UNIT 7

SPEED

Remote-controlled boat race

Remote-controlled car race

NATIONAL LEVEL
REMOTE-CONTROLLED CAR RACE
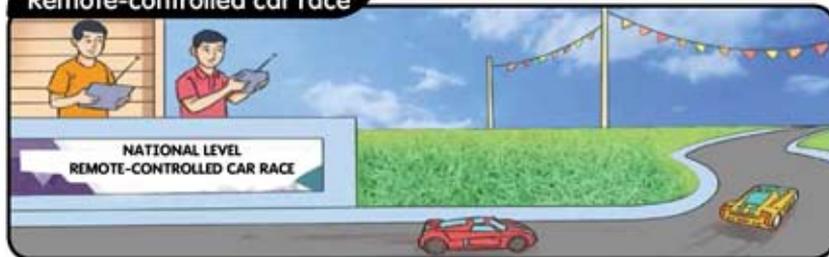
Remote-controlled drone race

The races shown in the pictures above are sports events that use remote control technology. Among the winning factors in these races is speed. What is speed? How does speed affect the chances of winning a race?

Units of Speed

All moving objects have speed. Speed is the measurement of how fast an object moves from one place to another. All objects move with different speeds. Observe the picture below. Can you state the vehicles that move the fastest and the slowest?

The car will definitely move the fastest while the bicycle will move the slowest.

In my opinion, the motorcycle will move faster than the car.

Pupils, if we want to find out which vehicle moves the fastest and the slowest, we need to measure and calculate the speed of each vehicle.

The measurements for distance and time of a moving object needs to be determined before calculating its speed. Do you know what are the units for distance and time?
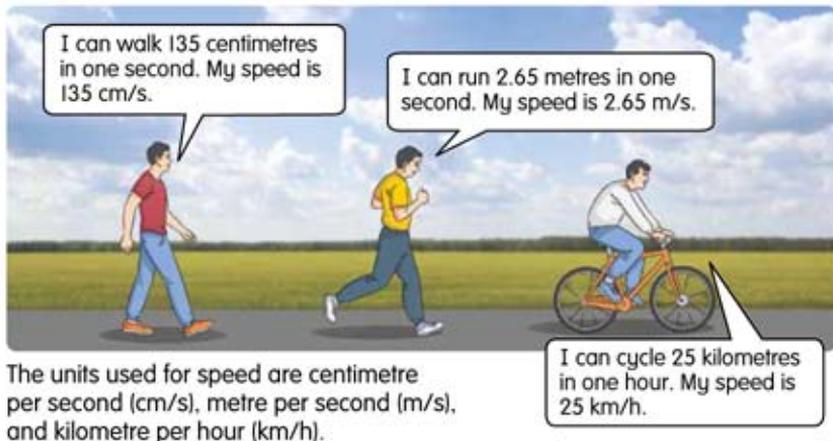
Distance can be measured in the units of centimetre, metre, and kilometre.

Time can be measured in the units of second, minute, and hour.

Speed is calculated based on the distance travelled by an object within a fixed time.

Observe the situations in the picture below.

> I can walk 135 centimetres in one second. My speed is 135 cm/s.

> I can run 2.65 metres in one second. My speed is 2.65 m/s.

> I can cycle 25 kilometres in one hour. My speed is 25 km/h.

The units used for speed are centimetre per second (cm/s), metre per second (m/s), and kilometre per hour (km/h).

SCIENCE INFO

The cheetah is the fastest animal on land with a speed of more than 100 km/h.

FUN ACTIVITY >> Units of Speed

Pairwork Activity

21st Century Learning Skills

Apparatus and materials: computer, Internet access, exercise book

Steps:

1. Find information on the speed of several objects using the Internet.
2. Record the name and the speed of these objects in a table.
3. Compare your findings with the other pairs.

Question:
What is meant by the speed of 100 metre/minute?

Why is it not suitable to measure the speed of a car in the unit of cm/s?

