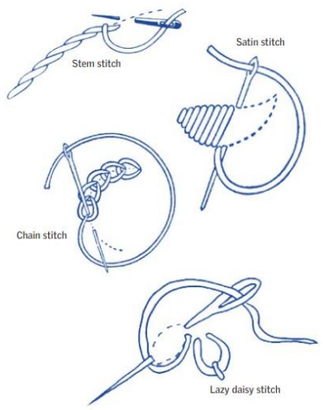
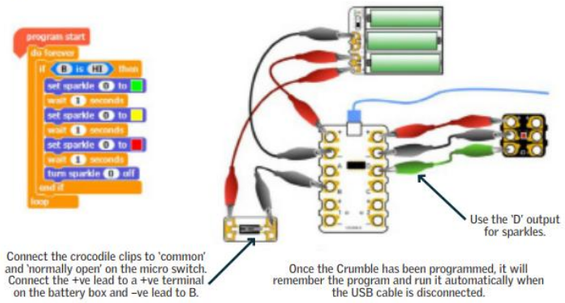
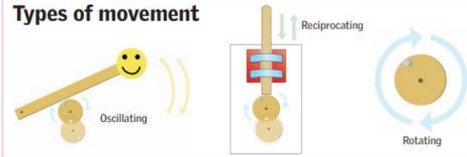
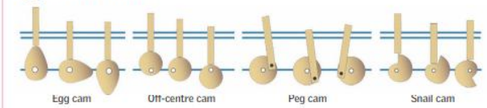
Charles Darwin Community Primary School Progression in Design Technology
Year 5

Term **Topic**	**Autumn** **Design, make and evaluate a mobile phone holder for yourself for to keep your phone safe in your bag**	**Spring** **Design, make and evaluate an electrical toy money box for yourself to help you save.**	**Summer** **Design, make and evaluate a moving toy for a child in Y2 as a present**
Themes	Textiles - Combining different fabric shapes	Electrical - Monitoring and control	Mechanisms – Cams, Pulleys or Gears
Prior knowledge	From Y2 puppet making From Year 4 making a purse	Electricity unit Y4	Y1 sliders and levers Y3 levers and linkages
Prior skills	Experience of basic stitching, joining textiles and finishing techniques. • Experience of making and using simple pattern pieces.	Initial experience of using computer control software and an interface box, a standalone box or microcontroller, e.g. Crumble. • Some experience of writing and modifying a program to make a light turn on or flash on and off. • Understanding of the essential characteristics of a series circuit and experience of creating a battery-powered, functional, electrical product.	Experience of axles, axle holders and wheels that are fixed or free moving. • Basic understanding of different types of movement. • Experience of cutting and joining techniques with a range of materials including card, plastic and wood. • An understanding of how to strengthen and stiffen structures.
Key vocabulary	• seam, seam allowance, wadding, reinforce, right side, wrong side, hem, template, pattern pieces • name of textiles and fastenings used, pins, needles, thread, pinking shears, fastenings, iron transfer paper • design criteria, annotate, design decisions, functionality, innovation, authentic, user, purpose, evaluate, mock-up, prototype	reed switch, toggle switch, push-tomake switch, pushto-break switch, light dependent resistor (LDR), tilt switch • light emitting diode (LED), bulb, bulb holder, battery, battery holder, USB cable, wire, insulator, conductor, crocodile clip • control, program, system, input device, output device, series circuit, parallel circuit • function, innovative, design specification, design brief, user, purpose	cam, snail cam, off-centre cam, peg cam, pear shaped cam • follower, axle, shaft, crank, handle, housing, framework • rotation, rotary motion, oscillating motion, reciprocating motion • annotated sketches, exploded diagrams • mechanical system, input movement, process, output movement • design decisions, functionality, innovation, authentic, user, purpose, design specification, design brief
NC Statutory Requirements	**Key stage 2** Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment]. When designing and making, pupils should be taught to: **Design** use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design **Make** select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities **Evaluate** investigate and analyse a range of existing products evaluate their ideas and products against their own design criteria and consider the views of others to improve their work understand how key events and individuals in design and technology have helped shape the world **Technical knowledge** apply their understanding of how to strengthen, stiffen and reinforce more complex structures understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages] understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] apply their understanding of computing to program, monitor and control their products.		
