Experiments with magnets

Class practical

Magnets provide an introduction to attraction and repulsion, and to action at a distance.

Apparatus and materials

For each student group

Magnets, different types (at least 2 pairs)

Iron filings [1]

Nails

Other materials for testing magnetic behaviour, including small scraps of paper

Compasses

Sheets of paper

Health & Safety and Technical notes

Iron filings must be kept out of eyes (and sinks). It is worth warning the class to keep fingers away from faces when iron filings are around.

Read our standard health & safety guidance [2]

You could use cylindrical, horseshoe, 'flat', ceramic, or strong (Eclipse major) magnets. A large permanent magnet should be used with teacher supervision.

One of the pairs of magnets should be strong enough so that, when separated by a few centimetres, students can feel attraction and repulsion.

Procedure

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a Hold pairs of magnets and feel the forces between them, repulsions as well as attractions.

b Use the magnets to try to attract nails and other materials. Some of them (such as small scraps of paper) cannot be attracted by a magnet.

c Place a magnet underneath a piece of paper and scatter iron filings on top to reveal a magnetic field pattern.

The purpose of the sheet of paper is to prevent direct contact between magnets and filings, since they can be hard to separate. Tap the paper gently to ensure the filings do not stick together.

d Place compass needles tip-to-tail near to a magnet. Record their orientations, to plot the maget's field as continuous 'field lines'.

e Suspend a bar magnet and show it aligns roughly North and South. The pole which points North is the "North-seeking pole" of the magnet.

Teaching notes

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1 The observation that a single magnet can experience and exert both attractive and repulsive forces with other magnets is important. It allows introduction of the idea that magnets have two different 'ends' or 'faces', called poles.

2 To show a magnetic field pattern to a whole class, you could place a magnet on an overhead projector, with a piece of transparent material on top of it, and sprinkle the iron filings on to this.

3 You can use a compass to develop the idea of magnetic polarity. The compass points towards the Earth's North. The arrowhead end of the needle is a North-seeking pole. All magnets have a North-seeking pole and a South-seeking pole. Poles that are the same always repel each other. Poles that are different always attract each other. Show this with pairs of compass needles.

4 Sometimes students get into a tangle about North-seeking and South-seeking poles when they learn that the Earth is a big magnet, and that the pole that is geographically to the North must be a South-seeking pole. So at this stage it is unhelpful to shorten 'North-seeking pole' and 'South-seeking pole' into plain North and South poles.

This experiment was safety-checked in July 2005

Related guidance

Exhibiting magnetic field patterns [3]

Related experiments

Breaking a magnet [4]

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[1] http://www.nuffieldfoundation.org/node/1883
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