GOVERNOR'S OFFICE OF ENERGY DEVELOPMENT

Advancing Utah's Energy Future

Minerals in Our Daily Lives

Grade/Subject: 8th Science

Strand/Standard 8.4.1 Construct a scientific explanation based on evidence that shows that the uneven distribution of Earth's mineral, energy, and groundwater resources is caused by geological processes. Examples of uneven distribution of resources could include Utah's unique geologic history that led to the formation and irregular distribution of natural resources like copper, gold, natural gas, oil shale, silver, and uranium. (ESS3.A)

Lesson Performance Expectations:

- Students will explore what a mineral is, where they are found in Utah and what minerals are used for. They will construct a scientific explanation of what causes some minerals to be found in Utah while others aren't and why the minerals found here are not distributed evenly across the state.

Materials:

- Samples of minerals and other substances that are used to make a cell phone (One of each)

- **Mineral Boxes** (one of each item per box, one box per group)
  - Container
  - Glass marble
  - Picture of ice
  - Sugar cube
  - Cotton ball
  - Aluminum foil
  - Wood
  - Rock salt
  - Plastic beads
  - Small vial of liquid water
  - Small piece of granite

- Computers or printed materials about mining in Utah
- Tape (2 small pieces for each student)
- Posters of Utah's Geologic History (http://www.mapstore.utah.gov/pi054.html - One per student group)
- Copies of a blank outline map of Utah for each student.
- A copy of the Utah Mining District Areas and Principle Metal Occurrences Map. This map can be ordered here from the Utah Department of Natural Resources bookstore. Online link here.

Time:

Two 45 minute class periods

Teacher Background Information:

- **What are minerals?** Minerals are naturally occurring inorganic, pure substances. No matter how tiny of a piece of mineral you have, it is identical to all other pieces of that same mineral. Minerals have a very orderly

structure, meaning each atom is arranged in a specific pattern known as a crystal lattice. This structure is usually, but not always, seen as crystals. There are more than 3000 known minerals on Earth. Combinations of different minerals make up all the rocks on earth.

- **What are minerals used for?** The bricks of the school building, the glass in your windows, your gaming machines, your cell phones, iPads, and computers – none would exist without minerals. Minerals are also essential in science and industry, for everything from computer circuits to diamond drills. Apart from their utility, beautiful and precious gems cut from mineral crystals give us pleasure to wear or just look at. Minerals are our most valuable and widely used natural resources.
- **What minerals are found in Utah?** Utah is rich in many minerals that make life as we know it possible: copper, gold, silver, uranium, iron, lead, zinc, molybdenum, phosphate, salt, potash, beryllium, and gilsonite top the list. The world's largest known beryllium resource is in Juab County, and the world's largest open-pit copper mine is at Bingham Canyon just southwest of Salt Lake City (Source: Utah Mining Association). Copper is used for electrical equipment, cooking, roofing, coins, and as a poison. Beryllium is used in alloys with other metals to increase conductivity, lightness, and stability. Information about rocks and minerals in Utah. Information about the uses of minerals. Video: Exploring Utah's Mining History. (7.43 min)
- **How are minerals accessed?** Generally, minerals are extracted through mining operations and processes.

Student Background Knowledge:

- Students need to know that are rocks made from minerals. The rocks you find in a stream or your backyard came from the mountains and hills around you. These mountains are made of rocks and rocks are made up of minerals. See this National Park Service website about rocks.
- Students need to understand the difference between renewable and nonrenewable resources.

Teacher Step by Step: A 3-d lesson should insist students do the thinking. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

1. **Phenomenon - Mystery Box**

All of the following substances are used to make a cell phone. Find samples of as many as you can and pictures of what you can't and place them all in a box. (See pictures at end of lesson.)