Examples of information that the pupils can find are the movements of tortoises, rabbits, horses, athletes, and objects such as motorcycles, cars, ships, aeroplanes, rockets, and others.

Relationship Between Speed, Distance, and Time

Wow, they're really fast! How can I complete this track in the shortest time?

I'll definitely win if I'm able to move the fastest.

Race cars need to reach the finishing line in the shortest time to win a race. How does the speed of an object such as the race car affect the distance it travels and the time taken for it to move?
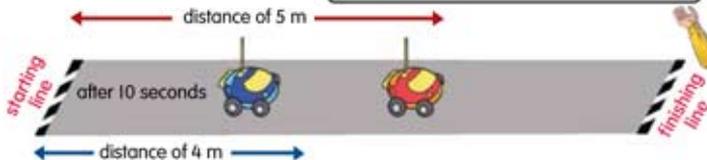
For a fixed distance, the faster car takes a shorter time to reach the finishing line.

takes 20 seconds to reach the finishing line

takes 17 seconds to reach the finishing line

starting line

finishing line

For a fixed time, the faster car also moves farther.

distance of 5 m

after 10 seconds

starting line

finishing line

distance of 4 m

Thus, an object that moves faster takes a shorter time to move within a fixed distance. An object that moves faster also moves for a farther distance within a fixed time.

7.1.2

The Relationship Between Speed and Time

Group Activity

1. **Aim:** _____

2. **Problem statement:** How does speed affect the time taken for an object to move within a fixed distance?

3. **Hypothesis:** _____

4. **Variables:**
   (a) manipulated: _____
   (b) responding: _____
   (c) constant: _____

5. **Apparatus and materials:** ruler with a groove along the centre, stopwatch, adhesive tape, books, cardboard, marble
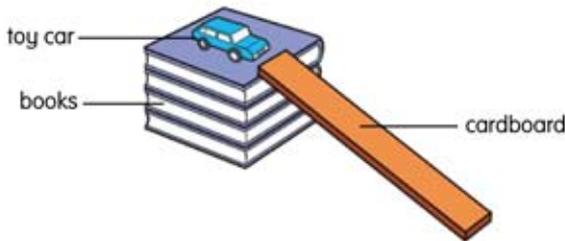
6. **Steps:**

marble
grooved ruler
books
cardboard
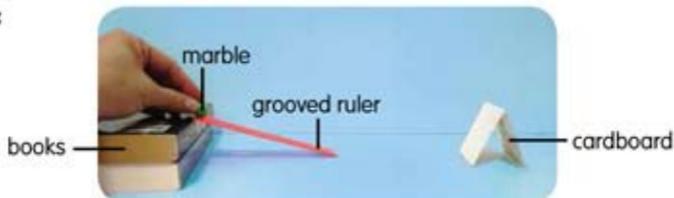
   (a) Prepare the apparatus and materials as shown in the picture.
   (b) Put the marble in the groove of the ruler. Then, release the marble and start the stopwatch.
   (c) Stop the stopwatch when the marble touches the cardboard.
   (d) Record your result in a table.
   (e) Repeat steps 6(b) to 6(d) by increasing the number of books to increase the height of the plane.
   (f) Plot the graph of change for the number of books against time.

7. **Data:** _____

8. **Interpreting data:**
   (a) Why is the number of books increased?
   (b) What is the relationship between the speed and the time taken for the marble to move?

9. **Conclusion:**
   _____

7.1.2.
7.1.5

The number of books can be increased based on the need of the experiment.

The Relationship Between Speed and Distance

Group Activity

1. **Aim:** _____

2. **Problem statement:** How does speed affect the distance travelled by an object within a fixed time?

3. **Hypothesis:** _____

4. **Variables:**
   (a) manipulated: _____
   (b) responding: _____
   (c) constant: _____

5. **Apparatus and materials:** stopwatch, metre ruler, books, toy car, cardboard

6. **Steps:**

   _____

7. **Data:** _____

8. **Interpreting data:**
   (a) Why is the number of books increased?
   (b) How can you obtain a more accurate measurement of the distance?
   (c) What is the relationship between the speed and the distance travelled by the toy car?

