

Building a physical theory

The goal of this exercise is to build a model of the magnets that are contained in a popular magnetic construction toy. Each piece has the shape of a regular polygon, with a magnet embedded in each side. Based on observations, you should formulate a theory and propose experiments that can be used to validate or disprove its predictions. The final goal is to obtain a complete understanding of the internal structure of the object.



A possible (but not mandatory) series of questions to be asked and experiments to be carried out could be the following:

1. Take two pieces, choose a pair of magnets (one in each piece) and study how they attract/repel as a function of their mutual orientation. Is anything surprising in this behaviour?
2. Take now three pieces. First, make two of them to slowly approach until they magnetically stick to each other. Then, choose a side in the third piece and approach it to a pair of sticking sides of the other two pieces. Is the magnetic force attractive or repulsive?
3. Take now four pieces. Make them to stick pairwise. Characterize the magnetic force between these pairs. Is the force repulsive or attractive? Does it sign depend on the orientation of the pieces and/or of the approaching sides?
4. From these experiments, try to build a (at least qualitative) theory of the internal structure of the toy that is able to explain the observed features.
5. Use this theory to make further non-trivial predictions and try to experimentally confirm or disprove them.