TeachEngineering

Mines to Mobiles: Aqueous Solutions and Environmental Chemistry

Day 1

DO NOW

Complete the "*Mines to Mobiles*" Warm-Up Questions with your group

Mines to Mobiles Warm-Up Questions

Directions: Work with your group to answer the following. You may include drawings to help illustrate your answer.

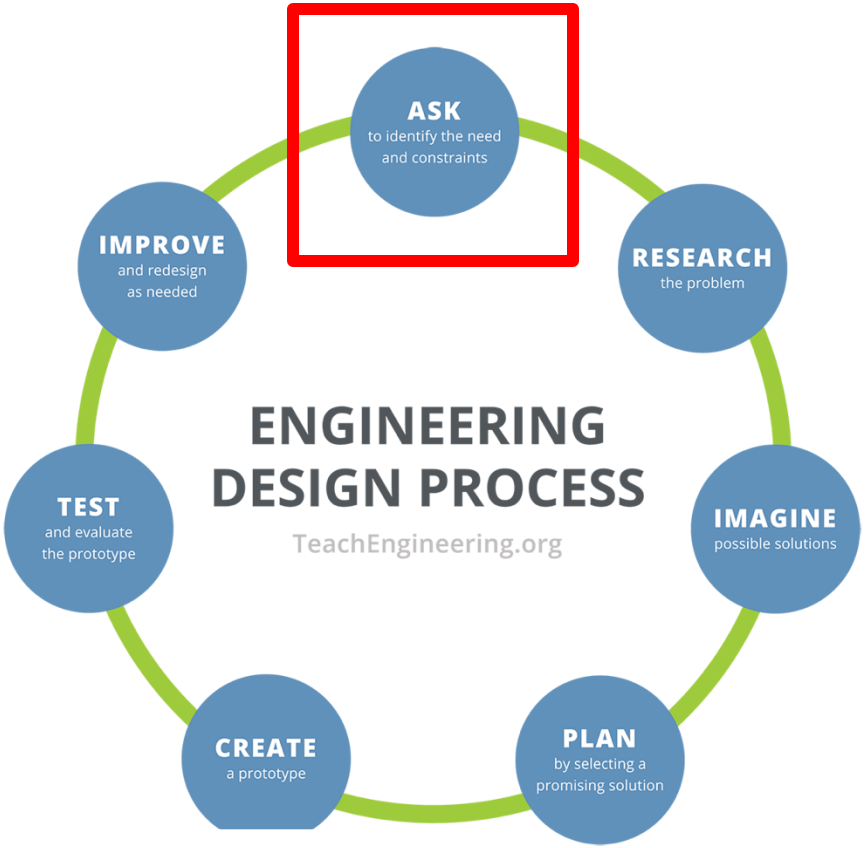
1. What is mining?

2. What are common metals obtained from mining?

3. What impact does mining have on the environment?

4. Name two everyday items that are made from metals.

DAY 1 (45 MINS)

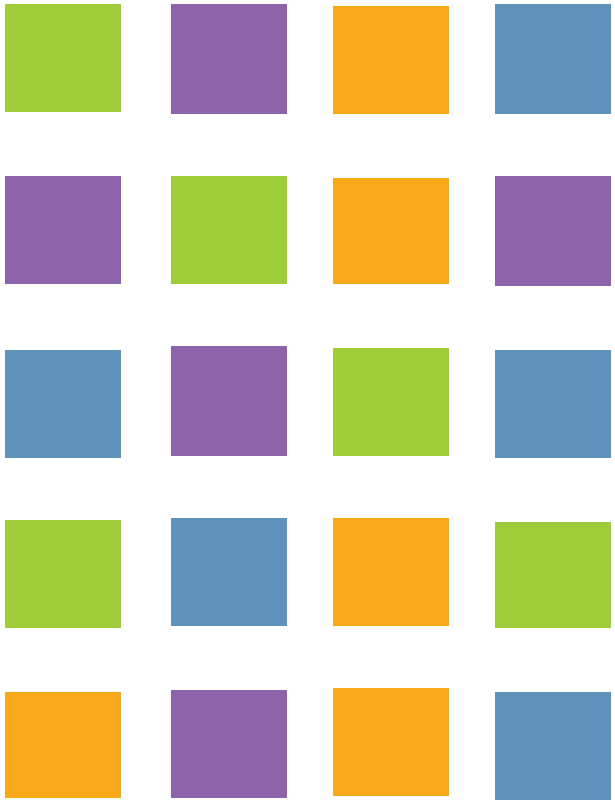


Teach Engineering

WHAT ARE PHONES MADE OF?

