**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**  |
| SKILLS | **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. |
| KNOWLEDGE | **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**  |
| SKILLS | **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. |
| KNOWLEDGE | **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**  |
| SKILLS  | **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. |
| KNOWLEDGE  |  | • 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**  |
| SKILLS  | **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 |
| KNOWLEDGE  |  | • 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** |
| SKILLS | **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. |
| KNOWLEDGE | **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'. |