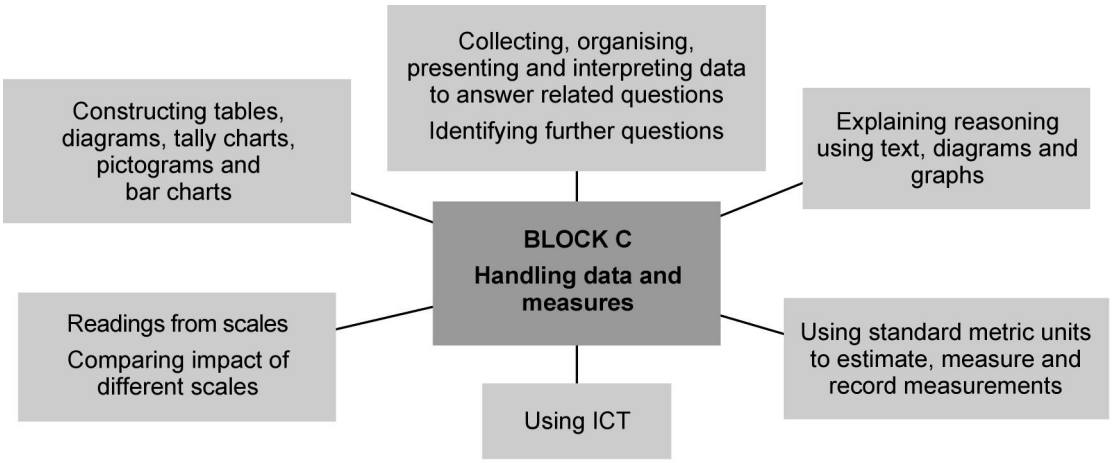
Year 4: Block C — Three 2-week units

Handling data and measures



Objectives End-of-year expectations (key objectives) are highlighted	Units 1	 2	 3
• Suggest a line of enquiry and the strategy needed to follow it; collect, organise and interpret selected information to find answers	✓	✓	✓
• Answer a question by identifying what data to collect; organise, present, analyse and interpret the data in tables, diagrams, tally charts, pictograms and bar charts, using ICT where appropriate	✓	✓	✓
• Report solutions to puzzles and problems, giving explanations and reasoning orally and in writing, using diagrams and symbols	✓	✓	✓
• Choose and use standard metric units and their abbreviations when estimating, measuring and recording length, weight and capacity; know the meaning of 'kilo', 'centi' and 'milli' and, where appropriate, use decimal notation to record measurements (e.g. 1.3 m or 0.6 kg)	✓	✓	✓
• Interpret intervals and divisions on partially numbered scales and record readings accurately, where appropriate to the nearest tenth of a unit	✓	✓	✓
• Compare the impact of representations where scales have intervals of differing step size		✓	✓

Speaking and listening objectives for the block

Objectives	Units 1	 2	 3
• Use time, resources and group members efficiently by distributing tasks, checking progress, making back-up plans	✓	✓	✓

Opportunities to apply mathematics in science

Activities		Units		
		1	2	3
4a	Moving and growing: Measure and record relative sizes of bones. Discuss changes over time. Suggest measurements to take to answer questions such as 'Who has the longest arms?'. Choose how to present the results.	✓		
4d	Solids, liquids and how they can be separated: Observe and measure volumes of liquids, recording them in tables. Explain conservation of volume of liquids when poured into different containers.	✓		
4b	Habitats: Sort animals and plants according to own criteria. Select ways of recording the groupings.		✓	
4c	Keeping warm: Collect data about cooling liquids over time, e.g. temperature of cooling tea every 15 minutes. Record results in a table. Make readings from thermometers with different scales.			✓

Key aspects of learning: focus for the block

Enquiry	Problem solving	Reasoning	**Creative thinking**
Information processing	**Evaluation**	**Self-awareness**	Managing feeling
Social skills	**Communication**	Motivation	**Empathy**

Vocabulary

problem, solution, calculate, calculation, method, explain, reasoning, reason, predict, pattern, relationship, classify, represent, interpret

data, information, survey, questionnaire, graph, chart, table, diagram, horizontal axis, vertical axis, axes, label, title, scale, interval, pictogram, bar chart, tally chart, greatest/least value

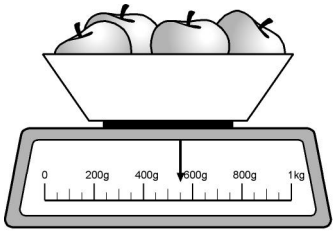
metric unit, standard unit, millimetre (mm), centimetre (cm), metre (m), kilogram (kg), gram (g), litre (l), millilitre (ml)

