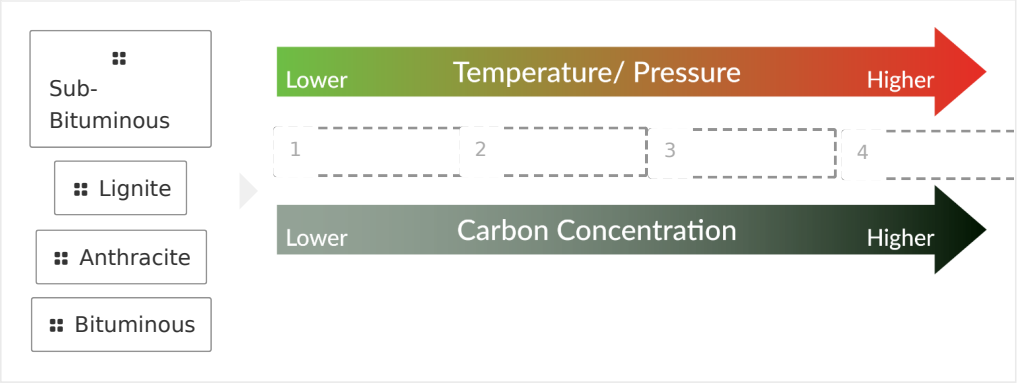
SI Geology - Full Discipline Demo

Geologic Resources

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Geology - Full Discipline Demo
Course	SI Geology - Full Discipline Demo
Instructor	Sales SI Demo

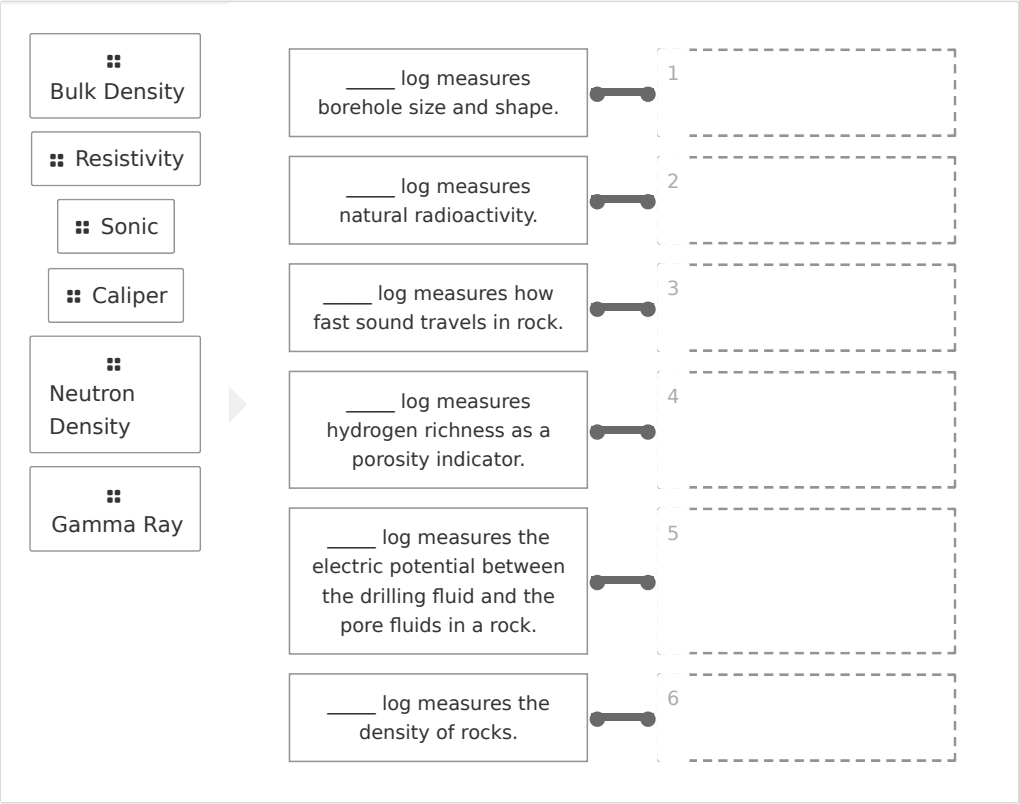
Test Your Knowledge



Correct answers:

1 Lignite 2 Sub-Bituminous 3 Bituminous 4 Anthracite

Match each term with the best definition.



