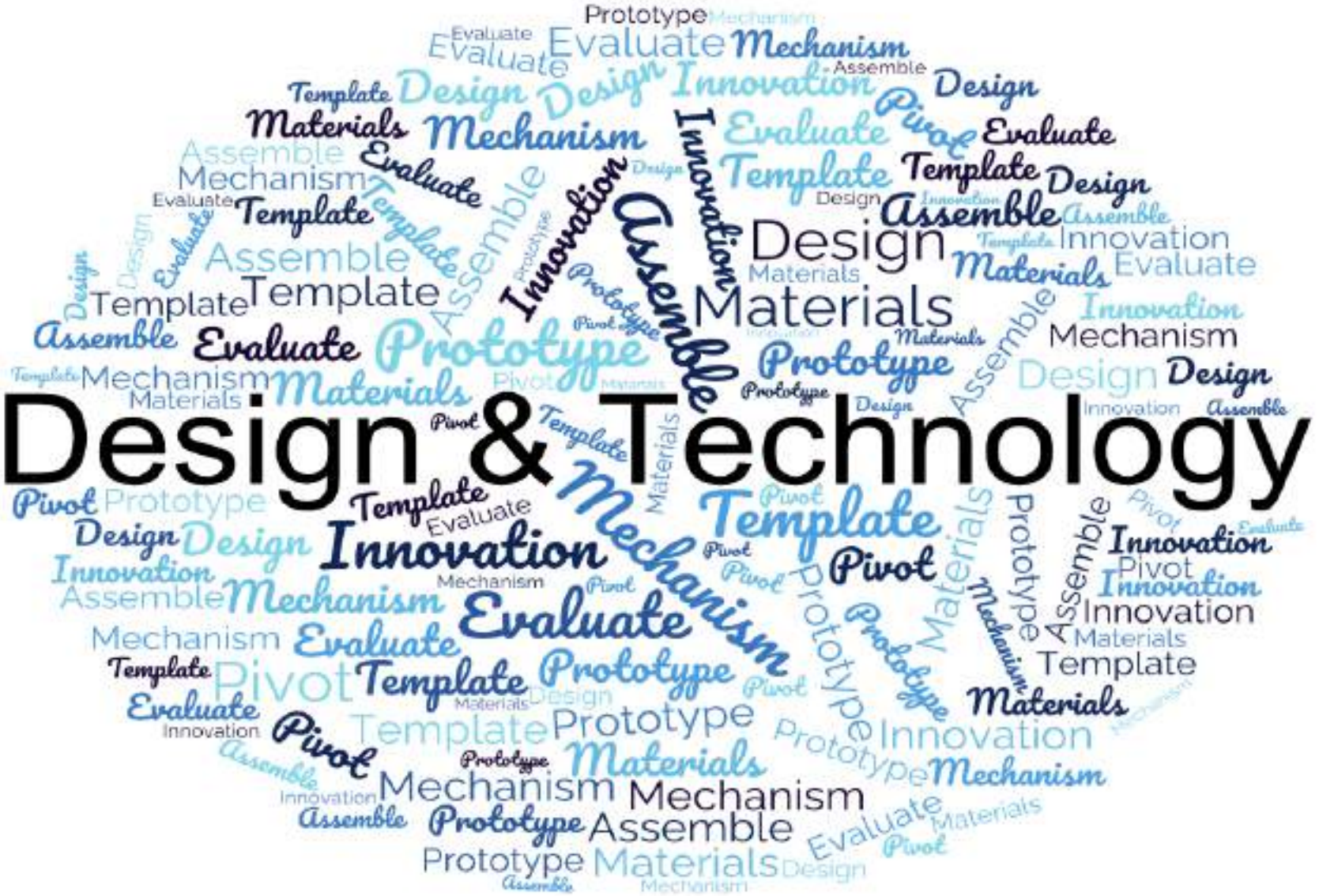

Computing at Sir Martin Frobisher Academy

Subject Leadership
2023/24

CONTENTS

Subject Leaders at SMFA

- Subject Leaders provide professional leadership for a subject or group of subjects to secure high-quality first teaching, a rich curriculum, and the effective use of resources. The success of this will be measured by the impact on learning and progress for pupils.
- We do not expect Subject Leaders to be an 'expert' in the subject they lead. What is important is that they have the overview of what is going well and what needs to be improved – based on evidence.
- Subject leaders at SMFA are part of both the Middle Leadership and the SMFA Extended Leadership Teams
- Each Subject Leader has an assigned Mentor (from SLT)

All Subject Leaders will

- Be part of our distributed leadership
- Utilise the expertise, passion, pedagogical awareness, and strengths of other leadership team members.
- Establish a collective responsibility for demonstrating that everyone makes a difference.
- Moving the school forward through driving the implementation aspect of each subject
- Professionally develop themselves and other staff team members
- Raise standards across all aspects of the curriculum.
- Enrich the curriculum.
- Share knowledge, expertise, skill, passion, and enthusiasm.

How does the role of Subject Leader fit into SMFA's Ofsted Statement of Action?

The staff, pupils and school community are working on areas identified in June 2023's Ofsted inspection as areas that need to be developed. The actions below link directly to the role of school Middle Leaders.

AFI 1 – Curriculum

"Most of the curriculum has been reviewed and newly implemented to take into account what pupils know. This process is further ahead in its development in reading and mathematics. In these areas, leaders consider the starting points of pupils carefully, so they build knowledge and understanding step by step. Teachers receive effective training and support. As a result, teachers plan learning that helps pupils build on prior learning. This ensures that pupils deepen their learning and are consequently generally achieving well."

Most of the curriculum has been reviewed and newly implemented. Aside from English and mathematics, leaders have identified gaps in pupils' learning and are further refining the curriculum to include what knowledge pupils need to learn to catch up. This includes pupils' knowledge of subject-specific vocabulary. Leaders should ensure that the curriculum they intend to offer is planned well, using the information they know about what pupils need to learn. Leaders should ensure that teachers are trained to implement the curriculum so that their delivery adheres to leaders' specification, ensuring that pupils catch up and are ready for the next stages of their education.

