

# Mass –Cubic Metres.

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## Differentiate and Assess

Not every student will be ready to investigate this concept at this Level and so we will need to differentiate to ensure every student is learning at their leading edge. Select the Differentiate button on this screen.

## Integrate

Every mathematical concept is integrally related to other mathematical concepts. Teaching and learning related concepts simultaneously develops deep relational understanding. Select the Integrate button on this screen.

## Intervene

Some students may not yet be ready to investigate this concept at any Level, and so we will need to provide some intervention. Select the Intervention button on this screen.

# MASS – CUBIC METRES.

## EXPLICIT TEACHING PLAN OVERVIEW PAGE

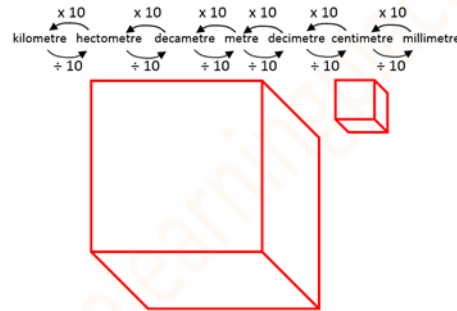
THIS PAGE IS A SUMMARY OF THE EXPLICIT TEACHING PLAN, INCLUDING STRATEGIC QUESTIONS, AND DESCRIBING THE SEQUENCE WHICH WILL OCCUR OVER MULTIPLE LESSONS.

RESOURCES: CUBIC CENTIMETRES, CHENILLE STICKS, STRAWS, PENCIL, PAPER

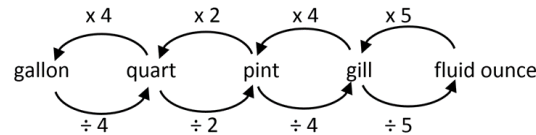
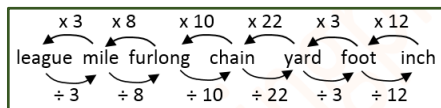
### WHAT COULD WE DO?

Children:

- explain that a cubic metre is created when a square metre has another dimension added, turning it into a cube, for example,



- investigate  $\text{cm}^3$  and  $\text{m}^3$ , explaining they are cubic centimetres and cubic metres, and not centimetres cube/d or metres cube/d.
- estimate and measure volumes and capacities in cubic metres.
- investigate the imperial system's cubic and liquid units of measurement, for example, cubic inch, cubic foot, cubic yard, cubic mile



### WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

Children

- ask one another questions about volumes of models and objects with flat surfaces and straight edges in cubic metres and compare metric system and the imperial cubic and liquid units of measurement, for example:
  - ▶ how has the square metre been turned into a cube to make a cubic metre?
  - ▶ what is the difference between a cubic metre and a metre cube/d?
  - ▶ what does  $\text{m}^3$  say?
  - ▶ how could we use cubic metres to measure the volume and capacity of large objects and places?
  - ▶ what cubic units of measurement are used in the imperial system?
  - ▶ what liquid units of measurement are used in the imperial system?

# MASS – CUBIC METRES.

## EXPLICIT TEACHING PLAN

FULL EXPLICIT TEACHING PLAN, EMBEDDING DEEP RELATIONAL UNDERSTANDING, METALANGUAGE, AND QUESTIONS THAT MAY BE USED OVER MULTIPLE LESSONS.

### WHAT COULD WE DO?

Children think about, talk and listen to a friend about, then have the opportunity to share what they already know.

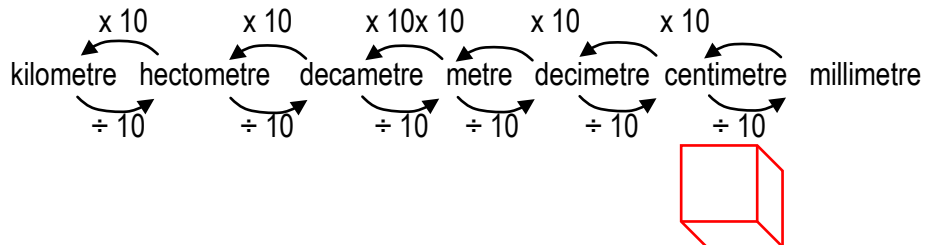
Record, for example, volume is the amount of space an object takes up.

