

Level 3 Cambridge Technicals in Engineering: Diploma in Engineering

Ideal for ambitious, talented students who want to pursue a technology-based career.

Future Apprenticeships and Careers

Product Design

Engineering Sectors including Aviation,
Automotive, Renewable Power etc.

Technician & Maintenance

Civil Engineering

Building Services

Architecture

1.7 million employed in Engineering



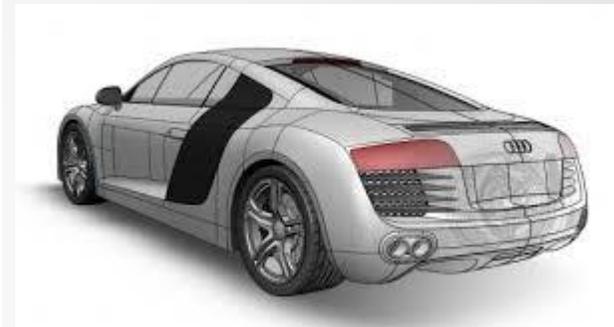
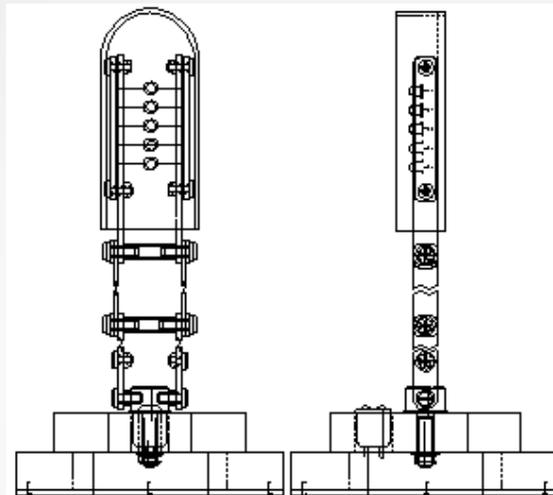
Materials Technology & Science



Mechanical Systems



Engineering Design



2D and 3D CAD

Production and Manufacturing



Focus on Learning Software

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- Introduction
- Motion
- Levers
- Linkages
- Gear systems
- Ratchet and pawl
- Pulley systems
- Sprocket and chain
- Lifting systems
- Cams and followers
- Crank and slider
- Screw threads
- Multiple choice
- Reference

Efficiency

Search this resource [v] Search keywords... Search

A machine which moves a load by a certain distance can be said to be doing 'work'. In real machines, more work (or energy) is put in than is got out.

The efficiency of a machine is the ratio of the useful output of work to the total input of work.

Efficiency can also be expressed in terms of mechanical advantage and velocity ratio.

Click here for a worked example.

In real life mechanisms never run 100% efficiently. This is because parts twist, bend and rub against each other making them less efficient.

$$\text{Efficiency} = \frac{\text{work out}}{\text{work in}} \times 100\%$$

$$\text{Efficiency} = \frac{\text{mechanical advantage}}{\text{velocity ratio}} \times 100\%$$

<http://www.focuslearning.co.uk/u/1571/xqrmnvFyuFraBjFCxErfidjgBEorjgzbx>

Design Technology Resources

View Pack Sitemap Search the resources... Search

- NEW Smart, Modern & Composite Materials
- NEW Videos DT Video Library
- DT Materials Database
- KD Fittings & Flatpack Furniture
- Mechanical Toys
- Focus on Mechanisms
- Focus on Metals: Manufacturing Processes
- Focus on Wood Joints
- Graphic Products: Printing Processes
- Focus on Plastics: Manufacturing Processes
- Focus on Product Analysis
- Focus on the Food Industry

Design Technology

Focus on Mechanisms 3D

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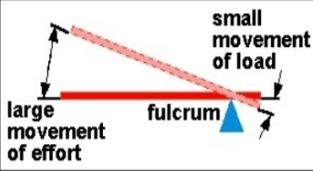
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- Introduction
- Class 1
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- Ratchet and pawl

Levers: Introduction

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A lever is a rigid rod pivoted about a fixed axis called a fulcrum. Levers are used to change the direction of motion of a force, and to magnify or diminish it.



There are three classes of lever. Each class has the fulcrum, effort and load arranged in a different way.

The most commonly found types of lever are Class 1 and 2 as they provide **mechanical advantage**. This means that with a small effort you are able to move a large load.

