Spring Block 4

# Mass, capacity and temperature

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White Rose MATHS

# Small steps

| | |
|---|---|
| Step 1 | Compare mass |
| Step 2 | Measure in grams |
| Step 3 | Measure in kilograms |
| Step 4 | Four operations with mass |
| Step 5 | Compare volume and capacity |
| Step 6 | Measure in millilitres |
| Step 7 | Measure in litres |
| Step 8 | Four operations with volume and capacity |

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# Small steps

**Step 9** Temperature

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# Compare mass

## Notes and guidance

In this small step, children revisit learning from Year 1 as an introduction to mass. They should have experience of using a range of scales to weigh different everyday objects, but may need to revisit this skill. The focus of this small step is not for children to identify the mass of objects in grams or kilograms, but rather to compare the mass of two or more objects.

Children use the language "heavier" and "lighter" alongside the inequality symbols to compare mass. They can also use cubes or similar objects as a non-standard unit of measurement to compare different objects. This will help children in the next two steps when they are formally introduced to grams and kilograms for the first time.

## Things to look out for

- Children may not be able to use balance scales accurately. For example, they may place the objects on one side too close to the centre, meaning that the scales cannot be used to accurately compare the masses.
- Children may need to revise the use of inequality symbols.
- Children may think that the larger the object, the greater its mass must be.

## Key questions

- What does "heavier" mean?
- What does "lighter" mean?
- What does "< / > / =" mean?
- How do you use a balance scale?
- Which object is heavier/lighter? How do you know?
- Which object has the greater/smaller mass? How do you know?

## Possible sentence stems

- The _____ is heavier than the _____

  _____ > _____
- The _____ is lighter than the _____

  _____ < _____

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
- Compare and order lengths, mass, volume/capacity and record the results using >, < and =

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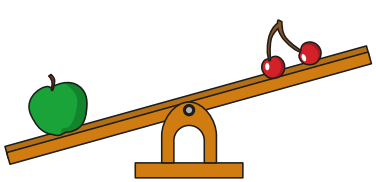
# Compare mass

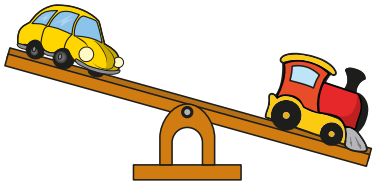
## Key learning

Use a set of balance scales to compare the mass of everyday objects.

Discuss what children notice.

- Complete the sentences for each picture.

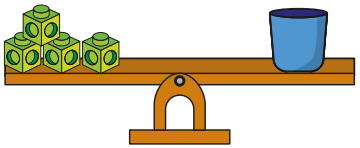


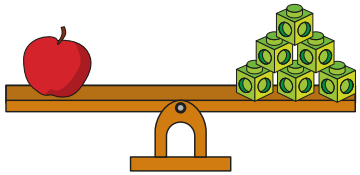


The _____ is heavier than the _____

The _____ is lighter than the _____

- Count the cubes to find the mass of each object.

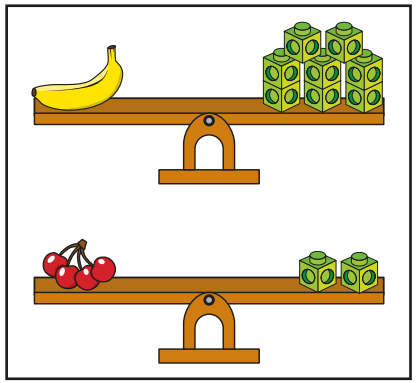


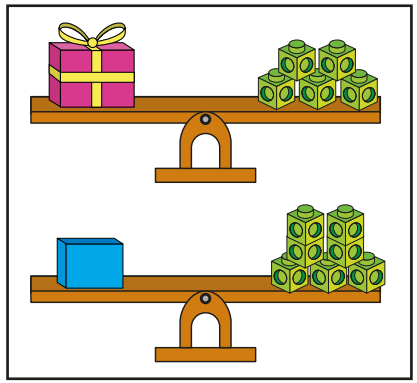


Which object is heavier?

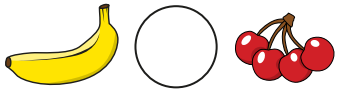
How do you know?

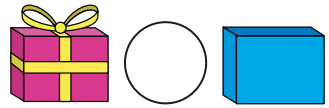
- Count the cubes to find the mass of each object.





Write <, > or = to compare the masses.





Give children a selection of objects. Ask them to choose three objects and use scales to order them from heaviest to lightest.

Ask children to complete this sentence for their set of objects.

The _____ is heavier than the _____, but lighter than the _____

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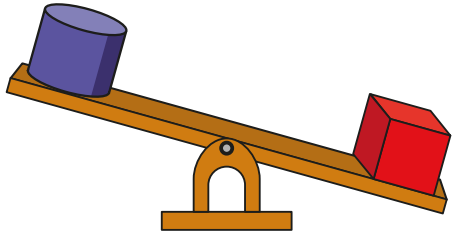
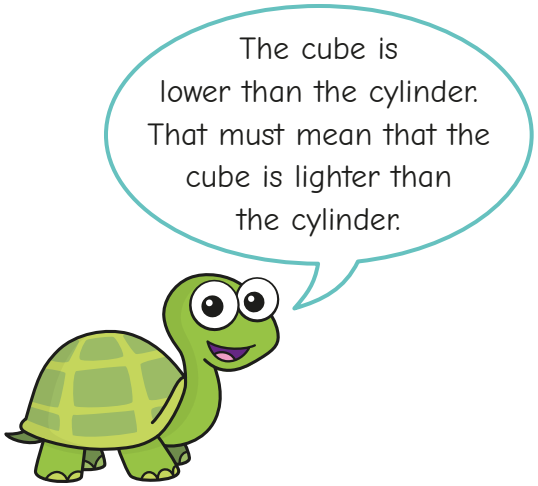
# Compare mass

## Reasoning and problem solving

Tiny is comparing masses.



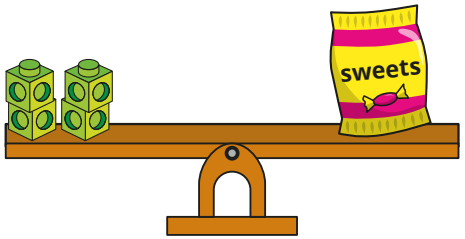



Do you agree with Tiny?

Why?

No

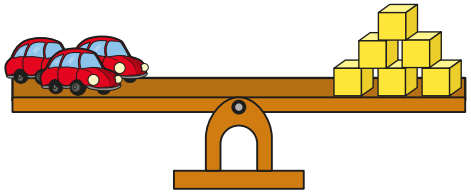
Ron uses cubes to find the mass of one bag of sweets.




What is the mass of 2 bags of sweets?

8 cubes

Which object is lighter, a car or a cube?



How do you know?

cube

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# Measure in grams

## Notes and guidance

Over the next small steps, children will be introduced to standard units of measure.