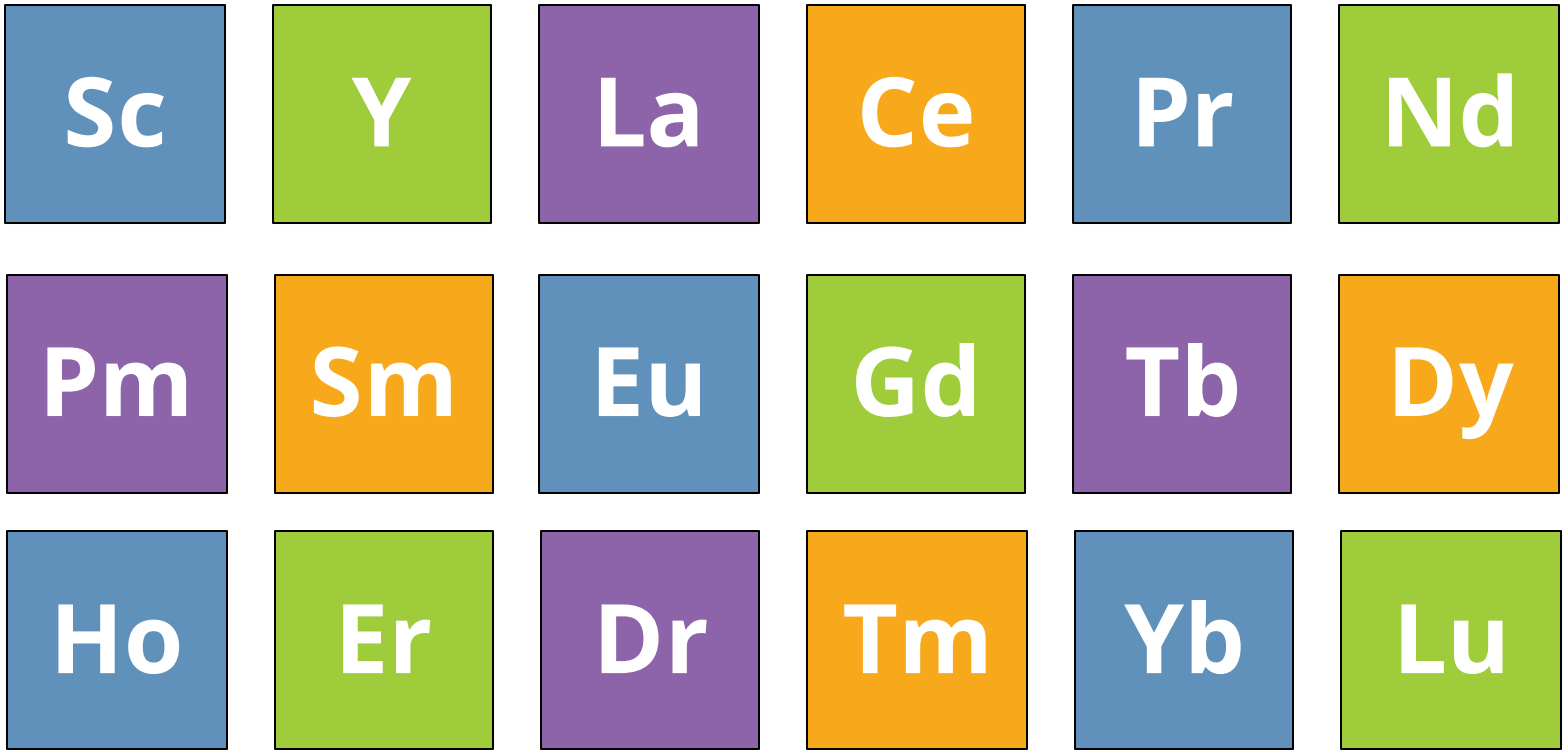
What metals do they use?

Where do we get these metals from?



PHONES ARE MADE OF MANY METALS

We particularly care about lanthanides (rare earth elements) for displays.



