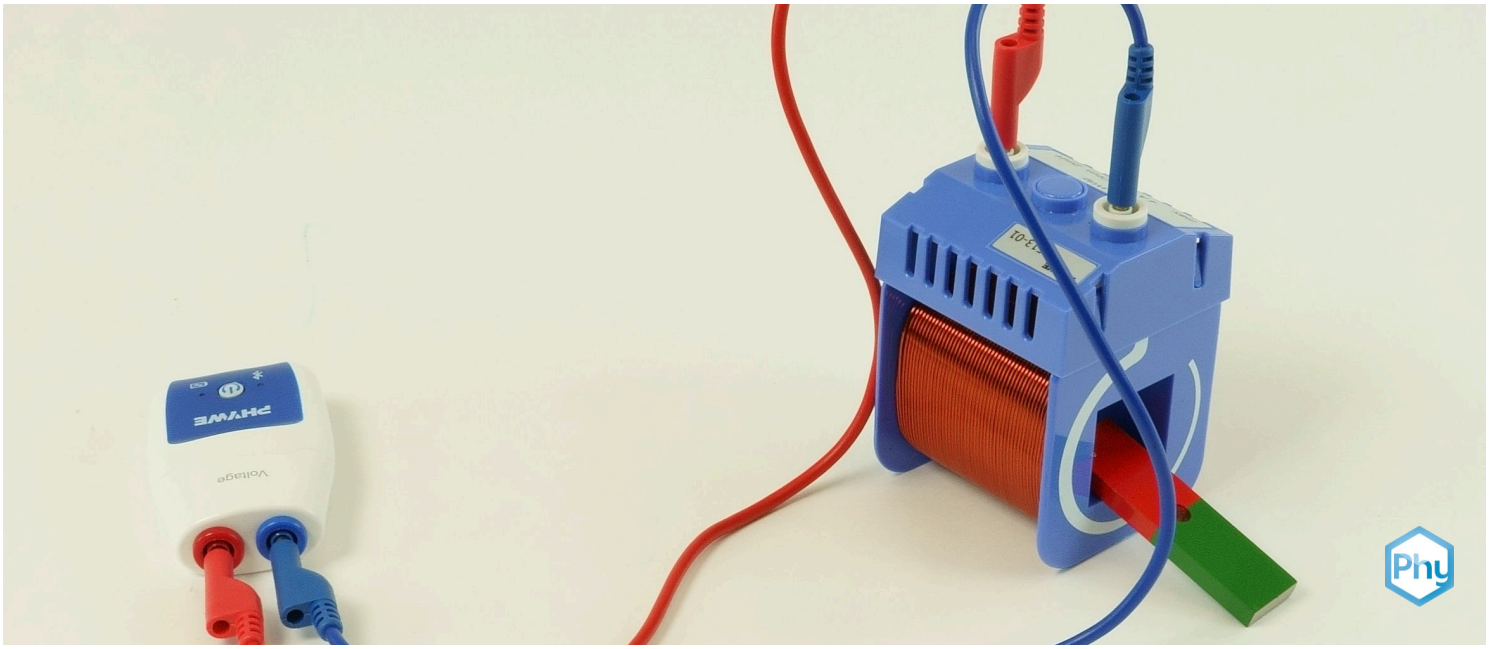
Generation of induced voltage with a permanent magnet (DEMO)



Physics > Electricity & Magnetism > Electromagnetism & Induction

Physics > Electricity & Magnetism > Electric generator, motor, transformer

Difficulty level	Group size	Preparation time	Execution time
medium	-	10 minutes	20 minutes

This content can also be found online at:

http://localhost:1337/c/6492f42c3759e10002069160

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Teacher information

Application

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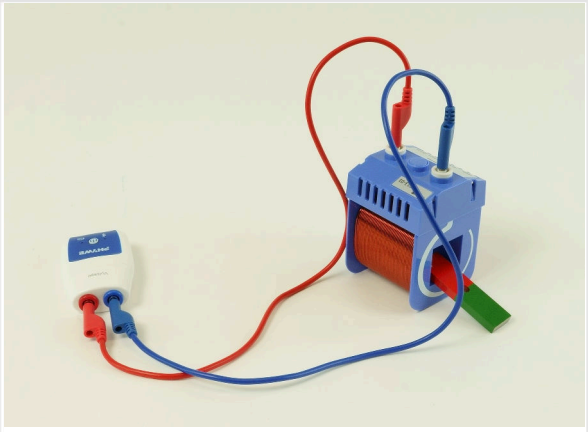

Experimental setup

Electromagnetic induction (also Faraday induction, after Michael Faraday, induction for short) refers to the creation of an electric field when the magnetic flux changes.

In many cases, the electric field can be detected directly by measuring an electric voltage.

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Other teacher information (1/2)

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Prior knowledge

No prior knowledge is required.

Principle

The change in magnetic flux acting on an electrical conductor induces an electrical voltage and thus an electrical current flow in that conductor.

Other teacher information (2/2)

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Learning objective

Students should understand the principle behind electromagnetic induction.

Tasks

Investigate how induction voltages can be generated with the help of a permanent magnet and which conditions influence their level.

