Norfolk Public Schools
Science Learning in Place Plan: Environmental science Lessons

Week 4: April 6 – 10, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Minerals and Energy Resources Reading & Text Annotation: • Read **"Ore Deposit"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Minerals and Energy Resources** Concept Analysis: • Review the article **"Ore Deposits"** • Answer the questions on the handout **"Ore Deposits Concept Analysis"**	**Minerals and Energy Resources** Reading & Text Annotation: • Read **"Mineral and Biological Resources"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Minerals and Energy Resources** Concept Analysis: • Review the article **"Mineral and Biological Resources"** • Answer the questions on the handout **"Mineral and Biological Resources Concept Analysis"**	**Minerals and Energy Resources** Concept Analysis: • Complete the worksheet entitled, **"Minerals Reading"**

Week 5: April 13 – 17, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Spring Break				

Week 6: April 20 – 24, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Mining Reading & Text Annotation: • Read **"Coal Mining in Virginia"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Mining** Concept Analysis: • Review the article **"Coal Mining in Virginia"** • Answer the questions on the handout **"Coal Mining in Virginia Concept Analysis"**	**Mining** Reading & Text Annotation: • Read **"Mining Lithium"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Mining** Concept Analysis: • Review the article **"Mining Lithium"** • Answer the questions on the handout **"Mining Lithium Concept Analysis"**	**Mining** Concept Analysis: • Complete the worksheet entitled, **"Gold Rush Boomtowns: Cross-Curricular Focus – History/Social science"**

CRITICAL READING *strategies*

Marking the Text

\# → Number the paragraphs

→ Circle key terms

→ Underline essential info

(...based on the reading purpose)

→ Box new vocab words

(...and define them in the margins)

Additional Ways to Mark the Text

→ [Bracket] information

(when underlining has been used for another purpose)

→ Write labels in the margins

(double underline labels to stand out from other marks)

Minerals and Energy Resources Concept Analysis

Directions: Answer and justify each question. Justify your answer by indicating the paragraph that supports your answer.

Ore Deposits Analysis Questions	**Justifications**
1. What is ore? What metals make up the most valuable or deposits?	1.
2. Why has iron been mined for thousands of years?	2.
3. Describe the process of smelting.	3.
4. What is ore genesis? What are the major types?	4.
Mineral & Biological Resources Analysis Questions	**Justifications**
1. What are mineral fuels and where are they most abundantly located?	1.
2. List the nonferrous base metals found in South America.	2.
3. What biological resources did South American farmers introduce to others?	3.
4. What animal resources from other continents benefited South Americans?	4.

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Ore deposits are a source of valuable metals and minerals

By National Geographic Society on 02.05.19
Word Count **725**
Level **MAX**

In this Oct. 9, 2012 photo, strings of melted gold from a 350 kg (almost 772 pound) gold bar drip into water during the smelting process at the Emirates Gold company in Dubai, United Arab Emirates. Dubai has set up gold refineries, vaults and jewelry-making facilities building building itself up as a center for the gold trade, between sources in Africa and consumers in the rising economies of China and India. Photo by Kamran Jebreili for AP.

Ore is a deposit in the Earth's crust of one or more valuable minerals. The most valuable ore deposits contain metals crucial to industry and trade, like copper, gold and iron.

Copper ore is mined for a variety of industrial uses. Copper, an excellent conductor of electricity, is used as electrical wire. Copper is also used in construction, and is a common material in pipes and plumbing.

NATIONAL GEOGRAPHIC

Like copper, gold is also mined for industry. For example, space helmets are plated with a thin layer of gold to protect astronaut's eyes from harmful solar radiation. However, most gold is used to create jewelry. For thousands of years, gold ore was mined as a basis for currency, or money. Most nations stopped valuing their money on the gold standard in the 20th century.

Iron ore has been mined for thousands of years. Iron, the second-most abundant metal on Earth, is the main component of steel. Steel is a strong, valuable building material. Iron is used in everything from glass to fertilizer to the solid rocket boosters needed for the space shuttle to leave the Earth's atmosphere.

Metals are often associated with particular ores. Aluminum, for example, is usually found in the ore called bauxite. Aluminum found in bauxite is used in containers, cosmetics and medicines.

Smelting And Electrolysis

When miners find rock containing mineral ore, they first extract the rock from the earth. This can be a huge process, sometimes displacing millions of tons of dirt. The rock is then crushed by powerful machinery.

