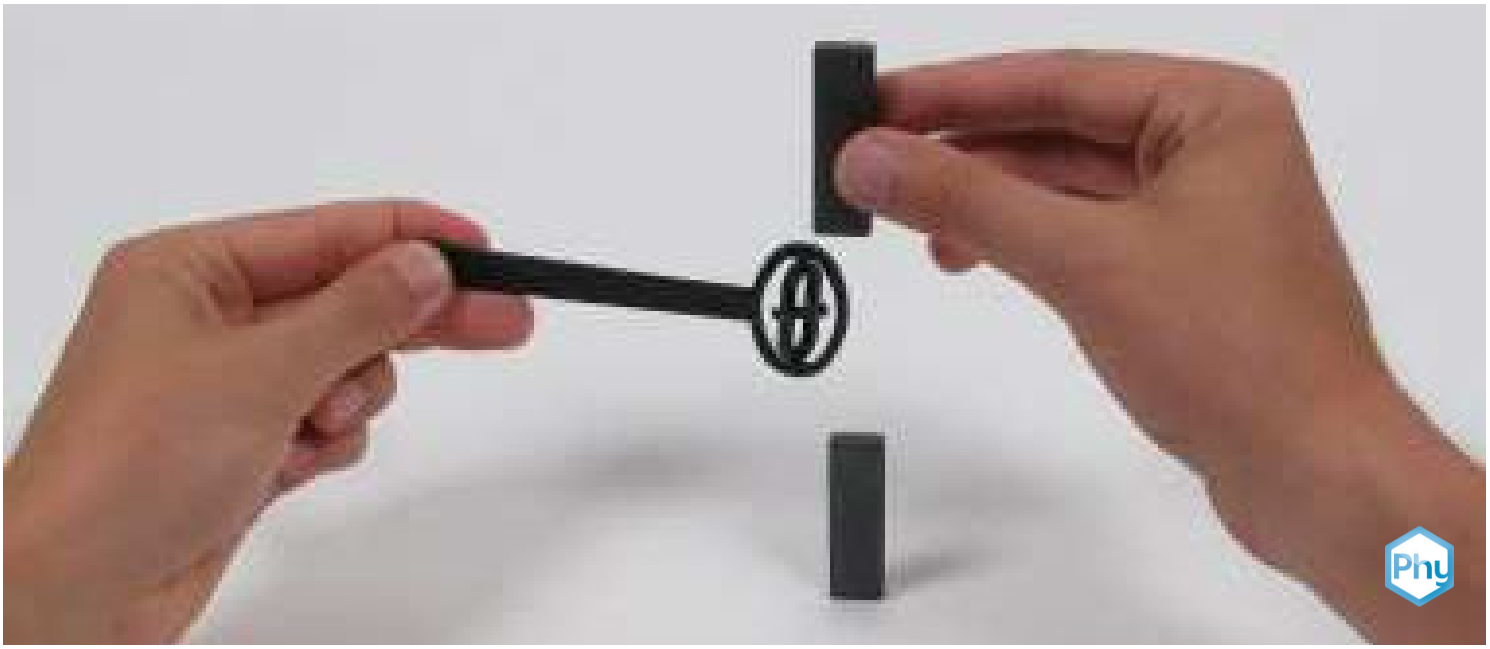
Pattern produced by the field lines of two like poles



The students use the iron powder and the magnetic field sensor to investigate the field shape between two similar magnetic poles.

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/626ba0c7d5e4f20003e32734

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Teacher information

Application

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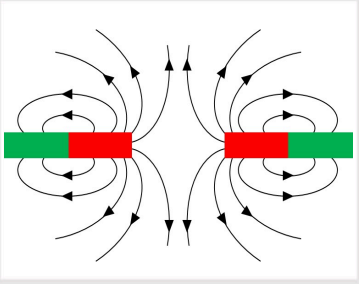

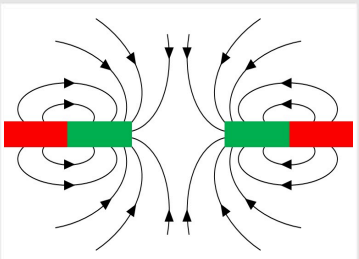

Field lines of two similar poles

Magnetic field lines illustrate the magnetic field.

However, they also have a real physical meaning because the density of the field lines indicates the strength of the magnetic forces and the direction of the field lines indicates the direction of the magnetic forces.

The field lines always run from the north to the south pole. When approaching two equal poles, the adjacent field courses result.

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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 know that a magnet can be used to attract or align a magnetizable material. In addition, they should know that magnetic poles with the same name repel each other and opposite ones attract each other.