Record, for example, capacity is the volume a container holds when it is filled to capacity.

Display a cubic centimetre, for example,



Record, for example,



### WHAT LANGUAGE COULD WE USE TO EXPLAIN AND ASK QUESTIONS?

- ▶ Today brings an investigation about volume and capacity.
- ▶ What do you know about volume and capacity?
- ▶ Talk about volume and capacity with a friend.
- ▶ Is anyone ready to share what they are thinking about volume and capacity?
  
- ▶ We've investigated volume and capacity.
- ▶ And we found that volume is the amount of space an object takes up in 3 dimensions.
- ▶ We found that the dimensions in an object are up and down and front to back and left to right.
- ▶ And we found that capacity is the volume a container holds when it is filled to capacity.
- ▶ We measured the volume and capacity of objects with faces and edges using cubic centimetres in an array pattern of layers, and we found that we could just measure the number of cubes in one layer and multiply it by the number of layers.
- ▶ We've investigated the metric system of measurement for length, area and volume and capacity of objects with faces.
- ▶ We found that the length units have been turned into cubes by adding 2 more dimensions, and we investigated cubic centimetres.
- ▶ Not everyone can read the words 'cubic centimetres'.
- ▶ So we have a symbol that says cubic centimetres.

Record, for example, cubic centimetres =  $\text{cm}^3$

Record, for example, 2 cubic centimetres =  $2 \text{ cm}^3$

Display, for example, 2 cubic centimetres =  $2 \text{ cm}^3$

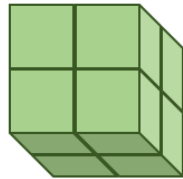
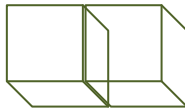
Display 2 cubic centimetres, for example,

Record, for example, Volume = 2 cubic centimetres

Make a model that is 2 centimetres cube/d, for example,

Record, for example, 2 centimetres cube/d

Volume = 4 cubic centimetres



Record, for example,  $2^3 \text{ cm}$

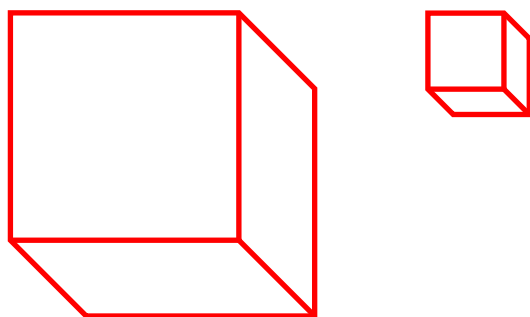
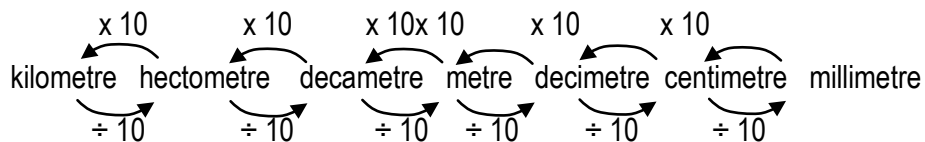
Record a line through the incorrect recording, for example,  ~~$2^3 \text{ cm}$~~

- ▶ The symbol is  $\text{cm}^3$
- ▶ The cm means centimetres.
- ▶ And the small 3 means cubic.
- ▶ So 2 cubic centimetres is recorded  $2\text{cm}^3$
- ▶ Are you thinking it says centimetres cube/d?
- ▶ Have you ever heard anybody call it a centimetre cube/d?
- ▶ Are they right? Let's investigate!
- ▶ This model has a volume of 2 cubic centimetres.
  
