Magnetic poles and polarity

In this experiment, students will become familiar with the effects of forces on a magnet, the names of the poles, and their determinations.

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/626a47c603522200034b4c5a

Teacher information

Application

Experiment setup - magnet with compass

Magnetic poles and their distinction

Freely movable magnets align themselves in north-south direction due to the earth's magnetic field. If a spun, twisted thread is used to suspend the magnet, the load causes a torque, which causes the magnet to rotate and not align exactly in the north-south direction. By using a thin, single nylon filament, this undesirable effect can be avoided. However, if the thread is too thick (fishing line) or too short, a torque can possibly be transmitted from the suspension, which also prevents an exact alignment in the earth field.

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Teacher information (1/2)

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Prior knowledge

Students should be aware that there is a geomagnetic field and that a compass can be used to determine the north-south direction. Ideally, students should know that every magnet is a dipole and that there are no magnetic monopoles.

Principle

A compass can be used to distinguish the north and south poles of permanent magnets, since the magnetic field of permanent magnets is usually much stronger than the earth's magnetic field. In this experiment, the compass serves only as an indicator of the poles of the bar magnets. Its actual function will be discussed in another experiment (Earth's magnetic field).

Teacher information (2/2)

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Learning objective

Students should recognize,

- that the strongest force effect occurs at the two ends
- why the two poles are called the North Pole and the South Pole,
- how to determine the poles and
- which force effects occur between magnetic poles.

Task

Students will identify where iron parts are most strongly attracted to a magnet and how to distinguish between the two ends of a magnet in terms of their effect.

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Safety instructions

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

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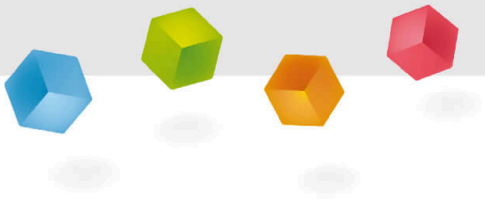

Student Information

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Motivation

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Experiment setup - magnet with compass

Magnetic poles and their distinction

As you know, freely movable magnets align themselves in north-south direction like a compass due to the earth's magnetic field. By approaching a permanent magnet to a compass, its display is influenced.

In this experiment, you will become familiar with the effects of forces on a magnet, the names of the poles, and their determinations.

Task

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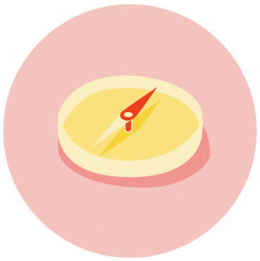
Why are the ends of a bar-shaped magnet marked differently?

- Determine at which points of a magnet iron parts are attracted most strongly.



- Investigate how the two ends of a magnet can be distinguished in their action.

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Equipment

Position	Material	Item No.	Quantity
1	Conductors/non-conductors,l-50 mm	06107-01	1
2	Bar magnet l 50 mm	07819-00	2
3	Iron wire, notched, d = 1,2 mm, 2 kg	06343-03	1
4	Pocket compass	06350-10	1

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Additional material

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Position	Equipment	Quantity
1	Thin thread	approx. 500 mm
1	Eraser	1
1	Pencil	1

Set-up

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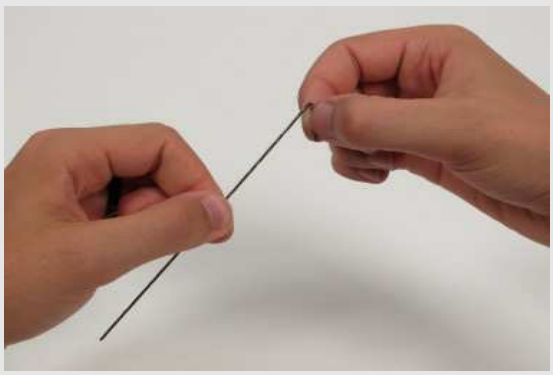
1. Attach one of the magnets in its center to the end of the thread so that it hangs horizontally.
2. Break off four pieces of equal length from the notched iron wire, if you don't already find these pieces.