Building on previous learning

Check that children can already:

- consider a question and develop a response by referring to relevant data
- make and use lists, tables and simple bar charts to organise and interpret the information
- use Venn diagrams or Carroll diagrams to sort data and objects using more than one criterion
- recall the relationships between kilometres and metres, metres and centimetres, kilograms and grams, litres and millilitres
- choose and use appropriate units to estimate, measure and record length and weight
- measure and draw to a suitable degree of accuracy, e.g. measure length to the nearest half centimetre and weight to the nearest half division on the scales

Unit 4C1 2 weeks

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Suggest a line of enquiry and the strategy needed to follow it; collect, organise and interpret selected information to find answers *I can think about an experiment, predict what might happen and decide how I could go about finding out whether it is true*	What are you trying to find out? What information are you aiming to collect? How? What do you think the result will be? Why? Why have you chosen to collect that information? What will it tell you? Gulab says that most children in our class walk to school. What data would you suggest that he collects to find out whether he is right?
• Answer a question by identifying what data to collect; organise, present, analyse and interpret the data in tables, diagrams, tally charts, pictograms and bar charts, using ICT where appropriate *I can collect data and put it in a table to help me explore an idea and find out more about it*	What information will you need to collect to answer your question? How will you collect it? How will you organise your data? How will you display it? What titles have you given your graphs? What labels have you put on the axes? What does this table tell you? Why did you choose a table to show your information? Why is it easy to interpret? Look carefully at one of your tables. How did it help you find out more about the data?
• Report solutions to puzzles and problems, giving explanations and reasoning orally and in writing, using diagrams and symbols *I can tell people what I have found out and show some graphs to back up my conclusions*	What have you found out? Does anything surprise you? Why? What evidence do you have to support your conclusions? What other questions could you ask now that you have finished your enquiry? What would you do differently if you carried out the enquiry again?
• Choose and use standard metric units and their abbreviations when estimating, measuring and recording length, weight and capacity; know the meaning of 'kilo', 'centi' and 'milli' and, where appropriate, use decimal notation to record measurements (e.g. 1.3 m or 0.6 kg) *I can measure lengths, weights, and times to help me find out more about a question I am exploring*	Estimate the weight of this bag of carrots. And of this tin of soup. Which units would you use to measure the weight of an orange? A centimetres B millilitres C grams D kilograms Which is heavier: 2000 g or 3 kg? Explain how you know. Can you tell me another way to say or write 8 kilograms? What about 500 grams?
• Interpret intervals and divisions on partially numbered scales and record readings accurately, where appropriate to the nearest tenth of a unit *I can measure lengths to the nearest half centimetre, weights in grams and kilograms, and times in seconds*	Here are some apples. What is the total weight of the apples?  Imagine a centimetre tape measure. The first part has been torn off and it starts at 8 centimetres. How can you use it to make a measurement in centimetres?

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Use time, resources and group members efficiently by distributing tasks, checking progress, making back-up plans *I can contribute to a task in my group so that we are all being helpful as we collect data*	How are you going to collect the data? How will you organise the tasks? What helped you to collect the data efficiently?

Learning overview

Children undertake enquiries to **answer a question that they are given**. The enquiry offers a chance to follow through the data handling cycle: pose a question, and answer it by **collecting data, and then organising, representing and interpreting it**. Children identify possible answers based on their findings. They suggest a further question to explore and revisit the data handling cycle by collecting further data.

Possible contexts for the enquiry can be found in science, for example in the QCA scheme of work: Unit 4a: Moving and growing; Unit 4d: Solids, liquids and how they can be separated; or Unit 4E: Investigating parachutes.

For example, children explore a hypothesis such as: *The bigger the object, the faster it falls*. They decide what data to collect to find out more. They consolidate their measurement skills and knowledge as they measure heights of the parachute drop-point above the ground, weights of the objects that they attach to the parachutes, sizes of the parachutes (defined by length of the side of the square forming the parachute), lengths of the parachute strings and times of the falls in seconds. Children **choose and use appropriate instruments and units** to measure and record lengths to the nearest half centimetre, weights in grams and kilograms to the nearest half division on the scales, and timings in seconds.

Children **organise** their measurements by tabulating them. They decide how best to do this. They look for patterns in the data that could support or refute the hypothesis. They consider how to **represent** the data in a bar chart. They **report their findings** orally and by showing their charts and tables. They develop further hypotheses, such as: *The larger the parachute, the longer the teddy takes to fall* or *Soft objects fall more slowly*. These suggestions are evaluated in groups and decisions made about which are suitable to pursue.

