Core Technical Principles
New and emerging technologies: Sustainability

A: We are using the Earth's resources all the time when we manufacture products. We are manufacturing more and more products using resources such as oil, metal ores and timber at an increasingly high rate. Collecting and processing raw materials, converting them into products and then using them consumes huge amounts of energy.
Using these resources has an impact on the planet, which we need to minimise for future generations. **Sustainabilit**y is about meeting our own present-day needs without compromising the needs of future generations. New technologies can be used to help us manufacture products more sustainably.

B: Finite resources

A finite resource is a resource that does not renew itself quickly enough to meet the needs of future generations. Examples are coal, oil and natural gas. Plants and organic materials, with the aid of heat and pressure over millions of years, become coal, oil or natural gas. Minerals and metal ores, for example cassiterite (tin) and chromite (chromium), are also considered finite resources, as once they are completely exhausted there is no natural way to renew them. Hydraulic fracturing, or **fracking**, is a new technology designed to extract gas and oil from shale rock, but is proving to be a controversial method of extraction because of concerns regarding environmental impact.

C: Non-finite resources

Non-finite resources are resources that can replenish quickly enough to meet our needs. Examples include water and plant life, such as trees. There are also common renewable energy resources that we are now using, such as solar, geothermal and wind power. Technological advancements have allowed us to use these renewable resources more effectively and to generate more energy from them, reducing our reliance on finite resources.
Designers need to think about the **life cycle** of a product. They need to consider the environmental impact of the product from the raw materials required, how long the product will last before it wears out and it's disposal at the end of its life. There are many different ways designers can do this including:

- Using low-impact materials
- Conserving resources by using recycled materials
- Reducing material usage
- Designing products that use less or no energy when the product is in use
- Ensuring a prolonged lifetime
- Making sure materials and components can be easily recycled and recovered at the end of their lifetime

These factors contribute to reducing the **ecological footprint** of the product.

ECOLOGICAL FOOTPRINT

D: The effect that a company or organisation has on people and communities is often referred to as its **social footprint**. Companies have a responsibility to consider human rights and the working conditions of their workforce. Companies with a good social footprint take care of their workers, in terms of health and safety, workforce equality, child labour and wider social issues that affect communities in their supply chains.

E: Disposal of waste

At the end of a product's useful life its disposal has to be taken into consideration. There are a number of ways waste can be dealt with.

Landfill: the most common method of organised waste disposal. It simply involves putting waste into the ground and burying it. This poses many problems as it can cause pollution of the local environment, such as contamination of ground water or soil. Decaying organic waste also generates methane gas - a greenhouse gas which is flammable and can be explosive. Many other problems occur, including the smell coming from sites, effects on local wildlife and noise pollution, which can lead to reduced property prices.

Resource recovery: some materials can be recycled, some composted and some can be used in energy generation. Waste recycling reduces the use of newly created materials, while composting and energy generation reduces landfill.

Incineration: a waste treatment process that involves the burning of waste materials. It can reduce the amount of waste by up to 85%, significantly reducing the volume of landfill. However, the are concerns about pollutants in the gas emissions from incinerators, including large amounts of CO_2 being released into the atmosphere.

F: Life Cycle Assessment

Life cycle assessment allows us to look at the
process of making a product and assess the impact this process has on the environment from 'cradle to grave'. This means we can look at the environmental impact, from the sourcing of the raw materials e.g. cutting down trees or mining for oil, to the disposal of the materials at the end of the product's life.

G: Planned obsolescence

Some manufacturing companies plan or design products to have a short useful life. They do this so they will become obsolete; this means they will become unfashionable, or they will no longer function after a certain period of time. the companies then produce new and improved products at short intervals. They do this for a variety of reasons; it could be that technology has improved or simply to keep their sales at a steady level. This impacts on the environment and creates disposal issues.

H: Design for maintenance

This can mean a variety of things. From being able to change batteries to allowing access into the product to repair or replace worn out components. Some products, such as PCs are made up of different modules, which allows a module to be repaired or replaced in the event of a fault rather than the entire product. This system of using modules also means that some modules can be replaced in order to upgrade as technology improves.

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I: Keywords

- Finite resource: a resource that does not renew itself quickly enough to meet the needs of future generations
- Non-finite resource: a resource that can replenish quickly enough to meet our needs
- Life cycle: the life of a product from 'cradle to grave'
- Ecological footprint: the impact a product has on the environment throughout its life cycle
- Social footprint: the effect that a company or organisation has on people and communities
- Landfill: the disposal of waste material by burying it
- Resource recovery: when energy, a material, or a product is taken from waste and used
- Energy recovery: the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes
- Planned obsolescence: planning or designing a product to have a short life span.

J: Video and web-links

- Waste to energy: https://www.studentenergy.org/topics/waste-to-energy
- Life cycle assessment: https://www.youtube.com/watch?v=cYOC8_jJcII
- Landfill: https://www.youtube.com/watch?v=mA608GJ-EzM

Revision Checklist

I understand the meaning of the term sustainability	
I know the difference between finite and non-finite resources	
I understand that all products have an ecological footprint and I can explain what this means	
I understand that all products have a social footprint and I can explain what this means	
I know the problems associated with landfill as a means of waste disposal	
I understand that resources and energy can be recovered from waste	

Test yourself

1. Give two examples of finite resources.

2. Give two examples of non-finite resources.

3. Why should finite resources be avoided or used in limited amounts?

4. What can a company learn by conducting a life cycle assessment?

5. Explain three problems associated with landfill.