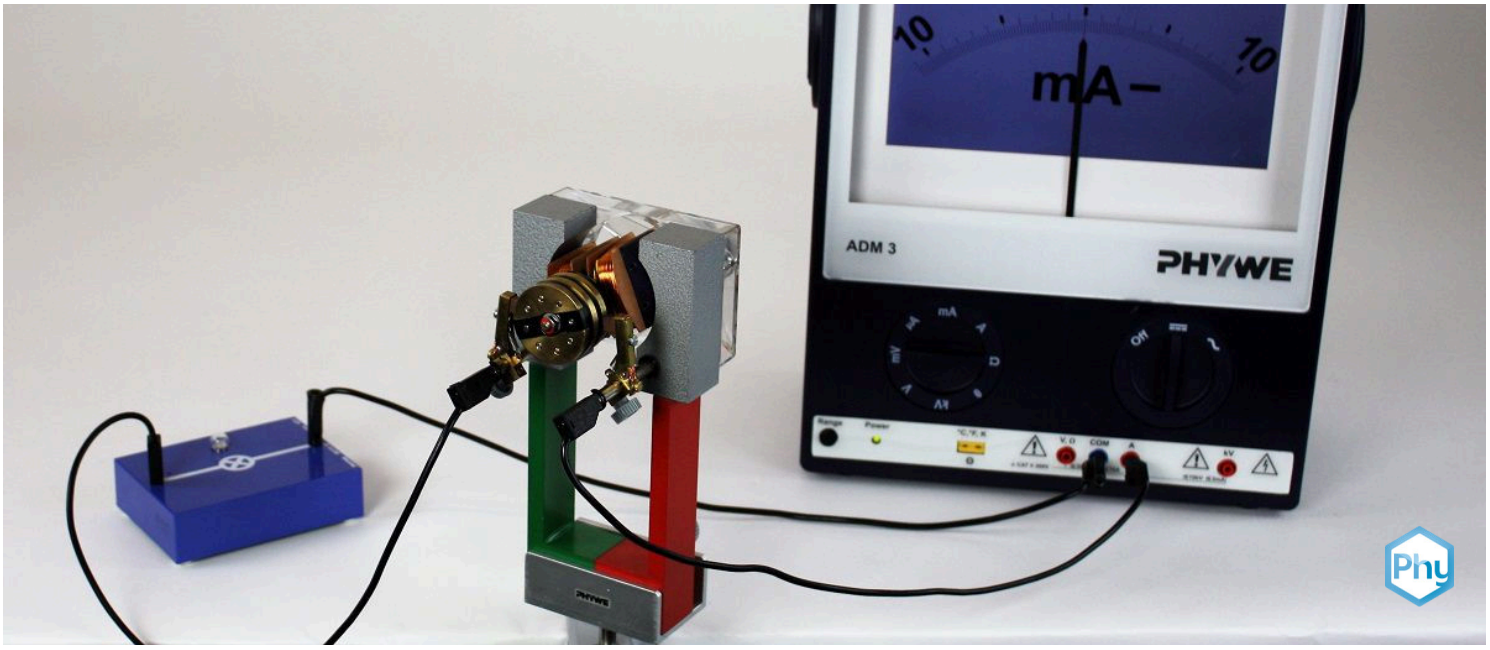
The alternating current generator (DEMO)



Physics > Electricity & Magnetism > Electromagnetism & Induction

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

Difficulty level	Group size	Preparation time	Execution time
medium	1	10 minutes	20 minutes

This content can also be found online at:

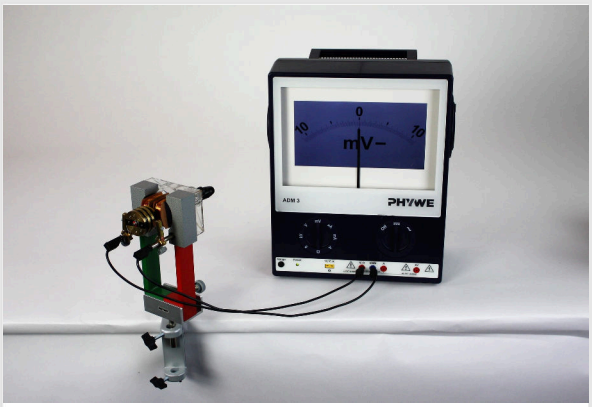
http://localhost:1337/c/617aac548e47ed0003a82b9b

PHYWE

Teacher information

Application

PHYWE



Test setup

An electric generator is an electrical machine that converts kinetic energy into electrical energy. The generator is the counterpart of the electric motor, which converts electrical energy into kinetic energy. It is based on the principle of electromagnetic induction discovered by Michael Faraday in 1831.

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

No prior knowledge is required.

Principle

If a coil is rotated in a magnetic field, an electrical voltage is generated at its ends (induction voltage). After each half turn of the coil, the voltage and current change sign. The resulting electrical energy can be used to operate a light bulb.

Other teacher information (2/2)

PHYWE

Learning

Students should understand how a generator works.

