

Year 6 Planning
DESIGN AND TECHNOLOGY
Mechanical Systems - CAMs
 Use mechanical systems in products

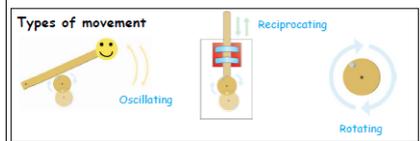
Prior Learning:

- 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 on how to strengthen and stiffen structures.

Lesson 1 - TECHNICAL KNOWLEDGE/MAKE SKILL KNOWLEDGE RECORDED IN KEY SKILLS BOOKS
WALT: Understand how CAMs can be used to produce different kinds of movement

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.*

TYPES OF MOVEMENT
 Show children examples of products that use a CAM mechanism *e.g. a toy with oscillating, rotating or reciprocating movement, a vehicle incorporating cam-driven components.*
 Discuss with the children different types of movement: rotary, oscillating and reciprocating. **Get children to record these types of movement in their books.**



FOCUSED TASKS (FTs)
 Introduce the types of CAMs by giving children pre-cut cams

Lesson 2 – EVALUATING COMPLETE PAGES 2-3 FROM ACCOMPANYING BOOKLET
WALT: Investigate and analyse a range of products

INVESTIGATIVE AND EVALUATIVE ACTIVITIES (IEAS)
 Make simple models of different types of cams or have toys available in which the cam mechanisms can be seen. Use videos, photographs and computer animations of products that cannot be explored through first-hand experience.

EVALUATING A MOVING TOY
 Finding existing toy products that have cams on and **deconstruct** to show the parts. Make example products using construction kits or consumable materials for children to investigate.

Ask children to choose one existing product and make an observational drawing. Alternatively, children could take photographs of the product and annotate (see page 2). Use 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*

Lesson 3 - DESIGNING COMPLETE PAGE 4 FROM ACCOMPANYING BOOKLET
WALT: Develop an authentic and meaningful design brief

CARRY OUT RESEARCH
 Get children to carry out research by completing a survey, interview or questionnaire in order to develop a design specification for their product.

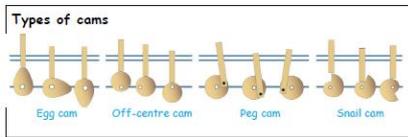
- Purpose of the product
- Intended Users
- Popular themes
- Context of product

Children must carefully considering the purpose and intended user for their product.
LINKED TO 3RD HOUR ACTIVITY

CREATING A DESIGN BRIEF
 Discuss with the children what they could design, make and evaluate? What type of moving toy should they make? A toy with oscillating, rotating or reciprocating movement other – specify.
 In groups, children need to consider the following questions:

1. *What type of moving toy shall I make?*
2. *What will be its purpose? business, entertainment, pleasure, play, educational, interests and hobbies, other – specify*

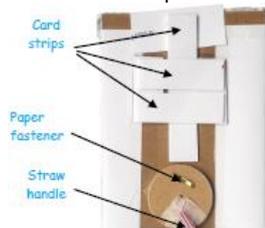
made from MDF or wooden wheels to mount on a piece of board and observe their movement with a follower.



Children to draw an example of these in their key skills books.

MAKING A TEACHER AID

Get children to make an easy teaching aids by mounting different CAM wheels on cardboard, foam board or corrugated plastic sheet. Card or foam wheels are easy to cut to different shapes.



When making a cam and lever mechanism, remember the distance between the cam and the pivot point of the lever will affect the amount of movement, with more movement close to the pivot.

ATTACH MODEL TO PAGE 1

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?



EDWARD DE BONO THINKING HATS

Next, ask children to record answers to these questions against **Edward De Bono Thinking Hats**. Explain what each hat represents.

- **WHITE: Facts**
- **RED: Feelings**
- **BLACK: Problems**
- **GREEN: Creativity**
- **YELLOW: Benefits**
- **BLUE: Process**

Encourage children to look for different types of movement in the home and in school. Children could print images from the internet to add to their 'mood' board and annotate.

3. *Who will use it? peers, siblings younger children, older children, shoppers, specific individuals, target groups, company, other – specify*
4. *What type of movement will it have? Will it be a moving vehicle or be stationary and have moving parts?*
5. *Which materials will I use to make it?*
6. *How will I make it fit for purpose?*

Now model how to develop an authentic and meaningful design brief with the children based on their research - this should consist of no more than seven criteria their product must meet.

Show children examples of design brief and explain that the design brief must concentrate on design outcomes (like size, function) not specific product details (like colour).

The design brief will allow children to focus on the problem they are solving and what they are trying to achieve from the product.

Develop a project title from the results:

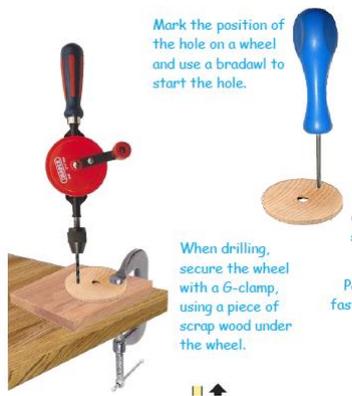
Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).

Lesson 4 - TECHNICAL KNOWLEDGE/MAKE KNOWLEDGE TO BE RECORDED IN KEY SKILLS BOOKS

WALT: Develop measuring, marking, cutting, shaping and joining skills

FOCUSED TASKS (FTs)

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?*



When making a cam and slider mechanism, position the cam, slider and guides correctly. Measure where the cam will go to at the base of its cycle so that it does not overlap the bottom of the board. The guides should be positioned so that there is enough clearance for the cam to turn at the top of its cycle.