Technical knowledge and understanding	The children could design their finish for their product using a variety of appropriate stitches. They could draw enlarged examples of e.g. insects, flowers, animals and then decide which stitch would be best for each part. Use square paper for a grid to ensure the stitches are in the right place and are the right size. **Tie dye** Children could decorate their fabric before they make up their product by tie dyeing.T he key to success is to tie the fabric very tightly with e.g. rubber bands or string so that the dye is prevented from reaching that part of the fabric.	• How could children adapt the program so that it would detect a burglar stealing the moneybox? • What type of output device could they use? • What type of switch could detect the movement of the moneybox? • How could the program be adapted to remind the user to save money on a regular basis?	**Glossary** • **Rotary motion** – movement that goes round. • **Oscillating motion** – moving to and fro around a pivot point, as in a lever. • **Reciprocating motion** – backwards and forwards movement in a straight line, as in a slider. • **Cam** – a mechanism that changes one sort of movement to another. Cams can be an off-centre wheel or a specially shaped wheel. • **Follower** – the device that follows the movement of the cam: a lever or a slider. • **Lever** – a piece of rigid material that moves to and fro around a pivot point creating oscillating motion. • **Slider** – a piece of rigid material that moves backwards and forwards in a straight line creating reciprocating motion. • **Guide** – a piece of material used to guide the movement of another. • **Spacer** – a piece of material used to create extra space to allow moving parts to move freely.

Techniques	**Stitches**  	**An example program for an electronic toy moneybox** A sparkle LED is connected to the Crumble and changes from green to yellow to red every time a plastic coin is placed through the slot of the moneybox and depresses a micro switch connected to terminal B.  	**Types of movement**  **Types of cams** 
KPIs	**Designing** • Generate innovative ideas by carrying out research including surveys, interviews and questionnaires. • Develop, model and communicate ideas through talking, drawing, templates, mockups and prototypes and, where appropriate, computer-aided design. • Design purposeful, functional, appealing products for the intended user that are fit for purpose based on a simple design specification.	**Designing** • Develop a design specification for a functional product that responds automatically to changes in the environment. • Generate, develop and communicate ideas through discussion, annotated sketches and pictorial representations of electrical circuits or circuit diagrams.	**Designing** • Generate innovative ideas by carrying out research using surveys, interviews, questionnaires and web-based resources. • Develop a simple design specification to guide their thinking. • Develop and communicate ideas through discussion, annotated drawings, exploded drawings and drawings from different views.
	Making • Produce detailed lists of equipment and fabrics relevant to their tasks. • Formulate step-by-step plans and, if appropriate, allocate tasks within a team. • Select from and use a range of tools and equipment to make products that are accurately assembled and well finished. Work within the constraints of time, resources and cost.	**Making** • Formulate a step-by-step plan to guide making, listing tools, equipment, materials and components. • Competently select and accurately assemble materials, and securely connect electrical components to produce a reliable, functional product. • Create and modify a computer control program to enable their electrical product to respond to changes in the environment.	**Making** • Produce detailed lists of tools, equipment and materials. Formulate step-by-step plans and, if appropriate, allocate tasks within a team. • Select from and use a range of tools and equipment to make products that that are accurately assembled and well finished. Work within the constraints of time, resources and cost.
	Evaluating • Investigate and analyse textile products linked to their final product. • Compare the final product to the original design specification. • Test products with intended user and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose. • Consider the views of others to improve their work.	**Evaluating** • Continually evaluate and modify the working features of the product to match the initial design specification. • Test the system to demonstrate its effectiveness for the intended user and purpose.	**Evaluating** • Compare the final product to the original design specification. • Test products with the intended user, where safe and practical, and critically evaluate the quality of the design, manufacture, functionality and fitness for purpose. • Consider the views of others to improve their work. • Investigate famous manufacturing and engineering companies relevant to the project
	Technical knowledge and understanding • A 3-D textile product can be made from a combination of accurately made pattern pieces, fabric shapes and different fabrics. • Fabrics can be strengthened, stiffened and reinforced where appropriate	**Technical knowledge and understanding** • Understand and use electrical systems in their products. • Understand the use of computer control systems in products. • Apply their understanding of computing to program, monitor and control their products. • Know and use technical vocabulary relevant to the project.	**Technical knowledge and understanding** • Understand that mechanical systems have an input, process and an output. • Understand how cams can be used to produce different types of movement and change the direction of movement. • Know and use technical vocabulary relevant to the project.