Give children experience of picking up and feeling gram weights and thinking about objects that have a similar mass to 1 g/10 g/100 g to help them contextualise their learning and support with estimating. They should also have experience of using balance scales and circular scales and think about the differences between them. They may find circular scales easier to use, especially when the arrow is pointing directly to a number. They may need support to estimate masses when the arrow does not point to a number on the scale.

In the next small step, children will develop this learning further as they go on to measure in kilograms.

## Things to look out for

- Children should only measure items up to 100 g, as numbers above 100 are not covered in Year 2
- Balance scales may not be accurate or may not be used accurately, which could lead to confusion.
- Children may not read circular scales accurately, particularly if the arrow is not pointing to a number.

## Key questions

- What is mass?
- What objects can you find the mass of?
- What object do you think has a similar mass to 1 g/10 g/100 g?
- How do you find the mass of an object using balance scales?
- How are circular scales different from balance scales?
- How can you find the mass of an object if the arrow is not pointing to a number shown on the scales?

## Possible sentence stems

- The arrow is pointing to _____
- The _____ has a mass of _____ g.
- The arrow is pointing between _____ and _____, so the _____ has a mass of about _____ g.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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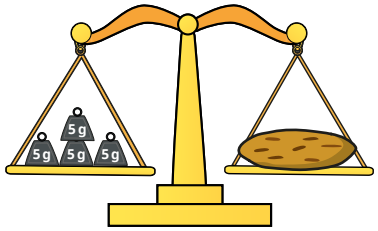
# Measure in grams

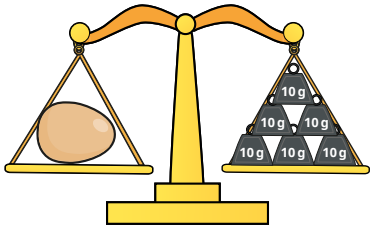
## Key learning

Ask children to pick up three different weights and then look for an object that they think has the same mass as one of the weights.

Children can use balance scales to see how accurate they were.

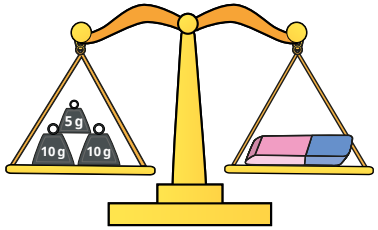
- What is the mass of each object?

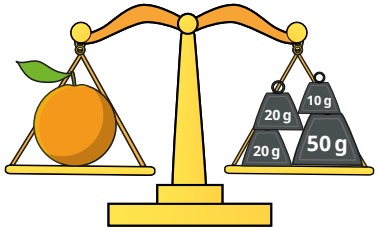


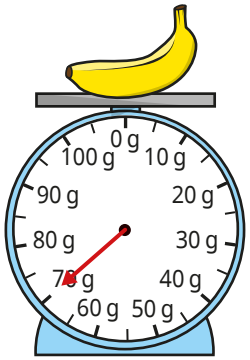

How did you work it out?

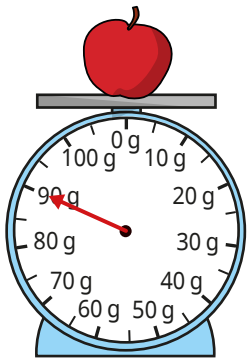
- What is the mass of each object?

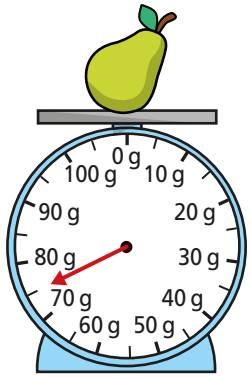



- What is the mass of each object?

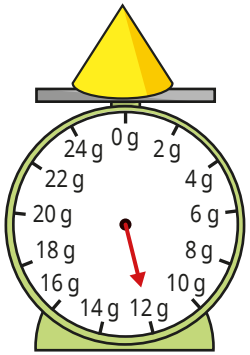


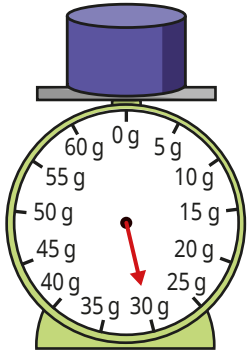



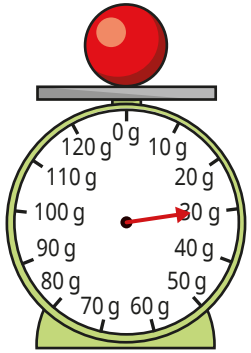




How are these scales different from balance scales? How are they similar?

- What is the mass of each 3-D shape?

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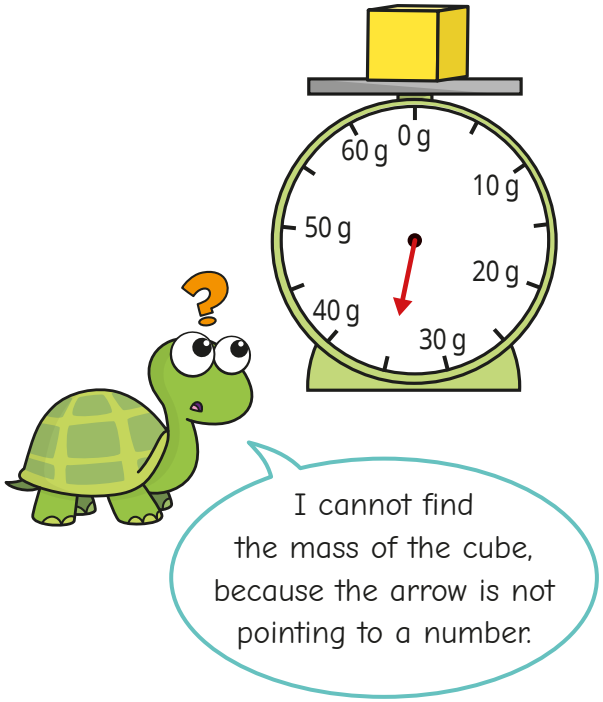
# Measure in grams

## Reasoning and problem solving

Tiny uses scales to find the mass of a cube in grams.



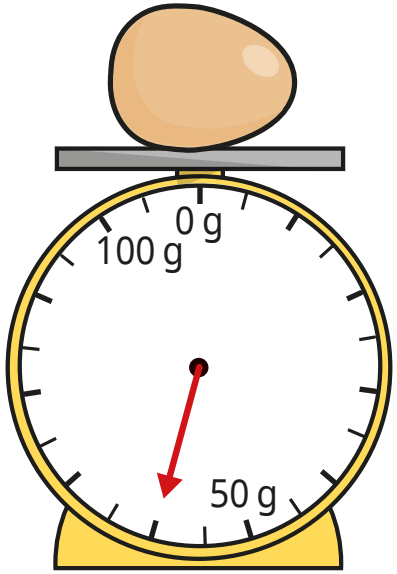

Do you agree with Tiny?

Why?

No

The cube has a mass of 35 g.