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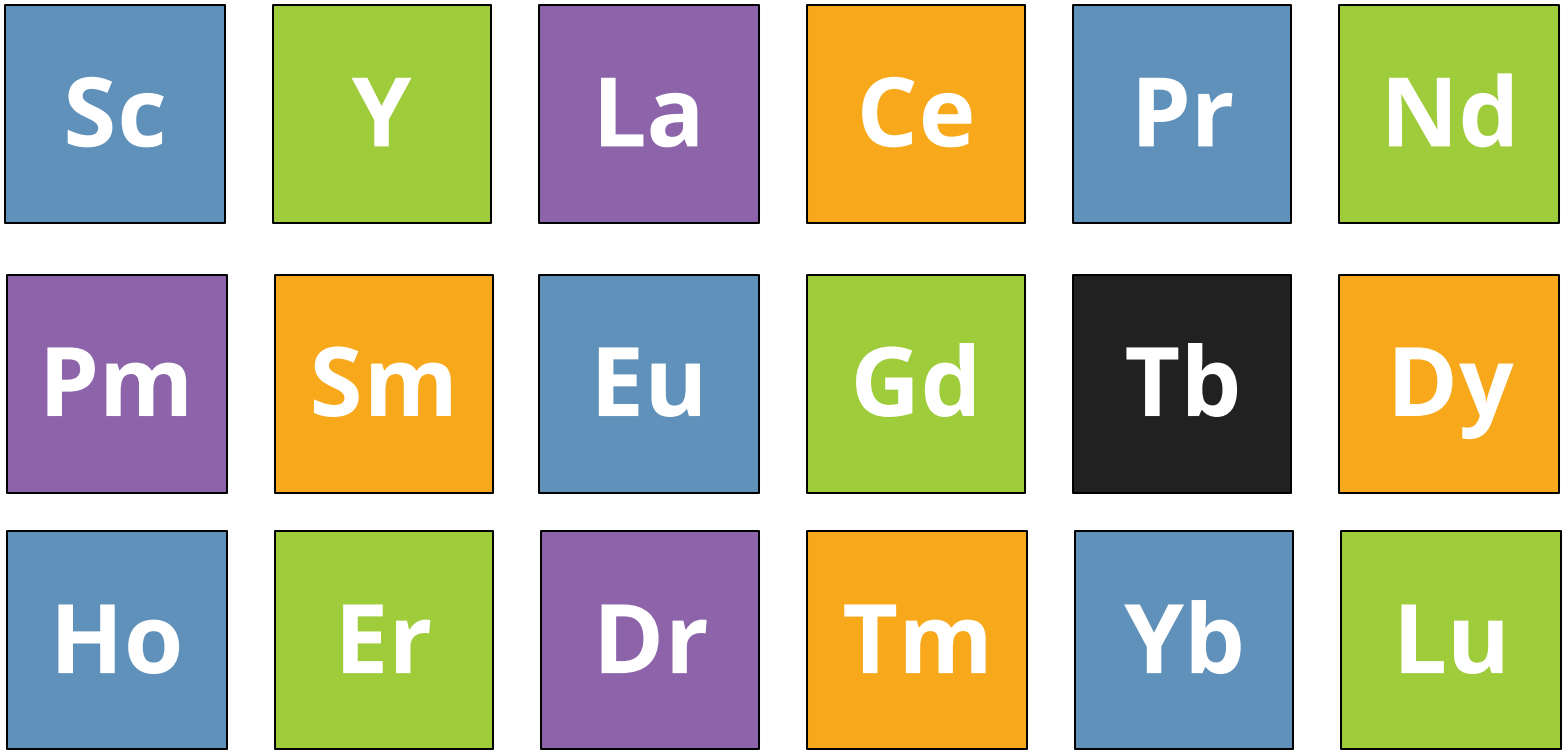


