MEASURE

During the sensori-motor phase	*By the end of the sensori motor phase students typically:*	*As students move from sensori-motor phase to emergent phase*
Early awareness of measure grows from their sensory awareness and opportunities to observe and play and explore. Students develop awareness of the size, shape and colour of objects through sensory exploration (either independently or with support from an adult) They have opportunity to respond to a wide range of stimuli, developing reliable responses and begin to communicate their likes/dislikes or ambivalence toward a stimuli. They use all their senses to experience and explore stimuli.	Place thing in and take things out of objects. Experience objects of different sizes –large boxes and small boxes, large gym balls and small balls in the ball pool. Begins to anticipate events through consistent routine and through the use of objects of reference. They experience different positions e.g. in the hammock, on the bean bag, inside the box etc Experiences moving things in to and out of containers.	Shows curiosity towards different objects and actively explores them Anticipate an activity or event through objects of reference Empties and fills containers, observing.
Common misconceptions and barriers to learning	***Supportive Strategies***	***Key Objectives***
Sensory impairment Communication skills Positioning and limited movement	Consistent repetition so learners generalise Consistent responses from adults Be skilled in observation of responses Supportive strategies that sensitively aid exploration Object /sensory cues for activities Limiting language Gradual extension and generalisation of tasks	**Anticipation of event** Footsteps recording

Pre-operational stage		
During the Emergent Phase	***By the end of the Emergent phase, students typically:***	***As students move from the Emergent phase to the Matching phase, they should demonstrate:***
Students initially attend to overall appearance of size, recognising one thing as perceptually bigger than another and using comparative language in a fairly undifferentiated and absolute way (big/small) rather than to describe comparative size (bigger/smaller). Over time, they note that their communities distinguish between different forms of bigness (or size) and make relative judgments of size. As a result, they begin to understand and use the everyday language of attributes and comparison used within their home and school environment, differentiating between attributes that are obviously perceptually different.	• distinguish tallness, heaviness, fatness and how much things hold • start to distinguish different forms of length and to use common contextual length distinctions; e.g. distinguish wide from tall • use differentiated bipolar pairs to describe things; e.g. thin–fat, heavy–light, tall–short • describe two or three obvious measurement attributes of the same thing; e.g. tall, thin and heavy • describe something as having more or less of an attribute than something else, e.g. as being taller than or as being fatter than. They have experience of coins/notes as a means of exchange. Start to link activities e.g. get swimming things after lunch, or know its visit day etc Experience filling and emptying different containers with objects, sand, water etc and observe.	The ability to identify big and small , long/short, heavy/light objects where the difference Is very apparent e.g. small dice and large dice and can sort. They are able to place small numbers of objects in order. They begin to anticipate events and link them with activity e.g. play time, lunch-time, home time. They begin to link days of the week with events e.g. Monday is swimming.
Common misconceptions	***Supportive strategies***	***Key objectives***
may not 'conserve' measures; e.g. thinking that moving a rod changes its length • may visually compare the size of two things, but make no effort to match; e.g. saying which stick is longer without lining up the bases • use bipolar pairs but may have difficulty with some comparative terms; e.g. to decide which is heavier but say both are heavy because both hands go down • may distinguish two attributes (such as tallness and weight) but not understand that the two attributes may lead to different orders of size for a collection, expecting the order for tallness and the order for weight to be the same • while describing different attributes of the same thing (tall, thin and heavy) may be confused by a request to compare two things by different attributes, particularly if the comparisons lead to different orders • often do not think to use counting to say how big or how much bigger; e.g. they may 'weigh' something by putting it into one side of a balance and smaller objects into the other side but not count the objects	Use concrete objects Don't use scales to weigh, allow the student to feel the weight and experience the heaviness of objects. Begin with really contrasting sizes of objects and gradually move to objects of more similar sizes. Show students how to compare using different methods e.g. which is the bigger box? What can we fit in the box? Can you fit in? Show how to compare length ensuring both items have the same base. Do not use pictures or drawn objects.	**Uses some positional language to describe themselves in space** **Match objects of similar size/weight.** **Identify big/small, long/short, heavy/light objects on request.** **Sort objects by size/weight.** **Mathssteps Time I50/J50** **Sequencing D30/G32/H31/H32/H33** **Spatial H43** **VOLUME J90**