Principle

Magnetic field lines always run from the north to the south pole and magnetic poles of the same name repel each other, while opposite magnetic poles attract each other. If two magnetic poles of the same name are brought closer to each other, the magnetic field lines in the intermediate area give way to each other and are compressed.

Teacher information (2/2)

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Learning objective

The students recognize the principle field lines between similar magnetic poles.

Task

Students use the iron powder and magnetic field sensor to investigate the field shape between like magnetic poles.

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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 must not be too smooth, because otherwise the powder can easily slip towards the magnet and larger powder-free areas are created around the poles.
- The iron powder may **not** directly to the magnets, because it is very difficult to remove again. In addition, do not contaminate any experimental parts with iron powder; especially not the polycarbonate plate.
- In case there is no image in the area between the magnets, increase the distance between the two magnets a little.

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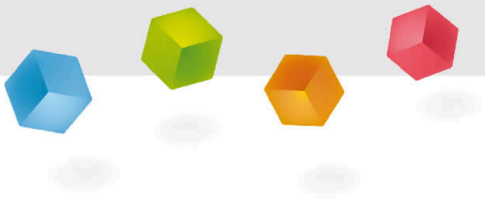

Student Information

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Motivation

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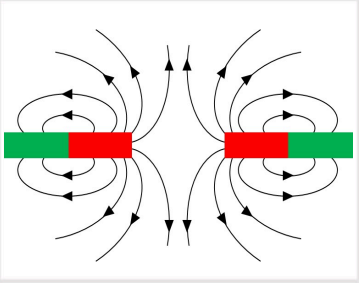

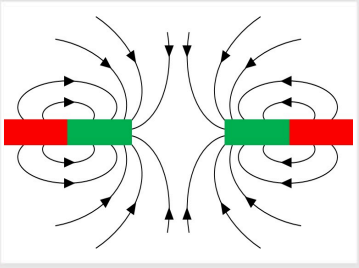

Field lines of two similar poles

As you have already learned, magnetic field lines illustrate the magnetic field.

However, they also have a real physical meaning because the density of the field lines indicates the strength of the magnetic forces and the direction of the field lines indicates the direction of the magnetic forces.

The field lines always run from the north to the south pole. You have already examined the magnetic field of a single magnet in more detail. When two identical poles approach each other, the individual magnetic fields influence each other, resulting in the adjacent field curves, which you will reproduce in this experiment.

Task

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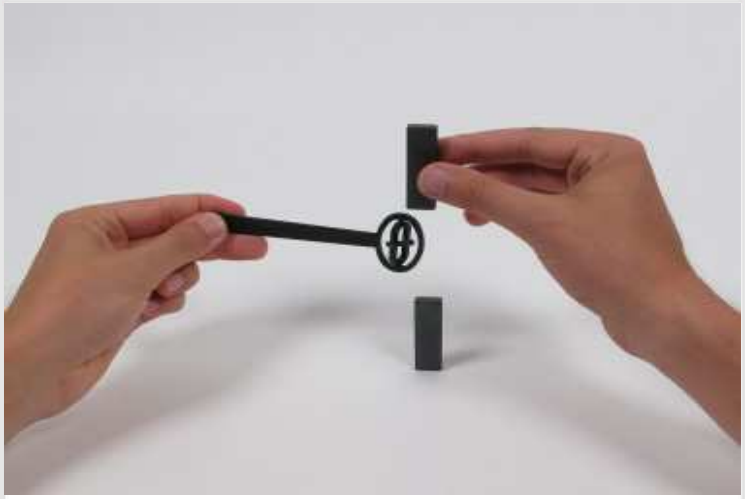

Task - Experimental setup

What is the field between two similar magnetic poles?

- Using iron powder and the magnetic field sensor, investigate the field shape between two similar magnetic poles.

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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	2
3	Sprinkler w. iron powder, 20 ml	06305-10	1
4	Magnetic field sensor	06309-00	1

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Additional material

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Position	Equipment	Quantity
1	Sheet of rough paper	DIN A4

Set-up

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Structure with polycarbonate sheet

- Cut a sheet of rough paper, approximately the size of the polycarbonate sheet (DIN A5).
- Prepare the sprinkle can by carefully replacing the lid with the sprinkle lid without scattering powder.
- Place the two bar magnets on the table with a mutual distance of 50 mm so that like (repulsive) poles face each other.
- Place the polycarbonate plate on the magnets and the paper on top of it.

