

## Mechanical systems: Year 5

### Cams

Design, make and evaluate a shop display for Stanley Yelnats to display his new invention.

#### Key learning in design and technology

##### Prior learning

- 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.

##### 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 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 are accurately assembled and well finished. Work within the constraints of time, resources and cost.

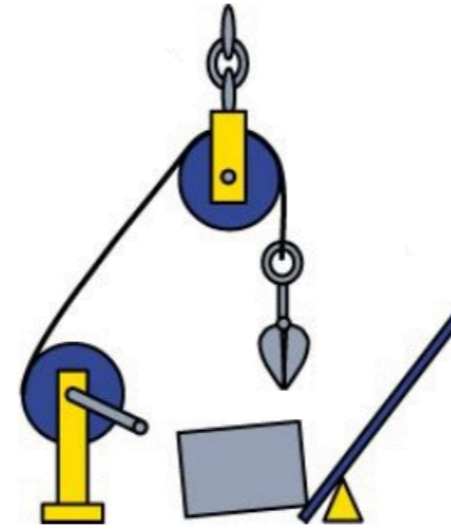
##### Evaluating

- 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

- 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.



#### Key vocabulary

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

#### 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 e.g. *How innovative is the product? What design decisions have been made? What type of movement can be seen? What types of mechanical components are used and where are they positioned? What are the input movement, process and output movement of the system? How well does the product work? Why have the materials and components been chosen? How well has it been designed? How well has it been made?*
  - 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)

- 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)

- 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 of the design, the manufacture, functionality, innovation shown and fitness for the intended user and purpose.

## Electrical systems: Year 5

### Monitoring and control

Design, make and evaluate an alarm for a valuable object for themselves to protect their own belongings.

#### Key learning in design and technology

##### Prior learning

- 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.

##### 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.

##### Making

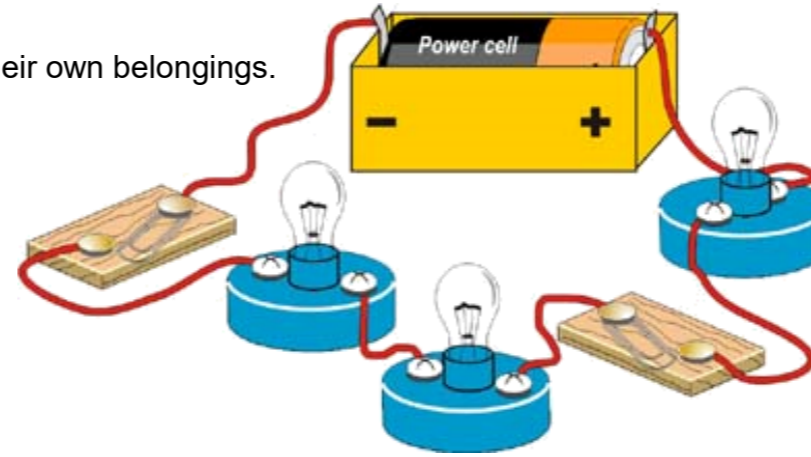
- Formulate a step-by-step plan to guide making, listing tools, equipment, materials and components.
- Competently select and accurately assemble materials, and securely connect electrical components to produce a reliable, functional product.
- Create and modify a computer control program to enable their electrical product to respond to changes in the environment.

##### 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.

##### 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.



#### Key vocabulary

Reed switch, toggle switch, push-to-make switch, push-to-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

#### 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 e.g. *Why is a computer control program used to operate the products? What are the advantages of using computer control? What input devices, e.g. switches, and output devices, e.g. bulbs and buzzers, have been used? Who have the products been designed for and for what purpose.*
- Investigate sensors such as light dependent resistors (LDRs) and a range of switches such as push-to-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.

#### 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, interface boxes or standalone boxes.

#### 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.
- 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.

## Textiles: Year 5

### Combining different fabric shapes

Design, make and evaluate a pair of slippers for an elderly relative to keep their feet warm.

#### Key learning in design and technology

##### Prior learning

- Experience of basic stitching, joining textiles and finishing techniques.
- Experience of making and using simple pattern pieces.

##### Designing

- Generate innovative ideas by carrying out research including surveys, interviews and questionnaires.
- Develop, model and communicate ideas through talking, drawing, templates, mock-ups 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.

##### Making

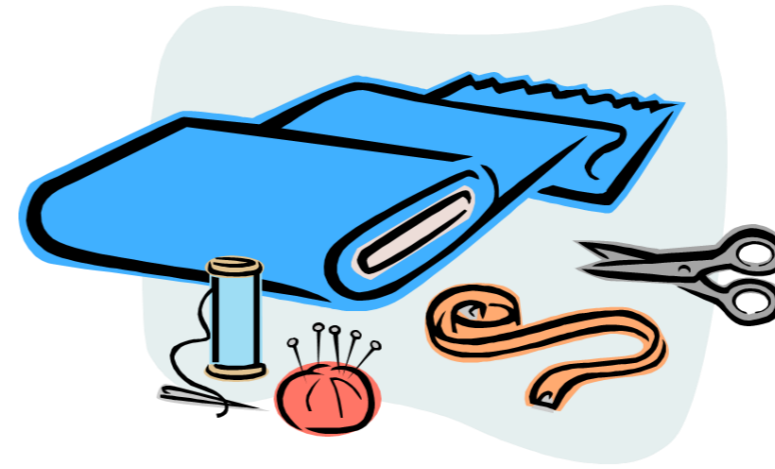
- Produce detailed lists of equipment and fabrics relevant to their tasks.
- Formulate step-by-step plans and, if appropriate, allocate tasks within a team.
- Select from and use a range of tools and equipment to make products that are accurately assembled and well finished. Work within the constraints of time, resources and cost.

##### 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.

##### 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.



#### 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

#### 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 e.g. *Is the product functional or decorative? Who would use this product? What is its purpose? What design decisions have been made? Do the textiles used match the intended purpose? What components have been used to enhance the appearance? To what extent is the design innovative?*
- 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 strengthened 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.

#### 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 2-D paper pattern making using grid or tracing paper to create a 3-D 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.

#### 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. printing on fabric. Children use a range of decorating techniques to ensure a well-finished final product that matches the intended user and purpose.
- 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.