Pre-operational stage		
During the Matching Phase	***By the end of the Matching phase, students typically:***	***As students move from the Matching phase to the Quantifying phase, they should be able to demonstrate:***
Students match in a conscious way in order to decide which is bigger by familiar readily perceived and distinguished attributes such as length, mass, capacity and time. They also repeat copies of objects, amounts and actions to decide how many fit (balance or match) a provided object or event. As a result, they learn to directly compare things to decide which is longer, fatter, heavier, holds more or took longer. They also learn what people expect them to do in response to questions such as 'How long (tall, wide or heavy, much time, much does it hold)?' or when explicitly asked to measure something. They begin to use the language of time and are able to sequence events.	attempt to focus on a particular attribute to compare two things; e.g. how much the jar holds • know that several things may be in different orders when compared by different attributes • line up the base of two sticks when comparing their lengths and fit regions on top of each other to compare area • use the everyday notion of 'how many fit' and count how many repeats of an object fit into or match another; e.g. How many pens fit along the table? How many potato prints cover the sheet? How many blocks fit in the box? • count units and call it 'measuring'; e.g. I measured and found the jar holds a bit more than 7 scoops. • use 'between' to describe measurements of uni-dimensional quantities (length, mass, capacity, time); e.g. It weighs between 7 and 8 marbles. Able to match times of the day to significant events and days of the week to significant events.	The ability to compare the length, height and size of objects using non-standard measure. They compare items using a simple balance They should be able to recognise the need for each measure to be the same. They understand that different attributes lead to different orders e.g. they understand that the biggest ball is not necessarily the heaviest. They begin to get a sense of area and capacity through covering and filling objects. They sequence events and begin to relate times to daily events.
Common misconceptions	***supportive strategies***	***Key Objectives***
while knowing that ordering objects by different attributes may lead to different orders, may still be influenced by the more dominant perceptual features; e.g. they may still think the tallest container holds the most • may count 'units' in order to compare two things but be fairly casual in their repetition of units, not noticing gaps or overlaps; e.g. placing the first 'unit' away from the end when measuring length, not worrying about spills when measuring how much a container holds, not stopping their claps immediately the music stops • do not necessarily expect the same 'answer' each time when deciding how many fit • may not think to use unit information to answer questions such as: Which cup holds more? Will the table slide through the door? • may not see the significance of using a common unit to compare two things and, when using different units, let the resulting number override their perceptual judgment	Provide for lots of practical experience of filling and emptying containers, ordering objects and using non-standard measure. Reinforce the fact that non-standard measures have to be the same e.g. each scoop has to be level, each steps cannot overlap etc.	**Compare 2 attributes of objects using non-standard measure.** **Sequence significant daily familiar events** **Sequence days of the week** **Mathsteps** **Time J50** **Sequencing I32/I33/I35/J32/J33/J36/K30** **Spatial-i43/i46/J44**

Pre-operational stage		
During the Quantifying Phase	***By the end of the Quantifying phase, students typically:***	***As students move from the Quantifying phase to the Partitioning phase, they should be able to demonstrate the ability to:***
Students connect the two ideas of directly comparing the size of things and of deciding 'how many fit' and so come to an understanding that the count of actual or imagined repetitions of units gives an indication of size and enables two things to be compared without directly matching them. As a result, they trust information about repetitions of units as an indicator of size and are prepared to use this in making comparisons of objects. They begin to use clocks to the hour.	• attempt to ensure uniformity of representations of the unit; e.g. check that the cup is always full, the pencil doesn't change length, the balls are the same size • use the representations of their unit carefully to make as close a match as possible, avoiding gaps and overlaps; e.g. choose a flexible tape to measure the perimeter of a curved shape • know why they need to choose the same size objects to use as units when comparing two quantities • see repeating one representation of the unit over and over as equivalent to filling or matching with multiple copies of it • connect the repetition of a 'unit' with the numbers on a whole-number calibrated scale • make things to a specified length in uniform units (including centimetres and metres) use provided measurements to make a decision about comparative size; e.g.use the fact that a friend's frog weighs 7 marbles to decide whether their own frog is heavier or lighter • count units as a strategy to solve comparison problems such as: Whose frog is heavier? Put the jars in order from the one that holds the most to the one that holds the least. • are prepared to say which is longer (heavier) based on information about the number of units matching each object • think of different things having the same 'size'; e.g. use grid paper to draw different shapes with the same perimeter • add measurements that they can readily think of in terms of repetitions of units; e.g. find the perimeter of a shape by adding each side can draw a clock-face and place numbers accurately around the clock, knowing the significance of 12, 6, 3 and 9. Pay an exact amount using a coin.	Select an appropriate measuring tool for the job. Measure accurately using non-standard measure Measure accurately using cm and metres. Begin to use the correct unit of measure Be able to find a collection of things that are near to a metre in length, near to a kg in mass, holds as much as 1 litre etc Tell the time on an analogue clock to the hour and half hour and begin to associate a time with an event e.g. school starts at 9. Be able to give an exact amount using a single coin or note, and begin to have some equivalences e.g. 2 lots of 5p=10p Know days of the week in order
Common misconceptions	**Supportive strategies**	***Key Objectives Y1***
while trying to make as close a match as possible to the thing to be measured, may find the desire to match closely overriding the need for consistency of unit; e.g. they may resort to 'filling' a region with a variety of different objects in order to cover it as	Keep activities concrete. Begin to record using cm.m.g.kg.l etc but ensure that students have a good feel for the measure. Use opportunities during the day to use the time at the hour and half past and link to events. Bring in coin of the day or note of the day and talk about what we can see using a white board magnifier.	**Measure accurately using standard measure.** **Measure and begin to record length, mass, volume and time.** **Sequence events in chronological order** **Recognise and use language related to dates** **Tell the time to the hour and half hour.** **Name coins and notes**

