3.2 Designing for a circular economy

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS circular economy • cradle to cradle • design for disassembly • durability • planned obsolescence • right to repair

Objective

Build the skills to answer exam questions on the **circular economy** : linear and circular flows, cradle to cradle, the six Rs, **design for disassembly** and durability, planned obsolescence and the right to repair.

You must be able to:

- distinguish a linear and a circular economy, and explain why inner loops (repair, reuse) save most
- apply the six Rs: rethink, refuse, reduce, reuse, repair, recycle
- describe features of design for disassembly and durability
- calculate the cost per year of service of two products
- explain functional, technological and style obsolescence, and right-to-repair laws

1 Key knowledge and worked examples

Linear and circular

- **Linear economy:** take, make, use, throw away.
- **Circular economy:** keep products and materials in use as long as possible, at their highest value, and design waste out. **Cradle to cradle:** every material becomes the raw material for something new.
- The inner loops save most: **repair** keeps all the embodied energy; **recycling** saves only the material and needs energy to reprocess.

The six Rs: rethink (a better way to meet the need, e.g. a shared tool library), refuse (avoid harmful materials or packaging), reduce (less material and energy), reuse (refillable bottles), repair (spare parts and instructions), recycle (reprocess the material).

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Design for disassembly and durability

- screws and clips instead of glue and welding; few, standard fasteners;
- fewer different materials, each marked (e.g. PP, ABS); no coatings that cannot be separated;
- **durability**: tough materials, protected weak points, a style that does not date quickly.

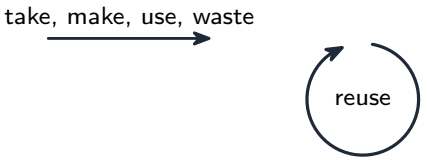
Planned obsolescence

Planned obsolescence is designing a product to become out of date or stop working sooner than needed, so people buy again: **functional** (parts wear out or cannot be replaced, e.g. glued-in batteries), **technological** (no more software updates), **style** (fashion makes it look old). It can lower prices and drive innovation, but wastes resources. **Right-to-repair** laws make firms supply spare parts and repair information (in the EU, for some appliances, up to 10 years).

Worked example. Kettle A costs ¥120 and lasts 2 years: ¥60 per year. Kettle B costs ¥200, lasts 8 years with one ¥40 repair: $(200+40)\div 8 = ¥30$ per year. B costs more in the shop but half as much per year, and sends a quarter as many kettles to waste.

2 Practice

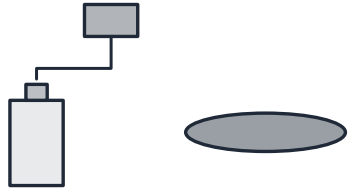
2.1 Distinguish between a **linear** and a **circular** economy. [2]



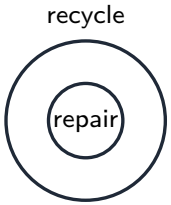
2.2 Identify which of the six Rs each action shows:

(a) a shop sells shampoo in bottles that customers bring back and refill; [1]

(b) a firm stops wrapping its cucumbers in plastic film. [1]



2.3 Explain why repairing a product saves more resources than recycling it. [2]

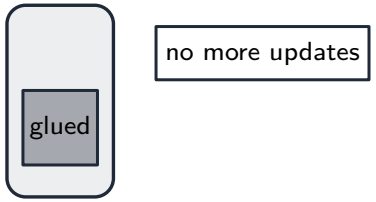


2.4 Toaster A costs ¥150 and lasts 3 years. Toaster B costs ¥320, needs one ¥40 repair and lasts 9 years. Calculate the cost per year of service of each and state which is better value. [3]



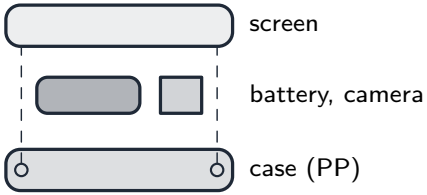
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2.5 Explain **two** kinds of planned obsolescence, with an example of each. [4]



3 Exam-style questions

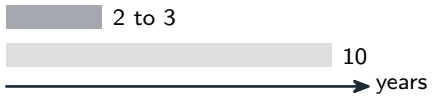
3.1 FixPhone is designing a smartphone that users can repair themselves. An exploded view is shown.



(a) Outline **two** features of design for disassembly shown in the diagram. [4]

(b) Explain **one** benefit to the user and **one** benefit to the environment of a battery that users can replace. [4]

3.2 Some firms design products to be replaced every two or three years.



Discuss whether planned obsolescence can ever be justified. [9]

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