1. What is your opinion on the child's question about measurement?

Answer: The child's question highlights the curiosity about why we need to measure things in daily life. My opinion is that measurement is essential to make sense of the world around us. It helps us quantify properties like length, mass, or time, ensuring accuracy in tasks such as building, cooking, or traveling. For example, measuring the length of a cloth ensures a tailor makes a perfectly fitting dress, and measuring time in a race determines the winner. Without measurements, our activities would lack precision, leading to confusion and errors.

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2. Find the physical quantities in the given situations and record them in the table.

Situation	Physical Quantity
Measuring the depth of a pit	Length
Measuring the weight of vegetables	Mass
Taking measurements by a tailor	Length
Using a stopwatch in a race	Time
Measuring blood pressure	Pressure
Measuring body heat	Temperature

Explanation: Each situation involves a measurable property. Length is used for distances (e.g., pit depth, tailor's measurements), mass for weight (e.g., vegetables), time for duration (e.g., race), pressure for blood pressure, and temperature for body heat.

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3. Find and write more physical quantities you are familiar with.

Answer: Additional physical quantities include:

- Area (e.g., surface of a wall for painting)
- Volume (e.g., amount of liquid in a container)
- Density (e.g., mass per unit volume of a substance)
- Speed (e.g., rate of motion of a vehicle)
- Force (e.g., pushing or pulling an object)
- Energy (e.g., work done in moving an object)

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4. Can all physical quantities be measured directly? If not, how are they expressed?

Answer: Not all physical quantities can be measured directly. Fundamental quantities like length, mass, and time can be measured directly using tools like a ruler, weighing scale, or stopwatch.

However, derived quantities like area, volume, and density are measured indirectly by calculating them using fundamental quantities. For example:

- **Area** = Length × Breadth
- **Volume** = Length × Breadth × Height
- **Density** = Mass ÷ Volume

These derived quantities depend on measurements of fundamental quantities to compute their values.

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5. What is a fundamental quantity?

Answer: A fundamental quantity is a physical quantity that exists independently and cannot be expressed in terms of other quantities. The seven fundamental quantities are length, mass, time, electric current, temperature, amount of substance, and luminous intensity.

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6. List the physical quantities from Table 1.1 that are fundamental.

Answer: From Table 1.1, the fundamental quantities are:

- Length
- Mass
- Time
- Temperature

Explanation: Pressure is a derived quantity (Force ÷ Area), so it is not fundamental.

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7. Do we use fundamental quantities only in daily life? Identify physical quantities in the given situations (e.g., painting a wall, measuring medicine).

Answer: No, we use both fundamental and derived quantities in daily life. The physical quantities in the given situations are:

- **Painting a wall**: Area (derived quantity)
- **Measuring medicine/liquid**: Volume (derived quantity)

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8. Complete the table for how area and volume are found.

Situation	**Physical Quantity**	**Method of Finding**
For painting the wall	Area	Area = Length × Breadth

Measurement of medicine/liquid	Volume	Volume = Length × Breadth × Height (or water displacement for irregular objects)

Explanation: Area is calculated by multiplying length and breadth, both fundamental quantities. Volume can be calculated as Length × Breadth × Height for regular shapes or by water displacement for irregular objects like a stone.

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9. Which quantities are used to find area and volume? Are they all distances between two positions?

Answer:

- **Quantities used**:
  - Area: Length and Breadth
  - Volume: Length, Breadth, and Height
- **Are they distances?**: Yes, length, breadth, and height are all distances between two positions, measured as the fundamental quantity of length.

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10. Write a definition for derived quantities.

Answer: Derived quantities are physical quantities that can be expressed in terms of fundamental quantities through mathematical operations. For example, area (Length × Breadth) and density (Mass ÷ Volume) are derived quantities.

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11. Complete the table for physical quantities, numerical values, and units from the given figures.

Situation	Physical Quantity	Numerical Value	Unit	Mode of Marking Measurements
Fig. 1.12	Temperature	37.8	Celsius	37.8°C
Fig. 1.13	Mass	14.2	Kilogram	14.2 kg
Fig. 1.14	Length	1.5	Metre	1.5 m

Explanation: The chapter provides the example of temperature (37.8°C). For Fig. 1.13, a gas cylinder's mass is 14.2 kg. For Fig. 1.14, a typical length measurement (e.g., a cloth) is assumed as 1.5 m, with the unit in metres.