What is the mass of the egg?




How do you know?

60 g

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# Measure in kilograms

## Notes and guidance

In this small step, children move on to measure mass in kilograms. There are similarities between this step and the previous one, but it is important that children understand the differences between the units. They need to be aware of the types of items that have a mass typically measured in kilograms and those that have a mass typically measured in grams.

Give children experience of picking up and feeling kilogram weights and thinking about comparing these to everyday objects. Children should realise that a kilogram is heavier than a gram but they do not need to know that there are 1,000 g in 1 kg.

Throughout the step, children use balance scales and circular scales to find the masses of different objects. They should become more confident and accurate when using these.

## Things to look out for

- Children may not understand the difference between kilograms and grams.
- Balance scales may not be accurate or may not be used accurately, which could lead to confusion.
- Children may not read circular scales accurately, especially if the arrow is not pointing to a number.

## Key questions

- What is mass?
- Which is greater, a kilogram or a gram?
- What types of objects would you measure in kilograms?
- What object do you think has a similar mass to 1 kg/10 kg?
- How can you find the mass of an object using balance scales?
- How can you find the mass of an object if the arrow is not pointing to a number shown on the scales?

## Possible sentence stems

- The mass of _____ is _____ kg.
- The arrow is between _____ kg and _____ kg.

  The mass of the object is about _____ kg.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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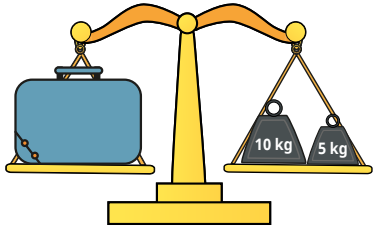
# Measure in kilograms

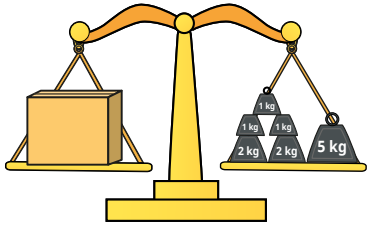
## Key learning

Ask children to pick up three different weights and then look for an object that they think has the same mass as one of the weights.

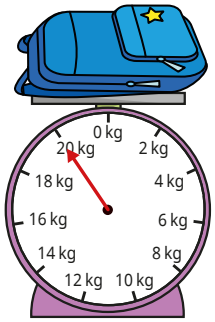
Children can use balance scales to check.

- What is the mass of each object?




- Read the scales to find the mass of each object.

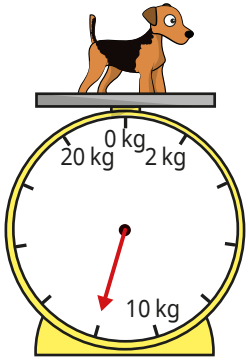


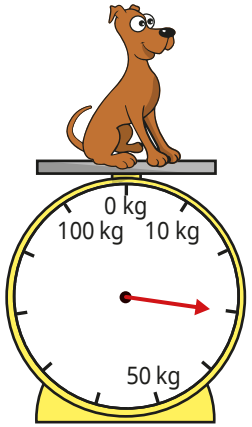


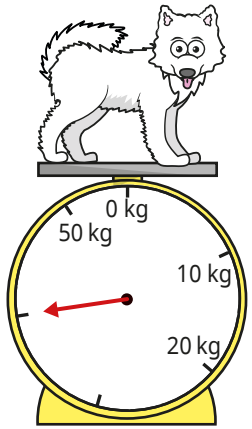
What do you notice about your answers?

What do you notice about the arrows?

- What is the mass of each dog?

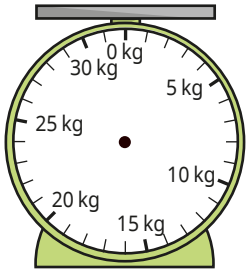


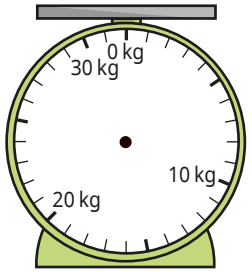



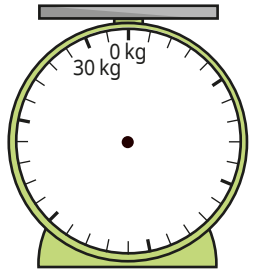




- Mark the masses on the scales.

| 5 kg | 12 kg | 17 kg |
|---|---|---|

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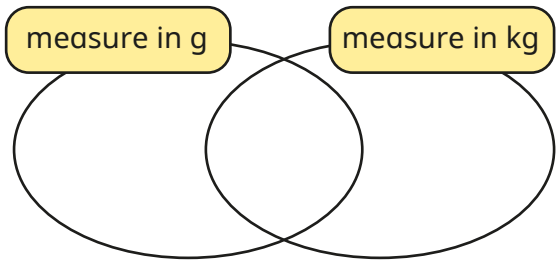
# Measure in kilograms

## Reasoning and problem solving

Sort Whitney and the objects into the groups.




Did your partner sort in the same way?

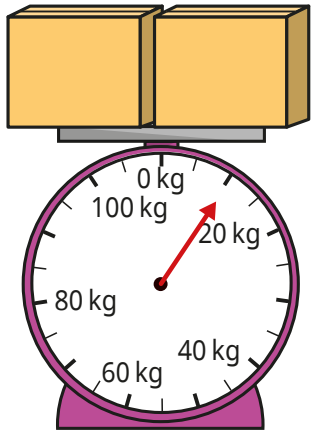
Find or think of some more objects to go into each group.

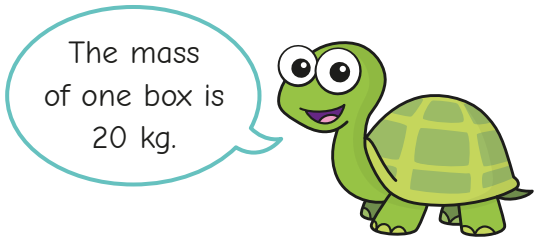
grams only:
paper clip, pencil

kilograms only:
rucksack, Whitney

either: book, pineapple

Tiny is finding the mass of **one** box.




Do you agree with Tiny?

Why?

No

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# Four operations with mass

## Notes and guidance

This small step gives children the opportunity to practise the calculation skills that they learnt earlier in the year in the context of mass. They can also consolidate their reading of different scales to find the information they need to solve the problems.

Children may need support to choose which operation to use, perhaps by drawing a bar model or part-whole model. Encourage them to share and try different methods and to consider the efficiency of their methods.

Children also solve multi-step problems involving mass. These may be challenging at first, so it is useful to model how to approach these sorts of problems.

## Things to look out for

- Children may select the incorrect operation to complete the calculation.
- Children may use inefficient strategies to complete calculations.
- Children may not read scales accurately, leading to errors in their calculations.
- Support may be needed to break down multi-step problems into smaller steps.