9. **Conclusion:**

   _____

7.1.2
7.1.5
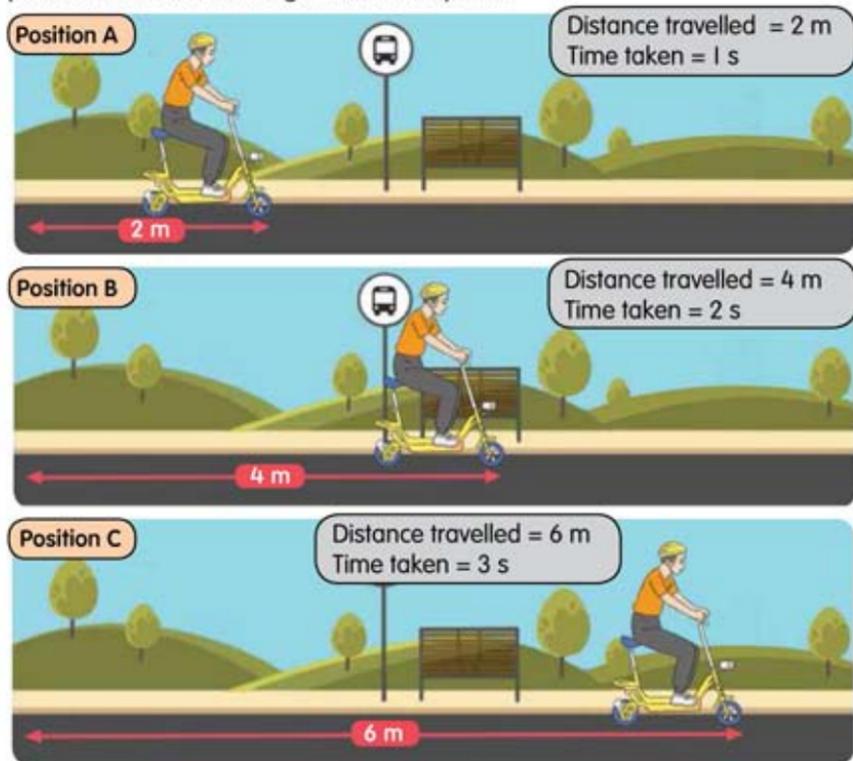
The number of books indicates the speed of the toy car.

Calculating Speed, Distance, and Time

Speed can be calculated based on the distance travelled by an object within a fixed time.

Speed can be calculated by dividing the distance travelled by an object with the time taken.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

A young man is riding an electric scooter on the road from position A to position C. The time taken and the distance travelled by him at each position are recorded. Do you know his speed?

Position A

Distance travelled = 2 m
Time taken = 1 s

2 m

Position B

Distance travelled = 4 m
Time taken = 2 s

4 m

Position C

Distance travelled = 6 m
Time taken = 3 s

6 m

His speed at each position is 2 m/s.

You're right, Alia. For every one second, the distance travelled by the electric scooter at position A, position B, and position C is the same, which is 2 m. Thus, the speed at each position is also the same, which is 2 m/s.
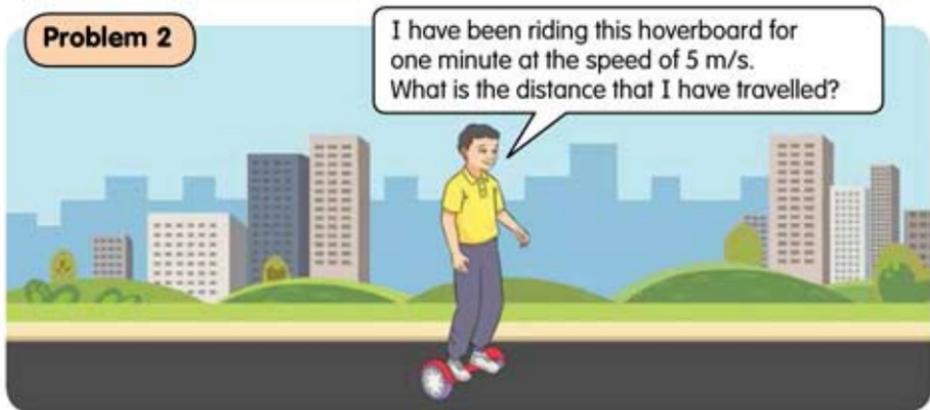
7.1.3

Problem 1

The train has travelled 250 km in two hours. What is the speed of the train?