Aligning INTENT, IMPLEMENTATION AND IMPACT to ensure we meet the criteria for a good quality of education in the Education Inspection Framework

Intent:

The Design and technology scheme of work aims to inspire pupils to be innovative and creative thinkers who have an appreciation for the product design cycle through ideation, creation, and evaluation. We want pupils to develop the confidence to take risks, through drafting design concepts, modelling, and testing and to be reflective learners who evaluate their work and the work of others. Through our scheme of work, we aim to build an awareness of the impact of design and technology on our lives and encourage pupils to become resourceful, enterprising citizens who will have the skills to contribute to future design advancements.

Our Design and technology scheme of work enables pupils to meet the end of key stage attainment targets in the National curriculum and the aims also align with those in the National curriculum. EYFS (Reception) units provide opportunities for pupils to work towards the Development matters statements and the Early Learning Goals.

Kapow Primary is an Artsmark partner and can support schools on their Artsmark journey, inspiring children, and young people to create, experience, and participate in great arts and culture.

Implementation:

The Design and technology National curriculum outline the three main stages of the design process: design, make and evaluate. Each stage of the design process is underpinned by technical knowledge which encompasses the contextual, historical, and technical understanding required for each strand.

The National curriculum organizes the Design and technology attainment targets under four subheadings: Design, Make, Evaluate, and technical knowledge. We have taken these subheadings to be our Kapow Primary strands:

- **Design**
- **Make**
- **Evaluate**
- **Technical knowledge**

Through Kapow Primary's Design and technology scheme, pupils respond to design briefs and scenarios that require consideration of the needs of others, developing their skills in the six key areas.

Each of our key areas follows the design process (design, make and evaluate) and has a particular theme and focus from the technical knowledge or cooking and nutrition section of the curriculum. The Kapow Primary scheme is a spiral curriculum, with key areas revisited again and again with increasing complexity, allowing pupils to revisit and build on their previous learning.

Lessons incorporate a range of teaching strategies from independent tasks, paired and group work including practical hands-on, computer-based, and inventive tasks. This variety means that lessons are engaging and appeal to those with a variety of learning styles. Differentiated guidance is available for every lesson to ensure that lessons can be accessed by all pupils and opportunities to stretch pupils' learning are available when required. Knowledge organizers for each unit support pupils in building a foundation of factual knowledge by encouraging recall of key facts and vocabulary.

Strong subject knowledge is vital for staff to be able to deliver a highly effective and robust Design and technology curriculum. Each unit of lessons includes multiple teacher videos to develop subject knowledge and support ongoing CPD. Kapow Primary has been created with the understanding that many teachers do not feel confident delivering the full Design and technology curriculum and every effort has been made to ensure that they feel supported to deliver lessons of a high standard that ensure pupil progression.

Impact:

The impact of Kapow Primary's scheme can be constantly monitored through both formative and summative assessment opportunities. Each lesson includes guidance to support teachers in assessing pupils against the learning objectives. Furthermore, each unit has a unit quiz and knowledge catcher which can be used at the start and/ or end of the unit.
After the implementation of Kapow Primary Design and technology, pupils should leave school equipped with a range of skills to enable them to succeed in their secondary education and be innovative and resourceful members of society.
The expected impact of following the Kapow Primary Design and technology scheme of work is that children will:

- Understand the functional and aesthetic properties of a range of materials and resources.
- Understand how to use and combine tools to carry out different processes for shaping, decorating, and manufacturing products.
- Build and apply a repertoire of skills, knowledge and understanding to produce high quality, innovative outcomes, including models, prototypes, CAD, and products to fulfil the needs of users, clients, and scenarios.
- Understand and apply the principles of healthy eating, diets, and recipes, including key processes, food groups and cooking equipment.
- Have an appreciation for key individuals, inventions, and events in history and of today that impact our world.

- Recognise where our decisions can impact the wider world in terms of community, social and environmental issues.
- Self-evaluate and reflect on learning at different stages and identify areas to improve.
- Meet the end of key stage expectations outlined in the National curriculum for Design and technology.

- Meet the end of key stage expectations outlined in the National curriculum for Computing.

Long Term Plan

	Structures	Mechanisms	Textiles	Electrical systems	Digital world	Cooking and nutrition
EYFS	Explore junk modelling, tinkering with temporary and permanent joins, and a range of materials. Create basic models to test in different conditions.	Explore a simple paper slider mechanism.	Explore and develop threading and weaving skills with different materials and objects.			Explore and become familiar with different fruits and vegetables, using their senses.
KS1	Build structures such as windmills and chairs, exploring how they can be made stronger, stiffer and more stable. Recognise areas of weakness through trial and error.	Introduce and explore simple mechanisms, such as sliders, wheels and axles in their designs. Recognise where mechanisms such as these exist in toys and other familiar products.	Explore different methods of joining fabrics and experiment to determine the pros and cons of each technique.	**KS2 only*** Create functional electrical products that use series circuits, incorporating different components such as bulbs, LEDs, switches, buzzers and motors. Consider how the materials used in these products can: • Protect the circuitry. • Reflect light. • Conduct electricity. • Insulate.	**KS2 only*** Learn how to develop an electronic product with processing capabilities. Apply Computing principles to program functions within a product including to control and monitor it. Understand how the history and evolution of product design lead to the on-going Digital revolution and the impact it is having in the world today.	Learn about the basic rules of a healthy and varied diet to create dishes. Understand where food comes from, for example plants and animals.
KS2	Continue to develop KS1 exploration skills, through more complex builds such as pavilion and bridge designs. Understand material selection and learn methods to reinforce structures.	**Mechanical systems** Extend pupils understanding of individual mechanisms, to form part of a functional system, for example: Automatas, that use a combination of cams, followers, axles/shaft, cranks and toppers.	Understand that fabric can be layered for effect, recognising the appearance and technique for different stitch and fastening types, including their: • Strength. • Appropriate use. • Design.			Understand and apply the principles of a healthy and varied diet to prepare and cook a variety of dishes using a range of cooking techniques and methods. Understand what is meant by seasonal foods. Know where and how ingredients are sourced.

