

Structures

Kapow objectives verbatim *tweaked/additional objectives*

	Y1		Y4		Y6
Term	Spring 1	Spring 2	Spring 2	Summer 1 or 2?	Autumn 1
Topic or SA	Stand alone	Stand alone	Topic - What's on Our Doorstep?	Stand-Alone	Stand-Alone
Unit title	Constructing a windmill	Baby bears chair	Constructing a Castle	Pavilions	Bridges
Design skills progression COMMUNICATION discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design	<ul style="list-style-type: none"> • Learning the importance of a clear design criteria • Including individual preferences and requirements in a design 	<ul style="list-style-type: none"> • Generating and communicating ideas using sketching and modelling 	<ul style="list-style-type: none"> • Designing a castle with key features to appeal to a specific person/purpose. • Drawing and labelling a castle design using 2D shapes, labelling: -the 3D shapes that will create the features - materials needed and colours. • Designing and/or decorating a castle tower on CAD software 	<ul style="list-style-type: none"> • Designing a stable pavilion structure that is aesthetically pleasing and selecting materials to create a desired effect. • Building frame structures designed to support weight. 	Designing a stable structure that is able to support weight Create a frame structure with focus on triangulation

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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Make skills progression</p>	<ul style="list-style-type: none"> • Making stable structures from card, tape and glue • Learning how to turn 2D nets into 3D structures • Following instructions to cut and assemble the supporting structure of a windmill • Making functioning turbines and axles which are assembled into a main supporting structure 	<ul style="list-style-type: none"> • Making a structure according to design criteria • Creating joints and structures from paper/card and tape • Building a strong and stiff structure by folding paper 	<ul style="list-style-type: none"> • Constructing a range of 3D geometric shapes using nets. • Creating special features for individual designs. • Making facades from a range of recycled materials. 	<ul style="list-style-type: none"> • Creating a range of different shaped frame structures. • Making a variety of free standing frame structures of different shapes and sizes. • Selecting appropriate materials to build a strong structure and for the cladding. • Reinforcing corners to strengthen a structure. • Creating a design in accordance with a plan. • Learning to create different textural effects with materials. 	<p>Making a range of different shaped beam bridges using triangles to create truss bridges that span a given distance and supports a load</p> <p>Building a wooden bridge structure</p> <p>Independently measuring and marking wood accurately</p> <p>Selecting appropriate tools and equipment for particular tasks</p> <p>Using the correct techniques to saws safely</p> <p>Identifying where a structure needs reinforcement and using card corners for support</p> <p>Explaining why selecting appropriating materials is an important part of the design process</p> <p>Understanding basic wood functional properties</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Evaluation skills progression</p>	<ul style="list-style-type: none"> • Evaluating a windmill according to the design criteria, testing whether the structure is strong and stable and altering it if it isn't • Suggest points for improvements 	<ul style="list-style-type: none"> • Testing the strength of own structures • Identifying the weakest part of a structure • Evaluating the strength, stiffness and stability of own structure 	<ul style="list-style-type: none"> • Evaluating own work and the work of others based on the aesthetic of the finished product and in comparison to the original design. • Suggesting points for modification of the individual designs. 	<ul style="list-style-type: none"> • Evaluating structures made by the class. • Describing what characteristics of a design and construction made it the most effective. • Considering effective and ineffective designs. 	<p>Adapting and improving own bridge structure by identifying points of weakness and reinforcing them as necessary</p> <p>Suggesting points for improvements for own bridges and those designed by others</p>