Metal is extracted from the crushed ore by one of two major methods — smelting or electrolysis.

Smelting uses heat to separate the valuable metal from the rest of the ore. Smelting usually requires a reduction agent, or another chemical, to separate metal from its ore. In the earliest smelters, the reduction agent was carbon in the form of charcoal. Charcoal burned with hematite ore, for instance, smelts iron.

Electrolysis separates metal from ore by using acid and electricity. Aluminum, which burns at a very high temperature, is extracted from bauxite by electrolysis. Bauxite is placed in a pool of acid, and an electrical current is run through the pool. The electrons in the current attach to oxygen and hydrogen, the other elements in bauxite, leaving the aluminum.

Ore Genesis

Earth contains only a finite amount of ore. Ore genesis, the process by which a deposit of ore is created, is estimated to take millions of years. There are three major types of ore genesis: internal processes, hydrothermal processes and surficial processes.

Ore can accumulate through geologic activity, such as when volcanoes bring ore from deep in the Earth to the surface. This is called an internal process. Ore can also accumulate when seawater circulates through cracks in the Earth's crust and deposits minerals in the areas around hydrothermal vents. This is called a hydrothermal process. Finally, ore can accumulate through processes that take place on the surface of the Earth, such as erosion. This type of ore genesis is called a surficial process.

Ore can also fall to Earth as rocky debris from the solar system. These pieces of debris, entering the atmosphere as shooting stars, are called meteorites. Many meteorites contain large amounts of iron ore.

Ore is a nonrenewable resource. Because modern societies rely so heavily on metallic ore for industry and infrastructure, miners must constantly seek new ore deposits. Mining companies have explored every continent, as well as the ocean floor, in their search for valuable ore. This scarcity contributes to ores value.

South America: Mineral and biological resources

By Encyclopaedia Britannica, adapted by Newsela staff on 01.28.20
Word Count **1,000**
Level **1050L**

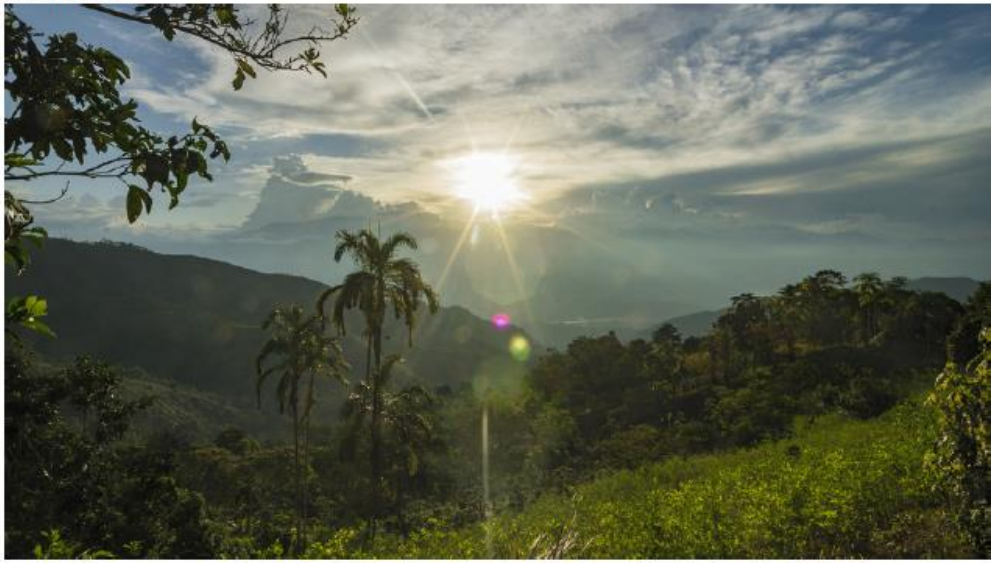


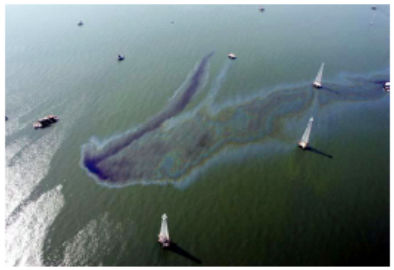
Image 1. The sunset over the Amazon rain forest in Peru. About 60 percent of the Amazon is in Brazil, and the rest is in Bolivia, Colombia, Ecuador, Guyana, Suriname, Venezuela and Peru. It is full of natural resources. Photo: gustavo ramirez/Getty Images.