- ▶ Now let's make 2 centimetres cube/d.
- ▶ A 2 centimetre cube/d means we have a cube where each dimension is 2 centimetres long.
- ▶ This model is 2 centimetres cube/d, which means it is a cube with dimensions of 2 centimetres, and has a volume of 8 cubic metres.
  
- ▶ A cubic centimetre is a unit of measurement for volume.
- ▶ While a centimetre cube/d is a description of an object.
- ▶ Are you thinking it looks like it says centimetres cube/d?
- ▶ Are you thinking the small 3 that says cubed should be before the cm?
- ▶ Let's see what 2 cubic centimetres would look like if we recorded the cube symbol and then the centimetre symbol.
- ▶ Does it look like the symbol for the cube is on the 2 not the centimetre?
- ▶ The only reason the small '3' that means cubed, is after the centimetre symbol is because we can't write it before the centimetre symbol.
- ▶ So the symbol  $\text{cm}^3$  says cubic centimetre, and not centimetre cube/d.

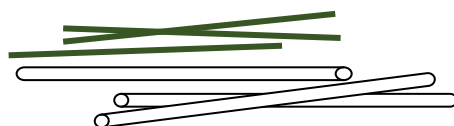
Record, for example,  $2 \text{ cm}^3 = 2$  cubic centimetres

Record, for example,  $3 \text{ cm}^3 = 3$  cubic centimetres

Display the metric measurement chart with a cubic metre, created by adding a dimension to the square metre to make a cube, for example,



Display some straws and chenille sticks, for example,



Place as many chenille sticks as necessary inside 2 straws to hold them together, experimenting to determine the optimum number of chenille sticks to use to ensure the metre long lengths will not bend, for example,



- ▶ How would we record 3 cubic centimetres?
- ▶ When you are ready to explain what the symbol says, you can start to record cubic centimetres using the symbol instead of the words.

▶ **Today we're going to use what we know about the metric system and cubic centimetres, to make a cubic metre.**

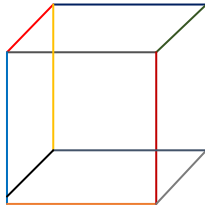
- ▶ Could we add a dimension to a square metre to make a cube?
- ▶ How many dimensions will be in a cubic metre?
- ▶ Will there be 3 dimensions?
- ▶ How long do you think each dimension in a cubic metre will be?
- ▶ Will each dimension be 1 metre?

- ▶ How could we construct a cubic metre?
- ▶ Could we use these straws and chenille sticks to construct a cubic metre?
- ▶ If each dimension is 1 metre, could we start by making lengths of 1 metre?
- ▶ How could we make a length of 1 metre?

- ▶ Could we place chenille sticks between two straws to hold them together?
- ▶ Does the join with the chenille stick still bend? Could we use more chenille sticks?
- ▶ Let's try 2 chenille sticks. Does it still bend? Let's try 3...

Children make 12 metre lengths. You could break the class into 12 groups, and have each group make a metre length.

Children join 12 one metre lengths together using more chenille sticks, make a cubic metre, for example,



Allow children to estimate the number of children they think will fit inside a cubic metre, then get inside the cubic metre in different orientations and arrangements.

Allow children to estimate the volume and capacity of large spaces, for example, the classroom, hall.

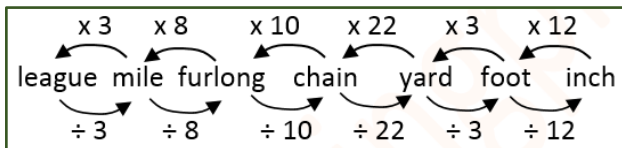
- ▶ Now that we know how to make strong metre lengths using chenille sticks and straws, how many will we need?
- ▶ How many edges in a cube?
- ▶ Are there 12 edges in a cube?
- ▶ Will we need 12 one metre lengths?

- ▶ Let's join the metre lengths together to make a cube.
- ▶ What unit of measurement have we made?
- ▶ Have we made a cubic metre?