## Key questions

- Do you need to add or subtract to solve the problem?
- How can you write this as a number sentence?
- How can you represent this using a bar model/ part-whole model?
- Is there more than one way to solve the problem?
- What do you need to do first? How do you know?

## Possible sentence stems

- To find the total mass, I need to _____ the mass of _____ and _____
- To find the mass of _____, I need to _____ from the total mass.
- First, I need to … Then, I need to …

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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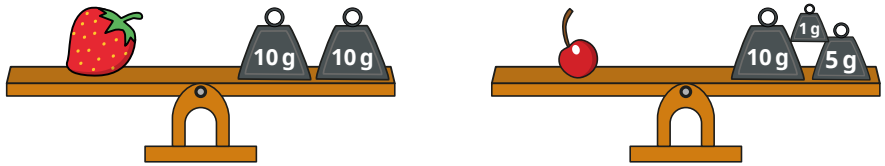
# Four operations with mass

## Key learning

- Complete the sentences.

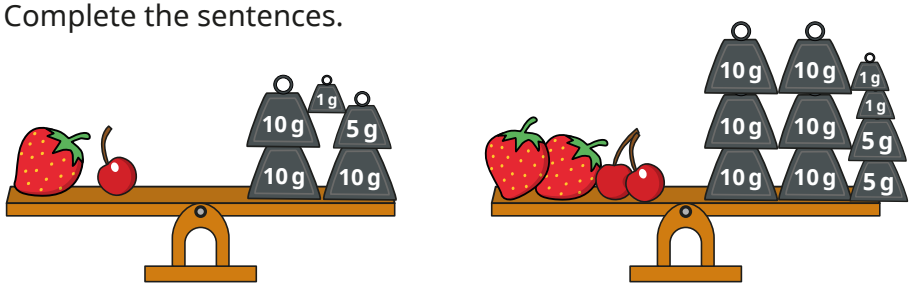



The mass of the strawberry is _____ g.

The mass of the cherry is _____ g.

The total mass of a strawberry and a cherry is _____ g.

- Complete the sentences.



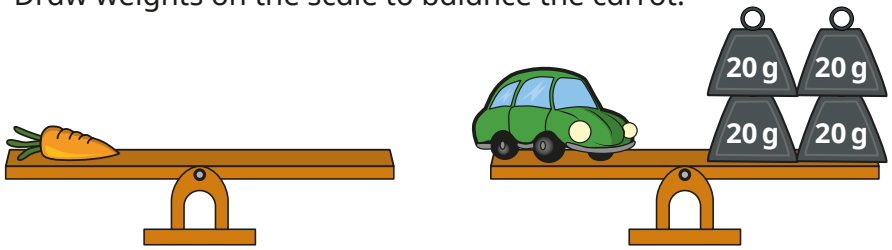

The total mass of a strawberry and a cherry is _____ g.

The total mass of 2 strawberries and 2 cherries is _____ g.

How did you work this out? Is there an easier way?

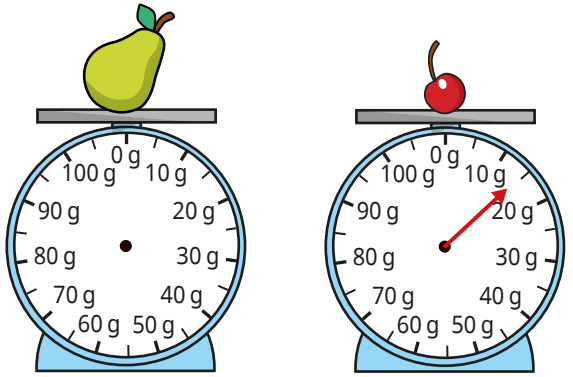
- The carrot is 40 g lighter than the car.

Draw weights on the scale to balance the carrot.




- The pear is 75 g heavier than the cherry.

Mark the mass of the pear on the scales.




- A tomato has a mass of 40 g.

An apple is 50 g heavier than the tomato.

A pear is 20 g lighter than the apple.

What is the mass of the pear?

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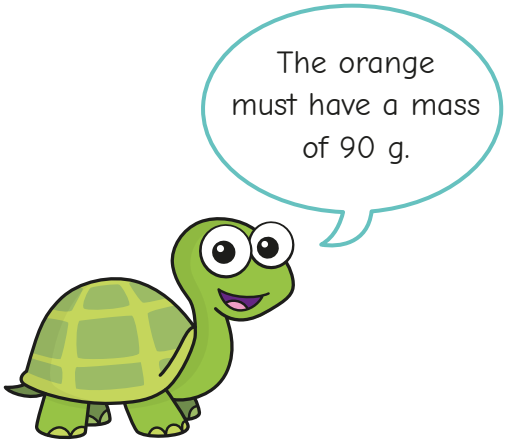
# Four operations with mass

## Reasoning and problem solving

Tiny is finding the mass of an orange and a pear.

The mass of the pear is 20 g more than the orange.

The pear has a mass of 70 g.

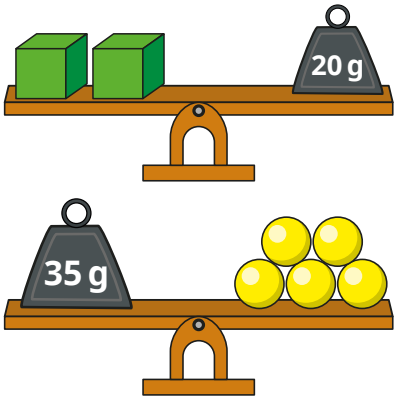



What mistake has Tiny made?

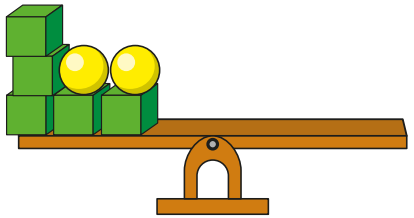
What is the mass of the orange?

50 g

These scales are balanced.




Draw weights to balance these scales.



Compare methods with a partner.

64 g shown in relevant weights

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# Compare volume and capacity

## Notes and guidance

Children encountered volume and capacity in Year 1 and in this small step they revisit this learning, before moving on to measuring in millilitres and litres in the next steps.

It is important that children know the difference between capacity and volume; discussion of the other uses of the word "capacity" in everyday life, such as a sports stadium, may support this.

Children compare the volume/capacity of different containers. Language such as "full", "half full", and "empty" could be a good starting point before comparing the amounts using "greater" and "less" and then the symbols.

There are plenty of opportunities within this step for children to complete practical tasks with different containers.

## Things to look out for

- Children may need reminding of language associated with volume and capacity from earlier learning.
- Children may not be able to identify/explain the difference between volume and capacity.
- Children may think it is impossible to compare the capacities of two different-sized/shaped containers.

## Key questions

- What is volume/capacity?
- What is the difference between volume and capacity?
- Which container has the greater/smaller capacity? How do you know?
- Which container is holding the greater/smaller volume?
- Which symbol should you use, <, > or =? How do you know?
- How could you check to see which container is holding the greatest/smallest volume?

