

# Mechanical systems

## Level

The target groups are KS3 and KS4 students of Engineering, Design and Technology.

## Resource aim

To enable students to learn about **mechanisms and mechanical systems** in order that they may solve problems and design and make products that include mechanisms.

## Learning objective

The objective is that students will know:

- that a mechanical system is a set of physical components that convert an input motion and force into a desired output motion and force
- that mechanical systems often comprise of a number of subsystems

## Resource description

The resources consist of Flash animations, HTML and PDF teaching resources and a PDF lesson plan.

The teaching resources cover the topics detailed in the learning objectives and include an interactive exercise about the systems and subsystems found on a bicycle.

The lesson plan guides the teaching of mechanisms systems and control. The lesson plan suggests a teaching methodology of Presentation, Practice, Production (PPP). The introductory lesson consists of a lead-in, presentation, controlled practice, free practice, production, review and follow on activities.

## How to use the resource

Use the lesson plan to guide students through activities that help them develop a thorough understanding of mechanisms and mechanical systems.

Differentiation may be achieved through:

- the pace of learning
- the amount of support given to students (by guided questions from the teacher,
- support from peers during student - student interaction.

## Follow on activities

1. Students should learn about:

- Cams
- Chain and sprocket
- Couplings
- Crank and slider
- Friction, lubrication and bearings
- Gears
- Levers
- Linkages
- Moments
- Motion
- Pulleys
- Ratchet and pawl
- Screws
- Springs

2. Students should analyse mechanical systems, i.e. study mechanical systems to understand what the system does, how it's made, what it's made of etc.

3. Students should record analysis findings by drawing process diagram of each system and subsystem.

4. Students should apply their knowledge to design and build mechanical systems using mechanisms kits and/or mechanical components and resistant materials.

## Lesson Plan: Mechanical systems (Lead-in)

Required resource: Mechanical\_systems.html on interactive whiteboard,  
GCSE mechanisms questions, e.g. AQA Engineering, Unit 1, Written Paper, Fri. 23 May, 2014  
Optional resource: a bicycle

T = Teacher

S = Student

Lesson length approx. 50 mins + extra for follow on activities

Stage	Activity	Reason	Interaction	Time
Lead-in	Teacher shows GCSE question AQA Engineering, Unit 1, Written Paper, Fri. 23 May, 2014 or similar. <i>(Download from AQA web site)</i>	To give students a reason for learning about mechanisms.	T - S	5 mins
Presentation	Teacher shows Lead-in_exercise.html on interactive whiteboard and asks students to identify the various mechanisms found on a bicycle. Teacher elicits that the various mechanisms work together in a complex mechanical system. If a bicycle is available, students study the various mechanisms on a bicycle.	Teacher shows range of mechanisms used in a bicycle mechanical system; illustrates range of mechanisms knowledge required.  Elicits notion of systems and subsystems.	T - S	5 mins
Controlled practice	Teacher elicits: <b>input, process, output</b> ; and uses examples from the bicycle mechanical system, e.g. bicycle steering: input – human effort; process/control: moves Class 1 lever; output: bicycle front forks and wheel turns.	Students identify subsystems on a bicycle.	T - S	2 mins
Free practice	Students use computers to view interactive bike animation and work out input, process, output for each bicycle mechanism. Students read the notes about systems and subsystems and feedback and control.	Students apply knowledge to identify systems and subsystems on a bicycle.	Individually S - S	35 mins
Production	Students draw process diagrams for the various systems and subsystems on a bicycle. Teacher issues mechanical systems PDF for students' records.	Students practice drawing process diagrams illustrating the mechanical systems they've identified on a bicycle.	S - S	
Review	Teacher questions students about systems and control.	To inform teacher and students about students' levels of understanding of mechanical systems .	T - S	3
Follow on activities	<ol style="list-style-type: none"> <li>1. Students view mechanisms animations and read mechanisms theory notes.</li> <li>2. Students analyse mechanical systems.</li> <li>3. Students build mechanical systems using kits, components and resistant materials.</li> </ol>	To develop students knowledge of mechanisms and mechanical systems.	Individually S - S	