Children plan what data to **collect** and how to **organise** it. They appreciate that they need to make careful choices and to use units of measurement consistently. In groups, they identify the measurements to make and share the work between the group members. They respond to questions such as:

What data do we need to collect?

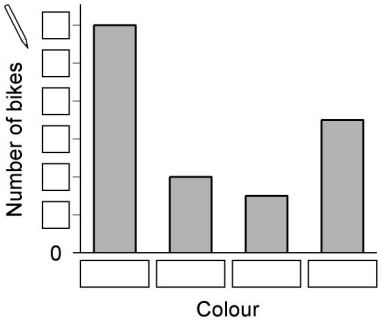
How can we collect the data?

How can we represent the data? Is there more than one way to represent the data? Which way would be best?

What conclusions can we draw about our hypothesis?

Unit 4C2 2 weeks

Objectives *Children's learning outcomes in italic*	**Assessment for learning**
• Suggest a line of enquiry and the strategy needed to follow it; collect, organise and interpret selected information to find answers *I can think of a question to ask about some information and organise the information to help me find out more about it*	What are you trying to find out? What information are you aiming to collect? How? Why have you chosen to collect that information? What will it tell you? Your class has collected data about the distances that children travel to school and the type of transport they use. What questions could you ask to find out more about this data?
• Answer a question by identifying what data to collect; organise, present, analyse and interpret the data in tables, diagrams, tally charts, pictograms and bar charts, using ICT where appropriate *I can choose from tables, diagrams, tally charts, pictograms and bar charts to show data so that it is easy to understand*	What information will you need to collect to answer your question? How will you collect it? How will you display your data? Why have you chosen that way to do it? When is a tally chart useful? Think of an example. Why is it useful? When is a bar chart useful? Think of an example. Why is it useful? What does this bar chart tell you? Why did you choose a bar chart to show your data? What makes the information in a bar chart easy or difficult to interpret?
• Report solutions to puzzles and problems, giving explanations and reasoning orally and in writing, using diagrams and symbols *I can explain how I solved a puzzle using a diagram to help me*	What have you found out? What charts or tables will you use to show your results? Are your results what you expected or were there any surprises? What evidence do you have to support your conclusions? What other questions could you investigate now that you have answered the original question? What would you do differently if you carried out the enquiry again?
• Choose and use standard metric units and their abbreviations when estimating, measuring and recording length, weight and capacity; know the meaning of 'kilo', 'centi' and 'milli' and, where appropriate, use decimal notation to record measurements (e.g. 1.3 m or 0.6 kg) *I can measure carefully lengths to the nearest half centimetre so that my measurement is accurate*	Estimate the height of the window. And the width of the door. Choose the correct answer: The width of the table is about… 1.5 cm 15 cm 150 cm 1500 cm In an hour, Meena can walk… 5 mm 5 cm 5 m 5 km What unit would you use to measure the distance from here to Paris? And the length of a shoe? Can you tell me another way to say or write 2 km? What about 4 m? And 5 cm? Someone told me that small balls roll further than large balls. What measurements would you make to find out if this is true? John said to Gemma: 'You can only measure the length of straight lines'. Is he right? How do you know?

<table>
<tr><th>Objectives
Children's learning outcomes in italic</th><th>Assessment for learning</th></tr>
<tr><td>• Interpret intervals and divisions on partially numbered scales and record readings accurately, where appropriate to the nearest tenth of a unit
I can use different kinds of rulers and measuring tapes to measure lengths accurately</td><td>Robbie collected information about the colours of some bikes. Here are his results.
<table><tr><th>Colour</th><th>Number of bikes</th></tr><tr><td>green</td><td>4</td></tr><tr><td>red</td><td>7</td></tr><tr><td>blue</td><td>12</td></tr><tr><td>pink</td><td>3</td></tr></table>This bar graph shows the information from the table. Fill in all the missing labels.
  </td></tr>
<tr><td>• Compare the impact of representations where scales have intervals of differing step size
I can compare graphs with different scales and decide which is the most useful</td><td>How did you decide on the scale for this axis?
Which scale helps you to interpret and draw conclusions most easily? Why?
[Show two bar charts showing the same data but with different step sizes on the scales.]
Tell me how you know that these two charts show the same data.
Which chart is better? Why?</td></tr>
<tr><td>• Use time, resources and group members efficiently by distributing tasks, checking progress, and making back-up plans
I can contribute to a task in my group so that we are all being helpful as we collect data
I can help the group to decide which graph or diagram is a good choice</td><td>How are you going to represent your data?
Why have you decided that this is the best way to represent your data?</td></tr>
</table>

Learning overview

In groups, children **collect data**, measuring where necessary. They work with a range of data, such as shoe size and width of shoe across the widest part of the foot, the number of letters in children's names, the width of their hand spans, the distance around their neck and wrist, data from nutrition panels on cereal packets, and so on.