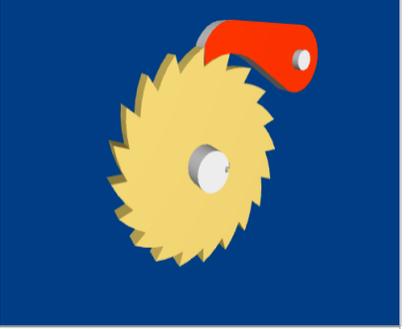
- Introduction
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Ratchet and pawl

Search this resource [v] Search keywords... Search

A ratchet is a wheel with saw-shaped teeth around its rim. The ratchet engages with a tooth shaped lever called a pawl.

[How to use the 3D simulation](#)



The purpose of a ratchet and pawl is to allow a shaft to rotate in one direction only and prevent rotation in the opposite direction.

Your Brief Today:

You are to investigate a **range of mechanisms** as part of a **product study** linked to the **Summer Tasks**.

Task 1

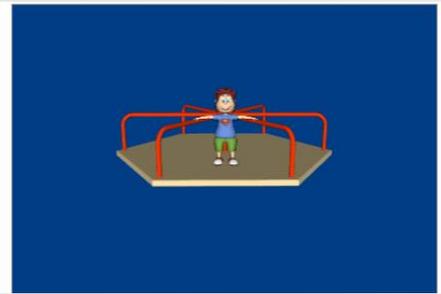
You must start to build up a bank of information in a **portfolio** to show that you have covered the full range of mechanisms on the specification list . This can be in electronic form to be saved in your Public Folder later in the course.

Task 2

As part of the **product study** you should:

- a) Analyse and disassemble(if possible) the product.
- b) Identify any types of motion and transmission of movement.
- c) Look at ways to calculate the movement of working parts.
- d) Study and consider concepts such as mechanical advantage, velocity ratio, efficiency, speed, RPM, torque, etc.
- e) Identify materials and manufacturing processes.

