

The Golden Reward Mine

Teaching Tip

Compound vs. Mixture: A Simple Separation

Compound vs. Mixture: A Simple Separation

The Golden Reward Gold Mine south of Lead was established in 1887 on a claim staked ten years earlier, at the peak of the Black Hills gold rush. The mine is located at the base of Terry Peak in the northern Black Hills.

The mine has changed owners several times during its history and gone through periods of both high and very low activity.

The late 1980s and 1990s were an especially productive time at the Golden Reward Mine. According to figures published by Wharf Resources (U.S.A), Inc., which currently owns the mine, the Golden Reward produced approximately 280,000 ounces of gold and 365,000 ounces of silver between 1989 and 1996.



Blast, Golden Reward Mine (Still from film)



The mine operation is described as "an open pit, truck, and shovel operation." This video clip (left) from a Golden Reward Mining Company film describes the process of drilling, setting explosives, and blasting rock and ore in a surface mine.

Another portion of the film (page 2) describes the heap-leaching process from just after blasting to just before the gold is extracted from the leachate - the

liquid used to separate the gold from the ore. The video also summarizes the intent of the mining company's reclamation plans at the time. (Mining companies operating in South Dakota and elsewhere in the U.S. are normally required to restore disturbed land as nearly as possible to its original condition.) Heap leaching of gold from ore using a cyanide solution is a process that dates to 1886. Other methods of extracting pure gold from ore have at times utilized mercury, bromine, chlorine, or sulfur.

The Golden Reward Mine

Teaching Tip

Compound vs. Mixture: A Simple Separation



Monitoring of possible environmental impacts from the Golden Reward and other mines in the Black Hills is ongoing.

During this activity your students will learn about compounds and mixtures. They will learn how a chemical change (reaction) is needed to break apart a compound and how mixtures can be separated by physical procedures. Your students will learn how workers at the Golden Reward Mine used a cyanide solution to chemically remove gold and silver from the ore they mined. Then your students will complete an activity in which they will use physical techniques to break apart a mixture.

Process:

- Introduce the activity by showing the “The Golden Reward Mine” videos above and by viewing the photos on the following [website](#).
- Discuss the history of mining in South Dakota and the current practice used by Wharf Resources to remove gold from the ore. Below are many websites with information about mining in South Dakota and the cyanidation process.
 - Dakota Pathways: [Mining Booms and Busts](#)
 - [South Dakotas Mineral and Mining website](#)

The Golden Reward Mine

Teaching Tip

Compound vs. Mixture: A Simple Separation



Heap-Leaching, Golden Reward Mine (Still from video)

- [New Interactive Construction Aggregate Map](#) with 519 licenses (view your area today)
- [Mining in SD](#) (SD Historical Society)
 - [Hard Rock Mining in the Black Hills](#)

Wharf Mine (Golden Reward)

- [History of Mining in South Dakota](#)
 - [Current Wharf \(Golden Reward Mine\) Expansion Project Plan of Operations](#)
 - [Video of Mining and Reclamation Plan of Wharf-Terry Peak Expansion Project](#)
 - [EPA: Treatment of Cyanide Heap and Tailings](#) (Process and Chemical Change)
 - [Processing Gold Ores Using Heap Leach-Carbon Adsorption Methods](#)
- Have your students complete the following lab activity. Your students will be given a simple mixture. Your students will separate the mixture into its individual components.

The Golden Reward Mine

Teaching Tip

Compound vs. Mixture: A Simple Separation

- A list of materials that could be used for the mixture is shown below. Gather the items below or other items of your choice; selected items should have specific characteristics that will allow the students to separate them. Characteristics like size, color, texture, density (float in water), solubility in water, etc. are helpful.

- Materials:

- Crackers
- Chocolate chips
- Rice
- Dry beans
- Small pieces of a Styrofoam plate/cup (Floats in water)
- Small pieces of white paper to compare to the plate; they will sink in water.
- Clean sand (One possible separation technique - Place the sand, salt and water mixture in a coffee filter to remove the sand. Then boil the water to remove the salt.)
- Salt (Dissolve in water, separate by boiling. Should be in controlled environment with parents or teacher.)
- Etc. (Be creative)



- Show the students the items you have selected for the mixture. Mix the items in front of them. Discuss mixtures; explain how each item in the heterogeneous (not uniform) mixture (left) maintains all of their original characteristics and are easily separated by physical means. Other mixtures like saltwater, which is a homogenous mixture (same throughout), might look different than the original components, but each component can still be separated by physical means (boil/evaporation in the example of saltwater). Also, the

components within a solution like saltwater could still retain some of their original characteristics. The salt looks different in the solution, but it will taste salty. The NaCl and H₂O are still separate within the solution; they have not changed

The Golden Reward Mine

Teaching Tip

Compound vs. Mixture: A Simple Separation

chemically into a different substance. This is not true of the cyanidation process described in the resource section above.

- Divide the prepared mixture so that each student has a sample to separate. Have the students separate the mixture in class or send the mixture home in a plastic baggie for separation at home. (Younger students: 3 – 5 items; older students 6-8 items)
- The students should separate the mixture into its original components.
- The students should return the separated components with a description of how each item was separated from the mixture.



Blast, Golden Reward Mine (Still from film)