SPACE

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. Reaches for objects Uncovers a hidden object
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		
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:***
As students move about their environment and explore the objects in it, they respond perceptually to spatial features, encoding shape and the location of objects they can see within a framework of landmarks. As a result, they begin to name things they can see and handle in ways that reflect attention to shape and they can match simple shapes in an impressionistic way. Also as a result, they begin to understand that we can represent the relative position of neighbouring things, for example, placing a toy boy under the toy table to 'stand for' the real boy under the real table.	distinguish shape from other attributes that relate to how things 'look' (colour, size, texture), although they may not do so consciously • use informal language that indicates they are responding to shape; e.g. 'the pointy one' • carry out matching tasks by selecting a matching shape from a collection and either posting shapes in boxes or fitting shapes into cut outs • notice similarity in the shape of familiar things, saying, for example, it 'looks like' a seesaw or a car or a ball • reproduce simple geometric configurations if only encoding is required; that is, build a matching shape or arrangement to one that is constantly in sight • draw simple figures by imitating how they have seen them drawn (including letters and numbers) • give directions from one landmark to the next when retelling a journey or places in a story; e.g. 'go to the pond, go on the bridge, go home'.	Match shapes that can be seen around the school and in the classroom: for example, on different display tables; in the home corner or classroom shop; on a 'shape walk' around the school. They start to become aware of some properties of solid shapes when looking at, talking about and comparing them: for example, shapes that are pointy… whose faces are all flat… that roll… Make shapes from modelling material such as: Playdough, Plasticine, sand… Talk about and recreate simple patterns made from people, beads, shapes, sounds In PE, stand in front of, behind, beside, opposite a partner… or between two others… Follow instructions to get through an obstacle course or over climbing equipment. Ability to match simple shapes to each other or to their outline/silhouette. Make collections of circles, triangles and squares. Describe the position of themselves using on, in and under. Follow positional instructions for on in and under. Extend simple 2-part object pattern e.g. cup/spoon/cup/spoon
Common misconceptions	***Supportive strategies***	***Key objectives***
refer to objects by their everyday or toy name (blocks, bricks, witch's hat) rather than their shape • may not think to turn a figure over or around in order to match or post in cut outs • may have difficulty in matching a shape by feel alone (e.g. in feely bags) as they grope and pat objects rather than explore in a way oriented to discerning shape • given drawings, will not distinguish, for example, triangles from 'almost triangles', relying on an impressionistic match • may be able to copy a figure such as a square with matchsticks but not be able generally to copy one from a ready made drawing unless shown how (that is, they have difficulty in dissecting the parts and deciding the sequence or route to bring the components together.	Lots of hands on experience with common 2D and 3d shape. Multi-sensory experiences of feeling shape, walking on outlines, having shapes drawn on their back, painting large shapes in water on the yard etc Provide big concrete experiences for students e.g. allow them to be in a large box, under a table, on a bench etc PE is a good area for them to rehearse the language of position. Use visuals/symbols to record position. Use formal mathematical language even if the students are not yet. Use a multi-sensory approach e.g. drawing shapes on students' backs, feely bags, walking around large shapes.	**Match 2 identical shapes** **Follows instructions with prepositions on/under/in** **Complete a 2 part object sequence (spoon/cup/spoon/cup)**

