuring those lengths.

Column I:
(a) Distance between Delhi and Lucknow
(b) Thickness of a coin
(c) Length of an eraser
(d) Length of school ground

Column II:
(i) centimetre
(ii) kilometre
(iii) metre
(iv) millimetre

SOLUTION

The SI units of length are kilometre (km), metre (m), centimetre (cm), and millimetre (mm), chosen based on the size of what is being measured.

(a) Distance between Delhi and Lucknow — this is a very large distance (hundreds of kilometres). The suitable unit is kilometre (km).

(b) Thickness of a coin — a coin is very thin, much less than 1 cm. The suitable unit is millimetre (mm).

(c) Length of an eraser — an eraser is a small object, typically a few centimetres long. The suitable unit is centimetre (cm).

(d) Length of school ground — a school ground spans tens of metres. The suitable unit is metre (m).

Answer: (a) → kilometre, (b) → millimetre, (c) → centimetre, (d) → metre.

Q2 Read the following statements and mark True (T) or False (F) against each.
(i) The motion of a car moving on a straight road is an example of linear motion.
(ii) Any object which is changing its position with respect to a reference point with time is said to be in motion.
(iii) 1 km = 100 cm

SOLUTION

(i) Linear motion is defined as motion along a straight line. A car moving on a straight road moves in a straight line — this is the definition of linear motion. → True.

(ii) The chapter states: 'An object is said to be in motion if its position changes with respect to the reference point with time.' This matches the statement exactly. → True.

(iii) From the chapter: 1 km = 1000 m and 1 m = 100 cm, so 1 km = 1000 × 100 cm = 1,00,000 cm. The statement claims 1 km = 100 cm, which is incorrect. → False.

Answer: (i) True, (ii) True, (iii) False.

Q3 Which of the following is not a standard unit of measuring length?
(i) millimetre (ii) centimetre (iii) kilometre (iv) handspan

SOLUTION

The chapter explains that standard units are part of the International System of Units (SI units), so that measurements by different people do not differ.

Millimetre (mm), centimetre (cm), and kilometre (km) are all SI-recognised units of length.

A handspan is a body-part measurement. The chapter specifically explains that handspans differ from person to person and are therefore not standard units.

Hence, handspan is not a standard unit of measuring length.

Answer: (iv) handspan — it varies from person to person and is not an SI unit.

Q4 Search for the different scales or measuring tapes at your home and school. Find out the smallest value that can be measured using each of these scales. Record your observations in a tabular form.

SOLUTION

This is an observation-based activity. Below is a model answer.

A 15-cm ruler (school scale): The smallest division is 1 mm, so the smallest measurable length is 1 mm.

A 30-cm ruler (geometry scale): Smallest division is usually 1 mm; smallest measurable length = 1 mm.

A tailor's flexible measuring tape: Smallest division is usually 1 mm; smallest measurable length = 1 mm.

A metre scale (wooden/metal): Smallest division is 1 mm; smallest measurable length = 1 mm.

Record these in a table with columns: Name of scale, Smallest value measurable.

The key point from the chapter is that 1 mm is the smallest value measurable with a standard scale.

Answer: Most common scales (rulers, measuring tapes, metre scales) have 1 mm as their smallest measurable value.

Q5 Suppose the distance between your school and home is 1.5 km. Express it in metres.

SOLUTION

From the chapter: 1 km = 1000 m.

Distance = 1.5 km.

Converting: 1.5 km = 1.5 × 1000 m = 1500 m.

Answer: 1.5 km = 1500 m.

Q6 Take a tumbler or a bottle. Measure the length of the curved part of the base of glass or bottle and record it.

SOLUTION

This is a hands-on measurement activity.

The base of a tumbler or bottle is curved, so a rigid ruler cannot measure it directly.

Method (from Section 5.4 of the chapter): Use a flexible measuring tape or a thread. Wrap the thread along the curved part of the base. Mark where the thread meets its starting point. Straighten the thread and measure its length using a metre scale.

Record the result with the unit (e.g., 'The length of the curved base = ___ cm'). Always write both the number and the unit in your result.

Answer: Use a thread or flexible tape to measure the curved base; straighten the thread against a scale to read the length. Record result with unit (e.g., 24 cm).

Q7 Measure the height of your friend and express it in (i) metres (ii) centimetres and (iii) millimetres.

SOLUTION

This is a measurement and conversion activity.

Step 1: Measure your friend's height using a metre scale or measuring tape. Suppose the measured height is 1.4 m (model value).

(i) In metres: 1.4 m.

(ii) In centimetres: 1 m = 100 cm, so 1.4 m = 1.4 × 100 = 140 cm.

(iii) In millimetres: 1 cm = 10 mm, so 140 cm = 140 × 10 = 1400 mm.

Use your actual measured value and apply the same conversions: multiply by 100 for cm, multiply by 1000 for mm.

Answer: Example for height = 1.4 m: (i) 1.4 m, (ii) 140 cm, (iii) 1400 mm. Apply the same conversions to your actual measurement.

Q8 You are given a coin. Estimate how many coins are required to be placed one after the other lengthwise, without leaving any gap between them, to cover the whole length of the chosen side of a notebook. Verify your estimate by measuring the same side of the notebook and the size of the coin using a 15-cm scale.

SOLUTION

This is an estimation and verification activity.

