Representation of the field lines of a bar magnet

The students should get a first impression of the structure of a magnetic field.

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/626a8e9f144e9e0003334b6b

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

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Teacher information

Application

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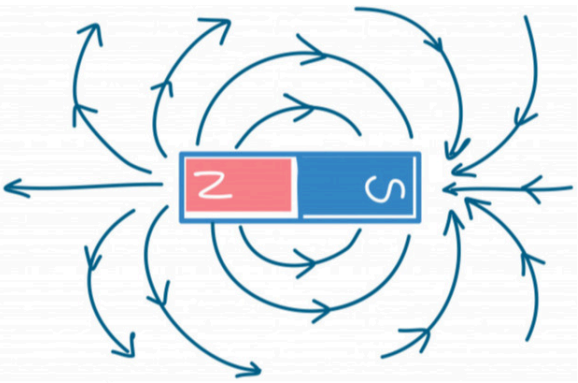

Representation of the field lines of a bar magnet

Representation of the field lines of a bar magnet

Field lines are imaginary or drawn three-dimensional lines that illustrate the force exerted by a field on a specimen. They provide information about the respective direction of the force and, based on their density, also about the strength of the field at different points in space.

They are used, for example, in electricity, gravitation or magnetism. The field lines can be used to illustrate why a specimen behaves in a certain way in a field.

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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 and is surrounded by a field. They should also to know that a magnet can be used to attract or align a magnetizable material.

Principle

Iron can be magnetized and aligns itself parallel to the field lines in a magnetic field. Iron filings can thus be used to illustrate the field lines. In this experiment, the students create a two-dimensional section of the field lines of a magnet.

Teacher information (2/2)

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Learning objective

The students should get a first impression of the structure of a magnetic field.

Task

Students have to illustrate the shape of the magnetic field of a bar magnet using iron powder.

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Safety instructions

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

Annotation:

The paper used must not be too smooth, because otherwise the iron powder can easily slip on the paper towards the magnetic poles and no powder remains in the vicinity of the poles. Too rough paper, however, makes it difficult to fill the iron powder back into the shaker. Care must be taken that the polycarbonate plate and the magnet do not come into direct contact with iron powder.

The spatial structure of the field lines can be shown for the area around the magnetic poles if they are immersed in iron filings. However, the students should better refrain from this experiment, since the very fine iron powder is difficult to remove from the magnets again.

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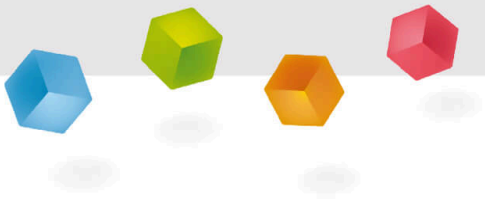

Student Information

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Robert-Bosch-Breite 10
37079 Göttingen

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Motivation

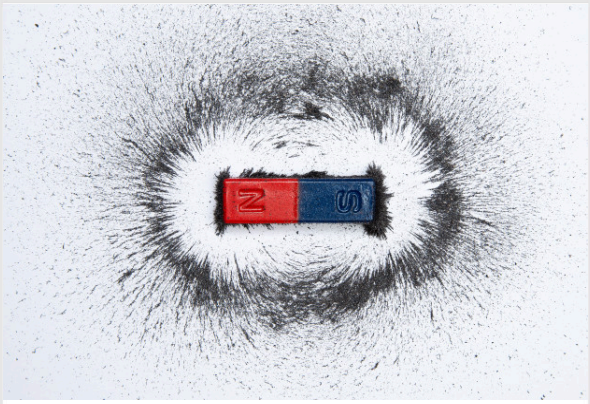


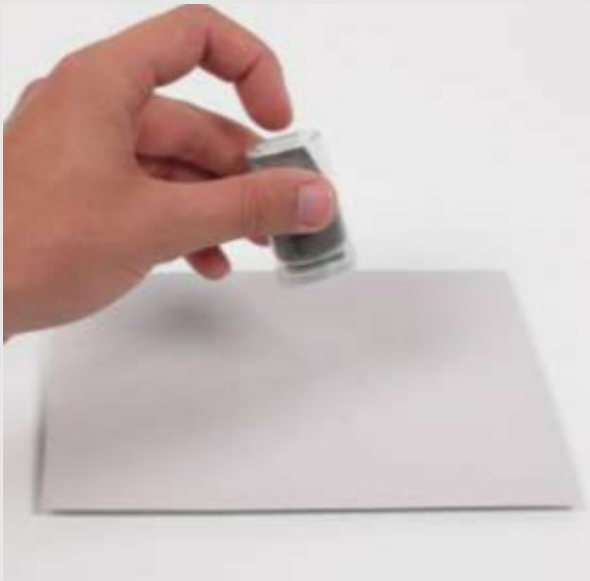
Illustration of the field lines in the vicinity of a bar magnet with iron powder

Representation of the field lines of a bar magnet

Field lines are imaginary or drawn three-dimensional lines that illustrate the force exerted by a field on a specimen. They provide information about the respective direction of the force and, based on their density, also about the strength of the field at different points in space. In this experiment you will learn how to visualize the magnetic field lines of a bar magnet in a simple way.

