Spring Block 5

Mass and volume

Small steps

Step 1	Heavier and lighter
Step 2	Measure mass
Step 3	Compare mass
Step 4	Full and empty
Step 5	Compare volume
Step 6	Measure capacity
Step 7	Compare capacity

Heavier and lighter

Notes and guidance

In this block, children are formally introduced to mass for the first time. They may have some understanding of describing something as heavy or light from their own experience or from previous learning in Reception.

Children begin by holding objects to compare them, using the language of "heavier" or "lighter". They then use balance scales to check their comparisons. They need to understand that the heavier object is lower on the balance scale. At this stage, children do not need to measure the actual mass of objects in order to compare them.

Children may assume that larger objects are heavier than smaller objects or that objects that are the same size/shape have the same mass. Comparing the mass of a large inflated balloon and a small ball of modelling clay, and comparing the mass of an inflated and a water-filled balloon should help to overcome these misconceptions.

Things to look out for

- Children may think that larger objects are always heavier.
- Children may think that if an object can hold something inside, it must be heavy. For example, they may think a box must be heavy because it can hold things inside it.

Key questions

- Which object do you think is heavier/lighter?
- Is a _____ heavier or lighter than a _____?
- How can you show which object is heavier/lighter?
- Are large objects always heavier than small objects? How do you know?
- How does the balance scale show which object is heavier?
- If two objects are the same size and shape, does that mean that they have the same mass? How do you know?

Possible sentence stems

- The _____ is heavier/lighter than the _____
- The _____ has the same mass as the _____
- I know which object is heavier/lighter because ...

National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weights; capacity and volume; time

Heavier and lighter

Key learning

Read *Mighty Maddie: Comparing Weights* by Stuart J Murphy.

Ask children to describe objects as lighter or heavier, as Maddie did when tidying her room. Do they agree with Maddie that the teddy bear is light and the toy train is heavy?

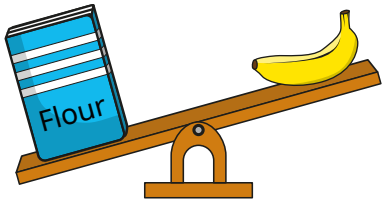
Ask children to draw an object that they think is heavy and an object that they think is light. They can explain to a partner why they chose each object.

Did children draw similar objects?

Collect different objects from outside or from around the classroom.

Use a balance scale to compare pairs of objects using the language of "heavier" and "lighter". Challenge children to find two objects that have the same mass. Ask children to find the heaviest and lightest objects that they can.

- Which object is lighter?



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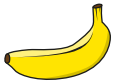
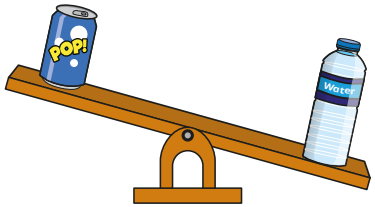


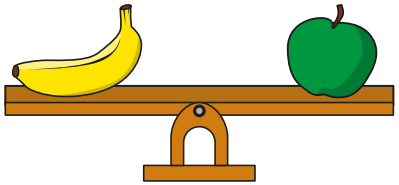
How do you know?

- Write **heavier** or **lighter** to complete the sentence.



The bottle is _____ than the can.

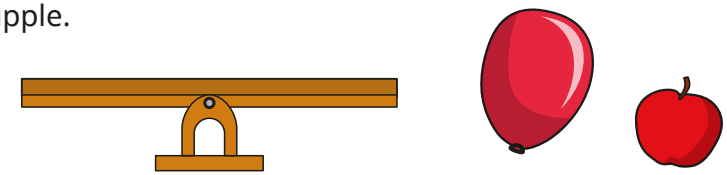
- What do you know about the masses of the banana and the apple?



Heavier and lighter

Reasoning and problem solving

Mo, Jo and Max are comparing the mass of a balloon and an apple.



Mo

I think the balloon will be heavier because it is bigger.

Jo

I think they will have the same mass because they are both red.

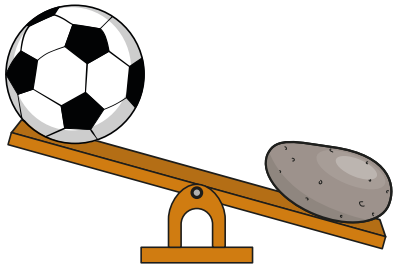
I think the apple will be heavier than the balloon.

Max

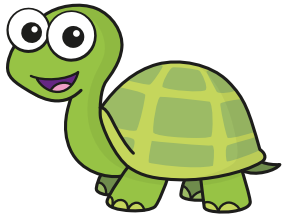
Who do you agree with?

