8 SUSTAINABLE ENGINEERING AND CIRCULAR ECONOMY

Electronic systems and responsible engineering

READING COMPREHENSION

1 **Read the text about responsible engineering and decide if the sentences below are true (T) or false (F) then correct the false ones.**



Electronic systems are part of everyday life. We use them in mobile phones, gadgets, devices, machines, and tools, often without being aware of how they work or what they are made of. Behind each of these systems, there **is a combination of materials, energy, and electronic components** that allow information to be processed and functions to be carried out in a controlled way.

The development of an electronic system involves a **sequence of stages**, from material extraction and component manufacturing to system assembly, use, and final disposal. Each of these stages has an impact on energy consumption, material use, and waste generation. Many electronic devices contain metals and synthetic materials that require significant resources to produce. For this reason, engineers must consider **the entire life cycle of electronic systems** in order to reduce environmental impact and work on sustainable solutions. Because they have long-term consequences, modern engineering does not focus only on how systems work, but also on how they are designed, used, and reused. The choice of materials, the number of components, and the efficiency of the system influence not only performance, but also durability, maintenance, and end-of-life treatment.

This perspective is essential in modern engineering, where **technical efficiency** and **environmental responsibility** are connected, especially in the design of electronic systems. As a result, many engineering decisions are increasingly guided by the **principles of the circular economy**. These principles aim to **minimise resource extraction** and **waste generation** while maintaining the functional and technological performance of electronic systems.

	T	F
1 The use of electronic systems makes their environmental impact less significant.	☐	☐
2 The use stage is the only phase of an electronic system that affects energy.	☐	☐
3 Decisions made during the design phase can influence what happens to an electronic system after it stops working.	☐	☐
4 Synthetic materials are easy to produce.	☐	☐
5 Modern engineering considers durability a result of both material choice and system efficiency.	☐	☐
6 An electronic system can be technically efficient but environmentally problematic.	☐	☐
7 The circular economy encourages engineers to think beyond performance and functionality.	☐	☐
8 Waste generation is a consequence of several stages in the life cycle, not just disposal.	☐	☐

VOCABULARY

2 **Read the text again and match the words (1-8) with their definitions (a-h).**

1 gadgets	a ☐	The ability of a product or material to last a long time without breaking or needing replacement.
2 manufacturing	b ☐	The process of putting parts or components together to form a complete product or system.
3 assembly	c ☐	The industrial process of making products using machines, tools, and raw materials.
4 waste	d ☐	Small electronic tools or machines.
5 synthetic	e ☐	The actions needed to keep a machine or system working correctly, such as checking, cleaning, or repairing it.
6 reused	f ☐	Made by chemical processes, not found naturally, often used to describe artificial materials.
7 durability	g ☐	Materials or products that are no longer useful and are thrown away or discarded.
8 maintenance	h ☐	Used again instead of being thrown away, often after repair or cleaning.

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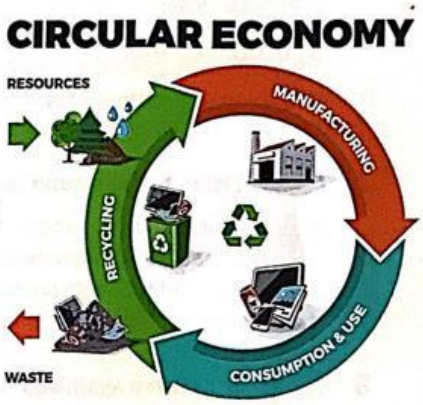
Circular economy

LISTENING

3 13 **Read the text about the principles of circular economy and complete it with the words from the box. Then listen and check.**

disassembly	design	environmental	unnecessary	generation	labeling
	landfills	performance	recovering	replacement	

The circular economy is based on **four main principles** that aim to keep economic activity going while reducing waste and protecting the planet. Instead of using resources once and then throwing them away, this approach encourages people and industries to **rethink** how materials are used, **reuse** products whenever possible and **make better use** of the resources we already have.



Reduce

This principle focuses on reducing the consumption of resources, energy and materials, and avoiding (1) _____ parts from design and production to use and consumption. It means using fewer components, less raw material, and lower power consumption. In general, simpler and more efficient systems tend to have a smaller (2) _____ **footprint**. Reducing the number of components simplifies production and lowers material use during manufacturing.

Reuse

Reuse in electronics refers to extending the life of products and components by making them **repairable**, **upgradable**, and **reusable**. Many electronic components can be reused if systems are designed for (3) _____. This principle depends heavily on modular (4) _____. When devices can be easily opened, repaired, or upgraded, they remain in use for longer periods. Reuse reduces the need for new components, lowers production demand, and helps slow down the (5) _____ of electronic waste.

Recycle

Electronic products contain valuable materials, including metals, alloys, and engineered materials that can be recovered after use. The principle of recycling focuses on (6) _____ these materials at the end of a product's **life cycle** and reintroducing them into new production processes. Recycling depends on material selection and (7) _____, and system design.

Design for Longevity

Design for **longevity** means creating products that can operate over long periods of time without frequent failure or (8) _____ loss. This principle focuses on durability, reliability, and resistance, especially in components that are exposed to heat, electrical stress, or mechanical movement. Good electronic design reduces **waste** and increases product **lifespan** by using high-quality components and material. When products last longer, the need for frequent (9) _____ is reduced, which directly limits electronic waste and decreases the demand for new resources. Well-designed electronic systems support material recovery, reduce reliance on raw material extraction, and limit the accumulation of electronic waste in (10) _____.

VOCABULARY

4 **Read the text again and complete the definitions below with the words in colour.**

1 _____: the total environmental impact caused by a product, system, or activity.
2 _____: all the stages a product goes through, from raw material extraction and manufacturing to use and end-of-life disposal or recycling.
3 _____: the length of time a product is expected to function before it stops working or becomes obsolete.
4 _____: the ability of a product or system to operate reliably over a long period of time.
5 _____: able to be fixed when a component or system fails.
6 _____: materials or products that are no longer useful and are discarded.
7 _____: designed so that components or software can be improved or replaced.
8 _____: able to be used again, either in the same system or in a different one.

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