



THE SCIENCE OF “FRINGE”

EXPLORING: METEORITES

A SCIENCE OLYMPIAD THEMED LESSON PLAN

EPISODE 315: Os

Overview:

Students will learn about meteorites and ways of finding them.

Grade Level: 9-12

Episode Summary:

The Fringe Team investigates a deceased thief who is found floating in mid-air. Walter and the team try to determine what is making his body float and why he was trying to steal Osmium, the densest element. Meanwhile, the scientist behind the invention that allowed the thief to float works on recruiting additional test subjects to help him refine his invention. He enlists their help in getting the raw materials he needs, some of which are only available from meteorites.

Related Science Olympiad Event:

Astronomy - Teams will demonstrate an understanding of the basic concepts of math and physics relating to galaxies.

Learning Objectives:

Students will understand the following:

- Meteorites are objects from space that survive the trip through the atmosphere and impact with the ground.
- Meteorites are classified into 3 types: rocky, iron, and stony-iron.
- Most meteorites are small and do not create a crater, but can be identified by their unique characteristics compared to terrestrial rocks.





Episode Scenes of Relevance:

- The Fringe Team discussing Lutetium and where it can be found (30:12 ‘mixed with’ – 31:02 ‘call Broyles’)
- The thieves examining meteorites (33:04 ‘almost done’ – 33:35 ‘need your help’)

Online Resources:

- Fringe “Os” full episode: <http://www.fox.com/watch/fringe>
- Science Olympiad Astronomy event: http://soinc.org/astronomy_c
- NASA Meteors and Meteorites: <http://solarsystem.nasa.gov/planets/profile.cfm?Object=Meteors>
- Meteorite.org: <http://meteorite.org/>

Procedures:

1. Tell your students that they are going to learn about meteorites and how they are found.
2. Have your students research meteorites in resources such as astronomy textbooks and websites and discuss what they have learned.
3. Divide your class into small groups. Have each group complete the following activity:
 - a. Materials: magnet, sheets of paper, Ziploc bags, microscope, buckets
 - b. Either as a group, or prior to class, use the buckets to collect small piles of debris at the base of gutter downspouts around the school or at home. Ideally this is done right after a rain storm.
 - c. Sift through the debris and remove all the large portions (sticks, leaves, etc).
 - d. Place a small amount of debris on a sheet of paper.
 - e. Put the magnet in the Ziploc bag and vigorously rub the bag through the debris on the paper for several minutes.
 - f. Manually remove any large pieces of debris that are stuck to the bag, then carefully remove the magnet from the bag.
 - g. Put the bag under the microscope and look at the particles that are still stuck to it. Some of them will be micrometeorites that have a distinct dark, pock-marked shape.
 - h. Tally the number of micrometeorites each group finds.
4. Discuss with the class the results of the activity. Be sure to address:
 - a. Why was it important to get debris from gutter downspouts? How else could they possibly collect samples?
 - b. What specific characteristics of the micrometeorites allowed this process to isolate them from other types of particles?
 - c. Why is this technique not suitable for general scientific studying of meteorites?

Additional Discussion Suggestions:

- Most scientists want to be able to study larger meteorites. What techniques and geographical locations do they utilize in order to collect samples??
- Meteorites don’t only fall on Earth, but also on other planetary bodies. If you were an astronaut on another planet, how would you determine if a rock is native to the planet or a meteorite?
- Why do most meteorites have a pockmarked appearance?

Extension to Other Subjects:

Literature: Meteorites occasionally make national news, often when a scientist claims they found evidence of extra-terrestrial life in them. Research some of these recent headlines and evaluate how accurate the scientific information is reported.



Chemistry: Meteorites often have a distinct chemical composition that is much different from terrestrial rocks. Research these differences and possible reasons for why they exist.

History: Throughout history, many large scale meteorites have produced such large impact craters that they have a global impact. Research some of these events and what effects they have on the planet.

National Science Standards Alignment:

D. Earth and Space Science – Earth and space science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

H.D.4 Origin and evolution of the universe

- a. The origin of the universe remains one of the greatest questions in science. The "big bang" theory places the origin between 10 and 20 billion years ago, when the universe began in a hot dense state; according to this theory, the universe has been expanding ever since.
- b. Early in the history of the universe, matter, primarily the light atoms hydrogen and helium, clumped together by gravitational attraction to form countless trillions of stars. Billions of galaxies, each of which is a gravitationally bound cluster of billions of stars, now form most of the visible mass in the universe.
- c. Stars produce energy from nuclear reactions, primarily the fusion of hydrogen to form helium. These and other processes in stars have led to the formation of all the other elements.