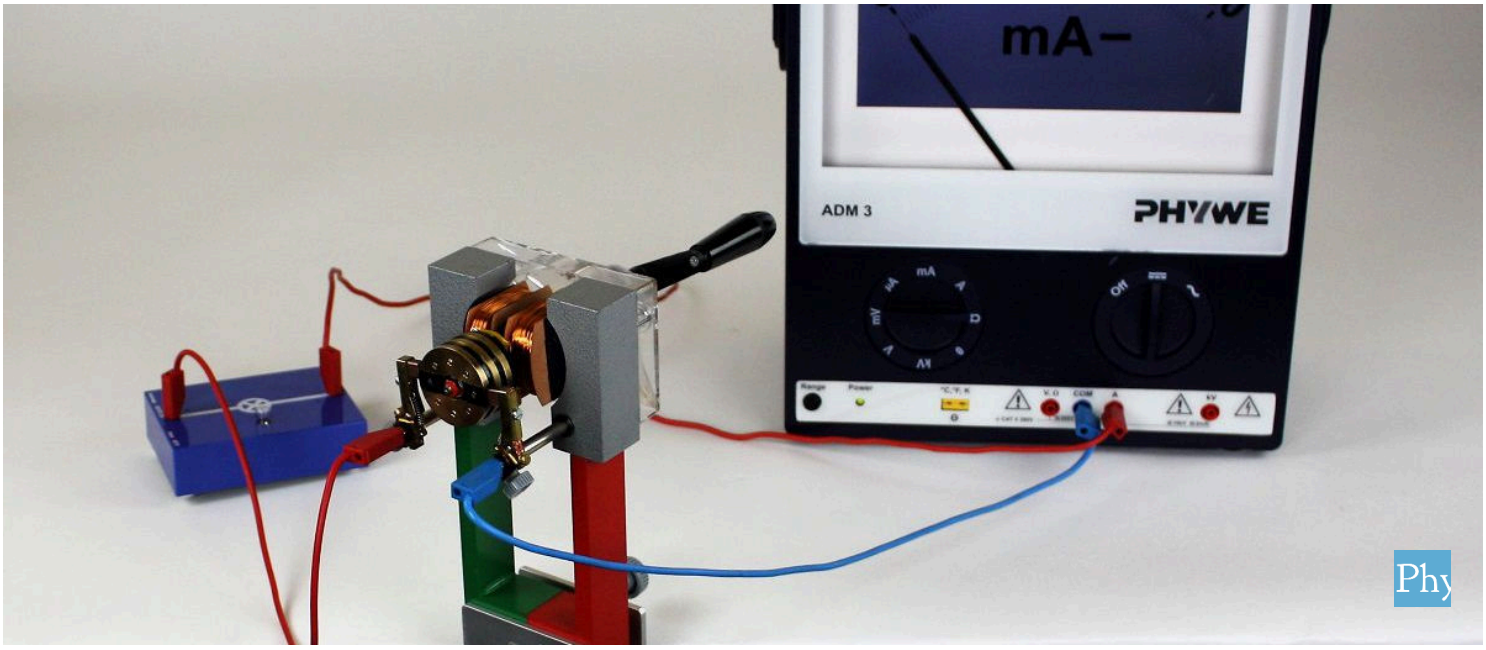
The direct current generator (DEMO)



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

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Teacher information

Application

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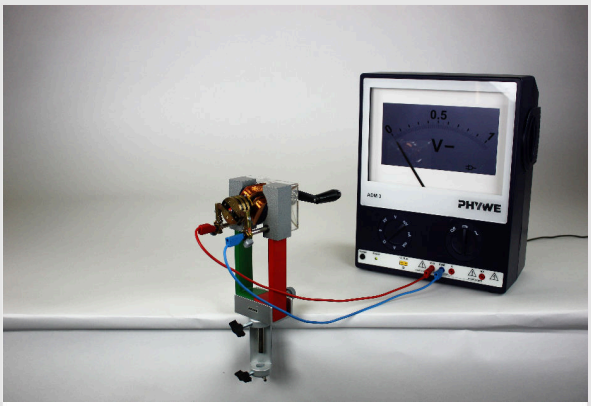

Test setup

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.

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Other teacher information (1/2)

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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 changes its sign. If the poles of the coil winding are reversed at this moment with the aid of a so-called collector, a DC voltage is produced. The resulting electrical energy can be used to operate an incandescent lamp.

Other teacher information (2/2)

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Learning

Students should understand how a DC generator works.

Tasks

Investigate how to generate voltage and current using a DC generator.

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Student Information

Motivation

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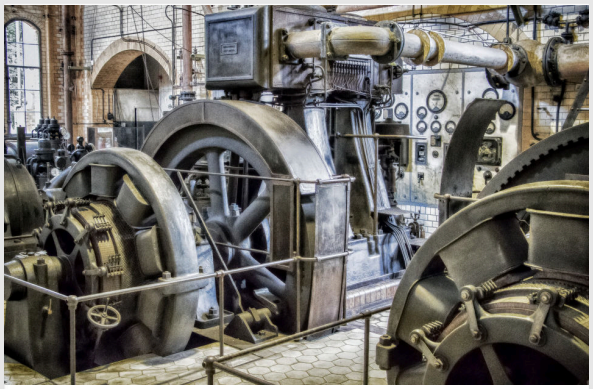

Historical generator

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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, red	07362-01	2
13	Connecting cord, 32 A, 750 mm, blue	07362-04	1

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Structure (1/2)

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- Set up the experiment according to Fig. 1.
- Assemble the motor attachment according to Fig. 2.
- 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.