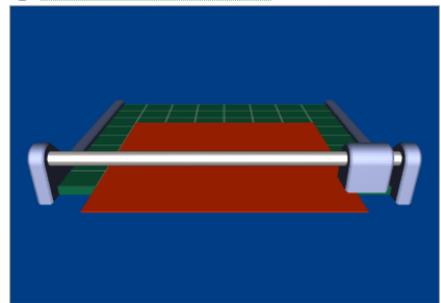
Types of Motion



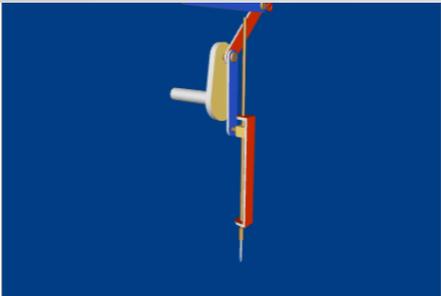
ROTARY



OSCILLATING

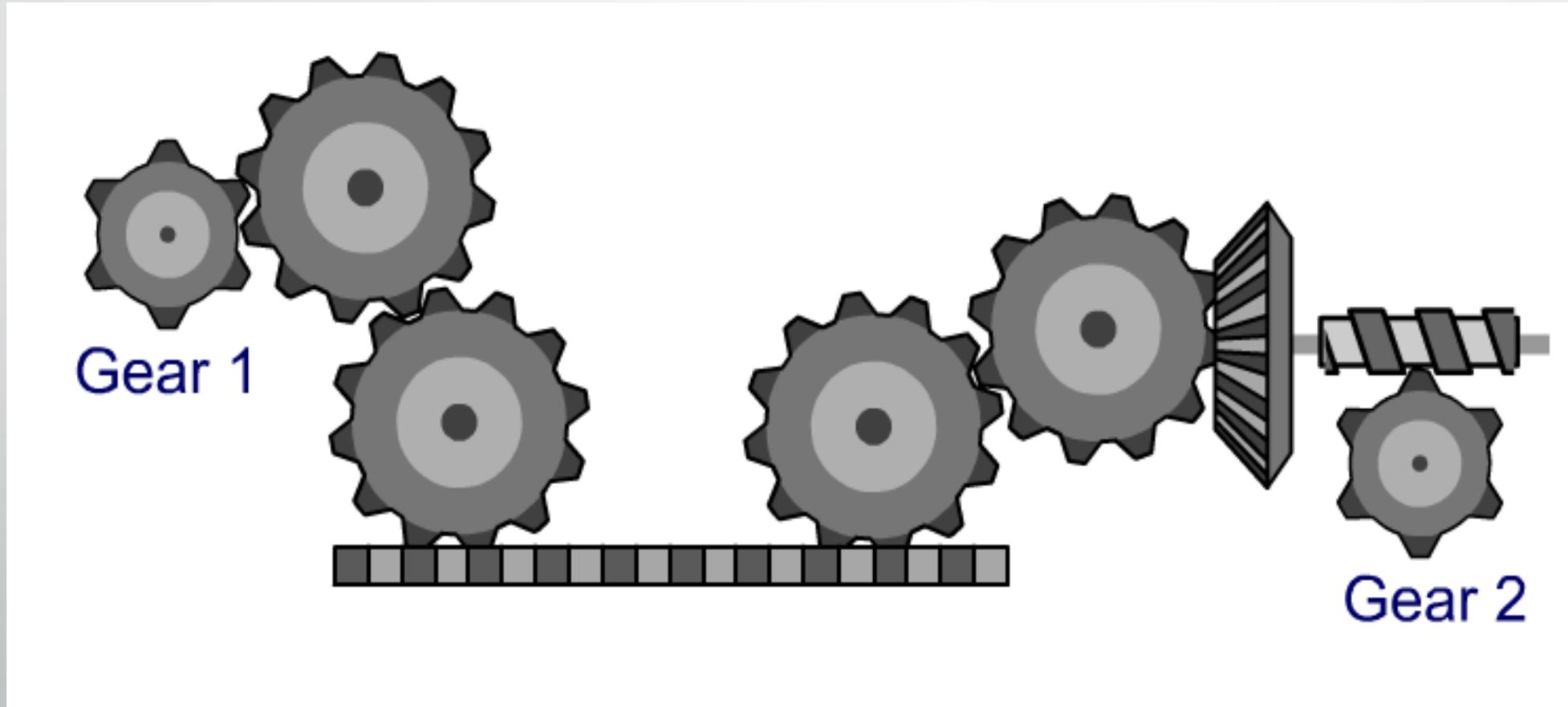


LINEAR