## Possible sentence stems

- The volume of liquid in A is _____ than the volume of liquid in B.
- The capacity of container A is _____ than the capacity of container B.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels
- Compare and order lengths, mass, volume/capacity and record the results using >, < and =

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# Compare volume and capacity

## Key learning

Give children some different containers.

Ask which container they think has the smallest/ greatest capacity.

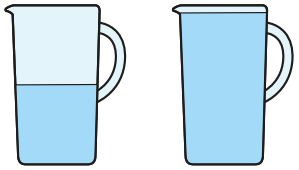
Ask them to explore the capacity of the containers using rice or water.

Discuss how they can work out which container has the greatest capacity.

- Here are three glasses of water.


  - Which glass is full?
  - Which glass is half full?
  - Which glass is empty?

- Here are two jugs of water.




  Write "more" or "less" to complete the sentence.

  Jug A has _____ water than jug B.

  Write <, > or = to compare the volumes.

  volume of water in jug A ◯ volume of water in jug B

- There is some milk in glass A.

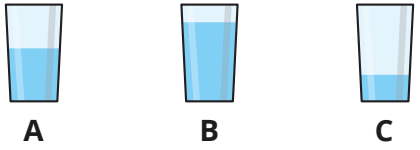

  Colour the glasses so that:

  - glass B has more milk than glass A
  - glass C has less milk than glass A

  Is there more than one answer? Why?

- Which glass contains the most water?


- Write "more" or "less" to complete the sentences.




  Glass C has _____ water than glass B.

  Glass A has _____ water than glass C, but _____ water than glass B.

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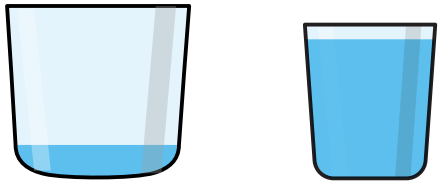
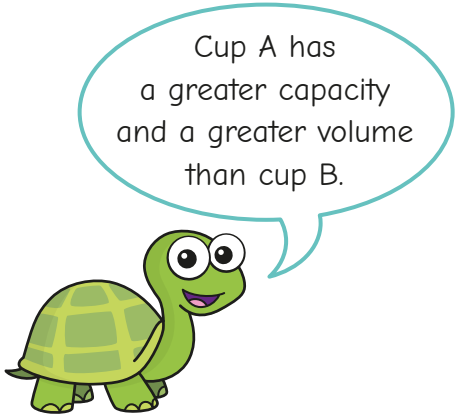
# Compare volume and capacity

## Reasoning and problem solving

Here are two cups of water.




Do you agree with Tiny?

Why?

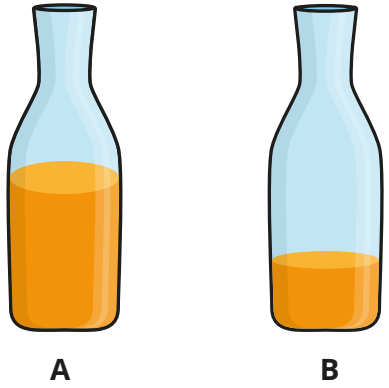
No

Kay has two full bottles of juice.

She pours some juice from bottle A into a cup.

She pours some juice from bottle B into a glass.

The picture shows how much juice is left in each bottle.




Which has more juice in it, the cup or the glass?

How do you know?

glass

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# Measure in millilitres

## Notes and guidance

In this small step, children use the skills from the previous step to support them in measuring volume in millilitres. This should be introduced practically to give children the understanding of how much space, for example, 100 ml takes up. This will be important when comparing to litres in the next step.

Carefully model how to accurately read the scales in order to avoid mistakes. Once they are secure in this, children read a range of scales to measure the volume of liquid in a container. The scales become gradually more complex, and children need to develop strategies to work out the volume shown. All containers should have a maximum capacity of 100 ml, as children have not yet explored numbers greater than 100.

Real-life contexts could be used to support understanding, for example juice cartons, teaspoons and tablespoons.

## Things to look out for

- Children may look at the top of the container and find the capacity rather than the volume.
- Children may require support in interpreting more complex scales.
- Children may think that it is impossible to find the capacity of a container without a scale.

## Key questions

- What is capacity? What is volume?
- How can you measure the volume of water in this container?
- How does the scale on the container help?
- How can you accurately draw the volume on this container?
- How could you find the capacity of this container?
- What mistakes do you think people may make when reading this scale?
- If the water level is between these two marks, what would be a sensible estimate for the volume?

## Possible sentence stems

- The container has a capacity of _____ millilitres.
- The volume of _____ in the _____ is _____ millilitres.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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# Measure in millilitres

## Key learning

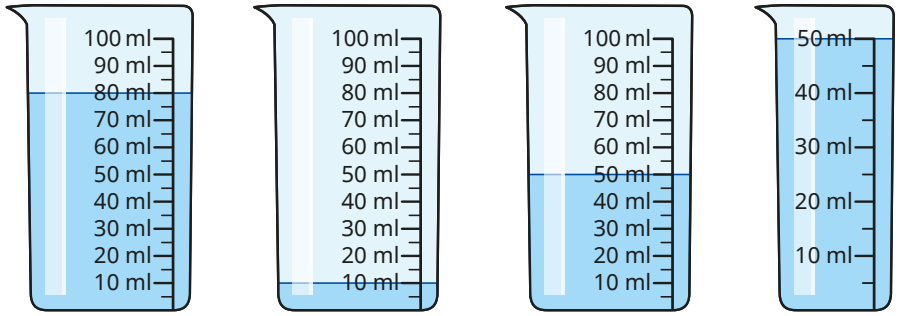
Provide a variety of different containers with millilitres clearly labelled, for example measuring spoons, measuring jugs and measuring beakers. Pour some water into each container.

Ask children to measure the volume of water in each container.

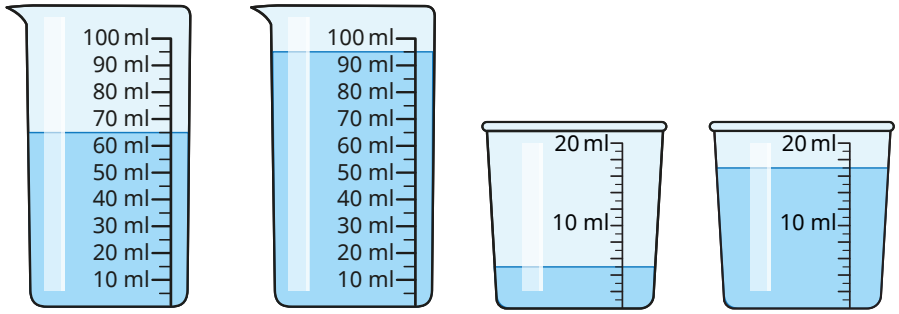
Challenge them to estimate the capacities of containers that have no scale.

They can check their answers by filling the containers and then pouring the water into a measuring jug.

- How much water is there in each beaker?

