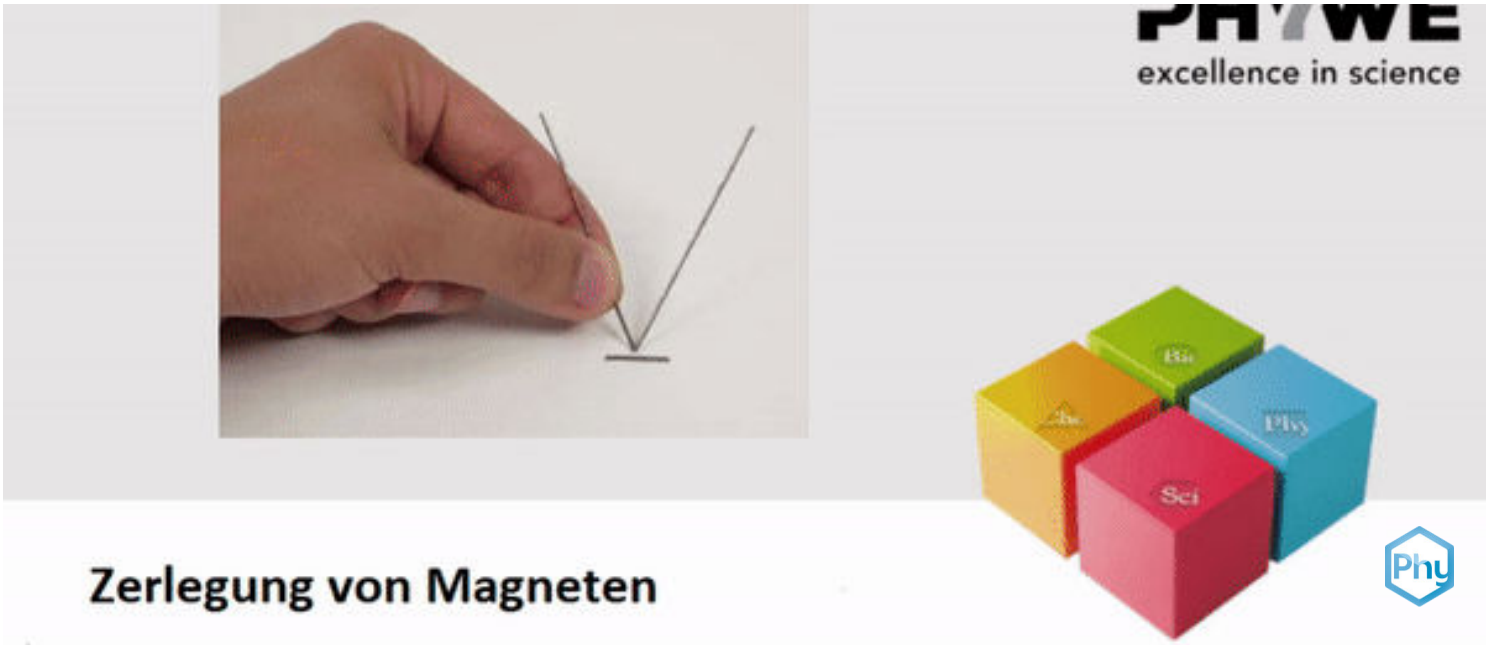
Breaking down magnets (elementary magnets)



In this experiment, students are asked to perform and analyze the division of a magnet themselves.

Physics > Electricity & Magnetism > Magnetism & magnetic field

Difficulty level	Group size	Preparation time	Execution time
easy	1	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/626a7a9b03522200034b52d4

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Teacher information

Application

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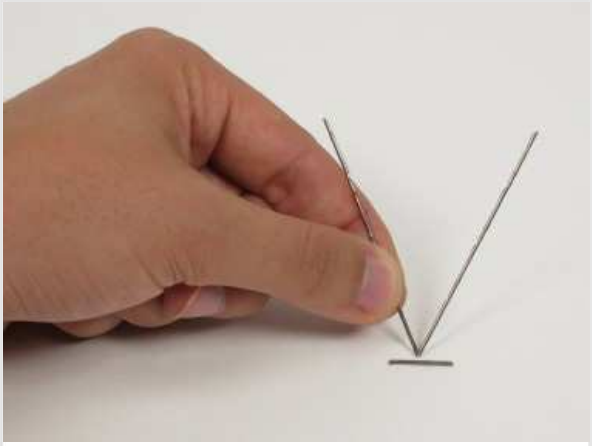

Experiment setup - magnet disassembly

Decomposition of magnets -Elementary magnets

If you separate a magnet in the middle, two new magnets are formed, each with a north pole and a south pole.