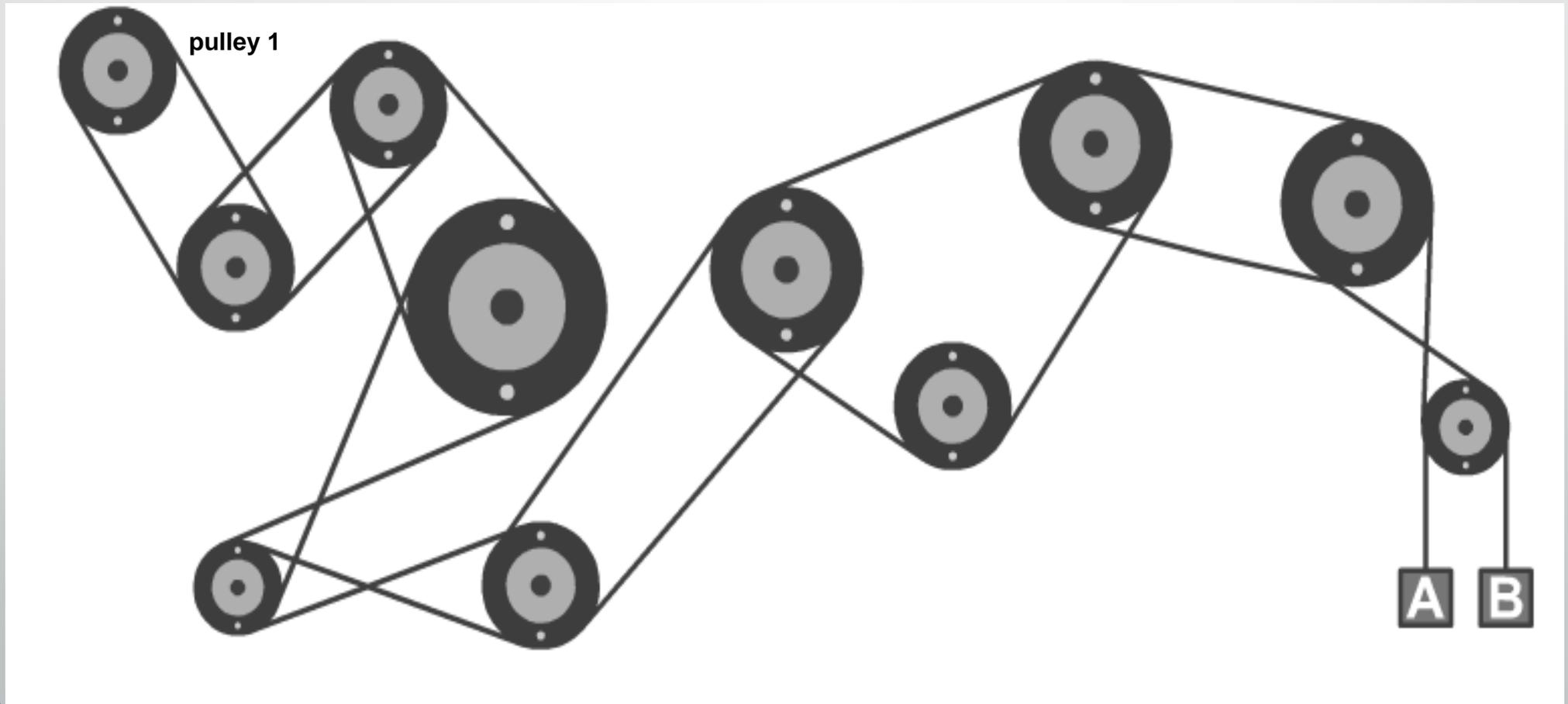


RECIPROCATING

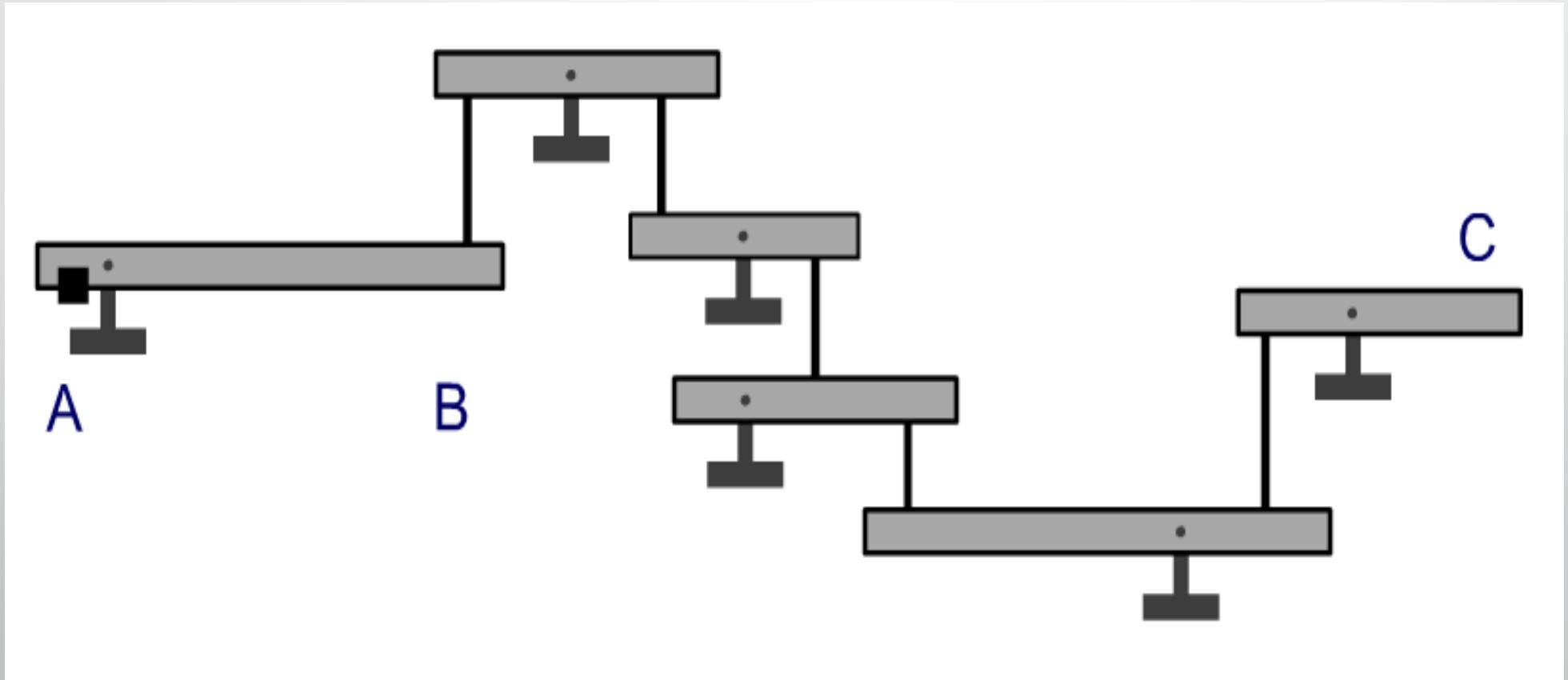
If gear 1 turns in a clockwise direction, which direction will gear 2 turn in?