Why?

Max



The football is heavier, because it is higher.



Do you agree with Tiny?

Why?

No

Measure mass

Notes and guidance

In this small step, children use a variety of non-standard units, such as cubes or bricks, to measure the mass of an object.

Building on the previous step, children should understand that when a scale is balanced, objects have the same mass. On a balanced scale, the number of non-standard units on one side tells them the mass of the object on the other side. Highlight the importance of choosing the same non-standard unit to measure the mass. Measuring the mass of an object using an assortment of different non-standard units, such as a number of cubes, pencils and wooden bricks, makes it difficult to record the object's mass.

Children may find it difficult to balance objects exactly. If an object does not balance exactly, encourage them to use the closest number or to try a different non-standard unit.

Things to look out for

- Children may find it difficult to balance objects exactly using non-standard units. For example, an object may be heavier than 3 bricks, but lighter than 4 bricks.
- When using objects as non-standard units for measuring, children may think that a certain type of object has a certain mass, for example that all cubes have the same mass, or all bricks have the same mass.

Key questions

- What does it mean when the scales are balanced?
- How do you know if two objects have the same mass?
- If you add one more cube, what will happen?
  If you take away one cube, what will happen?
- Which classroom objects are the best units to measure the mass of the object? Why?
- Why should you not use a variety of objects to measure the mass of an object?
- What is the mass of the _____ in cubes?

Possible sentence stems

- The mass of the _____ is the same as the mass of _____ cubes.
- The mass of the _____ is _____ cubes.

National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Measure mass

Key learning

Read *So Light, So Heavy* by Susanne Strasser.

Ask which animals were as heavy as the elephant.

Take children outside to collect objects and then get them to record the mass of each object using non-standard units, for example cubes.

Ask children to complete the sentence for each object.

The mass of the _____ is the same as _____ cubes.

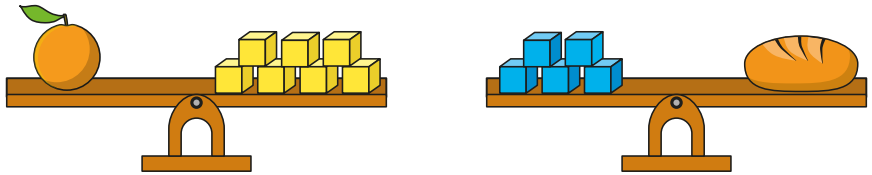
Remind children how to find and record the mass of an object using cubes.

Repeat for the same object using a different non-standard unit, for example pencils or bricks.

What do children notice?

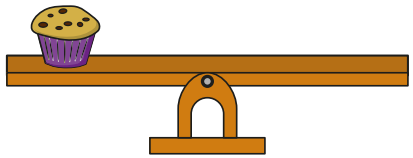
Discuss whether pebbles would be a good unit to measure the mass of something.

- What is the mass of each object?

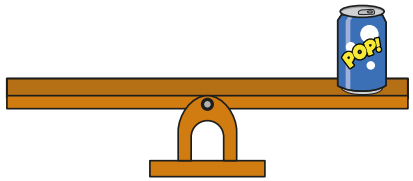


The mass of the _____ is _____ cubes.

- Draw cubes to balance the scales.
  - The mass of the muffin is 4 cubes.



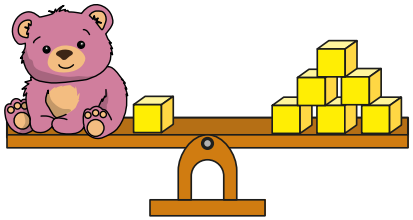
  - The mass of the can is 9 cubes.



Measure mass

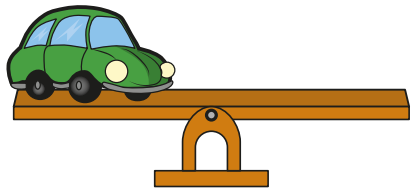
Reasoning and problem solving

What is the mass of the teddy bear?



How do you know?