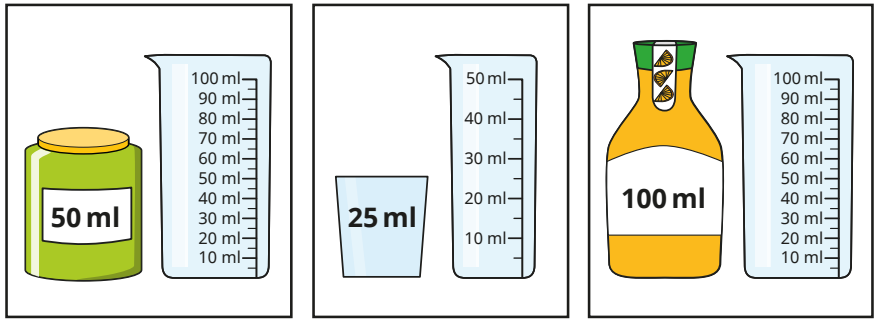



- How much water is there in each container?




- Each container is emptied into a beaker.

  Draw a line on each beaker to show the volume of liquid.

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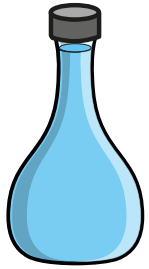
# Measure in millilitres

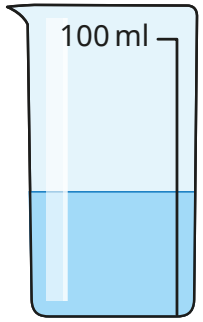
## Reasoning and problem solving

How can you measure the capacity of the container?



Pour the liquid into a measuring jug.

Estimate the amount of water in the container.

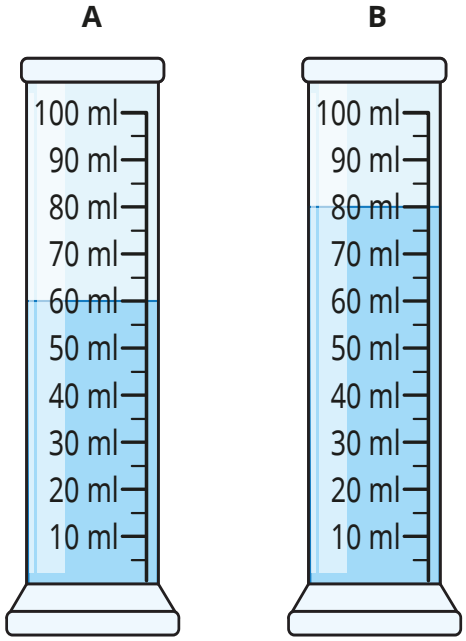



Explain your answer.

approximately 45 ml

A teaspoon holds 5 ml.

How many teaspoons of liquid are there in each container?




A: 12

B: 16

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# Measure in litres

## Notes and guidance

This small step builds on skills from the previous step, now focusing on litres. It is important that children experience seeing and practically measuring litres. They could then compare a number of litres to the same number of millilitres (for example, 10 l and 10 ml). While children do not yet need to know that 1 l = 1,000 ml, they do need to be aware that 1 litre is significantly more liquid than 1 millilitre.

As with the previous step, children read progressively harder scales that count in 2s, 5s and 10s. Model strategies to read these scales and encourage children to share their methods.

Children also shade a container to show a certain volume. This will be built on in Year 3, where children will measure in both litres and millilitres, rather than focusing on each unit in isolation.

## Things to look out for

- Children may mix up millilitres and litres.
- Children may need support when reading more complex scales.
- If only looking at pictures, children may believe that millilitres and litres take up a similar amount of space.

## Key questions

- How can you measure the volume of this container?
- How are litres and millilitres different?
- How much water do you estimate is in this container?
- What strategy did you use to read the scale? Is there a more efficient way?
- Where do you need to draw a line on the scale? How do you know?
- Would you measure the capacity of this container in litres or millilitres?

## Possible sentence stems

- The capacity of the container is _____ litres.
- The volume of _____ in the container is _____ litres.
- 1 litre is _____ than 1 millilitre.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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# Measure in litres

## Key learning

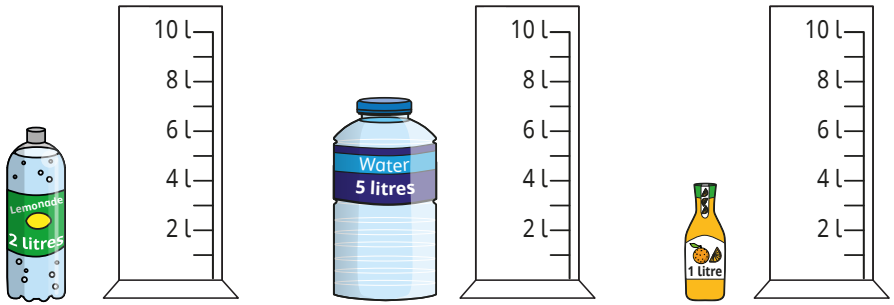
Provide a variety of containers labelled in litres for children to measure the capacities of different containers.

Challenge children to estimate the capacities and to check how accurate they were.

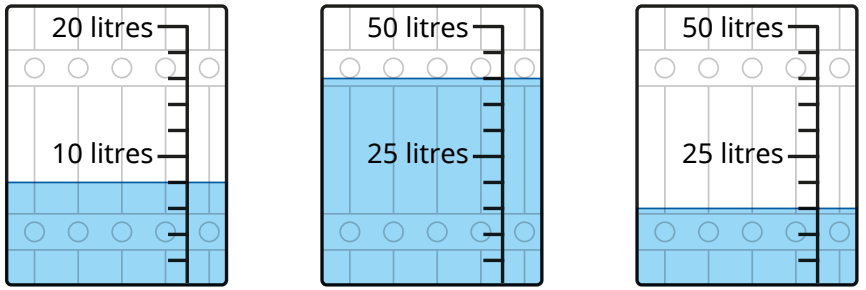
- How much water is there in each bucket?


- The liquid from each bottle is emptied into a container.

  Draw on the containers to show how much liquid they contain.

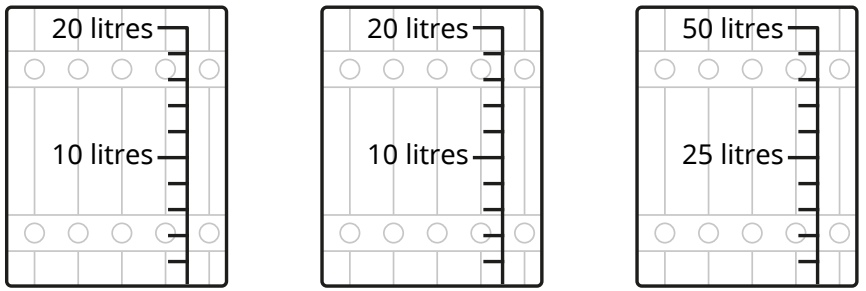



- How much liquid is there in each barrel?




- Draw lines on the barrels to match the labels.

