**Mechanisms**

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|  |  | Year 1 | Year 2 | Year 3 | Year 5 |
|  |  | **Wheels and axels** | **Making a moving monster/animal** | **Pneumatic toys** | **Pop-up book** |
| S  K  I  L  L  S | **Design** | • Designing a vehicle that includes wheels, axles and axle holders, that when combined, will allow the wheels to move.  • Creating clearly labelled drawings that illustrate movement. | • Creating a class design criteria for a moving monster.  • Designing a moving monster for a specific audience in accordance with a design criteria. | • Designing a toy which uses a pneumatic system.  • Developing design criteria from a design brief.  • Generating ideas using thumbnail sketches and exploded diagrams.  • Learning that different types of drawings are used in design to explain ideas clearly. | Designing a pop-up book which uses a mixture of structures and mechanisms.  • Naming each mechanism, input and output accurately.  • Storyboarding ideas for a book. |
| **Make** | • Adapting mechanisms, when:  ● they do not work as they should.  ● to fit their vehicle design.  ● to improve how they work after testing their vehicle. | • Making linkages using card for levers and split pins for pivots.  • Experimenting with linkages adjusting the widths, lengths and thicknesses of card used.  • Cutting and assembling components neatly | • Creating a pneumatic system to create a desired motion.  • Building secure housing for a pneumatic system.  • Using syringes and balloons to create different types of pneumatic systems to make a functional and appealing pneumatic toy.  • Selecting materials due to their functional and aesthetic characteristics.  • Manipulating materials to create different effects by cutting, creasing, folding and weaving. | • Following a design brief to make a pop up book, neatly and with focus on accuracy.  • Making mechanisms and/or structures using sliders, pivots and folds to produce movement.  • Using layers and spacers to hide the workings of mechanical parts for an aesthetically pleasing result. |
| **Evaluate** | • Testing wheel and axle mechanisms, identifying what stops the wheels from turning, and recognising that a wheel needs an axle in order to move. | • Evaluating own designs against design criteria.  • Using peer feedback to modify a final design. | • Using the views of others to improve designs.  • Testing and modifying the outcome, suggesting improvements.  • Understanding the purpose of exploded-diagrams through the eyes of a designer and their client. | • Evaluating the work of others and receiving feedback on own work.  • Suggesting points for improvement. |
| K  N  O  W  L  E  D  G  E | **Technical** | • To know that wheels need to be round to rotate and move.  • To understand that for a wheel to move it must be attached to a rotating axle.  • To know that an axle moves within an axle holder which is fixed to the vehicle or toy.  • To know that the frame of a vehicle (chassis) needs to be balanced. | • To know that mechanisms are a collection of moving parts that work together as a machine to produce movement.  • To know that there is always an input and output in a mechanism. • To know that an input is the energy that is used to start something working.  • To know that an output is the movement that happens as a result of the input.  • To know that a lever is something that turns on a pivot.  • To know that a linkage mechanism is made up of a series of levers | • To understand how pneumatic systems work.  • To understand that pneumatic systems can be used as part of a mechanism.  • To know that pneumatic systems operate by drawing in, releasing and compressing air. | • To know that mechanisms control movement.  • To understand that mechanisms can be used to change one kind of motion into another.  • To understand how to use sliders, pivots and folds to create paper-based mechanisms. |
| **Additional** | • To know some real-life items that use wheels such as wheelbarrows, hamster wheels and vehicles. | • To know some real-life objects that contain mechanisms. | • To understand how sketches, drawings and diagrams can be used to communicate design ideas.  • To know that exploded-diagrams are used to show how different parts of a product fit together.  • To know that thumbnail sketches are small drawings to get ideas down on paper quickly. | • To know that a design brief is a description of what I am going to design and make.  • To know that designers often want to hide mechanisms to make a product more aesthetically pleasing. |