5 cubes

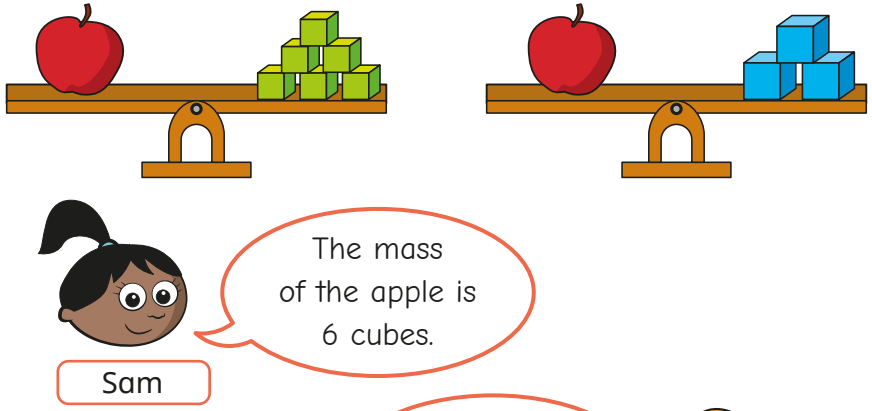


The toy car is heavier than 5 cubes, but lighter than 9 cubes.

Draw cubes on the scales to show what the mass of the car could be.

6, 7 or 8 cubes

Sam and Ron are finding the mass of an apple.



Who do you agree with?

Why?

Both children are correct.

Compare mass

Notes and guidance

In this small step, children compare the masses of two objects, still using non-standard units of measure.

Children should know that if, for example, an apple has the same mass as 6 cubes and a banana has the same mass as 4 cubes, then the apple is heavier than the banana, provided the cubes have the same mass.

Children use their knowledge of "heavier" and "lighter" from earlier in the block to compare the masses of objects. It is important that children are also exposed to examples of objects that have the same mass as each other.

Once children are confident comparing two objects, they can begin to order the masses of more than two objects and to use the language of "heaviest" and "lightest".

Things to look out for

- Children may try to use different non-standard units to measure the masses of objects, which will not allow accurate comparisons to be made. For example, if the mass of an apple is 5 cubes and the mass of an orange is 2 bricks, this does not necessarily mean that the mass of the apple is greater.

Key questions

- What does it mean when the scales are balanced?
- What is the mass of the _____ in cubes?
- Which of the two objects is heavier/lighter? How do you know?
- How much heavier/lighter is the _____ than the _____?
- Why do you need to use the same unit to measure the masses of the objects?

Possible sentence stems

- The mass of the _____ is _____ cubes.
- I know that the _____ is lighter/heavier than the _____ because ...
- The heaviest/lightest object is the _____

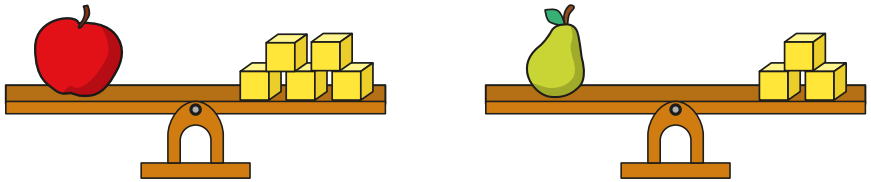
National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Compare mass

Key learning

- Ron is measuring the mass of fruit using cubes.



  - What is the mass of the apple?
  - What is the mass of the pear?
  - Choose a word to complete the sentence.

heavier lighter

The apple is _____ than the pear.

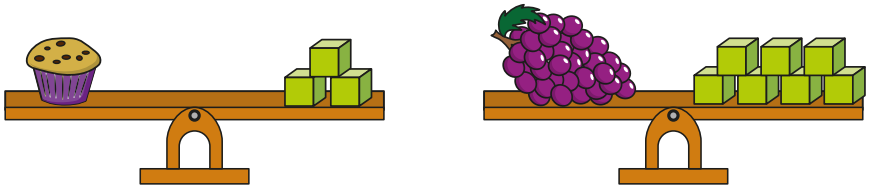
How do you know?

Collect two objects from outside.

Ask children to predict which object is heavier and which is lighter. Measure the mass of each object in cubes to find out which object is heavier.

How much heavier is it?

- Complete the sentences.

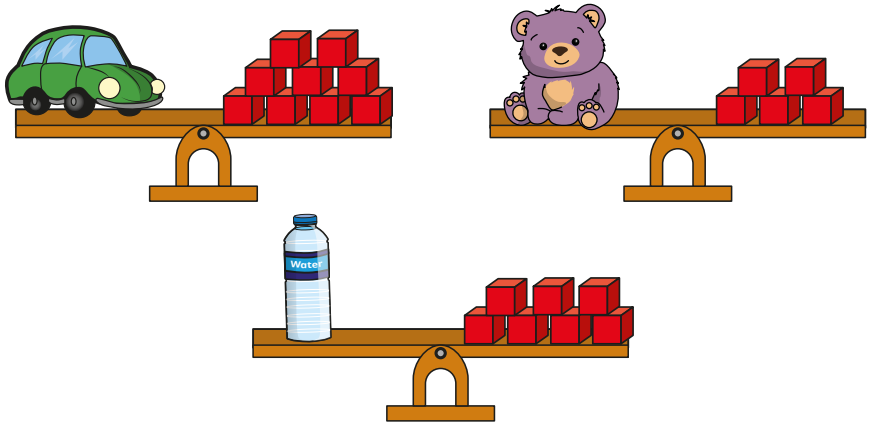


The mass of the muffin is _____ cubes.