Links to other subjects	**Spoken language** – ask questions, formulate, articulate and justify answers, arguments and opinions. Consider and evaluate different viewpoints. **Science** – work scientifically investigating properties of fabrics. Children plan different types of scientific enquiries to answer questions.	**Science** – apply knowledge and understanding of circuits, switches, conductors and insulators. **Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems. Use sequence, selection, and repetition in programs. Work with variables and various forms of input and output.	**Computing** – use search technologies for research purposes and be discerning when evaluating digital content. **Science** – forces and movement: explore the effects of simple machines on movement.

	History – significant person/people in their locality linked to textiles and products e.g. Vivienne Westwood, Virgil Abloh **Mathematics** – apply knowledge of how 2D nets can be formed into 3D shapes; apply skills of accurate measuring using standard units i.e. cm/mm. **Art and design** – investigate methods of adding colour, pattern and texture on to textiles and how to make their own textiles through weaving or felt making. **Computing** – children express themselves and develop ideas using a range of information and communication technology resources.	**Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm. **Spoken language** – asking questions to check understanding, develop technical vocabulary and build knowledge	**Mathematics** – use mathematical vocabulary to describe position, direction and movement. **Art and design** – use and apply drawing skills. Use techniques with colour, pattern, texture, line and shape.
Lessons	**Investigative and Evaluative Activities (IEAs)** • Children investigate, analyse and evaluate a range of existing products which have been produced by combining fabric shapes. Investigate work by designers and their impact on fabrics and products. Use questions to develop children's understanding • Children investigate and analyse how existing products have been constructed. Children disassemble a product and evaluate what the fabric shapes look like, how the parts have been joined, how the product has been strengthen and stiffened, what fastenings have been used and why. • Children investigate properties of textiles through investigation e.g. exploring insulating properties, water resistance, wear and strength of textiles.	**Investigative and Evaluative Activities (IEAs)** Discuss a range of relevant products (such as nightlights, garden lights, alarm systems, security lighting, electronic moneyboxes) that respond to changes in the environment using a computer control program • Investigate sensors such as light dependent resistors (LDRs) and a range of switches such as pushto-make, push-to-break, toggle, micro and reed switches. To gain an understanding of how they are operated by the user and how they work, ask the children to use each component to control a bulb in a simple circuit. Remind children about the dangers of mains electricity. • Children could research famous inventors related to the project e.g. Thomas Edison – light bulb.	**Investigative and Evaluative Activities (IEAs)** • Discuss with the children different types of movement: rotary, oscillating and reciprocating. Make simple models of different types of cams or have toys in which the cam mechanisms can be seen. Use videos, photographs and computer animations of products that cannot be explored through first-hand experience. • Encourage children to look for different types of movement in the home and in school. • Use observational drawings and questions to develop understanding of the products in the handling collection and those that children have researched • Children could research and, if possible, visit engineering and manufacturing companies that are relevant to the product they are designing and making e.g. car engine manufacturers
	Focused Tasks (FTs) • Develop skills of threading needles and joining textiles using a range of stitches. This activity must build upon children's earlier experiences of stitches e.g. improving appearance and consistency of stitches and introducing new stitches. If available, demonstrate and allow children to use sewing machines to join fabric with close adult supervision. • Develop skills of sewing textiles by joining right side together and making seams. Children should investigate how to sew and shape curved edges by snipping seams, how to tack or attach wadding or stiffening and learn how to start and finish off a row of stitches. • Develop skills of 2D paper pattern making using grid or tracing paper to create a 3D dipryl mock-up of a chosen product. Remind/teach how to pin a pattern on to fabric ensuring limited wastage, how to leave a seam allowance and different cutting techniques. • Develop skills of computer-aided design (CAD) by using on-line pattern making software to generate pattern pieces. Investigate using art packages on the computer to design prints that can be applied to textiles using iron transfer paper	**Focused Tasks (FTs)** Through teacher demonstration and explanation, recap measuring, marking out, cutting and joining skills with construction materials that children will need to create their electrical products. • Using a model circuit, demonstrate and enable children to practise using different input and output devices. Allow them to practise methods for making secure electrical connections e.g. using wire strippers, twist and tape connections, screw connections, crocodile clips and connecting blocks. • Remind children how to avoid making short circuits. • Drawing on science understanding, ask the children to explore a range of electrical systems that could be used to control their products, including a simple series circuit where a single output device is controlled, a series circuit where two output devices are controlled by one switch and, where appropriate, parallel circuits where two output devices are controlled independently by two separate switches. • Drawing on related computing activities, ensure that children can write and modify computer control programs that include inputs, outputs and decision making. Test out the programs using electrical components connected to microcontrollers.	