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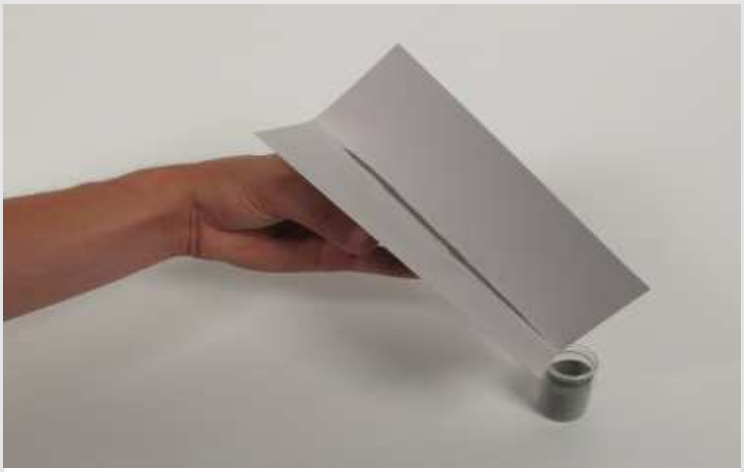
Procedure (1/3)

Execution - sprinkle iron powder

- Sprinkle iron powder evenly onto the paper from a height of approx. 50 mm until the field line pattern is visible.
- Tap the tabletop lightly from below several times until the iron powder is clearly arranged in lines.
- Observe carefully the course of the field lines and take a photo if necessary.

Procedure (2/3)



Procedure - Fill iron powder into powder dispenser

- Then pour the iron powder back into the sprinkle can by making a crease in the paper.
- Carefully close the can with the lid without holes.
- Remove the polycarbonate plate.

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Procedure (3/3)

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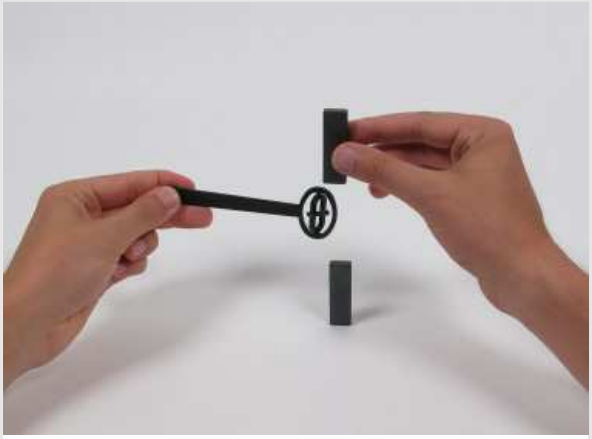

Execution - Alignment sensor magnet

- Place one magnet vertically on the table and hold the other one about 50 mm above it so that like poles face each other.
- Move the magnetic field sensor in the space between and next to the magnets and get an impression of the spatial course and orientation of the field based on the orientation of the sensor magnet.

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Report

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Task 1

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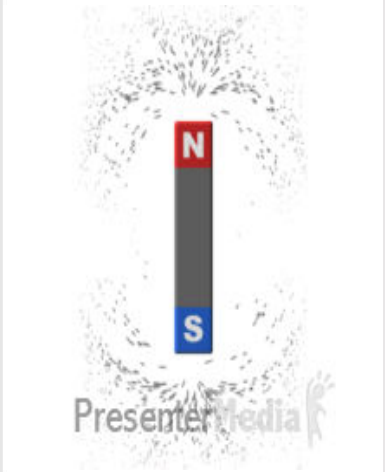

Describe the course of the field lines, which you can recognize from the arrangement of the iron punch verse (implementation):

The field lines run from one magnet pole _____ towards the other pole of the same magnet. In _____ does a field line run from one magnet to the other. In _____ between the two magnets, there is a distinct boundary that _____ the two magnetic fields.

separates | the middle | no case | bent

Check

Task 2

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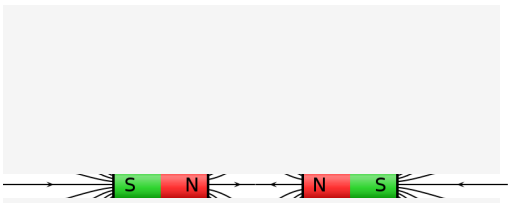
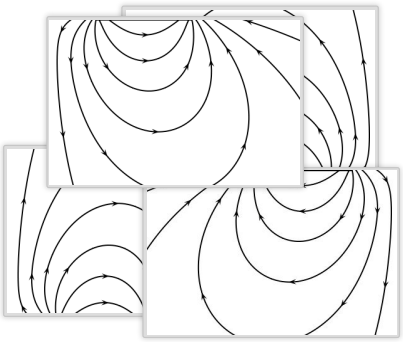
Reproduce the field lines of the iron powder!





Check

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Task 3

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Two independent fields of the two magnets are detected.

○ True ○ False

Check

The field shape determined by the iron powder is not a cut through the spatial field.

○ True ○ False

Check

Slide	Score / Total
Slide 16: Course of the field lines	0/4
Slide 17: Reproduce the field lines of the iron powder!	0/4
Slide 18: Multiple tasks	0/2

Total 0 / 10

Solutions Repeat

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