The mass of the grapes is _____ cubes.

The muffin is _____ than the grapes.

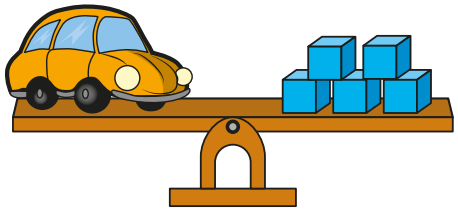
- Order the objects from lightest to heaviest.

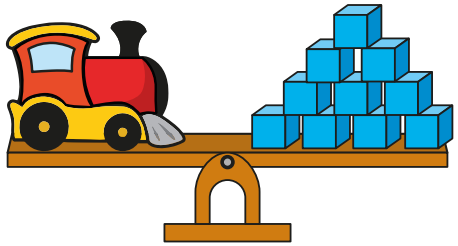


Compare mass

Reasoning and problem solving

How much heavier is the train than the car?

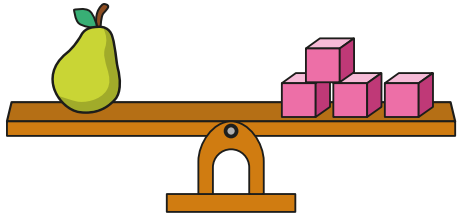


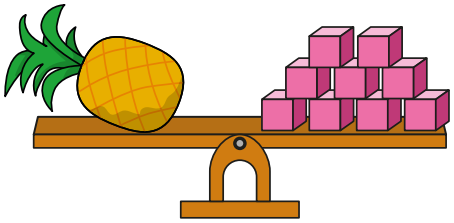


How did you work it out?

5 cubes

An apple is heavier than the pear, but lighter than the pineapple.





What could the mass of the apple be?

5, 6, 7 or 8 cubes

Full and empty

Notes and guidance

In this small step, children are introduced to volume and capacity for the first time. They begin by exploring practically the idea that capacity is the maximum amount that something can hold. Ensure that they experience a range of different sizes and shapes of containers and begin to make basic comparisons to see which has the greater capacity.

Children then explore the concept that volume is the amount of something inside a container. They describe the volume in a container using phrases such as “empty”, “nearly empty”, “nearly full” and “full”.

At this stage, no formal measurements of volume or capacity, such as litres, are used.

Key questions

- Which container do you think can hold more water? Why?
- Can two glasses that look different hold the same amount of water? Why?
- Does a taller/wider glass always hold more water?
- What does “full”/“empty” mean?
- How are “nearly empty” and “nearly full” different?

Possible sentence stems

- I think that this container can hold more water because ...
- The glass is full/empty because ...
- The glass is nearly empty/nearly full because ...

Things to look out for

- Children may believe that different shapes or sizes of containers must have different capacities or that a taller container must have a greater capacity than a shorter one, regardless of width.

National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Full and empty

Key learning

Read *A Beach For Albert: Capacity* by Eleanor May.

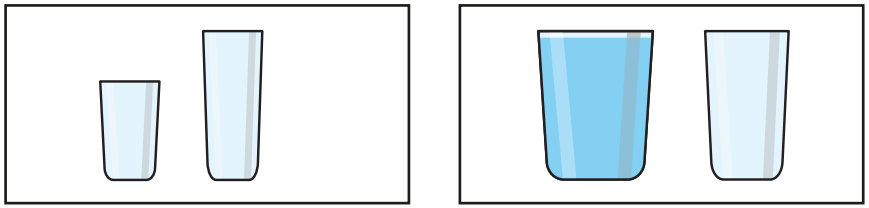
Children compare how much water each of the containers can hold and make suggestions about what other items Albert could use to carry the water.

Encourage children to describe how much water is in the pool using phrases such as "empty", "nearly empty", "nearly full" and "full".

Provide children with a variety of different sizes and shapes of container. Get them to predict which one has the greatest capacity. Challenge children to investigate how they can work out which container has the greatest capacity, for example filling one container with water and then pouring the water into another container.

