# Engineering

| The History of Engineering | Materials and their properties | Types of Production |
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| Gain a deeper understanding of the history of engineering and how the industrial revolution, computers and the use of automation have dramatically changed the engineering industry.<br><br>A look into technological push and the evolution of products such as mobile phones.<br><br>A look at some of the ways emerging technologies have made changes in business with examples including the use of QR codes during covid-19.<br><br>Looking Forward<br>Engineers are helping feed and support an increasingly urban world population that could reach 10 billion by the year 2050. They are working to ensure that all people have access to clean, fresh water and adequate shelter.<br><br>Engineers today are developing safe, efficient, and renewable forms of energy. They are helping to improve our health with more effective drugs and medical treatments. They are working to design new and more powerful ways of creating, storing, and using information.<br><br>Engineers are now and will continue to be critical to advancing technologies that will allow individuals to work, learn, and play in new and interesting ways. | Understand materials, components and processes for a given engineered product.<br><br>**Ferrous metals.** Eg Mild steel, wrought iron and stainless steel.<br>Ferrous metals contain iron, are magnetic and oxidise (rust).<br>**Non-ferrous metals**. Eg Aluminium, titanium, copper, silver and zinc.<br>Non-ferrous metals do not contain iron, are not magnetic and a usually more resistant to corrosion (rust) that ferrous metals.<br>**Thermosetting polymers.** Eg Phenol-formaldehyde, polyamides and polyurethane.<br>When thermosetting polymers are moulded they do not soften and they cannot be reshaped.<br>**Thermoforming polymers.** Eg Polyethylene, polypropylene and acrylic.<br>When thermoforming polymers are moulded they can soften and be reshaped.<br>**Properties of engineering materials.**<br>**Strength.**<br>Strength is the ability of a material to resist deformation.<br>**Hardness.**<br>Hardness is the ability of a material to resist bending or cutting.<br>**Toughness.**<br>Toughness is the ability of a material to absorb energy without damaging. | **Production is about creating goods and services. Managers have to decide on the most efficient way of organising production for their particular product.**<br><br>**There are three main types of production to choose from:**<br><br>**Job production** where items are made individually and each item is finished before the next one is started. Designer dresses are made using the job production method.<br><br>**Batch production**, where groups of items are made together. Each batch is finished before starting the next block of goods. For example, a baker first produces a batch of 50 white loaves. Only after they are completed will he or she start baking 50 loaves of brown bread.<br><br>**Flow production**, where identical, standardised items are produced on an assembly line. Most cars are mass-produced in large factories using conveyor belts and expensive machinery such as robot arms. Workers have specialised jobs, for instance, fitting wheels |

There is an extensive range of products produced within the Engineering industry. In order to make it easier to categorise them they are usually divided into the following **sectors**.

## Aerospace

The main activities of an aerospace engineer are to research, design, manufacture, operate and maintain aircraft. A huge range of products are developed within this sector including **helicopters, fighter jets**, reconnaissance aircraft and unmanned vehicles. The aerospace industry is dominated by large, well established, global companies like Airbus and Boeing.

## Automotive

This sector deals with the development of vehicles from **cars and motorbikes to lorries and trains**. Much cutting edge technology goes into making these transport systems safe, efficient and as environmentally clean as possible.

## Chemical

Chemical engineers design and operate industrial processes that convert raw materials into valuable products. Professionals working in chemical engineering make sure these products are safe and do the jobs they are supposed to do. Examples of products that are made within this sector include **petrol, cement, salt, cleaning fluids, medicines and paint**.

## Electrical and Electronics

This is a huge sector and is very diverse in the range of products that are produced. Examples of products that are produced include electric generators and motors, consumer electronic equipment (radio, TV, audio, calculators, microwaves) **power cables, computers**. Almost all products that are bought today contain some electrical or electronic components.

## Communications

This sector includes products that use modern technology and materials to communicate, use and transfer information around the globe. They are often ground breaking technology, new and innovative, examples include **mobile phones, satellites systems**, video conferencing, wifi, routers.