Materials in a Cell Phone	
Quartz Sand (Glass)	Sapphire (Glass)
Crude oil (Plastic, PVC)	Fiberglass
Mineral pigments, resin (Paint/Ink)	Charcoal
Lead (Galena)	Tantalum
Beryllium (Beryl)	Zinc
Aluminum (Bauxite)	Germanium
Lithium	Gallium
Cobalt	Nickel
Graphite	Palladium

Gold	Iron
Copper (Malachite)	Tungsten
Silver (Argentite)	Neodymium
Platinum	Silicon (Feldspar, quartz)

Tell the students that the substances you have in the box all have something in common. Take the items out of the box one at a time and place them on a table where the students can see them. Briefly explain what each one is. When all the items have been removed, ask the students to record three observations about any patterns they see in the items on their student sheet. Ask them to explain what they think the materials have in common and then ask three questions about what they have seen. The teacher will guide them to questions about where all the materials come from, if they are found in Utah, and whether there are a lot available.

2. **What is a mineral?**

To help the students understand what a mineral is, provide each group with a container that has the items in the table below. They will take an item out of the container, list it on their student sheet, decide if it is a mineral or not and explain why they came to that conclusion. Go through the items together and list their reasons for including or not including items on the board. When you are done you should have a definition of what a mineral is. The students will record this definition.

Sugar cube Cotton ball Wood	Not minerals - organic
Plastic beads	Not minerals - not naturally occurring
Vial of liquid water	Not a mineral - not solid
Glass marble	Not a mineral - no crystal structure
Small piece of granite	Not a mineral - not homogenous
Aluminum foil (aluminum is an elemental mineral) Rock salt Picture of ice Other minerals such as quartz or feldspar	Minerals

3. **What minerals are found in Utah and how are they used?**

Mineral Scavenger Hunt: Provide the students with the name of a mine in Utah. You can use the suggested mines on the list accompanying this lesson. They will research what minerals are found in that mine and what those minerals can be

used for. Provide each student with two of the 'Mineral Scavenger Hunt' slips. They will fill out slips for two of the minerals found in their mine, find an object in the classroom that is made using that mineral and tape the paper to it. When all of the students are finished, have them walk around the room looking at the other students' paper slips. They will record the information for four other objects on their student sheet.

Show the students the baby graphic illustrating how many minerals they use in their lifetime and read the story "What are Minerals Used For" by Carl Ege, found in the Utah Geological Survey Notes v. 34 no. 2, June 2002, or online at this link: https://geology.utah.gov/map-pub/survey-notes/glad-you-asked/what-are-minerals-used-for/
You may want to show the students this video (4:40 minutes) about the uses of minerals.

Watch the Rio Tinto video and virtual tour about mining at Kennecott.

4. **Minerals are not evenly distributed in Utah.**
As part of their research the students found information about how their mineral was formed. Ask them to describe what they think that means about what has happened in Utah in the past. Compare answers with their group and together come up with a list of events that they think happened in Utah's past.
Provide each group with images or information showing Utah's geologic history, such as the poster: Utah: A Geologic History From Paleozoic to Present or Deep Time Maps. Ask them to find the events they predicted. Were they right?
Provide each student with a blank outline map of Utah. Ask them to color in the areas of the state where they think their mineral could be found. They will compare their map with the Map of Utah Mining Districts. Write a statement explaining why your mineral isn't found everywhere in Utah.

5. **Explaining the Phenomenon**
Discuss the predictions the students made about what all of the items in the box had in common. Reveal that all of the items are used to make cell phones. Could products like cell phones be manufactured without mining the minerals that are found in Utah? Video: Where Does Your Phone Come From? (length 2:29)

Assessment of Student Learning.

1. If Utah were to be cut off from other states and countries, how would that affect your daily life?
2. What could we still make?
3. What would we miss out on?
4. Explain what causes some minerals to be found in Utah but not others and why they are not distributed evenly across the state.