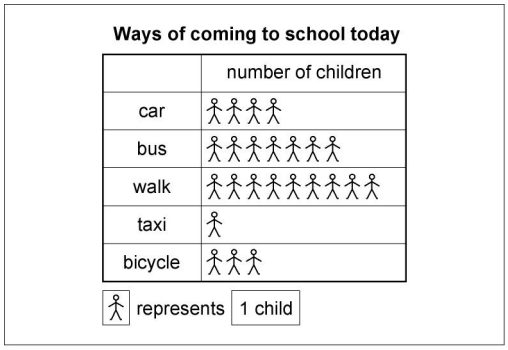
They **decide on a suitable question or hypothesis** to explore for each data set they work on. For example, 'We think that…boys have larger shoes than girls', '…our neck measurements are twice as long as our wrist measurements', '…girls' names have more letters than boys' names' or '…children in our class would prefer to come to school by car but they usually have to walk'.

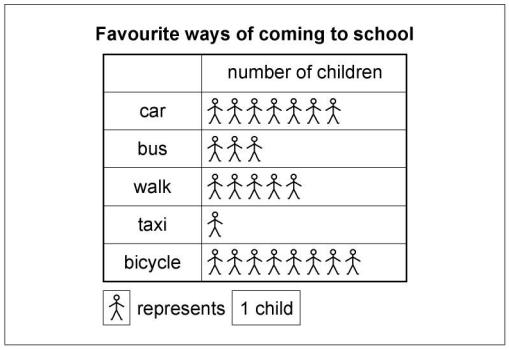
Children consider what data to collect and how to collect it. They **collect their data and organise it in a table**. They choose a **Venn or Carroll diagram**, or a horizontal or vertical **pictogram or bar chart** to represent the data. Where appropriate, they use the support of an ICT package. They justify their choice within the group so that they can present it.

Children **interpret** their diagrams and graphs against their hypothesis or question and **draw a conclusion**. They respond to questions such as:

What can you tell from comparing these two graphs?

What do you think are the reasons for the differences?

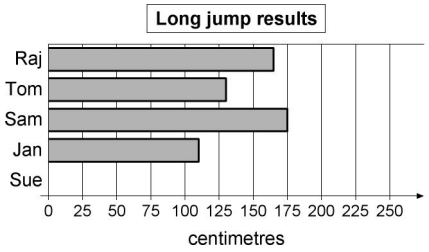




Children present their data in a different way; for example, they change the step size of scales using steps of 2, 5, 10 and 20, as appropriate. They **evaluate the effect of different scales** on interpretation of the data. Children look at the way in which others have represented their data and decide as a class which graphs, charts and tables are the most meaningful.

Unit 4C3 2 weeks

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Suggest a line of enquiry and the strategy needed to follow it; collect, organise and interpret selected information to find answers *I can think about an investigation, predict what might happen and decide how I could go about finding information, perhaps by doing a survey or taking measurements*	What are you trying to find out? What information are you aiming to collect? How? Why have you chosen to collect that information? What will it tell you? Imagine that the class is going to organise a tea-party for parents. What information would you need to find out? What are the simplest ways that you can find the information?
• Answer a question by identifying what data to collect; organise, present, analyse and interpret the data in tables, diagrams, tally charts, pictograms and bar charts, using ICT where appropriate *I can collect data in different ways and decide whether to put it in a table, diagram, tally chart, pictogram or bar chart so that it is easy to understand*	What information will you need to collect to answer your question? How will you collect it? Why do you think it is a good idea to tally in fives? How will you display your data? What does this graph tell you? Why did you choose this type of graph? What makes the information easy or difficult to interpret? Make up two questions that can be answered using the information in your graph or table or chart. What were the advantages of using a computer?
• Report solutions to puzzles and problems, giving explanations and reasoning orally and in writing, using diagrams and symbols *I can tell people what I have found out and show some graphs to back up my conclusions*	What have you found out? What graphs, charts or tables will you use to show your results? Are your results what you expected or were there any surprises? What evidence do you have to support your conclusions? What other questions could you ask now that you have finished your enquiry? Would you use a computer to help you? Why or why not? What would you do differently if you carried out the enquiry again?
• Choose and use standard metric units and their abbreviations when estimating, measuring and recording length, weight and capacity; know the meaning of 'kilo', 'centi' and 'milli' and, where appropriate, use decimal notation to record measurements (e.g. 1.3 m or 0.6 kg) *I can estimate the length of a line in centimetres and millimetres and then measure the line to see how close my estimate was*	Estimate the capacity of this washing-up bowl. And of this bottle. Choose the correct answer. A drinking glass holds about… 0.2 litres 2 litres 20 litres 200 litres What unit would you use to measure the capacity of a watering can? Of an oil tank? Of a coffee cup? Can you tell me another way to say or write 6 litres? What about 750 millilitres? Look at these cards. They have weights in grams or kilograms. 5 kg, 500 g, ¼ kg, 1.5 kg, 750 g Put the cards in order from the lightest to the heaviest. How did you order the cards? Why did you put this measurement here?

