DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES

Measurement: Mass, volume, and capacity

Level 2 (Year 3/ Year 4)

Teacher Booklet

Task 1	Timo is making himself a treasure box. He is wondering which box has the largest volume. Use the cubes to find the volume of the different boxes.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C. There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. GM3-2: Find areas of rectangles and volumes of cuboids by applying multiplication. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Compare and order the volume of objects. • Explain volume as the space inside an object/container. • Use standard units to measure volume. • Calculate the number of units to describe the measurement.

Mathematical language	Volume, cubic centimetres, cubes, cuboids, units of measure, measurement count.
Sharing back/Connect	Select students to share who measure the volume of the boxes in a systematic way by layering the bottom first and then filling the rest of the box and ensuring that there are as little spaces as possible. Also focus attention on students who use grouping solutions to find the measurement unit count. **Connect** Select student explanations of the volume where the 1 cm^3 cubes and 1000 cm^3 cubes did not fit exactly. Discuss and explore with the students how to describe the volume exactly using the language of fractions.
Teacher Notes	• For the launch, provide a variety of boxes of different shapes and sizes and facilitate students to explore the volume using informal units of measure (e.g., blocks, lego pieces). Revisit the concept that the volume of an object is the amount of space it takes up. • For the task, have a variety of different sized and shaped small boxes. Provide students with centi-cubes (1 cm^3) and 1000 cm^3 cubes to measure the volume. • Facilitate the students to notice that an object is measured by the number of unit volumes that fit into it. Additionally, for accuracy of measurement, there should be no gaps or spaces between the 1 cm^3. • Explore as part of this activity, that the volume of an object stays the same (does not change) when cut up and rearranged. • Expect students to record and use representations to show their thinking. • For the independent task, have a collection of different sized and similar boxes or containers. Give the students the centi-cubes (1 cm^3 & 1000 cm^3) to find the volume.
Independent Tasks	What box has the most volume? What box has the least volume? Which boxes have the same volume? Represent how you found the volume for each box and label which one has the most volume, the least volume, and same volume.
Anticipations	

Task 2	Look at the net of the box and estimate how many cubes you will need to fill the box. Check your estimate by making the box and filling it with 1 cm^3 cubes. Draw a representation which shows the volume of the box.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used. Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. GM3-2: Find areas of rectangles and volumes of cuboids by applying multiplication. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.

Learning Outcomes: Students will be able to:	• Use standard units to measure volume. • Find the volume of cuboids. • Compare and order the volume of objects. • Describe the relationship between area and volume.
Mathematical language	Nets, volume, cubes, area, cubic centimetres, cuboids, units of measure, measurement count.
Sharing back/Connect	Select students to share who have noticed and used the relationship between finding the area (first layer) and using this to find the volume. If no students have noticed this, highlight the relationship to them. **Connect:** Ask the students to build different cuboids with 20 x 1 cm^3 cubes and record the volume. Discuss and explore with students how the shape changes but the volume stays the same.
Teacher Notes	• For the task, have a variety of nets for cuboids with different volumes and centi-cubes. • Launch the tasks by show students the 1 cm^3 cubes but do not let them use them before they make estimates of the volume of their cuboid. • Expect students to use grouping and multiplication to find the volume and to represent the volume measurement using cm^3 • For the independent activity, provide students with centi-cubes or multi-link.
Independent Tasks	Use the 24 cubes to design some box shaped buildings. Draw a representation of your design and write the volume for each one.
Anticipations	

Task 3	What is the volume of the classroom using the unit measure of cubic metres? Draw a representation to use to explain and justify your solution.
Big ideas	There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units.
Learning Outcomes: Students will be able to:	• Estimate volume measurement using standard units. • Represent volume measurement using a 3D representation. • Use grouping or multiplication to find volume measurement. • Identify and explain the relationship between area and volume measurement.
Mathematical language	Cubic metre, cuboids, cubes, volume, area, unit, measurement count.
Sharing back/Connect	Select students to share who have developed a 3D representation to justify or those who have used multiplication and the relationship between area and volume to develop their volume estimate. **Connect:** Ask students to make predictions about the volume of another school space (e.g., corridor, hall) and draw a 3D representation of this.
Teacher Notes	• For the launch, have pictures of large spaces (e.g., shipping container, warehouse, hall, lounge) and ask students to identify the units of measure which would be used to measure these larger units. Explore why you need a larger and uniform unit of measure. • Have a cubic metre prepared and introduce this to students as a cubic metre and record as 1 m^3. • Facilitate students to understand that volume is the space inside a unit. • Expect students to use grouping or multiplication and to represent using 3D representations as a way to explain and justify finding the volume of a uniform space. • Support students to develop a sound benchmark of the size of a cubic metre.

