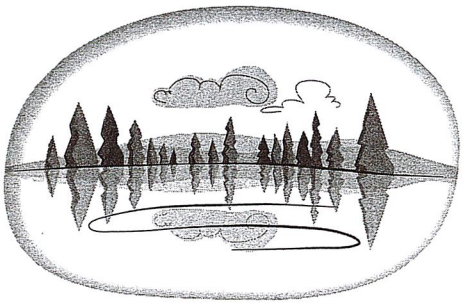
Renewable or Nonrenewable?



People depend on Earth's resources for many things. Some of Earth's resources are renewable over a person's lifetime. Some are nonrenewable over a person's lifetime. Put an X next to all the things that are considered renewable resources over a person's lifetime.

____ **A.** wind

____ **B.** soil

____ **C.** meat from cows

____ **D.** water

____ **E.** wood for building houses

____ **F.** coal

____ **G.** salmon

____ **H.** granite rock for building material

____ **I.** oxygen we breathe

____ **J.** aluminum used in cans

____ **K.** cotton to make clothing

____ **L.** flowers

____ **M.** naturally formed gemstones

____ **N.** nuclear fuel

____ **O.** corn

____ **P.** petroleum oil

____ **Q.** gold

____ **R.** natural gas

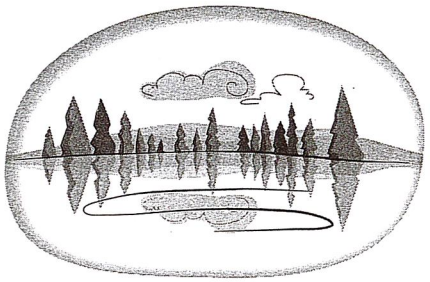
____ **S.** sunshine

____ **T.** cooking oil

Explain your thinking. Describe what you know about renewable and nonrenewable resources.

Renewable or Nonrenewable?

Teacher Notes



Purpose

The purpose of this assessment probe is to elicit students' ideas about Earth's natural resources. The probe is designed to find out if students can distinguish between renewable and nonrenewable natural resources.

Type of Probe

Justified list

Related Concepts

Energy resources, natural resources, nonrenewable resources, renewable resources, sustainability

Explanation

The best answer is A, C, D, E, G, I, K, L, O, S, and T. Earth's land, ocean, atmosphere, and biosphere provide humans with many things they need. Natural resources include air, water, soil, rocks and minerals, metals, energy, plants, and animals. These natural resources are considered renewable if they are replenished naturally and over relatively short periods of time. Some renew at faster rates than others, making them more sustainable than those that do not renew very quickly. For instance, sunshine, which is used for solar energy, is renewable because the Sun always shines. Wind energy is another renewable resource. You cannot stop the wind from blowing any more than you can stop the Sun from shining, which makes wind easy to "renew."

Any plants that are grown for use in food and manufactured products are also renewable resources. Trees used for building material, cotton used for clothes, and food crops (such as corn, which can also be used to make a fuel called ethanol), can all be replanted and regrown after the harvest is collected. Animals are also considered a renewable resource because, like plants, animals can be bred to make more. Livestock (such as cows, pigs, and chickens) all fall into the renewable category. Fish are also considered renewable, but this categorization is a bit trickier because although some fish are actually farmed for production,

much of what we eat comes from wild stocks in lakes and the ocean. Those wild populations are in a delicate balance, and if that balance is upset by too much fishing, the population may die out. If a population dies out, it is no longer considered a renewable resource.

Depending on how water is used, it may be considered a renewable resource. You cannot really "use up" water, but you also cannot make more of it. There is a limited supply of fresh water on Earth, and it cycles through the planet in various forms—as a liquid (bodies of water, tiny droplets in clouds), a solid (polar ice caps and glaciers, tiny ice crystals in clouds), and a gas (water vapor). Liquid water can be used to generate hydroelectric power, which we get from water flowing through dams. Hydroelectric power is considered a renewable resource because we do not actually take the water out of the system and use it up to get electricity.

Some students may think oxygen is a nonrenewable resource because we use it up when we breathe. However, oxygen is continually cycled back into the atmosphere through photosynthesis.

Nonrenewable resources are not easily replenished by the environment. They can also be available in limited supplies. This limitation is usually due to the long time it takes for nonrenewable resources to be replenished. Replenishing an inch of soil may take 200 years or more. Some resources take thousands and millions of years to replenish. Nonrenewable resources include soil, ores containing metals, rocks and minerals, and energy fuels. The aluminum used to make beverage cans comes from an ore. The aluminum can be recycled from the can, but it cannot be renewed (replenished).

