KS4-17-02: Using Resources - Explore life Cycle Assessments

- Describe what's meant by a lifecycle assessment
- Discuss the life cycle assessments for a plastic shopping bag and a paper shopping bag
- Describe the problems with life cycle assessments

Definition: A life-cycle assessment (LCA) is an analysis of the overall environmental impact that a product may have throughout its lifetime.

The cycle is broken down into four main stages which are:

- Raw Materials
- Manufacture
- Usage
- Disposal

In your own words write a sentence which explains the definition of life-cycle assessment.

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Key Facts

- Obtaining the necessary raw materials has an impact on the environment which may include:
  - Using up limited resources such as **ores** and **crude oil**.
  - Damaging habitats through **deforestation** or **mining**.
- Manufacturing processes also have an impact on the environment which may include:
  - Using up **land** for factories.
  - The use of fossil fuelled machines for production and transport.
- Usage of a product may also affect the environment although it depends on the type of product. For example, a wooden desk has very little impact whereas a car will have a significant impact (air pollution).

The disposal of outdated products has an impact on the environment which may include:

- Using up space at **landfill sites.**
- Whether the product or its parts can be **recycled**.

- A life cycle assessment is carried out using the data of a given product and the criteria of the assessment.
- Rarely is there a perfect product with zero environmental impact, so often a compromise is made between environmental impact and economical factors.

Life Cycle Assessment of Shopping Bags

	Plastic	Paper
Raw Materials	Crude oil which is a finite resource which requires a lot of energy to process.	Recycled paper or trees. Making paper requires more energy than recycling paper but much less than making plastics.
Manufacture	Fractional distillation, cracking & polymerization, not much waste as crude oil is completely used & cheap to manufacture.	Pulping paper uses a lot of energy, sulfur dioxide & produces waste.
Usage	Is reusable.	Most are not reusable.
Disposal	Can be recycles but is costly and produces pollution. Can be stored in a landfill, take up space and is not biodegradable.	Biodegradable, non-toxic & can be recycled.

Conclusion

Considering both life-cycle assessments, the plastic bag is the better option. Even though they aren't biodegradable, they do have a **much longer lifespan** and thus are less harmful than paper bags.

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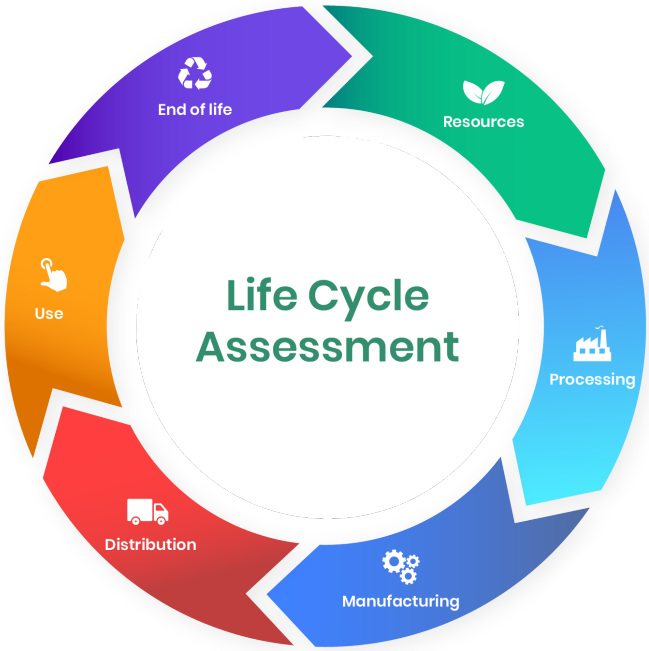

Ethene is used to make poly(ethene). Poly(ethene) is used to make plastic bags. The table below shows data from a Life-Cycle Assessment (LCA) for a plastic bag and a paper bag.

	Plastic bag	Paper bag
Raw materials	Crude oil or natural gas	Wood
Energy used in MJ	1.5	1.7
Mass of solid waste in g	14	50
Mass of CO_2 produced in kg	0.23	0.53
Volume of fresh water used in dm^3	255	4520

A company stated: 'A Life-Cycle Assessment shows that using plastic bags has less environmental impact than using paper bags'. Evaluate this statement. Use the language set out in the key fact on the previous page, your knowledge and the information from the table.
[6 marks]

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The UK government has advised supermarkets to stop using plastic bags due to their environmental impact. Most plastic bags are made from polythene.

The table below shows ways to deal with large numbers of waste shopping bags.

Method	What happens to the plastic bag
Burned	Collected, transported and burnt to release energy
Reused	Customer uses the bag again
Dumped	Mixed with other household waste, collected, transported and disposed of at a landfill
Recycled	Collected, transported washed and melted to make new plastic items

Use the information in the table and your knowledge to give one advantage and one disadvantage for each of the methods used to deal with plastic bags in the table above.
[8 marks]