	Unit 1	Unit 2	Unit 3	Unit 4		
EYFS (Reception)	**Structures**	**Cooking and nutrition**	**Textiles**	**Structures**		
	Junk modelling	Soup	Bookmarks	Boats		
	Autumn lesson	**Christmas lesson**	**Spring lesson**	**Easter lesson**	**Summer lessons**	
	Hibernation box	Sliding picture	Flower threading	Hanging decoration	Designing a rainbow salad and Making a rainbow salad	
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Year 1	**Mechanisms**	**Structures**	**Textiles**	**Mechanisms**	**Cooking and nutrition**	★ Celebrate KS1's achievements in D&T, with a gallery of their products. ★ Set an invention challenge with scrap materials. ★ Extra-curricular trips. ★ Overflow time to complete units.
	Making a moving story book	Constructing a windmill	Textiles: Puppets	Wheels and axles	Smoothies (6 lessons)	
Year 2	**Mechanisms**	**Cooking and nutrition**	**Mechanisms**	**Structures**	**Textiles**	
	Fairground wheel (5 lessons)	Balanced diet (6 lessons)	Making a moving monster	Baby bear's chair	Pouches	

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 3	**Textiles**	**Electrical systems**	**Mechanical systems**	**Digital world**	**Cooking and nutrition**	**Structures**
	Cross-stitch and applique Cushions or Egyptian collars	Electric poster	Pneumatic toys	Wearable technology	Eating seasonally (6 lessons)	Constructing a castle
Year 4	**Electrical systems**	**Mechanical systems**	**Digital world**	**Cooking and nutrition**	**Structures**	**Textiles**
	Torches	Making a slingshot car	Mindful moments timer	Adapting a recipe (6 lessons)	Pavilions	Fastenings
Year 5	**Mechanical systems**	**Digital world**	**Cooking and nutrition**	**Structures**	**Textiles**	**Electrical systems**
	Option 1: Gears and pulleys Option 2: Making a pop-up book	Monitoring devices	Developing a recipe (6 lessons)	Bridges	Stuffed Toys	Doodlers
Year 6	**Digital world**	**Cooking and nutrition**	**Structures**	**Textiles**	**Electrical systems**	**Mechanical systems**
	Navigating the world	Come dine with me (6 lessons)	Playgrounds	Waistcoats	Steady hand game	Automata toys

Progression of Skills

Progression of skills and knowledge

Structures

EYFS (Reception)

		Junk modelling	Boats
Skills	Design	• Making verbal plans and material choices. • Developing a junk model.	• Designing a junk model boat. • Using knowledge from exploration to inform design.
	Make	• Improving fine motor/scissor skills with a variety of materials. • Joining materials in a variety of ways (temporary and permanent). • Joining different materials together. • Describing their junk model, and how they intend to put it together.	• Making a boat that floats and is waterproof, considering material choices.
	Evaluate	• Giving a verbal evaluation of their own and others' junk models with adult support. • Checking to see if their model matches their plan. • Considering what they would do differently if they were to do it again. • Describing their favourite and least favourite part of their model.	• Making predictions about, and evaluating different materials to see if they are waterproof. • Making predictions about, and evaluating existing boats to see which floats best. • Testing their design and reflecting on what could have been done differently. • Investigating the how the shapes and structure of a boat affect the way it moves.
Knowledge	Technical	• To know there are a range to different materials that can be used to make a model and that they are all slightly different. • Making simple suggestions to fix their junk model.	• To know that 'waterproof' materials are those which do not absorb water.
	Additional		• To know that some objects float and others sink. • To know the different parts of a boat.

Progression of skills and knowledge

Structures

		Year 1	Year 2
		Constructing a windmill	**Baby bear's chair**
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.
	Make	• Making stable structures from card. • 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. • Finding the middle of an object. • Puncturing holes. • Adding weight to structures. • Creating supporting structures. • Cutting evenly and carefully.	• 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.
	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.
Knowledge	Technical	• 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 the sails or blades of a windmill are moved by the wind. • To know that a structure is something built for a reason. • To know that stable structures do not topple. • To know that adding weight to the base of a structure can make it more stable.	• 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.
	Additional	• 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 windmills are used to generate power and were used for grinding flour.	• To know that natural structures are those found in nature. • To know that man-made structures are those made by people.

Progression of skills and knowledge

Structures

		Year 3	Year 4
		Constructing a castle	**Pavilions**
Skills	Design	• 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 pavilion structure that is aesthetically pleasing and selecting materials to create a desired effect. • Building frame structures designed to support weight.
	Make	• Constructing a range of 3D geometric shapes using nets. • Creating special features for individual designs. • Making facades from a range of recycled materials.	• 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 cladding. • Reinforcing corners to strengthen a structure. • Creating a design in accordance with a plan. • Learning to create different textural effects with materials.
	Evaluate	• 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.	• Evaluating structures made by the class. • Describing what characteristics of a design and construction made it the most effective. • Considering effective and ineffective designs.
Knowledge	Technical	• To understand that wide and flat based objects are more stable. • To understand the importance of strength and stiffness in structures.	• To understand what a frame structure is. • To know that a 'free-standing' structure is one which can stand on its own.
	Additional	• 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 know that a pavilion is a a decorative building or structure for leisure activities. • To know that cladding can be applied to structures for different effects. • To know that aesthetics are how a product looks. • To know that a product's function means its purpose. • To understand that the target audience means the person or group of people a product is designed for. • To know that architects consider light, shadow and patterns when designing.

Progression of skills and knowledge

Structures

		Year 5	Year 6
		Bridges	**Playgrounds**
Skills	Design	• Designing a stable structure that is able to support weight. • Creating a frame structure with a focus on triangulation.	• Designing a playground featuring a variety of different structures, giving careful consideration to how the structures will be used, considering effective and ineffective designs.
	Make	• 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.	• Building a range of play apparatus structures drawing upon new and prior knowledge of structures. • Measuring, marking and cutting wood to create a range of structures. • Using a range of materials to reinforce and add decoration to structures.
	Evaluate	• 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.	• Improving a design plan based on peer evaluation. • Testing and adapting a design to improve it as it is developed. • Identifying what makes a successful structure.
Knowledge	Technical	• 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.	• To know that structures can be strengthened by manipulating materials and shapes.
	Additional	• To understand the difference between arch, beam, truss and suspension bridges. • To understand how to carry and use a saw safely.	• To understand what a 'footprint plan' is. • To understand that in the real world, design , can impact users in positive and negative ways. • To know that a prototype is a cheap model to test a design idea.

