

## Leonardo Mechanical Systems

**SECONDARY** Level 5 Design Creativity Technology

### Leonardo's Mechanical Systems

Time Frame: 1 hour > (1 planned activity + teacher activities) + LdV exhibition visit

#### Suitable VELS Outcomes

#### Communication

LEVEL 5 Listening, viewing and responding and Presenting

##### Listening, viewing and responding

Students modify their verbal and non-verbal responses to suit particular audiences. They interpret complex information and evaluate the effectiveness of its presentation. When responding, they use specialised language and symbols as appropriate to the contexts in which they are working. They consider their own and others' points of view, apply prior knowledge to new situations, challenge assumptions and justify their own interpretations.

##### Presenting

Students use the communication conventions, forms and language appropriate to the subject to convey a clear message across a range of presentation forms to meet the needs of the context, purpose and audience. They provide and use constructive feedback and reflection to develop effective communication skills.

#### Design Creativity Technology

LEVEL 5 Investigating and designing, Producing, Analysing and evaluating

##### Investigating and designing

At Level 5, students use various strategies and sources of information to investigate and research a range of factors relevant to more sophisticated design briefs to which they have contributed. During the design process they clarify their understanding of design brief requirements and their design ideas by gathering, responding to and providing feedback to others. They develop evaluation criteria from the design brief to inform their judgments during the design process. They use a variety of drawing and modelling techniques to visualise design ideas and concepts. Students demonstrate understanding of design elements and principles and use appropriate technical language.

##### Analysing and evaluating

At Level 5, students select appropriate equipment and techniques to safely test and evaluate the performance of their products/systems. They suggest modifications to improve their products/systems in light of evaluation of their performance, function and appearance. They recommend improvements to the performance, function and appearance of others' product/systems. They describe and analyse the social and environmental impacts of their own and others' designs, products and technological systems.



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## Leonardo Mechanical Systems

### Thinking Processes

LEVEL5 Reasoning, processing and inquiry. Creativity and Reflection, evaluation and metacognition.

#### Reasoning, processing and inquiry

At Level 5, students use a range of question types, and locate and select relevant information from varied sources when undertaking investigations. When identifying and synthesising relevant information, they use a range of appropriate strategies of reasoning and analysis to evaluate evidence and consider their own and others' points of view. They use a range of discipline-based methodologies. They complete activities focusing on problem solving and decision making which involve an increasing number of variables and solutions.

#### Creativity

At Level 5, students apply creative thinking strategies to explore possibilities and generate multiple options, problem definitions and solutions. They demonstrate creativity, in the ways they engage with and explore ideas in a range of contexts.

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Download Student Activity sheets on Leonardo's gears to accompany Exhibition visit.

For Leonardo teaching resources: refer to School Programs Resource list

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### Context

This unit of work is designed as an investigation tool to accompany **any design brief that is based on mechanism use.**

Since Leonardo could not depend on any 'prime movers' such as gas, electricity or the internal combustion engine Leonardo investigated ways of converting reciprocating motion to rotary motion, a basic need for all machinery. To achieve this he experimented with ratchets, gears, cams, pulleys, cranks and linkages, and racks and pinions. He harnessed wind power, muscle power and power in springs and flywheels.



## Leonardo Mechanical Systems

### Student Challenge

Learn about different kinds of mechanisms in classroom and in practice at Leonardo da Vinci's machines exhibition.

Investigate the way Leonardo's inventions convert one kind of motion to another. Reflect on what his designs have become today and the types of energy that drive them. Incorporate investigation results into design and make task.

### Teacher overview

Leonardo da Vinci is an eminently suitable designer/inventor to teach students about mechanisms from. Many of his machines are interactive. All the machines at the LdV exhibition use 'raw' mechanisms that Leonardo developed in his sketchbook and may have modelled. Many of his inventions were not built during his lifetime. Visiting the exhibition will provide students with an insight into:

- the vast and prolific range of ideas Leonardo had to solve problems
- the methods of movement that he directed in his designs, when no gas or electricity was available.

It is envisaged that the findings students bring back from the LdV exhibition can be integrated into a design and technology task. Students might be required to design a moving device that uses 2 simple mechanisms.

Here are some possible basic design briefs:

- **Design and make an automata**

Design and make an automata (or mechanical toy) that has at least two moving parts. It must be able to fit inside a standard shoebox (120mm x 300mm x70mm). It must be visually exciting, funny, intrigue viewers and hold their attention for at least a minute. It could have a Leonardo theme.

Mechanisms used: cam,crank,gear,pulley,ratchet, lever

*(In early 1500's Leonardo da Vinci made a lion in honour of king Louis XII. It advanced towards him, stopped, opened its chest with a claw and pointed to the fleur-de-lis coat of arms of France. It is possible that Leonardo may have made other automata but records are very sketchy.)*



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- Design and make a mini buggy

The buggy should incorporate use of gears, be no longer than 200mm and take part in a class race.

- Design and make a spring powered motorised water vehicle

### Activity 1

#### Pre exhibition

Introduce Leonardo da Vinci to students and his inventions.  
What kinds of energy were available in Italy in the 1480's?  
Discuss.

Introduce types of mechanisms.

(bring in examples of devices which use gears, rack and pinions, levers etc.)

Students identify different kinds of mechanisms and motion.

**Types of mechanisms: cam, crank, gears, pulley, ratchet & lever**

**Types of motion: linear, reciprocating, rotary, oscillation, intermittent & irregular**

Students might role-play actions of each device (your call!) for other groups to identify.

Set a quiz for students using pictures of larger mechanisms on types of motion used.

Introduce design brief of your choice.



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