Tasks

Investigate how to generate voltage and current using a generator.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

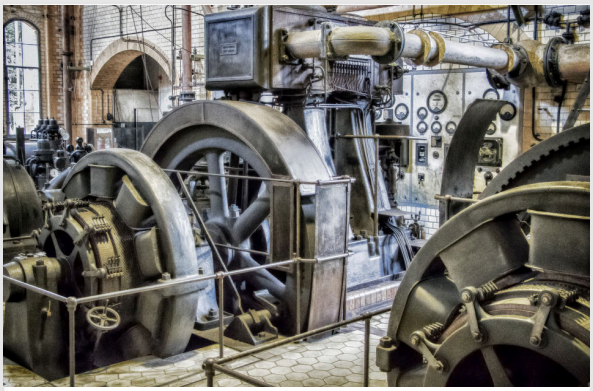
PHYWE

Student Information

Motivation

PHYWE

An electric generator is an electrical machine that converts kinetic energy into electrical energy. The generator is the counterpart of the electric motor, which converts electrical energy into kinetic energy. It is based on the principle of electromagnetic induction discovered by Michael Faraday in 1831.



Historical generator

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	PHYWE Demo Multimeter ADM 3: current, voltage, resistance, temperature	13840-00	1
2	Bench clamp	02012-00	1
3	Plate holder, opening width 2 - 35 mm	06509-00	1
4	U-magnet, large, U-shaped, limb length 130 mm, colored poles	06320-00	1
5	Motor set	06550-00	1
6	Rotor coil, Double-T armature	06554-00	1
7	Cord pulley	06558-01	1
8	Crank handle	06559-01	1
9	Lamp holder E10, on base plate	06002-00	1
10	Filament lamps 4V/0.04A, E10, 10	06154-03	1
11	Filament lamps 3.5V/0.2A,E10, 10	06152-03	1
12	Connecting cord, 32 A, 750 mm, black	07362-05	3

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

Structure (1/2)

PHYWE

- Set up the experiment according to Fig. 1.
- Assemble the motor attachment according to Fig. 2 and Fig. 3 on the next slide.
- Slide the axle [1] of the double T-anchor into the bearing bore [3] of the motor attachment and screw it tight with the cord washer [2].
- Put the crank on the pulley.
- Place the brushes [4] of the motor attachment as shown in Fig. 3 against one uninterrupted slip ring each.

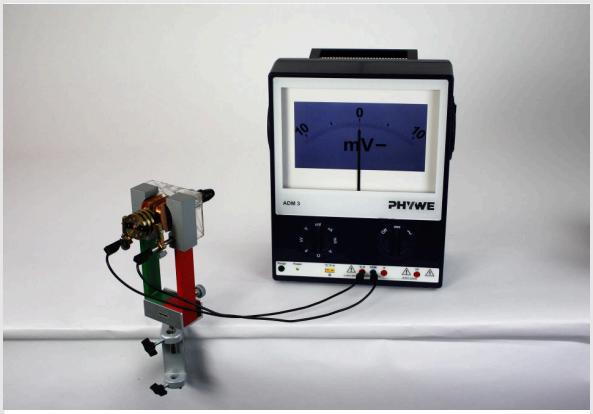


Fig. 1

Structure (2/2)

PHYWE

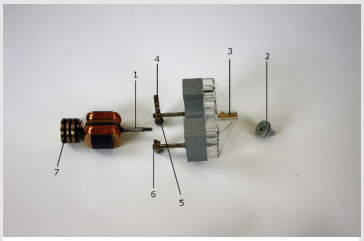


Fig. 2

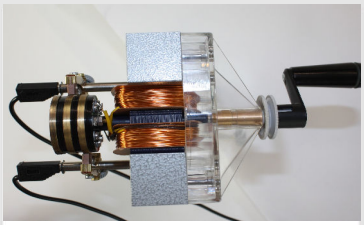


Fig. 3

- Pull the knurled screw [5] slightly upwards so that the two angled lever arms of the grinding brushes are in line. This tensions the spring and presses the brushes onto the slip rings.
- Tighten the knurled screws [5]. This establishes the electrical contact between armature coils and connection sockets [6].
- Select the measuring range -10 mV- ... +10 mV-, i.e. the measuring range with zero point in the middle.

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

Procedure (1/3)

PHYWE

- Set up the experiment according to Fig. 1.
- Connect the connection sockets [6] of the motor to the inputs of the multimeter for voltage measurement.
- Turn the crank slowly in one direction, watch the meter.
- Change the direction of rotation.
- Select the AC voltage measuring range 3 V~ (Fig. 4).
- Turn the crank quickly, watch the meter.

