Unit 23: Time

Objectives
By the end of this unit, pupils will be able to:
• Calculate the average speed of a moving object.

Suggested resources
Stop watches; A poster that shows the units of time and how to convert them; Drawing of a speedometer; Cardboard showing some examples of average speeds

Common errors that pupils make
Pupils get confused between units of time and those of speed and distance. Ensure that pupils know the difference between the units, and use the units appropriately. Explain the meaning of ‘per’ in ‘kilometres per hour’, as telling you how many kilometres can be travelled in any one hour, if the speed is constant.

Pupils confuse actual speed, with average speed. Discuss real-life situations, describing a journey by bus, with several stops for picking up and dropping off passengers. The average speed takes into account the time when the bus is standing still, to give you an idea of how long the journey will take (on average). While the bus may be travelling at varying speeds of say 50 km/h or 80 km/h, the average speed will be considerably less, as it slows down and stops for passengers.

Evaluation guide
Pupils to:
1. Find average speed of given word problems.

Lesson 1  Pupil’s Book page 141

Preparation
You will need to have:
• Pupil’s Book  • Stopwatches
• A poster that shows the units of time and how to convert them
• Drawing of a speedometer
• Cardboard showing some examples of average speeds.

Starter activity
Ask pupils to estimate distances. Ask them what time it might take to cover such distances. Guide the pupils to check whether their estimates are sensible. As a fun alternative, you could take the pupils onto the playing fields and measure a distance of 40 or 50 metres. Ask a few pupils to run the distance while their classmates time them on the stopwatches. This data can be used in class later in the lessons.

Lesson focus
The lesson focuses on the calculation of average speed, time and distances. Explain that if 10 km is covered in 2 hours then 5 km will be covered in one hour. This is usually written as 5 km/hr (kilometres per hour) and is the average speed. Let the pupils know that average speed is distance covered divided by time taken to cover the distance. Speed = \( \frac{\text{Distance covered}}{\text{Time taken}} \).

Explain also that this formula can be used to find distance and time i.e. Distance = Speed \times Time and Time = \( \frac{\text{Distance}}{\text{Speed}} \). Work through the example on page 142 in the PB with the pupils to make sure
the pupils understand the concept. Give a few more examples if necessary. The data collected during the starter activity could serve as further examples i.e. you can calculate the speed at which each of the pupils ran. Then ask the pupils to work through Exercise 1 on page 142.

**Answers**

**Exercise 1**

1. \(78 \text{ km} \div 3 \text{ hours} = 26 \text{ km/h average speed}\)
2. \(140 \text{ km} \div 3 \text{ hours} = 47 \text{ km/h}\)
3. a) Hare = \(16 \text{ km} \div 0.5 \text{ hours} = 32 \text{ km/h}\)
   Horse = \(20 \text{ km} \div 0.75 \text{ hours} = 26.7 \text{ km/h}\)
b) The horse runs faster
4. Bus = \(255 \text{ km} \div 3 \text{ hours} = 85 \text{ km/h}\)
   Car = \(200 \text{ km} \div 2.5 \text{ hours} = 80 \text{ km/h}\)

**Assessment**

Check whether pupils can define and calculate average speed and also find time, distance and average speed. Make sure pupils understand the concept of average speed and why we use it to calculate the time taken to travel a distance.

**Extension activity**

Complete the following extension exercise by completing the table.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Time</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance = 614 km;</td>
<td>time = 12 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 648 km;</td>
<td>time = 24 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 825 km;</td>
<td>time = 35 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 1 024 km;</td>
<td>time = 42 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 557 km;</td>
<td>time = 18 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 258 km;</td>
<td>time = 11 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 985 km;</td>
<td>time = 31 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 1 125 km;</td>
<td>time = 25 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 18 km;</td>
<td>time = 0.5 hrs</td>
<td>Speed =</td>
</tr>
<tr>
<td>Distance = 7 km;</td>
<td>time = 0.25 hrs</td>
<td>Speed =</td>
</tr>
</tbody>
</table>

**Homework activity**

Ask pupils to do find out about some real life situations in which being able to calculate average speed would be useful. They should also find out how average speed is used to calculate travelling distances and travelling times e.g. how do we able to tell exactly when a bus or train would arrive?

**Lesson 2**  [Pupil’s Book page 141]

**Preparation**

You will need to have:
- Pupil’s Book
- Stopwatches
- A poster that shows the units of time and how to convert them.

**Starter activity**

Get feedback from pupils about the homework research and have a brief discussion about travelling times to places near to the location of your school. Ask pupils how long they estimate it would take to travel to the nearest large town.

**Lesson focus**

In this lesson we concentrate on manipulating the Distance, Speed and Time formula i.e. instead of calculating speed only, we can use the formula to calculate distance or time. Work through the example on page 143 in the PB and show pupils how we change the subject of the equation by means of inverse operations. Below is a useful diagram which contains the three variations of the formula.

- **Distance = speed \times time**
- **Speed = \frac{\text{distance}}{\text{time}}**
- **Time = \frac{\text{distance}}{\text{speed}}**

Ask pupils to complete the exercise on page 143 of the PB.
Answers

Exercise 2

1. a) 2 hours  b) 3 hours
c) 2.5 hours  d) 5 hours
e) 8.75 hours
2. a) 12 km  b) 6 km
c) 20 km  d) 9 km
e) 2 km
3. a) 135 km  b) 112.5 km
4. 580 km + 200 km/h = 2.9 hours
   (2 hours and 54 minutes)
5. 5 600 km ÷ 1 400 km/h = 4 hours

Assessment
Check that pupils are able to use the formula to find distance rather than speed. Pupils should understand that knowing any two of the three variables will enable them to find the third. If pupils have difficulty, give them extra practice.

Homework activity
Ask pupils to complete the Revision exercise on page 144 in the PB.

Lesson 3 Workbook page 42

Preparation
You will need to have:
- Workbook.

Starter activity
Complete the challenge on page 143 of the PB.

Lesson focus
Check the answers to the Revision exercise before commencing the assessment task. Pupils have to complete Worksheet 23 in the WB.

Answers

Revision exercise

1. | Distance       | Time  | Average speed |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>200 cm</td>
<td>10 s</td>
<td>20 cm/s</td>
</tr>
<tr>
<td>150 cm</td>
<td>5 s</td>
<td>30 cm/s</td>
</tr>
<tr>
<td>15 cm</td>
<td>3 s</td>
<td>5 cm/s</td>
</tr>
</tbody>
</table>
2. 56 km ÷ 8 km/h = 7 hours
3. 100 m ÷ 4 hours = 25 m/h
4. 100 m ÷ 10 seconds = 10 m/s
5. | Distance       | Time  | Average speed |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4 km</td>
<td>2 hours</td>
<td>2 km/h</td>
</tr>
<tr>
<td>5 km</td>
<td>0.5 hours</td>
<td>10 km/h</td>
</tr>
<tr>
<td>12 km</td>
<td>6 hours</td>
<td>2 km/h</td>
</tr>
<tr>
<td>64 km</td>
<td>8 hours</td>
<td>8 km/h</td>
</tr>
<tr>
<td>42 km</td>
<td>1.5 hours</td>
<td>28 km/h</td>
</tr>
<tr>
<td>80 km</td>
<td>2.5 hours</td>
<td>32 km/h</td>
</tr>
<tr>
<td>1 200 km</td>
<td>30 hours</td>
<td>40 km/h</td>
</tr>
</tbody>
</table>

Assessment
This assessment tests the extent to which the pupils have achieved the objectives stated at the beginning of this unit. Check pupil’s answers and give extra help to any pupils that are experiencing difficulty.

Extension/Homework activity
Complete any worksheet questions that still need to be finished.

Workbook answers Worksheet 23

1. Done
2. Distance/time
3. 50 km
4. 60 km per hour
5. 6.28 km per hour
6. $4\frac{1}{2}$ hours
7. 5 10 kg
8. 4 km per hour
Objectives
By the end of this unit, pupils will be able to:
• Measure temperature of places, objects or body at different times
• Compare degrees of hotness of various objects in degrees Celsius
• Compare degrees of hotness of various areas in degrees Celsius
• Identify the usefulness of temperature to our daily life.

Suggested resources
Thermometer, fridge or refrigerator, warm water, ice, flask; Data on meteorological information on some towns (weather forecasts, etc.)

Key word definitions
thermometer: an instrument for measuring and indicating temperature
temperature: the degree or intensity of heat present in a substance or object

Frequently asked questions
Q What prior knowledge should the pupil have?
A Pupils should be able to say whether things are hot or cold.
Q How can I help the pupils to understand the concept?
A Refer pupils back to real-life situations where they use temperature.

Common errors that pupils make
Pupils cannot read a thermometer. Give plenty of practical experience in reading a thermometer, explaining how to read the scale. Remind them of the way they have learned to read scales on rulers and jugs, in earlier units. This is the same. Take the temperature of the air, and then hold a thermometer in some heated water, and allow the pupils to observe how the temperature rises, and how this is reflected on the position on the scale.

Evaluation guide
Pupils to:
1. Read temperature of given objects.
2. Compare temperatures of objects, town and locations.

Lesson 1 Pupil’s Book page 145

Preparation
You will need to have:
• Pupil’s Book
• Thermometer
• Warm water and ice
• Flask.

Starter activity
Ask the pupils to read the thermometer provided by the teacher. Tell the pupils that the thermometer is used to measure the temperature of objects or bodies. Provide some warm water and ask the pupils to feel how hot by trying to touch. If possible also provide also some ice and ask the pupils to describe how cold it is.

Lesson focus
Show the thermometer and explain how to read it. Explain to the pupils what a boiling point is and also what a freezing point is. Provide hot objects and cold objects and allow the pupils to see the differences in them. Ask the pupils to touch their friend’s body to feel the temperature. They will notice that body temperatures are slightly different from one person to the other, and they should know that a high body
temperature can be a symptom of sickness. Also explain to pupils that ambient temperature changes during the day i.e. peak temperatures are reached at midday and the lowest temperatures are reached late at night/early hours of the morning. Work through Exercise 1 on page 145 with the pupils and guide them through their thinking processes. Also ask pupils to complete Exercise 2 on page 146. Let each pupil feel the hotness or coldness of different temperatures during the day. Allow pupils to use the thermometer to find temperatures.

Answers
Exercise 1
1. A child can be hot or cold
2. a) a room can be hot or cold
   b) Boiling water is hot
   c) Iced water is cold
   d) Water for food is hot
   e) Mid-day is hot
   f) Rain is cold
   g) Air conditioning is cold
   h) A light bulb is hot when on
   i) A light bulb is cold when off
3. Pupils to record their findings.
4. Pupils to record their findings.
5. Pupils to record their findings.

Exercise 2
Class exercise to be done with pupils in class.

Assessment
Check that pupils can define, read and measure temperature. If extra practice is needed, record the daily temperature for a week and ask pupils to read it each day.

Homework activity
Ask pupils to complete the Challenge activity on page 146 in the PB. This can be done as a homework activity. Ask pupils to write three hot objects and three cold objects in their books. They should also find out the hottest and coldest town in Nigeria.

Lesson 2  Pupil’s Book page 147

Preparation
You will need to have:
• Pupil’s Book
• Data on meteorological information on some towns (weather forecasts, etc.)

Starter activity
Bring newspaper weather forecasts to school. These should preferably have weather reports for as many cities/towns as possible. If possible try and have weather reports for as many other countries across the globe. Ask pupils to examine the temperatures for their country’s cities and towns and to comment on any patterns or peculiarities they may notice e.g. why are high-lying areas colder than places close to the coast?

Lesson focus
Explain that towns, villages and cities have different weather conditions. The conditions also change from day to day, month to month and from country to country. Also explain the difference between maximum and minimum temperatures and why these occur. This part of the discussion should allow pupils to draw on the research they dealt with in the previous lesson. Give a weather forecast for a particular day and ask them questions. Ask the pupils to answer Exercise 3.

Answers
Exercise 3
1. a) Okada and Ifo are the coldest
   b) Okada and Ifo
   c) 32°
   d) Ikeja
   e) 2°
   f) Ifo, Agbowa, Agege, Shomolu
   g) 2°
2. 15°
3. a) June
   b) January
   c) March
   d) 4°
   e) 38°
   f) 28°
   g) June
4. a) Damascus
   b) Johannesburg
   c) 38°
   d) 18°
   e) 10°
Assessment
Check that pupils understand how temperatures differ throughout the world and during the course of the day. Pupils should be able to distinguish between hot and cold temperatures.

Extension activity
Complete the following exercise.

Study the table showing temperatures in different parts of the world and answer the questions.

<table>
<thead>
<tr>
<th>Place</th>
<th>Country/State</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canberra</td>
<td>Australia</td>
<td>17</td>
</tr>
<tr>
<td>Bombay</td>
<td>India</td>
<td>30</td>
</tr>
<tr>
<td>McMurdo</td>
<td>Antarctica</td>
<td>–16.5</td>
</tr>
<tr>
<td>Ottowa</td>
<td>Canada</td>
<td>4.5</td>
</tr>
<tr>
<td>Naresna</td>
<td>Alaska</td>
<td>–13</td>
</tr>
<tr>
<td>Cedarhurst</td>
<td>New York</td>
<td>12</td>
</tr>
<tr>
<td>Karasjok</td>
<td>Norway</td>
<td>–27</td>
</tr>
</tbody>
</table>

1. Put the temperatures in order from coldest to warmest.
2. How much colder is McMurdo than Naresna?
3. How much warmer is Bombay than Ottowa?
4. Reykjavik in Iceland is 17 degrees colder than Cedarhurst. What is the temperature in Reykjavik?
5. How much colder is Naresna than Canberra?
6. What is the difference in temperature between the warmest and coldest place?
7. The temperature in Tokyo is 46 degrees warmer than Karasjok. What is the temperature in Tokyo?