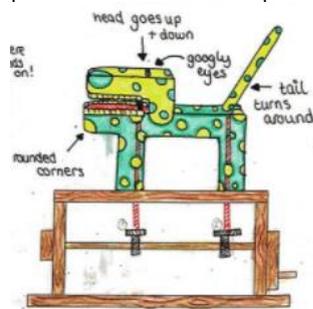
Lesson 5 - DESIGNING COMPLETE PAGES 5-7 FROM ACCOMPANYING BOOKLET

WALT: Communicate ideas through annotated sketches

In this lesson, model how to communicate ideas through detailed, annotated sketches.

WORKING DRAWINGS

Ask children to create initial design sketches of their design. Children annotate their working drawing explaining their thought process and techniques.



The drawings should indicate the design decisions made, including the location of the **components, materials, dimensions, and the appearance and finishing techniques** for the product.

Children to consider the following questions:

*Which materials will I use to make it?
How will I make it fit for purpose?*

ISOMETRIC PROJECTION

Model to the children how to represent a 3D object in two dimensions on paper through an isometric projection. When drawing, children need to consider:

- The relationship between the lengths of the edges
- The angles between them
- Parallel and perpendicular lines

Lesson 6 – MAKING COMPLETE PAGES 7-9 FROM ACCOMPANYING BOOKLET

WALT: Produce a step-by-step plan and lists of tools, equipment and materials

MAKING A PROTOTYPE

Ask children to consider the following questions when making their prototype:

- *How will I make the body or housing for the moving parts?*
- *What tools and materials will I need?*
- *What order will I work in?*
- *What constraints am I working to?*
- *Do I need to change anything?*
- *Will my product meet the needs, wants and interests of the user group?*

Using corrugated card and straws, children should make a high quality prototype, applying knowledge, understanding and skills from **Focused Tasks (FTs)**. Ask children to explore a range of decorative finishing techniques to ensure a well-finished prototype that matches the intended user and purpose.



Example prototype

RECORD THE MAKE

Get children to produce a detailed, step-by-step plan, listing tools and materials. Children can take photographs

CONSTRUCT CARD HOUSING

Remind the children how to construct a wooden frames or card housings using their skills gained from *Year 5: Frame Structures*.

Model joining thin sections of wood using card strips to make joints.

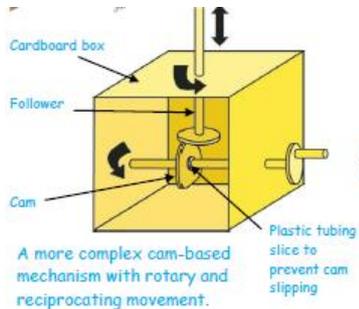


Attach thick corrugated card to 5 of the faces, leaving one side open to view the CAM mechanism.

Note: If time is an issue, then cardboard housing can be purchased.

Demonstrate the accurate and safe use of tools and equipment. Allow children to explore combining rotary and reciprocating movement.

Allow children to make a multilink structure, representing the card housing, to support their understanding of 3D drawing.



USING COMPUTER-AIDED DESIGN

Extend children to develop their computer-aided design (CAD) skills by using such as Techsoft 2D Primary or Microsoft Word to generate and modify appearance and finishing techniques for the product. Children should recognise that designs can be easily modified and repeated on the computer without the need for a physical product.

at each stage of the make [see page 7 of booklet].

Ask children to explore a range of textiles to compare their properties in terms of water resistance and strength. They could test how the use of a textiles cover can strengthen a structure. Discuss the impact of the technique on water resistance, strength and appearance.

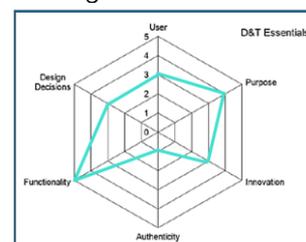
LINKS TO SCIENCE

CRITICALLY EVALUATE THE DESIGN

Encourage children not to be afraid to include any failed designs into displays of final products. Include evaluations of why the designs didn't work and how children would make them work. This links to design in the real world and the concept that designs don't always work first time around.

Get children to consider the views of others to improve their work and revise their design criteria.

Discuss the model below and key terminology [REFER TO PAGE 14 in booklet]. Show children how to evaluate against the six essential characteristics by giving it a score from 0-5, with 0 being the lowest score.



Note:

One Project booklet is required per child for the entire 6-week unit. Preferably A3 size.

During the first 3 weeks of the modelling teaching sequence, children will complete the first half of their booklet outlined in the plans above. When creating the design brief and communication of ideas, children must decide in their groups on a product they would like to manufacture.

Lesson 4 requires all children to make a cardboard housing for their finished product.

Lesson 6 requires children to make a prototype of their chosen design using materials [paper, card and straw].

Throughout the application weeks, children will work in their groups and complete the second half of their project booklet [pages 10-15]. Outlined below are the tasks children are required to complete.

Application of Skill

TASK SHEET

Mechanical Systems - CAMs

Use mechanical systems in products

1. Make a high quality product, applying knowledge, understanding and skills from IEAs and FTs. **Make a product using a CAM.** Include a photograph and drawing of the finished product. [page 11-12]
2. Compare the final product to the original design specification. [page 12]
3. Test products with the intended user, where safe and practical [page 13]
4. Critically evaluate the quality of the design, manufacture, functionality and fitness for purpose. [page 14]
5. Consider the views of others to improve your work using Thinking Hats [page 15]
6. **ENGLISH TASK - Investigate famous manufacturing and engineering companies relevant to the project e.g. Alec Issigonis, George Stephenson, Nikola Tesla, James Watt. Karl Benz, Thomas Edison.**