Step 1 — Estimate: Look at the notebook side and the coin. Mentally picture how many coins would fit end to end along that side. Write down your estimate.

Step 2 — Measure: Use a 15-cm scale to measure (a) the length of the chosen side of the notebook, and (b) the diameter (length) of the coin.

Step 3 — Calculate: Number of coins needed = Length of notebook side ÷ Length

(diameter) of coin.

Example: If the notebook side is 28 cm and the coin diameter is 2.5 cm, then coins needed = 28 ÷ 2.5 = 11.2, so approximately 11–12 coins.

Step 4 — Compare your estimate with the calculated answer and discuss any difference.

Answer: Measure the notebook side and coin diameter using the scale, then divide: Number of coins = notebook length ÷ coin diameter. Compare with your estimate.

Q9 Give two examples each for linear, circular and oscillatory motion.

SOLUTION

Linear motion (motion along a straight line):

1. A car moving on a straight road.
2. A ball falling straight down after being dropped.

Circular motion (motion along a circular path):

1. A stone tied to a thread and whirled in a circle.
2. A merry-go-round moving in a circle.

Oscillatory motion (to-and-fro motion about a fixed position):

1. A swing moving to and fro.
2. A pendulum moving to and fro about its rest position.

Answer: Linear: (1) car on a straight road, (2) dropped object falling straight down. Circular: (1) stone whirled on a thread, (2) merry-go-round. Oscillatory: (1) swing, (2) pendulum.

Q10 Observe different objects around you. It is easier to express the lengths of some objects in mm, some in cm and some in m. Make a list of three objects in each category and enter them in Table 5.6.

SOLUTION

This is an observation activity. A model answer is given below.

Objects best measured in mm (very small objects):

1. Thickness of a coin (~2 mm)
2. Width of a pencil lead (~0.5–1 mm)
3. Thickness of a glass pane (~4 mm)

Objects best measured in cm (small to medium objects):

1. Length of an eraser (~5 cm)

2. Length of a pencil (~17 cm)
3. Width of a book (~14 cm)

Objects best measured in m (large objects):

1. Height of a door (~2 m)
2. Length of a classroom (~8 m)
3. Height of a table (~0.75 m)

Answer: mm: thickness of a coin, pencil lead width, glass pane thickness. cm: eraser length, pencil length, book width. m: door height, classroom length, table height.

Q11 A rollercoaster track is made in the shape shown in Fig. 5.19. A ball starts from point A and escapes through point F. Identify the types of motion of the ball on the rollercoaster and corresponding portions of the track.

SOLUTION

Trace the ball's path from A to F and note the shape of the track in each part.

A to B — the ball rolls down a straight, sloping ramp. Motion along a straight line is linear motion.

B to E — the track curves into a loop and the ball goes all the way around it (through the bottom at C and the top at D before coming back to E). Motion along a circular path is circular motion.

E to F — the ball comes out of the loop and moves along a straight, horizontal rail. This is again linear motion.

Answer: A to B: linear motion (straight sloping ramp). B to E: circular motion (the loop, passing C at the bottom and D at the top). E to F: linear motion (straight horizontal rail).

Q12 Tasneem wants to make a metre scale by herself. She considers the following materials for it — plywood, paper, cloth, stretchable rubber and steel. Which of these should she not use and why?

SOLUTION

A metre scale must be rigid and must not stretch, shrink, or bend, so that measurements remain accurate and consistent.

Paper: Too flimsy and can get wet, crumple, or tear easily. It cannot give accurate measurements. Should NOT be used.

Cloth: Cloth is flexible and can stretch or sag, giving inconsistent readings. Should NOT be used.
Stretchable rubber: Rubber stretches when pulled, so the scale markings would shift. Measurements would not be accurate. Should NOT be used.
Plywood: Rigid and stable; can be used to make a scale. Acceptable material.
Steel: Rigid, stable, and durable; commonly used for scales. Acceptable material.
The chapter also mentions that flexible measuring tapes are used for curved surfaces, not for standard length measurement with a rigid scale.

Answer: Tasneem should NOT use paper, cloth, or stretchable rubber — these bend, tear, or stretch and give inaccurate readings. Plywood and steel are rigid and suitable.

Q13 Think, design and develop a card game on conversion of units of length to play with your friends.

SOLUTION

This is an open-ended creative activity. Here is a model design.
Game name: 'Unit Swap'
Materials: A set of cards. Each card has a length written on it (e.g., '2 km', '500 cm', '25 mm', '3 m').
How to play:
1. Shuffle all cards and deal 5 to each player.
2. Place a 'target unit' card in the centre (e.g., 'Convert to cm').
3. Each player picks a card from their hand and converts the length on it to the target unit, writing the answer on a sheet.
4. The player with the largest converted value wins that round and takes all cards played.
5. The player with the most cards at the end wins.
Conversions used (from the chapter): 1 km = 1000 m; 1 m = 100 cm; 1 cm = 10 mm.
Variation: Make 'Match' cards — one card shows '1.5 km' and the matching card shows '1500 m'. Players try to find matching pairs.

Answer: Design 'Unit Swap': players convert lengths to a target unit using 1 km = 1000 m, 1 m = 100 cm, 1 cm = 10 mm; highest converted value wins each round. Or make matching pairs (e.g., '1.5 km' ↔ '1500 m').