The magnetic field (Item No.: P1432100)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 14-16
Topic: Electricity
Subtopic: Magnetical and electrical field
Experiment: The magnetic field

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

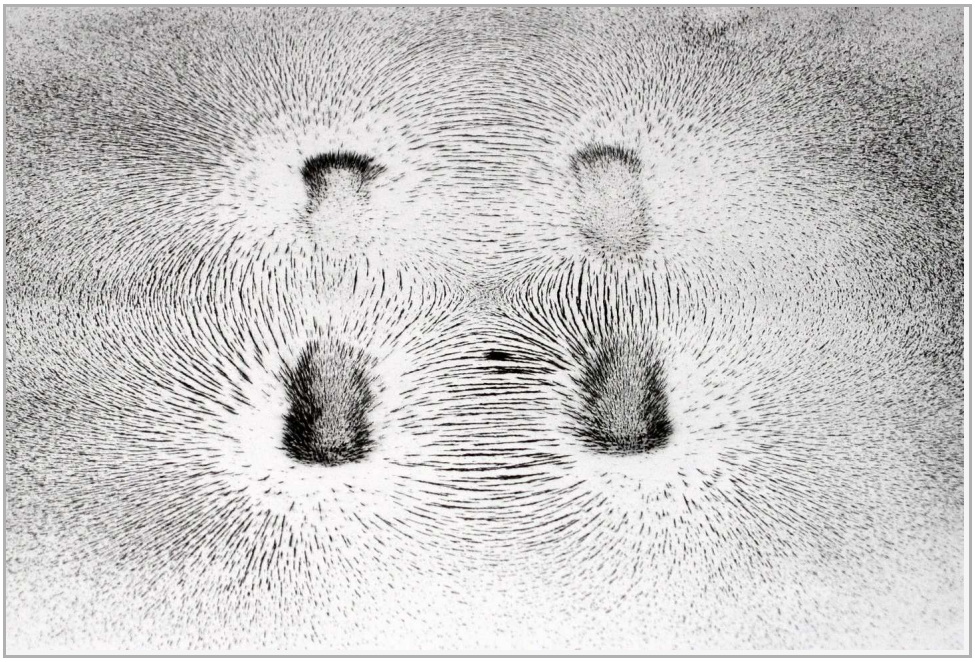
Introduction

The effect of a magnet can be described by the magnetic field that has a certain direction and strength throughout the room. This field can be made visible by sprinkling iron filings around a magnet.

The experiment can also be carried out with an overhead projector (see note in "Set-up and procedure").

Task

Strength and direction of the magnetic field.



Equipment

Position No.	Material	Order No.	Quantity
1	Bar magnet, l = 72mm	07823-00	2
2	Iron powder, techn. 500 g	30067-50	1
3	Fixing spray in bottle 280ccm	02723-05	1
4	Glass plate, 200x300x4 mm	08204-00	1
5	Sprinkler w. iron powder, 20 ml	06305-10	1
6	White DIN A4 or letter paper		
	Recommended equipment for presentations with the overhead projector:		
A	Overhead projector	47181-93	1
B	Glass plate 200 mm x 300 mm x 4 mm	08204-00	1
C	OHP pen		

Robert-Bosch-Breite 10
D - 37079 Göttingen
Tel: +49 551 604 - 0
Fax: +49 551 604 - 107
info@phywe.de
www.phywe.com

Set-up and procedure

Set-up and procedure

Setup of the experiment with paper and fixing spray (Fig.1):

- Place a bar magnet on the table, place the glass plate and a sheet of white paper on the magnet.
- Sprinkle iron powder onto the paper.
- Knock on the table or on the glass plate until the field line image is clearly visible.
- Sprinkle more powder where the field lines are not clearly visible.
- Use fixing spray to fixate the image, in order to show it around in class.

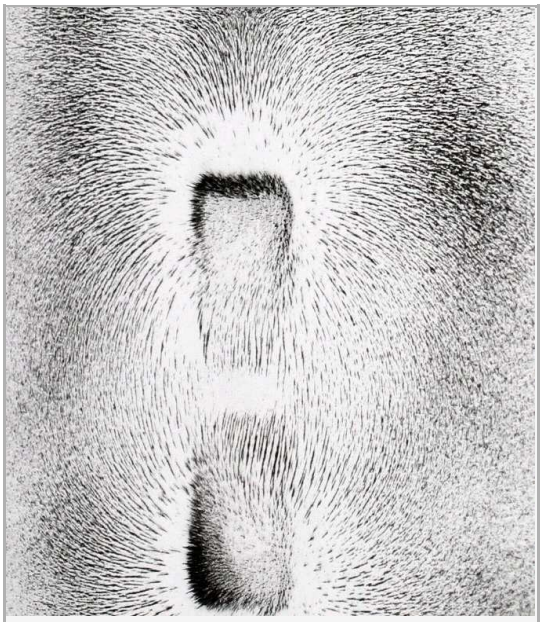


Fig.1

Repeat the experiment with different alignments (Fig.2):

- with two magnets that are positioned in one line.
- allow once the like poles to be facing each other and then again the opposite poles.
- with two magnets lying parallel to each other.
- place the magnets once in the same direction and then once in the opposite direction.