Provide pairs of children with a container and a jug of water. As they pour water into their containers, ask them to describe the volume of water in the container using phrases such as "empty", "nearly empty", "nearly full" and "full".

- In each pair, which container has the greater capacity?



- Show the volume in each glass.

nearly empty **nearly full** **full**

Compare answers with a partner.

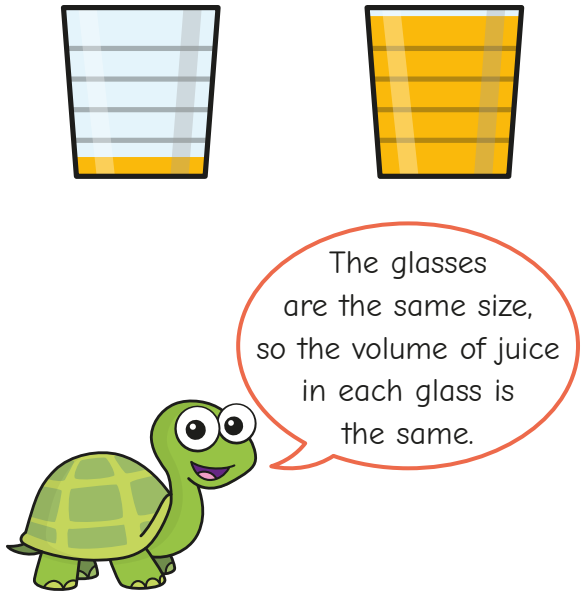
- Choose words to complete the sentence about each glass.

empty	nearly empty	nearly full	full

The glass is _____

Full and empty

Reasoning and problem solving

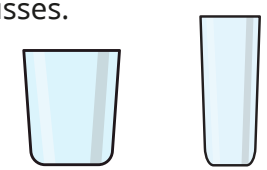


Do you agree with Tiny?

Explain your reasons.

No

Jo and Max are comparing their glasses.



Jo **Max**

Why do Jo and Max think this?

Whose glass can hold more water?

Jo **Max** **cannot tell**

cannot tell

Compare volume

Notes and guidance

In this small step, children develop their understanding of volume further and start to compare volumes using the language of "more than" and "less than".

Initially, children make simple visual comparisons between identical containers, using the language introduced in the previous step. They should still be exposed to a range of different size and shape containers. Children then compare and order more than two glasses. This can include following instructions to show a certain volume, for example showing more than half full, but less than nearly full.

Challenge children to also compare volumes in containers with different capacities. For example, if glasses are the same height but different widths and the level of the water is the same, then the wider glass must have a greater volume of water inside. Practical explorations of these types of problems will be key.

Key questions

- What does "empty"/"nearly empty"/"nearly full"/"full" mean?
- If the glasses are the same size and shape, how do you know which has more water in it?
- How can you order the volumes from greatest to smallest?
- What do you know about two glasses that are the same height, but one is wider than the other?

Possible sentence stems

- The glass is _____
- Glass A has _____ water than glass B.
- I know that there is _____ water in glass _____ because ...

Things to look out for

- When comparing volumes in different-sized containers, children may believe that if the water level is higher up the container, then the volume of water must be greater.

National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Compare volume

Key learning

- Use the words to describe the volume of juice in each glass.

empty	nearly empty	nearly full	full

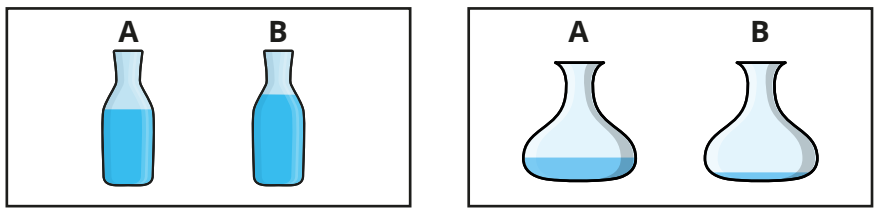
A B C

Glass _____ is _____

Write **more** or **less** to compare the volumes.

- Glass A has _____ juice than glass C.
- Glass C has _____ juice than glass A.
- Glass C has _____ juice than glass B.
- Glass B has _____ juice than glass A.

- Write **more** or **less** to compare the volumes.



Container A has _____ water than container B.

- Glass A has more water than glass B.

  Glass C has less water than glass B.