**Structures**

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|  |  | Year 1 | Year 2 | Year 3 | Year 5 |
|  |  | **Constructing a windmill** | **Baby Bear’s chair** | **Constructing a castle** | **Bridges** |
| S  K  I  L  L  S | **Design** | • Learning the importance of a clear design criteria.  • Including individual preferences and requirements in a design. | • Generating and communicating ideas using sketching and modelling.  • Learning about different types of structures, found in the natural world and in everyday objects. | • 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 | • Designing a stable structure that is able to support weight.  • Creating a frame structure with a focus on triangulation. |
| **Make** | • 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 | • 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. | • Constructing a range of 3D geometric shapes using nets.  • Creating special features for individual designs.  • Making facades from a range of recycled materials. | • Making a range of different shaped beam bridges. • Using triangles to create truss bridges that span a given distance and support a load.  • Building a wooden bridge structure.  • Independently measuring and marking wood accurately.  • Selecting appropriate tools and equipment for particular tasks.  • Using the correct techniques to saws safely.  • Identifying where a structure needs reinforcement and using card corners for support.  • Explaining why selecting appropriating materials is an important part of the design process.  • Understanding basic wood functional properties. |
| **Evaluate** | • 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. | • Exploring the features of structures.  • Comparing the stability of different shapes.  • Testing the strength of own structures.  • Identifying the weakest part of a structure.  • Evaluating the strength, stiffness and stability of own structure.. | • 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. | • Adapting and improving own bridge structure by identifying points of weakness and reinforcing them as necessary.  • Suggesting points for improvements for own bridges and those designed by others. |
| K  N  O  W  L  E  D  G  E | **Technical** | • 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 | • To know that shapes and structures with wide, flat bases or legs are the most stable.  • To understand that the shape of a structure affects its strength.  • 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 | • To understand that wide and flat based objects are more stable.  • To understand the importance of strength and stiffness in structures. | • 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 properties.  • To understand the material (functional and aesthetic) properties of wood. |
| **Additional** | • To know that a client is the person I am designing for. • To know that design criteria is a list of points to ensure the product meets the clients needs and wants.  • To know that a windmill harnesses the power of wind for a purpose like grinding grain, pumping water or generating electricity.  • To know that windmill turbines use wind to turn and make the machines inside work.  • To know that a windmill is a structure with sails that are moved by the wind.  • To know the three main parts of a windmill are the turbine, axle and structure. | • To know that natural structures are those found in nature.  • To know that man-made structures are those made by people | • To know the following features of a castle: flags, towers, battlements, turrets, curtain walls, moat, drawbridge and gatehouse - and their purpose.  • To know that a façade is the front of a structure.  • To understand that a castle needed to be strong and stable to withstand enemy attack.  • To know that a paper net is a flat 2D shape that can become a 3D shape once assembled. • To know that a design specification is a list of success criteria for a product. | • To understand the difference between arch, beam, truss and suspension bridges.  • To understand how to carry and use a saw safely. |

**Textiles**

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|  |  | Year 2 | Year 4 | Year 6 |
|  |  | **Pouches** | **Cross-stitch and applique** | **Waistcoats** |
| S  K  I  L  L  S | **Design** | • Designing a pouch. | • Designing and making a template from an existing Egyptian collar and applying individual design criteria. | • Designing a waistcoat in accordance to a specification linked to set of design criteria.  • Annotating designs, to explain their decisions |
| **Make** | • Selecting and cutting fabrics for sewing.  • Decorating a pouch using fabric glue or running stitch.  • Threading a needle.  • Sewing running stitch, with evenly spaced, neat, even stitches to join fabric.  • Neatly pinning and cutting fabric using a template | • Following design criteria to create a cushion or Egyptian collar.  • Selecting and cutting fabrics with ease using fabric scissors.  • Threading needles with greater independence.  • Tying knots with greater independence.  • Sewing cross stitch to join fabric.  • Decorating fabric using appliqué.  • Completing design ideas with embellishing the collars based on design ideas (Egyptian collars). | • Using a template when cutting fabric to ensure they achieve the correct shape.  • Using pins effectively to secure a template to fabric without creases or bulges.  • Marking and cutting fabric accurately, in accordance with their design.  • Sewing a strong running stitch, making small, neat stitches and following the edge.  • Tying strong knots.  • Decorating a waistcoat, attaching features (such as appliqué) using thread.  • Finishing the waistcoat with a secure fastening (such as buttons).  • Learning different decorative stitches.  • Sewing accurately with evenly spaced, neat stitches |
| **Evaluate** | • Troubleshooting scenarios posed by teacher.  • Evaluating the quality of the stitching on others’ work.  • Discussing as a class, the success of their stitching against the success criteria.  • Identifying aspects of their peers’ work that they particularly like and why. | • Evaluating an end product and thinking of other ways in which to create similar items. | • Reflecting on their work continually throughout the design, make and evaluate process. |
| K  N  O  W  L  E  D  G  E |  | • To know that sewing is a method of joining fabric.  • To know that different stitches can be used when sewing.  • To understand the importance of tying a knot after sewing the final stitch.  • To know that a thimble can be used to protect my fingers when sewing. | •To know that applique is a way of mending or decorating a textile by applying smaller pieces of fabric to larger pieces. •To know that when two edges of fabric have been joined together it is called a seam.  •To know that it is important to leave space on the fabric for the seam.  •To understand that some products are turned inside out after sewing so the stitching is hidden. | • To understand that it is important to design clothing with the client/ target customer in mind.  • To know that using a template (or clothing pattern) helps to accurately mark out a design on fabric.  • To understand the importance of consistently sized stitches. |