Correct answers:

1 Caliper 2 Gamma Ray 3 Sonic 4 Neutron Density

5 Resistivity 6 Bulk Density

Exploration

What are REEs?

- Rare Electrical Elements
- Regular Earth Elements
- Rare Earth Elements ✔
- Regular Electrical Elements

Coal is formed in deposition-dominated, oxygen-poor environments such as _____.

- shallow marine environments
- desert environments
- volcanic environments
- swamp environments ✔

The transformation from peat into coal is known as _____.

- migration
- catagenesis
- coalification ✔
- metagenesis

What geophysical log measures the natural radioactivity of rock units?

- Caliper log
- Gamma ray log ✔
- Resistivity log
- Density log

What is the purpose of geophysical logs utilized in resource exploration?

- Geophysical logs provide real-time images of the Earth's interior to identify mineral resources.
- Geophysical logs are used to measure the distance between resource deposits and the Earth's surface.
- Geophysical logs help in assessing the economic value of resources by analyzing market demand.
- Geophysical logs record physical properties of rock formations to infer subsurface characteristics and identify potential resources. ✔

Exercise 1

Talc ($Mg_3Si_4O_{10}(OH)_2$) is commonly used in various cosmetics. What physical properties of talc make it an ideal ingredient in makeup?

As you saw in this exercise, corundum (Al_2O_3) is a very hard mineral. Based on your results, what other mineral from the exercise could be useful as an abrasive, such as in sand paper?

Data Table 1: Unknown Minerals Identification
(SAMPLE ANSWER BELOW)

Mineral Sample	Color/Clarity	Streak	Hardness	Other Distinctive Properties	Mineral Name
1	White or colorless/ transparent to translucent	White	3	Effervesces in acid	Calcite
2	White or colorless/ transparent to translucent	No streak	7	Hard; looks greasy	Quartz
3	Gray to black/opaque	Dark gray	6	Magnetic and heavy	Magnetite
4	White or colorless/ transparent to translucent	White	2.5	Tastes like salt; very light	Halite
5	Grayish blue/opaque	No streak	>6.5 (9)	Very hard; some surfaces glossy	Corundum
6	White or pale green/opaque	White	<2.5 (1)	Feels like soap	Talc

Data Table 2: Household Products and Their Descriptions
(SAMPLE ANSWER BELOW)

Product Name	Description
Antacid Tablets	White and chalky. Fizzes in acid
Baby Powder	White and very soft. Repels water
Glass Plate	Semi-hard and you can see through it
Magnet	Dark gray. Magnetic
Nail File	Dark colored. Very hard and gritty

Table Salt	Clear and light. Tastes salty

Data Table 3: Minerals and Their Corresponding Products
(SAMPLE ANSWER BELOW)

Mineral Name	Product Name
Calcite	Antacid tablets
Quartz	Glass plate
Magnetite	Magnet
Halite	Table salt
Corundum	Nail file
Talc	Baby powder

Exercise 2

List the samples according which experienced the highest heat and pressure, with one being the lowest amount of heat/pressure and three being the highest.

Describe how increasing heat and pressure change the properties of coal, using your observations of the samples in this exercise as examples.

Data Table 4: Coal Properties and Identification
(SAMPLE ANSWER BELOW)

Sample	Color	Texture	Appearance	Density (g/mL)	Type of Coal
1	Black	Hard and brittl	Shiny, but leaves dust on hands	Variable	Bituminous Coal
2	Dark Brown	Crumbles easily	Few small plant fragments	Variable	Lignite
3	Black	Very hard and s	Very glassy	Variable	Anthracite

Exercise 3

List the lithologies (rock types) present on your well log from the most radioactive (1) to the least radioactive (4).