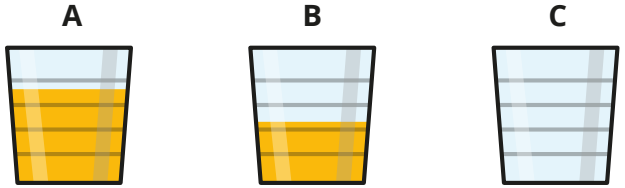
  Show the volume of water that could be in glasses A and C.

A B C

- Glass C has less juice than glass A but more juice than glass B.

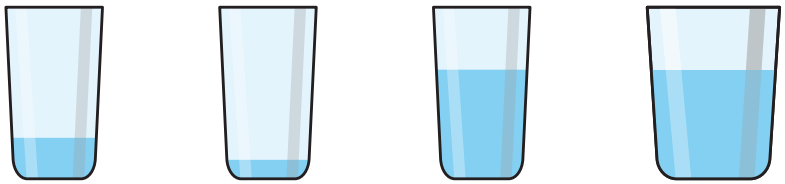
  Show the volume of juice that could be in glass C.

A B C



- Put the glasses in order from smallest to greatest volume.

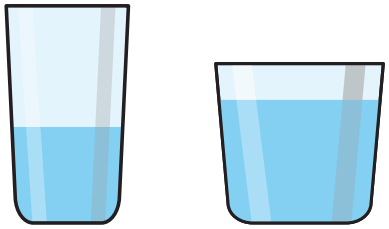
A B C D

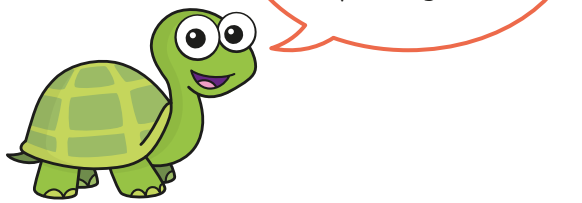


Compare volume

Reasoning and problem solving

The glasses can hold the same amount of water.

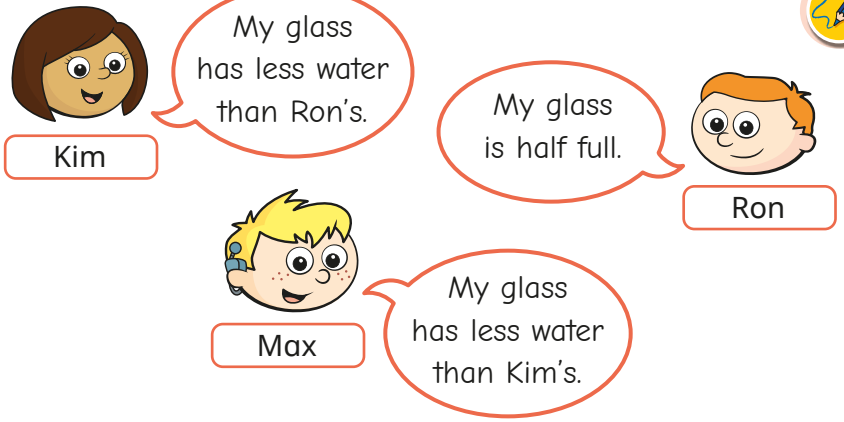




Explain Tiny's mistake.

Glass A is less than half full and glass B is more than half full, so glass B must have more water.

Kim, Ron and Max are describing their glasses of water.



Show how much water could be in each glass.

Compare answers with a partner.

multiple possible answers

Measure capacity

Notes and guidance

In this small step, children measure the capacity of different containers using non-standard units of measure. They formalise their understanding that the capacity of a container is how much of something it can hold. This can be cups of water or sand, cubes or marbles and so on.

Show children that to measure the capacity of a container, they need to make sure that the unit of measure remains the same, for example the same size of marble or the same size of cup. They also need to see that to accurately measure the capacity of a container, they must fill the container to the top.

Discuss different non-standard units of measure, and how some are more accurate than others. For example, cups of water and sand are more accurate than cubes or marbles because they take up more of the space in the container.

Things to look out for

- Children may not completely fill the container or the unit of measure, for example a cup.
- Children may use pebbles or marbles of different sizes when measuring the capacity of a container.

Key questions

- How can you measure how much liquid fills this container?
- What else can you fill the container with?
- How many cups of sand are needed to fill the container?
- How many marbles are needed to fill the container?
- Which unit of measure is more accurate? Why?
- If the cubes/marbles are smaller, will it take more or fewer cubes/marbles to fill the container than larger ones?
- If a cup is larger, will it take more or fewer cups to fill a container? How do you know?

Possible sentence stems

- _____ cubes are needed to fill the container.
- The capacity of the container is _____ cups of water.