	• For the independent activity, have a variety of pictures of different sized cuboid spaces (e.g., shipping container, aquarium, lounge, warehouse).
Independent Tasks	Estimate the volume of the space using cubic metres. Record your estimate using m^3 and draw a 3D representation to justify this. Choose 5 spaces around your home and community and write the place. Estimate the volume of the space using cubic metres. Record your estimate using m^3 and draw a 3D representation to justify this.
Anticipations	

Task 4	Matiu and Linea have a carton of juice the same size. Matiu measures the volume of the carton of juice using cubic centimetres. Linea measures the capacity of her carton using water and millilitres. They compare their results and are surprised. With your carton use the two units of measure to find out what surprised them. Make sure you explain and justify your answer using representations.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C. There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. GM3-2: Find areas of rectangles and volumes of cuboids by applying multiplication. NA2-1: Use simple additive strategies with whole numbers and fractions.

	NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Measure the volume of a container using millilitres (mL). • Measure the volume of a container using cubic centimetres ($cm^{3)}$ • Compare and describe the relationship between volume and capacity and millilitres and cubic centimetres. • Calculate and record measurement units to describe the measurement count.
Mathematical language	Liquids, cubic centimetres, capacity, millilitres, litres, volume.
Sharing back/Connect	Select students to share who use a range of measurement language and have recorded using both cm^3 and ml. Alternatively model the measurement recording for the students. **Connect:** Have a set of pictures of containers and ask students to estimate and record their volume as cm^3 and mL.
Teacher Notes	• Have cuboid containers to represent the cartons and measuring jugs with millilitre scales and centicubes to use as measuring tools. • Facilitate students to notice the use of the different measuring units for liquids and solid objects and the terms capacity and volume. • Expect students to record their ideas using representations (3D drawings) and measurement units. • Emphasise the following to support students in developing sound benchmarks: - A millilitre is about the same volume as a cubic centimetre. - The litre is defined as the amount of liquid that will fill a cube, which is a volume of 1000 cm^3. So, 1 mL is the same as 1 cm^3. - Millilitres is the measure used for liquids and cubic centimetres for solids. - The space any container holds is its volume - The term capacity is used to talk about the volume of the liquid a container holds without spilling any. - Emphasise that the term litre/litres are used for measuring the volume of liquids. • For the independent task have a measuring container that contains 50mL (¼ of a cup) and a range of containers to measure.

Independent Tasks	Use the measuring container to find out the capacity of the containers. Record the measurement in mL and record your findings on a numberline using a scale of 50 mL.
Anticipations	

Task 5	Find the containers that have the same capacity but are a different shape. Prove that they have the same or almost the same capacity. Make sure that you explain and justify your reasoning using a range of representations including a number-line.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C. There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Use standard units (millilitres and litres) to describe and measure capacity. • Calculate the numbers of units to describe the measurement. • Represent measurement scales in different ways.
Mathematical language	Capacity, millilitre, litre, scale, unit, measurement count.

Sharing back/Connect	Select students to share who have used a variety of representations including a number line with equally spaced marks to represent equal volume between measurements. Encourage and model the use of standard unit measurement language (e.g., millilitres, litres, 500mL is halfway to 1L). **Connect:** Have a number line which is marked from 50 mL to 1000mL with a scale but no other numbers. Ask students to identify how many millilitres would be represented at certain points.
Teacher Notes	• To launch the task, ask students to discuss what they know about millilitres and litres and to give benchmarks of when they would be used. • Have a range of measuring jugs/cups with different marked measures and closely watch for students who choose inappropriate measures. • Expect students to use a number line to re-represent the measurement. Support them to notice that the marks on the number line need to be equally spaced because the spaces between them represent slices of equal volume. Highlight that uniformity needed in measuring volume and this is the same in measuring capacity. • Facilitate students count in 100s (or other combinations) to work out that one litre is 1000mL. Support them to go beyond one litre and to use fractional language. • Make links to the terms, millilitre, and millimetre, and that the term milli represents one thousand. • For the independent task, have a selection of measuring jugs/cups with millilitre markings on the side and a selection of unmarked containers.
Independent Tasks	Tasi is making juice for a party. He would like to know how much liquid each container will hold. Predict the millilitres and litres for each container. Test your prediction with the measuring jug. Use a number line to represent the measurement.
Anticipations	

