Chapter 1

Making measurements

IN THIS CHAPTER YOU WILL:

Science skills:

- describe how to take measurements of length, volume and time
- describe what density is and whether an object will float.

English skills:

- describe experiments and give instructions using sequencers with imperatives and the past passive voice
- use adjectives, comparatives and superlatives.

Exercise 1.1 Measuring length and volume

IN THIS EXERCISE YOU WILL:

Science skills:

- understand some of the important terms used when taking measurements in physics.

English skills:

- use the correct verb forms and words like *first*, *then*, and *finally* to give instructions and write descriptions.

KEY WORDS

volume: the space occupied by an object

SI unit: the Système International d'Unités is the internationally agreed system of units for scientists all over the world

immerse: to cover something in a fluid (usually water) so that the object is submerged

In this exercise, you are going to look at some of the important terms used when taking measurements of quantities, such as length and **volume**, as well as how to give instructions.

1 a Read the paragraph below and then complete the table with words from the paragraph.

> Jake measured the length of a block of wood. He used a ruler to measure it. He wrote the following statement in his notebook:
>
> length of block = 22.4 cm

Term	Definition	Example from paragraph
quantity	something that can be measured	
measuring instrument	what is used to measure a quantity	
value	the result of measuring a quantity	

b The value of a quantity has a number and a unit. What is the unit of length in the paragraph in part **a**?

.....

2 a Complete the first two columns of the table using the words below. Then write the **SI unit** for each quantity in the third column.

balance **length** **mass** **measuring cylinder**
metre ruler **stopwatch** **time** **volume**

Measuring instrument	Quantity measured	SI unit

b Write each row of the table as an instruction. One has been done for you. Use the Language tip to help you.

Use a metre ruler to measure length in centimetres.

.....

.....

.....

LANGUAGE TIP

Each unit has a symbol, for example, kilogram (kg), metre (m) and cubic metre (m^3).

LANGUAGE TIP

To give instructions, use the basic form of a verb, for example: *stand, hold, cut, observe*. This is called the imperative and goes at the start of the sentence:

Use a ruler to measure length.

LANGUAGE FOCUS

When you give instructions, use words like *first, next, then, after that* and *finally* to help the reader follow the steps.

Use *first* to begin your instructions:

First, put an empty beaker on the balance and take a reading.

Use *next, then* or *after that* to introduce each following step. (In this context, they mean the same thing.)

Then/Next/After that, fill the beaker with water, place the beaker on the balance and take a second reading.

Use *finally* to introduce the last step:

Finally, subtract the first reading from the second reading to find the mass of the water.

To give instructions, you only need the basic verb (the imperative). To describe an experiment, use the past tense. For most verbs, this means adding *-ed* to the base verb. For irregular verbs, look at a verb list. These lists give three forms of the verb:

give, gave, given

hold, held, held

The second form is the past form: *gave, held*

3 a Read Siti's description of how she measured the volume of a stone and underline the verbs in the past tense.

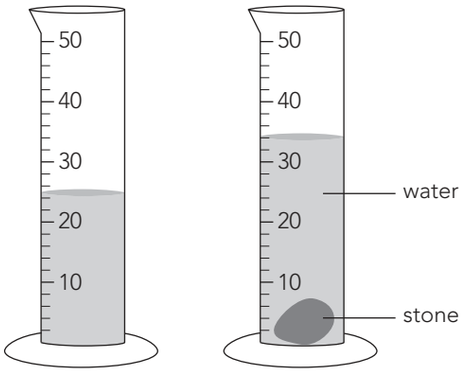

Figure 1.1: Apparatus to find the volume of a stone.

I half-filled a measuring cylinder with water. I recorded the volume of the water. I **immersed** a stone under the water and recorded the new volume. To determine the volume of the stone, I calculated the difference between the two volumes.

b Read the Language focus box again, then write Siti's description as instructions. The first step has been done for you.

First, half-fill the measuring cylinder with water.

Exercise 1.2 Density

IN THIS EXERCISE YOU WILL:

Science skill:

- describe density and understand whether an object will float or not.

English skill:

- describe and compare things using adjectives.

KEY WORDS

density: the ratio of mass per unit volume for a substance

mass: the quantity of matter in an object

In this exercise you are going to look at **density**, which is the measure of a substance's **mass** per unit volume, and whether or not an object will float.

LANGUAGE TIP

The word *per* means *for each* and is often shown by a solidus (/).

4 a (Circle) the correct equation for calculating density.

density = mass × volume density = $\frac{\text{volume}}{\text{mass}}$ density = $\frac{\text{mass}}{\text{volume}}$

b If mass is measured in kilograms and volume is measured in cubic metres, give the unit of density.

LANGUAGE FOCUS

Adjectives are words that describe things, for example: *dense, heavy, complex, narrow, scientific, small.*

Adjectives come before nouns or after *to be*, and they only have one form. This means you use the same adjective for singulars and plurals:

A complex experiment Complex questions The questions were complex.

Use the comparative form of adjectives to compare two things.

To make the comparative form of adjectives with one syllable (for example, *small*) or with two syllables ending in *-y* or *-w* (for example, *heavy, narrow*), add *-er*:

smaller heavier narrower (Note: final *-y* becomes *i*.)

To make the comparative form of other adjectives, put *more* in front of them:

more complex

Then add *than*:

Those words are more complex than these words.

To compare more than two things, use the superlative form of the adjective.

-er comparatives → *the -est* superlatives

more comparatives → *the most* superlatives

For example:

This ball was heavier than the other balls. It was the heaviest of all of the balls.

This experiment was more complex than the other experiments. It was the most complex of all of them.