Pre-operational stage		
During the Recognising Phase	***By the end of the Recognising phase, students typically:***	***As students move from the Recognising phase to the Describing phase, they should be able to demonstrate:***
Students' exploration of objects and space through touch and sight gradually becomes more regulated as they attend to spatial features and construct mental and visual representations of shapes and arrangements in space. As a result, they can copy simple figures and recognise figures of 'the same shape', constructing visual images or prototypes of what people mean when they refer to common figures and objects; e.g. *This is a rectangle because it looks like a rectangle*. Also as a result, they construct visual images of familiar objects and of where objects are within familiar spaces and locations.	describe figures and objects using terms that are evocative of shape, such as 'corner', 'pointy', 'lopsided', 'slanty' • learn the names of some shapes (triangle, cube), although which names they know will depend upon the frequency and naturalness of everyday use at school and home • describe conventional figures and objects by reference to prototypes they 'look like'; e.g. 'It's a door shape'. • select ready-made materials that 'look right' to make recognisable models of parts of their environment (e.g. circular pieces for wheels, a cylinder for a tree trunk) • remember what some families of shapes look like and produce recognisable versions; e.g. draw a figure that resembles a triangle with three lines that more or less join at their end points or as a continuous curve with three 'straight' sides and three corners • remember key aspects of the way things look and try to reproduce them in their drawings; e.g. drawing circles for wheels, putting two eyes, a nose and a mouth on a face • begin to give simple explanations that relate shape to purpose (e.g. circles for wheels, blocks to stack) • relate the position of objects to each other in familiar settings using terms such as 'behind', 'near' • draw or make simple 'route' maps and models that show a sense of spatial relationships and order, although only for local settings that they have freely explored.	Understand and use in practical contexts the words: shape, pattern… flat, curved, round, straight, solid, hollow, corner, face, side, end… Describe the model and say what shapes have been used to make it. For example: The garage for my car has been made from lots of blocks, and they have straight edges and flat sides and ends. Find similar shapes on faces of objects. For example: find two circles, such as a drinks mat and the base of a jar; find two triangles, such as a silk scarf and a Logiblock Without using its name, describe a thin plastic shape hidden in a cloth bag. For example: My shape has three corners and three sides. My shape is curved all the way round Sort into trays a collection of varied flat shapes, either thin plastic shapes, shapes made from paper, or drawn or stuck on card, and explain how they have been sorted: for example, shapes with corners, with three sides… • Find shapes which are **not** square, round… •Make repeating patterns from bricks or beads: for example, two cubes, one cone, two cubes, one cone… Understand and use in practical contexts: position, over, under, above, below, on, in, outside, inside, behind, beside, before, after, next to, opposite, between… close, far, apart… Describe a walk round the school or its grounds: We went along the path, through the tunnel in the adventure playground and then across the field… • In class, answer questions such as: Who is sitting next to, beside, in front of…
Common misconceptions	***supportive strategies***	***Key Objectives***
explore objects using touch (e.g. in a feely bag) oriented to shape as a whole, and are not generally focused on the parts • while implicitly knowing some features of a familiar type of figure (triangles have three sides, triangles are pointy), do not recognise them in that way; a triangle is a triangle because it looks like one	Signs and symbols for shape vocabulary. Make collections or displays of circles, squares and triangles Begin to introduce more formal shape vocabulary Teach position vocabulary in familiar concrete experience e.g. in PE where they can position themselves under, on, in etc	**Use everyday words to describe position, Direction and movement** **Talk about, recognise and recreate patterns** **Use language to describe the shape and size of solids and flat shapes**

• can identify familiar shapes singly but not within complex configurations or in non-standard orientations • use terms such as 'corner', 'pointy', 'lopsided', 'slanty' vaguely and inconsistently • are not consciously aware of properties; e.g. they could produce a recognisable rectangle without realising that it had right angles • when drawing a 2D figure (e.g. a circle) to represent a 3D object (e.g. a ball), think of the region inside the circle as inside the ball rather than as the surface of the ball • in trying to represent what an object is rather than how it happens to look, may draw what they know to be there; e.g. they show a hidden handle on a cup, or draw more sides of a cube than one could possibly see • will often show a mixture of viewpoints in the same picture; e.g. side view of the legs of the table and top view of the table top and the items on it.		

Concrete operational stage		
During the Describing Phase	***By the end of the Describing phase, students typically:***	***As students move from the Describing phase to the Analysing phase, they should be able to demonstrate the ability to:***
Through their own physical and perceptual action on spatial configurations focused on interpreting, describing and representing the parts making the whole, students make sense of the spatial relationships within figures, objects and arrangements and in the visual representations of them. As a result, they identify the features of particular figures *(This has four sides and two of its sides are equal.)* and objects *(This has six faces and they are all rectangles.)* Also as a result, students pay attention to the shape and placement of component parts when they draw, match, make and copy things and are able to think of objects in positional relationship to each other rather than in relation to themselves.	respond to a request to 'tell me about the shape of this …' using language such as 'flat', 'curved', 'side', 'round', 'face', 'edge', 'square', 'angle', 'base' • compare and contrast geometric figures • are able to identify the faces, edges and vertices of a geometric object and hence select component parts to make it in various forms (skeletal, hollow) • understand that the word 'shape' refers to or signifies both a 2D and 3D attribute and so understand, for example, that a cube and a square are different shapes and have different names even if they cannot recall the names • when using a 2D figure (e.g. a circle) to represent a 3D object (e.g. a ball), interpret the region inside the circle as representing the surface of the ball • match the 2D shapes with the faces of standard 3D shapes • select nets that have the right component parts to match a simple object • pay attention to the shape and placement of component parts when they interpret and make drawings • observe the component geometric parts within pictures and patterns and the movements needed to produce them • attempt to produce visual reality in drawings by only drawing the objects or parts of objects that can be seen • rearrange and combine a few shape pieces (e.g. tangrams) to make another specified shape, such as a square • repeat multiple copies of a figure in a systematic way to create a pattern • recognise repetitions of the same shape embedded within arrangements and patterns • identify component parts to show that a shape or arrangement is symmetrical • are able to describe one thing being between others and put key features in order on a map • attempt to show a bird's eye view of familiar settings with a rough sense of proximity	Use everyday language to describe features of familiar 3D and 2-D shapes, including the cube, cuboid, sphere, cylinder, cone, pyramid, cylinder, pentagon, hexagon, Octagon, circle, triangle, square, rectangle…, referring to properties such as the shapes of flat faces, or the number of faces or corners… or the number and types of sides. • Make and describe models, patterns and pictures using construction kits, everyday materials, Plasticine… Fold shapes in half, then make them into symmetrical patterns. Begin to relate solid shapes to pictures of them. • Use everyday language to describe position, direction and movement. Use one or more shapes to make, describe and continue repeating patterns… Sort shapes and describe some of their features, such as the number of sides and corners, symmetry (2-D shapes), or the shapes of faces and number of faces, edges and corners (3-D shapes). • Make and describe shapes, pictures and patterns using, for example, solid shapes, templates, pinboard and elastic bands, squared paper, a programmable robot… Relate solid shapes to pictures of them. • Begin to recognise line symmetry. • Use mathematical vocabulary to describe position, direction and movement: for example, describe, place, tick, draw or visualise objects in given positions. • Recognise whole, half and quarter turns, to the left or right, clockwise or anti-clockwise. Know that a right angle is a measure of a quarter turn, and recognise right angles in squares and rectangles. Give instructions for moving along a route in straight lines and round right-angled corners: for example, to pass through a simple maze… Be able to draw simple plans of familiar areas.