4 litres | 13 litres | 35 litres

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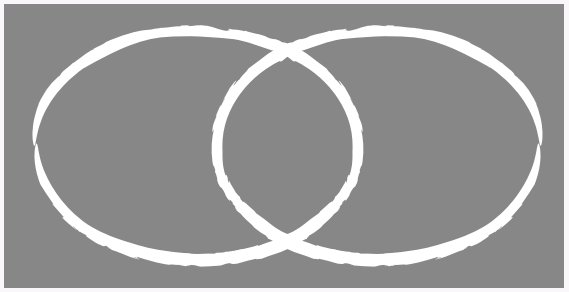
# Measure in litres

## Reasoning and problem solving

Draw the sorting diagram on the playground.

measure in litres

measure in millilitres



Collect different-sized containers for children to put into the sorting diagram.

Discuss children's ideas as a class.

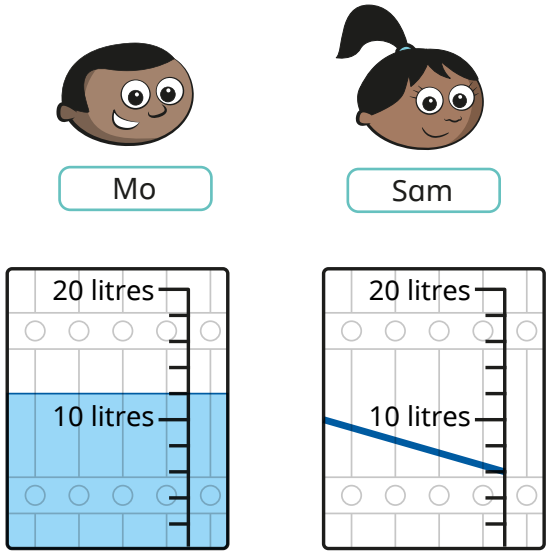
Discuss why the capacity of some containers could be measured in either litres or millilitres.

A bottle has a capacity of 2 litres.

How many bottles are needed to hold 9 litres?

5 bottles

Mo and Sam both think that they have shown 6 litres of water in the barrel.




What mistakes have they made?

Talk about it with a partner.

Mo has not used the scale correctly and has just counted 6 lines on the scale.

Sam has not drawn a horizontal line.

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# Four operations with volume and capacity

## Notes and guidance

In this final small step on volume and capacity, children use the skills they have learnt so far to answer questions involving the four operations. As with the similar step on mass, this is a useful step to consolidate learning and identify any gaps the children may have.

Children complete a range of one-step problems, identifying the operation needed to complete the calculation. They could do this by recognising key words, writing a number sentence or using a bar model. They need to be able to read scales accurately to complete the calculations without mistakes.

Children then complete multi-step problems. Initially, these may need to be modelled to help children break them down into smaller steps.

## Things to look out for

- Children may not read scales accurately.
- Children may make calculation errors, for example in times-tables.
- Children may select the incorrect operation to complete the calculation.

## Key questions

- Which operation should you use for this question?
- How could you write this as a number sentence?
- How could you represent this using a bar model?
- Is there more than one way to work this out?
- What mistake do you think some people may make?
- What did the question ask you to find? How do you know you have found it?
- What do you need to do first? How do you know?

## Possible sentence stems

- To find the total volume, I need to _____ the volumes.
- To find how much more container A holds, I need to _____
- First I need to ... Then I need to ...

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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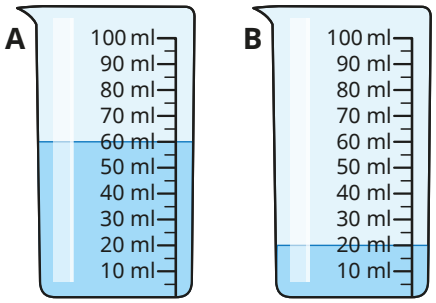
# Four operations with volume and capacity

## Key learning

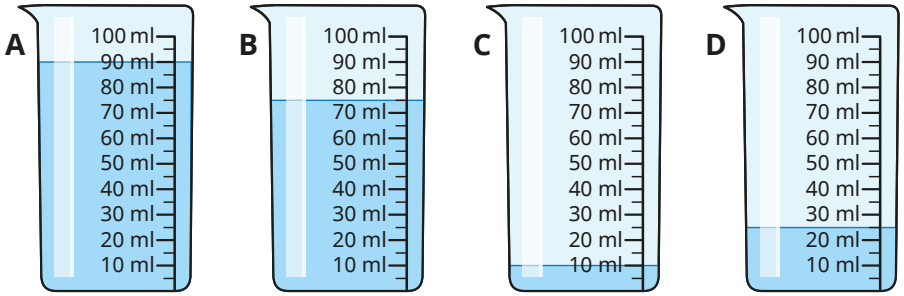
- Find the volume of water in each beaker.

  Then complete the sentences.

  - The total volume of water in jug A and jug B is _____ ml.
  - Jug A contains _____ ml more water than jug B.



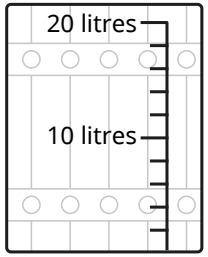

- Match each beaker with another so that the total volume is 100 ml.



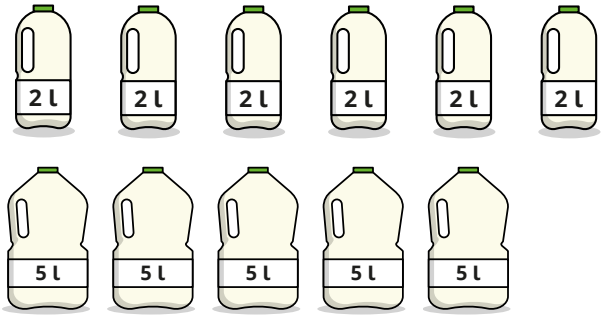

  Beaker E has 50 ml of water. How much more water is needed so that the total volume is 100 ml?

- Tom pours 2 litres of water into the barrel 6 times.

  Draw a line to show where the water reaches.



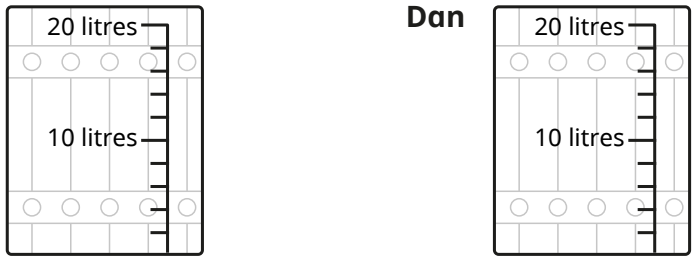

- How much milk is there altogether in each set of cartons?




- Fay and Dan both have some milk.


  They each pour their milk into a barrel.

  Draw a line to show where the milk will reach in each one.