South America is rich in mineral resources, although they are highly localized. Few countries have a good balance of fuels and raw materials. Two countries, Uruguay and Paraguay, have almost no mineral wealth.

Mineral Fuels

Oil and natural gas are found in abundance in several areas of South America. The greatest quantities are located near Venezuela's Lake Maracaibo and the nearby Caribbean coast. In fact, Venezuela is one of the world's largest oil producers, with major deposits of natural gas as well. Since 1972, Ecuador has become a major oil producer, developing oil deposits east of the Andes, the mountain range that runs down the length of the continent. Oil fields were brought into production in the early 1970s in the Peruvian Amazon. Argentina has traditional oil-producing regions around the city of Comodoro Rivadavia. Oil deposits can also be found near the southern tip of the continent in Patagonia and Tierra del Fuego. Colombia has long been self-sufficient in oil and gas production.

Overall, South America is poor in coal resources.



Iron And Ferroalloys

South America contains about one-fifth of the world's iron ore reserves, which is iron in its natural rock form able to be dug up and processed. The most important beds are located in Brazil and Venezuela. The great majority of the continent's reserves are in Brazil. Similar high-quality beds of iron ore are also found in Venezuela, Bolivia and the Chilean Andes.

Among ferroalloys — those ores that combine iron with other elements — manganese occurs in the Brazilian states of Amapá and Minas Gerais. It can be found as well in highland Bolivia. Chile ranks third in the world for largest reserves, while Peru comes in fourth.

Nonferrous Base Metals

Nonferrous metals — metals that do not contain iron — are abundant in South America. The continent's copper reserves represent more than one-quarter of the world's total. Nearly all of these reserves are found in Chile and Peru. In Chile, deposits in the northern Atacama Desert contain the largest amounts of copper known in the world. Peru's deposits are found in the country's central Andean ranges as well as in the south.

Bolivia ranks among the world's largest tin producers. Significant tin deposits also occur in Brazil's western Amazon basin near the Madeira River. Lead and zinc are found in the Brazilian state of Minas Gerais, as well as areas in the Andes that include the central mountains of Peru, the highlands of Bolivia and the northern Argentine mountains.

Precious Metals And Gemstones

Europeans used South America as a major source of gold and silver from the 1530s through the late 1700s. Today, however, the region contributes only a small percentage to the world's production of these precious metals. Brazil is South America's leading gold producer, with deposits in the Amazon basin accounting for much of the output. Gold is also produced in the Carajás mountains in the north. Gold deposits in Colombia's Atrato River basin are significant. The metal is also still produced in Venezuela. It continues to be important in gold-mining centers in the Andes of Peru and Chile. As far as silver is concerned, Peru has historically been one of the world's main exporters. However, production has decreased. Ecuadorean silver is located primarily in the Andes, while Colombia, Argentina and Bolivia also produce silver in their highland areas.

Many regions of South America, mainly in Brazil, are famous for their gems. The ancient bedrocks of the Brazilian Highlands are rich in precious stones, including diamonds. Other precious or semiprecious stones are abundant in the same region, notably topazes, aquamarines, garnets, opals and sapphires. Colombia is famous for its emeralds.

Botanical Resources

South America has abundant biological resources. This refers to areas of plant and animal life. These resources are unevenly distributed. For example, there are limited large areas suited to wide-scale agriculture. These include the Argentine Pampas, central Chile and southeastern Brazil.

South American farmers grew numerous plants as food crops before Europeans arrived. These were later introduced into Europe, Asia and Africa and became dietary staples there. South America changed how the world ate through these crops: corn (maize), potatoes, tomatoes, cassava, beans and cocoa.

The vast forests that cover about half of the continent are considered South America's richest natural resource. Brazil has more than 1.5 million square miles (3.88 million square kilometers) of tropical rain forest. It is the most densely forested country in the region. However, since the 1980s, rapid deforestation in the Amazon rain forest has become a worldwide concern. This is because of deforestation's effects on the environment. Tropical grasslands represent South America's second major botanical resource.

Animal Resources

Animal resources play a major role in the economies of most South American countries. In the times before European contact, South American farmers domesticated relatively few animals. Llamas and alpacas were farmed in the high Andes. They were raised for their wool and their meat. Guinea pigs were raised as a meat source in the Andean highlands from Colombia to Argentina.