**Cooking and Nutrition**

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|  |  | Year 1 | Year 3 | Year 4 | Year 6 |
|  |  | **Smoothies** | **Eating seasonally** | **Adapting a recipe** | **Come dine with me** |
| S  K  I  L  L  S | **Design** | • Designing smoothie carton packaging by-hand. | • Designing a recipe for a savoury tart | • Designing a biscuit within a given budget, drawing upon previous taste testing judgements. | • Writing a recipe, explaining the key steps, method and ingredients. • Including facts and drawings from research undertaken. |
| **Make** | • Chopping fruit and vegetables safely to make a smoothie.  • Juicing fruits safely to make a smoothie. | • Following the instructions within a recipe.  • Tasting seasonal ingredients.  • Selecting seasonal ingredients.  • Peeling ingredients safely.  • Cutting safely with a vegetable knife. | • Following a baking recipe, including the preparation of ingredients.  • Cooking safely, following basic hygiene rules.  • Adapting a recipe to meet the requirements of a target audience. | • Following a recipe, including using the correct quantities of each ingredient.  • Adapting a recipe based on research.  • Working to a given timescale.  • Working safely and hygienically with independence. |
| **Evaluate** | • Tasting and evaluating different food combinations. • Describing appearance, smell and taste.  • Suggesting information to be included on packaging.  • Comparing their own smoothie with someone else’s. | • Establishing and using design criteria to help test and review dishes.  • Describing the benefits of seasonal fruits and vegetables and the impact on the environment.  • Suggesting points for improvement when making a seasonal tart. | • Evaluating a recipe, considering: taste, smell, texture and appearance.  • Describing the impact of the budget on the selection of ingredients.  • Evaluating and comparing a range of food products.  • Suggesting modifications to a recipe (e.g. This biscuit has too many raisins, and it is falling apart, so next time I will use less raisins). | • Evaluating a recipe, considering: taste, smell, texture and origin of the food group.  • Taste testing and scoring final products.  • Suggesting and writing up points of improvements when scoring others’ dishes, and when evaluating their own throughout the planning, preparation and cooking process.  • Evaluating health and safety in production to minimise cross contamination |
| K  N  O  W  L  E  D  G  E |  | • To know that a blender is a machine which mixes ingredients together into a smooth liquid.  • To know that a fruit has seeds.  • To know that fruits grow on trees or vines.  • To know that vegetables can grow either above or below ground.  • To know that vegetables are any edible part of a plant (e.g. roots: potatoes, leaves: lettuce, fruit: cucumber). | • To know that not all fruits and vegetables can be grown in the UK.  • To know that climate affects food growth.  • To know that vegetables and fruit grow in certain seasons. • To know that cooking instructions are known as a ‘recipe’.  • To know that imported food is food which has been brought into the country.  • To know that exported food is food which has been sent to another country.  • To know that eating seasonal foods can have a positive impact on the environment.  • To know that similar coloured fruits and vegetables often have similar nutritional benefits.  • To know that the appearance of food is as important as taste. | • To know that the amount of an ingredient in a recipe is known as the ‘quantity.’  • To know that safety and hygiene are important when cooking.  • To know the following cooking techniques: sieving, measuring, stirring, cutting out and shaping.  •To understand the importance of budgeting while planning ingredients for biscuits.  • To know that products often have a target audience. | • To know that ‘flavour’ is how a food or drink tastes.  • To know that many countries have ‘national dishes’ which are recipes associated with that country.  • To know that ‘processed food’ means food that has been put through multiple changes in a factory.  • To understand that it is important to wash fruit and vegetables before eating to remove any dirt and insecticides.  • To understand what happens to a certain food before it appears on the supermarket shelf (Farm to Fork). |