closely as possible • may not understand that the significance of having no gaps and overlaps is that the 'true' measurement is independent of the placement of the units • may still think of the unit as an object and of measuring as 'fitting' in the social sense of the word (How many people fit in the elevator? How many beans in the jar?) and so have difficulty with the idea of combining part-units as is often needed in order to find the area of a region • may confuse the unit (a quantity) with the instrument (or object) used to represent it; e.g. they may think a square metre has to be a square with sides of 1 metre, may count cubes for area and not think of the face of each as the unit • may interpret whole numbered marks on a calibrated scale as units but may not interpret the meaning of unlabeled graduations		**Mathssteps Time K50/K51** **Sequencing L30/M30** **Spatial-J43/K40/L40/M40/M41** **VOLUME-k90** **NCTEM Y1 MASTERY page 22-26**

Concrete operational stage		
During the measuring Phase	***By the end of the Measuring phase, students typically:***	***As students move from the Measuring phase to the Relating phase, they:***
Students come to understand the unit as an amount (rather than an object or a mark on a scale) and to see the process of matching a unit with an object as equivalent to subdividing the object into bits of the same size as the unit and counting the bits. As a result, they see that part-units can be combined to form whole units and they understand and trust the measurement as a property or description of the object being measured that does not change as a result of the choice or placement of units.	expect the same number of copies of the representation of their unit to match the object being measured regardless of how they arrange or place the copies • understand that the smaller the unit the greater the number; e.g. are able to say which is the longer of a 1-kilometre walk and a 1400-metre walk. • compose 'part-units' into wholes, understanding, for example, that a narrow garden bed may have an area of 5 or 6 square metres even though no whole 'metre squares' fit into the bed • can themselves partition a rectangle into appropriate squares and use the array structure to work out how many squares are in the rectangle • interpret the unnumbered graduations on a familiar whole-number scale • understand the relationship between 'part-units' and the common metric prefixes; e.g. know that a unit can be broken into one hundred parts and each part will be a centi-unit • work with provided measurement information alone; e.g. order measurements of capacity provided in different standard units, make things which meet measurement specifications.	Demonstrate familiarity with measuring scales. They begin to show the ability to compare different units of measure e.g. 350g < 1kg They are able to compare 2 measures and say which is greater and by how much (using numbers to 1000) They start to notice the sameness about different measures e.g. 100cm and 1m.
Common misconceptions	***Supportive Strategies***	***Key Objectives (y2)***
while partitioning a rectangle into appropriate squares and using the array structure to find its area, may not connect this with multiplying the lengths of the sides of a rectangle to find its area • while understanding the inverse relationship between the unit and the number of units needed, may still be distracted by the numbers in measurements and ignore the units; e.g. say that 350 grams is more than 2 kilograms • while converting between known standard units, may treat related metric measures just as they would any other units, not seeing the significance of the decimal structure built into all metric measures.	Ensure that when teaching area this is linked to multiplication arrays. Use the opportunity to point out to students that the arrays for 1x1, 2x2, 3x3 etc always make a square. Pupils should also be encouraged to see the perimeter of a square as repeated addition and multiplication. Give concrete opportunities for pupils to see that 1000g masses=1kg etc Give pupils opportunity to walk 100m, to walk 1km etc so they get a feel for these distances. Help pupils to notice when they are using measuring jugs that they have 1litre or 1000ml and that they are the same.	**Combine amounts of money to make a value, including using £ and p symbols** **Tell the time to the nearest 5 minutes.** **Choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity and volume (litres/ml) and time to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels** **Compare and sequence intervals of time** **Tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times** **Sequence seasons and months of the year** **Mathsteps Time L50/L51** **Volume – L90/L91** **NCTEM Y2 MASTERY page 25-26**

