# Plants at Work

Trace plant materials from harvest to industrial product.

**BOT.4.4** "Investigate the industrial use of plants."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** In each paragraph, underline the plant part used, circle the product made from it, and number the processing steps in order.

### From Field and Forest to Factory

1. A T-shirt begins in a cotton field, not a clothing factory. Cotton plants produce soft fibers around their seeds. At a mill, machines separate the fibers from seeds, spin the fibers into yarn, and weave or knit the yarn into fabric. Cotton is useful for clothing because its fibers can be twisted into strong, flexible threads that absorb moisture. But growing cotton for large-scale textile production can require substantial irrigation in dry regions. Dyeing and finishing the fabric can also use water and release polluted wastewater if a factory does not treat it. The plant supplies a useful material, while farming and manufacturing shape its environmental cost.

2. A shipping box starts with another plant material: wood from trees such as pine. Paper mills chip the wood, then separate cellulose fibers from much of the lignin that binds them. Workers mix the fibers with water, spread the pulp into sheets, and press and dry it. Thick sheets can become corrugated cardboard for boxes. Pine grows as a managed crop in many regions, and mills can recycle used cardboard into new boxes. However, cutting trees faster than forests regrow can damage habitats. Pulping and drying also require energy, so recycling does not make box production free of environmental costs.

3. Corn can supply starch for industrial packaging rather than food. A factory extracts starch from corn kernels and can turn it into loose-fill pieces that cushion products during shipping. Starch-based loose fill can break down in water and can biodegrade under suitable conditions, unlike conventional polystyrene foam, which persists for a long time. Yet corn farms need land, fertilizer, and fuel, and using edible crops for packaging can compete with food production. The finished product matters too: starch pieces may be a poor choice for goods that must stay dry. Investigating a plant-based product means tracing the plant part, processing steps, useful properties, and costs.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. How do cotton fibers become fabric, and what property makes the fabric useful for clothing?

2. How does a mill turn pine wood into cardboard, and why might used cardboard be valuable to the mill?

3. Why might starch-based loose fill replace polystyrene foam in some shipments, and what limits its use?

4. Why does making an industrial product from a plant not guarantee that it has no environmental cost? Give one farming cost and one manufacturing cost from different examples.

## 3 YOUR TURN

Your own words

Design a disposable cafeteria tray made from one plant material in the passage. In three or four sentences, identify the plant part, describe two processing steps, and explain one environmental trade-off of making your tray.

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## PART 1 · READ AND MARK

In each paragraph, underline the plant part used, circle the product made from it, and number the processing steps in order. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | How do cotton fibers become fabric, and what property makes the fabric useful for clothing? | **Machines separate the fibers from seeds, spin them into yarn, and weave or knit the yarn into fabric. The fibers make strong, flexible threads that absorb moisture.** |
| 2 | How does a mill turn pine wood into cardboard, and why might used cardboard be valuable to the mill? | **The mill chips wood, separates its cellulose fibers, mixes them with water, and presses and dries the pulp into sheets. The mill can recycle used cardboard into new boxes.** |
| 3 | Why might starch-based loose fill replace polystyrene foam in some shipments, and what limits its use? | **Starch-based loose fill can biodegrade under suitable conditions, while polystyrene foam persists. Because starch pieces can break down in water, they may not suit goods that must stay dry.** |
| 4 | Why does making an industrial product from a plant not guarantee that it has no environmental cost? Give one farming cost and one manufacturing cost from different examples. | **Cotton farming can require substantial irrigation in dry regions. Making cardboard from pine requires energy for pulping and drying.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

I would make a disposable cafeteria tray from pine wood. A mill would chip the wood and separate its cellulose fibers to make pulp. Workers could press the pulp into a tray shape and dry it. Pulping and drying take energy, so making the tray still has an environmental cost.

Accept other plant materials from the passage if the proposed processing steps and environmental trade-off are accurate. For question 4, accept any supported farming cost and manufacturing cost from different examples.