**Electrical Systems (KS2 only)**

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|  |  | Year 4 | Year 5 | Year 6 |
|  |  | **Torches** | **Doodlers** | **Steady hand game** |
| S  K  I  L  L  S | **Design** | • Designing a torch, giving consideration to the target audience and creating both design and success criteria focusing on features of individual design ideas. | • Identifying factors that could be changed on existing products and explaining how these would alter the form and function of the product.  • Developing design criteria based on findings from investigating existing products. • Developing design criteria that clarifies the target user. | • Designing a steady hand game - identifying and naming the components required.  • Drawing a design from three different perspectives.  • Generating ideas through sketching and discussion.  • Modelling ideas through prototypes.  • Understanding the purpose of products (toys), including what is meant by ‘fit for purpose’ and ‘form over function’ |
| **Make** | • Making a torch with a working electrical circuit and switch.  • Using appropriate equipment to cut and attach materials.  • Assembling a torch according to the design and success criteria. | • Altering a product’s form and function by tinkering with its configuration.  • Making a functional series circuit, incorporating a motor.  • Constructing a product with consideration for the design criteria.  • Breaking down the construction process into steps so that others can make the product. | • Constructing a stable base for a game.  • Accurately cutting, folding and assembling a net.  • Decorating the base of the game to a high-quality finish.  • Making and testing a circuit.  • Incorporating a circuit into a base. |
| **Evaluate** | • Evaluating electrical products.  • Testing and evaluating the success of a final product. | • Carry out a product analysis to look at the purpose of a product along with its strengths and weaknesses.  • Determining which parts of a product affect its function and which parts affect its form.  • Analysing whether changes in configuration positively or negatively affect an existing product.  • Peer evaluating a set of instructions to build a product | • Testing own and others finished games, identifying what went well and making suggestions for improvement.  • Gathering images and information about existing children’s toys.  • Analysing a selection of existing children’s toys. |
| K  N  O  W  L  E  D  G  E | **Technical** | • To understand that electrical conductors are materials which electricity can pass through.  • To understand that electrical insulators are materials which electricity cannot pass through.  • To know that a battery contains stored electricity that can be used to power products.  • To know that an electrical circuit must be complete for electricity to flow.  • To know that a switch can be used to complete and break an electrical circuit. | • To know that series circuits only have one direction for the electricity to flow.  • To know when there is a break in a series circuit, all components turn off.  • To know that an electric motor converts electrical energy into rotational movement, causing the motor’s axle to spin.  • To know a motorised product is one which uses a motor to function. | • To know that batteries contain acid, which can be dangerous if they leak.  • To know the names of the components in a basic series circuit, including a buzzer. |
| **Additional** | • To know the features of a torch: case, contacts, batteries, switch, reflector, lamp, lens.  • To know facts from the history and invention of the electric light bulb(s) - by Sir Joseph Swan and Thomas Edison. | • To know that product analysis is critiquing the strengths and weaknesses of a product.  • To know that ‘configuration’ means how the parts of a product are arranged. | •To know that ‘form’ means the shape and appearance of an object.  •To know the difference between 'form' and 'function'.  •To understand that 'fit for purpose' means that a product works how it should and is easy to use.  • To know that form over purpose means that a product looks good but does not work very well.  • To know the importance of ‘form follows function’ when designing: the product must be designed primarily with the function in mind.  • To understand the diagram perspectives 'top view', 'side view' and 'back'. |