

Resource to Result

Trace resources, chemical changes, and effects on society.

MS-PS1-3 "Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic..."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each natural resource, circle each chemical process, and number each benefit or challenge to society. Your marks should help you trace how a resource becomes a synthetic material and affects people.

Materials with a Past

- ① Many useful materials begin as natural resources, substances from Earth or living things. Crude oil, a liquid pumped from underground rock, contains many chemicals. At a factory, workers separate some of these chemicals and link small molecules into long chains through chemical reactions. The chains form nylon, a synthetic material. Nylon can be shaped into strong fibers for clothing, ropes, and parachutes. Its durability can improve safety and make products last longer. However, nylon is usually made from fossil resources, and discarded nylon can remain in the environment for a long time.
- ② Plants can also supply starting chemicals. Corn kernels contain starch, which can be broken into sugars. Microorganisms can change the sugars into lactic acid, and factories can chemically join lactic acid molecules to make a plastic called PLA. This synthetic plastic may become cups, food containers, or packaging. Because its starting resource can be grown again, PLA may reduce dependence on fossil resources. Yet a plant-based label does not guarantee that an item will disappear quickly. Many PLA products need the heat and moisture of an industrial composting facility to break down as intended.
- ③ Alternative fuels show another resource-to-material pathway. Vegetable oils from crops such as soybeans or canola can react with an alcohol and a catalyst to form biodiesel. This fuel can be blended with petroleum diesel and used in some diesel engines. Using biodiesel can create a market for crops and may lower some emissions compared with petroleum diesel. Its effects on society are not all the same, though. Farmers need land, water, and energy to grow the crops, and using large areas for fuel crops can compete with food production. Pathway information helps judge choices.

2 ANSWER WITH EVIDENCE Use the passage

- 1 Use nylon and PLA to explain how both examples support the idea that synthetic materials come from natural resources. Include each starting resource and what happens to it.

- 2 How does the passage show that a plant-based label does not automatically mean an item is easy to dispose of? Use PLA as evidence.

- 3 What information from the passage would help a community weigh one benefit of biodiesel against one possible cost?

- 4 Which material has a fossil resource starting point, and which two start with crops? Explain why all three still count as synthetic materials or fuels.

3 YOUR TURN Your own words

Choose a synthetic material, medicine, food product, or alternative fuel that is not named in the passage. In exactly two sentences, name its natural resource, describe the chemical process that changes it, and explain one benefit and one possible challenge for society.

PART 1 • READ AND MARK

Underline each natural resource, circle each chemical process, and number each benefit or challenge to society. Your marks should help you trace how a resource becomes a synthetic material and affects people. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Use nylon and PLA to explain how both examples support the idea that synthetic materials come from natural resources. Include each starting resource and what happens to it.	Nylon starts with chemicals in crude oil that are separated and chemically linked into long chains. PLA starts with corn starch that becomes sugars and lactic acid, then lactic acid molecules are chemically joined into plastic.
2	How does the passage show that a plant-based label does not automatically mean an item is easy to dispose of? Use PLA as evidence.	Although PLA can start with a renewable plant resource, many PLA products need the heat and moisture of an industrial composting facility to break down as intended.
3	What information from the passage would help a community weigh one benefit of biodiesel against one possible cost?	Biodiesel may create a market for crops and lower some emissions compared with petroleum diesel. Growing fuel crops also needs land, water, and energy, and can compete with food production.
4	Which material has a fossil resource starting point, and which two start with crops? Explain why all three still count as synthetic materials or fuels.	Nylon starts with crude oil. PLA starts with corn, and biodiesel starts with vegetable oils from crops. Each resource undergoes chemical changes to form a new human-made material or fuel.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Bioethanol fuel can be made when yeast chemically changes sugars from corn or sugarcane into ethanol. It can reduce the use of gasoline, but growing crops for fuel can use land and water that might otherwise support food crops.

Accept equivalent descriptions of the resource-to-process-to-product pathways and effects stated in the passage. For Part 3, accept accurate examples that identify a natural resource, a chemical change, one benefit, and one reasonable challenge in exactly two sentences.