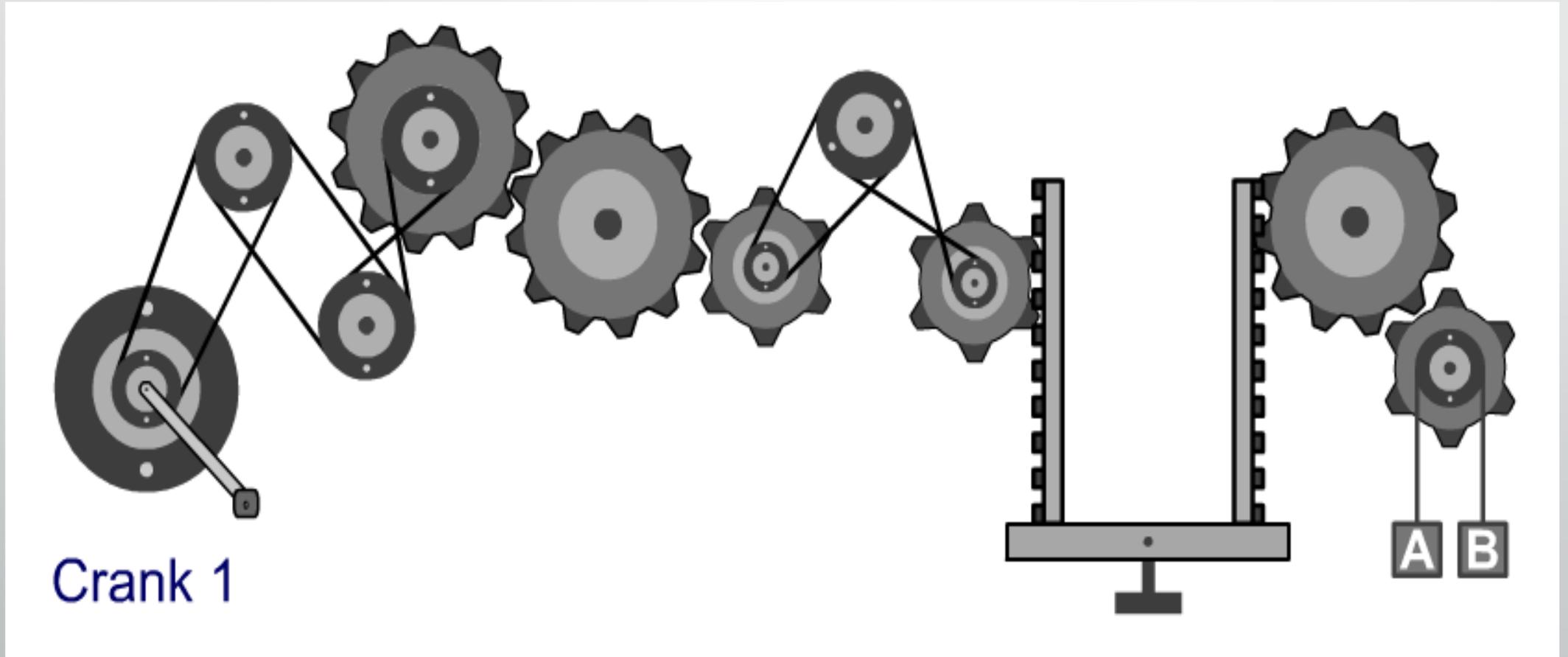
If pulley 1 turns in a clockwise direction, will weight A rise or fall?



If the weight moves from point A to point B, will point C rise or fall?