Homework activity
Ask pupils to complete the Revision exercise on page 149 of the PB.

Answers
Revision exercise
1. Boiling point is 100° and freezing point is 0°
2. Afternoon
3. Class exercise
4. Pupil’s to draw
5. Pupil’s to draw
6. Degrees Celsius
7. The liquid expands and moves up

Lesson focus
Check the answers to the Revision exercise before commencing the assessment task. Pupils have to complete Worksheet 24 in the WB.

Answers
WB Worksheet 24

Extension activity
Pupils can research and find out the body temperatures of different animals.

Workbook answers Worksheet 24

1. a) temperature   b) thermometer
   c) centigrade    d) 100 °C
   e) 0 °C
2. 39 °C, 29 °C, 8 °C, 20 °C, 12 °C, 10 °C, 4 °C
3. Pupils to record
4. a) Umuahia      b) Benin City
   c) 38 °C         d) 27 °C
   e) Benin City, Port Harcourt, Abeokuta & Ibadan, Lagos, Wari, Onne, Lapai, Umuahia
5. 13 °C
6. Lapai
7. Abeokuta
8. Pupils to give their own suggestions.
Unit 25  Area

Objectives
By the end of this unit, pupils will be able to:
• Calculate the area of a right-angled triangle.

Suggested resources
Square grid paper, old newspaper; Marker; A chart/poster with shapes and columns of a rectangle and a square drawn on squared paper; A chart/poster with a rectangle divided into two right-angled triangles drawn on squared paper

Key word definitions
area: the amount of space that a shape covers
square centimetre (cm²): a square unit that has all four sides equal to 1 cm
height: the distance from the base of the triangle to the top point of the triangle
base: the length of the side of the triangle that is opposite the top point

Frequently asked questions
Q What prior knowledge should the pupil have?
A The pupils need to understand length and must be able to measure and calculate length.
Q How much time should I allow for teaching this unit?
A You need to do practical work in this unit, so it is important to allow yourself and the class plenty of time to engage with the topic. You should allow at least one full week for this work (at least 5 to 6 hours in total).

Common errors that pupils make
Pupils cannot apply the formula correctly. Evaluate whether the pupils understand how to find the area of a rectangle. If not, then revise the work in the previous lesson. Once you have established that the pupil can calculate the area of a rectangle using the formula, work through the starter activity for this lesson again. Ensure that the pupils understand why we say that the area of a triangle is half the area of a rectangle and how this relates to the formula.

Evaluation guide
Pupils to:
1. Find the area of given right-angled triangles.

Lesson 1 Pupil’s Book page 150

Preparation
You will need to have:
• Pupil’s Book
• Square grid paper, old newspaper
• Marker
• A chart/poster with shapes and columns of a rectangle and a square drawn on squared paper
• A chart/poster with a rectangle divided into two right-angled triangles drawn on squared paper.

Starter activity
Stick a large rectangle drawn on squared grid paper onto the board. Ask the pupils to calculate the area of the rectangle. Discuss the answers and the ways to check whether the answer is correct. Using a marker, draw a clear diagonal across the rectangle. Ask the pupils to name the type of triangles they see. They should recognise that the triangles are right-angled triangles. Ask the pupils what the area of one of the triangles will be. Pupils should be able to ‘see’ that the area of the triangle will be half the area of the rectangle. Discuss with the class why this is so and how they know the answer is half the area of the rectangle. Write the formula for finding the area of a triangle on the board. Explain to the pupils that this is the formula for finding the area of a triangle. Ask them if they agree that it is the correct formula and encourage pupils to reason their response. Pupils should recognise that the area will be \( \frac{1}{2} l \times w \). Allow pupils to discover that \( \frac{1}{2} b \times b \) and \( \frac{1}{2} l \times w \) are equivalent expressions.
Lesson 2  Pupil's Book page 153

Preparation
You will need to have:
- Pupil's Book
- Square grid paper, old newspaper
- Marker
- A chart/poster with shapes and columns of a rectangle and a square drawn on squared paper
- A chart/poster with a rectangle divided into two right-angled triangles drawn on squared paper.

Starter activity
Check pupils responses to the Challenge activity set in the previous lesson. Revise the use of the formula to find the area of a triangle.

Lesson focus
This lesson is a continuation of the previous lesson and is centered around Exercise 2. Pupils must use the area formula for a triangle to complete the exercise. Provide pupils with lots of guidance and monitor their progress regularly. If time permits, pupils can attempt the Extension activity below.

Answers
Exercise 2
1. 16 cm²  2. 27 cm²  3. 30 cm²
4. 486 cm²  5. 36 m²  6. 112 cm²
7. 76 cm²  8. 60 m²  9. 146 cm²
10. 396 cm²
11. a) 4 cm²  b) 4.5 cm²  c) 21.6 cm²
d) 32 cm²  e) 35 cm²
12. 1 800 cm²

Assessment
Check that pupils can calculate the area of a triangle using a formula and explain the steps again if necessary.

Homework activity
Pupils complete any unfinished activities for homework.
**Lesson 3**  
*Pupil's Book page 156*

**Preparation**

You will need to have:
- Pupil's Book
- Square grid paper, old newspaper
- Marker
- A chart/poster with shapes and columns of a rectangle and a square drawn on squared paper
- A chart/poster with a rectangle divided into two right-angled triangles drawn on squared paper.

**Starter activity**

Discuss real life situations where finding the area of a triangle would be useful. Revise the use of the formula to find the area of a triangle.

**Lesson focus**

This lesson is a continuation of the previous lesson and is centered around the Revision exercise. Go through the summary on page 155 and demonstrate how to find the area of a triangle again using board work. Provide pupils with lots of guidance and monitor their progress regularly. Pupils must complete the Revision exercise on page 156 in the PB. This will provide an assessment of pupil's progress. Take in their note books to mark at the end of the lesson.

**Answers**

**Revision exercise**

1. Area of rectangle = 400 m$^2$;  
   Area of triangle = 200 m$^2$
2. a) 270 m$^2$  
   b) 200 m$^2$  
   c) 70 m$^2$
3. 144 m$^2$
4. Less
5. | Base | height | area |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A 8 cm</td>
<td>3 cm</td>
<td>12 cm$^2$</td>
</tr>
<tr>
<td>B 5 cm</td>
<td>4 cm</td>
<td>10 cm$^2$</td>
</tr>
<tr>
<td>C 18 cm</td>
<td>6 cm</td>
<td>54 cm$^2$</td>
</tr>
<tr>
<td>D 19 cm</td>
<td>18 cm</td>
<td>171 cm$^2$</td>
</tr>
<tr>
<td>E 25 m</td>
<td>20 m</td>
<td>250 m$^2$</td>
</tr>
<tr>
<td>F 10 m</td>
<td>18 m</td>
<td>90 m$^2$</td>
</tr>
</tbody>
</table>

**Assessment**

Pupils should be able to find the area of a triangle, provide additional exercises for any pupils who are experiencing difficulties.

**Extension activity**

Put some square root and square numbers on the board for pupils to work with if they finish early.

---

**Lesson 4**  
*Workbook page 45*

**Preparation**

You will need to have:
- Workbook.

**Starter activity**

Go through the answers to the Revision exercise.

**Lesson focus**

Pupils have to complete Worksheet 25 in the WB. This forms an assessment that tests the extent to which the pupils have achieved the objectives stated at the beginning of this unit.

**Answers**

**Worksheet 30**

**Assessment**

Check that pupils can find the area of given right-angled triangles.

**Extension/Homework activity**

Pupils to complete corrections from the Revision exercise.

**Workbook answers Worksheet 25**

1. a) 32 cm$^2$  
   b) 540 cm$^2$  
   c) 24 cm$^2$  
   d) 192 cm$^2$  
   e) 63 cm$^2$
2. a) 84 cm$^2$  
   b) 4.5 cm  
   c) 2.5 cm  
   d) 80 cm$^2$  
   e) 270 cm$^2$  
   f) 91 cm$^2$  
   g) 336 cm$^2$  
   h) 63 cm$^2$  
   i) 5 cm  
   j) 728 cm$^2$
3. a) 9 cm$^2$  
   b) 17.5 cm$^2$  
   c) 31 cm$^2$  
   d) 63.7 cm$^2$  
   e) 75 cm$^2$
Objectives

By the end of this unit, pupils will be able to:

• Use cubes to find the volume of a cuboid and a cube
• Use a formula to find the volume of a cuboid
• Identify the difference between cubes and cuboids.

Suggested resources

Cubic centimetre cubes or similar, cuboids of various dimensions, 0.25ℓ, 0.5ℓ and 1ℓ containers, large cubes to demonstrate (optional); Cubic centimetre cubes or similar, cuboids of various dimensions; Packaging in various dimensions (optional)

Key word definitions

volume: the amount of space that an object takes up. It is the capacity of a container

cubic centimeter: a metric unit of measure equal to \(\frac{1}{1000}\) of a litre written as cm³

cuboid: a box shaped object

Frequently asked questions

Q What prior knowledge should the pupil have?
A Pupils should be able to estimate, measure and compare the capacity of containers and solve problems related to capacity. Pupils should also be able to use the four basic operations to calculate capacity.

Q How can I help my pupils understand volume and cubic capacity?
A Collect cuboid-shaped empty containers and let the pupils fill them with cubic centimetre cubes. Transparent, waterproof rigid containers are especially useful, as the cubes are visible and they can be filled with water, so that pupils can make the connection between litres and cubic centimetres.

Common errors that pupils make

Pupils get confused about the names of the dimensions and deciding which is which. By turning the boxes around, pupils can see that the height can become the width, the length the width and so on, so just keep practising naming the dimensions. When using pictures of cuboids made from centimetre cubes, pupils only count the cubes they can see. Give the pupils the opportunity to make the cuboids with individual cubes and to count them. Encourage them to work out where the hidden cubes are in the diagrams and to count the cubes in rows, rather than individually.

Evaluation guide

Pupils to:

1. Use cubes to find the volume of cuboids and cubes.
2. Use formulae to find volume of cuboids.
3. Identify the difference between cubes and cuboids.

Lesson 1 Pupil’s Book page 157

Preparation

You will need to have:

• Pupil’s Book
• Cubic centimetre cubes or similar, cuboids of various dimensions, 0.25ℓ, 0.5ℓ and 1ℓ containers, large cubes to demonstrate (optional)
• Cubic centimetre cubes or similar, cuboids of various dimensions
• Packaging in various dimensions (optional).
Starter activity

Find the perimeters and areas of various squares and rectangles (covered in Units 20 and 25). Ask the pupils questions such as ‘What is the perimeter/area of a square with 6 cm sides?’, ‘What does each side of a square field measure if its area is 25 m² (5 m)?’ ‘The dimensions of a rectangle are 5 cm and 8 cm, what is its area/perimeter (40 cm²/26 cm)?’ and ‘If a rectangle has a perimeter of 24 cm, what could its dimensions be (6 by 6, 10 by 2, 8 by 4, …)?’ Check that the pupils use the correct unit of measure in their answers.

Lesson focus

As this lesson introduces volume using cubic centimetres, spend some time allowing the pupils to experiment with the cubes and boxes of different dimensions. Allow them to compare the number of cubes with the capacity, and to see how many cubes fit along each of the dimensions. Explain that 1 cm³ is equal to 1 ml and that 1 000 cm³ = 1 ℓ. If you have the time and the resources, pupils could prove this by filling a 200 ml or 250 ml container with centimetre cubes. Four groups of pupils could each fill a 250 ml container, or five groups could each fill a 200 ml container, both of which equals 1 ℓ. Revise the properties of cubes and cuboids, showing the pupils some examples if available, for example cereal packets and dice. Allow the pupils to look into the empty containers to see the space inside, as you explain that volume is the space that an object takes up. Look at the worked example on page 158 of the PB. Use large demonstration cubes, if you have them, and put them in different arrangements, for example 3 by 2 by 2. Explain that there are 12 cubes in all of the arrangements and that all the cuboids have a volume of 12 cm³.

Show the pupils how to write cubic centimetres, explaining that the superscript 3 represents the third dimension, the height. Point out each dimension on the cuboids. Turn the shapes around, so that the length becomes the height and name the dimensions again. After the pupils complete Exercise 1, work through the example on page 159 of the PB, encouraging them to count in rows. Then ask the pupils to complete Exercise 2. For the Challenge, you could also give the pupils cubes to use, but advanced pupils will probably be able to work it out using multiplication facts.

Answers

Exercise 1

1. a) 20 cm³
   b) 36 cm³
   c) 60 cm³

2. a) 8 cm³
   b) 15 cm³
   c) 20 cm³

Assessment

Assess whether pupils can use centimetre cubes to find the volume of a cuboid.

Extension activity

Pupils also complete the Challenge activity on page 159 of the PB if there is time available.

Homework activity

Ask the pupils to find some examples of cuboids to bring in for a class display to use later on.

Lesson 2  Pupil’s Book Page 159

Preparation

You will need to have:

• Pupil’s Book
• Cubic centimetre cubes or similar, cuboids of various dimensions, 0.25 ℓ, 0.5 ℓ and 1 ℓ containers, large cubes to demonstrate (optional)
• Cubic centimetre cubes or similar, cuboids of various dimensions
• Packaging in various dimensions (optional).