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12. What can be understood from the table above?

Answer: A physical quantity is expressed by a numerical value indicating its magnitude followed by its unit. For example, 37.8°C represents temperature with a value of 37.8 and unit Celsius, ensuring clarity and standardization in measurements.

13. Record the measurements of a child's height using two sticks of different lengths in the Science Diary.

Activity	Physical Quantity	Reference Object Used for Measurement	Recorded Quantity
Measuring the height of the child	Length	Longer stick (e.g., 50 cm)	3 sticks = 150 cm
Measuring the height of the child	Length	Shorter stick (e.g., 25 cm)	6 sticks = 150 cm

Explanation: The height of the child (assumed as 150 cm) is measured using sticks of different lengths. The longer stick requires fewer units, while the shorter stick requires more, but the final measurement remains the same when converted to centimetres.

14. Measure the volume of water in a bucket using two glasses of different sizes and tabulate the results.

Activity	Physical Quantity	Reference Object Used for Measurement	Recorded Quantity
Measuring the quantity of water	Volume	Larger glass (e.g., 500 mL)	4 glasses = 2000 mL
Measuring the quantity of water	Volume	Smaller glass (e.g., 250 mL)	8 glasses = 2000 mL

Explanation: The volume of water (assumed as 2000 mL) is measured using glasses of different sizes. The larger glass requires fewer units, while the smaller glass requires more, but the total volume remains consistent.

15. Analyze the table from the above activities. Are the measurements the same? Why or why not?

Answer:

- **Are the measurements the same?**: Yes, the measurements are the same when converted to standard units (e.g., 150 cm for height, 2000 mL for volume).
- **Why or why not?**: The measurements differ in terms of the number of sticks or glasses because the reference objects (sticks or glasses) have different sizes. However, when converted to standard units (cm or mL), the measurements are equal because they represent the same physical quantity.

- **Why use a fixed reference?**: Using a fixed reference (e.g., metre or litre) ensures measurements are consistent worldwide, avoiding confusion caused by varying reference objects.

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16. What are the practical problems of using traditional units like foot, cubit, and hand span?

Answer:

- **Low accuracy**: Traditional units vary between individuals (e.g., one person's cubit differs from another's).
- **Difficulty in analysis**: Measurements using traditional units are hard for people in other regions to understand, leading to confusion in trade or construction.

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17. Complete the relationships for units of length.

Answer:

- 1 metre = **100 centimetres**
- 1 centimetre = **10 millimetres**
- 1 metre = **1000 millimetres**

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18. What is the measurement mentioned in the municipality notice about plastic bags?

Answer: The measurement is **30 micrometres** (μm), referring to the minimum thickness of plastic bags allowed.

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19. How many micrometres make one metre?

Answer: 1 metre = **1,000,000 micrometres**.

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20. What is the abbreviation "km" on a traffic sign, and how many metres is it?

Answer:

- **Abbreviation**: Kilometre
- **Relationship**: 1 kilometre = **1000 metres**

---

21. Discuss situations where units like Astronomical Unit (AU) and light year are used.

Answer:

- **Astronomical Unit (AU)**: Used to measure distances within the solar system, such as the average distance from Earth to the Sun (approximately 150 million km). For example, the distance to Mars is often expressed in AU for simplicity.
- **Light Year**: Used to measure vast distances in space, such as between stars or galaxies. It represents the distance light travels in one year (approximately 9.46×10^{12} km). For instance, the distance to Proxima Centauri is about 4.24 light years.

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22. Why are weight blocks placed on one side of a scale when weighing apples?

Answer: Weight blocks are placed on one side of the scale to balance the mass of the apples on the other side, ensuring the apples' mass equals the known mass of the blocks, allowing accurate measurement.

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23. What does the quantity printed on toothpaste or tablet packages mean?

Answer: The quantity printed (e.g., 50 g or 100 mg) represents the mass of the toothpaste or tablet, indicating the amount of substance in the package, measured in grams or milligrams.

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24. Identify the relationship between units of mass and kilogram.

