



Knowledge and Skills Mind Map (DT)

Year 6 — Summer Term

Knowledge - 
Skill - 

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Mechanical Systems:

Pulleys or Gears

'Can I design, make and evaluate a mechanical system using pulleys or gears for a specific user and purpose?'

1. Can I investigate, analyse and evaluate existing products that use pulleys or gears?

- **Prior Knowledge (Year 4 Summer):** Know that simple mechanisms (e.g. levers) can help make work easier by changing movement. Created a pop up page in Year 4.
- **Vocabulary:** gear, pulley, axle, rotate, mechanism, force, direction, speed, system, function, user, purpose, evaluate
- Know that mechanical systems use components such as gears or pulleys to transfer motion (e.g. turning a handle moves another part)
- Know that gears can change the speed, direction or force of movement (e.g. a large gear turning a small gear increases speed)
- Know that pulleys use a wheel and rope to lift or move objects more easily (e.g. raising a load using less effort)
- Know that products are designed for a specific user and purpose (e.g. a toy with gears or a flag pulley system for lifting)
- Know that mechanisms are used in everyday products to make them functional (e.g. cranes, bikes, lifts, toys)
- Know that analysing existing products helps us understand how they work and how they could be improved
- Know that working safely is important when handling simple mechanisms (e.g. avoiding trapping fingers in moving parts, using materials safely and sensibly)

Task: Explore a range of everyday products and simple models that use gears or pulleys (e.g. toy cars with gears, a simple pulley made with string and a spool, classroom objects like blinds or flag systems), guiding discussion on who the product is for (e.g. children, workers, households) and its purpose (e.g. to lift, move or create motion). Identify key components such as gears, axles or pulleys and explain how they affect movement. **In books,** children draw an annotated sketch of one product or simple model, labelling components (e.g. gear, pulley, axle) and explaining how the mechanism works with notes such as "this gear makes the movement faster" or "this pulley helps lift the load more easily."

Evaluating: Investigate, analyse and evaluate existing everyday products and existing or pre-made toys that incorporate gear or pulley systems

Technical Knowledge:

- Understand that mechanical and electrical systems have an input, process and an output.
- Understand how gears and pulleys can be used to speed up, slow down or change the direction of movement.
- Know and use technical vocabulary relevant to the project.

2. Can I explore how pulleys or gears change direction, speed or force?

- **Prior Knowledge:** Know that gears and pulleys are used in mechanical systems to transfer movement.
- **Vocabulary:** gear, pulley, axle, rotate, mechanism, force, direction, speed, system, function
- Know that gears change the direction of movement (e.g. two gears together can rotate in opposite directions)
- Know that gears can change speed depending on their size (e.g. a small gear turning a large gear slows movement, a large gear turning a small gear speeds it up)
- Know that pulleys can change the direction of force (e.g. pulling down on a rope lifts an object up)
- Know that pulleys can make lifting easier by reducing the effort needed (e.g. using more than one pulley spreads the load)
- Know that mechanisms can be tested to see how effectively they work (e.g. observing speed, direction or ease of movement)
- Know that working safely is important when exploring mechanisms (e.g. keeping fingers away from moving parts, securing materials and using simple tools carefully)

Task: Using simple classroom materials (e.g. cardboard wheels, bottle tops, string, pencils for axles), children build and test basic gear or pulley systems. Guide discussion on how changing the size of gears or arrangement of pulleys affects direction, speed and effort. Encourage children to experiment by swapping components and observing outcomes.

In books, children draw and annotate at least two different mechanisms (e.g. a pair of gears and a simple pulley), labelling components (gear, axle, pulley, string) and explaining what happens, with notes such as "this gear makes it spin faster" or "this pulley changes the direction of force."

Technical Knowledge:

- Understand that mechanical and electrical systems have an input, process and an output.
- Understand how gears and pulleys can be used to speed up, slow down or change the direction of movement.
- Know and use technical vocabulary relevant to the project.



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3. Can I develop a design specification for a mechanical system?

