

¹ Deep within our Earth's crust there lies some of our most important natural resources. These resources help to heat our homes, run our cars, and maintain machinery in our major industries. As the high demand for these natural resources continues to grow, so must the realization that these resources are limited and **nonrenewable**.



² **Nonrenewable resources** like coal, petroleum, and natural gas, are those resources that are limited in quantity and cannot be replaced quickly after use. Coal, petroleum, and natural gas are produced **organically** which is why they are classified as **fossil fuels**. Fossil fuels form from the remains of plants and animals over millions of years. These resources also contain **hydrocarbons** or compounds of carbon and hydrogen. Stored energy collected by plants and animals from millions of years ago remains in the compounds. It's this stored energy that is released when the hydrocarbons are burned. The burning causes the bonds to break in the hydrocarbons which release heat and light. As countries have become more industrialized, humans have increased the amount of hydrocarbons that are burned, therefore increasing the amount of energy we consume. Before we get into the factors that make these resources nonrenewable, let's discuss how they are formed.

³ The coal deposits that exist on our planet today were formed by the remains of plants from millions of years ago. These remains have gone through the process of **carbonization**. The process begins when plants that are not fully decomposed are buried in areas that have little or no exposure to oxygen. Swamp areas and bogs fit this condition. Once the plants are buried, they become a substance called **peat**. While in the swamp or bog, the peat is partially consumed by bacteria. This causes the methane gas, CH_4 to be released, along with carbon dioxide, CO_2 . The chemical composition of the peat changes as the gas is released. Eventually if the oxygen is present in the swamp or bog, then only peat will be produced. You see, it is the absence of oxygen that allows the first stage of coal production, carbonization, to occur. There also needs to be enough time for coal to form. When there is not enough time, the peat will not transform into coal. In Europe, specifically Iceland and Scotland, peat is used for fuel. The peat is harvested and burned to provide heat for homes. There are also some electric power plants that use peat as fuel.

⁴ Once peat is produced, it may become buried by sediment. The pressure and heat from the overlying layers causes gases and water to be released from the peat. **Lignite**, which is denser and often called brown coal, is formed through this process. More sediment layers are added to the lignite causing an increase in the temperature and pressure. The lignite becomes **bituminous coal**. The most abundant type of coal on our planet is bituminous coal or soft coal. Bituminous coal contains about 80% carbon. **Anthracite**, which is the hardest type of coal, is produced after bituminous coal is placed under extreme pressure and high temperatures. Anthracite is found in areas of the Earth's crust where there is folding and in places where there is high tectonic activity. This type of coal contains about 90% carbon and like bituminous coal, releases a huge amount of heat when it is burned.

⁵ Petroleum and natural gas formed from the remains of plants and microorganisms. These remains accumulate on the lake and ocean floors. They were buried by sediment and over time the accumulation of sediment increased the heat and pressure. Imagine, millions of years of heat and pressure weighing heavily on this sediment. As a result, the remains went through chemical changes that converted them into petroleum and natural gas. Both substances contain hydrocarbons, but in different forms. Petroleum or oil contains liquid hydrocarbons. Natural gas, as its name suggests, contains gaseous hydrocarbons.

⁶ Our consumption of petroleum and natural gas has increased to meet the needs of transportation, farming, and other industries around the world. As you can imagine, finding petroleum and natural gas deposits is a very important task for scientists and industries alike. These deposits are extremely valuable because of high demand and low supply. Deposits of petroleum and natural gas are usually found in **permeable** sedimentary rocks. These rocks are the perfect environment because their interconnected spaces allow the liquid petroleum to easily flow. Increasing pressure from the accumulation of sediments causes the fluids within the sedimentary rock to be forced out of the rock's pores. Water, oil, gas, and other fluids make their way up through layers within the permeable rock. Eventually, the fluids reach a layer of rock that is **impermeable**. This layer is referred to as the **cap rock**. Once the petroleum accumulates and fills all the spaces beneath the cap rock, an oil reservoir is formed. Natural gas, which is less dense, rises above the petroleum, but remains under the cap rock. Water stays below the petroleum because it is the densest of the three substances. Petroleum and natural gas may also be located in **oil traps**. Oil traps are found in the Earth's crust where faults or cracks have sealed the oil reserves.

7 Even though fossil fuels are nonrenewable, they are one of the major sources of our planet's energy. Our plastics, synthetic fabrics, medicines, waxes, detergents, shampoos, insecticides, and many other products are produced using **crude oil**. Crude oil is unrefined petroleum. Many places around the world depend on coal for heat and energy. Coal deposits are located worldwide. However, the United States, Russia, and China combined have two-thirds of our world's coal deposits. Geologists believe we have overlooked areas that contain undiscovered petroleum deposits. They also believe that we have located most of our petroleum reserves around the world. One resource, **oil shale** has been studied by geologists. Oil shale, which contains petroleum, could be the resource we need to boost our petroleum supply. However, it is cheaper to mine petroleum from sedimentary rocks than it is to mine oil shale. Our dependence on fossil fuels may eventually need to step aside as our supplies lessen around the world.

Name _____



Date _____

Nonrenewable Resources - Fossil Fuels

<p>1. Why is sedimentary rock a good environment for petroleum and natural gas deposits?</p> <p>_____</p> <p>_____</p>	<p>2. The hydrocarbons in fossil fuels are the result of carbon and hydrogen compounds from the remains of plants and animals.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>
<p>3. Based on context clues, what does the word permeable mean?</p> <p>_____</p> <p>_____</p>	<p>4. Explain how cap rock helps the Earth's crust to maintain its petroleum and natural gas reservoirs.</p> <p>_____</p> <p>_____</p>
<p>5. Summarize the formation of coal.</p> <p>_____</p> <p>_____</p>	<p>6. What are oil traps?</p> <p>_____</p> <p>_____</p>

Name _____



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Nonrenewable Resources - Fossil Fuels

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| <p>7. Petroleum companies have started to mine oil shale because it is a cheaper deposit to mine.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p> | <p>8. Two-thirds of our world's coal deposits are located in _____.</p> <p><input type="radio"/> A China, Japan, and Great Britain</p> <p><input type="radio"/> B United States, Russia, and China</p> <p><input type="radio"/> C Russia, Great Britain, and China</p> <p><input type="radio"/> D United States, Great Britain, and Japan</p> |
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Nonrenewable Resources - Fossil Fuels - Answer Key

1 Sedimentary rock is a good environment for petroleum and natural gas deposits because of its permeability. The petroleum and natural gas are able to flow easily through the interconnected spaces of the layers within the rock.

2 True

3 Rocks have spaces or cracks that allow liquids to flow within the rock or penetrate the rock.

4 The cap rock is the layer of the Earth's crust that is impermeable. The petroleum and natural gas cannot penetrate this rock. Therefore, the petroleum and natural gas are allowed to build up and form reservoirs.

5 Coal is formed from the remains of dead plants. The plant remains are buried prior to decomposing in an environment that lacks oxygen. Swamps and bogs tend to have this characteristic. Once buried, these remains become peat. The peat becomes partially consumed by bacteria. This causes methane gas and carbon dioxide to be released. The chemical composition of the peat changes as the gas is released. After peat is produced, it may become buried by sediment over time. The pressure and heat from the overlying layers cause gases and water to be released from the peat. Lignite or brown coal is then produced. More layers of sediment are added on top of the lignite. The increase in temperature and pressure changes the lignite into bituminous coal. When bituminous coal is placed under extreme pressure and temperature, anthracite coal is produced.

6 Oil traps are locations in the Earth's crust where faults and cracks have sealed up oil reserves.

7 False

8 United States, Russia, and China