Animals introduced to the continent — cattle, horses, goats, sheep, pigs and chickens — all adapted rapidly and thrived in the New World. Cattle have become especially important in areas such as the grasslands of Venezuela and Colombia, the Argentine Pampas and the rolling plains of Uruguay. Sheep and goats have done well on the drier, colder grazing lands of the Patagonian plains.

Minerals Reading

Minerals are an important part of our every-day lives. In fact, practically every manufactured product that you might use in a typical day contains materials made from minerals.

What is a Mineral?

A **mineral** is a naturally occurring, solid, inorganic substance that has a definite chemical composition and crystal structure. For an Earth material to be considered a mineral, it must have the following characteristics:

1. Minerals are **naturally occurring** – they are not made by humans.

2. Minerals are **solids** – they are not liquids or gases at room temperature.

3. Minerals have an **ordered atomic arrangement** -- the chemical elements that make up each mineral are arranged in a particular way - this is why minerals 'grow' as crystals. Each mineral has a unique internal arrangement of atoms and crystal structure.

4. Minerals have a **definite chemical composition (make-up)** – each one is made of a particular mix of chemical elements.

Quartz crystals

5. Minerals are **inorganic** – they have never been alive and are not made from plants or animals.

QUESTIONS:

1. Based on the 5 characteristics of minerals, describe why the following examples are **NOT** minerals:

   a. Paper:_____

   _____

   b. Ice:_____

   _____

2. Graphite and Diamond are both made up of the same element - Carbon. However, they are identified as different minerals. Why?

   _____

   _____

   _____

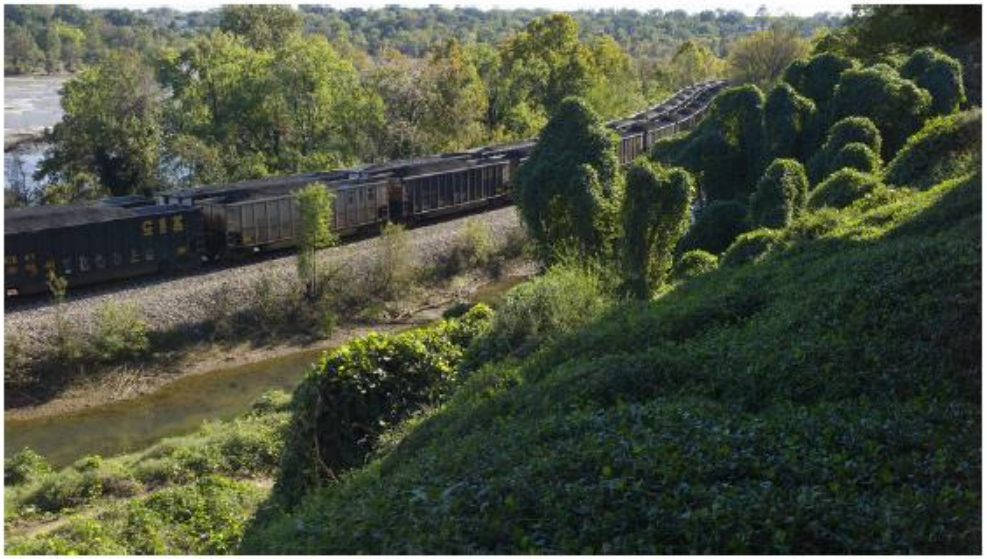
Mining Concept Analysis

Directions: Answer and justify each question. Justify your answer by indicating the paragraph that supports your answer.

Coal Mining in Virginia Analysis Questions	**Justifications**
1. When and where were the first mines dug in Virginia?	1.
2. How did the Richmond coal industry influence transportation?	2.
3. How did people use coal?	3.
4. What interrupted coal transportation from Richmond?	4.
Mining Lithium Analysis Questions	**Justifications**
1. What is meant by "lithium makes the wheels of modern life turn"?	1.
2. How does lithium help the fossil fuel supply?	2.
3. Why did the lithium mining organization stop operating?	3.

The start of coal mining in Virginia

By Virginia Department of Mines, Minerals and Energy, adapted by Newsela staff on 03.10.20
Word Count **757**
Level **950L**



Coal trains follow the path of the James River on October 18, 2018 as they enter downtown Richmond, Virginia. Photo: Andrew Lichtenstein/Corbis via Getty Images

The first commercial production of coal in the American colonies began in 1748 with the Richmond coalfield located in Virginia. Over the next 200 years, hundreds of drill holes, shafts, slopes and open pit mines were developed. With the development of the coalfield came transportation improvements. They included roads, two canals and four railroad companies. Mining engineering practices were also improved by the Richmond coal industry. Initially, mining was haphazard. Accidents and lost coal were common. Explosions of methane or coal dust claimed hundreds of miners' lives. Modern mining methods such as ventilation, roof support and mechanized mining machinery did not appear until much later. However, Virginia coal mines were unable to compete with coalfields elsewhere and the last major mine closed in 1927.