Starter activity

Repeat the starter activity of Lesson 1.

Lesson focus

As this lesson follows on from the previous lesson work through the example on page 159 of the PB, encouraging pupils to count in rows. Then ask the
pupils to complete Exercise 2. Give pupils addition cubes to work out, by drawing them plus their measurements, on the board.

**Answers**

**Exercise 2**

24 cm³

**Assessment**

Assess whether pupils can use centimetre cubes to find the volume of a cuboid.

**Extension activity**

Pupils to complete the additional cube questions drawn on the board.

**Homework activity**

Ask the pupils to sketch examples of cuboids in and around their home.

**Lesson 3**  
*Pupil’s Book page 160*

**Preparation**

You will need to have:

* Pupil’s Book.

**Starter activity**

Ask the pupils to multiply three numbers together, for example 3 × 4 × 5; 20 × 2 × 5; 10 × 2 × 4. Include 2 × 2 × 2; 3 × 3 × 3 and 10 × 10 × 10. Also ask the pupils to find three numbers whose product is 24, 30, 60, 100 and 120.

**Lesson focus**

Remind the pupils that squares and rectangles have two dimensions: length and width. Explain that the third dimension of cuboid is called the height. This is why a cuboid is a 3-D shape and a rectangle is a 2-D shape.

Work through the example on page 160 of the PB, which shows the pupils how to use dimensions, instead of counting cubes. Encourage pupils to use the dimensions in Exercise 3, and then to check their answers by counting the cubes. For the Challenge, remind the pupils that a cube is a special cuboid in which the three dimensions are all the same. They may need to use a written method of multiplication for some calculations.

Now introduce the formula for finding the volume of a cuboid. First, revise the formula for the area of a rectangle, and then explain that the volume is found by multiplying this area by the third dimension, which is the height. This makes the formula: length × width × height, or l × w × h.

Ask pupils to complete Exercise 3. For the word problems, encourage the pupils to write down the calculation they are using, to reinforce the formula.

**Answers**

**Exercise 3**

1. a) 240 cm³  
   b) 360 cm³  
   c) 420 cm³  
   d) 432 cm³  
   e) 175 cm³  
   f) 343 cm³

2. 240 cm³

3. 120 000 cm³

4. 63 000 cm³

5. 249 600 m³

6. 6 480 m³

7. 2.7

8. 7.5 cm

**Assessment**

Pupils should be able to find the volume of a cuboid using a formula.

**Extension activity**

Complete the following exercise.

1. A water tank is 11 meters high, 11 meters long, and 5 meters wide. A solid metal box which is 9 meters high, 3 meters long, and 2 meters wide is sitting inside the tank. The tank is filled with water. What is the volume of the water in the tank?
2. Find the volume of each L-block.

a)  

\[
\begin{array}{c}
5 \text{ m} \\
5 \text{ m} \\
12 \text{ m} \\
13 \text{ m}
\end{array}
\]

b)  

\[
\begin{array}{c}
3 \text{ cm} \\
4 \text{ cm} \\
6 \text{ cm} \\
12 \text{ cm}
\end{array}
\]

Homework activity
Pupils should complete the Revision exercise on page 161 of the PB.

Lesson 4 Workbook page 46

Preparation
You will need to have:
• Workbook.

Lesson focus
Check the answers to the Revision exercise before commencing the assessment task. Pupils have to complete Worksheet 26 in the WB. This assessment tests the extent to which the pupils have achieved the objectives stated at the beginning of this unit. You should give the pupils a set time (30–40 min) in which to complete the assessment. Each pupil should work on their own. Encourage pupils not to spend too much time on one question if they get stuck. Instead, they should leave it and come back to it if they have time left. Encourage them to check their answers if they finish before the set time is over. Collect in the answers to mark them, identify any problem areas and revisit those areas if necessary.

Answers

Revision exercise
1. Practical
2. Practical
3. A cube is a box shape that has equal sides
A cuboid is a box shape that may have different size sides

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5 cm</td>
<td>3 cm</td>
<td>7 cm</td>
<td>105 cm³</td>
</tr>
<tr>
<td>B</td>
<td>8 cm</td>
<td>15 cm</td>
<td>1 cm</td>
<td>120 cm³</td>
</tr>
<tr>
<td>C</td>
<td>18 cm</td>
<td>2.4 cm</td>
<td>35 cm</td>
<td>1 512 cm³</td>
</tr>
<tr>
<td>D</td>
<td>6 m</td>
<td>9.5 cm</td>
<td>7.2 cm</td>
<td>410.4 m³</td>
</tr>
<tr>
<td>E</td>
<td>20 m</td>
<td>18 m</td>
<td>5.6 m</td>
<td>2 016 m³</td>
</tr>
</tbody>
</table>

5. 2 688 m³
6. 2.5 cm

Assessment
Pupils should be able to find the volume of a cuboid and also be able to define and recognize a cuboid.

Extension activity
Pupils to think of real life situations where it would be important to know the volume of a cuboid, for example a container ship or when packing a lorry.

Homework activity
Pupils to complete any corrections from the Revision exercise.

Workbook answers Worksheet 26
1. Pupils to record
2. 5 000 cm³ = 5 litres
3. 1 000 litres
4. 1 cubic centimetre
5. a) 480 cm³  
   b) 70 cm³  
   c) 1200 cm³  
   d) 8 cm  
   e) 16.66 cm
Unit 27: Capacity

Objectives

By the end of this unit, pupils will be able to:

• Find the relationship between litres and cubic centimetres

• Identify the use of litres as a unit of capacity.

Suggested resources

A poster showing the conversion factor between litres and millilitres (1 ℓ = 1 000 ml), alternatively, write this on the board and refer to it throughout this unit; Drinking glasses, tea cups, mugs, milk bottles, measuring jugs or cylinders (pupils should bring; Their own items to school, but have spares on hand for those pupils who forget, or are unable to bring their own); A variety of items of different capacities; some should have very different capacities, for example a bucket and a thimble; some should be trickier to compare, for example a glass and a mug. You could include items from the resources listed in Lesson 1. Each pupil should have two cups of different capacities, as well as a large spoon; Labels with different capacities written on them, pins; Cube of dimension of 10 cm × 10 cm × 10 cm; Flash cards.

Common errors that pupils make

When comparing litres and millilitres, some pupils will simply compare the numbers and forget about the units. Remind the pupils that they need to convert all measurements either to litres or to millilitres before they can compare different capacities. Pupils often get confused about when to divide and when to multiply when they convert between units of measurement in general. Remind them that when they convert from a large unit to a small unit, they are making many small units from a larger unit, so they need to multiply. When they convert from a smaller unit to a larger unit, they are combining many smaller units together to form a larger unit, so they need to divide. Keep reminding them to refer to the conversion factor on the board. The word problems in Exercise 20.5 are simple, but some pupils will still claim that they are not sure what to do. As is always the case with word problems, encourage your pupils to read each problem through carefully and to identify the key facts, before deciding which operations to use.

Evaluation guide

Pupils to:

1. Find the relationship between litres and cubic centimetres.

2. Identify the use of the litre as a unit of capacity and the established relationship between litre and cubic cm³.

Lesson 1 Pupil’s Book page 162

Preparation

You will need to have:

• Pupil’s Book

• A poster showing the conversion factor between litres and millilitres (1 ℓ = 1 000 ml), alternatively, write this on the board and refer to it throughout this unit

• Drinking glasses, tea cups, mugs, milk bottles, measuring jugs or cylinders (pupils should bring their own items to school, but have spares on hand for those pupils who forget, or are unable to bring their own)

• A variety of items of different capacities. You could include items from the resources listed in Lesson 1. Each pupil should have two cups of different capacities, as well as a large spoon

• Labels with different capacities written on them, pins

• Flash cards.
Starter activity

Hold up two containers of very different capacities, for example a small plastic glass and a large plastic bottle. Ask your pupils to think of different ways in which they can find out how many of the small plastic glasses will fit into the big plastic bottle. One way is to fill the bottle with water and then count how many times you can fill the glass from the bottle. Another way is to fill the glass with water and empty it into the bottle, counting how many times this process must be repeated. Now place a measuring cylinder or a measuring jug next to the glass and the bottle. Ask the pupils questions such as ‘Does this give us new ways of doing this calculation?’ ‘Which way is easiest?’ ‘Which way is messiest?’ and ‘Which method do you prefer?’

Lesson focus

The focus of this lesson is the definition of capacity and measuring the capacity of everyday objects. Make sure that all your pupils understand what capacity is, as well as the relationship between litres and millilitres. Revise the basic conversion facts: 1 000 ml = 1 ℓ and 1 ℓ = 1 000 ml. Revise how to multiply and divide by 1 000 quickly. Have five different-sized containers in the class. Write labels for each container, for example 1 ℓ; 3 250 ml; 1 500 ml; 4.5 ℓ and 2 500 ml. Paste the labels on the containers. Have flash cards with the converted amounts written on them: 1 000 ml; 3.2 ℓ; 1.5 ℓ; 4 500 ml and 2.5 ℓ. Pupils need to match the flash card to the correct container. Discuss with the pupils why it is necessary to be able to convert millilitres to litres and vice versa. Work through the examples on page 162 of the PB and ask pupils to complete Exercise 1 on page 163 of the PB.

Answers

Exercise 1

1. a) 3 000 cm³  
   c) 375 cm³  
   e) 5 750 cm³
   b) 500 cm³  
   d) 2 500 cm³
2. a) 2 litres  
   c) 1⅔ litres  
   e) 8⅓ litres
   b) 5½ litres  
   d) 7 litres
3. a) 4 000 cm³  
   c) 8 000 cm³
   b) 500 cm³  
   d) 2 500 cm³

4. a) 1.5 ℓ  
   b) 0.4 ℓ  
   c) 9.8 ℓ  
   d) 6.5 ℓ  
   e) 4.45 ℓ
5. a) 2 ℓ 968 ml  
   b) 3 ℓ 250 ml  
   c) 5 ℓ 600 ml  
   d) 7 ℓ 208 ml  
   e) 1 ℓ 600 ml

Assessment

Pupils should be able to convert correctly between units in capacity.

Homework activity

Pupils have to complete the Challenge activity on page 162 of the PB.

Lesson 2 Pupil’s Book page 164

Preparation

You will need to have:

- Pupil’s Book
- A variety of items of different capacities; some should have very different capacities, for example a bucket and a thimble; some should be trickier to compare, for example a glass and a mug. You could include items from the resources listed in Lesson 1. Each pupil should have two cups of different capacities, as well as a large spoon.

Starter activity

Think up a simple word problem of your own that involves capacity and write it on the board. Read through the problem with your pupils, and then ask each pupil to draw their own diagram to illustrate the basic facts. Work through the examples on page 162 of the PB and ask pupils to complete Exercise 1 on page 163 of the PB.

Lesson focus

This lesson focuses on finding the capacities of various objects. These problems are presented as word problems. Therefore, you will have to remind pupils of the principles behind translating word sums into mathematics. Work through one or two
examples with your pupils. Make sure that your pupils understand each example, and advise them to refer back to these examples as they complete Exercise 2.

**Answers**

**Exercise 2**

1. \( \frac{360}{43} \times 8 \times 5 = 40 \text{ litres of petrol will be used for a 360 km journey} \)

2. \( \frac{24}{4.8} = 5 \)

3. \( 345 + 568 + 1671 = 2584 \text{ cm}^3 = 2.584 \ell \)

4. \( 540 + 480 + 432 + 908 = 2360 \text{ cm}^3 = 2.36 \ell \)

5. \( 0.75 \ell \times 35 = 26.25 \ell = 26250 \text{ cm}^3 \)

6. a) \( 8 \times 250 \text{ ml} = 2000 \text{ ml} = 2 \ell \)
   
b) \( 31 \times 2 \ell = 62 \ell \)
   
c) \( 365 \times 2 \ell = 730 \ell \)

7. \( 5950 \div 350 = 17 \)

8. \( 12000 - 250 - 9000 - 780 = 1970 \text{ ml} = 1.97 \ell \)

9. \( 5400 \text{ cm}^3 \div 18 = 300 \text{ cm}^3 = 0.3 \ell \)

10. \( 12.5 \ell - 8.025 \ell = 4.475 \ell \)

**Assessment**

Assess the performance of pupil’s in the following. Can they:

- Add capacities correctly
- Subtract capacities correctly
- Multiply capacities correctly
- Divide capacities correctly
- Solve word problems that involve capacity.

**Extension activity**

Ask pupils to complete the Challenge activity on page 164 of the PB.

**Homework activity**

Ask pupils to list the capacity of five household containers at home.

**Lesson 3**

Pupil’s Book page 165

**Preparation**

You will need to have:

- Pupil’s Book
- A variety of items of different capacities; some should have very different capacities, for example a bucket and a thimble; some should be trickier to compare, for example a glass and a mug.

**Starter activity**

Ask pupils to read out the containers they listed for homework and their capacities. Talk about common capacities for household items, for example 500 ml or 1 litre. Ask pupils to suggest why containers are similar sizes and not very large sizes such as 50 litres.

**Lesson focus**

Allow time for pupils to experiment with different size containers and then go through the unit summary on page 165 of the PB. Ask pupils to complete the Revision exercise on page 165.