- ▶ Now that we have made our cubic metres, let's investigate how many children could fit inside it!
- ▶ How many children do you estimate will fit inside your cubic metre?
- ▶ Could we stack the children?
- ▶ Does the size of the children matter?

- ▶ Now that we can visualise a cubic metre, could we estimate the volume of the room?
- ▶ Could we estimate the length of the 3 dimensions?
- ▶ What is the length of the room?
- ▶ What is the width of the room?
- ▶ So how many cubic metres would be in 1 layer?
- ▶ What is the height of the room?
- ▶ How many layers will there be?
- ▶ So about what is the volume of the room?

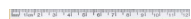
Record, for example,



Record, for example, square inch, square foot, square yard, square mile.

Record, for example, foot

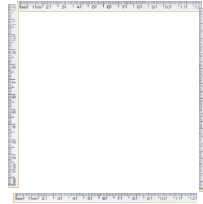
Display a foot long ruler, for example,



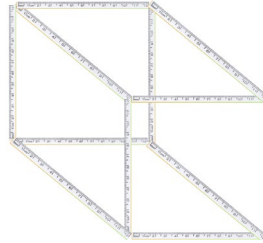
- ▶ We've investigated the metric systems units of measurement.
- ▶ And we found that the French mathematician who invented it about 300 years ago, based the metric system on place value which creates values by multiplying and dividing by 10.
- ▶ We've investigated the imperial units of measurement that the metric units of measurement for length and area replaced.
- ▶ And we found that the measurement system was called the Imperial system because its units were created over many centuries by different empires.
- ▶ We found that the Imperial system for length and area are difficult to convert between because they multiplied and divided by different numbers.
- ▶ We found that people in the USA still use the Imperial system of measurement.
- ▶ **Today we're going to investigate the units of measurement in the Imperial system for measuring volume and capacity.**
- ▶ Just like the metric system, the imperial system turned lengths into cubes to measure the volume and capacity of objects with faces.
- ▶ We know that the Imperial system had a unit of length called a foot.
- ▶ We know that a foot is about the length of your ruler.

Record, for example, square foot

Demonstrate the area of a square foot by making a square using 4 rulers, for example,



Demonstrate the volume of a cubic foot by making a cube using 12 rulers, for example,



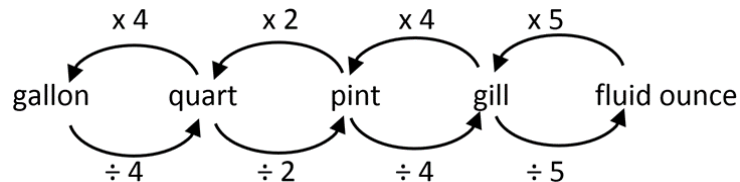
Display an inch on the ruler, for example,



Display 3 rulers end to end to demonstrate a yard, for example



Record, for example,



- ▶ The foot was turned into a square to measure area, and called a square foot.
- ▶ And we know that a cube is the best shape to measure volume and capacity of objects with flat surfaces and straight edges.
- ▶ So the square foot was turned into a cube, and called a cubic foot.
- ▶ Other units of measurement were also turned into cubes including the cubic inch, cubic yard and cubic mile.
- ▶ So these are some of the units that the Imperial system uses to measure volume and capacity of objects with faces.
- ▶ The Imperial system also has liquid units to measure volume and capacity of objects and containers with curved surfaces.
- ▶ They started with a pint, which is just over half a litre.
- ▶ They multiplied the pint by 8 to get a gallon.
- ▶ In the USA, people still buy petrol by the gallon!
- ▶ And called a quarter of a gallon, a quart.
- ▶ In the USA, people still buy milk by the quart!
- ▶ They divided the pint by 4 to get a gill.



- ▶ And divided the gill by 5 to get a fluid ounce.
- ▶ There is also an imperial unit to measure mass, called an ounce – which is different to a fluid ounce!
- ▶ You don't have to remember any of this!
- ▶ You just need to be aware that there is another system of measurement, that people in the USA use.
- ▶ And that the metric system is much more efficient because it is based on place value!