Introduction

The United States is blessed with an ample supply of coal. This fossil fuel helped our country become the world's industrial leader. The story of coal in the American colonies began with discoveries in the 1670s in what is now western Illinois. Virginia's first mines were dug along the James River west of Richmond in 1701. With easy access to a tidewater port, the Richmond coalfield developed rapidly. The first documented commercial coal production in the American colonies was in the Richmond field in 1748. This field eventually produced an estimated 8 million tons of coal.

Transportation facilities had a major influence on the Richmond coal industry. Ocean-going vessels could dock and load on the James River as far inland as Richmond. The Richmond coal mines were only 10 to 15 miles from the docks. Road improvements, such as the Midlothian Turnpike (now U.S. Highway 60), were built to handle coal wagon traffic. The James River moved large amounts of coal to tidewater docks. The Kanawha Canal — the brainchild of future president George Washington — did as well.

Later, canals were replaced by more efficient rail lines. The Chesterfield Railroad, one of Virginia's first rail lines, was built solely to move coal.

While Richmond coal production was increasing, other coalfields were also being developed. The coal regions of Pennsylvania, Maryland and the Valley fields of western Virginia began shipments to tidewater ports by the middle 1800s. Coals from Flat Top and Pocahontas fields in western Virginia soon followed. Such competition took its toll on Richmond coal production. Operations were also hampered by the U.S. Civil War (1861–1865) and mismanagement of mining operations. The larger mines continued operations until the late 1800s. Coal was becoming increasingly difficult to mine there, however, and production steadily declined.

Transportation And Development

For more than 200 years, the Richmond coalfield contributed to turning Richmond into a major trade center. Coal initially was used for household purposes. Later, and more importantly, it was burned as a forge fuel, and an iron industry soon developed in Richmond. Coal was transported on dirt roads from the mines. The Midlothian Turnpike, a major road, was built near the pits of Midlothian and Black Heath in 1802 to speed up delivery.

Kanawha Canal was completed in 1795. The mines north of the James River could then transport their coal by barge to Rocketts (now the Fulton area). It was replaced in 1880 by the Richmond and Alleghany Railroad.

Small mines opened in the Carbon Hill district in the early 1800s. They produced coal for the local market. By 1827, business was good. The supply of coal in the Carbon Hill mines proved to be worth commercial development.

To move larger quantities of coal, the Tuckahoe Creek Navigation Company was chartered. In 1828, the Tuckahoe Canal was completed. It connected Tuckahoe Creek to the James River and Kanawha Canal. The Tuckahoe Canal was in constant use until 1840, when the Tuckahoe and James River Railroad was built. This rail line increased the amount of coal delivered to Richmond and Fredericksburg from the Carbon Hill mines.

Interstate transportation of coal from the Richmond coalfield was interrupted in 1861 by the Civil War. Coal production during the war years, 1861-1865, was primarily directed to the Confederate war effort. When Union troops marched on Richmond, molds and machinery for forging cannons and other weapons were taken from foundries and dumped into the James River. The Confederates did not want them falling into the hands of the enemy. After the war, several new mines were dug, and old ones re-opened. By 1927, though, the last major mines had closed.

Today, only parts of this coal mining and transportation system are still preserved. The rest reverted to swamp or were removed as suburban Richmond grew.

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Desert is ideal for mining lithium that greases wheels of modern life

By Atlas Obscura, adapted by Newsela staff on 03.06.19
Word Count **575**
Level **1040L**

Image 1. Lithium in various stages of dehydration. Photo by: Lauren Dauphin/USGS Landsat Data

The surface of the Salar de Atacama in Chile is incredibly dry. Most living creatures stay away from the salar, which is a dry flat area.

Underneath it, though, is a treasure trove of lithium.

Lithium is a light, valuable metal and Salar de Atacama holds the world's largest and purest supply of it. Lithium helps power many electronics, including smartphones and computers.

Flamingos touch down sometimes in the area, which is surrounded by volcanos. They land while traveling back and forth between the wetlands of Chile and Argentina. Otherwise, there is no full-time life visible on the salar. Even insects don't live there.