Progression of skills and knowledge

Mechanisms / mechanical systems

		Year 1	
		Making a moving storybook	**Wheels and axles**
Skills	**Design**	• Explaining how to adapt mechanisms, using bridges or guides to control the movement. • Designing a moving story book for a given audience.	• 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.

	Make	• Following a design to create moving models that use levers and sliders.	• Adapting mechanisms, when:
			  • they do not work as they should.
			  • to fit their vehicle design.
			  • to improve how they work after testing their vehicle.

	Evaluate	• Testing a finished product, seeing whether it moves as planned and if not, explaining why and how it can be fixed. • Reviewing the success of a product by testing it with its intended audience.	• Testing wheel and axle mechanisms, identifying what stops the wheels from turning, and recognising that a wheel needs an axle in order to move.
Knowledge	**Technical**	• To know that a mechanism is the parts of an object that move together. •To know that a slider mechanism moves an object from side to side. • To know that a slider mechanism has a slider, slots , guides and an object. • To know that bridges and guides are bits of card that purposefully restrict the movement of the slider.	• 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.
	Additional	• To know that in Design and technology we call a plan a 'design'.	• To know some real-life items that use wheels such as wheelbarrows, hamster wheels and vehicles.

Progression of skills and knowledge

Mechanisms / mechanical systems

		Year 2	
		Fairground wheel	**Making a moving monster**
Skills	**Design**	• Conducting simple surveys or discussions to gather opinions on what others need or like in a design. • Knowing that a survey is used to find out what people like. • Using a simple design brief that outlines the intended use, target user, and key features of the product, to create simple design criteria. • Knowing that a design brief helps to decide what to make. • Knowing that design criteria are the steps for making a product successful. • Creating ideas with design criteria in mind. • Referring to specific parts of existing products when generating ideas. • Knowing that the design criteria help when thinking of ideas. • Using labels to explain parts of a design, label materials, etc. • Using labels to explain parts of a design, label materials, etc. • Knowing that drawings can help explain how something works. • Knowing that a label explains part of a drawing.	• Creating a class design criteria for a moving monster. • Designing a moving monster for a specific audience in accordance with a design criteria.
	Make	• Choosing materials, ingredients or components from a wider range of materials, ingredients or components. • Explaining their choices based on the properties of materials and components. • Knowing some properties of materials like hard, soft, flexible, waterproof, strong etc. • Following and recalling simple safety instructions. • Knowing that some tools are sharp like scissors and knives. • Choosing known geometric shapes when making. • Beginning to shape objects to improve how they work. • Knowing the names of some geometric shapes: triangle, pyramid, square, cube, circle, sphere. • Considering balance in their finishing, like evenly spaced decoration.	• 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.
	Evaluate	• Discussing a range of existing products and saying what they like and dislike about them. • Evaluating existing products against design criteria. • Evaluating their ideas and creations against simple design criteria. • Knowing that design criteria help to decide if their product is a success. • Suggesting improvements to their peers' designs and products. • Knowing that improve means to make something better. • Knowing that their suggestions can improve someone else's work.	• Evaluating own designs against design criteria. • Using peer feedback to modify a final design.
Knowledge	**Technical**	• To know everyday objects have mechanisms. • To know many things that move have parts inside to help them work. • To know mechanisms usually limit unwanted movement. • To know everyday objects utilise wheels and axles. • To know wheels must be able to turn to work effectively. • To know axles allow wheels to turn without falling off.	• 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.
	Additional	• To know the features of a fairground wheel include the wheel, frame, pods, a base an axle and an axle holder.	• To know some real-life objects that contain mechanisms.

Progression of skills and knowledge

Mechanisms / mechanical systems

		Year 3	Year 4
		Pneumatic toys	Making a slingshot car
Skills	Design	• 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 shape that reduces air resistance. • Drawing a net to create a structure from. • Choosing shapes that increase or decrease speed as a result of air resistance. • Personalising a design.
	Make	• 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.	• Measuring, marking, cutting and assembling with increasing accuracy. • Making a model based on a chosen design.
	Evaluate	• 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 speed of a final product based on: the effect of shape on speed and the accuracy of workmanship on performance.
Knowledge	Technical	• 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 understand that all moving things have kinetic energy. • To understand that kinetic energy is the energy that something (object/person) has by being in motion. • To know that air resistance is the level of drag on an object as it is forced through the air. • To understand that the shape of a moving object will affect how it moves due to air resistance.
	Additional	• 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 understand that products change and evolve over time. • To know that aesthetics means how an object or product looks in design and technology. • To know that a template is a stencil you can use to help you draw the same shape accurately. • To know that a birds-eye view means a view from a high angle (as if a bird in flight). • To know that graphics are images which are designed to explain or advertise something. •To know that it is important to assess and evaluate design ideas and models against a list of design criteria.

Progression of skills and knowledge

Mechanisms / mechanical systems

Year 5

***New* Gears and pulleys**

Skills	Design	• Noticing wider-reaching problems or needs in the community. • Identifying a wide range of needs and potential barriers through market research. • Writing more complex problem statements that consider multiple factors and constraints. • Creating more complex design criteria that require considering detailed user needs, environmental impact, materials and cost. • Coming up with a broader range of ideas and deeper innovation, requiring pupils to think critically about their ideas' practicality and originality. • Beginning to use more complex annotated sketches, such as cross-sectional and exploded diagrams and pattern pieces in design. • Using a series of prototypes to refine and improve their designs.
	Make	• Consistently apply safety instructions. • Select appropriate scissors to handle delicate cutting tasks and challenging materials. • Cutting patterns and drawings accurately. • In supervised groups, using hot glue guns safely. • Recognising that hot glue is useful for joining materials that need a strong bond that sets quickly. • Choosing PVA glue over hot glue for its safety when joining materials in less intensive projects.
	Evaluate	• Reflecting on the usability, aesthetics, innovation and sustainability of products and discussing how design choices impact these aspects. • Assessing their designs against a more complex set of design criteria that includes functionality, aesthetics, user experience, sustainability and cost. • Considering alternative materials, tools or techniques that could enhance the product. • Providing feedback that is helpful, specific, and encouraging. • Incorporating feedback from peers or users improve their product further, explaining the changes they made and the impact they had.
Knowledge	Technical	• That mechanical systems that use gears in everyday objects (eg bicycle, clock). • That gears and pulleys allow us to transfer movement and force from one part of a mechanical system to another. • That gears allow us to increase the output of a mechanism.
	Additional	• That market research is a way of collecting information about problems or needs. • That constraints are things that might stop our ideas being successful. • That original and innovative ideas are different from what has been made before. • That annotations are detailed labels and comments on diagrams. • That risks are things that might happen. • That hot glue creates a strong bond quickly. • That is often better to choose safer equipment. • That sustainability means thinking about the materials that were used to make a product and how the product was made. • That their final product can still be improved by different materials or techniques. • That evaluating their designs in detail will help them understand its successful and less successful parts. • That feedback should be positive, helpful and specific. • That explaining how they used feedback to improve their design can help them create better products in the future.