METALS COME FROM THE EARTH'S CRUST

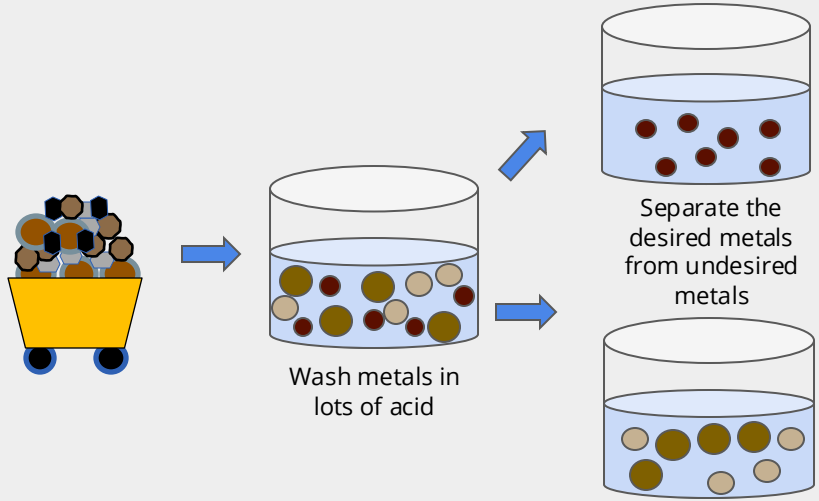
Mining involves two main steps:

Step 1: Extraction

Miners dig into the earth to take metals from rock.

Step 2: Purification

Often, metals do not come clean and ready to use. We need to separate them from other metals and clean them for manufacturing.

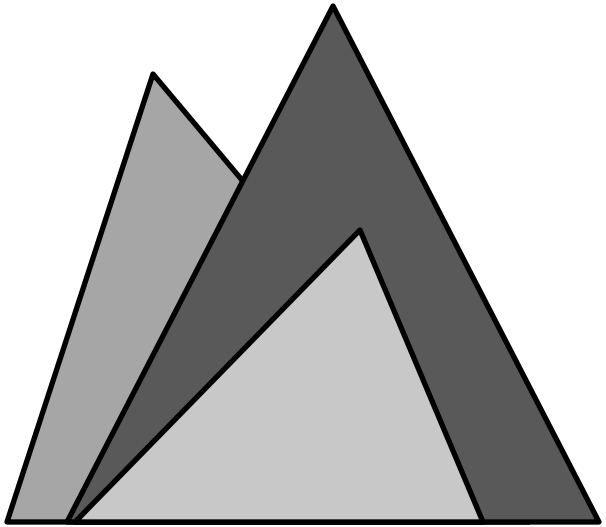


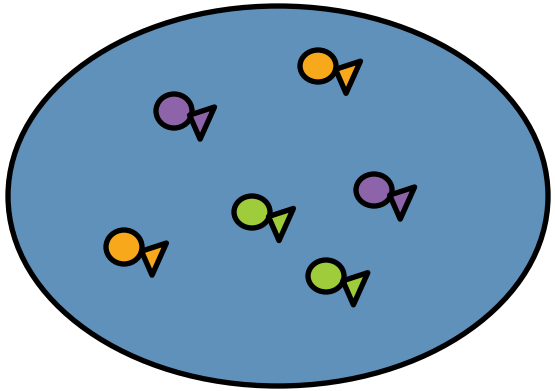
Mining Process

MINING POLLUTION

If acid leaks from mines…how could this affect the local ecosystem?