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Procedure (1/6)

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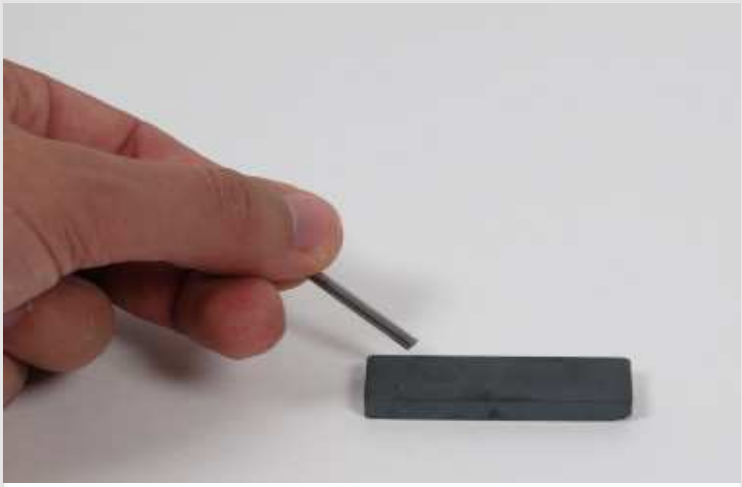

Execution - test with iron rods

- Check with the iron rod (l= 50 mm) whether it is attracted with the same force at all points of a magnet (see also the adjacent figure).
- Make notes of your observations as appropriate.

Procedure (2/6)

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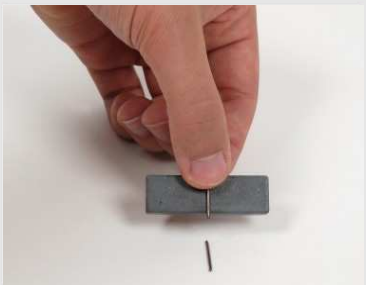

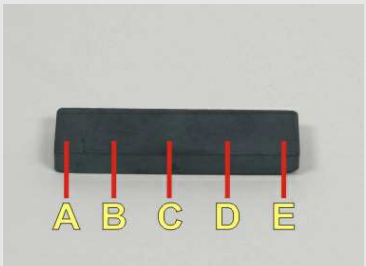

- Hold a piece of iron wire with your thumb on the magnet without the tape as shown in the figure.
- Then try to hang as many other pieces of wire as possible one below the other on the held wire.
- Repeat the experiment at different points on the magnet.
- Note in Table 1 how many pieces of wire got stuck in the different places

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Procedure (3/6)

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Implementation - magnet on the thread

- Hold the tethered magnet up by the thread (see illustration). Since the thread may have been twisted during its manufacture, the magnet may rotate at first.
- In that case, brake it out after a few seconds until it settles in a certain position.
- One pole of the magnet now points to the north. Mark this end of the magnet with a pencil (N = North / S = South). It is the north pole of the magnet, the other end is the south pole.

Procedure (4/6)

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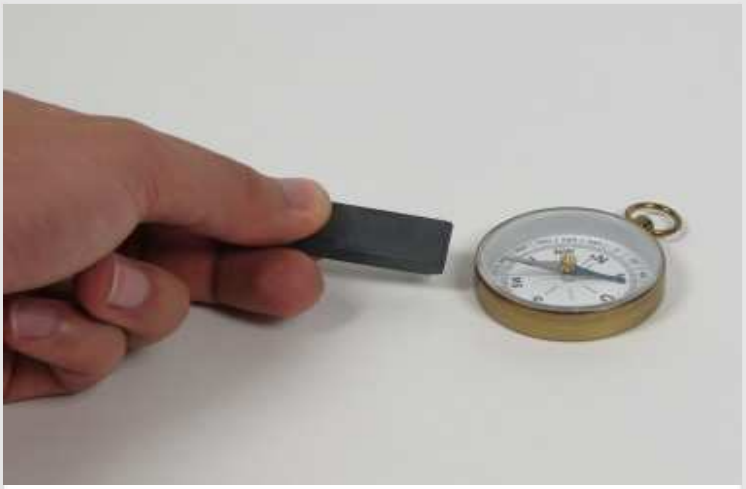

Execution - approach from the side

- Now approach the north pole to the compass from the side (figure).
- Carefully observe the behavior of the compass needle.
- Alternately approach the marked and unmarked ends of the magnet to the compass.
- Again, carefully observe the behavior of the compass needle.

