Pattern produced by the field lines of two unlike poles

Students use the iron powder and compass to investigate the field shape between two opposite 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/626ba5fdd5e4f20003e32752

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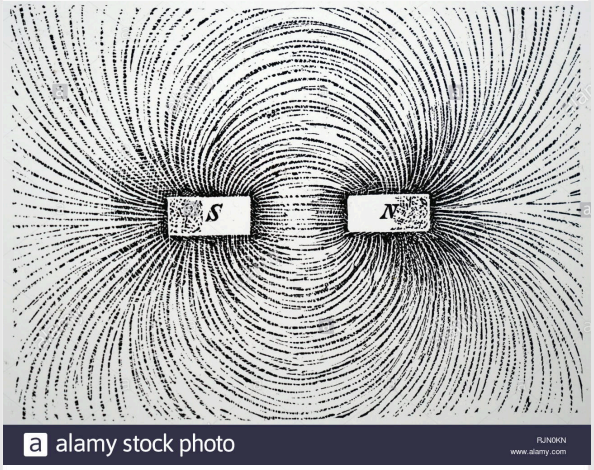
Teacher information

Application



Field lines - opposite poles

Field lines from two opposite 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 two opposite poles approach each other, this results in the adjacent field course.

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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 opposite magnetic poles are approached, the magnetic field lines are closed in the intermediate area between the magnets. In the outer region, the resulting magnetic field resembles that of a single bar magnet.

Teacher information (2/2)

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Learning objective

The students recognize the principle field line between opposite magnetic poles.

Task

Students use the iron powder and compass to investigate the field shape between two opposite magnetic poles.

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Notes on structure and implementation

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- For the experiment, the paper must not be too smooth, because otherwise the iron powder can easily slip towards the magnetic poles and larger powder-free areas can develop around the poles.
- The iron powder may **not** get directly onto the magnets, because it is very difficult to remove again. Do not contaminate any experimental parts (especially the polycarbonate plate) with iron powder.
- In case there is no image in the area between the magnets, increase the distance between the two magnets a little.
- The investigation of the direction of the field lines with the compass could also be done as in experiment P1086300. However, because of the rather large diameter of the compass, only poor results are obtained. If the distance between the magnets is increased to better match the compass diameter, the earth's magnetic field becomes noticeable. By the suggested north-south alignment this disturbance can be eliminated to a large extent with the given experimental arrangement.

Safety instructions

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

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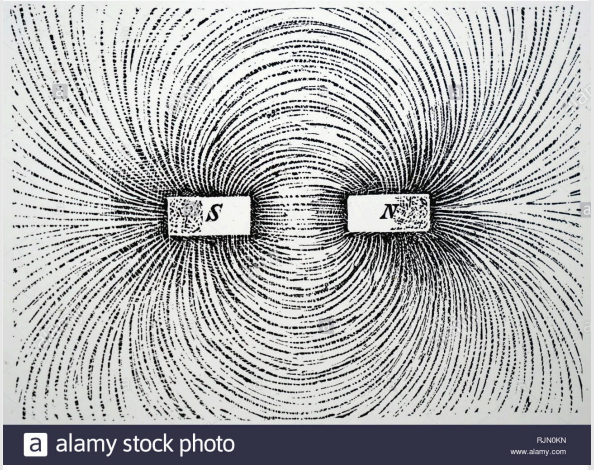
Student Information

Motivation



Field lines - opposite poles

Field lines from two opposite poles

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

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 opposite poles approach each other, the individual magnetic fields influence each other, resulting in the adjacent field curve, which you will reproduce in this experiment with the help of iron powder and a compass.

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Task

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What is the field between two opposite magnetic poles?

- Using iron powder and the compass, investigate the field shape between two opposite 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	Pocket compass	06350-10	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 opposite (attracting) poles are facing each other.
- Place the polycarbonate plate on the magnets and the paper on top of it.

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Procedure (1/3)

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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)

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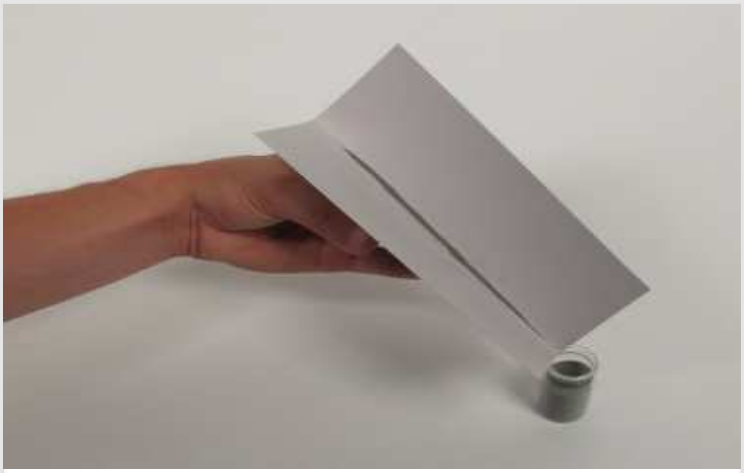

Procedure - Fill iron powder into powder dispenser

- 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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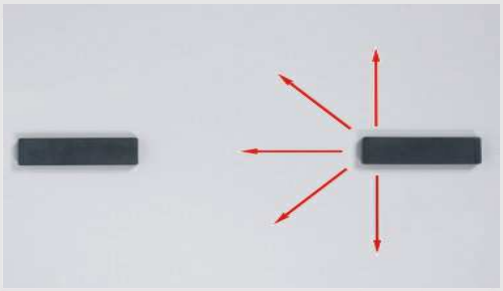

- Increase the distance between the magnets to about 100 mm and move the compass, starting from one magnetic pole, always in the direction in which the compass needle points.
- The path of the needle's axis of rotation corresponds approximately to a field line. Repeat the process several times with slightly different initial positions at the magnetic pole as shown in the figure.

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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 opposite pole of the _____ magnet. The farther the field lines are from the common axis of the two magnets, the _____ they are bent. Field lines emerging from the sides run partially toward the other pole of the _____ magnet.

Not needed: *weaker

same
other
bent
more

Check

Task 2

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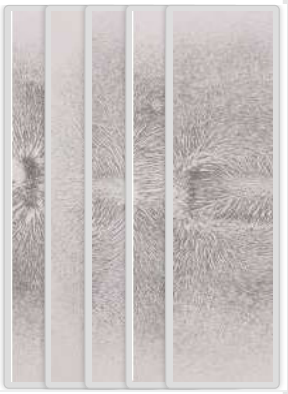
Use drag and drop to try to arrange the pre-made pattern on the right side correctly according to the iron powder!

Pattern iron powder:



Check

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Task 3

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The compass is moved along the paths that were also marked by the iron powder.

○ True ○ False

Check

Further away from the magnets, the compass needle aligns itself more and more with the earth's field.

○ True ○ False

Check

Slide	Score / Total
Slide 17: Course of the field lines	0/4
Slide 18: Pattern iron powder:	0/5
Slide 19: Multiple tasks	0/2

Total 0 / 11

Solutions Repeat

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