Unit	Relation to Kilograms
Milligram	1 kilogram = 1,000,000 milligrams
Gram	1 kilogram = 1000 grams
Quintal	1 quintal = 100 kilograms
Tonne	1 tonne = 1000 kilograms

---

25. Identify the relationship between units of time and second.

Unit	Relationship with Second
Minute	1 minute = 60 seconds
Hour	1 hour = 3600 seconds

---

26. Complete the relationship between units of volume.

Answer:

- 1 litre = **1000 cm^3**

- 1 litre = **1000 millilitres**

---

27. Calculate and tabulate the mass, volume, and density of sawdust and sand in a cardboard box.

Substance	Mass	Volume	Mass ÷ Volume (Density)
Sawdust	2 kg	0.04 m^3	2 ÷ 0.04 = 50 kg/m^3
Sand	4 kg	0.04 m^3	4 ÷ 0.04 = 100 kg/m^3

Explanation: Assume a box with dimensions 0.5 m × 0.4 m × 0.2 m (volume = 0.04 m^3). The mass of sawdust is assumed as 2 kg and sand as 4 kg based on typical values. Density is calculated as Mass ÷ Volume.

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28. What are the characteristics of SI units?

Answer:

- They are standardized units, ensuring consistency.
- They are internationally accepted, used worldwide.
- Units of all other quantities can be expressed in terms of these units.

---

29. Complete the table for derived units.

Derived Quantity	Equation	Unit
Area	Area = Length × Breadth	m × m = m^2
Volume	Volume = Length × Breadth × Height	m × m × m = m^3
Density	Density = Mass ÷ Volume	kg ÷ m^3 = kg/m^3

---

30. Define derived units.

Answer: Derived units are units of derived quantities that are expressed using fundamental units through mathematical operations, such as m^2 for area or kg/m^3 for density.

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31. Compare incorrect unit notations with correct ones and suggest general rules.

Unit Written Incorrectly	General Rules
1000 KG/M^3, 1.5 KG	Use lowercase for unit symbols (kg, m).

1000 kgs/m³, 1.5 kgs	Do not use plurals for unit symbols.
1000 kg/m³, 1.5 kg	Correct notation; no plural or uppercase errors.
1000 kg/m/m/m	Use a single division symbol (/) for derived units (e.g., kg/m³).
1000 kg/cubic metre, 1000 kilogram per m³	Do not mix unit symbols with names; use kg/m³.
1 kg 500 g	Use a single unit (e.g., 1.5 kg or 1500 g).
273 Kelvin, 250 Metre	Use lowercase for unit names (kelvin, metre) unless named after a person (e.g., Kelvin).

32. Identify correct and incorrect methods for writing units and state the rule.

Physical Quantity	Correct Method	Incorrect Method	Rule
Force	N	n	Symbols of units named after individuals use uppercase (e.g., N for Newton).
Length	60 cm is the length of the desk.	60 cm. is the length of the desk.	No full stop or comma after the symbol unless at the end of a sentence.
Length	The length of the desk is 60 cm.	The length of the desk is 60 cm	Correct; full stop is at the end of the sentence.
Energy	N.m or N m	Nm	Use a space or dot between units in compound units.

33. Measure the length of a pen and your height, and identify the units and least count.

Measurement	Value	Unit	Least Count
Length of the pen	15 cm	cm	0.1 cm (1 mm)
Your height	150 cm	cm	0.1 cm (1 mm)

Explanation: A typical pen length is around 15 cm, and a student's height is assumed as 150 cm. The least count of a standard scale or measuring tape is 0.1 cm.

34. Are there instruments with a least count smaller than 0.1 cm?

Answer: Yes, instruments like vernier callipers and micrometres have smaller least counts (e.g., 0.01 cm for vernier callipers, 0.001 cm for micrometres).

35. Measure the thickness of a paper stack and calculate the thickness of one paper.

Measurement	Value
Number of papers in the stack	50
Thickness of the paper stack	5 mm
Thickness of one paper	5 mm ÷ 50 = 0.1 mm

Explanation: A stack of 50 papers with a total thickness of 5 mm gives a per-paper thickness of 0.1 mm.

36. Measure the volume of a stone using a measuring jar.

Measurement	Value
Unit used	Millilitre (mL)
Least count	1 mL
Initial water level	100 mL
Water level after dipping the stone	150 mL
Volume of the stone	150 mL - 100 mL = 50 mL (or 0.00005 m^3)

Explanation: The volume is calculated by water displacement, where the rise in water level equals the stone's volume.