**Focused Tasks (FTs)** • Give children pre-cut cams made from MDF or wooden wheels to mount on a piece of board and observe their movement with a follower. • Demonstrate how to use a hand drill safely to make an off-centre cam and position it accurately in a housing. Ensure children secure the wheel with a G-clamp and use a piece of scrap wood under the wheel to avoid drilling through the bench hook or table. Stress the importance of measuring accurately and checking before cutting any holes or gluing. It is important to line up the cam and follower otherwise the mechanism may not work smoothly. How high will the cam lift the follower? • Develop measuring, marking, cutting, shaping and joining skills using junior hacksaws, G-clamps, bench hooks, square section wood, card triangles and hand drills to make cam mechanisms and construct wooden frames or card housings, as appropriate. Demonstrate the accurate and safe use of tools and equipment
	Design, Make and Evaluate Assignment (DMEA) • Set an authentic and meaningful design brief. Children generate ideas by carrying out research using e.g. surveys, interviews, questionnaires and the web. Children develop a simple design specification for their product. • Communicate ideas through detailed, annotated drawings from different perspectives and/or computer- aided design. Drawings should indicate design decisions made, the methods of strengthening, the type of fabrics to be used and the types of stitching that will be incorporated. • Produce step-by-step plans, lists of tools equipment, fabrics and components needed. Allocate tasks within a team if appropriate. • Make high quality products applying knowledge, understanding and skills from IEAs and FTs. Incorporate simple computer-aided manufacture (CAM) if appropriate e.g. vinyl cutting or screen printing. Children use a range of decorating techniques to ensure a well-finished final product that matches the intended user and purpose.	**Design, Make and Evaluate Assignment (DMEA)** Develop an authentic and meaningful design brief with the children. • Ask the children to generate innovative ideas by drawing on research and develop a design specification for their product, carefully considering the purpose and needs of the intended user. • Communicate ideas through annotated sketches, pictorial representations of electrical circuits or circuit diagrams, including the microcontroller, interface box or standalone box to be used. Drawings should indicate the design decisions made, including the location of the electrical components and how they work as a system with an input, process and output. Reference should be made to the control program used and how it will operate to control the inputs and outputs. • Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate, allocate tasks within a team.	**Design, Make and Evaluate Assignment (DMEA)** • Develop an authentic and meaningful design brief with the children. • Children generate innovative ideas by carrying out research including surveys, interviews and questionnaires and develop a design specification for their product, carefully considering the purpose and intended user for their product. • Communicate ideas through detailed, annotated sketches from different views and/or exploded diagrams. The drawings should indicate the design decisions made, including the location of the components, how they work as a system and the appearance and finishing techniques for the product. • Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate, allocate tasks within a team. • Make high quality products, applying knowledge, understanding and skills from IEAs and FTs. Children should use a range of decorative finishing techniques to ensure a well finished final product that matches the intended user and purpose. • Evaluate throughout and the final product in use, comparing it to the original design specification. Critically evaluate the quality

	• Evaluate both as the children proceed with their work and the final product in use, comparing the final product to the original design specification. Critically evaluate the quality of the design, the manufacture, functionality, innovation shown and fitness for intended user and purpose, considering others' opinions. Communicate the evaluation in various forms e.g. writing for a particular purpose, giving a well-structured oral evaluation, speaking clearly and fluently.	• Make high quality products, applying knowledge, understanding and skills from IEAs and FTs. Create and modify a computer control program to enable the product to work automatically in response to changes in the environment. • Critically evaluate throughout and the final product, comparing it to the original design specification. Test the system to demonstrate its effectiveness for the intended user and purpose.	
Assessment questions	What research did you do before making the product? What did you have to consider when you made your design? Who was the audience? • How did you choose what fabric to use? Why was that a good choice? Did you learn any new techniques when making the case? Did it work? What would you change if you made another? What would you keep the same? How could you use the techniques you learned to make something different?	How did you decide what your product should look like? What did you need to include in your design to hit the spec? Why did you need a step-by-step plan? What previous learning did you use in this task? How did you have to modify the product to meet the original design? What worked well? Did it work? How well did it work?	How did you decide what to make? Did you do any research? Which tools did you use for each part of the making? Would there have been a better way of doing any of the steps? How well did the finished product match the design? Which parts matched? Was the car fit for purpose – did it work well? Did anyone else give you any advice? Did the child like the car? How would you improve if you did it again?