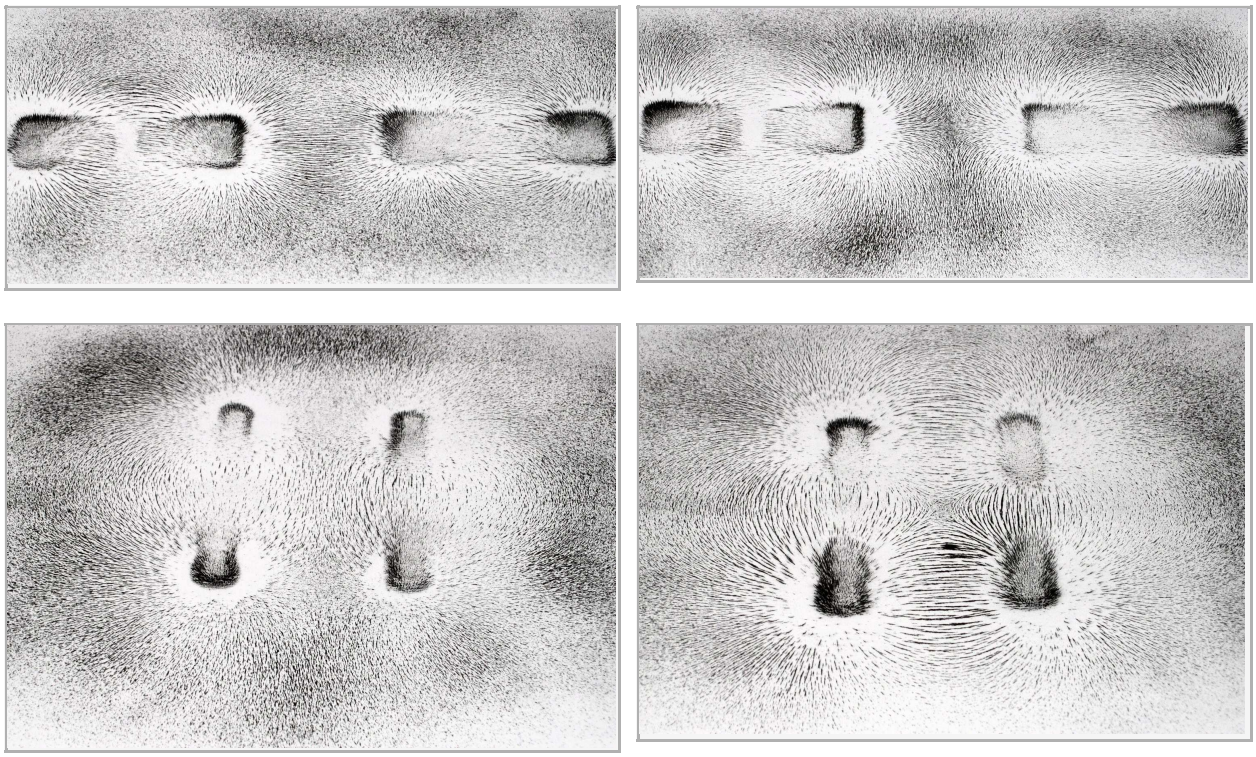


Fig.2

Note: The experiment can also be carried out with an overhead projector (Fig. 3).
If the experiment is to be performed with an overhead projector, then the iron powder is to be sprinkled directly onto the glass plate. In order to trace the field lines with an OHP pen, the second glass plate is placed on the first and drawn on.

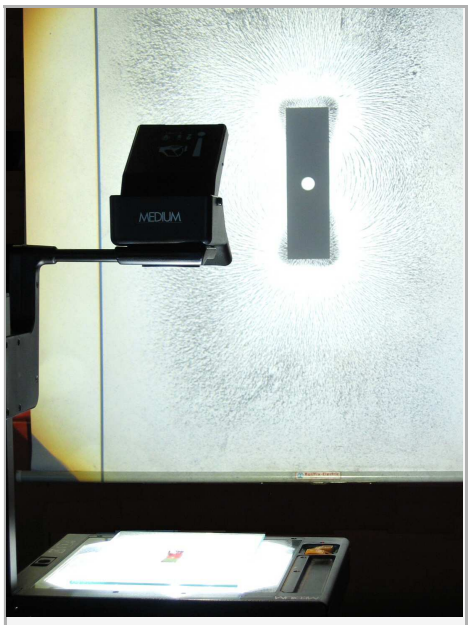


Fig.3

Results and evaluation

Results

If the iron powder is sprinkled onto the surface above a magnet, then the particles form lines. These lines bend in an arch from one pole to the other pole. The lines of the magnetic field are closer together at the poles where they are extremely bent. Further away from the poles the arches run nearly parallel to the magnet and are spread farther apart from each other.
If the opposite poles of two magnets come together, then the lines from one magnet run to the other. The lines run again in arches between opposite poles.
If like poles are held close together, then the lines of the individual magnets become distorted, and avoid each other.

Evaluation

The line pictures occur, because the iron particles have become magnetized. That what magnetizes the particles is called the magnetic field. It is said that a field exists in the space around the magnet. The particles are magnetized at their location in the direction of the magnetic field and then stick preferably to each other in the direction of the field. The lines show everywhere the direction of the field. Continuous lines that indicate everywhere (throughout the line) the direction of the field are called field lines. A magnetic field has a distinct direction everywhere (throughout the line). If two field lines would cross or if a field line would branch off, then the direction would not be distinctly determined here. Field lines therefore never cross.
The field lines run between the opposite poles of one or more magnets. The direction of the field lines is defined from the north pole to the south pole and is depicted with arrows. The direction of the arrows indicates how a compass would point. The poles of a magnet are the regions where a great number of field lines enter or exit the magnets. With parallel magnets the field between the ends is increased if they are positioned at the opposite ends and weakened if they are positioned at like ends. The closer together the field lines, the stronger the field at this spot.

Remarks:
The field lines continue to run within the magnet. They are always closed curves in static magnetic fields.

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www.phywe.com