

**WIND ENERGY IS  
INEXHAUSTIBLE AND  
INFINITELY  
RENEWABLE. IT'S  
SIMPLE BUT IT'S  
TRUE.**

## DT Knowledge Organiser – Mechanical Systems

### Lower KS2: Year 4

**Opportunities for teaching Diversity, Equality & Cultural Capital:**  
Visit the Visit the model of Ugthorpe windmill at St. Anne's hall in Ugthorpe.  
Visit Redcar to see the off-shore wind farm.



#### Key Knowledge about Mechanisms

Wheels, Axles and Gears.

Mechanisms are the parts that make something work.

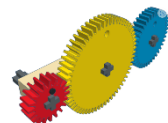
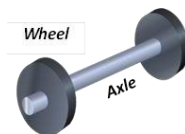
Mechanisms are all around us! Most objects that help us in our lives are made up of different mechanisms.

Wheels, Axles and Gears are mechanisms that help things to move.

Wheels are circular objects that roll on the ground, helping vehicles and other objects to easily move.

Axles are rods that help wheels to rotate. The wheel can either rotate freely on the axle, or be attached to (and turn with) the axle.

Gears are wheels with cogs (teeth) on. Gears transfer energy from one part of a machine to another. Gears can change the direction, speed or force (power) of movement.



#### What you will have learnt by the end of this unit.

- ❖ To understand and use electrical systems in their products
- ❖ To develop design criteria, based on research, to design functional, appealing products aimed at individuals or groups
- ❖ To select from a wide range of tools and materials to ensure a high-quality finish
- ❖ To consider the views of others to evaluate their work and make improvements based on this.

#### What you have already learnt in Yr3.

- To apply understanding of how to strengthen, stiffen and reinforce more complex structures
- To use simple research methods to inform the design of products
- To select from a wider range of tools and equipment to perform practical tasks with increasing accuracy
- To select from and use a wider range of materials and components according to their properties
- To evaluate their ideas and products against their own design criteria to make improvements

#### Recall and Remember:

Windmills are an example of wheel-and-axle machines where the force is applied to the wheel, then transferred to the axle and then to the gears.

Windmills can be used to convert wind power to mechanical or electrical energy.

Connected gears move in opposite directions – clockwise & anticlockwise.

Gears can be used to change the direction, speed or force of a movement.

Smaller gears rotate faster than larger gears.

#### Quick Quiz

*What practical mechanical purposes can windmill winding mechanisms be used for?*

*What are cogs?*

*Do large gears or small gears create more force?*

*What is the difference between a vertical axle and a horizontal axle?*

### Key Designing Skills I will learn/use

You need to think about the purpose of your product. What mechanical function does it need to be able to perform?

**Framework:** The upright structure of your windmill should be stable - firmly secured to a base. It must be strong and rigid enough to support the wheel and axle / sails when they are turning.

**Wheel:** Consider what to make your sails from, they need to be strong enough to catch the wind energy without bending. How are you going to attach the sails to the axle to ensure both parts rotate?

**Axle:** Consider what length you will need your axles to be. How will your axles be supported? What will you use for to hold them in place?

**Gears:** What size gears will you need? How will you attach the gears to your axles? How will you ensure the horizontal and vertical gears are connected?

### Key Building & Evaluating Skills I will learn/use

#### Building:

The framework could be made from cardboard boxes, plastic bottles, plastic cups. Remember this needs to be quite rigid.

The sails could be made from folded paper, card or plastic.

The axles could be made from straws, doweling or plastic.

Sail Wheel: Think about the size and material of your sail wheel and how to secure it to horizontal axle.

Gears: You could try making your own gears out of strong or corrugated cardboard or you could use plastic gears from a modelling set.



#### Evaluating:

How well does your windmill mechanism work?

Does it move using wind-power? Can the horizontal axle rotate to lift a weight?

Do the gears transfer the horizontal rotation to a vertical rotation?

Does it move smoothly? Does it meet its purpose?

What could you do to improve your design or mechanism?

### Key Vocabulary

Mechanism	The moving parts that make an object function
Wheel	A circular object that revolves on an axle
Axle	A rod or spindle passing through the centre of a wheel
Gear	A wheel with cogs on.
Horizontal	A line or object that is level from right to left
Vertical	A line or object that is straight from top to bottom
Rotate	To spin around a central point
Transfer	To move from one place to another
Rigid	Firmly fixed, stiff
Stable	Not likely to fall or give way
Design	To plan a project to make a new structure or product.
Experiment	Try out new ideas and methods.
Technique	Use a particular method or skill.
Develop	Show improvement and change.
Evaluate	Express an opinion of the merits and faults of a final product.
Present	Show & demonstrate a piece of work so it can be appreciated by an audience.

### My skills and Knowledge that I may use from other subjects

- Apply measuring skills and knowledge of position to DT products.
- Develop understanding of weather, environmental needs and climate change – Geography and Citizenship.

### What you will have you learnt by the end of LKS2

To show that my design meets some set criteria.

To follow a step-by-step plan, choosing the right equipment and materials.

To design a product and make sure that it looks attractive.

To select the most appropriate tools and techniques for a given task.

To work accurately to measure, make cuts and holes.

To use adhesives to secure materials together securely.

To design fair tests to evaluate my models/prototypes.

To draw labelled diagrams of my models.

To suggest improvement to my own work and that of others.