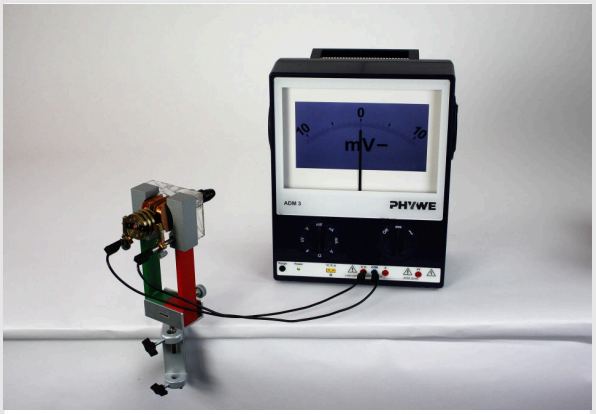


Fig. 4

Procedure (2/3)

PHYWE

- Set up the experiment according to Fig. 5.
- Attach the lamp socket with 4 V bulb to the stand rod using the double socket.
- Select the measuring range -10 mA- ... +10 mA-.
- Turn the crank slowly at first, then faster, watching the meter and bulb.
- Change the direction of rotation.

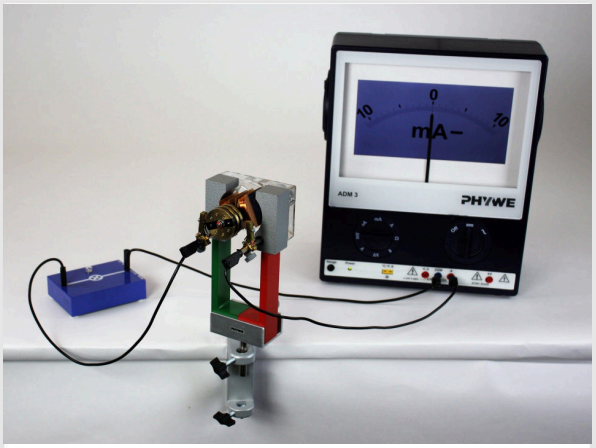


Fig. 5

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

Procedure (3/3)

PHYWE

- Select the measuring range 100 mA~ (Fig. 6).
- Turn the crank quickly, watch the lamp and meter.
- Insert the 3.5 V / 0.2 A bulb.
- Select the measuring range 300 mA~.
- Turn the crank quickly, watch the lamp and meter.

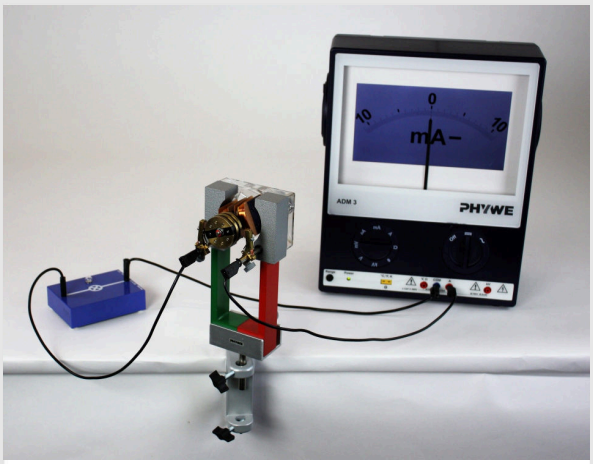


Fig. 6

PHYWE

Report

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

Task (1/5)

PHYWE

How does the pointer behave when measuring DC voltage?

- He's not striking out.
- He strikes out alternately to the left and right.
- He swings to his left.
- He's striking out to the right.

Task (2/5)

PHYWE

Drag the words into the correct boxes!

When turning the crank _____, especially the pointer of the meter moves back and forth with large deflections, while a _____ glow of the bulb is only slightly visible. At _____ speed, the movement of the pointer becomes _____, but it gradually increases. The bulb gets brighter and brighter as it does so.

slowly
faint
smaller
greater

Check

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

Task (3/5)

PHYWE

How does the pointer behave during DC current measurement?

- He strikes out alternately to the left and right.
- He swings to his left.
- He's not striking out.
- He's striking out to the right.

Task (4/5)

PHYWE

Drag the words into the correct boxes!

An electrical voltage is generated in a coil rotating in the _____. This process is called _____. When measuring _____ and current in measuring ranges for _____ and direct current respectively, the pointers of the measuring instruments deflect to the right and left, thus an _____ is generated, the period of which corresponds to one full coil rotation.

- induction
- voltage
- alternating voltage
- magnetic field
- direct voltage

Check

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de

Task (5/5)

PHYWE

Drag the words into the correct boxes!

If the measuring devices are set to ranges for _____ or AC current, the pointer deflection increases with _____, i.e. the induced voltage and the current _____. An alternating current flows through the connected bulb. So mechanical energy is converted into electrical energy. The greater the speed, the greater the _____, and the lamp burns brighter.

speed

increase

AC voltage

electrical power

Check

Slide	Score / Total
Slide 14: Voltage measurement	0/3
Slide 15: Speed during voltage measurement	0/4
Slide 16: Current measurement	0/4
Slide 17: Operating principle of the alternator	0/5
Slide 18: AC voltage and electrical power	0/4

Total score 0 / 20

Show solutions Repeat

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

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

info@phywe.de
www.phywe.de