

# LESSON 3

## PART A:

### Objective:

Students will apply their knowledge of the benefits and drawbacks of the **resources** (e.g. copper, plastic, etc.) used in electronics (from Lesson 1) to deepen their understanding of the life cycle of electronic **products** (computers, printers, cameras, etc.).

### Materials:

- Copies of the “Product Life Cycle” puzzle on page 16: one per group of students, cut into small pieces
- Envelopes (one per small group; preferably envelopes that are being reused)
- One set of puzzle pieces made on an overhead transparency and cut up
- Overhead projector

### Activities:

1. Distinguish between **resources** (= ingredients in a product, e.g. copper, plastic, cardboard) and finished **products** (e.g. desktop computers, printers, notebook computers, cameras, etc.).
2. Ask students to get into groups of two to three. Provide each group with an envelope with the “Product Life Cycle” puzzle. Ask students to put puzzle pieces into a logical order. Some of the students will see that the pieces create a loop or cycle rather than a sequence.
3. Ask one group to present the cycle using the overhead projector.
4. Solicit questions and big ideas for the current discussion and for the bulletin board.



## PART B:

### Objective:

Students will learn about the **environmental** opportunities and drawbacks at each stage of a product’s life cycle.

### Materials:

- Chart paper, bristol board or posters that have already been used on one side
- Sticky tack or conventional tacks
- Markers that do not bleed through the paper
- Blank Life Cycle Worksheet on page 18
- Before class, put the name of one stage of the product life cycle (e.g. “manufacturing” or “distribution”) on one big piece of paper and hang it on the wall in the room. The teacher repeats this for all of the stages. The papers are spread throughout the room. **This would be an excellent activity to do outside. The papers could be put on flattened cardboard boxes on the ground.**

### Activities:

1. Provide an example of an environmental drawback or opportunity at the Design stage of a desktop computer. For example, an opportunity is that computers could be designed to be made from only one type of plastic for more efficient recycling. A drawback is that the cost of upgrading components on your current desktop computer may sometimes be more expensive than buying a whole new one, resulting in discarded systems that still have many working components.
2. See page 17 for more examples. Solicit an example for the Distribution stage. For example, an opportunity is that computers could be distributed to stores by trucks powered by hydrogen fuel cells, or by train, instead of trucks powered by gasoline. A drawback is that the polystyrene foam in packing boxes is not accepted by many recycling programs in Canada. Note: there will be some repetition among the stages. For example, reducing the amount of potentially hazardous materials in a computer can be considered a design challenge as well as a manufacturing challenge. Tell students to focus more on the ideas than on the particular stage in which they should be considered.
3. Divide students into six groups. Each group starts at a different poster/stage and writes as many ideas as possible about an environmental drawback or opportunity at this stage. The groups rotate to a new poster/stage when the teacher asks a student to shout “cycle”. At the next stage, the new group reads the work of the previous group and then adds ideas. The students “cycle” until each group has visited at least three stages. At each stage, encourage the students to carefully read the work of the other groups as they will need as many ideas as possible for their summary sheet so they can prepare for the “Jeopardy” game in the next lesson.
4. Give each student a copy of the blank Life Cycle Worksheet on page 18. Ask students to complete the sheets individually, but encourage them to consult the posters around the room to get as many ideas as possible.
5. Ask students to revisit their own personal “So What” charts/graphics from Lesson 2 and consider whether or not there is anything that they would like to add to the chart. Invite students to add another piece of paper to the chart if necessary.

# PRODUCT LIFE CYCLE PUZZLE

## DESIGN



Designers and engineers make choices that affect how computers are made, how they are used, and how they look.

## RESOURCES



Resources are the materials from which computers are built and can be both natural and human-made.

## MANUFACTURING



Manufacturing is the process of taking raw materials and energy and turning them into computers.

## DISTRIBUTION



Distribution is the process of getting products from the factory to users.

## USE



We use computers on a regular basis for both work and play.

## END OF USE



**RECYCLING**



**DISPOSAL**

There are several choices for managing aging or unwanted computers: extending their life through reuse and refurbishment, and recycling for use in new products. Unfortunately, they are often still disposed of in landfill sites.