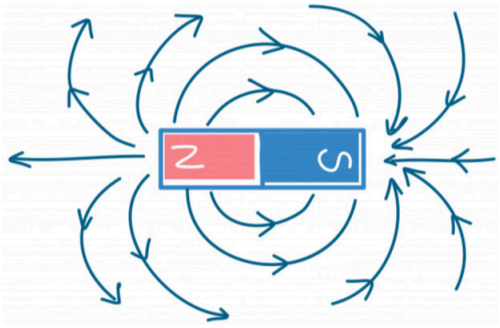
Note: Do not let the magnet come in direct contact with the iron powder. You will have trouble getting it off again.

Task



What does the magnetic field look like?

- Illustrate the shape of the magnetic field of a bar magnet through iron powder.



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Equipment

Position	Material	Item No.	Quantity
1	Polycarbonate plate, 136x112x1 mm	13027-05	1
2	Bar magnet l 50 mm	07819-00	1
3	Sprinkler w. iron powder, 20 ml	06305-10	1

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Position	Material	Item No.	Quantity
1	Polycarbonate plate, 136x112x1 mm	13027-05	1
2	Bar magnet l 50 mm	07819-00	1
3	Sprinkler w. iron powder, 20 ml	06305-10	1

Additional material

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Position	Equipment	Quantity
1	Sheet of rough paper	DIN A4

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Set-up

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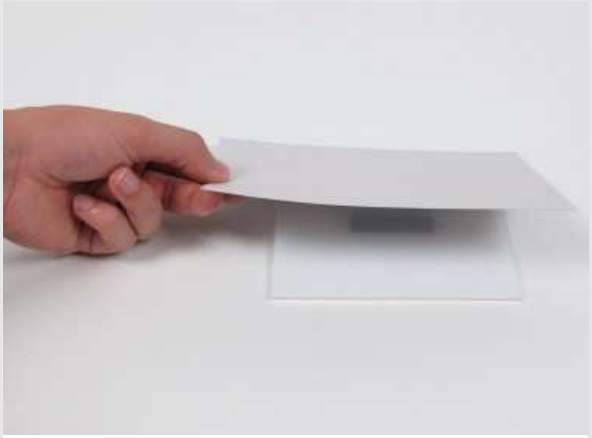

Experiment setup - deposit on the magnet

- Cut a sheet of rough paper approximately the size of the polycarbonate plate (DIN A5) and place the sheet on top of the plate.
- Both together are now placed in the center of the magnet, as shown in the adjacent figure.
- Replace the lid of the iron powder can with the spreader lid.

Implementation (1/2)

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Execution - sprinkling with iron powder

- Sprinkle the paper evenly with iron powder by tapping lightly on the can held at an angle from a height of about 10 cm until a definite arrangement of the iron particles can be seen.
- Tap the tabletop lightly from below several times until the iron powder has formed clearly visible lines. If necessary, take a photo of the result.

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Procedure (2/2)

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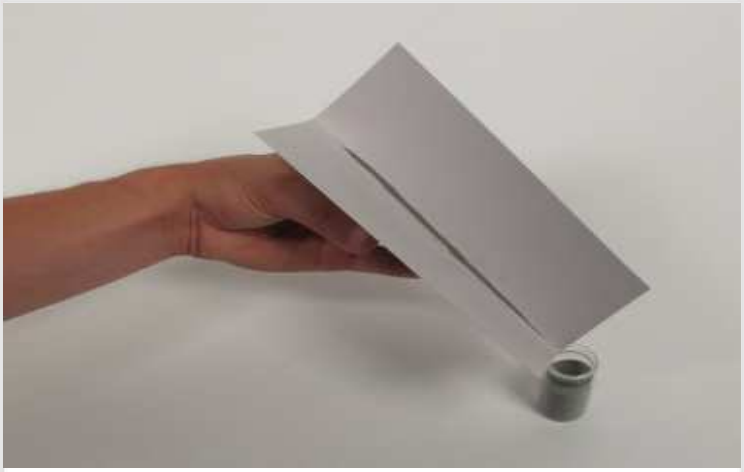

Implementation - filling spreader

- After the experiment, carefully fill the iron powder back into the open shaker without scattering powder by carefully folding the paper. The magnet should not be in the vicinity.
- Carefully close the can.

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Report

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Task 1

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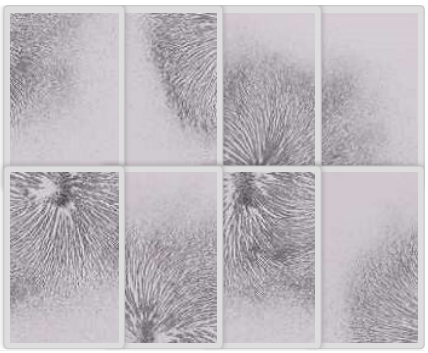
Construct the pattern formed by the iron powder.



Check

Task 2

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The arrangement of the iron powder corresponds to the course of the field lines in the plane of the paper. Describe this course.

Directly above the poles, the iron powder accumulates especially _____, because here the attraction is so strong that it is _____ from the surroundings. In the vicinity of the poles, the field lines run _____ to all sides. Laterally from the magnet they run _____ from one pole to the other.

attracted | strongly | radially | bent

Check

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