This phenomenon indicates that there are smallest magnetic units, similar to chemistry with regard to atoms. Substances consist of a multitude of smallest units, the atoms or molecules. In physics these smallest magnetic units are called elementary magnets. According to this definition, an elementary magnet is the smallest magnetic unit in a ferromagnetic substance. However, there are no magnetic monopoles.

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Teacher information (1/2)

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Prior knowledge

The students should know that a magnet has a north and a south pole. They should also know that a magnet can be used to turn a magnetizable material into a magnet and how a compass works.

Principle

There are no magnetic monopoles. If you divide a magnet into two parts, both parts have both a north and a south pole. The smallest non-divisible units of a magnet are the so-called elementary magnets.

Teacher information (2/2)

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Learning objective

The students recognize that when a magnet is divided into two pieces, magnets with north and south poles are always created again. No magnetic monopoles can be produced.

Task

The students are to determine whether two magnets can be produced by dividing a magnet, each with only one pole. To do this, a notched iron wire is first magnetized and then divided.

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Safety instructions

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The general instructions for safe experimentation in science education apply to this experiment.

Annotation:

To achieve the strongest possible magnetization of the iron wire, the strongest available permanent magnet should be used.

To determine the polarity of the small wire sections, it is expedient to proceed in such a way that the wire is approached to the compass in a vertical position from above in the direction of the axis of rotation of the compass needle to the maximum and then the wire is moved at right angles to the compass needle. The tip of the needle with the opposite polarity follows to the same side. This procedure should be demonstrated for the students before the experiment.

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Student Information

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Motivation

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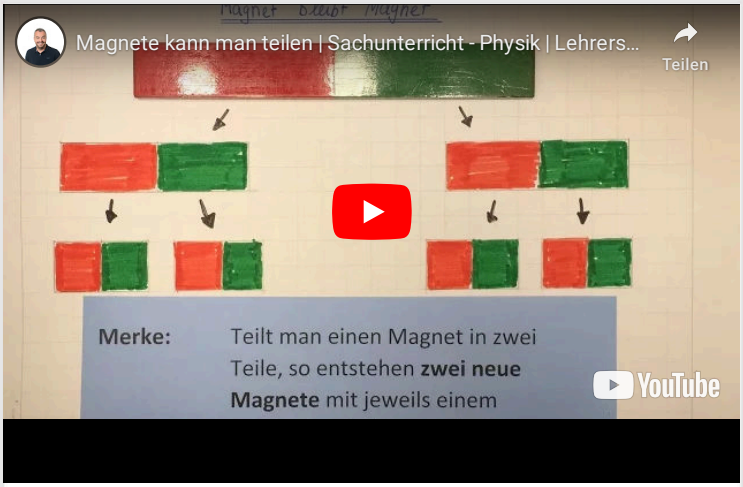

https://www.youtube.com/watch?v=9qtbUn-QTA0&ab_channel=Lehrerschmidt

Magnet disassembly

Elementary magnets

Magnets can be shared!

If you have watched the video, you will have understood that when a magnet is cut into two pieces, new magnets with north and south poles are created.

In this experiment, you will perform and analyze the division of a magnet yourself.

Task

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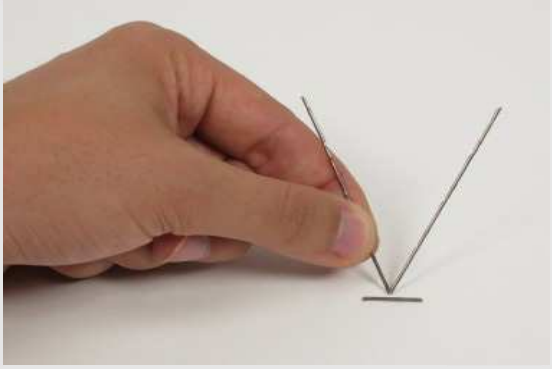
Are there magnets with only one pole? (so-called magnetic monopoles)



- Investigate whether two magnets can be made by dividing a magnet, each with only one pole.