37. Measure the time for 10 oscillations using a stopwatch.

Answer: Time required for 10 oscillations = **20 seconds**.

Explanation: Assuming a typical pendulum, 10 oscillations might take 20 seconds, giving a period of 2 seconds per oscillation, as a reasonable estimate.

Let's Assess Questions

1. Identify the odd one out and explain common features.

I. a) Kilogram, b) Kilometre, c) Second, d) Mole

- **Odd One Out**: Kilometre
- **Explanation**: Kilogram, Second, and Mole are SI units of fundamental quantities (mass, time, amount of substance). Kilometre is a derived unit of length (1000 metres).

II. a) Time, b) Area, c) Mass, d) Electric current

- **Odd One Out**: Area
- **Explanation**: Time, Mass, and Electric Current are fundamental quantities. Area is a derived quantity (Length × Breadth).

III. a) Metre, b) Kilogram, c) Second, d) Degree Celsius

- **Odd One Out**: Degree Celsius
- **Explanation**: Metre, Kilogram, and Second are SI units of fundamental quantities (length, mass, time). Degree Celsius is not an SI unit; the SI unit for temperature is Kelvin.

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2. Fill in the table for units of length.

Unit	Relationship with Metre
Kilometre	1 km = 1000 metres
Millimetre	1 m = 1000 millimetres
Centimetre	1 m = 100 centimetres

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3. Convert the following measurements to SI units.

- **a) 2000 g**: 2000 g = 2000 ÷ 1000 kg = **2 kg**
- **b) 1 h**: 1 h = 1 × 3600 s = **3600 s**
- **c) 1.5 km**: 1.5 km = 1.5 × 1000 m = **1500 m**
- **d) 200 cm**: 200 cm = 200 ÷ 100 m = **2 m**

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4. Arrange units of mass in ascending order.

- **Units**: Kilogram, Milligram, Quintal, Gram
- **Answer**: Milligram, Gram, Kilogram, Quintal

Explanation:

- 1 milligram = 0.001 g
- 1 gram = 0.001 kg
- 1 kilogram = 0.01 quintal
- Quintal is larger than kilogram but smaller than tonne (not listed).

Extended Activities

1. Identify different units used in our locality for measuring length and mass in the past.

Answer:

- **Length**:
  - **Cubit**: Distance from elbow to fingertip, varying between individuals.
  - **Hand Span**: Distance across an open hand, inconsistent due to hand size.
  - **Foot**: Length of a person's foot, varying by individual.
- **Mass**:
  - **Seer**: A traditional unit, approximately 0.933 kg.
  - **Maund**: Equal to 40 seers, approximately 37.32 kg.
- **Limitations**: These units lacked standardization, varied by region and person, and were less accurate than SI units.

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2. Prepare a seminar paper on the rules to be followed when writing units.

Title: Rules for Writing SI Units

Content: The International System of Units (SI) ensures standardized and consistent measurements worldwide. To write units correctly, the following rules must be followed:

1. **Lowercase for Symbols**: Unit symbols like kg (kilogram) and m (metre) are written in lowercase, except for units named after individuals, like N (Newton) or K (Kelvin). For example, 1000 KG is incorrect; use 1000 kg.
2. **No Plurals for Symbols**: Unit symbols do not take plural forms. Writing 1.5 kgs is wrong; use 1.5 kg.
3. **No Mixing Symbols and Names**: Use either the symbol (kg/m^3) or the full name (kilogram per cubic metre), not a mix like kg/cubic metre.
4. **Single Unit Usage**: Avoid combining units, such as 1 kg 500 g; use 1.5 kg or 1500 g.
5. **No Punctuation After Symbols**: Do not place a full stop or comma after a symbol unless it ends a sentence. For example, 60 cm is correct, but 60 cm. is wrong unless it's the end of a sentence.
6. **Uppercase for Namesake Units**: Symbols for units named after people, like Newton (N) or Kelvin (K), use uppercase, but their names are lowercase (newton, kelvin).
7. **Compound Units**: Use a space or dot for compound units, like N.m or N m for energy, not Nm. These rules ensure clarity and universality in scientific communication, preventing errors in fields like engineering, medicine, and education.