Solution 1:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{250 \text{ km}}{2 \text{ hours}}$$

$$= 125 \text{ km/h}$$

Problem 2

I have been riding this hoverboard for one minute at the speed of 5 m/s. What is the distance that I have travelled?

Let's solve the problem above. Firstly, make sure that the unit for time, which is minutes, is converted into seconds. How many seconds are there in one minute?

One minute is equal to 60 seconds, Mr Hadi.

That's right, Adam. We can use the formula below to calculate the distance.

The distance travelled can be calculated by multiplying the speed with the time taken.

Distance = Speed x Time

Solution 2:

Distance = Speed x Time

= 5 m/s x 1 minute

= 5 m/s x 60 seconds

= 300 m

Problem 3

I have been driven for 10 km at the speed of 50 km/h. What is the time taken for me to travel, in minutes?

To solve this question, we can use the formula below to calculate time.

The time taken can be calculated by dividing the distance travelled with the speed.

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

Solution 3:

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$= \frac{10 \text{ km}}{50 \text{ km/h}}$$

$$= 0.2 \text{ hour} \times 60 \text{ minutes}$$

$$= 12 \text{ minutes}$$

I move slowly at the speed of only 5 cm/s. What is the time taken for me to move 100 cm?

The speed of a lorry is 0 km/h. Does the lorry move or remain stationary? Why?

SCIENCE INFO

The rotation of Earth on its axis causes its surface at the equator to move at the speed of approximately 1656 km/h.

Aim: To define operationally the speed of an individual

Group Activity

Apparatus and materials: stopwatches, pencil, paper

Steps:
1. Carry out a running activity on the school field.
2. Appoint four members of the group as timekeepers and one member as a runner.
3. The timekeepers will be at station A, station B, station C, and station D respectively as shown in the picture.

station D
50m
station C
starting line
finishing line
50m
50m
station A   50m   station B
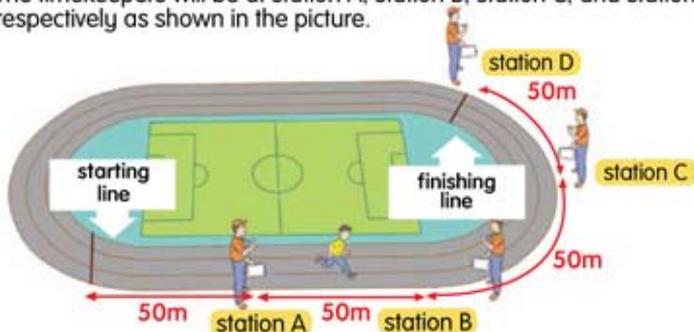
4. The runner will start running from the starting line to the finishing line.
5. All the timekeepers will start their stopwatches when the running starts.
6. The timekeepers will stop their stopwatches when the runner passes by their respective station.
7. Record the stopwatch readings in the table.

Station	Distance (m)	Time (s)
A	50	
B	100	
C	150	
D	200	

8. Make a bar chart based on the table.
9. Present the results of your group.

Questions:
1. Is the speed of the runner at each station the same? Why?
2. State the manipulated variable and the responding variable.
3. What is the operational definition of speed in this activity?
4. If the runner keeps running for 400 m, predict the runner's speed. Explain your answer.