LAND **WATER** **AIR**

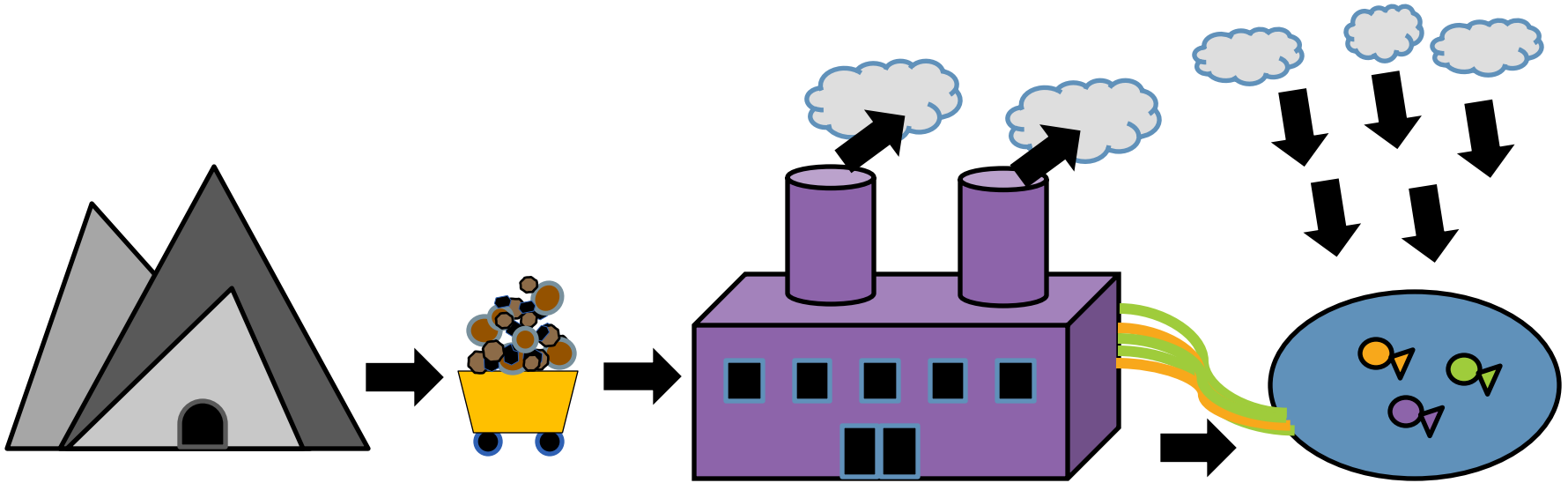




Mining Pollution

ENVIRONMENTAL ENGINEERS

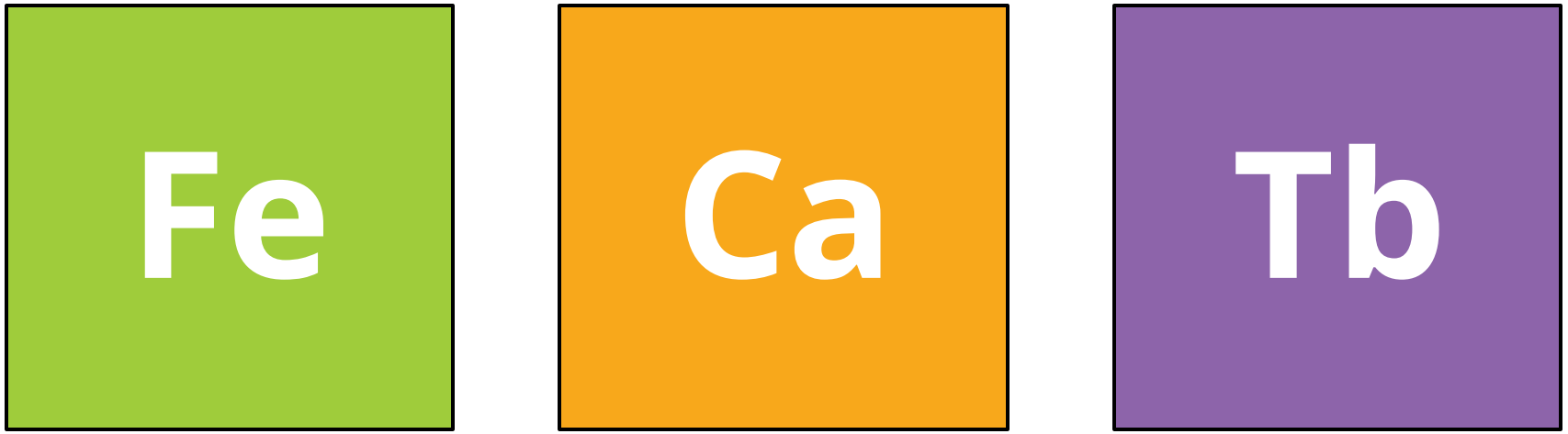
Design new mining techniques to make purifying metals safer for workers and the surrounding environment.



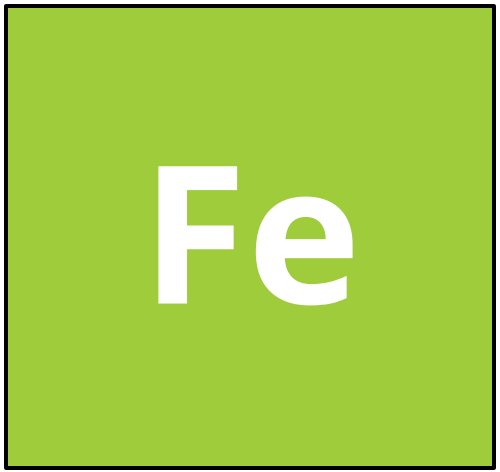
Mining Water Pollution

CAN YOU FIND THESE ELEMENTS?

