

Design & Technology

‘Cleaner’ design and technology- a product’s life cycle

Multiple Choice

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don’t spend too much time on one question

Good luck!

Q1. Which of the following has a positive impact on the environment?

- A** Inefficient work practices
- B** Pollution
- C** Reducing waste during manufacture

Q2. What type of energy is sourced from plants?

- A** Biomass
- B** Tidal
- C** Wind

Q3. Which one of the following vehicles would be most environmentally friendly when transporting raw material?

- A** Electric truck
- B** Plane
- C** Cargo boat

Q4. The definition of 'product miles' is which of the following?

- A** How far the product can go before it breaks / is thrown away
- B** The total distance produce is transported from the place of production to the place of use.
- C** The total distance the user has to travel to buy the product

Q5. Which one of the following **will not** help during the 'End of life' process?

- A** Design for disassembly
- B** Labelling of materials
- C** Using permanent joining techniques in design

Q6. Which one of the following **will not** help reduce energy consumption during the manufacturing process?

- A** Simplification of processes
- B** Achieving optimal use of materials
- C** Using biodegradable materials

Q7. Energy efficiency labels follow which rating system?

- A** A – G
- B** 1 – 10
- C** 1* – 5*

Q8. Disposal to landfill can cause which of following?

- A** Groundwater pollution
- B** Improved soil fertility
- C** Improved air quality in the surrounding area

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Q11. Recycling materials plays an important role in preserving the world's natural resources. Outline how products can be designed for recycling. **(4 marks)**

Q12a. Discuss the issue of 'repair versus replacement' from a consumer's point of view. **(6 marks)**

Q12b. Explain how a company may benefit from carrying out a life cycle assessment on its products. **(4 marks)**

Q13. Give **two** ways that a product can be sustainably disposed of at the end of its useful life **(2 marks)**

Q14. List **two** textile raw materials that can be considered environmentally friendly **(2 marks)**

Q15. Explain how the inclusion of smart materials in electronic products aids the end-of-life disassembly **(4 marks)**

Answers

Q1. C

Q2. A

Q3. A

Q4. B

Q5. C

Q6. C

Q7. A

Q8. A

Q9.

Expect responses to consider any of the following topics:

Raw material sourcing:

- Deforestation, e.g. damage to the rainforests and increases in CO₂
- Habitat/ ecosystem destruction, e.g. Great Barrier Reef
- Mining, e.g. metal ores
- Drilling, e.g. oil production
- Farming
- Consumers may choose sustainable fibres such as organic cotton as produced without pesticides/insecticides or PET polyester as recycled plastic bottles and finite oil is not used.

Transportation:

- Mileage of product from raw material source, manufacture, distribution, user location and final disposal
- Carbon footprint – carbon produced during the manufacture and use of products

The six Rs:

(in relation to their impact on the ecology of the planet)

- RECYCLE e.g. break down a part or materials and separate into same materials and use to make a new part/product
- REDUCE e.g. use less energy, materials and resources to manufacture a product or part
- REUSE e.g. repurpose/upcycle and use for something new
- RETHINK e.g. is there a better way of manufacturing /using materials to have less of an impact on the planet etc.
- REFUSE e.g. customers choose to not buy products that are unsustainable to make/consume
- REPAIR e.g. replace a part or component when defective to extend life and delay throwing away/end of life disposal.

Pollution:

- Pollution of the oceans e.g. polymers in the ocean
- Atmospheric pollution including acid rain
- Consumers may choose unbleached/undyed cotton as no bleach or harmful dyes used

Q10.

Discussion to address the following issues:

- Once a product stops working it is thrown away
- It is often cheaper to replace a product than to repair it
- New and improved models/products are released by companies to entice new sales
- Often some of the new models are cheaper than the older models
- Replacement parts are often withdrawn by companies meaning that you cannot get spare parts
- Some parts are designed to break/wear out before other parts so the product becomes unusable
- New and developing technology and features mean people want the latest/newest products and gadgets
- Generally acceptable amongst a large section of society / lazy / lack of knowledge to fix / repair things
- Reliance on built in obsolescence to generate / perpetuate consumer cycle

Q11.

- Use materials that can be/have been recycled/use as few nonrecyclable materials as possible (1)
- Products are easy to dismantle / easy to separate different materials (1)
- Use as few different materials as possible (1)
- Use as few parts/little material as possible (1)
- Coding/markings materials so they can easily be identified (1)
- Avoid surface treatments which will need to be removed before recycling (1)
- Make products from materials which require low energy for recycling (1)

Q12a.**Positives of repair**

- Product has an extended life time increasing its appeal (1)
- Less cost to repair than replace (1)
- Plentiful supply of spares (1)
- Some products are designed for consumer (DIY) repair (1)
- Some companies provide strong after-sales backup/support/repair (1)
- Some people prefer/want to stick/keep with what they have/are familiar with/sentimentality (1)
- Environmentally aware customers may prefer sustainability/avoid waste/disposal (1)
- Saved data/info (1)

Positives of replacement

- New features / upgrades / styles/trends / fashions available (1)
- Sometimes cheaper to buy new (repair difficult/expensive / time consuming/regular) (1)
- New products readily available/convenient, whereas replacement parts are not (1)
- Generally quicker to replace than repair (1)
- Reliability of a new product (1)

Q12b.

- Determine/investigate cradle to grave (mention of any stage of life) carbon footprint/energy use/environmental impact/materials used (1)
- Reduce a carbon footprint/emissions/meet emission targets/environmentally friendly (1)
- Reduce the volume / range / amount of materials required (1)
- Reduce manufacturing/material costs/waste/errors (1)
- Savings made/increased profit (1)
- Reduce the amount of energy required to manufacture /distribute the product / reduce energy costs. (1)
- Promote the product as being environmentally friendly/green/avoid fines (1)
- Setup production nearer to suppliers / markets (1)
- Reduce transportation costs (1)
- Reduce the amount of time required to manufacture the product / Improve manufacturing speed (1)
- Get the product onto the market more quickly (1)
- Predict product lifespan/failure (1)

- Plan/provide improved/longer lasting product/replacement (1)
- Choose/change materials for future products (1)

Q13.

- Separation for recycling (1)
- Segregation of waste (1)
- Reclamation/re-use of materials
- Use of licensed disposal contractors/licensed tipping facilities (1)
- Repurposing/upcycling of the product (1)
- Identification of biodegradable parts (1)

Q14.

- Cotton (1)
- Linen (1)
- Wool (1)
- Hemp (1)
- Jute (1)
- Recycled fibres (1)

Q15.

- Shape memory polymers (SMP) and shape memory alloys (SMA) are starting to be used to replace traditional polymer fixings.
- Active disassembly at the end of a product's life reduces the amount of human interaction needed at this phase of the product lifecycle.
- At the end of the product's useful life the product may be heated or exposed to an electric current. These stimuli cause a change in shape of the fixing or fastening.
- The reduction in size of the fixing or fastening or the adjustment in shape of a cantilever clip etc would allow for the fixing to become loose.
- The contraction of the SMA or SMP component would enable either partial or complete removal of the joint.
- The product may be vibrated to help separate the device into component parts.