**Answers**

**Revision exercise**

1. Capacity is the amount of space a container can hold in units of capacity
2. 1000 cm\(^3\)
3. 1 cm\(^3\)
4. 1000 ml
5. 1 \ell
6. Learner draws measuring cylinder
7. 1 teacup holds 250 ml; therefore 1 litre is = 4 cups
8. A teaspoon holds 5 ml and an eyedropper holds approximately 1 ml so a teaspoon holds more liquid than an eyedropper
9. a) \( 450 \text{ ml} + 550 \text{ ml} = 1 \ell \)
   
b) \( 9 \ell 453 \text{ ml} - 6 \ell 353 \text{ ml} = 3 \ell 100 \text{ ml} \)
10. \( 500 \text{ ml} = 500 \text{ cm}^3 \)

**Assessment**

Pupils should be able to understand the meaning of capacity and how to solve problems involving capacity.
Homework activity
Pupils to use the following work sheet to continue measuring containers at home.

<table>
<thead>
<tr>
<th>Container or Fluid</th>
<th>Volume in ml, cl or ℓ</th>
<th>Is it MORE or LESS than 1 litre?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200 ml</td>
<td>LESS than 1 litre</td>
</tr>
</tbody>
</table>

Lesson 4  Workbook page 49

Preparation
You will need to have:
• Workbook.

Start activity
Go through the worksheet from Lesson 3 homework.

Lesson focus
Check the answers to the Revision exercise before commencing the assessment task. Pupils have to complete Worksheet 27 in the WB.

Answers
Worksheet 27 page 49.

Assessment
Pupils should be able to convert litres into cubic centimetres and also to compare various units of capacity.

Workbook answers Worksheet 27

1. a) Total = 133.8 litres  
   b) 133 800 cm³
2. a) 250 ml + 750 ml = 1ℓ  
   b) 500 cm³ + 500 cm³ = 1ℓ  
   c) 1ℓ – 350 ml = 650 ml  
   d) 6 350 ml
3. a), b) Litres are useful for measuring petrol consumed, the amount of liquids used or needed for a recipe, the capacity of containers, tanks etc.
4. a), b) litres, centilitres, millilitres, kilolitres
5. 4ℓ = 4 000 cm³  
   4 000 + 6 = 666.67 cm³
6. a) 1 ml = 0.001ℓ  
   b) 5 ml = 0.005ℓ  
   c) 250 ml = 0.25ℓ
7. 29 cl or cm³ = 2.9ℓ  
   35 cl or cm³ = 3.5ℓ
8. 4ℓ = 4 000  
   4 000 ÷ 6 = 666.67
9. a) 1 ml  
   b) 5 ml  
   c) 250 ml
10. 29 cl or = 2.9ℓ  
   35 cl or = 3.5ℓ
11. a) 6  
    b) 11  
    c) \( \frac{1}{2} ℓ \)
Objectives
By the end of the unit, pupils will be able to:
• Describe the shape of the earth
• Compare volume of a sphere and cuboid.

Suggested resources
String, rope, objects with circular faces (oranges or apples), pairs of compasses, pins, nails, pencils, a globe of the earth; Cardboard box

Key word definitions
sphere: a round solid figure, or its surface, with every point on its surface equidistant from its centre
radius: a straight line from the centre to the circumference of a circle or sphere
hemisphere: a half of a sphere

Frequently asked questions
Q What prior knowledge should the pupil have?
A Pupils need a good understanding of the concept of circles. They need to be able to measure length and distance round a circle. They also need to understand and be able to choose the appropriate unit of circumference.

Q How do I ensure that pupils learn the concept of circumference effectively?
A Give pupils as much practice as possible. Make them draw circles and measure round them. You can also allow pupils to practise measuring of circumference on the school playing ground and on paper.

Evaluation guide
Pupils to:
1. Describe the shape of the earth.
2. Say which is bigger, the volume of the sphere or the volume of the cuboid that encloses it.

Lesson 1  Pupil’s Book page 166

Preparation
You will need to have:
• String, rope, objects with circular faces (oranges or apples), pairs of compasses, pins, nails, pencils, a globe of the earth
• Cardboard box
• Pupil’s Book.

Starter activity
Provide a globe to allow pupils to see the shape of the Earth. Compare this shape with orange shape and ball shapes and ask pupils to draw these shapes in their books.

Lesson focus
This lesson focuses on the shape of the earth and the volume of a sphere. Ask pupils to mention other objects that are spherical in shape. Explain to the pupils that a sphere has a centre just like an orange. Cut an orange into two equal halves and show to the pupils its centre. Tell them that each half of a sphere is called a hemisphere. Work through Questions 1 to 6 of Exercise 1 on page 166 and 167 of the PB and guide pupils in their thinking processes when they attempt to answer the questions.

Answers
Exercise 1
1. Learners give their own examples of spherical shapes
2. Spherical
3. Sphere
4. Learners draw 2 halves of sphere
5. Learners show the centre and radius
6. Hemisphere

Assessment
Pupils should be able to find diameter of a sphere and calculate the volume of a sphere. Give extra practice examples if needed.

Homework activity
Ask pupils to solve the Challenge problem on page 170.

Lesson 2 Pupil’s Book page 167

Preparation
You will need to have:
- Globe
- Various spherical objects
- Pupil’s Book.

Starter activity
Remind pupils of the previous lesson and work through the answers to the extension activity.

Lesson focus
Book and guide pupils in their thinking processes when they attempt to answer the questions. Ask pupils to compare the volume of a sphere and volume of a box. Show to the pupils by demonstration that the volume of a sphere is less than the volume of any box that it can fit inside. Work through the examples on page 167 of the PB with the pupils to prepare for Exercise 2. Complete Exercise 2 page 168 of the PB.

Answers
Exercise 2
1. a) \( \frac{4}{3} \times \frac{22}{7} \times 7^3 = 205 \frac{1}{3} \) cm³
   b) \( \frac{4}{3} \times \frac{22}{7} \times 3.5^3 = 179 \frac{2}{3} \) cm³
   c) \( \frac{4}{3} \times \frac{22}{7} \times (\frac{21}{2})^3 = 4851 \) cm³
   d) \( \frac{4}{3} \times \frac{22}{7} \times 5^3 = 523.1 \) cm³
   e) \( \frac{4}{3} \times \frac{22}{7} \times 2.5^3 = 65.48 \) cm³
2. a) \( \frac{5}{2} \times \frac{4}{3} \times \frac{22}{7} \times 3^3 = 56.57 \) cm³
   b) \( \frac{5}{2} \times \frac{4}{3} \times \frac{22}{7} \times 7^3 = 718.667 \) cm³
   c) \( \frac{5}{2} \times \frac{4}{3} \times \frac{22}{7} \times (\frac{21}{2})^3 = 2425.5 \) cm³
   d) \( \frac{5}{2} \times \frac{4}{3} \times \frac{22}{7} \times 6^3 = 452.571 \) cm³
   e) \( V = \frac{4}{3} \times \frac{22}{7} \times r^3 \) so \( 25 = \frac{88}{21} \times r^3 \); then \( 25 \times \frac{88}{21} = r^3 \); \( r = 1.814 \) cm³
3. a) \( V = \frac{4}{3} \times \frac{22}{7} \times r^3 \) so \( 25 = \frac{88}{21} \times r^3 \); \( r = 1.814 \) cm³
   b) \( 89.83 = \frac{4}{3} \times \frac{22}{7} \times r^3 \); \( 89.83 = \frac{88}{21} \times r^3 \);
       \( r = 7.22 \) cm³
   c) \( 108\pi = \frac{4}{3} \times \pi \times r^3 \) so \( 25 = \frac{88}{21} \times r^3 \);
       then \( 25 \times \frac{88}{21} = r^3 \); \( r = 4.327 \)
   d) \( \frac{32}{3} = \frac{4}{3} \times \pi \times r^3 \); \( \frac{32}{3} \times \frac{3}{4} = r^3 \); \( r = 3 \)
   e) \( 36\pi = \frac{4}{3} \times \pi \times r^3 \); \( 36 = \frac{3}{4} \times r^3 \); \( r = 2 \)
4. Spherical bowl with \( r = 4 \) m hemisphere
   \( V = \frac{1}{2} \times \frac{4}{3} \pi r^3 = \frac{4}{6} \times \frac{22}{7} \times 4^3 = 134.095 \) m³
5. \( V = \frac{1}{2} \times \frac{4}{3} \pi r^3 = \frac{4}{6} \times \frac{22}{7} \times 7^3 = 718.667 \) m³
6. \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 2.1^3 = 38.808 \) cm³
7. \( V = 10 \times 8 \times 7 = 560 \) cm³
   Therefore to fill the box \( 560 - 113.143 = 446.857 \) cm³ is needed.
8. Sphere: \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 7^3 = 1437.333 \) cm³
   Cube: \( V = 7 \times 7 \times 7 = 343 \) cm³
   Therefore the sphere is larger
9. Volume of hemisphere with diameter 1.4 cm.
   \( r = 0.7 \) cm
   \( V = \frac{1}{2} \times \frac{4}{3} \pi r^3 = \frac{4}{6} \times \frac{22}{7} \times 0.7^3 = 0.718 \) cm³
10. \( V = \frac{3}{2} \pi r^3 \); so \( 36 = \frac{4}{3} \times \frac{22}{7} \times r^3 \);
    \( r^3 = 36 \times \frac{3}{4} \times \frac{7}{22} = 2.04 \) cm
    radius \( \frac{1}{4} \) of 2.04 = 0.512 cm;
    \( V = \frac{4}{3} \pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 0.512^3 = 0.5624 \) cm³

Assessment
Some pupils may struggle with this section of work. Make sure that they understand how to use the formula to calculate the volume of a sphere and hemisphere.

Extension/Homework activity
Challenge page 170 of PB.
Lesson 3 Workbook page 50

Preparation
You will need to have:
- Workbook.

Starter activity
Go through the challenge homework from Lesson 2. If time permits discuss the volume of different planets and compare them.

Lesson focus
Pupils have to complete Worksheet 28 in the WB.

Answers
Worksheet 28 at end of lesson.

Assessment
This assessment tests the extent to which the pupils have achieved the objectives stated at the beginning of this unit.

Extension/Homework activity
Pupils to list and draw as many spherical objects as they can think of.

Lesson 4 Pupils Book page 170

Preparation
You will need to have:
- Pupil’s Book.

Starter activity
Go through the answers to Worksheet 28.

Lesson focus
This lesson concludes Unit 28. Go through the summary on page 170 with pupils and recap on the content of the unit. Pupils should then complete the Revision exercise.

Answers
Revision exercise
1. Shape of the earth is a sphere
2. Learner gives 3 examples of other spheres
3. Hemisphere

4. \[ V = \frac{4}{3}\pi r^3 \]
5. \[ V = \text{length} \times \text{breadth} \times \text{height} \]
6. Diameter = 1.4 m therefore radius = 0.7 m
   \[ V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 0.7^3 = 1.43733 \text{ m}^3 \]
7. Shere \[ V = 100 \text{ cm}^3 \]
   \[ V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} r^3; 100 \times \frac{3}{4} \times \frac{7}{22} = r^3; r = 2.389 \]
   
   Radius \[ \frac{1}{2} \text{ of } 2.389 \text{ cm } = 1.1945 \text{ cm} \]
   \[ V = \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} r^3 \times 1.1945^3 = 7.142 \text{ cm}^3 \]
8. Spherical bowl is a hemisphere
   \[ V = l \times b \times h = 8 \times 7 \times 6 = 336 \text{ cm}^3 \]
   \[ 336 \text{ cm}^3 - 134.095 \text{ cm}^3 = 201.905 \text{ cm}^3 \]
Unit 29 Three-dimensional shapes

Objectives
By the end of this unit, pupils will be able to:
• State the properties of three-dimensional shapes such as cuboid, pyramids, cubes and so on
• Solve quantitative problems on the three-dimensional shapes.

Suggested resources
Wall chart, a collection of 3-D shapes, a model of a tetrahedron; Graph paper; Paper, rulers, protractors, scissors, tape; Paper for drawing nets, glue, examples of the 3-D shapes; Different boxes, such as Toblerone boxes or cereal boxes.

Key word definitions
three-dimensional shape (3-D): a figure that has three dimensions of length, width and height
flat surface: a surface that is straight
face: a flat surface
edge: a line where two faces meet
vertex: the point where two sides of an angle meet (the plural is vertices)
plane of symmetry: a flat surface that divides a 3-D shape into two identical shapes

Frequently asked questions
Q What prior knowledge should the pupil have?
A Pupils need to have knowledge of the following 2-D shapes: rectangle, square, triangle, circle, pentagon, hexagon, heptagon and octagons, and the following 3-D shapes: sphere, cylinder, cuboid, cube, cone, and pyramid. These were dealt with in earlier grades.
Q What skills do pupils need to do the work?
A Pupils need to be able to measure, draw and cut out shapes with precision. They also need to be able to paste neatly.

Evaluation guide
Pupils to:
1. Give the properties of 3-dimensional shapes.
2. Solve given quantitative aptitude problems relating to three-dimensional shapes.

Lesson 1 Pupil’s Book page 171

Preparation
You will need to have:
• Pupil’s Book
• Wall chart, a collection of 3-D shapes.

Starter activity
Discuss the properties of the 3-D shapes that the pupils learnt about in the previous grade. Use the wall chart showing the various shapes. Cover up the names of the shapes and ask the pupils to identify them. Allow volunteers to describe a particular 3-D shape. The rest of the class has to identify the shape using the pupil’s description.