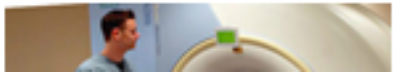
## Mechanical

This sector includes products that are powered mechanically or automatically. Examples of products that fit into this sector include **robots, engines, lifts, drills, presses**, bearings, power tools and many industrial machines.

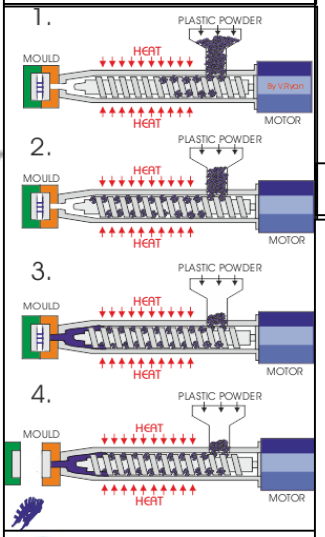
## Biomedical

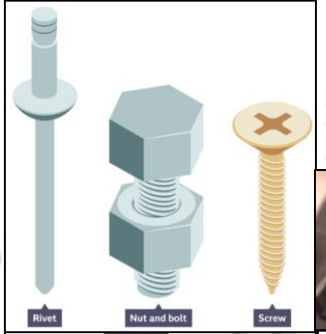
This sector involves the development and manufacture of diagnostic and therapeutic products as well as drugs and medicines. With the average life expectancy rising there is a huge emphasis within this sector for development of new products.

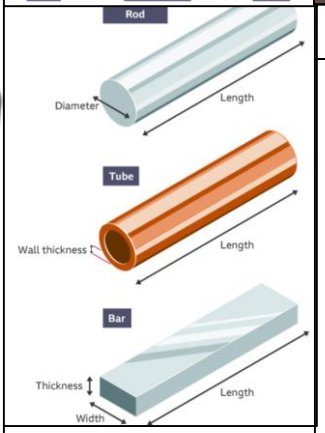
Examples of products within this sector include **artificial joints, MRI scanners, wheel chairs**, body supports, X-ray machines and drugs.

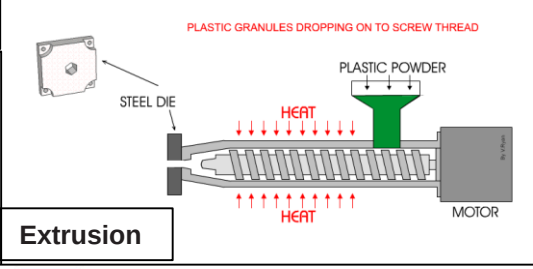


## Injection moulding

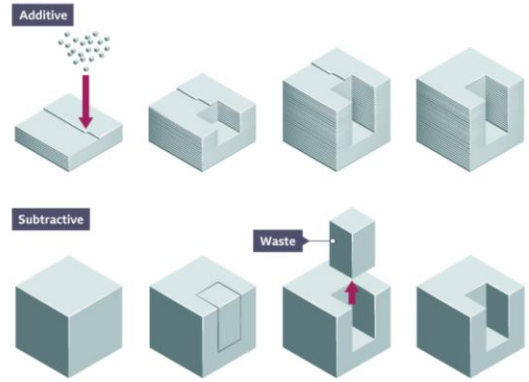


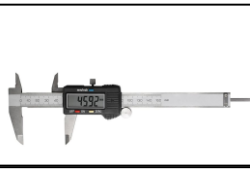




## Extrusion




A custom-made or **bespoke** product that is made from metal could be made based on a customer **design specification**. Products such as rings and jewellery are often made personally for a customer and only one will ever exist.

Digital micrometer



Digital vernier caliper

**Accuracy and quality control**

Unlike metal, materials such as timber, paper and board change shape easily depending on temperature or the amount of moisture they are holding. Metal can change shape and expand in the heat, but it is not prone to the same amount of movement as timber is. It is often the case that engineers can work to a fine **tolerance** when using metal.

**Digital micrometers** can be used to measure the width of a material and **digital vernier calipers** can be used to measure the outside width, inside dimensions and depth of holes. Both tools measure to 1/100 of 1 millimetre (mm) and can be read quickly because of the digital screen.