National Curriculum links

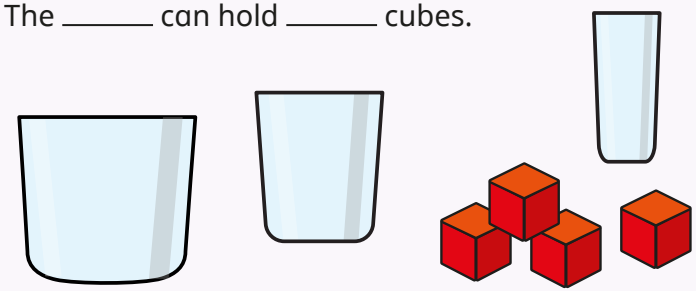
- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Measure capacity

Key learning

Give children cubes of the same size and different containers. Ask them how many cubes they can fit into each container and to complete the sentence for each container.

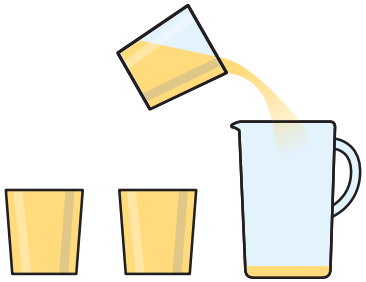
The _____ can hold _____ cubes.



As a class, measure and record the capacities of different containers using cubes, water and sand. Make sure children see that each cup of water must have the same amount in it.

What do children notice? Ask if they think that cubes or cups of water/sand are better for measuring capacity. Can they explain why?

- 3 cups of sand fill one container.

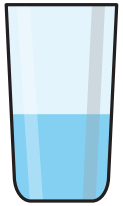


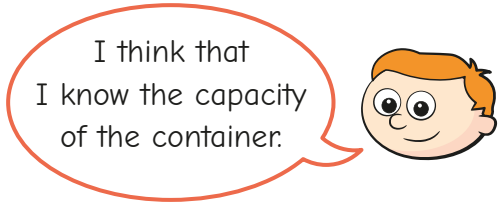
Complete the sentences.

The capacity of 1 jug is _____ cups of sand.

The capacity of 2 jugs is _____ cups of sand.

- Ron has poured 2 glasses of water into the container.





Why does Ron think this?

How could he check?

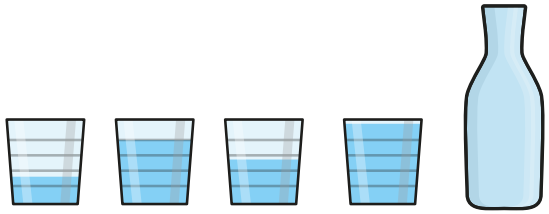
What is the capacity of the container?

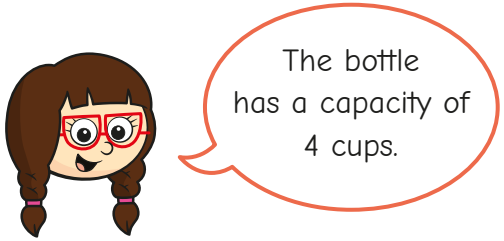
Measure capacity

Reasoning and problem solving

Jo pours these cups of water into the bottle.

The water fills the bottle.



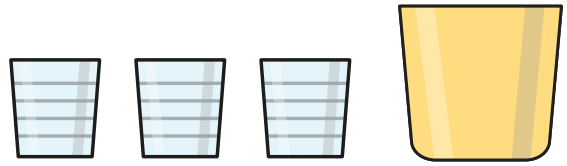


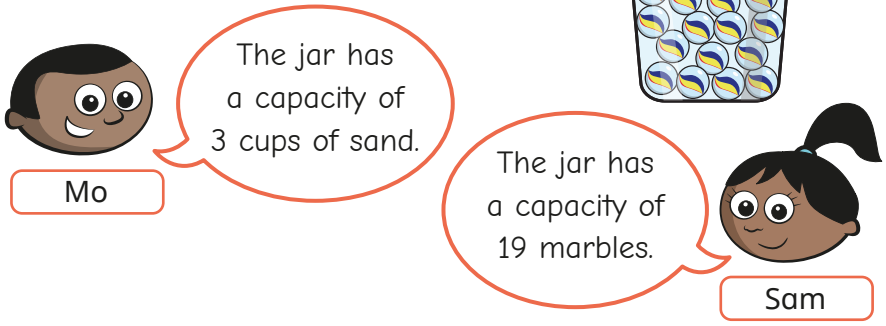
Do you agree with Jo?

