Introduction to Engineering

In this unit, students will discover the basics of the world of engineering.

What is “engineering”? Is it using materials and processes to manufacture a single item? Is it applying new technologies to mass production of well known products? Or is it implementing methods to reduce waste and improve the sustainability of energy sources? Engineering is all of these things and many more. It affects all aspects of our lives, from the daily use of time saving appliances to performance materials applied in ways we may never have imagined.

Year 10

Students will investigate the processes used to manufacture modern products within different engineering sectors.
They will also study some of the new developments in materials and engineering technology that have an impact on life today - or will have in the very near future.

Key Skills:

- The development of core knowledge and understanding of engineering sectors, their interconnections and how they relate to the roles of employees in engineering industries
- Knowledge and skills of the stages involved in planning and implementing an engineering project
- The development and application of skills such as problem solving, design, creativity, communication and collaboration.
- The homework tasks provide an opportunity for you to link and apply the knowledge they have learnt in the classroom to real-life examples. They are also designed to help students develop research skills and become independent learners.

Engineering Sectors	Good and Bad Technology/Engineering	Prototypes
Understand that Engineering is made up of many specialist sectors. Be able to give examples of products from each sector. Understand what design engineers do and recognise stereotypes. Improve knowledge of famous design engineers and inventors. Recognise the characteristics that successful design engineers share.	To have an understanding of the purpose of technology and to understand the good and bad aspects that developing technology brings. The design world is constantly changing with the advancement in technology. For manufacturers, this change will have an impact for its workforce and production capabilities. Positives: accuracy improvements, cost effective, sharing of ideas Negatives: less workforce needed, costly start up prices, waste materials to dispose of. These continuous advancements can become challenging for companies who will always want to be ahead of trends, but at the same time also want to ensure they still have profit.	Prototypes: Prototype modelling can be constructed to test different elements of a design to help work out how viable it is likely to be. Modelling can involve creating a whole scaled up or down product or it may just be needed to help work through an important element of the design. You will find an introduction to materials, learn about some basic cardboard skills such as scoring and strengthening, making circles and cones, but also how to connect pieces together with flanges, tabs and slots. You then might want to add movement to your models, using rotation to make a cuff, add

		dials and buttons to your idea, or even wheels and axles.
The History of Engineering	**Materials and their properties**	**Types of Production**
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. A look into technological push and the evolution of products such as mobile phones. 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. Looking Forward 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. 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. 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. **Ferrous metals.** Eg Mild steel, wrought iron and stainless steel. Ferrous metals contain iron, are magnetic and oxidise (rust). **Non-ferrous metals**. Eg Aluminium, titanium, copper, silver and zinc. Non-ferrous metals do not contain iron, are not magnetic and a usually more resistant to corrosion (rust) that ferrous metals. **Thermosetting polymers.** Eg Phenol-formaldehyde, polyamides and polyurethane. When thermosetting polymers are moulded they do not soften and they cannot be reshaped. **Thermoforming polymers.** Eg Polyethylene, polypropylene and acrylic. When thermoforming polymers are moulded they can soften and be reshaped. **Properties of engineering materials.** **Strength.** Strength is the ability of a material to resist deformation. **Hardness.** Hardness is the ability of a material to resist bending or cutting. **Toughness.** 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.** **There are three main types of production to choose from:** **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. **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. **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

Key Terms	Extended Learning & Support
• **Automation** The use of control systems for operating equipment such as machinery and processes in factories; this reduces human input. • **Client** The person/people/audience being designed for and whose needs are being met. • **Commercial process** Manufacturing method used to produce products in quantity. • **Commercial product** A product intended to make money. • **Conceptual stages (of design)** Use of models, sketches and computer aided design (CAD) to show the design of a product as it develops. • **Ethics** Moral decisions when designing and manufacturing. • **Fabricate** Using processes such as cutting, bending, joining and assembly to produce products. • **Finite** A material or source which will one day run out. • **Iterative design** Design methodology based on a cyclical process of analysing, prototyping and testing to refine a product. Each iteration and result starts the process again. • **Market pull** Products developed to meet the needs of society or a specific section of the market. • **Mechanical device** Mechanism which produces and/or changes movement. • **Nesting** The tessellation of shapes or nets on a material to minimise the amount of waste during manufacture. • **Physical properties** Properties that refer to the actual matter that forms the material (eg insulation, conductivity, fusibility). • **Planned obsolescence** Deliberately designing the lifecycle of a product to be short, forcing the user to update their products quickly. • **Prototype** An early model or sample of a product used to test a concept. • **Technology push** Technological discoveries used to drive the development of a product. • **Tolerance** The minimum and maximum measurements that can be accepted when manufacturing.	Creative things you can do to support your Engineering projects Extended learning online: • Explore the world of STEM through our interactive games: https://new.siemens.com/uk/en/company/education/students/interactives.html • Watch a number of the videos on the YouTube playlist below and attempt to copy the techniques shown to improve your sketching ability. Start with the video at the bottom of the playlist (the oldest) and work your way towards the top to gradually increase the level of challenge. Continue to practice after watching all the videos by attempting the drawing of everyday objects from around your house using the techniques or designing a new product and sketching your ideas. https://www.youtube.com/playlist?list=PLUmGIca4HGqZKHiBZtL_zHjh2HBoBNerA