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Interpret intervals and divisions on partially numbered scales and record readings accurately, where appropriate to the nearest tenth of a unit *I can use different kinds of rulers and measuring tapes to measure lengths accurately*	Here are some children's long jump results. Sue jumped 212 cm. Draw Sue's long jump result on the graph.  Use the graph to estimate how much further Sam jumped than Jan. Harry, Eve and Khalid measured the same objects. Here are Harry's measurements. pencil length 16 cm computer screen width 33 cm door width 77 cm cube length 1.9 cm ruler width 3.8 cm room length 830 cm Eve wrote her measurements in millimetres. What did she write? Khalid wrote his measurements in metres. What did he write? What would you use? Would you use different units for different measurements? Why or why not?
• Compare the impact of representations where scales have intervals of differing step size *I can compare graphs with different scales and decide which is the most useful*	How did you decide on the scale for this axis? Which scale helps you to interpret and draw conclusions most easily? Why?
• Use time, resources and group members efficiently by distributing tasks, checking progress, and making back-up plans *I can contribute to a task in my group so that we are all being helpful as we collect data* *I can help the group to decide what we have found out*	What conclusions have you drawn? What evidence have you got to back up your conclusions? Are your conclusions what you expected?

Learning overview

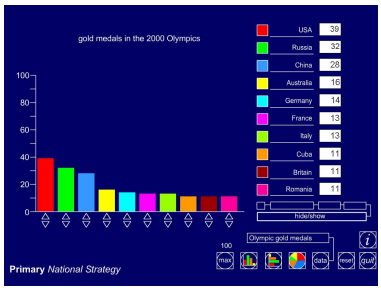
Children undertake one or more of three **enquiries**:

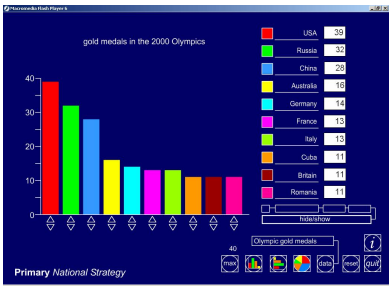
- What vehicles are very likely to pass the school gate between 10:00 am and 11:00 am? Why? What vehicles would definitely not pass by? Why not? What vehicles would be possible but not very likely? Why? What if it were a different time of day? What if the weather were different?
- Does practice improve estimation skills? Children estimate the lengths of five given lines and record the estimate, measured length and difference. They repeat the activity with five more lines to see whether their estimation skills have improved after feedback.
- What would children in our class most like to change in the school? Children carry out a survey after preliminary research to whittle down the number of options to a sensible number, e.g. no more than five.

Children **identify a hypothesis** and **decide what data** to collect to investigate their hypothesis. They **collect the data** they need and **decide on a suitable representation**. In groups, they consider different possibilities for their representation and explain why they have made their choice.

In the first enquiry, children use **tallies and bar charts**. In the second, they use **tables and bar charts** to compare the two sets of measurements. In the third, they use a range of tables and charts to show their results, including **Venn and Carroll diagrams**. They **use ICT** where appropriate.

Children explore **the effect of changing the step size** on the scale of graphical representations, considering step sizes of 1, 2, 5, 10 and 20 as appropriate. For example, these graphs were produced by the ITP 'Data handling'. The bar charts show the number of gold medals in the 2000 Olympics, first with the vertical axis numbered in 20s from 0 to 100 and then with the vertical axis numbered in 10s from 0 to 40.





Children consider how the differences appear to be greater on the bar chart with the scale numbered in 10s than on the bar chart with the scale numbered in 20s.

In groups, children **interpret their data and draw conclusions**. They decide on the statements of findings which have good evidence to support them. They discuss what further questions they could go on to ask.