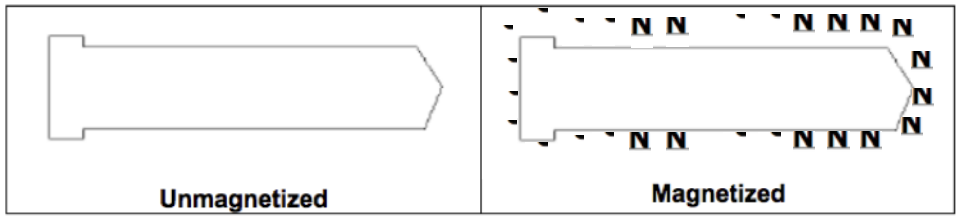
Evaluating Magnetism Models – Quiz KEY

Quiz Question 1

1) Consider the model from a different group, similar to but not the same as Group 2's model:



Description: There are no magnetic entities associated with the unmagnetized nail, but when a magnet is rubbed along the surface of the nail, it deposits small N and S entities (like dust particles) loosely along the surface, as shown.

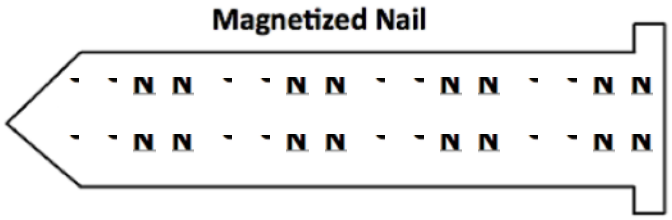
Which of the following observations made by some other groups would be difficult to explain (or could not be explained) using this model? (Choose all that apply.)

A. The magnetized nail behaves like a two-ended (bar) magnet.
B. Cutting the magnetized nail in half produces two pieces that each behave like two-ended magnets.
C. Cutting the nail anywhere along its length produces two pieces that each behave like two-ended magnets.
D. Each end of the magnetized nail can pick up the same number of paper clips.
E. When cut in half, each end of each half of the nail (four ends in all) can pick up the same number of paper clips.
F. After dropping the magnetized nail in water and removing it, the wet nail is still magnetized.

Feedback: Observations C, E, and F would be hard to explain using this group's model. Cutting the nail in half would produce two, two-ended pieces (B), but cutting into about 2/3 and 1/3 pieces would produce two one-ended pieces, so observation C couldn't be explained. If cut in half, in this model the cut ends on both halves would be weaker (fewer N or S particles) than the head or tip ends, so observation E couldn't be explained. Finally, if the N and S entities are deposited like dust particles, then like dust, they would likely wash off in water, so observation F couldn't be explained.

Quiz Question 2

2) Now consider a group who found that, when they cut a magnetized nail into either halves or ¼ and ¾ pieces, the pieces of the magnetized nail still behaved as if they were two-ended.



Description*:* Inside the nail, there are equal numbers of separate N and S magnetic particles that can move around when attracted or repelled by a magnet. In the unmagnetized nail, they are all jumbled up randomly. When the nail is rubbed with one pole of a bar magnet, the magnetic particles arrange themselves as shown in the diagram.

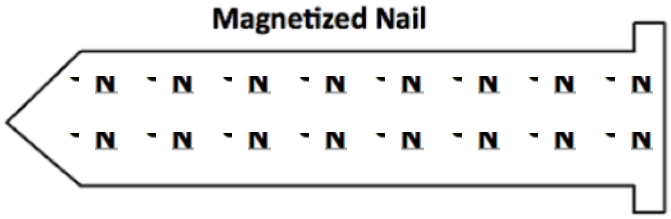
Which of the following observations made by some other groups would be difficult to explain using this model? (Choose all that apply.)

A. The magnetized nail behaves like a two-ended (bar) magnet.
B. Cutting the nail anywhere along its length produces two pieces that each behave like two-ended magnets.
C. Each end of the magnetized nail can pick up the same number of paper clips.
D. When cut in half, each end of each half of the nail (four ends in all) can pick up the same number of paper clips.
E. After dropping the magnetized nail in water and removing it, the wet nail is still magnetized.

Feedback: Observation B would be hard to explain using this group's model. Although cutting the nail in half or into ¼ and ¾ pieces would produce two two-ended pieces, cutting the nail into 1/8 (say, cutting off the tip between the first set of S-entities and the first set on N-entities on the left) and 7/8 pieces would produce two one-ended pieces.

Quiz Question 3

This group's model is similar to the last group's model. In this case, the group performed experiments in which they cut a number of magnetized nails into two pieces of various lengths and found that **both pieces were always two-ended**. Here is their model for the magnetized nail:



Description*:* Inside the nail there are equal numbers of separate N and S magnetic particles that can move around when attracted or repelled by a magnet. In the unmagnetized nail, these N and S particles are all jumbled up randomly. When the nail is rubbed with one pole of a bar magnet, the magnetic particles arrange themselves alternately along the length of the nail.

3) Could this model be used to explain the observation that when a magnetized nail is cut into two pieces of arbitrary lengths both pieces are **always two-ended**?

A. Yes, according to the model diagram, anywhere the nail is cut would produce two pieces that are both two-ended.
B. No, according to the diagram, there are some places where the nail could be cut and the two pieces produced would not be two-ended.

Feedback: Choice B is correct. For example, slicing off just a small slice at the head would create a piece with only N particles, creating a one-ended sliver of a magnet. The remainder of the nail would also be one-ended, with both ends being South Poles.