Common misconceptions	Supportive strategies	*Key Objectives Y1 and Y2*
• may use descriptive terms in ambiguous or incorrect ways; e.g. using 'side' to mean 'on the side' as distinct from 'top' or 'bottom' • may still respond to figures by their overall appearance, and may therefore continue to be tricked when a shape is presented in an unfamiliar orientation; e.g. a square drawn 'on its point' may not be recognised as a square, others will say that will be a square 'if you turn it around' • will be aware of some properties related to a common figure, but these properties may continue to play no detectable role in the recognition of the figure and students do not generally call upon properties to justify why a figure is or is not in a particular class • may give vague descriptions that could apply to a number of different shapes, perhaps focusing on only one feature of a figure or object • although now understanding which objects or parts of objects are seen or not seen, do not yet understand how they are seen (shape, orientation, size) and so have difficulty making their drawings 'look right' • even when provided with a drawing to copy, are influenced by how they think about or describe the object to themselves, so if told a drawing is a cube, they make the top face more square, if told it is a house they make the top more slanted • may have little overall sense of relative position or scale in their plans and maps; e.g. they may draw their own desk larger than those of other students in the class.	Ensure that you show familiar shapes in different orientations e.g. triangles with their base at the top, squares presented as sitting on a point etc Ask 'how do we know?'-so students are encouraged to give evidence – I know it's a triangle because it has 3 sides.	**Y1** **Recognise, name and describe common 2D and 3D shapes** **Y2** **Use mathematical vocabulary to describe position, direction and movement** **Use mathematical vocabulary to describe position, direction and movement** **Describe properties of 3-D shapes, including number of edges, vertices and faces**