Progression of skills and knowledge

Mechanisms / mechanical systems

		Year 5	Year 6
		Pop up book	Automata toys
Skills	Design	• 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.	• Noticing wider-reaching problems or needs in the community. • Coming up with a broader range of ideas and deeper innovation, requiring pupils to think critically about their ideas' practicality and originality. • Beginning to use more complex annotated sketches, such as cross-sectional and exploded diagrams and pattern pieces in design.
	Make	• 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.	• Producing lists of equipment, materials and tools that they need for a task. • Selecting materials, components or ingredients based on research or user needs. • Explaining their choices, referring to their research. • Considering which equipment will work well together. • Choosing from the known range of equipment available to them with little guidance. • Assessing risks associated with different tools and equipment. • Understanding and explaining the importance of each safety rule. • Consistently apply safety instructions. • Cutting jelutong or other harder wood with a coping saw or a tenon saw in small groups. • Cutting in a back-and-forth sawing motion where appropriate. • In supervised groups, using hot glue guns safely. • Recognising that hot glue is useful for joining materials that need a strong bond that sets quickly.
	Evaluate	• Evaluating the work of others and receiving feedback on own work. • Suggesting points for improvement.	• Assessing their designs against a more complex set of design criteria that includes functionality, aesthetics, user experience, sustainability and cost. • Providing feedback that is helpful, specific and encouraging. • Incorporating feedback from peers or users to improve their product further, explaining the changes they made and the impact they had.
Knowledge	Technical	• 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.	• To know that the mechanism in an automata uses a system of cams, axles and followers. • To know that different shaped cams produce different outputs. • To know which mechanisms are working together to make a mechanical system. • To know that there are different directions of movement. • To know that mechanisms can change one type of movement to another.
	Additional	• 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.	• To know that an automata is a hand powered mechanical toy. • To know that a cross-sectional diagram shows the inner workings of a product.

Progression of skills and knowledge

Electrical systems (KS2 only)

		Year 3	Year 4
		Electric poster	Torches
Skills	Design	• Carry out research based on a given topic (e.g. The Romans) to develop a range of initial ideas. • Generate a final design for the electric poster with consideration to the client's needs and design criteria. • Design an electric poster that fits the requirements of a given brief. • Plan the positioning of the bulb (circuit component) and its purpose.	• Designing a torch, giving consideration to the target audience and creating both design and success criteria focusing on features of individual design ideas.
	Make	• Create a final design for the electric poster. • Mount the poster onto corrugated card to improve its strength and allow it to withstand the weight of the circuit on the rear. • Measure and mark materials out using a template or ruler. • Fit an electrical component (bulb). • Learn ways to give the final product a higher quality finish (e.g. framing to conceal a roughly cut edge).	• 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.
	Evaluate	• Learning to give and accept constructive criticism on own work and the work of others. • Testing the success of initial ideas against the design criteria and justifying opinions. • Revisiting the requirements of the client to review developing design ideas and check that they fulfil their needs.	• Evaluating electrical products. • Testing and evaluating the success of a final product.
Knowledge	Technical	• To understand that an electrical system is a group of parts (components) that work together to transport electricity around a circuit. • To understand common features of an electric product (switch, battery or plug, dials, buttons etc.). • To list examples of common electric products (kettle, remote control etc.). • To understand that an electric product uses an electrical system to work (function). • To know the name and appearance of a bulb, battery, battery holder and crocodile wire to build simple circuits.	• 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.
	Additional	• To understand the importance and purpose of information design. • To understand how material choices (such as mounting paper to corrugated card) can improve a product to serve its purpose (remain rigid without bending when the electrical circuit is attached).	• 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.

Progression of skills and knowledge

Electrical systems (KS2 only)

		Year 5	Year 6
		Doodlers **New!**	Steady hand game
Skills	Design	• 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	• 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	• 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 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 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'.

Vocabulary

Design and technology vocabulary

EYFS Reception

Food: Soup

- Fruit
- Vegetables
- Safety
- Knife
- Blade
- Tool
- Edge
- Handle
- Chop
- Slice
- Cut
- Saucepan
- Blender
- Chopping board
- Hob
- Boil
- Blend
- Mix
- Packaging
- Recyclable
- Metal
- Plastic
- Reusable

Structures: Junk modelling

- Join
- Stick
- Cut
- Bend
- Slot
- Scissors
- Measure
- Materials
- Fix

Textiles: Bookmarks

- Thread
- Weave
- Pattern
- Sew
- Sewing needle
- Embroider
- Design
- Evaluate

Design and technology vocabulary

EYFS Reception

Structures: Boats

- Waterproof
- Absorb
- Prediction
- Variable
- Experiment
- Investigation
- Float
- Sink
- Junk

Design and technology vocabulary

KS1 Year 1

Mechanisms: Making a moving story book

- Assemble
- Design
- Evaluation
- Mechanism
- Model
- Sliders
- Stencil
- Target audience
- Template
- Test

Structures: Constructing a windmill

- Axle
- Base
- Centre
- Design
- Evaluation
- Equal
- Evaluate
- Middle
- Rotate
- Rotor
- Rotor Blades
- Sails
- Same
- Stable
- Strong
- Structure
- Test
- Weak
- Wind
- Windmill

Textiles: Puppets

- Decorate
- Design
- Fabric
- Glue
- Model
- Hand puppet
- Safety pin
- Staple
- Stencil
- Template

Design and technology vocabulary

KS1 Year 1

Mechanisms: Wheels and axles

- Axle
- Axle holder
- Chassis
- Design
- Evaluation
- Fix
- Mechanic
- Mechanism
- Model
- Test
- Wheel