If crank 1 turns in a clockwise direction, does weight A rise or fall?

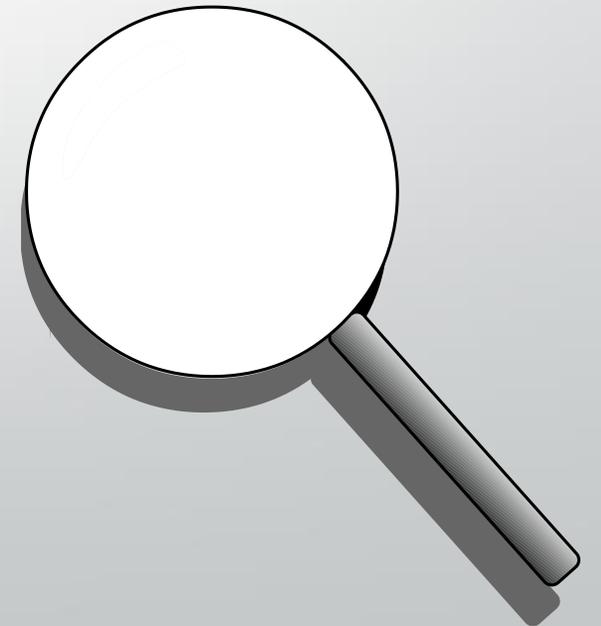


Product analysis is an important starting point.

You need to collect information about **products**.

You then need to **analyse** their workings carefully.

When you are analysing a product it is helpful if you can **divide the task** into separate areas.





Go through each step of the analysis of your products and answer the questions:

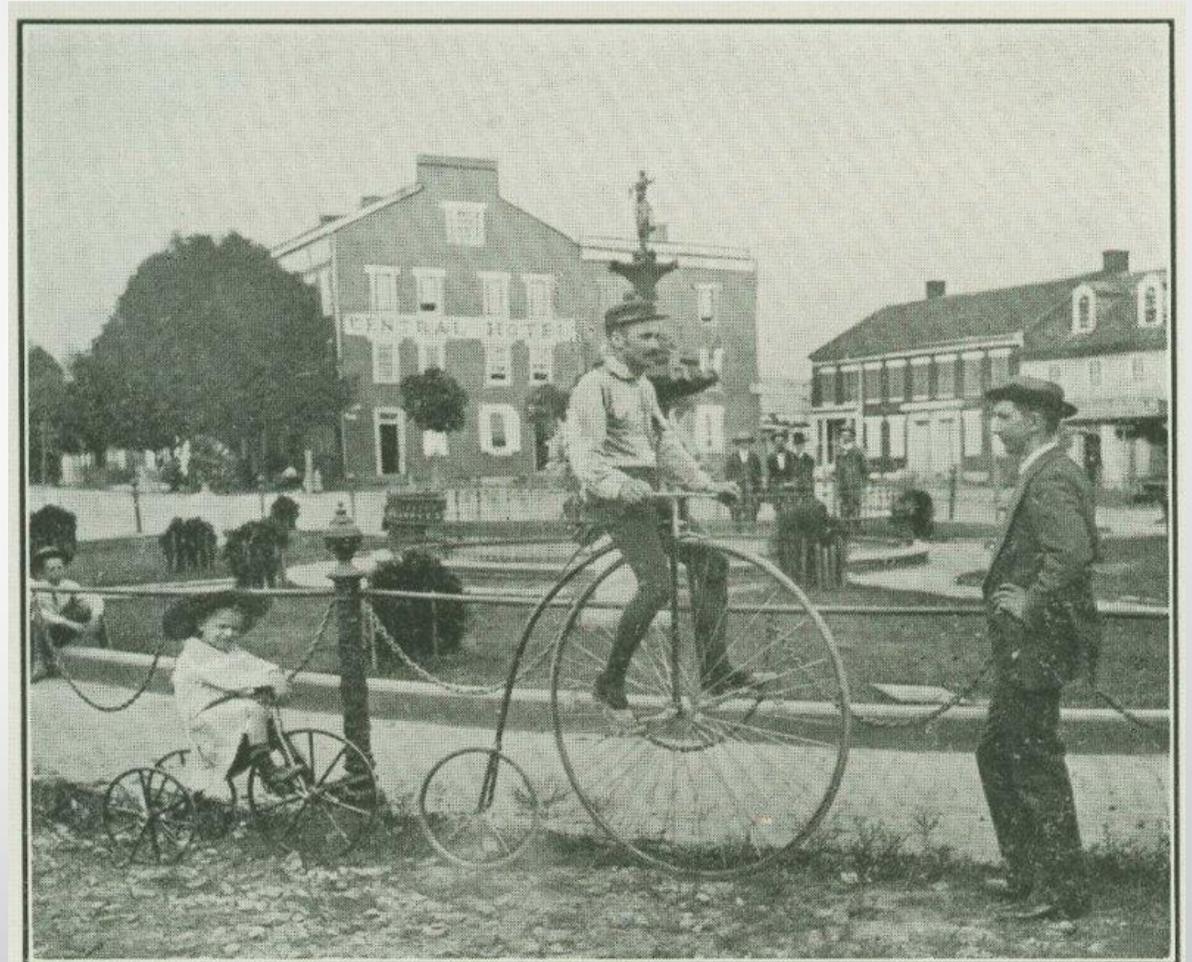
- What is the product for?
- What is its **function**?
- What is its **form**?
- How does it move?
- What **mechanisms** are used?
- How **efficient** is it?
- How is it made/**manufactured**?
- What **materials** have been used?