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Equipment

Position	Material	Item No.	Quantity
1	Magnet, d=8 mm, l=60 mm	06317-00	1
2	Iron wire, notched, d = 1,2 mm, 2 kg	06343-03	1
3	Pocket compass	06350-10	1

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Set-up

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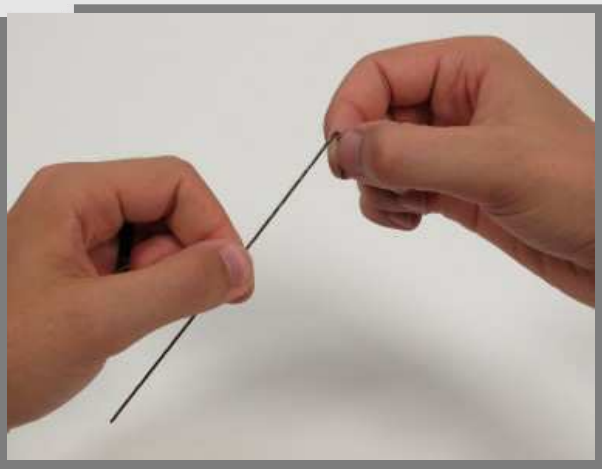

Test setup

- Break off a section of the iron wire.
- Place the compass on the table so that it is always at least one meter away from the bar magnet.
- The compass is used to detect the magnetic poles. If the tip of the compass needle, which was previously pointing south, is pulled toward the object, there will be a north pole at that end of the object.
- The same applies to the detection of the south pole.

Procedure (1/3)

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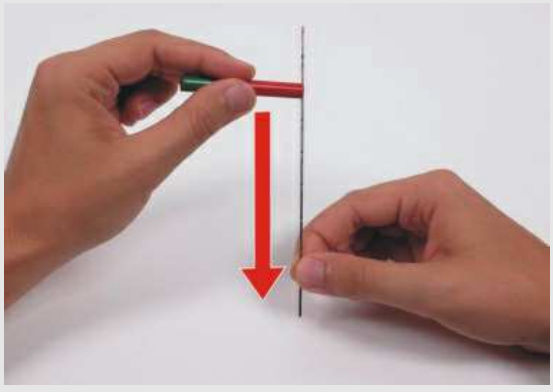
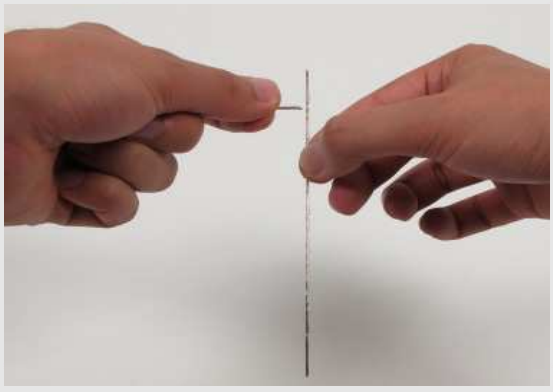
- Stroke one pole of the magnet several times in the same direction along the notched iron wire
- Use the short piece of wire to check whether and where magnetic poles have formed on the notched iron wire.





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Procedure (2/3)

