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# Question 1:

## What is a life-cycle assessment?

The DfE Computer Display Project (CDP) conducted this analysis of computer displays using a life-cycle assessment (LCA) approach, which allows for a comprehensive analysis of the environmental consequences of a product system over its entire life. LCA, which is increasingly being used by industry, contains four major steps:

1. **Goal Definition and Scoping** lays out why the LCA is being conducted, its intended use, and the system or data categories to be studied.
2. **Life-Cycle Inventory (LCI)** involves quantifying inputs (e.g., raw materials and fuel) and outputs (e.g., emissions, effluents, and products).
3. **Life-Cycle Impact Assessment (LCIA)** involves characterizing the effects of the inputs and outputs (as identified in the life-cycle inventory step) on the environment and human and ecological health.
4. **Improvement Assessment or Life-Cycle Interpretation** uses findings from the analysis to identify and evaluate opportunities for reducing life-cycle environmental impacts or to reach conclusions and recommendations. This step is left to the electronics industry and others to complete, using the results of this study.

In the LCI and LCIA steps, the inputs and outputs and environmental impacts associated with the product throughout its life are quantified and characterized for each life-cycle stage: raw material extraction, materials processing, product manufacturing, product use, and end-of-life. Each of these major stages of the product life-cycle are described in Figure 1.1.

In addition to the LCA, the study incorporated some methodologies more typical of the EPA Design for the Environment (DfE) Program's Cleaner Technologies Substitutes Assessment (CTSA) approach. Such an approach includes a more detailed assessment of the impacts of specific chemicals, and an evaluation of comparative cost and performance of different displays. For this analysis, the DfE streamlined CTSA approach was incorporated by analyzing three specific chemicals found in computer displays (lead, mercury, and liquid crystals), and by including a consideration of product costs and performance.

Figure 1.1. Life-cycle stages of a computer display

Inputs	Life-cycle stages	Outputs
Materials →	<p><b>Raw materials extraction/acquisition</b> Activities related to the acquisition of natural resources, such as mining and transporting raw materials to processing facilities.</p>	→  → Wastes
	<p><b>Materials processing</b> Processing natural resources by reaction, separation, purification, and alteration steps in preparation for the manufacturing stage; and transporting processed materials to product manufacturing facilities.</p>	
Energy →	<p><b>Product manufacture</b> Processing materials and assembling component parts to make a computer display.</p>	→
Resources →	<p><b>Product use, maintenance, and repair</b> Displays are transported to and used by customers. Maintenance and repair may be conducted either at the customer's location or taken back to a service center or manufacturing facility.</p>	→ Products
→	<p><b>End-of-life</b> At the end of its useful life, the display is retired. If reuse and recycle of usable parts is feasible, the product can be transported to an appropriate facility and disassembled. Parts and materials that are not recoverable are then transported to appropriate facilities and treated (if required or necessary) and/or disposed of.</p>	→