Task 6	Find the mass of each bag of objects. Record the mass in grams and represent this on a number-line. Find the difference in grams between for the bags of objects and put them in order from most massive to least massive.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Compare and order the mass of objects. • Use measurement language to describe the comparison of mass. • Find the mass of objects in grams and kilograms.
Mathematical language	Mass, scale, grams, kilogram, difference, massive.
Sharing back/Connect	Select students to share who have used a variety of representations including a number line with equally spaced marks to represent the scale. Encourage and model the use of standard unit measurement language (e.g., grams, kilograms, 1000 grams is the same as one kilogram). **Connect:** Ask students to draw a numberline and represent the difference between: 49 grams and 32 grams 330 grams and 1 kilogram 1 kilogram and 682 grams.

Teacher Notes	• To launch the task, ask students if they have heard the word 'gram' and 'kilogram' and what they think it means. Have centi-cube (1gm) and bags of objects which have a mass equivalent to 1 kg. Let the students lift and hold them. Discuss the use of g for grams and kg for kilograms to record the measures of mass. • Have digital or analogue scales which measure in grams and kilograms and bags of objects which have differing measures of mass. • The mass of an object is the amount of matter in it. Avoid using the term "weigh" instead refer to finding the mass of objects. Similarly, facilitate students use the terms more massive or less massive rather than heavier or lighter • Note, the mass of the object is measured by the number of unit masses that balance it. Scales find the weight of an object. This is the force of gravity by which it is attracted to the Earth (gravitational pull). However, because gravity is almost the same everywhere on Earth an object's weight provides a good estimate of its mass. A kilogram is a national and international agreed unit (metric standard) for measuring mass. • Expect students to use a number-line as a representation and facilitate students to ensure that the marks on the number line are equally spaced because the spaces between them represent slices of equal mass. • Notice whether students use multiplicative reasoning when counting in groups of tens to make a 100g, or 20s, or 50s to make 100g or 1000g, or 100s to make 1000g.
Independent Tasks	Find the difference in mass between each pair of measures. Represent your solution on an empty number-line. 19 grams and 67 grams 75 grams and 26 grams 183 grams and 57 grams 43 grams and 118 grams 312 grams and 99 grams 708 grams and 409 grams 1 kilogram and 446 grams
Anticipations	

Task 7	Find three things which would have a total mass of one kilogram. Draw a number line to represent the mass measure of each item and show how altogether their estimated mass is one kilogram. Now use the scales to check the mass of each object against your estimation. Draw another number line to represent the mass measure of each item from the scale and show the individual and combined mass. How close to one kilogram was your estimation?
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Estimate the mass of objects in grams and kilograms. • Find the mass of objects in grams and kilograms. • Convert grams to kilograms. • Use measurement language to describe the measurement of mass.
Mathematical language	Mass, less massive, more massive, equal mass, kilogram, gram, scales.
Sharing back/Connect	Select students to share who have closely approximated a total mass of 1 kg (including slightly below and above a kg). Facilitate students to describe how 1000 grams is the same as one kilogram.

	Connect: Ask students to explain and justify which measure is closest to one kilogram. 1kg and 9g OR 990g 1½kg OR 750g 500g OR 1½kg
Teacher Notes	• Have a range of objects of differing size and mass and a digital/analogue scale to measure the mass. • Facilitate students to notice that different scales may have different markings but the space between markings still represents grams. • Expect students to use measurement language including finding the mass, more massive, less massive, grams, kilograms. • Facilitate students to notice and use benchmarks such as 1000 grams is one kilogram (composite units), 500 grams is ½ of a kilogram. • Notice students who understand that the measurement total in grams is recorded as a larger number than the measurement in kilograms although these are equivalent. If this does not emerge then address it explicitly. • For the independent task, have digital/analogue scales and a selection of objects.
Independent Tasks	Choose a group of objects that you predict will have a total mass of: 50g 175g 1 and a ½ kg 1kg and 350g 1kg and 990g 2kg Use the scales to check the mass of the group. Draw a number line and represent the mass measure of each item in the group and show the total mass. How close were you to the total mass you were trying to make?
Anticipations	

Task 8	In most competitive ball games, the rules are that balls should have the same mass. Select three balls used in the same competitive sport. Estimate and record the mass for each ball. Use the scales to find out the mass of each ball in the set and record this in grams and kilograms. Was the mass of each ball exactly the same? If there was a difference between the mass of the balls, what was it? What about other balls which are not used competitively? Do they have the same mass? Check using the same process.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.
Learning Outcomes: Students will be able to:	• Use a scale to find the mass of an object in grams and kilograms. • Record measurement of mass using standard units. • Compare the mass of an object using standard units.
Mathematical language	Mass, estimate, scale, exact, gram, kilogram, unit, measurement count.
Sharing back/Connect	Select student explanations who have used a range of measurement language. During the discussion and connect, facilitate students to notice that size is not always relevant to mass (e.g., marble and beach ball). **Connect:** Ask students to order a variety of pictures of different balls according to their mass and their volume and discuss what they notice.