Cooking and nutrition: Smoothies

- Blender
- Fruit
- Healthy
- Ingredients
- Recipe
- Smoothie
- Vegetable
- Seed
- Root
- Leaf
- Stem
- Flavour
- Design
- Cut
- Juice
- Table knife
- Juicer
- Plant
- Bush
- Tree
- Vine
- Chopping board
- Fork
- Taste
- Select
- Blend
- Evaluate
- Compare

Design and technology vocabulary

KS1 Year 2

Cooking and nutrition: Balanced diet

- Appearance
- Balanced
- Carbohydrates
- Combination
- Dairy
- Design
- Design brief
- Diet
- Feel
- Grate
- Grater
- Menu
- Oils
- Prepare
- Proteins
- Review
- Scissors
- Smell
- Snip
- Spread
- Spreads

Mechanisms: Making a moving monster

- Evaluation
- Input
- Lever
- Linear motion
- Linkage
- Mechanical
- Mechanism
- Motion
- Oscillating motion
- Output
- Pivot
- Reciprocating motion
- Rotary motion
- Survey

Structures: Baby bear's chair

- Function
- Man-made
- Mould
- Natural
- Stable
- Stiff
- Strong
- Structure
- Test
- Weak

Design and technology vocabulary

KS1 Year 2

Textiles: Pouches

- Accurate
- Fabric
- Knot
- Pouch
- Running-stitch
- Sew
- Shape
- Stencil
- Template
- Thimble

Mechanisms: Fairground wheel

- Design brief
- Design criteria
- Evaluate
- Frame
- Model
- Opinion
- Rotate
- Survey

Design and technology vocabulary

KS2 Year 3

Cooking and nutrition: Eating seasonally

- Arid
- Climate
- Complementary
- Country
- Export
- Import
- Mediterranean
- Mock-up
- Mountain
- Peel
- Polar
- Seasonal
- Seasons
- Snip
- Temperate
- Texture
- Tropical
- Weather

Structures: Constructing a castle

- 2D shapes
- 3D shapes
- Castle
- Design criteria
- Evaluate
- Facade
- Feature
- Flag
- Net
- Recyclable
- Scoring
- Stable
- Strong
- Structure
- Tab
- Weak

Textiles: Cushions / Egyptian collars

- Accurate
- Applique
- Cross-stitch
- Cushion
- Decorate
- Detail
- Fabric
- Patch
- Running-stitch
- Seam
- Stencil
- Stuffing
- Target audience
- Target customer
- Template

Design and technology vocabulary

KS2 Year 3

Electrical systems: Electric poster

- Battery
- Bulb
- Circuit
- Circuit component
- Crocodile wires
- Electrical product
- Electrical system
- Final design
- Information design
- Initial ideas
- Peer assessment
- Research
- Self assessment
- Sketch

Mechanical systems: Pneumatic toys

- Exploded-diagram
- Function
- Input
- Lever
- Linkage
- Mechanism
- Motion
- Net
- Output
- Pivot
- Pneumatic system
- Thumbnail sketch

Digital world: Wearable technology

- Analogue
- Analyse
- Annotate
- Badge
- CAD
- Control
- Design criteria
- Develop
- Digital
- Digital revolution
- Digital world
- Display
- Electronic
- Fastening
- Feature
- Feedback
- Form
- Function
- Initiate
- Layers
- Loops
- Micro:bit
- Monitor
- Net
- Point of sale
- Product
- Product concept
- Program
- Sense
- Simulator
- Smart
- Technology
- Test
- User

Design and technology vocabulary

KS2 Year 4

Structures: Pavilions

- Aesthetic
- Cladding
- Design criteria
- Evaluation
- Frame structure
- Function
- Inspiration
- Pavilion
- Reinforce
- Stable
- Structure
- Target audience
- Target customer
- Texture
- Theme

Cooking and nutrition: Adapting a recipe

- Adapt
- Addition
- Budget
- Buttery
- Combine
- Comment
- Construct
- Cream
- Crunchy
- Cuboid
- Fold
- Hygiene
- Layout
- Market research
- Modify
- Multiplication
- Opinion
- Pounds
- Sieve
- Sift
- Target audience
- Texture
- Unique
- Wooden spoon

Textiles: Fastenings

- Aesthetic
- Assemble
- Book sleeve
- Design criteria
- Evaluation
- Fabric
- Fastening
- Mock-up
- Net
- Running-stitch
- Stencil
- Target audience
- Target customer
- Template

Design and technology vocabulary

KS2 Year 4

Electrical systems: Torches

- Battery
- Bulb
- Buzzer
- Cell
- Component
- Conductor
- Copper
- Design criteria
- Electrical item
- Electricity
- Electronic item
- Function
- Insulator
- Series circuit
- Switch
- Test
- Torch
- Wire

Mechanical systems: Making a slingshot car

- Aesthetic
- Air resistance
- Chassis
- Design
- Design criteria
- Function
- Graphics
- Kinetic energy
- Mechanism
- Net
- Structure

Digital world: Mindful moments timer

- Advantage
- Annotate
- Assemble
- Aesthetic
- Block
- Brand identity
- Brand
- Bug
- CAD
- Clipart
- Coding
- Criteria
- Debug
- Design
- Develop
- Disadvantage
- Display
- Ergonomic
- Evaluate
- Exhibition
- Feedback
- Form
- Function
- Join
- Logo
- Loop
- Mindfulness
- Model
- Net
- Product
- Program
- Prototype
- Research
- Script
- Sketchpad
- Test
- Timer
- User
- Variable

Design and technology vocabulary

KS2 Year 5

Cooking and nutrition: Developing a recipe

- Abattoir
- Adaptation
- Balanced
- Beef
- Brand
- Cook
- Cross-contamination
- Develop
- Enhance
- Equipment
- Farm
- Label
- Measure
- Nutrient
- Nutrition
- Nutritional value
- Preference
- Press
- Process
- Safety
- Theme

Mechanical systems option 1: Gears and pulleys

- Annotate
- Gear
- Gear system
- Input
- Market research
- Output
- Problem statement
- Pulley
- Pulley system
- Research
- Sustainability
- Teeth