- **Prior Knowledge:** Know that pulleys and gears can change direction, speed and force in a mechanical system.
Vocabulary: design specification, design brief, user, purpose, function, system, gear, pulley, axle, mechanism
- Know that a design brief explains what the product is and who it is for (e.g. a pulley system to lift an object for a classroom task or a gear system for a moving toy)
- Know that a design specification outlines what the product must do to be successful (e.g. must include a working mechanism, must move in a specific direction, must be suitable for the user)
- Know that mechanical systems are designed to perform a function (e.g. lifting, moving or transferring motion)
- Know that design decisions are based on how mechanisms work (e.g. choosing gears to increase speed or pulleys to make lifting easier)
- Know that ideas can be developed and communicated using simple annotated diagrams (e.g. showing how components connect and move)
- Know that working safely is important when planning a mechanical product (e.g. selecting appropriate materials, avoiding sharp edges and ensuring components are secure)

Task: Discuss the design brief of creating a mechanical product using gears or pulleys, identifying the user (e.g. children using a toy, someone needing to lift an object) and purpose (e.g. to move, lift or transfer motion). Guide children to develop clear design criteria such as including a working mechanism, being stable and suitable for the intended use. **In books,** children write a design specification (e.g. must include a gear or pulley system, must create movement, must be stable and safe, must be suitable for the user), then produce an annotated diagram of their idea, labelling components such as gears, pulleys, axles and explaining choices with notes such as “this gear will increase speed” or “this pulley will help lift the load.”

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.

Technical Knowledge:

- Understand that mechanical and electrical systems have an input, process and an output.
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4. Can I plan and make a mechanical system product?

- **Prior Knowledge:** Know that a design specification explains how a mechanical system should work and what it must include.
- **Vocabulary:** mechanism, gear, pulley, axle, system, function, force, direction, speed, components, design specification
- Know that a plan helps organise the steps needed to make a product (e.g. building the frame before adding the mechanism)
- Know that materials and components must be selected carefully to create a working system (e.g. using card, string or bottle tops for gears or pulleys)
- Know that mechanical components must be assembled accurately for the system to work (e.g. gears must connect correctly, pulleys must be aligned)
- Know that mechanisms must be secure and stable to function effectively (e.g. axles fixed firmly so they can rotate smoothly)
- Know that working safely is important when constructing products (e.g. using scissors carefully, securing parts properly and avoiding loose moving parts)

Task: Recap design specifications and annotated diagrams. Support children in creating a clear step-by-step plan, listing materials and components (e.g. cardboard, string, dowel/pencils for axles, bottle tops). Children then build their mechanical product, assembling parts carefully and testing throughout to ensure the system works (e.g. checking movement, rotation or lifting action). **In books,** children record their step-by-step plan and produce a labelled diagram of their final product, identifying key components (e.g. gears, pulleys, axles) and explaining how the system works, with notes such as “this gear makes the movement faster” or “this pulley helps lift the object.”

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.

Technical Knowledge:

- Understand that mechanical and electrical systems have an input, process and an output.
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5. Can I evaluate my mechanical system product and suggest improvements?

- **Prior Knowledge:** Know that a mechanical system can be made by assembling components and following a plan.
- **Vocabulary:** evaluate, mechanism, system, function, force, direction, speed, user, purpose, improve
- Know that evaluation involves comparing a product to its design specification (e.g. checking if the mechanism works as intended)
- Know that a mechanical system should function effectively for its user and purpose (e.g. lifting, moving or rotating as designed)
- Know that products can be tested to check performance (e.g. observing movement, speed, direction or strength of the mechanism)
- Know that identifying problems helps improve a design (e.g. weak joins, misaligned gears, loose components)
- Know that improvements can be made by modifying components or construction (e.g. strengthening structures, adjusting alignment or changing sizes of gears/pulleys)
- Know that feedback from others can help evaluate a product (e.g. comments on how well it works or how easy it is to use)
- Know that working safely is important when testing products (e.g. keeping hands clear of moving parts and ensuring components are secure)

Task: Test the completed mechanical products, observing how effectively the system works (e.g. how smoothly gears rotate, whether a pulley lifts an object successfully, whether movement is controlled). Guide discussion on how well each product meets its intended user and purpose. **In books,** children write a detailed evaluation of their product, explaining how well it meets the design specification, what works well (e.g. "the gears turn smoothly and increase speed") and what could be improved (e.g. "I need to fix the axle more securely to stop slipping" or "I would change the gear size to improve movement").

Evaluating:

- 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:

- Understand that mechanical and electrical systems have an input, process and an output.
- Know and use technical vocabulary relevant to the project.