Direction of a magnetic field (Item No.: P6300169)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricty
Subtopic: Electric generator, motor, transformer
Experiment: Direction of a magnetic field

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

Additional Requirements:

- Tablet with measure App
- Power Supply

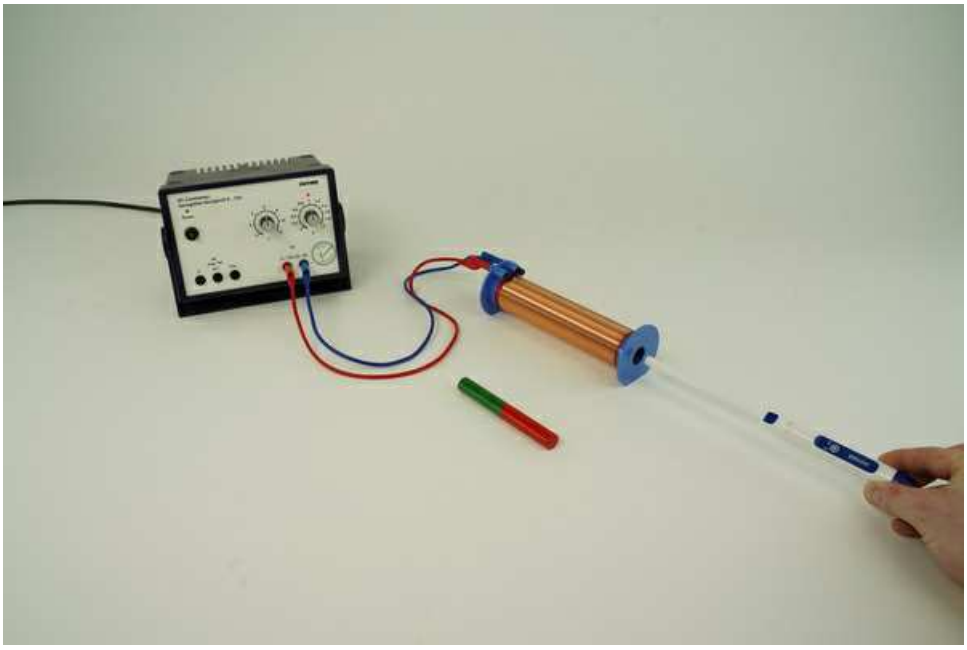
Experiment Variations:

Keywords:

magnetic field, coil, magnetism, magnet, permanent magnet, direction of a magnetic field

Information for teachers

Introduction



Application
The magnetic field has a direction.There is a north and a south pole. The field from the north to the south pole is defined as positive and from the south to the north pole as negative. To get a connection to everyday life, a compass helps our navigation. The magnetic field direction of a coil is fundamental and the basis for many other electromagnetic experiments.

Educational objective
The students analyze the direction and the magnetic flux density of the magnetic field. The magnetic field of the coil and the permanent magnet can be compared. The polarity of the coil is important. If you change the polarity at the coil the direction of the magneticfield will change too.

Task

1. Mesure the magneticfield of a permanent magnet.
2. Mesure the magneticfield of a coil.
3. Mesure the magneticfield of a coil with reversed polarity.

Prior knowledge
The students should have already gained experience concerning the basics of direct and alternating current as well as the principle of magnetic induction.

Principle
The permantentmagnet has an Northpole (red) and a Southpole (green). The magnetic field is from the northpole to the southpole defined as positiv. In the other direction, from the southpole to the northpole it's defined as negativ. The magnetic flux density decreases quadratically with the distance to the permanent magnet.
The current-carrying coil generates a magnetic field. The direction of the magnetic field depends on the electrical polarity of the coil. With a known current direction, the orientation of the magnetic field can be determined with the right-hand-curl-rule.

Notes concerning the set-up and execution of the experiment
When measuring the magnetic field of the coil, the permanent magnet should be as far away as possible, because it is stronger and influences the measurement. When measuring the permanent magnet, the coil should not be current-carrying or have a sufficient distance to the magnetic sensor, because the magnetic field of the coil can also influence the measurement.