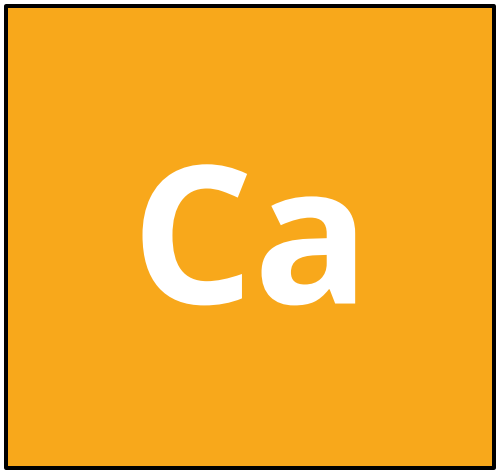
Using the Periodic Table of Elements, can you find iron (Fe), terbium (Tb), and calcium (Ca)?



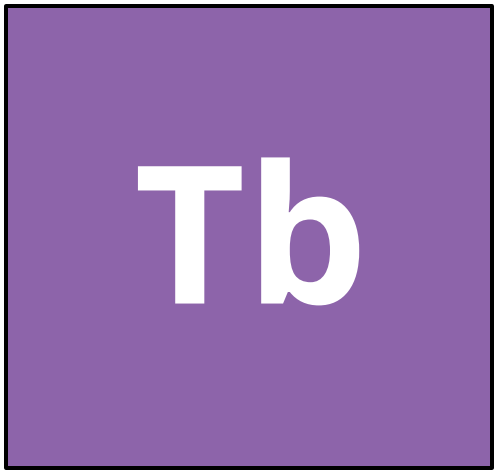
THE METALS WE WILL BE “MINING”



Transition Metal



Alkaline Earth Metal



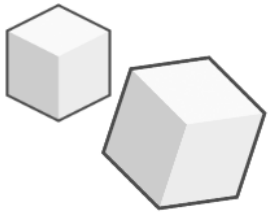
Rare Earth Metal

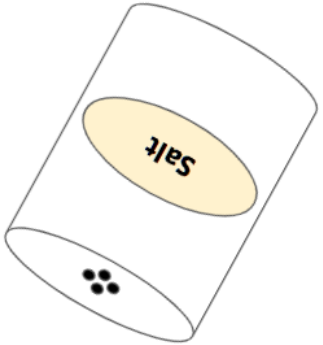
USING SAFE ALTERNATIVES

In class, we will not be putting calcium, terbium, or iron in acid.

Instead, we will be using their safer (but chemically similar) counterparts.

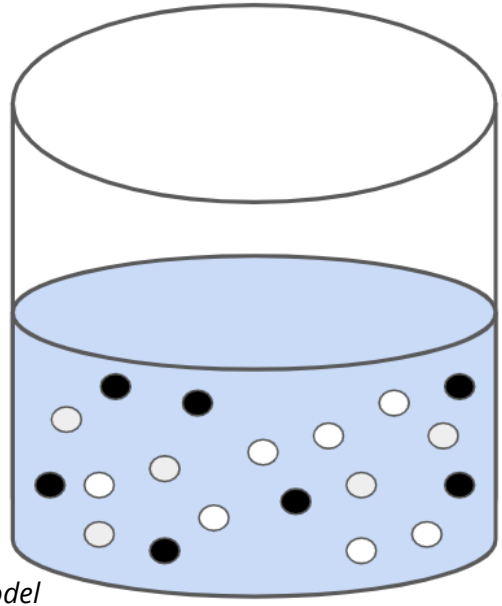
"Iron"





"Rare Earth Element" (REE)
Terbium

"Calcium"