Mechanical systems option 2: Making a pop-up book

- Aesthetic
- Computer-aided design (CAD)
- Caption
- Design
- Design brief
- Design criteria
- Exploded-diagram
- Function
- Input
- Linkage
- Mechanism
- Motion
- Output
- Pivot
- Prototype
- Slider
- Structure
- Template

Design and technology vocabulary

KS2 Year 5

Textiles: Stuffed toys

- Accurate
- Annotate
- Appendage
- Blanket-stitch
- Design criteria
- Detail
- Evaluation
- Fabric
- Sew
- Shape
- Stuffed toy
- Stuffing
- Template

Electrical systems: Doodlers

- Circuit component
- Configuration
- Current
- Develop
- DIY
- Investigate
- Motor
- Motorised
- Problem solve
- Product analysis
- Series circuit
- Stable
- Target user

Design and technology vocabulary

KS2 Year 5

Structures: Bridges

- Abutment
- Accurate
- Arched bridge
- Beam bridge
- Coping saw
- Evaluation
- File
- Mark out
- Material properties
- Measure
- Predict
- Reinforce
- Research
- Sandpaper
- Set square
- Suspension bridge
- Tenon saw
- Test
- Truss bridge
- Wood

Digital world: Monitoring devices

- Alert
- Ambient
- Boolean
- Consumables
- Decompose
- Development
- Device
- Duplicate
- Durable
- Electronic
- Inventor
- Lightweight
- Man-made
- Manipulate
- Manoeuvre
- Microplastics
- Model
- Monitor
- Monitoring device
- Moulded
- Plastic
- Plastic pollution
- Programming comment
- Programming loop
- Reformed
- Replica
- Research
- Sensor
- Strong
- Sustainability
- Synthetic
- Thermometer
- Thermoscope
- Value
- Variable
- Versatile
- Water-resistant
- Workplane

Design and technology vocabulary

KS2 Year 6

Cooking and nutrition: Come dine with me

- Balance
- Bitter
- Bridge method
- Complement
- Cookbook
- Farm to fork
- Method
- Nationality
- Reared
- Research
- Pairing
- Preparation
- Salty
- Sour
- Storyboard
- Sweet
- Umami

Mechanical systems: Automata toys

- Accurate
- Automata
- Axle
- Bench hook
- Cam
- Cam profile
- Component
- Cross-sectional diagram
- Diagram
- Dowel
- Evaluate
- Exploded-diagram
- Follower
- Form
- Frame
- Function
- Housing
- Mechanism
- Storefront
- Visual

Design and technology vocabulary

KS2 Year 6

Textiles: Waistcoats

- Accurate
- Adapt
- Annotate
- Design
- Design criteria
- Detail
- Fabric
- Fastening
- Knot
- Properties
- Running-stitch
- Seam
- Sew
- Shape
- Target audience
- Target customer
- Template
- Thread
- Unique
- Waistcoat
- Waterproof

Electrical systems: Steady hand game

- Assemble
- Battery
- Battery pack
- Benefit
- Bulb
- Bulb holder
- Buzzer
- Circuit
- Circuit symbol
- Component
- Conductor
- Copper
- Design
- Design criteria
- Evaluation
- Fine motor skills
- Fit for purpose
- Form
- Function
- Gross motor skills
- Insulator
- LED
- User

Design and technology vocabulary

KS2 Year 6

Structures: Playgrounds

- Adapt
- Apparatus
- Bench hook
- Cladding
- Coping saw
- Design
- Dowel
- Evaluation
- Feedback
- Idea
- Jelutong
- Landscape
- Mark out
- Measure
- Modify
- Natural materials
- Plan view
- Playground
- Prototype
- Reinforce
- Sketch
- Strong
- Structure
- Tenon saw
- Texture
- User
- Vice
- Weak

Digital world: Navigating the world

- 3D CAD
- Application (apps)
- Biodegradable
- Boolean
- Cardinal compass
- Client
- Compass
- Concept
- Convince
- Corrode
- Duplicate
- Environmentally friendly
- Equipment
- Feature
- Finite
- Function
- Functional
- GPS tracker
- If statement
- Infinite
- Investment
- Lightweight
- Loop
- Manufacture
- Materials (wood, metal, plastic etc.)
- Mouldable
- Navigation
- Non-recyclable
- Product lifecycle
- Product lifespan
- Program
- Recyclable
- Smart
- Sustainable
- Sustainable design
- Unsustainable design
- Variable
- Workplane

Planning (examples)

Product Concept – Year 6

Learning objective	Success criteria
• To develop a sustainable product concept.	• I can consider materials and their functional properties. • I can understand the need for sustainability in design. • I can develop a product idea through annotated sketches.

Before the lesson

Have ready:

- Presentation: Brain dump!
- Presentation: Planet Earth.
- Presentation: Product concept.
- Whiteboard and pen (one each).
- Pencils and pens (one each).
- Coloring pencils.

Print in advance:

- Activity: Product concept (one each).
- Activity: Product concept guided (adaptive teaching).
- Activity: Concept evaluation (one each).

Recap and recall

Display the presentation: Brain dump!

Attention grabber

Display the *Presentation: Planet Earth* and ask the children the question on slide 1. Give the children a moment to think before asking them for their thoughts. Show slide 2 and explain that we are all responsible for looking after the planet.
Display slides 3 and 4 to read and discuss the information about unsustainable design.
Explain that awareness about the dangers facing Earth is growing, and we must change aspects of our lifestyle as a species. Many products are still created for a very short lifespan and become waste after use. Some products, such as plastic straws and sauce sachets, are even single-use and thrown away after just a few hours of purchase.

Questions

- What do you think about the unsustainable product lifespan?
- What do we mean by 'non-recyclable', 'finite' and 'unsustainable'? (These are all keywords for materials that are limited in supply, cannot be remade into other products and therefore will eventually run out but be left in landfill or polluting the ocean.)
- How could you change your habits to help the planet? (The 'six Rs' of sustainability, making sustainable material choices.)

Show slides 5-8 and as you go through each image, explain that as our landfill waste increases, more and more toxic materials and chemicals find their way onto the land, into the soil and water systems such as rivers and lakes. Waste left on the beaches or released into the ocean pollutes the sea and can cause serious harm to marine life.
Display slide 9 and ask the children the questions.
Explain to the children that they will look at ways to improve their choices of materials to reduce the negative impact of waste on planet Earth.