Lesson focus
The focus is on identifying 3-D shapes. Emphasise the difference between 2-D and 3-D shapes. Start by going through all the technical terms (mathematical vocabulary) necessary for this unit. Try and have a model of each of the shapes covered in this unit available for the pupils to work with viz. Cube, triangular prism, rectangular prism, pyramid, cone, cylinder and sphere. Note that there are 2 different types of pyramids covered in this section i.e. triangular based and rectangular pyramids. Demonstrate how these shapes differ from each other by making clear reference to their edges, faces and vertices. Allow pupils to draw these shapes as this
will enhance their understanding of its properties. Complete Exercise 1.

**Answers**

**Exercise 1**

1. a) rectangular prism  
   b) triangular prism  
   c) cone  
   d) cylinder  
   e) cube  
   f) sphere  
   g) rectangular prism

2. a) 4  
   b) yes  
   c) triangles  
   d) 6  
   e) Learner draws triangular based prism

3. a) Learner names 2 of the shapes  
   b) Learner describes similarities of the 2 chosen shapes  
   c) Learner describes differences between the 2 chosen shapes

**Assessment**

Pupils should be able to identify 3-D and draw 3-D shapes. Draw additional shapes on the board for pupils to identify.

**Extension activity**

Ask pupils to do the Challenge activity on page 172 of the PB if there is time available during the lesson. If there is not enough time, pupils should complete the Challenge for homework.

**Homework activity**

Ask the pupils to draw any four of the 3-D shapes. They could also bring an example of an object that is the same as each of their drawings to class.

**Lesson 2**  
*Pupil’s Book page 174*

**Preparation**

You will need to have:  
- Pupil’s Book  
- Wall chart, a collection of 3-D shapes  
- Cardboard  
- Scissors, tape, glue.

**Starter activity**

In the classroom, display models of the different 3-D shapes that pupils have worked with. Encourage a class discussion about the properties of the shapes. Guide pupils by asking questions about the lengths of the sides, the shapes of the faces and the number of edges and vertices. Ask the pupils to group the shapes and to explain why they grouped them in the way that they did.

**Lesson focus**

The focus of this lesson is on identifying the properties of shapes and then using these properties to sort and compare them. Refer to the example on page 174 of the PB and work through the example of the square based pyramid by going through the properties viz. edges, angles, faces, vertices and symmetry. The point of the example is to show pupils that different 3-D shapes differ with respect to these properties. Use a few simple examples to explain the concept of symmetry to pupils. Emphasise that if a shape has symmetry, mirror images can be obtained when the object is halved, for example. Ask pupils to complete Exercise 2 on page 175 of the PB.

**Answers**

**Exercise 2**

1. |   | Edges | Faces | Vertices |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cube</td>
<td>12</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Cylinder</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Triangular prism</td>
<td>9</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

2. | Feature | Triangular based pyramid | Cone | Cuboid | Triangular prism |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Edges</td>
<td>6</td>
<td>1</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Surfaces</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Vertices</td>
<td>4</td>
<td>1</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Symmetry</td>
<td>4</td>
<td>-</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

3. a) A; E; G  
   b) D; F; H  
   c) B; C  
   d) A; B; C; D; E; F; G; H
e) F
f) B; C
g) B; C
h) A & E; B & C
4. a) Group 1 has circle planes
   b) Group 2 has circles and 2 surfaces
   c) Group 3 has 12 edges, 6 surfaces and 8 vertices
5. a) Cylinder can be made with A & B; a cuboid can be made with B; a triangular prism can be made with C
   b) Cylinder = 2 × A 1 × B; Cuboid 6 × B; Triangular prism 4 × C

Assessment
Pupils should be able to:
• Sort 3-D shapes
• Describe 3-D shapes
• Compare 3-D shapes.

Homework activity
Ask pupils to make paper/cardboard models of one of the following 3-D shapes:
Cube, cuboid, Cylinder, Triangular based pyramid, rectangular based pyramid, Cone.

In order to extend your brighter pupils, you can download from the internet some more complex 3-D shapes e.g. dodecahedron, and ask pupils to build models of these.

Lesson 3  Pupil’s Book page 177

Preparation
You will need to have:
• Pupil’s Book
• Wall chart, a collection of 3-D shapes
• Cardboard
• Scissors, tape, glue
• Protractors
• Paper for drawing nets
• Different boxes, such as Toblerone boxes or cereal boxes.

Starter activity
Work with the 3-D models pupils had to make for homework. Start off by using a self prepared model of any of the 3-D models and carefully open it up so that all the faces are seen as 2-D shapes. Stick the opened model on the board and ask pupils to identify the 2-D shapes that constitute the model. Ask pupils to hold up their models and ask the pupils to identify the 3-D shapes. Write the names of the shapes on the board. Ask the pupils to open up their models in the same way you have opened up yours and ask the pupils to talk about what they notice about the net that is made by each model.

Lesson focus
The lesson focuses on making models of 3-D shapes. This work should be done practically. You will need plenty of paper because the pupils will need practice getting the nets right. Follow the instructions on page 177 of the PB and ask pupils to follow the 5 steps outlined in the text. You may want to take a strong lead in this activity by giving the steps verbally to the pupils and making them to work at the pace you dictate. It is important that the pupils make all the models as this will help them understand the properties of the shapes better. Therefore, for additional practical exercise, it would be useful to bring boxes of different shapes and dimensions e.g. Tobelarone chocolate box, cereal boxes, etc., and to ask pupils to open them up and to sketch the nets for these shapes. It is important to allow the pupils to do all the practical work in this section which will help them understand both 2-D and 3-D shapes better. Complete Exercise 3.

Answers
Exercise 3
1. Learners draw net of their Maggi wrapper
2. Repeat using Omo packet
3. Cube; cuboid; cone; square based triangular pyramid; triangular prism
Assessment
Pupils should be confident at making nets for models of 3-D shapes and also identifying the correct 3-D shape from a given net. They should be able to design a net for a given 3-D shape.

Extension activity
Challenge page 179
1. Pupils design a net for the house.
2. Pupils make a model of the house using their net.

Homework activity
Ask the pupils to choose two different 3-D shapes that they see at home. They should draw or sketch the shape and design nets for each of these shapes. They should then construct the models using their nets.

Lesson 4  Pupil’s Book page 178

Preparation
You will need to have:
- Pupil’s Book.

Starter activity
Discuss the challenge from the previous lesson and establish if pupils need more time. Pupils will enjoy making the model but may need help.

Lesson focus
Pupils should also complete the Revision exercise on page 178 of the PB.

Answers
Revision exercise
1. A is a cuboid; B is a square based triangular pyramid; C is a cylinder; D is a triangular based prism; E is a cone; F is a triangular prism; G is a cube; and H is a sphere.
2. Learners construct models
3. a) 6  b) 5
c) 3  d) 4

Assessment
Pupils should be able to identify different shapes and draw their nets. Make sure that pupils understand what is meant by edges and faces.

Extension activity
Continue with the challenge from the previous lesson if more time is needed.

Homework activity
No homework activity, pupils can continue drawing nets of shapes.

Lesson 5  Workbook page 51

Preparation
You will need to have:
- Workbook.

Lesson focus
Check the answers to the Revision exercise before commencing the assessment task. Pupils have to complete Worksheet 29 in the WB.

Answers
Worksheet 29

Assessment
Pupils should be able to identify a three-dimensional shape and understand how a net can be folded to create a specific three-dimensional shape.

Extension/Homework activity
Corrections from revision exercise.
Workbook answers Worksheet 29

1. Three dimensional shapes are shapes with length, width and height.

2. a) Cube  
   b) Triangular prism  
   c) Rectangular prism  
   d) Triangular-based pyramid  
   e) Rectangular pyramid  
   Answers can also include: cone, cylinder, sphere.

3. A pyramid is a 3-D shape whose base is a polygon.

4. a) tins of food  
    b) drink cans  
    c) mugs  
    d) drinking glasses  
    e) rolling pins

5. |          | Faces | Edges | Vertices |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Cylinder</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>b) Triangular prism</td>
<td>5</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>c) Cone</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>d) Square-based pyramid</td>
<td>5</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>e) Cuboid</td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>f) Cube</td>
<td>6</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>g) Sphere</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

6. a) Cylinder  
   b) Cone  
   Sphere or hemisphere are other possible answers.

7. a) i) Triangular-based pyramid  
      ii) Triangular prism  
      b) Only the triangular-based pyramid  
      c) i) Cube  
      ii) Cuboid/rectangular prism  
      d) i) Cube and cuboid  
      ii) Triangular prism and triangular-based pyramid  

8. Cylinder – 3 2-D shapes  
   Cube and cuboid – 6 2-D shapes  
   Triangular prism – 5 2-D shapes  
   Triangular-based pyramid – 5 2-D shapes  
   Cone – 2 2-D shapes  
   Cylinder – 3 faces  
   Cone – 2 faces  
   Triangular-based pyramid – 5 faces  
   Cuboid/rectangular prism – 6 faces
Unit 30 Line and triangles

Objectives
By the end of this unit, pupils will be able to:
• Identify parallel and perpendicular lines
• Identify the different types of triangles
• Solve quantitative problems on lines and triangles.

Suggested resources
Pencil, ruler, set squares, protractor, cardboard, scissors; Two- and three-dimensional shapes; Models of equilateral, isosceles, and right-angled triangles

Key word definitions
identify: establish or indicate who or what (someone or something) is the amount of space that an object takes up. It is the capacity of a container
straight: extending or moving uniformly in one direction only; without a curve or bend
vertical: straight up
square corner: the angle where a vertical line meets a horizontal line
perpendicular lines: two lines which are at right angles to each other

Common errors that pupils make
Pupils cannot draw parallel lines accurately. When constructing a pair of parallel lines pupils should be careful when measuring the distance perpendicular to the first line. Use set squares or other square corners (such as the edge of a sheet of paper or ruler) to make sure the measurements are perpendicular, and always mark at least three points to check that they are correctly aligned.

Evaluation guide
Pupils to:
1. Identify parallel and perpendicular lines.
2. Solve quantitative aptitude problems on parallel and perpendicular lines.
3. State two properties each of equilateral, isosceles and right-angled triangles.
4. Solve given quantitative aptitude triangle problems.

Lesson 1 Pupil’s Book page 180

Preparation
You will need to have:
• Pupil’s Book
• Pencil, ruler, set squares, protractor.

Starter activity
Ask pupils to use a ruler to draw horizontal lines measuring 5 cm, 2 cm, 15 cm and 20 cm in their books. Ask them to draw vertical lines measuring 3.5 cm, 9 cm, 6 cm and 16 cm in their books. Ask pupils to draw a 4 cm horizontal line and 5 cm vertical line to begin from the same point and to measure the length of the line joining the two end points.

Lesson focus
This lesson focuses on the concept of parallel and perpendicular lines. Ask pupils to draw two horizontal lines measuring 5 cm that are 3 cm apart along the whole length. Guide the pupils to draw a parallelogram with AB parallel to CD and of 5 cm length with AD parallel to BC and of 4 cm length. Show how arrows are used to denote parallel lines and give pupils more practice work if necessary. Ask pupils to draw a vertical line and a horizontal line to touch each other at a point. The point at which they meet forms a perpendicular angle. The lines are therefore called perpendicular lines. Ask the pupils to draw rectangles PQRS with PQ = 6 cm and QR = 4 cm. Guide the pupils to identify the
perpendicular lines. Work through examples and activities to prepare the pupils for Exercise 1.

**Answers**

**Exercise 1**
1. Learners draw parallel lines 5 cm apart
2. Book; white board; ruler; table
3. Square, rectangle, rhombus, hexagon, trapezoid
4. Learners draw the shapes from Question 3
5. No

6. 
   - A
   - B
   - C
   - D
   - E
   - F
   - G
   - H
   - I
   - J

**Exercise 2**
1. 
   - a) no
   - b) no
   - c) no
   - d) yes
   - e) no
   - f) yes
   - g) yes
   - h) no
   - i) yes
   - j) no

2. 
   - a) rectangle
   - b) square
   - c) a parallelogram does not have perpendicular angles
   - d) a trapezium does not have perpendicular angles
   - e) a kite does not have perpendicular angles
   - f) a rhombus does not have perpendicular angles
   - g) right-angled triangle
   - h) isosceles triangle does not have perpendicular angles

**Assessment**

Pupils should be able to:
- Identify parallel and perpendicular lines
- Distinguish between parallel and perpendicular lines
- Draw parallel and perpendicular lines.

**Homework activity**

Ask pupils to complete and unfinished problems from the given exercises. Ask pupils to revise the concepts of angles viz. acute, obtuse, reflex, revolution.

**Lesson 2 Pupil's Book page 183**

**Preparation**

You will need to have:
- Pupil’s Book
- Pencil, ruler, set squares, protractor, cardboard, scissors
- Two- and three-dimensional shapes
- Models of equilateral, isosceles, and right-angled triangles.

**Starter activity**

Cut out lots of different types of triangles out of card, for use with the class. Ask a pupil to use a protractor to measure the angles of a few triangles. For each triangle they should add the three angles. Discuss with the pupils what they have observed about the sum of the three angles of each triangle.

**Lesson focus**

Refer to page 183 of the PB and work through the properties of the four main types of triangles. Emphasise the similarities and differences between the 4 types of triangle. Ask pupils to use their
mathematical instruments to draw at least one of each of the different triangles as accurately as they can. Now ask the pupils to complete Exercise 3.

**Answers**

**Exercise 3**

1. Isosceles
2. equilateral
3. a) right-angled  b) equilateral  c) equilateral  d) isosceles  e) right-angled
4 & 5. a) isosceles  b) equilateral  c) scalene  d) scalene
6. a) 2       b) 0       c) 4       d) 3

**Assessment**

Pupils should be able to recognise and name the different types of triangles. They should also be familiar with the properties of the different types of triangles.