Explain your answer.

No

Mo and Sam are measuring the capacity of a jar.





Who has used a more accurate measurement?

How do you know?

Mo

Compare capacity

Notes and guidance

In this small step, children compare the capacities of different containers, still using non-standard units of measurement.

Children recognise that if container A has a capacity of 3 cups of water and container B can hold more than 3 cups of water, then container B has a greater capacity than container A. They then move on to using inequality symbols to record this.

It is important that children know that the units of measure need to be the same for both containers in order to compare capacities. Remind them of the importance of filling each container to the top.

Finally, children compare more than two containers, putting them in either ascending or descending order of capacity.

Things to look out for

- Children may not completely fill each container.
- Children may not use the same units of measure for each container.
- Children may confuse the inequality symbols for "greater than" and "less than".

Key questions

- What can you use to measure the capacities of the containers?
- How many cups of water can the container hold?
- Which container can hold more marbles?
- Does container A hold more or less water than container B?
- Which container has the greater capacity? How do you know?
- How many more _____ does container A hold than container B?

Possible sentence stems

- Container A has a _____ capacity than container B.
- I know that container A has a _____ capacity because ...
- I need to use the same unit of measure because ...

National Curriculum links

- Compare, describe and solve practical problems for: lengths and heights; mass/weight; capacity and volume; time
- Measure and begin to record the following: lengths and heights; mass/weight; capacity and volume; time

Compare capacity

Key learning

Give children different-sized containers and cups of water as the unit of measure. Ask them to complete the sentences for each set of containers.

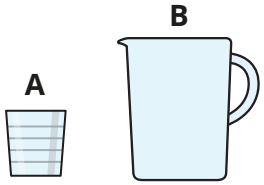
Container _____ can hold _____ cups of water.

Container _____ has a greater capacity than container _____

As a class, measure and record the capacities of different containers, using a range of non-standard units. Line up the containers in order, from smallest capacity to greatest for each non-standard unit. Discuss whether the containers are in the same order each time.

- Which container has the greater capacity?

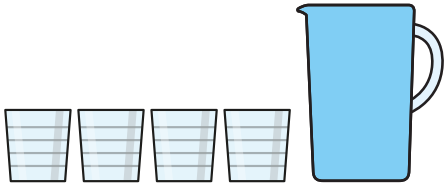
  How do you know?

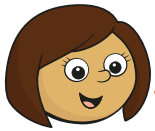


- Max and Kim are measuring the capacities of two jugs.

I used 4 cups to fill my jug.

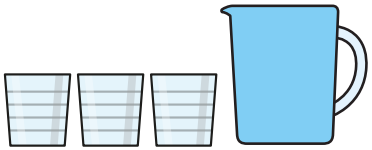
Max





I used 3 cups to fill my jug.

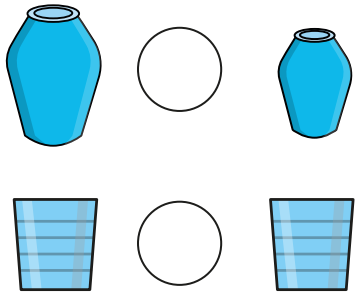
Kim



Which jug has the greater capacity?

How do you know?

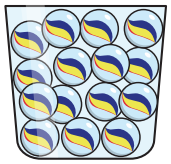
- Write < , > or = to compare the capacities of the containers.

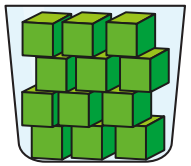


Compare capacity

Reasoning and problem solving

Mo and Sam are comparing the capacities of two jars.

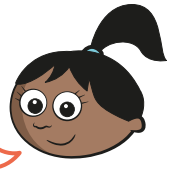




My jar can hold 15 marbles.

Mo

My jar can hold 12 cubes.



Sam

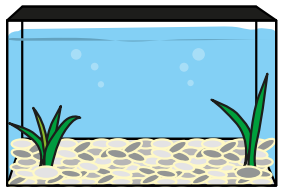
Can you tell which jar has the greater capacity?

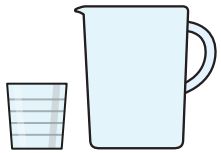
Why?

No

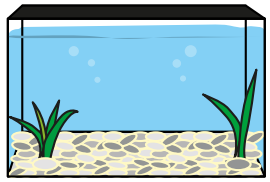
Dan fills his fish tank with 3 jugs of water.

Each jug can hold 4 cups of water.





Kay fills her fish tank with 8 cups of water.



Whose fish tank has the greater capacity?

How do you know?

Dan's