Analysis of products

For people who could not afford horses, the problem of **personal transport** required a new product.

Bicycles were early examples of **solutions to the problem** of personal transport; they were quicker and easier than walking.

Early solutions were **interesting!**



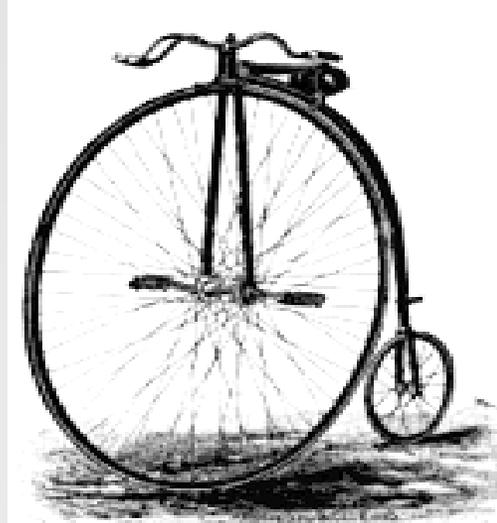
FIRST BICYCLE IN HANOVER
Allen H. Wentz on bicycle, Arnold Kleff on velocipede

1817



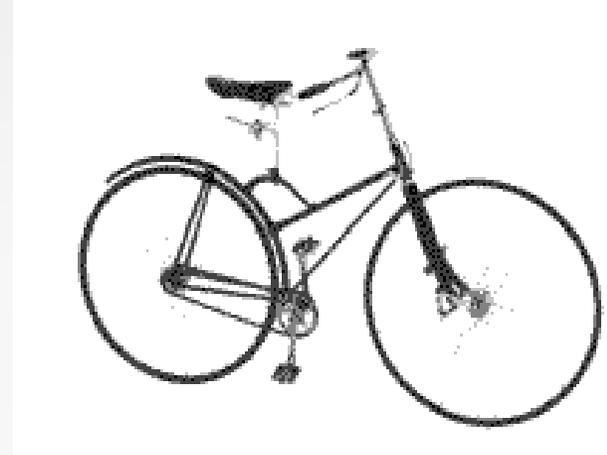
A walking bicycle

1870



The High Wheel
Bicycle
(Penny Farthing)