5 The adjectives in the table are frequently used in physics. Complete the table with their comparative and superlative forms. Use the Language focus box to help you.

Adjective	Comparative form	Superlative form
large		
high		
great		
heavy		
accurate		

6 Complete the paragraph about density and floating using comparative and superlative forms of the adjectives in brackets.

Density depends on mass and volume. If two objects have the same volume but one object has a ……. [great] mass, this means it will have a ……. [large] density. If an object is less dense than water then it will float. If an object is ……. [dense] than water then it will sink. If you pour three liquids with different densities into a measuring cylinder, then the liquid with ……. [high] density will sink to the bottom of the measuring cylinder. The liquid with ……. [low] density will be at the top.

Exercise 1.3 Measuring time

IN THIS EXERCISE YOU WILL:

Science skill:

- describe how to measure time.

English skill:

- use the past passive to describe an experiment.

KEY WORDS

fiducial marker: a mark used to identify the number of rotations

period: the time taken for one complete wave to pass a particular point

In this exercise, you are going to look at measuring time. In physics, time is often measured using a stopwatch or a light gate with an electronic timer.

7 Complete the sentences about measuring time using the words below.

average **interval** **oscillation** **period** **stopwatch** **time**

When you want to measure a short ……. of time, such as the ……. of a pendulum, you use a ……. to measure several oscillations then divide the ……. by the number of oscillations to calculate the ……. time of one oscillation. The time for one oscillation is called the ……. .

8 a Ajay carried out an experiment to measure the **period** of rotation of a potter's wheel. His teacher gave him the following instructions:

- Use a **fiducial marker** to mark the edge of the wheel.
- Switch on the wheel.
- Start the stopwatch.
- Time how long it takes for 20 rotations.
- Find the time it takes for one rotation (the period).

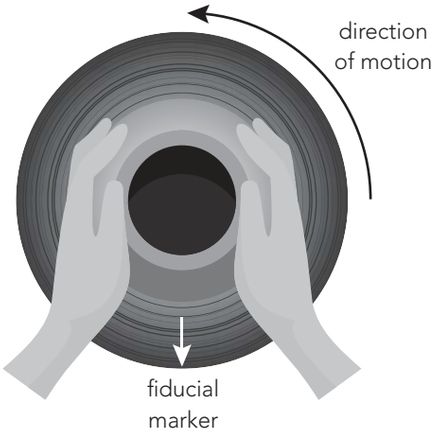

Figure 1.2: A potter's wheel.

Use the instructions to write a description of the experiment using the past tense. Use sequencers in your answer. The first sentence has been done for you.

First, Ajay used a fiducial marker to mark the edge of the wheel.

LANGUAGE FOCUS

When you write about experiments, you often need to use the past passive. This is because often, in science, the action is more important than the person doing the action. You can also use the passive when you do not know who did the action.

A scientist recorded the volume of water. (past tense)

Is it important to know which scientist? If the answer is no, the following sentence is better:

The volume of water was recorded. (past passive)

To change a past active sentence into a past passive sentence:

Look for the object (the thing after the verb) and move it to the front of the sentence.

The volume of water…

Decide if the word at the front (*volume*) is singular or plural, then add *was* (for singular) or *were* (for plural). *Was* and *were* are the past forms of *to be*:

The volume of water was…

Determine the past participle of the main verb (*recorded*). With regular verbs, add *-ed* to the verb (*record → recorded*). With irregular verbs, you need a verb table. The past participle is in the third column. For example:

bring	*brought*	*brought*
give	*gave*	*given*
make	*made*	*made*
put	*put*	*put*

Finally, add the past participle to the sentence:

The volume of water was recorded.

Here is another example:

We took the measurements using a measuring cylinder.

The measurements were taken using a measuring cylinder.

b Rewrite the description that you wrote in part **a** using the past passive. The first sentence has been done for you.

First, a fiducial marker was used to mark the edge of the wheel.

Chapter 2

Describing motion

IN THIS CHAPTER YOU WILL:

Science skills:

- describe the speed of an object and understand that acceleration is a change in speed
- analyse and interpret distance–time and speed–time graphs.

English skills:

- understand and use the vocabulary related to the motion of an object
- use the correct scientific terms and the present simple tense to describe and analyse distance–time and speed–time graphs.

Exercise 2.1 Speed

IN THIS EXERCISE YOU WILL:

Science skills:

- describe the speed of an object and how to calculate it.

English skills:

- understand and use important terms for describing speed.

KEY WORDS

speed: the distance travelled by an object per unit of time

average speed: the speed calculated from total distance travelled divided by total time taken

instantaneous speed: the speed at a particular moment in time

In this exercise, you are going to look at the **speed** of an object and important terms used to describe it.

1 Find the seven words in the word string. Write them on the lines below. One has been done for you.

speeddistancetimeaveragemetresecondinstantaneous

speed

.....

.....

.....

.....

.....

.....

LANGUAGE TIP

Definitions often follow this pattern: [X] *is a/the* [Y] *that* + verb:

A stopwatch is an instrument that measures time.

2 Complete the sentences about speed. Use the words and phrases below.

average speed **instantaneous speed** **metres** **metres per second** **seconds**

a $\frac{\text{total distance travelled}}{\text{total time taken}}$ is the equation that is used to calculate

.....

b When you divide distance (in .....) by time (in .....) that gives you the SI unit for speed: .....

c The equation that is used to calculate the ..... of an object (its speed at a particular moment in time) is $v = \frac{s}{t}$.

3 **a** A car travels 250 metres in 20 seconds. Calculate the speed of the car. Give the unit.

Speed: .....

b Explain whether this is the **average speed** or the **instantaneous speed**.

.....

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