**Homework activity**

Ask pupils to complete the Challenge activity on page 186 of the PB.

---

**Lesson 3  Pupil’s Book page 185**

**Preparation**

You will need to have:
- Pupil’s Book
- Two- and three-dimensional shapes
- Models of equilateral, isosceles, and right-angled triangles.

**Starter activity**

Check all outstanding homework. Briefly revise the concepts of lines and triangles.

**Lesson focus**

Ask pupils to complete the Revision exercise. Pupils should work on their own and the teacher should move around the class checking and monitoring the pupils’ progress.

**Answers**

**Revision exercise**

1. lines drawn measuring 5 cm, 8 cm and 2 cm
2. and 3.
   a)  
   b)  
   c)  
   d)  

4. A triangle in which all sides are equal
5. An equilateral triangle has all sides equal and all angles equal
   An isosceles triangle has 2 equal sides and 2 equal angles
   A scalene triangle has no angles or sides equal
   A right-angled triangle has one of its angles at a right angle
6. only the cuboid has parallel lines

**Assessment**

Make sure that pupils can distinguish between parallel and perpendicular lines and also recognise and name the different types of triangles. Pupils should be familiar with the properties of the different types of triangles and solve problems involving lines and triangles.

---

**Lesson 4  Workbook page 55**

**Preparation**

You will need to have:
- Workbook.

**Starter activity**

Check the answers to the Revision exercise before commencing the assessment task and go through any questions that caused problems.
Lesson focus

Pupils have to complete Worksheet 30 in the WB. This assessment tests the extent to which the pupils have achieved the objectives stated at the beginning of this unit. You should give the pupils a set time (30–40 min) in which to complete the assessment. Each pupil should work on their own. Encourage pupils not to spend too much time on one question if they get stuck. Instead, they should leave it and come back to it if they have time left. Encourage them to check their answers if they finish before the set time is over. Collect in the answers to mark them, identify any problem areas and revisit those areas if necessary.

Answers

WB Worksheet 30.

Assessment

Pupils should be able to identify parallel lines, perpendicular lines, names of different shapes and names of triangles. Make sure they are familiar with the terminology and can identify the angles of triangles and rectangles.

Workbook answers Worksheet 30

1. a) Slanted line b) Vertical line c) Horizontal line
2. a) parallel b) perpendicular
3. Teacher to check that arrows are correctly used to show parallel lines.
4. a) Trapezium has one pair of parallel lines
   b) Rectangle has two pairs of parallel line
   c) Square has two pairs of parallel lines
5. Teacher to check measurement of line drawn.
6. Parallel lines are lines that are the same distance apart along their whole length.
7. Perpendicular lines are lines which are at right angles to each other.
8. a) Desk b) Board c) Door d) Walls
   (there are other possible answers, such as book, rug, cupboard etc)
9. Teacher to check that perpendicular angles are correctly shown.
10. a) Scalene b) Isosceles c) Equilateral d) Right-angled (in any order)
11. Isosceles triangle.
12. Scalene triangle.
13. a) Isosceles triangle b) Equilateral triangle c) Right-angled triangle
14. a) 4 triangles b) 3 triangles
15. Right angle.
Objectives
By the end of this unit, pupils will be able to:
• Identify the components of a circle – radius, diameter, and circumference of a circle
• Differentiate between radius and diameter
• Solve quantitative problems on circles.

Suggested resources
Rulers marked in centimetres and millimeters, protractors; pairs of compasses, pencils, poster of the circle with the circumference, diameter and radius clearly marked and labelled; String, rope, objects with circular faces, pins, nails, pencils; Two- and three-dimensional shapes

Key word definitions
radius of a circle: a line from the centre of a circle to any part of the circumference
diameter: a line that joins two points on a circle and passes through the centre of the circle. It is twice the radius
circumference: this is the distance around a circle

Frequently asked questions
Q What prior knowledge should the pupils have?
A In Unit 21 pupils were introduced to the concepts associated with circles. They should, therefore, be able to draw on that knowledge confidently and apply it in this unit. However, it is advisable to revise these concepts again to help refresh their memories.

Evaluation guide
Pupils to:
1. Identify radius, diameter, and circumference of a circle.
2. Solve quantitative aptitude problems on circles.
3. Identify and determine radius of a circle.

Lesson 1  Pupil’s Book page 187
Preparation
You will need to have:
• Pupil’s Book  • Workbook  • Rulers marked in centimetres and millimeters, protractors; pairs of compasses, pencils, poster of the circle with the circumference, diameter and radius clearly marked and labelled  • String, rope, objects with circular faces, pins, nails, pencils  • Two- and three-dimensional shapes.

Starter activity
Provide a chalkboard, a pair of compasses, a ruler and a pencil or a mathematical set. Take the pupils outside and demonstrate how to draw a circle on the ground before they come back for demonstration on how to draw same on paper.

Lesson focus
Introduce the lesson by discussing the difference between a free-hand sketch or drawing, and a drawing or construction made to specified dimensions. First show pupils how we can draw neat accurate circles by tracing around circular objects. Allow pupils to draw a few circles of their own and ask them to measure the diameters and radii of the circles they have drawn. Explain the different concepts of radius, diameter and circumference of a circle. Ensure that all pupils can measure correctly using a ruler and protractor and that they are comfortable using a compass. Demonstrate how to draw a circle using a compass when given a certain radius or diameter. Refer to the steps on drawing a circle on page 188 of the PB. Complete Exercise 1 page 187 PB.

Answers
Exercise 1
1. 4 circles traced showing radius and diametre
2. Learners give measurements
**Assessment**
Assess the performance of pupils in measuring circumference and drawing circles with given radii using only a pair of compasses and pencils. Some pupils may find this difficult to manage.

**Extension activity**
Ask pupils to complete the Challenge activity on page 188 of the PB.

**Lesson 2**  
**Pupil’s Book page 189**

**Preparation**
You will need to have:
- Pupil’s Book
- Workbook
- Rulers marked in centimetres and millimeters, protractors; pairs of compasses, pencils, poster of the circle with the circumference, diameter and radius clearly marked and labelled.

**Starter activity**
Discuss the different circles found by pupils for the scavenger hunt homework activity of Lesson 1.

**Lesson focus**
Work through the example of how to draw a circle on page 188 of the PB. Pupils will have worked with circles previously and should be confident in finding the circumference of a circle. Ask pupils to complete Exercise 2 in the PB.

**Exercise 2**
1. a) b)–d) repeated with different size radii
2. a) 18.86 cm b) 326.86 mm c) 282.86 mm d) 26.39 cm

**Assessment**
Make sure that pupils are able to use a protractor and compass accurately.

**Homework activity**
Worksheet 31 page 57 questions 1–5.

**Lesson 3**  
**Pupil’s Book page 189**

**Preparation**
You will need to have:
- Pupil’s Book
- Workbook
- Rulers marked in centimetres and millimeters, protractors; pairs of compasses, pencils, poster of the circle with the circumference, diameter and radius clearly marked and labelled.

**Starter activity**
Revise the Circumference formula taught in Unit 21. Ensure that pupils are familiar with the relationship between the radius and the diameter as well as the relationship between the diameter and the circumference. Revise the concept of pi again. Also revise inverse mathematical processes and how to change the subject of an equation.

**Lesson focus**
Work through the examples on page 189 of the PB. Now they will have to manipulate the formula so that they are able to find the diameter or the radius. Ask pupils to complete Exercise 3 in the PB.

**Answers**

**Exercise 3**
1. a) 326.72 cm b) 13.19 cm c) 21.99 cm d) 65.97 cm e) 52.78 cm f) 329.87 mm g) 31.416 cm h) 131.94 cm i) 1.319 m j) 659.73 mm
2. $C = 2\pi r; 305 \text{ cm} = 2 \times \frac{22}{7} r; \text{ so } 305 \times \frac{7}{22 \times 2} r = 48.5 \text{ cm}$
3. $C = 2\pi r; 100 \text{ cm} = 2 \times \frac{22}{7} r; \text{ so } 100 \times \frac{7}{22 \times 2} r = 15.9 \text{ cm and } d = 31.8 \text{ cm}$
4. $C = 2\pi r; 144 \text{ cm} = 2 \times \frac{22}{7} r; \text{ so } 144 \times \frac{7}{22 \times 2} r = 22.9 \text{ cm and } d = 45.8 \text{ cm}$

---

Unit 31: Circles and other plane shapes
5. Circle with diameter 6 cm. radius is \(\frac{d}{2} = 3\) cm
C = \(2\pi r\);
C = \(2 \times \frac{22}{7} \times 3 = 18.85\) cm
Sum of circumference and radius
= 18.85 cm + 3 cm = 21.85 cm

**Assessment**

Pupils should be able to calculate the circumference of circles using a formula. Give extra practice if needed.

**Extension activity**

Ask pupils to find some everyday object with a circular shape and to measure the diameter and find the circumferences using the formula.

**Homework activity**

Worksheet 32 page 57 questions 5, 6 and 7.

### Lesson 4  **Pupil’s Book page 190**

**Preparation**

You will need to have:
- Pupil’s Book
- Workbook
- Protractor and compasses.

**Starter activity**

Give pupils some circle radius measurements and ask them to draw the circles. The ask them to find the diameter and circumference.

**Lesson focus**

Go through the summary on page 190 and then ask pupils to complete the Revision exercise on their own.

**Answers**

**Revision exercise**

1. A circle is a set of points all the same distance from a fixed point
2. a) The radius is the distance from the centre of the circle to any point on the circle
   b) The diameter is a line that joins 2 points on a circle that passes through the centre of the circle
   c) The circumference the distance around the circle
3. | Radius | Diameter | Circumference |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5 cm</td>
<td>10 cm</td>
<td>31.42 cm</td>
</tr>
<tr>
<td>7 cm</td>
<td>14 cm</td>
<td>43.98 cm</td>
</tr>
<tr>
<td>10.5 cm</td>
<td>21 cm</td>
<td>65.97 cm</td>
</tr>
<tr>
<td>2 cm</td>
<td>4 cm</td>
<td>12.57 cm</td>
</tr>
<tr>
<td>14.005 cm</td>
<td>28.01 cm</td>
<td>88 cm</td>
</tr>
</tbody>
</table>
4. Learners give their own list of circle shapes.
5. \(C = 2 \times \pi \times r\); so \(105 \text{ cm} = 2 \times \frac{22}{7} \times r\);
\(105 \times \frac{7}{22 \times 2} = 16.7\) and \(d = 33.4\) cm

**Assessment**

Pupils should be able to draw and measure circles accurately and also find the circumference using the formula.

**Homework activity**

Worksheet 31 page 58 questions 8, 9 and 10.

**Workbook answers**  **Worksheet 31**

1. A 2-D shape
2. Pencil, ruler, pair of compasses
3. Pupils to complete
4. Radius, diameter, circumference
5. a) 1.5 cm b) 2 cm
6. 2
7. a) 6 cm b) 11 cm
c) 1 cm d) 2.6 cm
e) 7.2 cm f) 15.5 cm
g) 12\(\frac{1}{2}\) cm h) 14 cm
i) 18 cm j) 24 cm
8. Semi circle
9. Quarter
10. Pupils to draw
11. Pupils to give examples such as saucer, clock, plate, saucepan lid.
12. Pupils to give their own examples.
13. Pupils to give their own examples.
Objectives

By the end of this unit, pupils will be able to:

• Prepare a tally of data
• Draw bar graphs and pictograms of information collected locally.
• Data on test results, weather and elections
• Biological data.

Suggested resources

Examples of bar graphs, block graphs, pictograms, tables and tallies, with each example labelled clearly as to what type of graph or chart it is; Data on test results; Data on weather; Data on elections; Biological data.

Key word definitions

tally: a recorded count of scores
pictogram: a graph using pictures to represent numbers
data: a set of facts or numbers
table: information arranged in rows and columns
graph: a diagram that represents data

Frequently asked questions

Q: What prior knowledge should the pupil have?
A: Pupils should have a good working knowledge of whole numbers and be comfortable with the four basic arithmetic operations of addition, subtraction, multiplication and division. Pupils should also be familiar with the concepts of tallies, tables, pictograms and block graphs.

Evaluation guide

Pupils to:
1. Find the mode of a given set of data.

Lesson 1  Pupil’s Book page 191

Preparation

You will need to have:

• Pupil’s Book
• Workbook
• Examples of bar graphs, block graphs, pictograms, tables and tallies, with each example labelled clearly as to what type of graph or chart it is.

Starter activity

Ask pupils to gather information from each of the other pupils in the class. They could find out how many family members each pupil has. Ask them to create a visual display of the information they have gathered. They may choose to display the data in any form other than in the form of numbers. This activity requires quite a bit of time as pupils need to gather information.

Lesson focus

This lesson focuses on the interpretation and representation of data in tallies. Use the information the pupils have collected during the starter activity and show pupils how they can display their data using a tally table. Work through the examples on page 191 of the PB to show pupils how a tally is recorded. Ask pupils to complete Exercise 1 on page 192 of the PB.

Answers

Exercise 1

1. a) ||||  |||| b) ||||  ||||  |||| c) ||||  ||||  ||||  |||| d) ||||  ||||  ||||  ||||
   e) ||||  ||||  ||||  ||||  ||||  ||||  ||||  |||| f) ||||  ||||  ||||  ||||  ||||
   g) ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||
   h) ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||
   i) ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||
   j) ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||
   k) ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||  ||||
2. a) 3  b) 14  c) 20  d) 29  
   e) 16  f) 17  g) 30  h) 22  
   i) 6   j) 14

3.  1s ||||  2s ||||  3s ||||  4s ||||  5s ||||

Assessment
Make sure pupils understand how to represent data using tallies. This lesson should not cause problems as it follows on from work in previous years.