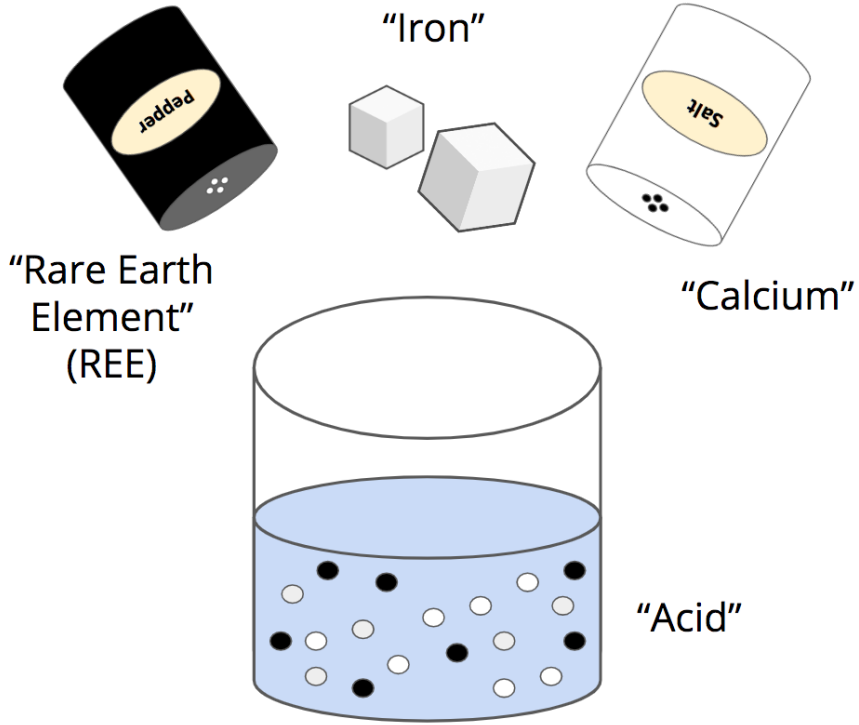
"Acid"

Initial Pepper Extraction Model

WHAT DO YOU ALREADY KNOW ABOUT SALT, SUGAR, WATER, AND PEPPER?

Talk to a shoulder partner.

Be ready to share your ideas.

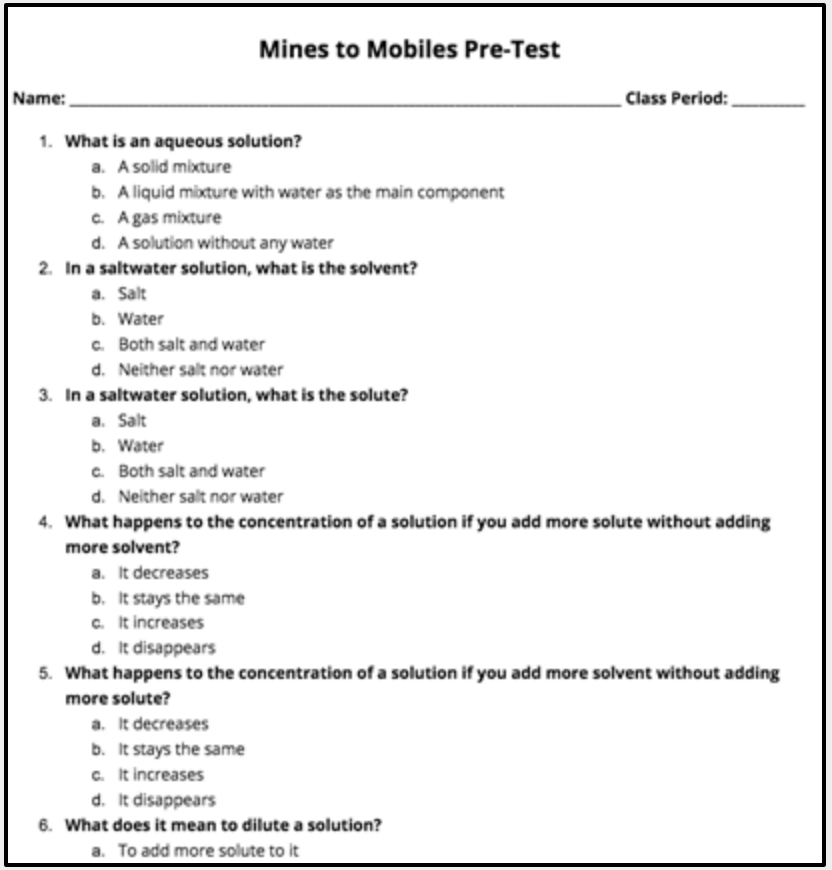


Initial Pepper Extraction Model

PRE-TEST

Complete on your own.

Try your best, and take your best guess!