It's "literally the driest place in the world," says Brian Jaskula, a scientist who works for the United States Geological Survey (USGS). That dryness makes it the world's best spot for lithium mining.

From above, as in the photo recently released from NASA and the USGS's satellite, the lithium mines create a mosaic pattern of rectangular shapes. The colored shapes are swimming-pool blues and hot whites. The green shapes range from dark and lawn-like to Mountain Dew-hued. Surrounded by a flat reddish brown backdrop of land, these shapes represent different stages in the 18-month lithium-mining process.

0.02 Percent Concentration Is "High"

The blue shapes are brine, freshly drawn from as few as 15 feet below the salar floor. They contain 0.02 percent lithium, a concentration that seems small. However, it is about 100 times higher than commercial lithium sites elsewhere in the world.

Until 2003, lithium was a relatively minor substance. It was used as medicine in a pill that stabilizes swings in mood and body temperatures. Lithium also could be found in glassware and in products that help grease car door hinges and wheels through hot days and freezing winters.

Now, lithium makes the wheels of modern life turn. It's used in lithium-ion batteries that power smartphones, laptops and, increasingly, electric vehicles.

"Rain is the enemy of a brine operation like this," says Jaskula. Without rain, the Salar de Atacama contains the perfect characteristics for lithium mining. It has a high lithium concentration below ground along with plenty of sun and hot wind to do the drying work once it's above ground.

Just The Right Color

The goal is to evaporate water and remove altering elements such as magnesium and salt from the brine. Eventually, the amount of lithium in the brine reaches 6 percent. The shapes look chartreuse, light green with a hint of yellow. At that point, it can be trucked away to processing plants where it is separated and shipped all around the world.

Electric vehicles powered by lithium could reduce the environmental damage caused by fossil fuels like oil and gasoline. However, the appetite for lithium could make this alternative unsustainable, too. The International Energy Agency predicts more than 120 million new electric cars will be on the road over the next 20 years. The new cars will require a significant quantity of lithium.

Just recently, a new lithium-mining company in the region dropped its project. It left because of protests from the Atacama community. The spot was quickly swallowed up by Chilean SQM, which along with American company Albermarle command most of the lithium business in Chile. While lithium looks like an ideal way to help handle climate change, its future is still not so clear.

Gold Rush Boomtowns

Cross-Curricular Focus: History/ Social Sciences

The discovery of gold in the California Territory sparked not only national interest, but even worldwide attention. California was not even a state yet when gold was discovered in 1848. There were few regulations on treasure hunting. Gold was there for the taking. The adventurous risked everything and came by the thousands. The cities of Sacramento, Stockton and San Francisco expanded from tiny little villages to huge, active towns almost overnight. A town that grows rapidly due to new business opportunities became known as a **boomtown**.

Towns grew increasingly larger as more and more settlers came to the area. People from all over the world came to San Francisco in particular. They brought a variety of goods and services with them, making San Francisco an international cultural center. People of the time compared it to London, England. Prices were very high, but goods from around the world were available.

Usually, boomtown populations were mostly men. Few women came to California in the early days of the Gold Rush. The men who came to find their fortunes believed they would quickly make lots of money to take back home to loved ones.

When it became clear that people were not going to become wealthy overnight, some miners returned to their home. Those who stayed began to send for their families. Women with skills like cooking, washing clothes and sewing were highly regarded. Men did not like to do these things for themselves. Women willing to travel to the West could make a very good living marketing their homemaking skills. If single women wanted to marry, they had their choice of hundreds of men.

Though gold is what attracted people to the boomtowns, few made their fortunes by finding it. Those who really struck it rich were the **entrepreneurs.** They took advantage of the opportunity to sell things to the large numbers of people around them. A good example of this is Levi Strauss. He invented and sold durable pants for miners. They caught on in a big way. We know them now as blue jeans. Today, you don't have to be a miner to wear jeans. Some discoveries endure over time.

Name: _____

Answer the following questions based on the reading passage. Don't forget to go back to the passage whenever necessary to find or confirm your answers.

1) What is a boomtown?

_____

_____

2) What is the name of one California boomtown? _____

_____

3) What were some of the things that motivated women to come eventually?

_____

_____

_____

_____

4) What did an entrepreneur do during the Gold Rush? _____

5) Would you have wanted to go to California for the Gold Rush? Why or why not? _____

_____

_____