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Student information

Motivation

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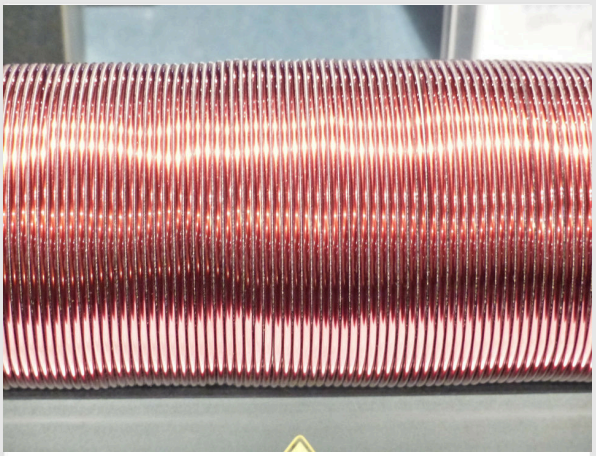

One coil

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Equipment

Position	Material	Item No.	Quantity
1	Cobra SMARTsense Voltage - Sensor for measuring electrical voltage ± 30 V (Bluetooth + USB)	12901-01	1
2	Coil, 300 turns	06513-01	1
3	Coil, 1200 turns	06515-01	1
4	magnet, l = 72mm, rodshaped, colored poles	07823-00	1
5	Connecting cord, 32 A, 750 mm, red	07362-01	1
6	Connecting cord, 32 A, 750 mm, blue	07362-04	1
7	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

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Set-up (1/2)

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For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** is required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check that on your device (smartphone, tablet, desktop PC) **Bluetooth** is **activated**.

iOS

Android

Windows

Set-up (2/2)

- Set up the experiment according to Fig. 1.
- Carry out the following experimental steps one after the other and observe the recorded voltage signal in each case.
- Enter your observation in the prepared table in the report.

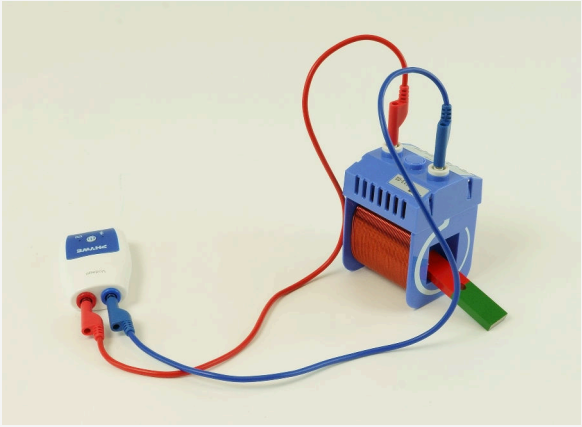

Fig. 1

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Procedure (1/2)

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Cobra SMARTsense

- Switch on the SMARTsense sensor and make sure that the end device can connect to Bluetooth devices.
- Open the PHYWE measureApp and select the sensor "Voltage".
- Select the sampling rate of your choice. The higher the sampling rate, the more accurate the measurement.

Procedure (2/2)

PHYWE

1. Move the magnet into the coil with the north pole first.
2. Move the magnet out of the coil again.
3. Move the magnet into the coil with the south pole first.
4. Move the magnet out of the coil again.
5. Move the magnet in and out of the coil faster.
6. Let the magnet rest in the coil.
7. Rotate the magnet in the coil around the longitudinal axis.
8. Replace the 400 turns coil with a 1600 turns coil and repeat the previous steps.

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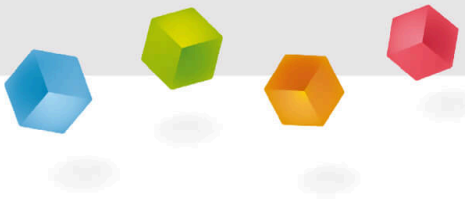

Report

Evaluation (1/3)

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Movement	Observation	Movement	Observation
North pole into coil		Faster movement of the magnet	
North pole out of coil		Magnet rests in the coil	
South pole into coil		Rotation of the magnet around the longitudinal axis	
South pole out of coil		As 1. to 4. for coil with 1600 turns.	

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Evaluation (2/3)

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Drag the words into the correct boxes!

From the results in steps 1 to 6, it is clear that a _____ is generated as long as the _____ and the _____ move relative to each other. However, as step 7 shows, the movement must be such that the _____ encompassed by the coil changes in the process. Thus: A voltage is _____ in a coil as long as the magnetic field enclosed by the coil changes.

magnetic field
magnet
induced
voltage
coil

Check

Evaluation (3/3)

PHYWE

Drag the words into the correct boxes!

The _____ of the induced voltage depends on whether the magnet is moving into or out of the coil and which _____ of the magnet is facing the coil. The _____ is higher the _____ the movement and the higher the number of turns of the induction coil.

pole
induction voltage
faster
direction

Check

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Slide	Score / Total
Slide 14: Influence of the movement of the magnet	0/5
Slide 15: Induction voltage	0/4

Total score 0 / 9

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