Standardized Test Preparation:

Minerals in Our Daily Lives

1. If Utah was no longer able to import minerals from other states and countries, how would that affect your daily life? Choose all that apply.
    a. The number and kinds of products available would decrease.*
    b. Less jewelry would be available to people.*
    c. More Utah minerals would be used to replace them.*

d. Very few changes would be noticed.

2. What minerals are mined in Utah? Choose all that apply.
    a. Gypsum*
    b. Copper*
    c. Salt*
    d. Diamonds

3. Could we make a cell phone out of minerals found in Utah?
    a. Yes, we have them all.
    b. Yes, we could make them all if we didn't have them.
    c. No, we do not have them all.*
    d. No, we do not know how.

4. Why are minerals not distributed evenly across the state? Choose all that apply.
    a. Minerals form under different geologic conditions.*
    b. Each state got a different amount and kind of minerals.
    c. Minerals are randomly spread around Earth.
    d. The atoms needed to make the mineral were present.*

Extension of lesson and Career Connections:
Understand the economic value of mining operations throughout the state

To further explore mining in Utah, choose from the following activities:

- All jobs are related to natural resources in some way; some are more directly related than others. Even though only a few jobs are involved in developing the natural resources, all jobs are involved in upgrading (manufacturing) or using (service industry) natural resources. Everything we use in our daily lives is dependent on mined materials. Utah is an abundant source for many of these required minerals. How does this affect Utah's economy? Find a manufacturer who uses one or more of the minerals mined in Utah to create a product we use daily. Research which mineral(s) is/are used, how much of that mineral is used, how much it costs, and any jobs that are related to the extraction, manufacture, and sale of that item.
- Choose one of the minerals you researched and follow its path from mine to consumer usage.

Minerals in Our Daily Lives

Name: _____

Phenomenon: Mystery Box

Record three observations about what occurred.	
Explain what you think all the materials have in common.	
Ask three questions about the materials.	

What is a Mineral?

Description of Item	Is it a mineral?	Why or why not?

What makes something a mineral?

Mineral Scavenger Hunt

Name of your mine:		What county in Utah is this mine located in?	
What minerals are found in this mine?			
Pick two of the minerals found in this mine. Research the properties of each mineral and what they are used for.			
Name of Mineral	How is this mineral formed?		What are some of the ways we use this mineral?

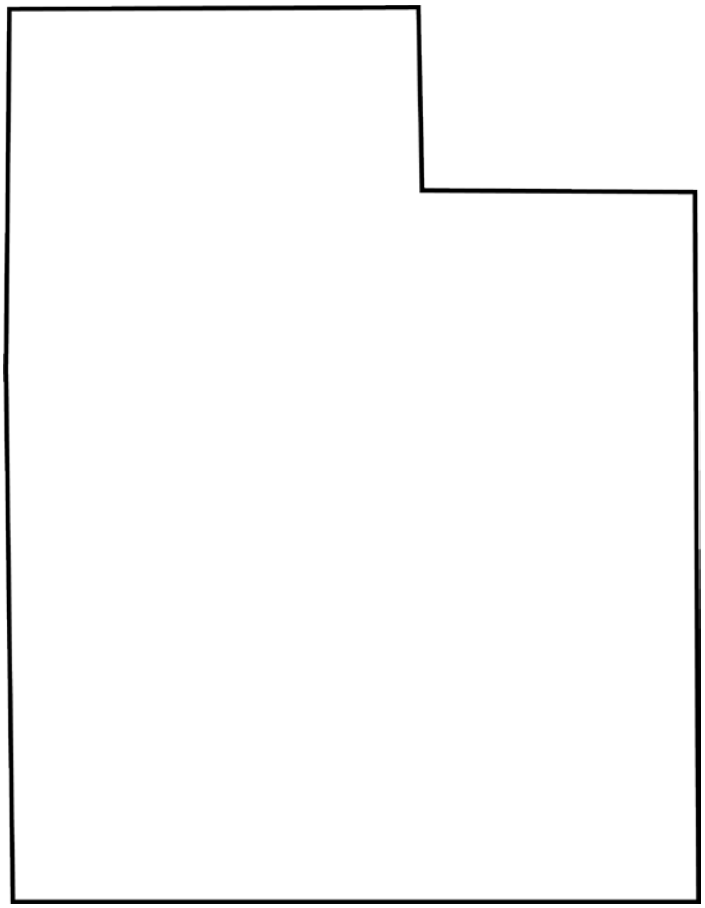
Your teacher will give you two slips of paper to write your information on. Tape them to objects in the room that contain the mineral. Walk around the room and find the papers for four minerals that you did not research. Record the information about these minerals below.