Homework activity
Worksheet 32 page 59 questions 1, 2 and 3.

Lesson 2  Pupil’s Book page 194

Preparation
You will need to have:
• Pupil’s Book  • Workbook.

Starter activity
Revise the concept of a table by showing pupils examples of different types of tables. Point out to pupils that tables are used to represent information. Tables also allow us to interpret the information easier. Hand out copies of tables that represent different types of information and ask pupils to explain what information each of their tables represent.

Lesson focus
This lesson focuses on the interpretation and representation of data in frequency tables. The lesson also shows how the use of tally tables are extended. Work through the example on page 194 of the PB and explain how a given set of data is transformed into a tally table and then a frequency table. Emphasis that a tally table and a frequency table do much the same thing with the data set. Ask pupils to complete Exercise 2 on page 195 of the PB.

Answers

Exercise 2
1. a)  
   b)  
   c)  
   d)  
   e)  
   f)  
   g)  
   h)  

2. Red  
   Blue  
   Green  
   Yellow

3.  2  3  4  5  6  7  8  9  10  11  12

Assessment
Pupils should be able to:
• Represent data in tallies
• Represent data in a table
• Interpret data.

Check their work during class time in order to identify any problems.

Extension activity
Ask pupils to do a tally of males and females in their extended family.
Lesson 3  Pupil’s Book page 196

**Preparation**
You will need to have:
- Pupil’s Book
- Workbook
- Examples of pictograms.

**Starter activity**
Revise the concept of a table by showing pupils examples of different types of tables. Point out to pupils that tables are used to represent information. Tables also allow us to interpret the information easier. Hand out copies of tables that represent different types of information and ask pupils to explain what information each of their tables represent.

**Lesson focus**
This lesson focuses on the interpretation and representation of data in pictograms. The lesson also shows how the use of tally tables are extended. Work through the example on page 196 of the PB and show pupils how the information contained the tally and frequency tables are transformed into graphical form viz. a pictogram. Pictograms are normally colourful and visually appealing graphs. Ask pupils to complete Exercise 3 on page 196 of the PB.

**Answers**

**Exercise 3**
1. a) 20  b) 5  c) Pepsi  d) 60  e) Coco cola
   Check pupil’s bar graphs.
2. a) 50  b) 60  c) Great Grace  d) 15  e) 19  f) 230
3. ![Graph](image)

Lesson 4  Pupil’s Book page 198

**Preparation**
You will need to have:
- Pupil’s Book
- Workbook
- Examples of bar graphs, block graphs.

**Starter activity**
Draw a table on the board to summarise the ages of the pupils in your class. The table below is an example. Adapt the first column to reflect the actual ages of your pupils. Complete the table by asking your pupils to put up their hands for questions such as ‘How many of you are girls and are 11 years old?’ and so on. Make sure that the total number of pupils matches the number of pupils present in your class. If your class has narrower age gaps, adapt the first column to reflect the actual ages of your pupils. You should aim for about six age groups. If you have a narrower age range, then use smaller age divisions, for example six, four or three months apart. Now draw a bar graph for the girls and a block graph for the boys. Discuss the differences between the two graphs, not only in terms of bars versus blocks, but also in terms of the shapes of the graphs.

**Lesson focus**
This lesson focuses on the representation of data in bar graphs. This lesson is an extension of the previous lessons and teaches another method of representing data visually. Make sure pupils understand how the set of axes are to be drawn and that numbering of the axes are done uniformly.
i.e. they must not place random numbers on these axes. Also the axes must be labeled clearly. Take great care to show how a value on one axis is related to another value on the other axis. Work through the example on page 198 of the PB with your pupils, and then ask them to complete Exercise 4.

### Answers

#### Exercise 4

1. Number of materials made at different factories
   ![Bar graph](image)

2 & 3. Marks | Number of pupils
---|---
10 | 1
11 | 1
12 | 22
13 | 14
14 | 6
15 | 6

4. Check pupil's bar graphs.

5. a) 12  b) 6  c) 5  d) 36
e) 12  f) 10 & 11

6. Number of pupils
   ![Bar graph](image)

7. Number of children
   ![Bar graph](image)

8. a) 45  b) 6  c) 12  d) 2

### Assessment

Pupils should be able to represent and interpret data in tables, tallies and bar charts. Check to make sure they can correctly interpret data in these forms.

### Extension activity

Ask pupils to complete the Challenge activity on page 201 of the PB.

### Homework activity

Worksheet 32 page 59 questions 4, 5 and 6.

### Lesson 5  Pupils Book page 201

#### Preparation

You will need to have:
- Pupil’s Book
- Workbook.

#### Starter activity

Go through the results of the challenge from the last lesson with pupils and recap on what they have learnt regarding pictograms and bar charts.

#### Lesson focus

This lesson consolidates Unit 32. Discuss the summary on page 201 with pupils and allow them to complete the Revision exercise during class time. Use the opportunity to walk around and check on pupil’s progress. Identify any pupils who are having problems with the work.

#### Answers

#### Revision exercise

1. A tally is a count
2. ||||
3. 1  
2  
3  
4  
5  

4. a) 60  b) 50  c) 65  d) Chess  
e) Draught
5. Check pupil’s bar graphs.

**Assessment**
Collect in the answers to mark them, identify any problem areas and revisit those areas if necessary.

**Homework activity**
Worksheet 32 page 60 Question 7.

**Workbook answers Worksheet 32**

1. A tally is a recorded count of scores, votes or other information.

2. c) 5

3. a) ||| b) |||| c) |||| d) |||| e) |||| f) ||||

4. A frequency table is a table showing the number of times a number or object occurs.

1.

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paw paw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strawberry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mango</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cashew</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. a)

<table>
<thead>
<tr>
<th>Marks</th>
<th>Tally</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. a) 40 b) 5 c) 9 d) the same amount of people.
Objectives
By the end of this unit, pupils will be able to:
• Find the mode of a given data
• Identify the mode as applicable in daily life activities
• Calculate the mean of a given data
• Identify mean of a set of data in daily life activities
• Solve quantitative aptitude problems on mode and mean of data.

Suggested resources
Sets of data (preferably taken from real-life situations); Data chart; Number cards

Key word definitions
mode: the number which appears most often in a set of numbers
mean: the average value of a set of numbers

Common errors that pupils make
Pupils sometimes give the frequency of the mode instead of the mode. This comes about when using frequency tables, as the pupils look to find the highest frequency, and simply write this down, instead of the number from the data. Make sure that they realise the mode has to be one of the original numbers in the set of data.

Evaluation guide
Pupils to:
1. Calculate mean of given data.
2. Calculate the mean from data received from the environment daily activities.
3. Solve quantitative reasoning problems on mode and mean of given data.

Lesson 1 Pupil’s Book pages 203

Preparation
You will need to have:
• Pupil’s Book
• Sets of data (preferably taken from real-life situations)
• Data chart

Starter activity
Display number cards with figures as follows: 4 tens, 2 elevens, 5 twelves, 3 thirteens, 8 fourteens and 3 fifteens not arranged in order. Ask questions on the displayed number cards, like: How many number cards are displayed on the cardboard? Which number is the highest in the number cards? Which is the lowest? Which of the numbers appear most common? What is the total of all the numbers displayed?

Lesson focus
Explain to the pupils that in a set of data, the number that appears most is said to be the most often and called the MODE of the data. Give examples like “there are 5 cups, 3 bowls, 8 jugs and 4 saucers on a table. Which of the items is the most common?” The pupils say ‘jugs’ and jug is the mode of the items presented. Ask pupils to state their ages in years. The most common age given is the mode of the ages of the pupils in the class. Also work through the example on page 203 and the example on page 204 of the PB. Ask your pupils to do Exercise 1 on page 204 of the PB.

Answers

Exercise 1
1. 4  2. 3  3. 10  4. 12
5. 6  6. 3 and 4  7. 15  8. 10
9. 0  10. 6
Assessment
Make sure pupils understand how to define and calculate mode of a data set.

Extension activity
Collect data: You and a partner find a busy traffic route and observe the passing cars from a safe distance. Record the make of all the cars that pass your observation point during a half an hour stint. Use the data collected to determine the most popular make of car.

Lesson 2  Pupil’s Book pages 204

Preparation
You will need to have:
• Pupil’s Book
• Sets of data (preferably taken from real-life situations)
• Data chart
• Number cards.

Starter activity
Revise the last lesson and remind pupils of how to tally numbers.

Lesson focus
This lesson follows on from Lesson 1. Pupils must now draw up a frequency distribution table. Use a simple example such as the number of boys and girl in the class and demonstrate on the board how to draw up a frequency distribution table. Ask your pupils to do Exercise 2 on page 204 of the PB.

Answers
Exercise 2
1. The mode is 3 2. The mode is 7
3. The mode is 15 4. The mode is Ogun
5. The mode is 8
6. a) oranges b) Babayaro
c) pigs d) 2007
e) December
7. a) 56–60 b) 22

Assessment
Make sure that pupils understand how to draw up a table. Remind pupils to check their numbers before counting up tallies.

Homework activity
Worksheet 33 page 63 questions 1–3.

Lesson 3  Pupil’s Book page 206

Preparation
You will need to have:
• Pupil’s Book
• Workbook.

Starter activity
Explain the concept of “average” to pupils. Tell them that in order to find an average, we add all the values in a data set and divide by the number of values that made up the data set. For example, to calculate the average mark pupils in the class scored on a test, all the pupils’ marks are added up and the total is divided by the number of pupils in the class.

Lesson focus
Ask the pupils to add together all the numbers in the list 1, 2, 1, 3, 2, 1, 3, 2, 2, 3 (20) and divide by the number of data items (10). Tell pupils this is the mean of the data. Make a frequency table with data and show to the pupils that the items that have the highest frequency is the mode. Demonstrate to the pupils how to find the mean using the tally table. Work through the example on page 206 of the PB and ask pupils to complete Exercise 3 of the PB.

Answers
Exercise 3
1. 5 2. 5.5 3. 12.375
4. 3 5. 5 6. 5
7. 5 8. 4 9. 15
10. 10
Assessment
Pupils should be able to define and calculate the mean of a data set.

Extension activity
Ask pupils to do the Challenge activity on page 207 of the PB.

Lesson 4  Pupil’s Book page 206

Preparation
You will need to have:
• Pupil’s Book
• Workbook.

Starter activity
Revise the work from the previous lesson on mean.

Lesson focus
This lesson follows on from Lesson 2. Examine the example on page 207 with pupils. Make a frequency table with data and remind pupils that the items that have the highest frequency is the mode. Demonstrate to the pupils how to find the mean using the tally table. Ask pupils to complete Exercise 4 page 207 of the PB.

Answers

Exercise 4

1.

<table>
<thead>
<tr>
<th>X</th>
<th>F</th>
<th>Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

$\sum f = 30$ $\sum fx = 113$

Average $= \frac{113}{30} = 3.766$

2.

<table>
<thead>
<tr>
<th>X</th>
<th>F</th>
<th>Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>14</td>
<td>84</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>72</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>63</td>
</tr>
</tbody>
</table>

$\sum f = 45$ $\sum fx = 339$

Average $= \frac{339}{45} = 7.533$

3.

<table>
<thead>
<tr>
<th>X</th>
<th>F</th>
<th>Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>13</td>
<td>6</td>
<td>78</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>15</td>
<td>7</td>
<td>105</td>
</tr>
</tbody>
</table>

$\sum f = 25$ $\sum fx = 334$

Average $= \frac{334}{25} = 13.36$

4.

<table>
<thead>
<tr>
<th>X</th>
<th>F</th>
<th>Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>22</td>
<td>264</td>
</tr>
<tr>
<td>13</td>
<td>14</td>
<td>182</td>
</tr>
<tr>
<td>14</td>
<td>6</td>
<td>84</td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td>90</td>
</tr>
</tbody>
</table>

$\sum f = 50$ $\sum fx = 641$

Average $= \frac{641}{50} = 12.82$

5.

<table>
<thead>
<tr>
<th>X</th>
<th>F</th>
<th>Fx</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

$\sum f = 30$ $\sum fx = 90$

Average $= \frac{90}{30} = 3$
6. 22.857
7. 5.25
8. a) 7 b) 3 c) 20 d) 3.05
9. a) 3 b) 20 c) 14 d) 3 e) 3.05
10. a) 1 b) 29 c) E d) 4.833

Assessment
Pupils should understand the difference between mode and mean and draw a simple bar graph.

Extension activity
Also ask pupils to complete the Quantitative Reasoning on page 210 of the PB.

Homework activity
Worksheet 33 page 61 questions 4 and 5.

Lesson 5 Pupil’s Book page 210

Preparation
You will need to have:
- Pupil’s Book
- Workbook.

Starter activity
Give pupils real life situations of examples of mean. For example bring in the rainfall and temperature tables for your area over 12 months and demonstrate to pupils why such tables are useful.

Lesson focus
Check the answers to the Quantitative Reasoning exercise then ask pupils to complete the Revision exercise. Take in their answers and mark them.

Answers
Revision exercise
1. a) The mean is the average
b) The mode is the most common number
c) The frequency is the number of times a number occurs
d) The distribution is the spread of the data
2. The mode on a graph is the one with the highest bar
3. 2
4. Average
5. a) Mode is between 3 and 5 = 4; mean = 3.5
b) Mode = 7; mean = 5.6
6. A frequency table has the number of times a number occurs
7. Mode = 1
   Mean = \( \frac{153}{60} \) = 2.55
8. Mode = 12
   Mean = \( \frac{172}{15} \) = 11.466

Assessment
When marking the Revision exercise be on the lookout for any pupils that may have not understood how to find the mode and mean. Give extra practice examples if needed.