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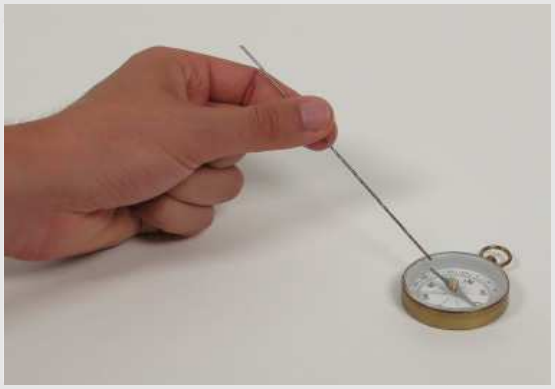
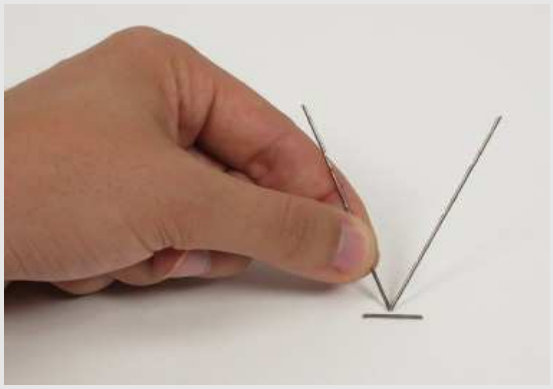
- Use the compass to determine which poles have been created on the wire.
- Bend the iron wire in the middle to an angle of approx. 45°. Use the short wire and the compass to check whether there is a magnetic pole at the bend.





Procedure (3/3)

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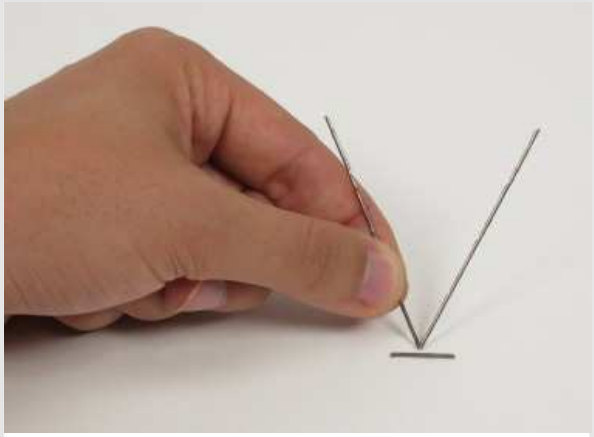

Feedthrough - Broken wire

- Break the wire completely at the bend and check whether magnetic poles are located at the two newly created wire ends. If poles have been created, determine the polarity of the poles found.
- Break one of the wire halves at all notches and check with the compass if the small pieces are also magnets. Since the wire pieces are very small, they must be brought close to the compass needle to detect magnetism.

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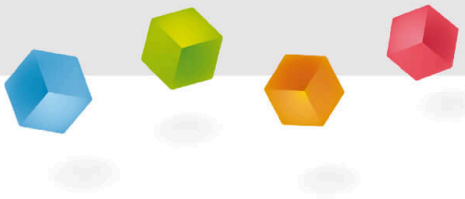

Report

Task 1

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Where did which poles form?

- [ ] One end of the wire is the north pole, the other is the south pole.
- [ ] The short piece of wire is tightened by both wire ends.
- [ ] The short piece of wire is only attracted by one end of the wire.

Check

What can be observed and what does it follow for the kink with respect to magnetic poles?

- [ ] The compass needle is deflected.
- [ ] The compass needle is not deflected.
- [ ] The piece of wire is tightened
- [ ] The wire piece is not tightened

Check

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Task 2

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Have magnetic poles formed at the new ends? If so, which ones?

- After breaking through, there is a north pole at one breaking point and no magnetic pole at the other.
- After breaking through, there is a south pole at one breaking point and no magnetic pole at the other.
- After breaking through, there is a north pole at one break and a south pole at the other.

Task 3

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Division - magnets with only one pole? Drag the words to the right places in the text.

It is _____ possible to make magnets with only one pole by division. This is due to the fact that each of the parts contains many aligned _____ magnets, each of which, in its total effect, produces complete _____ again.
Not needed: _____.

magnets
always
elementary
not

Check

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Task 4

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Magnetic properties of the buckling point

[ ] breaking through, the north pole of one half of the wire and the south pole of the other half of the wire met in the bend. Their magnetic effects on other objects cancelled [ ]. [ ] separation, each end of the wire [ ] exhibited its magnetic property.

After
individually
together
Before

Check

Slide	Score / Total
Slide 15: Multiple tasks	0/4
Slide 16: Formation magnetic poles	0/3
Slide 17: Determination of north and south pole	0/4
Slide 18: Determination of north and south pole	0/4

Total 0 / 15

Solutions Repeat

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