1880



A pedal cycle with
solid tyres

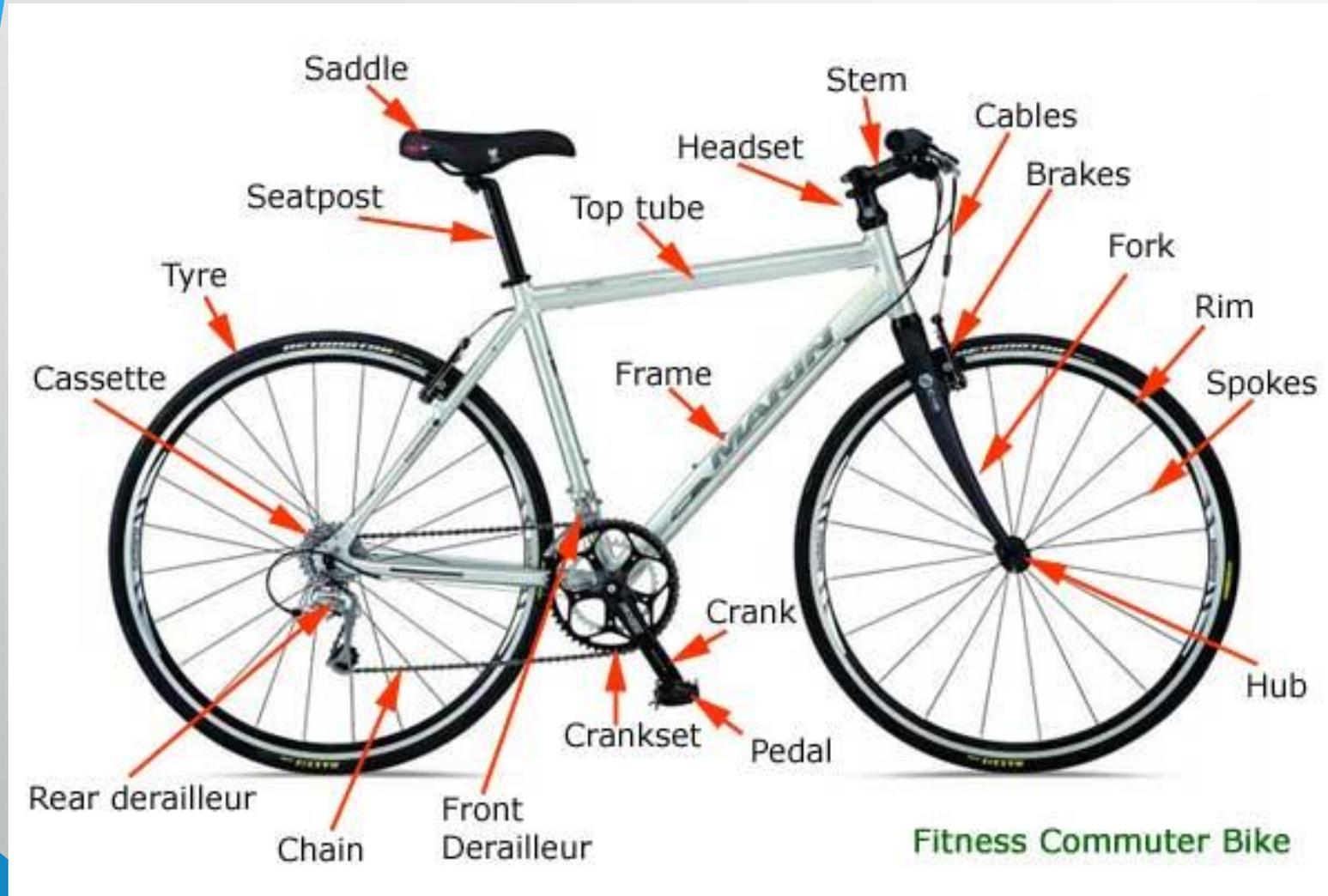
1890



A pedal cycle with
pneumatic tyres

Over time, **mechanisms** on bicycles **developed** and became more sophisticated and efficient.

Modern Bicycle Product Study



Type/Make:

Purpose: off road etc

Cost:

Mechanisms:

Materials:

Processes:



Think how you could carry out a product analysis on an unusual bicycle like this one.

Developments due to new technology

In the 1970s an inventor called **Clive Sinclair** introduced miniature televisions, pocket calculators and digital watches to Britain. The next problem he tried to solve was to:

Design and manufacture an electric vehicle

- In the mid-1980s people were concerned about **pollution** and oil reserves.
- Sinclair decided to invent an **environmentally friendly** vehicle, something between a bicycle and a small car.
- The machine would be **pedalled** as well as being **battery powered**.
- It would be a vehicle that young people would buy and use.

The design team
came up with a
contemporary
design – the
Sinclair C5



It was marketed as an **environmentally friendly** personal transport system that everyone would want.
Sinclair predicted sales of **100,000**.



You could carry out a product analysis on the Sinclair C5 and investigate the mechanisms and systems used to drive it along

Do you think that the **Sinclair C5** should now be looked at again as a viable transport alternative?

Do you think that it could be re-developed to include newer technologies that we now have?

Do you think that you are the type of person that would be able to investigate this sort of problem?



Work Experience can be linked with the course

