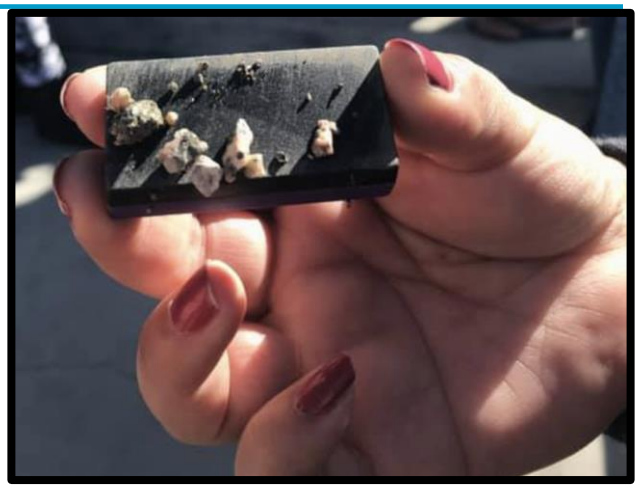
Adapted to STEMAZing ECE Format by
Carmen Barnes and DaNel Hogan

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

Mining with Magnets



NOTE: Children should always be given ample time to experiment, notice, and wonder before they are provided an explanation.

Always engage children with our two favorite questions:

What do you notice?
What do you wonder?

Resist the urge to answer any questions children have while exploring. Instead, respond back with questions to children and let them make sense of the world. Sample questions you might use: What do you think? Do you notice any patterns? What could we change? Can we test something else? What can we try next? If children ask a testable question, which they could answer by doing an experiment, talk through with them how they might design a test to help answer their question/ As much as possible and within reason, let them actually test their questions by trying the experiments they propose.

Learning Objectives

Children will…

- use a magnet to obtain magnetic bits from sand and then from soil.
- they will compare these two quantities to see which is a better source of magnetic bits.

Key Questions

Is there any iron in sand? Is there any iron in soil? Is there more iron sand or in other soil?

Vocabulary

Magnet
Magnetic
Magnetic poles
Attraction
Magnetism
Repel
Magnetic force
Strength
Iron

Materials

Magnet
Sand
Soil
Water
Paper towels
White or light colored piece of paper
2 plastic ziplock bags, labeled sand and soil

Adapted to STEMAZing ECE Format by
Carmen Barnes and DaNel Hogan

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

Notice and Wonder Developmentally Appropriate Practice

1. Ask children to predict what will happen when you roll the magnets through the sand.
2. Help them write their predictions.
3. Have children share what they know about mining.
4. Explain to them that they will be mining, but using magnets instead of explosives, picks, or shovels!
5. Distribute sand or take children to wherever they will be mining.
6. Have children move magnets in the sand or soil for a stated time or until they have an accumulation of materials on their magnets.
    - When we move the magnet in the sand or soil, what happens?
7. After the children have material on their magnet, they should rub and pick the material off of the magnet and put it onto the paper.
    - Why were the bits difficult to remove from the magnet?
8. To separate nonmagnetic material from the magnetic material on the paper, the children can put the magnet below the paper underneath the material that was collected. By moving the magnet around underneath the material on top of the paper and tilting the paper, the magnetic material will stay with the magnet and the nonmagnetic material can be dumped off the edge of the paper.
9. Dampen a paper towel with water. Put the paper towel with magnetic bits on it into a plastic bag and seal it.
    - This will need to be left for a day or two to allow it to rust.
    - Let children make observations each day.
10. Children can collect more and more magnetic material and then see how it interacts with the magnet.

Children should notice… (See what the Heck? below for the why.)

- magnets attract magnetic bits from the sand and soil.
- putting magnetic bits into the plastic bag with a wet paper towel will form rust. (This is the iron oxidizing. Iron oxide is rust.)
- the soil contains fewer magnetic bits than the sand (usually).
- when moving the magnet below the paper, the iron filings will start to stand up in little towers.
- they can move the magnet below the paper from a distance and still get the iron filings to move around. They don't have to be touching.

Extensions for Additional Learning

Discuss the different sizes and types of particles, and that a few may be micrometeorites! Examine the nonmagnetic materials also. How is the nonmagnetic sand different from the nonmagnetic soil? List what you have found (including hair, sticks, etc.)

Adapted to STEMAZing ECE Format by
Carmen Barnes and DaNel Hogan

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

Magnetic Slime: If enough iron filings are collected, you can put them into slime made using borax, glue, and water to make magnetic slime. The iron will rust over time so this can't be stored for long periods of time but is fun for children to experiment with while it lasts. For this you will need strong neodymium magnets. These can be found in most hardware stores sold as "Super Magnets" – look for the shiny, silver magnets.

Directions for making magnetic slime can be found here:
https://raisingsmartgirls.com/how-to-make-magnetic-slime/

Iron in Cereal – put a breakfast cereal in a plastic bag, remove as much air as you can, and seal it. Let children pound the cereal into bits using their fists or using big blocks or books to break up the cereal pieces into bits. Place a magnet in the bag with the bits and move it around to collect the iron filings. Talk with children about how iron is a mineral the body needs to make hemoglobin – a protein in red blood cells that carries oxygen from the lungs to all parts of the body, and myoglobin – a protein that provides oxygen to muscles.

Extensions for Additional Learning

As always, ask the children throughout the experiment what they notice and what they wonder. If their wonder questions are testable, as much as possible and within reason, let them actually test their questions by trying new experiments.

See below for examples of what they might wonder and experiments they might do to test their wonderings.

- I wonder how much iron is in the soil or sand over here?
- I wonder how much iron is in the soil at my house?
- I wonder how much iron is in… you name it?
    - Let them try it!
    - Rolling magnets around in different kinds of soil and sand and comparing how much iron you get is a great way to engage children. For older students you could even discuss why the amount of iron in sand and soil from different sources and locations might be not be the same.

#STEMAZingPictureBook Recommendations:

Magnets Push, Magnets Pull by David A. Adler and Anna Raff

Read on YouTube - (http://bit.ly/MagnetsPushMagnetsPullReadAloud)

Connections to the activity: Guide for young children learning about magnetism.

Safety Concerns

While not horrible to swallow one magnet, if children swallow more than one magnet they should immediately be taken to a doctor.

DaNel.Hogan@schools.pima.gov
Director of The STEMAZing Project

References

Adapted from experiments described in Core Knowledge and from Project Aims

What the heck? Explanation of the Mining With Magnets

Soil is found on the top layer of the earth's surface. It is made up of mineral particles mixed with animal and vegetable matter. The mineral particles are found in three size categories: sand, silt, and clay. What we commonly refer to as sand is usually large size particles without much humus (the animal and vegetable matter). In this investigation we referred to as two different materials, because of the visual difference and also the disparity in the amounts of **magnetic** materials they contain.

Magnetic material is found in observable quantities in beach sand and commercial play sand (sold for children's sand boxes). Soil with humus contains less magnetic materials proportionately. The magnetic particles in all types of soil consist mostly of magnetite, plus some ilmenite and a very few micrometeorites: there is sufficient **iron** content in all of these to be **attracted** by **magnets** of moderate **strength**.

AZ Early Learning Standards

Science Standard - Strand 1: Inquiry & Application - Concept 1: Exploration, Observation & Hypotheses
The child observes, explore, and interacts with materials, others, and the environment.

Science Standard - Strand 1: Inquiry & Application - Concept 2: Investigation
The child researches their own predictions and the ideas of others through active exploration and experimentation.