Main event

Display slides 1-3 of the *Presentation: Design concept* and read and discuss the information about sustainable design.
Explain that sustainable design is critical for the survival of the planet and its ecosystem, so everyone should make sustainable decisions at every opportunity. Designers, in particular, must understand that when the products they create become popular, this will increase the demand for resources to manufacture more.
Show slide 4 and read and discuss each of the examples given. Explain that cork and bamboo are incredibly sustainable resources because they can grow and be harvested without harming the environment.
*Explain to the children that plastic and metal can only be considered sustainable if recycled at the end of a product's lifespan and manufactured into new products. This is because by reusing the material, we are saving it from becoming waste and adding to landfill.
Show slides 5 and 6 to revisit Aria's (the client's) letter and the design criteria. Remind the children that in this lesson, we will be fulfilling point 4 and coming up with a product concept for our navigation tool.
Display slide 7 to read out the definition of 'concept': A visual plan of an invention or idea to share with others.

Activity: Product concept
Explain to the class that after learning about sustainable design and how we can make better material decisions for the planet, we will design our product concept for the navigation tool we programmed in the last lesson. Display slide 8 to show what their product concept will need to include.
Show slide 9 and review each of the materials' functional properties. Discuss these with consideration of the location of Adventure Awaits Co. (Australia) and what the product will need to achieve.
Prompt the children's thoughts with questions such as:

- How will the case protect the electronics contained inside?
- How will the product be operated by the user?

Hand out the children's project workbooks, including their design criteria and a copy of the *Activity: Product concept*. Ensure all the children have writing and drawing equipment to complete the activity.

Wrapping up

Hand each child a copy of the *Activity: Concept evaluation.* Divide the children into pairs to discuss the questions on the sheet. Looking at each other's design criteria, the pairs need to self and peer-assess their product concepts with two aspects that they like and one that they feel could be improved, giving suggestions for how this could be done.

Discuss the children's feedback as a class and ask the questions below.

- Does your product concept meet all of the design criteria?
- What could be improved about your product concept?
- Which materials did you choose and why?

Design a fairground wheel – Year 2

Learning objective	Success criteria
• To explore wheel mechanisms and design a fairground wheel.	• I can describe how axles help wheels to move a vehicle. • I can evaluate different designs. • I can design and label a working wheel.

Before the lesson

Have ready:

- Presentation: Wheels and axles images.
- Presentation: Fairground wheel images.
- Presentation: Fairground wheel design criteria.
- Items with wheels – bicycles or toy cars.
- Whiteboard and pens (one each).
- Circular objects to draw around.

Print in advance:

- Resource: City wheel letter.
- Activity: Wheel design (one each).
- Activity: Wheel design supported (adaptive teaching).
- Resource: key vocabulary.

Recap and recall

Before starting this unit, check that the children can recall:

- A mechanism is the parts of an object that move together.
- A wheel needs an axle to move.
- A wheel needs to be round to rotate and move.
- An axle moves within an axle holder.

Attention grabber

Optional: provide each child with a copy of the *Knowledge catcher* (see link: *Assessment – D&T Y2: Fairground wheel*) and ask them to complete it to the best of their ability. Explain that at the end of the unit, they will revisit it, adding more information in a different colour.

Play the link: Bob the Builder - Spring City Wheel - Season 19, Episode 36 on Video Link. Ask the children:

- **How do the builders know what kind of fairground wheel they are building?** (Someone will provide a design brief with criteria of what they would like the fairground wheel to be like; engineers and designers will have the correct parts made in factories and come up with instructions for the builders to ensure it meets the brief and will work safely.)

Read the *Resource: City wheel letter* to the children, which tells them that the local council is asking for a city wheel to be built to celebrate the town's character. Explain that the letter is an example of a **design brief** as it invites designs to be submitted for a particular set of **design criteria**:

- The wheel must be able to spin around.
- It must seat eight to ten people.
- It should be decorated to reflect the local area.
- Designs should consider appropriate material properties.

Explain to the children that they will design and make their version of the Spring City Wheel. Discuss with them what their **design criteria** need to be and how they can represent their design.
Inform the children that they will first need to undertake some research to help them make the best wheel possible. Ask them what we might need to research (e.g. materials used, mechanisms, seats/pod design, etc.).

Main event

Explain that the children will research how mechanisms work before designing their own fairground wheel.

Researching mechanisms

Display the selection of wheeled items in the classroom (see Have ready) and hand out whiteboards and pens (one each). Ask the children to draw each item, showing how the wheels work and how the object moves to recap their learning from the unit *D&T, Year 1, Mechanisms: Wheels and axles*. Arrange the children in pairs and carry out this activity verbally for any pupils who require further support (see Adaptive teaching).

Use **one** of the options below if wheeled items are unavailable:

- Show the link: Let's Get Rolling - Physics for kids on Video Link.
- Display the *Presentation: Wheels and axles images.*

Show slides 1–7 of the *Presentation: Fairground wheel images* and ask the children:

- **What do you like or dislike about the designs?** (Answers will vary but may include they do not like the metal seats as they would be uncomfortable to sit on; they like the bright colours, which make it look fun.)

Encourage the children to justify their opinions by referencing the images.

Show slide 8 and discuss what features the children may include in their design.

Designing mechanisms

Hand out the *Activity: Wheel design* (one each) and ask the children to draw and label what they want their wheel to look like. Provide a circular object to draw around or use the *Knowledge organiser* as a visual example for children struggling with the task.

Ensure the children understand the design must include the following:

- Enough pods to hold eight to ten people.
- A pod design that keeps the people safe inside.
- A wheel with an axle that allows it to rotate.
- A frame with a stable base and an axle holder.
- How the pods attach to the wheel.
- How the wheel attaches to the axle.
- How the axle fits into the frame.

Encourage the children to consider stable and strong structures.

Allow the children time to complete the activity and ask them the following questions to help them evaluate their design:

- **Is there anything you want to change about your design? Why?**
- **Which parts of your design do you like the most? Why?**

Wrapping up

Display the *Presentation: Fairground wheel design criteria* and ask the children which they have begun to consider, and which need further thought. Explain that they will continue in the next lesson by considering the properties of materials required for the build.