7.1.4
7.1.5

>> The Marble Route Tube

Make a route tube for a marble using a pair of scissors, adhesive tape, manila card, paper cup, marble, and paper.
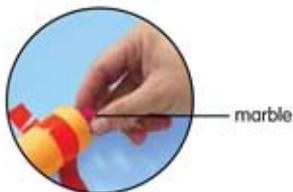
> ⚠️ Be careful when using scissors.

Steps:

1. Plan and make a route tube to enable a marble to slide and move down from a height and then fall into a paper cup.

example of the route tube for the marble

2. Make the tubes using a manila card.
3. Paste the tubes on a wall based on the routes that you have designed.
4. Ensure that each tube is only placed at an inclined position.
5. Release the marble to test the route tube.
6. Produce another route tube with a different angle of inclination to compare the speed of the marble moving down the tubes.

MIND REFLECTION >>

1. Speed is a measurement of how fast an object moves from one place to another.

2. Speed can be calculated based on the distance travelled by an object within a fixed time.

3. The units of measurement for speed are as follows:
   - centimetre per second (cm/s)
   - metre per second (m/s)
   - kilometre per hour (km/h)

4. Objects that move faster:
   - take a shorter time to move within a fixed distance.
   - move for a farther distance within a fixed time.

5. Speed can be calculated by dividing the distance travelled by an object with the time taken, that is:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

6. The distance travelled can be calculated by multiplying the speed with the time taken, that is:

$$\text{Distance} = \text{Speed} \times \text{Time}$$

7. The time taken can be calculated by dividing the distance travelled with the speed, that is:
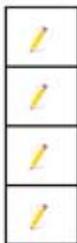
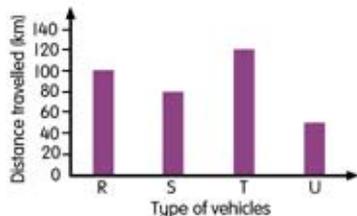$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

Answer all questions in the Science exercise book.

1. State the units of speed.

2. Tick (✔) the correct statements about speed.
   (a) Speed measures how fast an object moves from one place to another.
   (b) Objects that move faster take a longer time to move within a fixed distance.
   (c) Speed is the time taken by an object to move within one unit of distance.
   (d) All moving objects have speed.

3. The bar chart shows the distance travelled by four types of vehicles R, S, T and U in 120 minutes.
   (a) Which vehicle travels the fastest and the slowest?
   (b) Calculate the speed of each vehicle in km/h.

Jesy cycles to school every day at an average speed of 4 m/s. She takes 10 minutes to reach the school.

4. Based on the statement above, answer the following questions.
   (a) What is the distance between Jesy's house and the school?
   (b) Jesy's friend also cycles to school at the same average speed. However, her house is located at a distance of 6 km from the school. What is the time taken by Jesy's friend to reach the school?
   (c) One day, Jesy cycled faster, at the speed of 5 m/s. What is the time taken, in minutes, for Jesy to reach the school?

5. Speed is a measurement of how _____ an object moves from one place to another. The _____ an object moves, the _____ the distance travelled by the object within a fixed _____.

6. Sani and his friends carried out an experiment using the apparatus as shown in the picture below. The length of the inclined plane is 1 m. The result of the experiment is recorded in the table below.
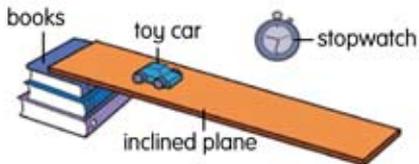
Number of books	Time taken (seconds)
1	10
2	8
3	6
4	4
5	2

a) What is the aim of this experiment?
b) Based on the experiment above, state the two constant variables.
c) State the relationship between the manipulated variable and the responding variable.
d) What is the fastest speed of the toy car?

7. An aeroplane takes three hours for a 2700 km journey. What is the speed of the plane in km/h?

8. A horse runs for 60 minutes at the speed of 70 km/h. What is the distance travelled by the horse?

9. A cyclist cycles at the speed of 6 m/s. Calculate the time taken, in minutes, for the cyclist to cycle 36 km.