Homework activity
Worksheet 33 page 61 questions 6, 7, 8 and 9.

Workbook answers Worksheet 33
1. Mode is the most common number or object in a set of data.
2. The mode
3. a) 2 b) 3 c) 10 d) banana
4. 10 years old
5. a) Pinto b) Jim c) Pinto d) Cantara
6. a) Mean = 3.8 b) Mean = 5.5 c) Mean = 4.7 d) Mean = 3.3
7. Mean = \( \frac{345 + 756 + 200 - 570 + 800}{5} \) = 534.2
8. Mean = \( \frac{12 - 15 - 18 + 21 + 24}{5} \) = 18
9. a) Tuesday b) Mean = 6 cm
10. Mean weight = \( \frac{1.5 + 2.3 + 2.1}{3} \) = 1.97 kg
11. Mean = \( \frac{56000 + 45000}{7} \) = N14 428.57
Objectives

By the end of this unit, pupils will be able to:
- Record data from experiments with coins and dice
- Identify various chance events in daily life activities.

Suggested resources

Coins, die

Key word definitions

experiment: a procedure carried out to verify the validity of a hypothesis
chance: a possibility of something happening

Evaluation guide

Pupils to:
1. Perform experiments as directed by the teacher, and record the result by tallying.

Lesson 1  Pupil’s Book page 203

Preparation

You will need to have:
- Pupil’s Book
- Coins, die.

Starter activity

Pair up pupils in the class and give each pair a coin and a die. Ask them to flip the coin at least 20 times and each time record the outcome. Check with them which coin toss had the greatest number of occurrences and which number was rolled the most on the die.

Lesson focus

This lesson focuses on the concept of chance using the toss of a coin. Which has two possible outcomes viz. heads or tails. Explain to pupils that each of these outcomes have an equal chance of occurring. This is called a 50-50 chance. Work through the example on page 211 of the PB. Ask pupils to complete Exercise 1 on page 211 of the PB.

Answers

Pupils to record their own answers.

Extension activity

Ask pupils to attempt the Challenge activity on page 212 of the PB.

Homework activity

Complete the following exercise.
1. A fair die is rolled.
   a) Find the probability of showing factors of 6.
   b) Find the probability of showing factors of 4.
   c) Find the probability of showing factors of 3.
2. Two fair coins are simultaneously tossed.
   a) Find all possible outcomes.
   b) Find the probability of showing head on the first coin
   c) Find the probability of showing tail on the second coin.
   d) Find the probability of showing at least one head.

Lesson 2  Workbook page 63

Preparation

You will need to have:
- Pupil’s Book
- Coins, die.

Starter activity

Check the answers to Exercise 1 before commencing the assessment task.
Lesson focus

Pupils can complete Worksheet 34 in the WB.

Answers

Workbook answers Worksheet 34.

1. Heads and tails
2. 1, 2, 3, 4, 5, 6
3. Dice
4. Pupils to complete the chart with their results
5. Pupils to draw the net.

Workbook answers Worksheet 34

1. Heads and tails
2. 1, 2, 3, 4, 5 and 6
3. Dice
4. Teacher to check tally tables.
5. Check pupil’s answers.
6. Teacher to check tally tables.
7. Possible outcomes = {HH, TT, TH, HT}
8. Teacher to check sketch.
9. Teacher to check sketch.
10. Possible outcomes = {HHH, HHT, HTH, HTT, TTT, TTH, THT, THH}
11. 8 possible outcomes.
12. The weather forecast, lottery draws, card games etc.
13. Many possible answers, teacher to check.
Design and make a *Ludo* game screen

This project allows pupils to combine their knowledge of a number of different topics, for example measurement and shape and space. It is also a way of engaging pupils to make a Ludo game to play with, especially in homes where toys and games may not be plentiful. Encourage pupils to engage with this project and they can practice measuring techniques while having a lot of fun! It is important that pupils are given sufficient materials to make the screen so that it can be played with. Also, once they have constructed their screen they will have a good understanding of the quadrilateral which will reinforce the work covered in 2-D shapes.

**Suggested resources**

Cardboard; Colour crayons; A ruler; A pencil; Eraser; 16 plastic discs (4 red, 4 blue, 4 green and 4 yellow); A sheet of hard paper or card

**Guidelines**

It will help if you allow pupils to work together. They can share materials and also help each other with the construction. It may be useful to have pupils help each other so that the task will be quicker to complete. For instance, while one or two pupils draw the squares another pupil could complete the construction of the die.

They should then be encouraged to suggest improvements to their construction. It is also important that pupils are given an opportunity to play the game when their game screens are done. An extension idea might include the construction of other game screens like snakes and ladders or draughts. If enough of these types of boards have been constructed and a sufficient variety has been made, these games could be donated to children’s hospitals or orphanages. In this way you could raise your pupils’ civic consciousness and develop in them a sense of sharing.
Objectives
The questions in this test cover Units 23–34, and so include questions on an array of topics covered in the units of this book. The questions follow the same order as the units, and so are not graded for difficulty, although in multi-part questions the easier questions are the first two. You may want to limit the questions for less able pupils, but ensure that they cover all the concepts in these units.

Lesson 1
Pupils should work through the questions on their own, taking the time they need. Encourage pupils not to spend too much time on a question if they get stuck. Instead, they should go on to the next question, and come back to the question they were struggling with if they have time at the end of the test. Encourage all pupils who have completed the test to spend at least five minutes checking their work. They should then have a quiet task to complete at their desks, so they do not disturb those who are still working.

Lesson 2
Hand back answer sheets to pupils. Go through the assessment with pupils and allow them to make corrections.

Answers to assessment 3
1. a) Two hundred and forty-three thousand five-hundred and seventy-six
   b) One million two thousand and ninety-one
   c) Three million one hundred and ninety thousand and two
2. a) 40 003
   b) 9 569 500
3. a) 34 612 < 63 413
   b) 607 987 > 67 087
   c) 1 260 211 < 2 167 002
   d) 90 000 005 > 9 009 009
4. 31; 33; 37; 41; 43; 47
5. a) 56 009
   b) 8 984 621

6.
<table>
<thead>
<tr>
<th></th>
<th>Ten Million</th>
<th>Million</th>
<th>Hundred Thousand</th>
<th>Ten Thousand</th>
<th>Thousand</th>
<th>Hundred</th>
<th>Tens</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>9</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

7. a) 36
     b) 770
     c) 315
8. a) 4:7
     b) 34:85
     c) 4:6:9
     d) 1:3
9. ₦30 000 was Bimbo’s share
10. a) ₦40
     b) 100 kg
     c) $60
11. 16%
12.

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal number</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1/2</td>
<td>0.1</td>
<td>33 1/3%</td>
</tr>
<tr>
<td>B 5/8</td>
<td>0.15</td>
<td>46 2/3%</td>
</tr>
<tr>
<td>C 1/4</td>
<td>0.09</td>
<td>50%</td>
</tr>
<tr>
<td>D 3/5</td>
<td>0.6</td>
<td>15%</td>
</tr>
<tr>
<td>E 1/3</td>
<td>0.33</td>
<td>10%</td>
</tr>
<tr>
<td>F 1/10</td>
<td>0.047</td>
<td>4%</td>
</tr>
<tr>
<td>G 3/20</td>
<td>0.15</td>
<td>25%</td>
</tr>
<tr>
<td>H 9/100</td>
<td>0.09</td>
<td>9%</td>
</tr>
<tr>
<td>I 18/25</td>
<td>0.33</td>
<td>10%</td>
</tr>
<tr>
<td>J 7/35</td>
<td>0.5</td>
<td>37 1/2%</td>
</tr>
</tbody>
</table>

13. 122 763
14. 75
15. ₦2 132.879
16. 50.706
17. 0
18. 23
19. $= 3\ 136$
20. $= 37.96$
21. $= 45$
22. $= 23.5$
23. $\text{N}280$ for Bode, $\text{N}5\ 320$ for Jossy
24. a) $8310$ b) $11\ 391$
25. a) $4\ 547$ b) $4\ 255$
26. $\frac{143}{12}$
27. $\frac{299}{63} \times 3\frac{11}{63}$
28. $8.214$
29. $1.654$
30. a) $60.03$ b) $6.003$
31. Move five spaces to the right $= -3$
32. $y$
33. $\text{N}3\ 116$
34. $2\ 801.120$ Cedis
35. $26.64\%$
36. there was a $\text{N}57.5$ discount
37. $19.9$ cm
38. $17.59$ cm
39. The diameter is 2 times the radius
40. a) Check pupil’s answers
    b) Check pupil’s answers
41. $137 - 79 = 58$ kg more than Bassey
42. $23$ kg and $300$ g all together
43. a) $40$ sets of $25$ g in $1$ kg
    b) $100$ sets of $25$ g in $2.5$ kg
44. $1$ packet $= 80$ g, $2$ packets $= 160$ g
45. $15$ kg of beans costs $\text{N}2\ 400$
46. $18.46$ km/h
47. $360$ km
48. $2.5$ hours
49. Bodija
50. To predict weather; to predict humidity
51. Equilateral, Isosceles, Right-angled, Scalene, Acute-angled, Obtuse-angled
52. Area of triangle $= \frac{1}{2} \text{base} \times \text{height}$
    $A = \frac{1}{2} \times 6 \times 8$
    $A = 24$ cm$^2$
53. If $1$ kl $= 1\ 000\ell$
    $\therefore 1\ 000 \times 4 = 4\ 000\ell$ in $4$ kilolitres
54. If he uses $45$ litres for $102$ km
    $\therefore$ for $1$ km $= (102 + 45 = 2.2666\ldots)$
    $\therefore$ for $462 = 462 \times 2.2666\ldots$
55. Oval, Spheroid, Circle
56. $179.59$ cm$^3$
57. Parallel lines are equidistant, point in the same direction and will never meet. Perpendicular lines meet at $90$ degrees.
58. – Base angles are congruent – The angles opposite the equal sides are equal
    – There is one pair of equal sides
59. (from left to right)
    Cube, Rectangular cuboid, cube, rectangular cuboid, triangle – not $3D$
60. a) $6$ b) $6$
61. a) $6$ b) $5$
62. a) 

63. $7.00 = r$
64. i) Check pupil’s tallies $1 = 4; 2 = 8; 3 = 17; 4 = 7; 5 = 6$.
   ii) Bar chart for class marks
   iii) Mode $= 3$
   iv) Median $= 3$
65. This question will be different for each student
Objectives

This practice examination is a summative assessment of work covered throughout the year. It is important that it is completed by individuals and not with the support of other pupils as this would not uncover any difficulties a learner may be having with particular concepts. Encourage pupils to not spend too much time on one problem. They should rather move onto the next problem and return to the difficult ones if they have time at the end of the examination.

Guidelines

Simulate examination conditions: tell the pupils that they have to work on their own and may not discuss questions or answers with other pupils; ensure quiet in the classroom while pupils work; write the start and end time of the examination on the board, with 10 minute intervals – cross out the time interval as the session progresses to help pupils keep track on time.

Complete the practice examination over two class sessions. Complete questions 1–10 in Session 1 and then questions 11–20 in Session 2.

Have pupils write their answers and workings out on loose sheets of paper so that you can take them in for marking.

Answers

1. a) 7 712  b) 5 885  c) 8 060  d) 15 089  e) 257.43  f) 251.01  g) 0.458  h) 22.83  i) 287  j) 25 7935  k) 27.2  l) 11 0308  m) 10 735.2  n) 13  o) 18  p) 374  q) 385  r) 40.24  s) 17  t) 2.49

2. a) 4 624  b) 15 625  c) 62 500  d) 5 √  e) 2√634  f) 10√94

3. 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79

4. a) 0.4; 40%  b) 0.96; 96%  c) 0.48; 48%

5. a) $\frac{8}{10}$  b) $\frac{13}{20}$  c) $\frac{21}{8}$

6. a) 12  b) 30  c) $\frac{16}{5}$  d) 6.5  e) 8  f) $\frac{1}{3}$

8. a) N$8 640  b) €21.94  c) $236.25

9. a) N$4 500 Profit in total  b) 72% profit

10. a) N$4 885  b) 7.13% loss


14. 100.3 kg  15. 15.08 m

16. 15 kg and 950 grams  17. 14.89 hours

18. 30 cm²

19. a) 10.15 m²  b) 22.33 m³

20. 3ℓ = 3 000 cm³

21. a) All sides equal; All angles equal  b) Two equal sides; Two equal angles  c) One right angle; no sides equal

22. a) no values given  b) no values given

23. a) 

<table>
<thead>
<tr>
<th>Range</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>0</td>
</tr>
<tr>
<td>4–9</td>
<td>3</td>
</tr>
<tr>
<td>10–14</td>
<td>5</td>
</tr>
<tr>
<td>15–20</td>
<td>8</td>
</tr>
</tbody>
</table>

Pupils can make a frequency chart with each value but we decided to group them – if so then their bar chart will also look different. Both are correct.

b) check pupil’s bar graphs
c) $\frac{19}{20}$  d) 14.5  e) 14

Assessment

On completion of the practice exam, look for correct answers and mistakes made by individuals. You should also be checking to see if there is a pattern in terms of any particular question causing a significant number of pupils’ difficulties.