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Procedure (5/6)

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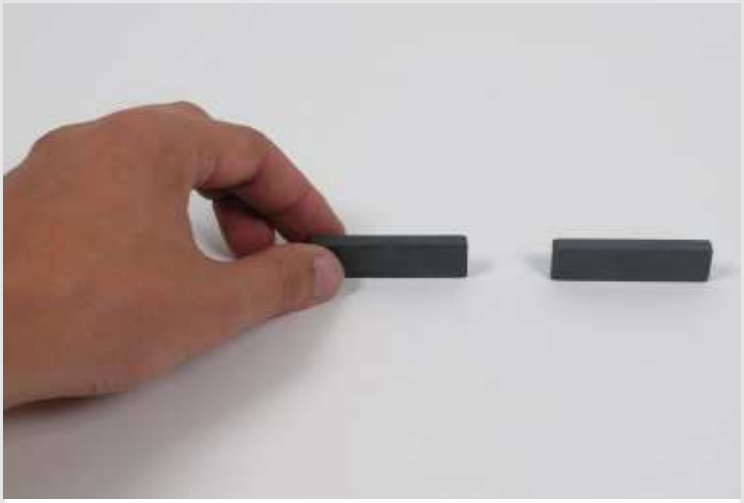

Execution - force effect poles

- Now use the compass to determine which end of the second magnet is the north pole.
- Also mark the ends of the second compass accordingly as before.
- On unmagnetized iron bodies, the two poles of a magnet have the same attractive effect.

Procedure (6/6)

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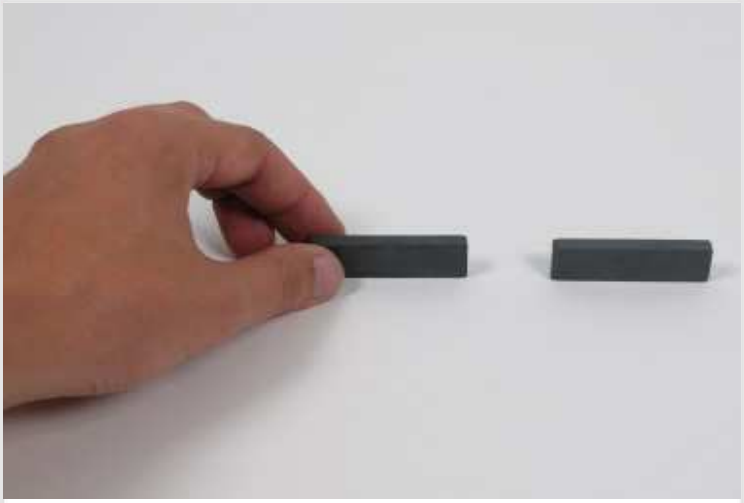

Execution - force effect poles

- Remove the tape from the magnet and now investigate with the two magnets which force effects occur between their poles (see adjacent figure).
- Record your observations in Table 2 and note whether the respective poles repel or attract each other.
- At the end, erase the marks on the magnet.

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Report

Table 1 / Task 1

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Enter your results in the table.

Position	Number of wire pieces
A	
B	
C	
D	
E	

The strongest attraction is found

- varies depending on the material.
- in the center of the magnet.
- at the ends of the magnet.
- distributed over the entire magnet.

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Table 2 / Task 2

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Approximated poles	Force effect
North Pole - North Pole	
North Pole - South Pole	
South Pole - North Pole	
South Pole - South Pole	

Enter your results in the table.

Drag the words into the correct boxes!

From the first two sub-tests it can be seen that at the _____ of the magnet, the _____, _____ force on iron bodies occurs. In the center of the magnet _____ force occurs.

ends | magnetic poles | no | the strongest

Check

Task 3

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Drag the correct words into the gaps

In a freely rotating, horizontally suspended bar magnet, the north pole points to _____, the south pole to _____. This orientation is caused by the _____. If you approach a magnetic north pole to the compass from the side, the tip of the compass needle points to this magnetic pole, which was previously oriented _____. If the other tip points to the magnet, one has approached the _____. Like magnetic poles _____ each other, unlike ones _____ each other.

north | earth magnetic field | south | south | attract | repel | south pole

Check

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Slide	Score / Total
Slide 19: Evaluation attraction	0/5
Slide 20: Magnet attraction	0/4
Slide 21: Determination of north and south pole	0/7

Total 0 / 16

Solutions | Repeat | Export text

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