Concrete operational stage		
During the Analysing Phase	***By the end of the Analysing phase, students typically:***	***As students move from the Analysing phase to the Relating phase, they:***
As students consciously compare and contrast spatial configurations, they form generalisations about relationships both within and between figures, objects, movements and arrangements. Through their own experimentation, they realise that when an object or arrangement is transformed, relationships between its component parts may be preserved or not, and they try to visualise 'what happens' when things are represented or moved. As a result, students establish that shapes and movements they recognise as in the same class have features in common, thus the term 'triangle' can now be interpreted as a collection of properties (a closed figure with three sides) that can be represented by many figures. Also as a result, students try to ensure that desired relationships are preserved when they make (e.g. produce a net of an object, make a scaled copy), represent (e.g. draw a map or a diagram of an object) or move things (e.g. look from a different view, fold and unfold, turn).	give a detailed list of properties in their descriptions of shapes, confidently asserting, for example, that rectangles always have four sides and always have right-angled corners • select figures and objects based on geometric descriptions such as 'has five faces and nine edges' • know from the properties of a rectangle that a slanted parallelogram cannot be a rectangle even though it is what a rectangular face on a block 'looks like' from 'the side' • understand that lines drawn obliquely to the horizontal suggest depth and incorporate this into their drawings of objects • use mathematical conventions to represent objects in different types of drawings • match suitable nets to prisms and pyramids that are actually present (not drawn) by considering the shape and placement of the component parts • produce their own nets for geometric shapes that they can see and handle • visualise the folding process to say which of a number of potential nets that have the right number and shaped components will actually fold up to form a cube or prism • select and build arrangements of geometric figures to match information in drawings and plans describe characteristic features of mirror symmetry; e.g. may explain that for mirror symmetry matching parts of figures are the same distance away from the mirror line • visualise and reproduce the folds and cuts needed to produce symmetrical designs • explain why they think a shape will not tile by focusing on the corners • identify the particular rotations, reflections and translations that relate the component parts of simple arrangements and patterns • understand that when figures are rotated, reflected and translated the position and/or orientation change but the size and shape do not, so the original figure can be superimposed on the transformed (or moved) figure	Respond to oral or written questions or instructions to tick or draw objects which are in a position: higher than, lower than, next to, below, further away from, on the edge of, at the corner of a given object. Sort 2-D shapes according to whether they have all, some or no right angles. In PE, follow instructions such as face west, turn clockwise through one right angle… Know that after turning through half a turn, or two quarter turns in the same direction, you are facing the opposite direction. • Sort 2-D shapes according to whether they have all, some or no right angles. Describe and find the position of a square on a grid of squares with the rows and columns labelled. Use, read and write the words: pattern, shape, 2-D, two-dimensional, 3-D, three-dimensional, line, side, edge, face, surface, base, point, angle, vertex, vertices, centre, radius, diameter, net and adjectives such as: curved, straight, regular, irregular, concave, convex, closed, open, circular, triangular, hexagonal, cylindrical, spherical, square-based, right-angled, Name, classify and describe 2-D and 3-D shapes: circle, semi-circle, triangle, equilateral triangle, isosceles triangle, quadrilateral, rectangle, oblong, square, pentagon, hexagon, heptagon, octagon, polygon, cube, cuboid, pyramid, sphere, hemi-sphere, cylinder, cone, prism, tetrahedron, polyhedron. Identify simple nets of 3-D shapes. Classify 2-D shapes according to their lines of symmetry. Sketch the reflection of a simple shape in a mirror line parallel to one edge, where the edges of the shape or the lines of the pattern are parallel or perpendicular to the mirror line. Use compass point, north, south, east, west, north-east, north-west, south-east, south-west Recognise and identify simple examples of horizontal or vertical lines or edges in the environment. Know that angles are measured in degrees and that: • one whole turn is 360° or four right angles; • a quarter turn is 90° or one right angle; • half a right angle is 45°. Know that the angles at the corners of rectangles and squares are 90°, and that the angles of an equilateral triangle are 60°.

	• understand that when figures are enlarged or reduced, the shape stays the same but the size changes (the position and/or orientation may change); that is, 'scaled' figures keep the same shape and so look 'the same but smaller' or 'the same but bigger' • understand the use of 'scale' on a map to preserve proximity between things being represented; that is, to show the relative distance between things • recognise and use a top view to represent familiar locations on plans using order and relative proximity among landmarks.	Make and measure clockwise and anti-clockwise turns, describing them in degrees.
Common misconceptions	***Supportive Strategies***	***Key Objectives (y3 and 4)***
may include irrelevant features as properties of families of shapes if they have only experienced shapes in upright orientations; e.g. they may think that the 'top' and 'bottom' sides of a trapezium have to be parallel • may think that parallel lines have to be the same length May think that polygons have the same number of lines of symmetry as they do sides. • may not generally understand that one class of shapes can be included in another, so that while they can be taught to recite that squares are special rhombuses, most do not understand why or how • may have a well-developed concept of a particular shape, but their definitions may not provide sufficient features to define the shape; e.g. they may say that a rectangle is a shape with four sides and opposite sides the same length • may define a class of geometric shapes and include many of the known features, not simply a sufficient set, thus providing redundant information • may see properties as distinct from each other and so not see that some properties are a consequence of others; e.g. if a quadrilateral has four right angles it must have opposite sides the same length • cannot typically coordinate all the components and measurements needed to plan a net completely from imagination or from specifications (except for simple well-rehearsed objects).	Ensure students are shown examples where parallel and perpendicular lines are of differing lengths and thickness. Encourage them to look for examples in their environment. Find lines of symmetry on irregular polygons as well as regular. Always introduce the mathematical vocabulary. Students internalise vocabulary very quickly and enjoy learning new names –use precise vocabulary e.g. equilateral triangle Use Carroll diagrams or Venn diagrams to sort shapes demonstrating that shapes can belong to more than one class e.g. square is also a quadrilateral and a rectangle.	**Describe movements (in a straight line and turning), and understand angle as a measure of turn** **Describe and find the position of a square on a numbered grid** **Y4** **Describe and visualise 3-D and 2-D shapes; classify them according to their properties** **Make shapes and patterns with increasing accuracy** **Recognise reflective symmetry in 2-D shapes, reflections and translations** **Recognise positions and directions, and use co-ordinates** **Make turns; estimate, draw and measure angles; recognise rotations**