Teacher Notes	• During the launch, have pictures of objects that vary widely in size (volume) and mass with the mass of each object recorded. Ask the students to put them in order of mass (less massive, more massive) and explain their reasons. • Have a collection of sets of different types of balls (e.g., soccer balls, netballs, rugby balls, tennis balls, golf balls, table tennis balls, beach balls, hi-bounce balls, marbles). • Facilitate students to use the term massive in relation to the mass not the size or volume of the object. • For the independent task, have digital/analogue scales and a selection of objects.
Independent Tasks	Choose a group of objects that you predict will have a total mass of: 75g 300g 2 ½ kg 1kg and 150g 1kg and 770g 2kg and 2500g Use the scales to check the mass of the group. Draw a number line and represent the mass measure of each item in the group and show the total mass. How close were you to the total mass you were trying to make?
Anticipations	

Task 9	The yoghurt container label shows a mass of 125g, but the container is empty. How can you measure whether the mass would be 125g when it is full? Be ready to explain and justify how a unit of measure could prove that the mass of the full container would be 125g. Test your solution and unit of measure with other empty containers of different sizes and justify whether their mass when full is correctly recorded.
Big ideas	Conceptual understanding of measurement requires understanding of conservation and transitivity. Conservation requires understanding that when moved or subdivided, an object will retain its size. Transitivity involves understanding that the measures of two objects can be compared to a third object. For example, if object A weighs more than object B, and object B weighs more than object C, then object A will weigh more than object C. There are key principles related to measurement including that the size of the measurement unit remains the same (including identical units or subdivisions), units are repeated with no gaps or overlaps (iteration), the unit is part of a whole and the measurement is expressed as the total number of units used. There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM2-1: Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature, and time. GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. GM3-1: Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.
Learning Outcomes: Students will be able to:	• Measure the volume of a container using millilitres (mL) or grams. • Compare and describe the relationship between capacity and mass and millilitres and grams.
Mathematical language	Mass, grams, unit of measurement, millilitres, capacity.
Sharing back/Connect	Select students to share who make connections between measures for mass and capacity.

	Connect: The yoghurt container has a mass of 125g. What would the capacity be? The yoghurt container has a mass of 500g. What would the capacity be? The yoghurt container has a mass of one kilogram. What would the capacity be?
Teacher Notes	• For the launch, have pictures of objects of different mass and ask the students to identify which should be measured using grams or kilograms and why. • Have water and measuring jugs available to use. • Facilitate students to notice and discuss the relationship between mass and volume. The relationship between mass and volume is called density. Density is mass divided by volume ($\rho=m/v$), and water was used as the basis for establishing the metric unit of mass, which means a cubic centimetre ($1cm^3$) of water weighs one gram (1g). So, $1g/1cm^3 = 1\ g/cm^3$, giving water its easy-to-remember density. • For the independent task, have analogue/digital scale and a selection of objects to measure.
Independent Tasks	Use the scales to measure the mass of different objects and record as follows: Object Mass in grams Mass in kilograms When you have recorded the mass of five objects, order the objects from most massive to least massive. Record how much more mass you would need to make each object have the same mass as the object you labelled the most massive.
Anticipations	

Task 10	Fill in the missing values: 1000mL = ___l 1500mL = ___l and ___mL 1340mL = ___l and ___mL 1750mL = ___l and ____mL 2l = ___mL 1000g = _____kg 1250g = _____kg and _____g 1500g = _____kg and ____g 2000g = _____kg
Big ideas	There are relationships between measurement units, for example, conversion between metric units involves multiplication or division by a power of ten. There are relationships between measurement attributes, for example, the area of a rectangle and the volume of a rectangular prism.
Curriculum links	GM4-2: Convert between metric units, using whole numbers and commonly used decimals.
Learning Outcomes: Students will be able to:	• Find conversions for millilitres and litres. • Find conversions for grams and kilograms.
Mathematical language	Mass, grams, kilogram, millilitre, litre, convert, metric units.
Sharing back/Connect	Select students to share who justify their conversions using representations. Connect: Ask students to give the conversions for: 2 litres 3000 millilitres 3000 grams 2 kilograms 4500 millilitres
Teacher Notes	• Expect students to use a range of measurement language and use representations to justify their solution. • Have measuring jugs and analogue scales available for the students to use if needed.
Independent Tasks	Find the missing values: 2 000mL = _____l 500mL = 200mL and _____mL