Administering the Probe

This probe can be used with grades 3–12. It can be combined with the card sort formative assessment classroom technique described on pages 4–5. Be aware that some students may confuse this probe with renewable and nonrenewable energy resources in general. Make sure students know this probe is about Earth's natural resources, including living and nonliving materials and energy fuels. Make sure they know the time frame for this probe is whether a resource can be replenished in one's lifetime (estimate 100 years).

Related Core Ideas in *Benchmarks for Science Literacy* (AAAS 2009)

6–8 The Earth

- Some material resources are very rare and some exist in great quantities. The ability to obtain and process resources depends on where they are located and the form they are in. As resources are depleted, they may become more difficult to obtain.
- The wasteful or unnecessary use of natural resources can limit their availability for other purposes. Restoring depleted soil, forests, or fishing grounds can be difficult and costly.
- The benefits of Earth's resources—such as fresh water, air, soil, and trees—can be reduced by deliberately or inadvertently polluting them. The atmosphere, the oceans, and the land have a limited capacity to absorb and recycle waste materials.

9–12 The Earth

- The Earth has many natural resources of great importance to human life. Some are readily renewable, some are renewable only at great cost, and some are not renewable at all.

Related Core Ideas in *A Framework for K–12 Science Education* (NRC 2012)

3–5 ESS3.A: Natural Resources

- Energy and fuels that humans use are derived from natural sources, and their

use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

6–8 ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

Related Research

- Rule (2005) found that the use of the common word *oil* to refer to petroleum contributes to misconceptions. Some students think *oil* refers to cooking oil and thus may confuse renewable cooking oil with nonrenewable petroleum oil.
- In a study involving Turkish high school students, students held ideas such as (1) natural gas is a renewable resource, (2) renewable resources do not damage the environment, and (3) fossil fuels take only hundreds of years to replenish (Tortop 2012).

Suggestions for Instruction and Assessment

- This probe can be used as a card sort strategy (Keeley, Eberle, and Tugel 2007). Place the answer choices on cards and have students work in small groups to sort them into renewable resources and nonrenewable resources. Encourage students to discuss and defend their reasons for their card placement.
- Challenge students with more nuanced resources that may be both renewable *and* nonrenewable. An example would be lumber from trees. Trees can be planted, and therefore many people believe that they are completely renewable. This, however, is often not the case when we think about the time frame for renewing a resource. If trees are clear-cut and far more trees are removed than can be grown in a lifetime, the resource is not renewed within a usable amount of time. Also, trees that take a very long time to grow to maturity, such as the giant redwoods, may not be renewed in one's lifetime.
- Water, trees, fish, crops, and other naturally occurring resources are vital for human survival. Many of these resources could be classified as nonrenewable if they are not used responsibly. For example, fishing in an area at a rate above that of the fishes' reproductive cycle would cause the resource to become scarce and possibly extinct, and thus not renewable. Combine this probe with uncovering ideas about sustainability and responsible use of natural resources.
- It takes 100 years or more to make an inch of soil, on average. Students may think soil is a renewable resource because it is so plentiful. You may ask your students to research the amount of time it takes for soil to form and report on situations in which soil depletion is a problem.
- Compare and contrast the terms *recyclable* and *renewable*. Tin and aluminum cans are made from nonrenewable resources but can be recycled back into tin and aluminum cans or into other products. Bottled water contains water, a renewable resource, but the container is made from a nonrenewable resource that is recyclable. Discuss the advantages and disadvantages of recycling nonrenewable resources.
- Challenge students to come up with other materials that are difficult to classify as simply renewable or nonrenewable.
- Have students create a story or comic book about a nonrenewable resource with a sequential description of the conditions

that existed to create the raw materials, the composition of the resource, the process that created the resource, the way it is extracted, the environmental damage caused by extraction (if any), the way it is used, and the amount of the resource that is left.

- Have students debate whether the 3 Rs—reduce, reuse, and recycle—should be expanded to the 4 Rs—reduce, reuse, recycle, and renew.
- The Environmental Protection Agency has a resource for teachers to help define and describe natural resources, renewable resources, and nonrenewable resources. The following website also provides fact sheets on resource usage: *www3.epa.gov/epawaste/education/quest/pdfs/unit1/chap1/u1_natresources.pdf.*

References

American Association for the Advancement of Science (AAAS). 2009. Benchmarks for science literacy online. *www.project2061.org/publications/bsl/online.*

Keeley, P., F. Eberle, and J. Tugel. 2007. *Uncovering student ideas in science, vol. 2: 25 more formative assessment probes.* Arlington, VA: NSTA Press.

National Research Council (NRC). 2012. *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

Rule, A. 2005. Elementary students' ideas concerning fossil fuel energy. *Journal of Geoscience Education* 53 (3): 309–318.

Tortop, A. 2012. Awareness and misconceptions of high school students about renewable energy resources and applications: Turkey case. *Energy Education Science and Technology Part B: Social and Educational Studies* 4 (3): 1829–1840.