Name of Mineral	How is this mineral formed?	What are some of the ways we use this mineral?

In the previous section you researched how your minerals were formed. What does this tell you about Utah in the past?

Name of mineral:	How is it formed?	What does this tell you about Utah in the past?

Use what you have learned about how your minerals are formed and what has happened to the geology of Utah in the past to predict where you think these minerals could be found in Utah. Color in these areas on the map below.



Compare your prediction with a real mineral map of Utah. How close were you?

Explain what causes all minerals not to be found everywhere in Utah.
Give evidence to backup your claim. Explain why the minerals you researched are not found everywhere.

Explaining the Phenomenon

1. What did all of the objects in the box have in common?

2. Could we make cell phones without the products that are mined in Utah?

3. What are some other products that we wouldn't have without the minerals mined in Utah?

Mineral Scavenger Hunt- Student Slips

Utah's Minerals Scavenger Hunt Name of Mineral: Name of Mine where found: Renewable or Nonrenewable? Use for this mineral:	**Utah's Minerals Scavenger Hunt** Name of Mineral: Name of Mine where found: Renewable or Nonrenewable? Use for this mineral:
Utah's Minerals Scavenger Hunt Name of Mineral: Name of Mine where found: Renewable or Nonrenewable? Use for this mineral:	**Utah's Mineral Scavenger Hunt** Name of Mineral: Name of Mine where found: Renewable or Nonrenewable? Use for this mineral:
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ADDITIONAL MATERIAL

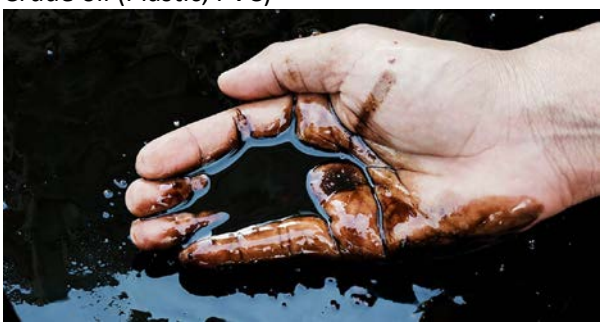
Major Mines in Utah	Minerals Mined
Bingham Canyon Copper Mine	Copper
Park City Mining District	Silver
Tintic Mining District	Silver
Brush Wellman	Beryllium
Glitter Mine, Little Salt Creek Gypsum Mine	Gypsum
Iron Mountain District	Iron
Intrepid Potash	Potash
Silver Reef, Escalante Silver Mine	Silver
InZinc Mining	Zinc
Energy Fuels Inc., Pandora Mine	Uranium

Mystery Box Pictures

Quartz Sand (Glass)

Sapphire (Glass)

Crude oil (Plastic, PVC)



Fiberglass

Mineral pigments, resin (Paint/Ink) 	Charcoal 
Lead (Galena) 	Tantalum 
Beryllium (Beryl) 	Zinc 
Aluminum (Bauxite)	Germanium

Lithium

Gallium

Cobalt

Nickel

Graphite 	Palladium 
Gold 	Iron 
Copper (Malachite) 	Tungsten 
Silver (Argentite)	Neodymium

	
Platinum 	Silicon (Feldspar, quartz)