**REUSE**



**REFURBISHMENT**

# TEACHER Answer Sheet for Desktop Computer Life Cycle Analysis

Stage	Opportunities	Drawbacks and Challenges
<b>Design</b>	<ul style="list-style-type: none"> <li>• Make components within tower easier to change.</li> <li>• Limit the power features on the computer to those which conserve electricity.</li> <li>• Make the initial start-up process quicker so people will be less reluctant to turn computers off.</li> <li>• Design for easy disassembly at end-of-use stage. For example, use snap-fit parts instead of screws and adhesives.</li> <li>• Make plastic casing from 100% recycled content plastic. Where new material is necessary, consider bioplastic.</li> <li>• Use flat screen monitors wherever possible (they take fewer resources to make and less power to run).</li> <li>• Design computers to meet energy compliance standards, like Energy Star.</li> <li>• Design shipping materials that are lighter, reusable and/or are made from recycled content.</li> </ul>	<ul style="list-style-type: none"> <li>• The cost of upgrading components on your current desktop computer may sometimes be more expensive than buying a whole new one, resulting in discarded systems that still have many working components.</li> <li>• Bioplastics may contaminate other plastic recycling streams during recycling process.</li> <li>• Recycled plastics are hard to secure in quantities that are large enough and clean enough for large-scale manufacturing in new products.</li> <li>• Plastics must meet fire-safety requirements.</li> </ul>
<b>Sourcing</b>	<ul style="list-style-type: none"> <li>• Establish a “fair trade” system with suppliers.</li> <li>• Purchase materials only from suppliers who meet stringent criteria related to sustainability principles.</li> <li>• Pay the “true cost” of materials instead of just their financial cost.</li> </ul>	<ul style="list-style-type: none"> <li>• Big companies have many suppliers who may also have many suppliers of their own, making it difficult to know what is happening at all sites.</li> </ul>
<b>Manufacturing</b>	<ul style="list-style-type: none"> <li>• Use factories that are powered with renewable energy and/or have strict energy conservation goals.</li> <li>• Provide safe and fair working conditions for employees at manufacturing facilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Electricity generated from renewable sources may not be available where the factory is located.</li> <li>• Electricity from renewable sources can be expensive, and the costs could be passed on from the manufacturer of the product to the purchaser.</li> <li>• Potentially hazardous materials, like flame retardants, do an important job: it is difficult to find less hazardous materials to replace them.</li> </ul>
<b>Distribution</b>	<ul style="list-style-type: none"> <li>• Use hybrid trucks and/or trains.</li> <li>• Ship by boat instead of by airplane to reduce the amount of emissions per computer.</li> <li>• Sell through stores that use stringent energy conservation techniques (e.g. less air conditioning and heating, fewer lights on, etc.).</li> <li>• Collect shipping containers and other packing materials for reuse.</li> <li>• Use cardboard that is made from 100% post-consumer fibre.</li> <li>• Eliminate as much polystyrene foam (commonly called Styrofoam™) as possible.</li> <li>• Package products in the most efficient way so less space is needed during shipping which reduces CO<sub>2</sub> emissions.</li> <li>• Use companies that are members of programs such as Clean Ways, which provides hook-up pods at service stations so trucks can plug into the building's power and therefore turn off the trucks (less idling means reduced emissions).</li> </ul>	<ul style="list-style-type: none"> <li>• Polystyrene foam is not accepted by some municipal recycling facilities.</li> <li>• Cardboard often contains material from new trees.</li> <li>• Most packaging material is used only once before it is recycled/disposed of.</li> <li>• Shipping by boat is slower than shipping by airplane.</li> <li>• Small packages are easily stolen from stores.</li> </ul>
<b>Use</b>	<ul style="list-style-type: none"> <li>• Set power settings to those that conserve the most electricity.</li> <li>• Use efficiently – turn on when there are a number of tasks to do; do not turn on and off for only one task.</li> <li>• Avoid screen-savers so that the computer will go into a power-saving mode.</li> <li>• Use a printer's duplexing feature to print on both sides of paper.</li> </ul>	<ul style="list-style-type: none"> <li>• Many people leave their computers on 24/7 and use screen savers which prevent the computer from going into power-saving mode.</li> </ul>
<b>End Of Use</b>	<ul style="list-style-type: none"> <li>• Ensure that hardware “take-back” programs are convenient for example, located at retail outlets or offer pick up from home or office.</li> <li>• Sell refurbished goods at regular retail outlets or online.</li> <li>• Provide safe and fair working conditions for employees at recycling and refurbishing facilities.</li> <li>• Improve processes used to reclaim the materials (for example metals) at the end of the product's use so that as much of the material can be recycled as possible.</li> </ul>	<ul style="list-style-type: none"> <li>• The retail cost of most electronics does not currently incorporate the cost of dealing with disposal and recycling. Adding end-of-use services may put the price of the product considerably above other products by other companies.</li> </ul>

## **Recycling**

Recycling involves collecting computers, sorting their parts, and processing their components into materials for use in new products.

After a computer is recycled back into basic materials, some of those materials can be made into other products – such as TV screens, metal auto parts, and playground structures.



## **Refurbishment**

When you send your computer to be refurbished, it is repaired and tested to ensure that it works well enough for someone else to use.



## **Reuse**

When you arrange for your computer to be reused (by donating it or giving it to someone), you give it an extended life. This can reduce the need to manufacture a new product which has positive consequences at every stage of the life cycle.



## **Disposal**

When people do not properly recycle, refurbish or reuse their computers, they often end up in landfills.



# A LOOK AT THE LIFE CYCLE OF A COMPUTER

## DESIGN

Designers and engineers make choices that affect how computers are made, how they are used, and how they look. They can make a desk top computer more environmentally and socially sustainable by, for example:

- Building it from materials that can be recycled;
- Making it easy to take apart for easier recycling;
- Designing it in a way that makes the price of the computer as accessible as possible to as many people as possible.



1



2

## RESOURCES

Resources can be both natural and human-made. Good environmental and social choices could include:

- Paying communities a fair price for resources;
- Minimizing the amount of raw materials required;
- Using recycled materials;
- Using resources that have special certifications to indicate that they have been responsibly sourced.



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## MANUFACTURING

Manufacturing is the process of taking raw materials and energy and turning them into computers. The manufacturing process can be socially and environmentally responsible by, for example:

- Providing appropriate rights and benefits to workers;
- Reducing pollution.



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## DISTRIBUTION

Distribution is the process of getting products from the factory to users. This includes the part of the life cycle that involves retail stores. Environmental and social considerations during a computer's distribution may include, for example, minimizing:

- How far a product needs to be shipped;
- The amount of packaging used.
- In addition, manufacturers may give preferential treatment to retail stores that have good energy conservation practices.



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## USE

How we use electronics can have both short and long-term impacts on communities around the world. To lessen the impact, we can do many things including:

- Activating power management settings;
- Sometimes adding upgrades to current products to extend their useful life instead of purchasing a completely new product.