Mines to Mobiles Pre-Test

Name: _____ **Class Period:** _____

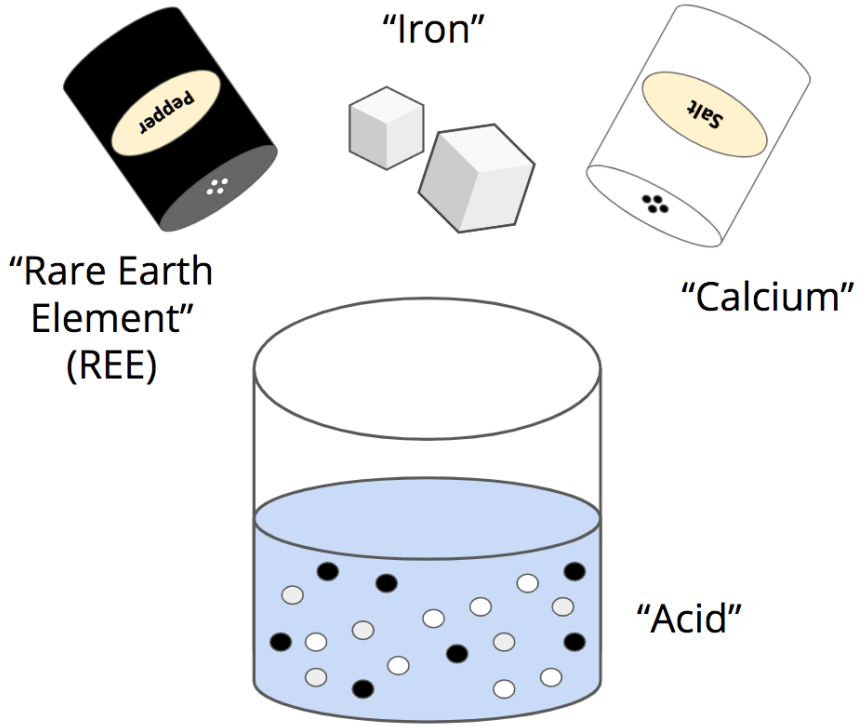
1. **What is an aqueous solution?**
   a. A solid mixture
   b. A liquid mixture with water as the main component
   c. A gas mixture
   d. A solution without any water
2. **In a saltwater solution, what is the solvent?**
   a. Salt
   b. Water
   c. Both salt and water
   d. Neither salt nor water
3. **In a saltwater solution, what is the solute?**
   a. Salt
   b. Water
   c. Both salt and water
   d. Neither salt nor water
4. **What happens to the concentration of a solution if you add more solute without adding more solvent?**
   a. It decreases
   b. It stays the same
   c. It increases
   d. It disappears
5. **What happens to the concentration of a solution if you add more solvent without adding more solute?**
   a. It decreases
   b. It stays the same
   c. It increases
   d. It disappears
6. **What does it mean to dilute a solution?**
   a. To add more solute to it

Mines to Mobiles Pre-Test

CLEARLY DEFINE THE PROBLEM

Your goal is to separate the “REE” from the “other metals” by dissolving the “calcium” and “iron.”

Based on the model we will use in class, what does this mean your group is actually doing?



Initial Pepper Extraction Model

CRITERIA AND CONSTRAINTS

Criteria

Requirements we use to determine whether our solution is successful

How will we know we were successful in extracting the most pepper from our solution?

Constraints

Limits to our solutions, otherwise known as things we cannot do

We have to pretend the water is incredibly strong acid, so what does this mean we cannot do?

CRITERIA AND CONSTRAINTS

Criteria

Must extract as much black pepper as possible

Must not extract any salt or sugar

Must be eco-friendly and make the least amount of mess

Constraints

Cannot use hands to extract pepper

Filtration system required

Limited time and resources to extract the black pepper

END OF DAY 1

Citations

- Ademski, E. (2025). *Initial Pepper Extraction Model* [Diagram]. TeachEngineering.
- Ademski, E. (2025). *Mines to Mobiles Pre-Test* [Image]. Teach Engineering.
- Ademski, E. (2025). *Mining Pollution* [Diagram]. Teach Engineering.
- Ademski, E. (2025). *Mining Process* [Diagram]. Teach Engineering.
- Ademski, E. (2025). *Mining Water Pollution* [Diagram]. Teach Engineering.
- Teach Engineering. *NGSS Engineering Design Process* [Diagram].
- *TeachEngineering.Org*, https://www.teachengineering.org/populartopics/designprocess. Accessed 24 June 2025.