

Magnetic field of the earth (Item No.: P6300069)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Tablet with measure App

Experiment Variations:

Keywords:

magnetic field, magnetism, direction of a magnetic field, earth magnet

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 north pole is not the same as the geographic north pole. The magnetic poles of the earth move and are not static.

Educational objective

The students analyze the direction and the magnetic flux density of the magnetic field of the earth.

Task

Mesure the magnetic field of the earth.
Vector calculation in 3 dimensional space.

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 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.

Notes concerning the set-up and execution of the experiment

When measuring the magnetic field of the earth, interference sources such as a permanent magnet should be as far away as possible, since this is stronger and influences the measurement.

Equipment

| Position No. | Material | Order No. | Quantity |
|--------------|--|-----------|----------|
| 1 | Cobra SMARTsense - 3-Axis Magnetic field | 12947-00 | 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 positiv and from the south to the north pole as negative. You mesure in this experiment the magnetic field of the earth.

Aufgabe

1. Mesure the magnetic flux density of the magnetic field of the earth.

Equipment

| Position No. | Material | Order No. | Quantity |
|--------------|--|-----------|----------|
| 1 | Cobra SMARTsense - 3-Axis Magnetic field | 12947-00 | 1 |

Setup and Procedure

Setup

Tape a sheet of paper on the table. Start the tablet with the measure app and connect it to the Cobra SMARTsense magnetic field sensor. Select the fine measuring range and only measure the magnetic field in the X direction. Set the measuring frequency to 100 Hz. (You may have to calibrate the magnetic field sensor. To do this, rotate the magnetic field sensor around its own axis and set it to zero at a medium value.)

Procedure

1. Take a measurement and turn the sensor in the horizontal plane. Draw an arrow on your piece of paper (Fig. 1), for the direction where the magnetic field is strongest. Write down the maxima and the minima (fig. 2).



2. Turn the magnetic field sensor perpendicular to the arrow and turn the magnetic field sensor in the vertical plane. Write down the maxima and minima.
3. Place the magnetic field sensor parallel to the arrow and turn the magnetic field sensor again in the vertical plane. Note the maxima and minima.

Report: Magnetic field of the earth

Results - Observation (1 point)

Describe the change of the magnetic field when you change the position and the direction of the magnetic sensor.

.....

Evaluation - Question 1 (3 points)

Why has the magnetic sensor sometimes a positive value and sometimes a negative value

.....

Evaluation - Question 2 (2 points)

You noticed the minimum and maximum in three different planes. Do these values have a connection? Explain your decision

.....

Evaluation - Question 3 (2 points)

How can the maximum of the third measurement be calculated theoretically from the previous measurements? Write down a formula.

.....

Evaluation - Question 4 (1 point)

Check where the north is with your tablet using a navigation app. Does this match your measurement?

.....