Formal operational stage		
During the relating Phase –	***By the end of the relating phase, students typically:***	***As students move from the Relating phase to the Operating phase, they:***
Students develop coordinated mental representations of spatial configurations in relation to their component parts enabling them to mentally manipulate and transform figures, objects and arrangements. Through investigating *properties* of shapes and movements and inter-relationships between them, their use of visual images becomes constrained by their more abstract verbal knowledge of the properties. As a result, students are able to visualise the result of systematically moving or folding figures or moving objects or themselves in relation to an object and to represent transformations. They also integrate distance and direction in their descriptions of paths and locations and can represent them on coordinate systems. Also as a result, students come to recognise relationships between properties and between common classes of shapes; e.g. *This square is also a rectangle because it has all the properties of a rectangle.*	understand what a definition is and use counter examples to show that a definition such as 'a rectangle is a shape with four sides and opposite sides the same length' is not adequate because it does not exclude some shapes that are not rectangles • use properties to convince themselves and others why a figure or object belongs to a class; e.g. *This is a square because it has four equal sides even though it is not resting on a 'flat bottom'*. • understand that knowing just a few properties of a figure or object enables us to work out (deduce) other properties • understand relationships between properties of figures; e.g. if a triangle has two equal angles then it has two equal sides • understand class inclusion and so can classify figures and objects hierarchically; e.g. all squares are rectangles but not all rectangles are squares • produce their own nets, considering in advance the level of precision needed to ensure the shape is correct in form and size, where tabs will be, and so on • predict which face on nets will match which face on corresponding objects • predict the effect of particular movements (translations, rotations and reflections) on the orientation and position of figures and objects • visualise an object or scene in different orientations, drawing other possible views of an object from information in 2D drawings.	Continue to name and describe shapes, extending to: parallelogram, rhombus, kite, trapezium, dodecahedron, scalene, octahedron. Describe properties of 3-D shapes, such as parallel or perpendicular faces or edges. Classify solids Identify the different nets for a closed cube (six square faces). Visualise 3-D shapes from 2-D drawings. Recognise the number of axes of reflective symmetry in regular polygons Sketch the reflection of a simple shape in a mirror line touching it at one point, where the edges of the shape are not necessarily parallel or perpendicular to the mirror line. Read and plot points using co-ordinates beyond the first quadrant Recognise parallel and perpendicular lines in quadrilaterals. Know that two lines that cross each other are called intersecting lines, and the point at which they cross is an intersection. Know that two lines that cross each other are called intersecting lines, and the point at which they cross is an intersection. Identify, estimate, order, measure and calculate acute and obtuse angles Use a protractor to measure given angles to the nearest degree.
Common misconceptions	***Supportive strategies***	***Key Objectives Y5 and 6***
Pupils confuse the mathematical vocabulary, words such as parallel and perpendicular. Often think that parallel lines also need to be the same length – often presented with examples that are. Pupils often think that all polygons have the same number of lines of symmetry as they do number of sides/angles. Confusion with number of angles, when shape is concave.	Ensure children are shown examples where parallel and perpendicular lines are of differing lengths and thicknesses, to ensure pupils look for the correct properties of the lines. Encourage children to look for examples in the environment, many pupils gaining success with drawn examples find this more difficult. Rather than just present pupils with pairs of lines, for them to decide if they are parallel or otherwise, ask them to draw a line parallel/perpendicular to one already drawn.	**Y5** **Use a protractor to measure given angles to the nearest degree.** **Distinguish between regular and irregular polygons** **Identify 3-d shapes from 2-d representations** **Know angles are measured in degrees and compare acute, obtuse and reflex angles** **Draw and measure angles to the nearest degree**

	Provide with 'nearly' examples, so they have to use a checking method – obvious examples will not be as valuable to them	**Describe and represent the result of a reflection or translation** **Identify angles at a point, in a turn and on a straight line Y6** **Identify angles at a point, in a turn and on a straight line** **Recognise vertically opposite angles and find missing angles** **Describe positions on the full co-ordinate grid** **Translate and rotate shapes on a co-ordinate grid and reflect in the axes** **Illustrate and name parts of a circle including radius, diameter and circumference.**