



# THE SCIENCE OF “FRINGE”

## EXPLORING: MAGNETISM

A SCIENCE OLYMPIAD THEMED LESSON PLAN  
EPISODE 317: Stowaway

### Overview:

Students will learn about magnetism and how magnets can be created and demagnetized.

**Grade Level:** 9-12

### Episode Summary:

A woman who was killed along with her family several months ago keeps being seen at the scenes of various other deaths. The Fringe team analyzes evidence from another crime scene and discovers that her blood is highly magnetic. While trying to track her down, they find evidence at another crime scene that the victim had created a bomb that is set to explode somewhere. As the team utilizes a variety of techniques to try to locate the bomb, they realize that the woman is intending to use it to try to kill herself permanently along with many innocent bystanders and they contact her in an attempt to stop the imminent attack.

### Related Science Olympiad Event:

Technical Problem Solving - Teams will gather and process data to solve problems.

### Learning Objectives:

Students will understand the following:

- Magnets are objects that produce an external magnetic field that applies a force to other ferromagnetic materials.
- Only ferromagnetic materials such as iron, nickel and certain rare earth elements can become magnetized.
- A magnet can have multiple poles or magnetic domains oriented on a variety of directions.





### Episode Scenes of Relevance:

- The Fringe team discusses the unique properties of Dana Gray's blood (14:43 'show you' – 15:35 'suits you')
- Peter and William/Olivia discuss what impact the bomb had (41:53 'thinking about' – 42:20 'thought is wrong')

### Online Resources:

- Fringe "Stowaway" full episode: <http://www.fox.com/watch/fringe>
- Science Olympiad Technical Problem Solving event: [http://soinc.org/tech\\_prob\\_c](http://soinc.org/tech_prob_c)
- National High Magnetic Field Laboratory: <http://www.magnet.fsu.edu/education/tutorials/index.html>
- Wikipedia page on magnets: <http://en.wikipedia.org/wiki/Magnet>
- University of Cambridge Learning about Ferromagnetic Materials: <http://www.doitpoms.ac.uk/tlplib/ferromagnetic/index.php>

### Procedures:

1. Tell your students that they are going to learn about magnetism and how magnets work.
2. Have your students research magnetism in resources such as physics 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: several flat refrigerator magnets, strong rare earth magnet (such as from an old computer hard drive), rulers, paperclips
  - b. The problem for the group to solve is to determine the characteristics of a normal flat refrigerator magnet.
  - c. Caution – don't put the rare earth magnet near the refrigerator magnet until the very end, as it will demagnetize it.
  - d. Use just a single flat magnet and paperclips to see what parts of the magnet attract the paperclips and what parts don't. Record your results.
  - e. Use 2 flat magnets together to determine what parts attract each other. Be sure to try all possible orientations. Record your results.
  - f. With the 2 flat magnets face to face and 'aligned' such that when you slide them across each other they 'snap' in discrete steps, use the ruler to determine how far apart the poles of the magnets are. Record your results.
  - g. Slide the strong magnet across 1 half of the flat magnet and check to see if the flat magnet is still magnetized. Repeat several times and record your results.
  - h. Create a summary of the characteristics of the flat magnets and present to the class.
4. Discuss with the class the results of the activity. Be sure to address:
  - a. How are the poles in the flat magnet aligned? Is it magnetic on both faces?
  - b. Why did the strong magnet 'erase' the magnetic properties of the flat magnet?
  - c. Were there differences in the pole spacing of the magnets amongst the class? What does the pole spacing indicate about the manufacturing of the magnet?

### Additional Discussion Suggestions:

- If you wanted to remagnetize the flat magnets, what would the process involve?
- How many magnets do the students think are in the classroom right now? Try to list off the various devices that contain them, including speakers, hard drives, motors, TVs, credit cards, and phones.
- Electromagnets are special magnets that can be turned on or off. What are some common uses of electromagnets?



**Extension to Other Subjects:**

Health Sciences: MRI is an acronym for Magnetic Resonance Imaging. It is a critical medical technology that relies on strong magnetic fields. Research the principles behind MRI and what role magnetism plays in it.

Politics: Much of the world's supply of neodymium comes from China, which is starting to restrict exports of it. Research why neodymium is such an important magnetic material and what some countries are doing in response to this.

History: Inventions or discoveries that rely up magnets have been critical to many historical periods of progress and cultural advancement. Research examples such as the compass and electrical power distribution, and report on the role magnets had in the technology.



**National Science Standards Alignment:**

A. Science as Inquiry – Science as inquiry requires students to combine processes and scientific knowledge with scientific reasoning and critical thinking to develop their understanding of science.

H.A.1 Abilities necessary to do scientific inquiry

- c. Use technology and mathematics to improve investigations and communications.
- d. Formulate and revise scientific explanations and models using logic and evidence.
- e. Recognize and analyze alternative explanations and models.
- f. Communicate and defend a scientific argument.