Equipment

Position No.	Material	Order No.	Quantity
1	Cobra SMARTsens - 3-Axis Magnetic field	12947-00	1
2	magnet, l = 72mm, rodshaped, colored poles	07823-00	1
3	Induction coil, 300 turns, d = 40 mm	11007-01	1
4	Connecting cord, 32 A, 750 mm, red	07362-01	1
5	Connecting cord, 32 A, 750 mm, blue	07362-04	1
6	PHYWE power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

Safety information

For this experiment, the general notes and intructions concerning safe experimentation in science classes apply.

Introduction

Application and Task

Application
A compass shows you where is north. The magnetic field of the Earth has a northpole and a southpole likes every magnet. The magneticfield from the north to the south pole is defined as positv and from the south to the north pole as negative. You mesure in this experiment the direction of the magnetic field of a permanent magnet and a current-carrying coil. Where is the northpole or the southpole of the coil?

Aufgabe
1. Mesure the magnetic flux density and whose direction at different position relativ to the permanent magnet.
2. Mesure the magnetic flux density and whose direction at different position relativ to the current-carrying coil.
3. Mesure the magnetic flux density and whose direction at different position relativ to the current-carrying coil with reverse polarity.

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Setup and Procedure

Setup

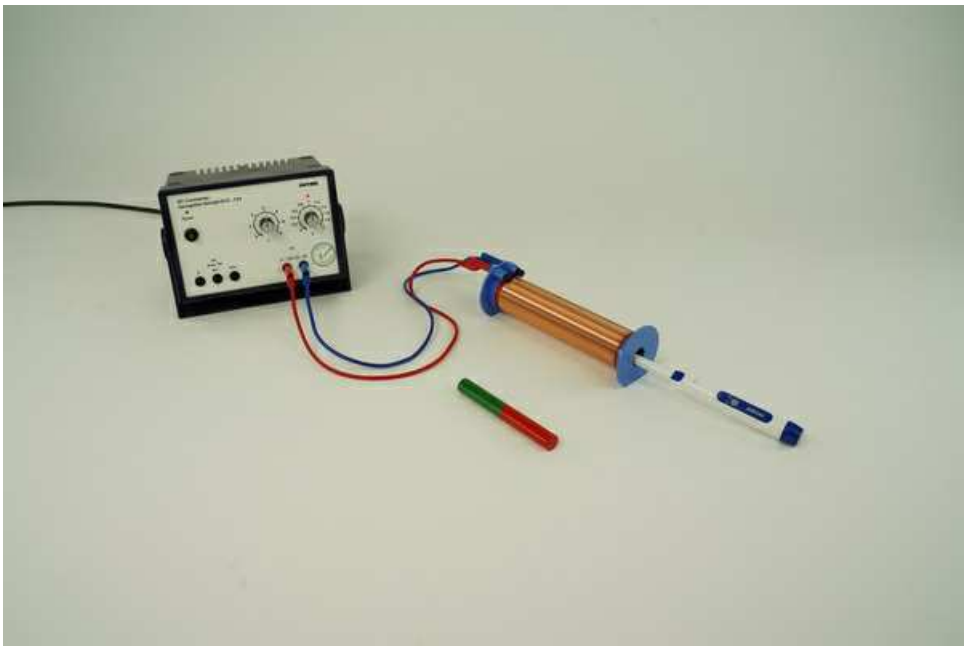

fig. 1

Build the experiment as shown in fig. 1. Start the tablet with the measure app and connect it to the Cobra SMARTsense magnetic field sensor.

Procedure

1. Hold the magnetic field sensor to the red end of the magnet and measure the magnetic flux density.
2. Hold the magnetic field sensor to the green end of the magnet and measure the magnetic flux density.
3. Move the magnetic field sensor around the magnet and measure the magnetic flux density.
4. Turn the magnetic field sensor around its own axis and measure the magnetic flux density.
5. Turn the magnetic field sensor around the coil and measure the magnetic flux density.
6. Hold the magnetic rock sensor against an opening in the coil and change the polarity of the coil.

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