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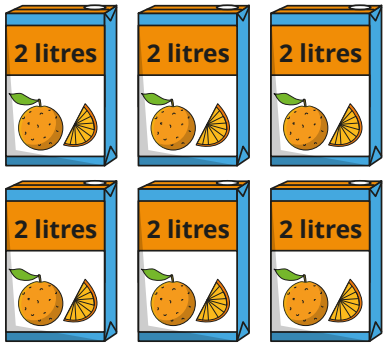
# Four operations with volume and capacity

## Reasoning and problem solving

Will all the juice fit into the jug?



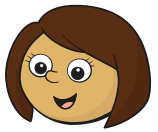


How do you know?

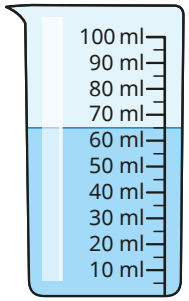
No

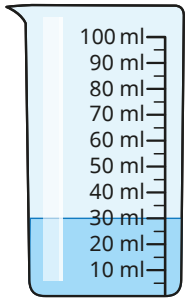
Max and Kim each have some water.

Max



Kim




Max pours out 20 ml of his water.

Kim adds 17 ml to her water.

Who has more water now?

How do you know?

Kim

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# Temperature

## Notes and guidance

In this small step, children are introduced to temperature, thermometers and the unit "degrees Celsius", written °C, for the first time.

Discuss the language of temperature such as "hot", "warm", "cold" and so on. Encourage children to compare places they have visited/differences in seasons to support this. Children recognise that the temperature is higher when the weather is warmer. They may also have heard of negative numbers in this context, but this does not need to be covered in Year 2

Children use their skills from previous small steps to read scales and to colour thermometers to represent temperatures, making links with number lines.

## Things to look out for

- Children may not read the scales accurately.
- Children may not draw accurately to represent a temperature, especially when estimating.
- Children may not have the conceptual understanding of what a "hot" or "cold" temperature is.
- When comparing two temperatures, children may look at the shaded part rather than the scales.

## Key questions

- What is temperature? What words do you use to describe temperature?
- What does "°C" stand for?
- What does the scale show?
- How do you know that you have read the temperature correctly?
- How do you know that you have shown the correct temperature on the thermometer scale?
- How can you compare these two thermometers?

## Possible sentence stems

- The temperature of/in _____ is cold/warm/hot.
- The temperature of/in _____ is _____ °C.
- The difference between the two temperatures is _____ °C.

## National Curriculum links

- Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels

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# Temperature

## Key learning

Discuss with children what they think temperature is.

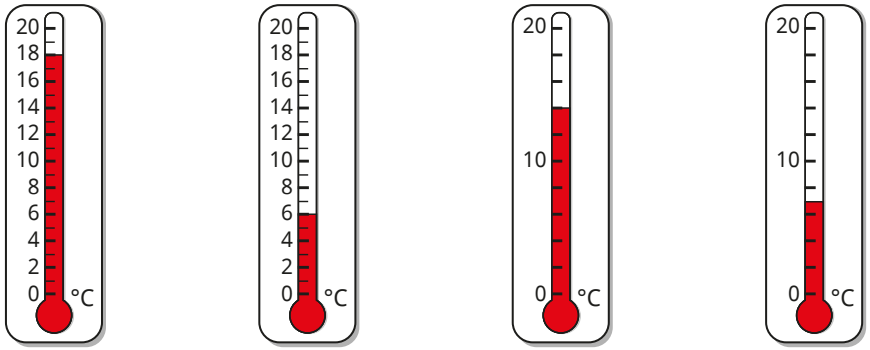
Ask them to think of a place that is hot, and then a place that is cold.

Discuss what words they can use to describe temperature.

Take temperatures around the school.

Get children to compare the different temperatures in different rooms using language such as warmer, hotter and colder.

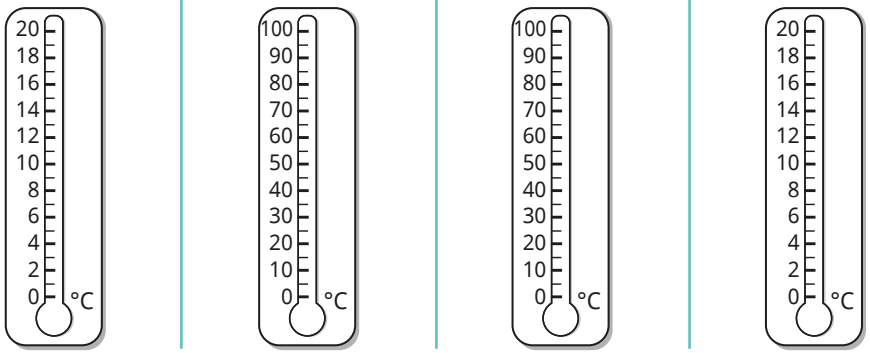
- What temperature is shown on each thermometer?




Write the temperatures in order, starting with the coldest.

- Colour the thermometers to show the temperatures.

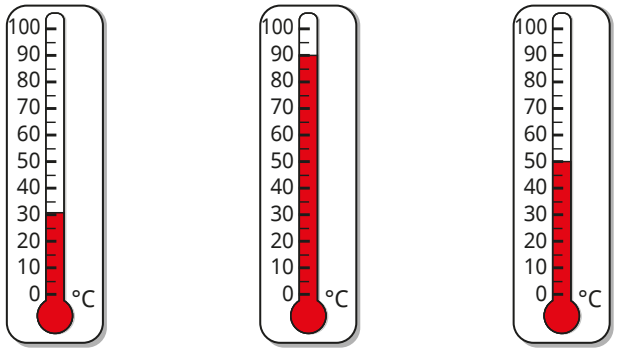
16 °C | 70 °C | 35 °C | 9 °C




- Mr Trent is cooking pasta.

He measures the temperature of the water three times.

What temperatures do the thermometers show?




What could have been happening at each stage when Mr Trent measured the temperature?

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# Temperature

## Reasoning and problem solving

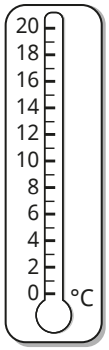
The table shows some temperatures around the world.

| London | New York | Madrid | Sydney | Oslo |
|---|---|---|---|---|
| | 7 °C | 17 °C | 26 °C | 2 °C |

London is 15 °C colder than Sydney.

Complete the table.

Show the temperature in London on the thermometer.




What is the difference in temperature between the hottest and coldest cities?

London: 11 °C

24 °C

Sam measures the temperature at 1 pm and at 5 pm.

There is a difference of 7 °C.

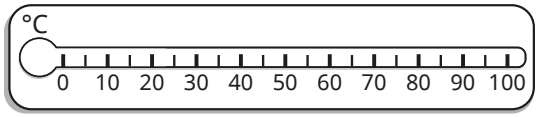
What could the temperatures be?

Compare answers with a partner.

multiple possible answers, e.g. 15 °C and 8 °C

Draw arrows to estimate where each temperature belongs on the thermometer.

1 °C | 99 °C | 47 °C | 67 °C




Compare methods with a partner.

arrows drawn to correct positions on the thermometer

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