Concrete operational stage		
During the relating Phase – Pathway 3	***By the end of the relating phase, students typically:***	***As students move from the Relating phase to the Operating phase, they:***
Students come to trust measurement information even when it is about things they cannot see or handle and to understand measurement relationships, both those between attributes and those between units. As a result, they work with measurement information itself and can use measurements to compare things, including those they have not directly experienced, and to indirectly measure things	• understand that known relationships between attributes can be used to find measurements that cannot be found directly; e.g. understand that we can use length measurements to work out area • know that for figures of the same shape (that is, similar) the greater the length measures the greater the area measures, but this is not so if the figures are different shapes • understand why the area of a rectangle and the volume of a rectangular prism can be found by multiplying its length dimensions and can use this for fractional side lengths • think of the part-units themselves as units; e.g. a particular unit can be divided into one hundred parts and each part is then a centi-unit • subdivide units to make measurements more accurate • choose units that are sufficiently small (that is, accurate) to make the needed comparisons • use their understanding of the multiplicative structure built into the metric system to move flexibly between related standard units; e.g. they interpret the 0.2 kilogram mark on a scale as 200 grams • notice and reject unrealistic estimates and measurements, including of things they have not actually seen or experienced	Begin to demonstrate a more abstract approach to measure, being able to imagine objects of particular lengths etc be able to understand where a measurement is obviously wrong e.g. the house was 1.3m tall or the horse weighed 230g They understand that the length of the sides of rectilinear shapes affect the actual perimeter and area. They can workout the area of compound shapes. They use money capably, understanding how to work out change by counting on or back. They can reliably tell the time and solve time and money problems They convert between units x and dividing by 10 and 100
Common misconceptions	***Supportive strategies***	***Key Objectives Y3 and 4***
Confusion in the time system because it is not metric. E.g. when converting minutes to seconds they might multiply by 10. They may use the wrong unit of measure, confusing between weight/length measures for example.	Use metre rule to demonstrate the link between metres and cm. E.g. show 10cm and show how there are 10 = sections representing 1/10 of a metre or 0.1m so they can see equivalences. Pupils could make 10cm rulers and stick them on to the metre rule so it becomes very visual.	**Y3** **Measure, compare and calculate measures using standard units** **Find the perimeter of simple 2D shape** **Add and subtract money, and give change** **Tell and write the time using an analogue clock to the nearest minute.** **Y4** **Convert between different units of metric measurements including money.** **Solve problems using units of time** **Find the area of rectilinear shapes by counting squares** **NCTEM MASTERY Y3 PAGES 22-25 AND Y4 PAGE 22-24**

Concrete operational stage		
During the Operating Phase- Pathway 4	***By the end of the pre-Operating phase, students typically:***	
Students have a wide understanding of measure and have a feel for estimating measures. They are able to make rough estimates on converting imperial to metric. They measure with greater accuracy and can use graduated scales ti read in between number labels. They read time confidently and can use the 24 hour clock and read timetables calculating travel time.	• use relationships between measurements to find measures indirectly; e.g. knowing that 1 mL = 1 cm3 they can find the volume of an irregular solid in cubic centimetres by finding how many millilitres of water it displaces using a capacity cylinder . Use, read and write standard metric units (km, m, cm, mm, kg, g, l, ml), including their abbreviations, and relationships between them. Convert larger to smaller units (e.g. km to m, m to cm or mm, kg to g, l to ml). Know imperial units (mile, pint, gallon lb oz). • Suggest suitable units and measuring equipment to estimate or measure length, mass or capacity. Measure and draw lines to the nearest millimetre. Record estimates and readings from scales to a suitable degree of accuracy. • Understand area measured in square centimetres (cm2). Understand and use the formula in words; 'length ´ breadth' for the area of a rectangle. Understand, measure and calculate perimeters of rectangles and regular polygons. • Use units of time; read the time on a 24-hour digital clock and use 24-hour clock notation, such as 19:53. Use timetables. Record estimates and readings from scales to a suitable degree of accuracy. • Calculate the perimeter and area of simple compound shapes that can be split into rectangles. • Appreciate different times around the world	
Common misconceptions	***Supportive strategies***	*Key Objectives y5 and 6*
When using 24 hour clock pupils add 10 instead of 12. Students may become confused betrween area and perimeter.	Students need to have experience of perimeter and area so they see that perimeter is length and area is the surface an object covers. Students need to develop conservation of area e.g. that if a piece of paper is cut up, all; the parts combined When teaching formulae it helps to let students discover the formula for themselves still has the same area.	**Y5** **Understand and use common approximate conversions between metric and imperial** **Measure and calculate the perimeter of composite rectilinear shapes** **Calculate the area of rectangles, and estimate the area of irregular shapes** **Use the properties of rectangles to find missing lengths and angles** **Y6** **Convert units of measure between smaller and larger**

		units **Convert between miles and kilometres** **Calculate the area of parallelograms and triangles** **Calculate and compare volume of cubes and cuboids** **NCTEM MASTERY Y5 PAGES 21-24 AND Y6 PAGES 30-33**