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<p>Technical knowledge progression</p>	<ul style="list-style-type: none"> • To understand that the shape of materials can be changed to improve the strength and stiffness of structures • To understand that cylinders are a strong type of structure (e.g. the main shape used for windmills and lighthouses) • To understand that axles are used in structures and mechanisms to make parts turn in a circle • To begin to understand that different structures are used for different purposes • To know that a structure is something that has been made and put together 	<ul style="list-style-type: none"> • To know that materials can be manipulated to improve strength and stiffness • To know that a structure is something which has been formed or made from parts • To know that a 'stable' structure is one which is firmly fixed and unlikely to change or move • To know that a 'strong' structure is one which does not break easily • To know that a 'stiff' structure or material is one which does not bend easily 	<ul style="list-style-type: none"> • To understand that wide and flat based objects are more stable. • To understand the importance of strength and stiffness in structures 	<ul style="list-style-type: none"> • To understand what a frame structure is. • To know that a 'free-standing' structure is one which can stand on its own. 	<p>To understand some different ways to reinforce structures To understand how triangles can be used to reinforce bridges To know that properties are words that describe the form and function of materials To understand why material selection is important based on their properties To understand the material (functional and aesthetic) properties of wood</p>
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Sequence of lessons	<p>Session 1; Designing a structure. Learning what a windmill is and constructing a model windmill by reference to design criteria created for the client, Mouse, who lives in the windmill in Old Amsterdam.</p> <p>Lesson 2: Assembling the structure Having decorated their templates, pupils construct the main part of their structure, making sure that it stands freely and holds together.</p> <p>Lesson 3: Assembling the windmill Children complete their turbines, through careful cutting and folding, and attach them to their structure, testing its strength and stability.</p> <p>Lesson 4: Testing and evaluating After adding the finishing touches to their windmills, children test their structures to check that they would make a suitable home for the mouse.</p>	<p>Lesson 1: Exploring stability Using a scientific approach, children test the stability of 3D shapes that they have moulded themselves, and explore man-made and natural structures.</p> <p>Lesson 2: Strengthening materials While reinforcing their mathematical vocabulary, children build different paper structures and then test them to destruction!</p> <p>Lesson 3: Making Baby Bear's chair (free lesson) Considering what kind of chair Baby Bear would like, pupils develop a design criterion which uses all their knowledge of building strong and stable structures and begin to make their chairs.</p> <p>Lesson 4: Fixing and testing Baby Bear's chair</p>	<p>Prior Learning: • To know the following features of a castle: flags, towers, battlements, turrets, curtain walls, moat, drawbridge and gatehouse - and their purpose. To understand that a castle needed to be strong and stable to withstand enemy attack (Link to History Learning)</p> <p>• To know that a paper net is a flat 2D shape that can become a 3D shape once assembled. (Link to Maths Arithmetic – Mix Up Friday)</p> <p>Session 1 = Introduce a design specification. Designing a castle with key features to appeal to a specific person/purpose. (Recap features from prior History Learning) Discuss importance of strength and stiffness in structures. Drawing and labelling their castle design using 2D shapes, labelling: -the 3D shapes that will create the features - materials needed and colours. Discuss wide and flat based objects are more stable. <i>(Use CAD software?)</i></p> <p>Session 2 = Constructing a range of 3D geometric shapes using nets.</p>	<p>Session 1 = Investigate Pavilions and discuss key features. What is an architect? To know that architects consider light, shadow and patterns when designing.</p> <p>Session 3 = Investigating making stable structures with toothpicks and sweets.</p> <p>Session 2 = Designing a stable pavilion structure that is aesthetically pleasing and designed to support weight and selecting materials to create a desired effect.</p> <p>Session 3 = Making a variety of free standing frame structures of different shapes and sizes. Needs to include: cladding, corners for strengthening and textured effects.</p> <p>Session 4 = Evaluating structures made by the class. Describing what characteristics of a design and construction made it the most effective. Considering effective and ineffective designs.</p>	<p>Session 1- investigate how to create arch and beam bridges and how to strengthen and reinforce them. Session 2- investigate and make a spaghetti truss bridge and investigate how it works, why it is effective and it can be strengthened and reinforced earlier. Session 3- build a wooden truss bridge, measure, mark out and cut wood. Practise skills of sawing and smoothing. Session 4- Evaluate bridge by testing it out and by considering the views of others.</p>
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		When Baby Bear's chair is complete, pupils test its strength and stability, and use their problem-solving skills to adapt their structure as necessary.	<p>Session 3 = Creating special features for individual designs which includes making facades from a range of recycled materials. Decoration of their castle.</p> <p>Session 4 = Evaluating own work and the work of others based on the aesthetic of the finished product and in comparison to the original design. Suggesting points for modification of the individual designs.</p>		
vocabulary	<p>Axle Bridge Design Design Criteria Model Net Packaging Structure Template Unstable Stable Strong Weak</p>	<p>Design criteria Man-made Natural Properties Structure Stable Shape</p>	<p>castle, façade = front structure, design specification = list of success criteria, towers, turrets, battlements, moat, gatehouse, curtain walls, drawbridge, flag, key features, strong, stiff, stable, 3D, 2D, shape, net, tab, scoring,</p>	<p>pavilion, structure, aesthetics = how a product looks, product's function = its purpose, target audience = the person or group of people a product is designed for, cladding, frame structure, free-standing, design criteria, natural, structure, innovative, 3D shapes, reinforce,</p>	<p>Arch, beam, reinforce, strengthen, strong, rigid, withstand, soft wood, hard wood structure, truss, tessellated beams, triangle formation, follow health and safety rules, know how selecting particular materials is an important part of the design process.</p>

