The power generating generator

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

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/617aab478e47ed0003a82b30

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

PHYWE

Teacher information

Application

PHYWE

Wind turbine with electricity generating generator

With the knowledge of Faraday's law of induction, it is possible to convert mechanical energy into electrical energy. Nowadays, this phenomenon is mainly used in generators that convert natural kinetic energy into electricity.

Typical examples of applications are turbines in hydroelectric power plants at dams or wind turbines. These use the movement of flowing air masses to drive a rotor, which is coupled to a generator with the aid of a gearbox. When this generator is set in rotation, it converts the rotational kinetic energy into an electric current.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/2)

PHYWE

Previous

Students should already have worked out and understood the basics of electromagnetic induction in order to understand how the principle of induction can be used for everyday technical applications.

Principle

The operation of the generator is based on the principle of electromagnetic induction. This means that a permanent magnet moving past an electromagnet causes a change in the magnetic flux and thus the generation of an electric current. In the generator, the principle is generated by the continuous rotary motion.

Other teacher information (2/2)

PHYWE

Learning

The experiment is designed to show the students the principle of an electricity-generating generator by means of three examples.

Tasks

In this experiment, the students are to construct and investigate the classic (bicycle) dynamo. To this end, they are to construct three different designs of this type of generator and determine their properties.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

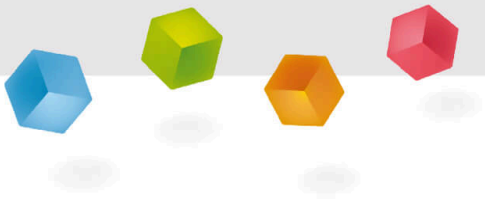
info@phywe.de
www.phywe.de

Safety instructions

PHYWE

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

PHYWE



Student Information

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Motivation

PHYWE

Wind turbine with electricity generating generator

You have already studied the phenomenon of electromagnetic induction in detail. Now, however, you are to examine the extent to which this can also be used for everyday applications.

You have generated a small electric current with the help of a rotating permanent magnet and a stationary electromagnet. But is it also possible to generate larger currents with the help of the experimental setup and feed them into the power grid?

Classic examples of the generation of electricity from kinetic energy (in this case rotation) are wind turbines, which convert wind energy into electricity.

Tasks

PHYWE

You know that you can generate a current, for example, with the help of a moving magnet. In this experiment, you will find out whether this process can also be used for everyday applications. In addition, you will learn which different designs are conceivable for generating electricity.

For this purpose you will build and examine three different designs of the so-called dynamo.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Equipment

Position	Material	Item No.	Quantity
1	Student set Electric motor / Generator, TESS advanced Physics	15221-88	1
2	Digital multimeter, 600V AC/DC, 10A AC/DC, 20 MΩ, 200 µF, 20 kHz, −20°C… 760°C	07122-00	1
3	Connecting cord,15A,25cm, red	07313-01	1
4	Connecting cord,15A,25cm, blue	07313-04	1
5	Filament lamps 1.5V/0.15A,E10,10 pieces	06150-03	1
6	Junction module, SB	05601-10	2
7	Socket module for incandescent lamp E10, SB	05604-00	1

PHYWE
Robert-Bosch-Breite 10
37079 Göttingen
Tel.: 0551 604 - 0
Fax: 0551 604 - 107
info@phywe.de
www.phywe.de

Structure & Implementation (1/2)

PHYWE

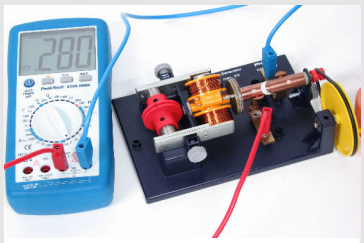
Experimental setup: Generator 1

Experiment: Part 1

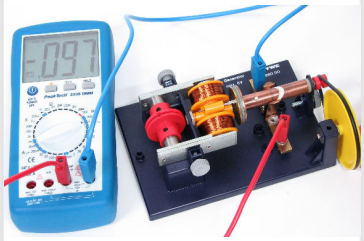
- Build the first generator as shown in the picture.
- The measuring instrument should be set so that it can measure AC voltages in the range up to $\pm 2\,V$ or alternating current up to $\pm 0,2\,A$ measures.
- Connect the drive shaft and the yellow crank wheel using the rubber belt.
- Set the drive wheel and thus also the shaft in rotation with the help of the lever. Observe the display of the multimeter.

Structure & Implementation (2/2)

PHYWE



Generator 2



Generator 3

Experiment: Part 2 & 3

- Now build the other two generators one after the other.
- Consider beforehand whether the generator produces AC or DC voltage and set the measuring device accordingly.
- Note: You can use a bulb socket with a bulb $1,5\,V$; $0,15\,A$to the connecting lines and thus make them light up.
- Rotate the generators again and observe the reading of the multimeter.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

PHYWE

Report

Task 1

PHYWE

Experimental setup: Generator 1

Which statements are true for your observations in the 1st part of the experiment?

- [ ] The multimeter shows virtually no deflection.
- [ ] It is alternating current/voltage.
- [ ] The multimeter shows a clear deflection.
- [ ] It is direct current/voltage.

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 2

PHYWE

Experimental setup: Generator 2

Which statements are true for your observations in the 2nd part of the experiment?

- [ ] The multimeter shows virtually no deflection.
- [ ] The multimeter shows a clear deflection.
- [ ] It is direct current/voltage.
- [ ] It is alternating current/voltage.

Check

Task 3

PHYWE

Experimental setup: Generator 3

Which statements are true for your observations in the 3rd part of the experiment?

- [ ] The multimeter shows a clear deflection.
- [ ] It is direct current/voltage.
- [ ] The multimeter shows virtually no deflection.
- [ ] It is alternating current/voltage.

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Task 4

PHYWE

Explain how the generators work. Also explain the process of electromagnetic induction.

The coil is in the magnetic field of the _____. When the bar magnet or _____ is made to rotate, the _____ flowing through it changes constantly. The changing magnetic field induces a _____ in the coil, which can be measured using the _____. The faster the rotation, the stronger the _____ and thus the _____. So the principle of the Generato works in reverse to that of the _____.

- permanent magnet
- voltage
- magnetic field change
- magnetic field
- multimeter
- coil
- electric motor
- induction

Check

Slide	Score / Total
Slide 13: Observation 1	0/2
Slide 14: Observation 2	0/2
Slide 15: Observation 3	0/2
Slide 16: Operation of the generator	0/8

Total 0 / 14

Solutions Repeat

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de