	1 200mL = ___l and ____mL 1 300l = _____l and ____mL 2l = _____mL 1050g = _____kg and _____g 2100g = ____kg and _____g
Anticipations	

Task 11	Maia and her sister Quantum have each picked a bucket of strawberries. The strawberries in Quantum's bucket are bigger than Maia's and she says that her bucket is more massive than Maia. They both measure the mass of their buckets. Maia's box is 1kg and 373g and Quantum's box is 1kg and 294g. Which box is more massive? How many grams would you need to add to make the boxes the same mass? Represent your solution using a number-line.
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these.
Curriculum links	GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Identify the most mass. • Solve addition and subtraction problems that involve mass.
Mathematical language	Mass, massive, measure, grams, kilogram, greater than, less than, the same.
Sharing back/Connect	Select and share student solutions in which they have subtracted in parts, used bridging to decades or used equivalence and compensation. Connect: What is the difference in mass between these measures? 1kg and 9 grams 1kg and 19 grams 1kg and 99 grams
Teacher Notes	- Expect students to use a number line and equations to represent their solution. - Notice and facilitate student reasoning which recognises that size does not determine density.
Independent Tasks	What is the difference in mass between these measures? 1kg and 8 grams 1kg and 18 grams 1kg and 998 grams

	1kg and 509 grams 1kg and 999 grams 2kg and 19 grams 2kg and 99 grams 3kg and 999 grams 4kg and 999 grams
Anticipations	

Task 12	Jeremiah has a box of chocolates. The label on the box says that the net weight of the box is 245g. Someone has eaten some of the chocolates and when Jeremiah measures the mass of the box, it is now 177g. What mass of the chocolates was eaten?
Big ideas	There are a range of attributes that we can measure including length, mass, time, area, angle, and volume. When we measure, we use comparison, specifically, we compare like properties to see which is greater. We can make comparisons using standard or non-standard units of measure and we use mathematical language to describe these.
Curriculum links	GM2-2: Partition and/or combine like measures and communicate them, using numbers and units. NA2-1: Use simple additive strategies with whole numbers and fractions. NA3-1: Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals, and percentages.
Learning Outcomes: Students will be able to:	• Solve addition and subtraction problems that involve mass.
Mathematical language	Mass, massive, measure, grams, kilogram, greater than, less than, the same.
Sharing back/Connect	Select and share student solutions in which they have subtracted in parts, used bridging to decades or used equivalence and compensation. Connect: How would you work out a solution for this: I had a box of plums which had a mass of 1kg. Someone has eaten some of them and now their mass is 500g. How much has been eaten? I had a bottle of drink with a capacity of 1 litre. Someone has drunk some of it. Now it has 450mL left. How much did they drink? I had a bottle of drink with a capacity of 1 litre. Someone has drunk some of it. Now it has 799mL left. How much did they drink?
Teacher Notes	• Expect students to use a number line and equations to represent their solution.
Independent Tasks	Select one or more of the following assessment tasks (attached at the end of the document) as the independent activity: M8: Box of potatoes (mass and volume).

	M3C: Find objects which have a mass that is more than one kilogram but less tan two kilograms. M20B: Find the volume of a box
Anticipations	

DMIC
DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES
ASSESSMENT TASK

MEASUREMENT – MASS VOLUME CAPACITY: LEVEL 2 Task M8

What are the different ways you could measure this box of potatoes?

Include the units that you would use.

Estimate your measurements and justify these.

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ASSESSMENT TASK

MEASUREMENT – MASS, VOLUME, CAPACITY: LEVEL 2 Task M3C

Find some objects that have a mass of more than one kilogram (1kg) and less than two kilograms (2kg). Record the mass of each object and show this on a number-line to represent the scale.

(Teacher notes: Provide students with an analogue or digital scale and a collection of objects to measure).

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ASSESSMENT TASK

MEASUREMENT - MASS VOLUME CAPACITY: LEVEL 2 Task M20B

Jodie has used these cubes ($1cm^3$) to work out the volume of the container.

What is the volume of the container?

Show and explain different ways that she could use to work this out. What would be the quickest way and why?