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Tools/equipment	<p>Empty packaging to make up the windmill, if the templates provided are not used (see Print and Classroom resources)</p> <ul style="list-style-type: none"> • Scissors <p>Glue sticks</p> <ul style="list-style-type: none"> • Tape (preferably masking tape) • A5 stiff card for the base (one piece per pupil) <p>Pipe cleaners</p> <ul style="list-style-type: none"> • Blu Tack, Plasticine or an eraser 	<p>A piece of stiff cardboard (one per pupil)</p> <ul style="list-style-type: none"> • Plain paper • Playdough – a piece roughly the size of a golf ball for each child • Three pre-made structures – a cylinder, a cuboid and a triangular prism (as demonstrated in the Teacher video: Strengthening materials) • A pile of books of the same size/weight <p>Materials for children to make their own tube structures</p> <ul style="list-style-type: none"> • A4 paper (three sheets per pair/group) • Masking tape • Optional: Cylindrical objects, such as glue sticks, board pens, which can help the children to make their cylindrical shape • Either a book of the story of 'Goldilocks and the Three Bears', or link: 'Fairy Tales as Short Bedtime Stories: The Story of Goldilocks and the three bears' on Video Link • A demonstration model chair made from each set of the materials that your class will use to make their chairs (see Teacher video: Making Baby Bear's chair) • Paper for children to design their chair <ul style="list-style-type: none"> • Materials, depending on your chosen options (see Teacher video: Making Baby Bear's chair) either: Paper and masking tape, or Plastic/paper straws and pipe cleaners or Recycled materials (pupils could bring in kitchen roll tubes, packaging, specific materials, etc) 	<p>3D shapes, paper, castle design template, scissors, CAD software/laptops, printed nets, Blue tac, glue sticks, tape, kitchen roll tubes, packaging, etc.</p> <p>Optional: squared paper for children to make their own nets,</p> <p>Materials for the structures and castle base: two A3 pieces of card per pupil, one piece cut in half lengthways</p> <p>Materials for the façades:</p> <p>A3 coloured card</p> <p>Material textures printed, e.g. stone tiles, brickwork, etc.</p>	<p>Gumdrops or plasticine, lots of toothpicks, A4 stiff card bases, pencils, glue guns, tape, Assorted materials for making the frame: matchsticks, lolly sticks, toothpicks, straws, card, pipe cleaners, card triangles, Wide range of craft materials, e.g. tracing paper, card, sweet wrappers, leaves, crepe paper, fabrics, newspaper, wool, string, etc.</p>	<p>Spaghetti, Books, bricks, blocks, wood, lolly sticks, saws,</p>
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		<ul style="list-style-type: none"> • Paper and masking tape, or • Plastic/paper straws and pipe cleaners or • Recycled materials (pupils could bring in kitchen roll tubes, packaging, specific materials, etc) • Zip lock/sandwich bags labelled with children's names, to store individual children's materials and constructed piece 			
<p>Key events and/or individuals</p>			<p>Visit to Tintagle Castle, St Michaels Mount or Pendennis Castle?</p> <p>Or link to Lanhydrock House?</p>		