On the well log, the first track on the left (dashed line) is the caliper, which gives the diameter of the borehole. This is important for recognizing collapsed or "caved" zones (where the caliper line moves to the far right). What numbered sections on your well log correspond to a collapsed/caved reading?

What numbered sections have the best reservoir potential, and what rock types correspond with these sections? Explain your reasoning.

What causes shale zones to have false porosity?

What other factors might geologists consider when assessing reservoir potential?

Data Table 6: Description of Geophysical Logs
(SAMPLE ANSWER BELOW)

Type of Geophysical Log (Curve)	Description of What the Log Measures
Caliper	Borehole size and shape
Gamma Ray	Natural radioactivity (Ur, Th, 40K)
Neutron Porosity	Hydrogen richness (H2O, HCO3)
Density	Rock density (g/ml)

Competency Review

True or False?

Ores can be economically mined due to their high mineral content.

- True ✔
- False

True or False?

The properties of minerals have no significant impact on their utilization as valuable resources in different industries.

- True
- False ✔

Which geological process primarily contributes to the formation of fossil fuels, such as coal, oil, and natural gas?

- Metamorphism
- Volcanic activity
- Organic decomposition ✔
- Erosion and weathering

True or False?

Geophysical logs offer insights into subsurface properties like rock type, porosity, and fluid content, and they are read by interpreting the recorded changes in measurement values.

- [x] True
- [ ] False

A _____ measures the electric potential between the drilling fluid and the pore fluids in the rock.

- [x] Resistivity log
- [ ] Caliper log
- [ ] Sonic log
- [ ] Gamma ray log

Which physical properties of coal samples are commonly used for their identification and characterization?

- [ ] Taste and odor when heated.
- [x] Surface color and visual appearance.
- [ ] Elasticity under pressure.
- [ ] Radioactive decay rate.

How are geophysical logs primarily used to interpret lithologies and assess reservoir potential?

- [x] By recording variations in rock properties such as density, porosity, and resistivity.
- [ ] By analyzing seismic waves to determine the depth of underground resources.
- [ ] By directly observing the mineral composition using a microscope.
- [ ] By measuring the radioactive decay of minerals in the subsurface.

True or False?

The physical properties of coal samples, such as their color, texture, and luster, can provide valuable information for their identification and characterization.

- [x] True
- [ ] False

Extension Questions

Explain how the properties of minerals are connected to their practical use as valuable resources. Choose one mineral and describe two of its key properties (such as hardness, color, luster, or conductivity), and then discuss how these properties make it suitable for a specific application or industry. Provide a real-world example to illustrate your points. (SAMPLE ANSWER BELOW)

The relationship between mineral properties and their utilization as valuable resources is a fundamental aspect of understanding the significance of minerals in various industries. One illustrative example is the mineral quartz, which showcases how its properties directly contribute to its practical applications.

Quartz is a mineral characterized by its hardness and its unique property of piezoelectricity. Its hardness, rated 7 on the Mohs scale, signifies its resistance to scratching and abrasion, making it an ideal material for manufacturing high-quality glass products. The hardness of quartz ensures that glass products made from it are durable and able to withstand external forces. This makes quartz an essential component in the production of glass used in smartphones, windows, lenses, and even scientific instruments. The piezoelectric property of quartz, on the other hand, refers to its ability to generate an electric charge when subjected to mechanical stress. This property is harnessed in a wide range of applications, including quartz crystals used in electronic devices like watches and oscillators, where the precise frequency generated by the piezoelectric effect is critical for accurate timekeeping and signal generation.

In essence, the hardness of quartz ensures its durability in glass production, while its piezoelectric property finds applications in various electronics.