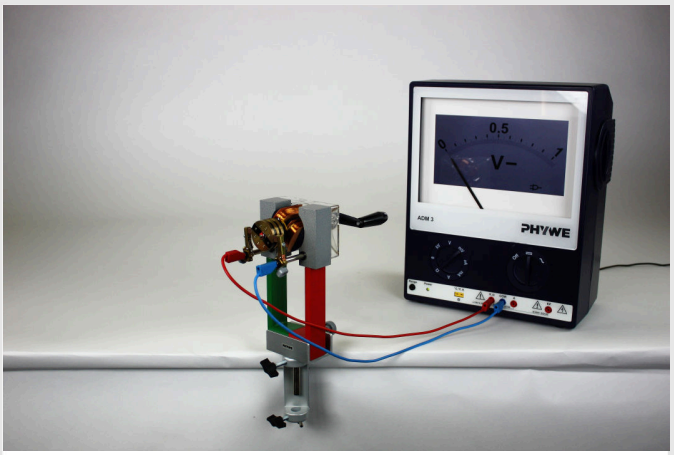

Fig. 1

Structure (2/2)

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- Place the grinding brushes [4] of the motor attachment against the interrupted slip ring as shown in 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].

Fig. 2

Fig. 3

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Procedure (1/3)

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- 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.
- Select the measuring range 1 V-.
- Turn the crank slowly and continuously in one direction, watch the meter.
- Note: If the pointer moves counterclockwise, change the direction of rotation or replace the connections on the meter.
- Set the measuring range to 3 V-.

Procedure (2/3)

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- Increase the rotation speed.
- Adjust the zero point of the pointer on the meter slightly towards the center.
- Carefully change the direction of rotation and observe the pointer deflection.
- Reset the zero point of the pointer.

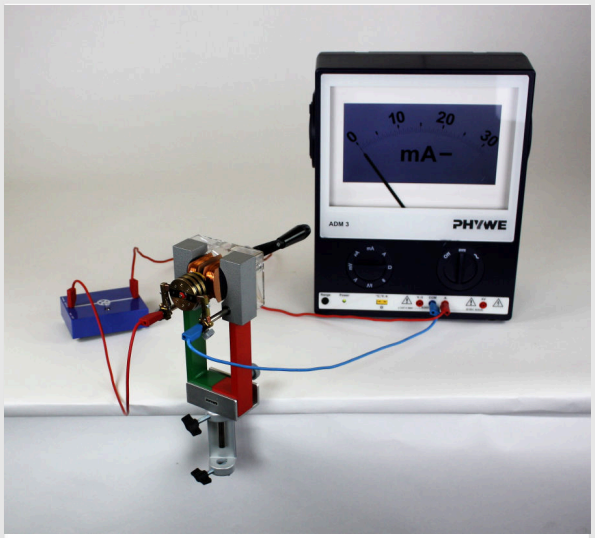

Fig. 4

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Procedure (3/3)

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- Modify the experiment according to Fig. 4, connect the meter and the 4V bulb in series and connect them to the motor. Pay attention to the correct polarity.
- Select the measuring range 100 mA-.
- Turn the crank slowly at first, then faster. Observe the meter and bulb.
- Insert the 3.5 V / 0.2 A bulb.
- Select the measuring range 300 mA-.
- Turn the crank quickly, watch the meter and bulb.

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Report

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Task (1/6)

Drag the words into the correct boxes!

If the crank is turned very slowly, the _____ of the meter will deflect very little to the right and go back to almost zero after each _____. If the crank is turned faster, the pointer is less and less able to follow the voltage change, and the _____ of the motor increases. The measuring range must then be set to 3 V-.

half turn
pointer
voltage

Check

Task (2/6)

How does the pointer behave after the direction of rotation of the crank has been changed?

- He's striking out in the opposite direction.
- He's striking out in the same direction.
- He's not striking out.

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Task (3/6)

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Drag the words into the correct boxes!

When turning the crank _____, especially the pointer of the meter moves in the lower range of the scale, while a _____ glow of the bulb in the same cycle is only slightly visible. At _____ rpm, the movement of the pointer becomes _____. The bulb gets brighter and brighter. The gauge only deflects to one side. The size of the reading depends on the _____. It increases up to 40 mA.

weak
speed
smaller
greater
slowly

Check

Task (4/6)

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How does the second bulb compare to the first green bulb?

- It glows fainter.
- It glows with the same intensity.
- It glows stronger.

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Task (5/6)

Drag the words into the correct boxes!

An _____ is generated in a coil rotating in the _____. This process is called _____. As the coil rotates slowly, you can see that the value of the voltage varies, but the pointer always moves in the _____, producing a (pulsating) DC voltage.

- magnetic field
- same direction
- electrical voltage
- induction

Check

Task (6/6)

Drag the words into the correct boxes!

A _____ flows through the _____. Mechanical energy is converted into _____. The greater the speed, the greater the _____, the lamp burns _____.

- electrical power
- brighter
- direct current
- electrical energy
- connected light bulb

Check

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Slide	Score/Total
Slide 14: Voltage measurement	0/3
Slide 15: Influence of the direction of rotation on the voltage	0/1
Slide 16: Current measurement	0/5
Slide 17: Comparison of light bulbs	0/1
Slide 18: Functionality of the direct current generator	0/4
Slide 19: Electrical power	0/5

Total score 0/19

Show solutions Repeat

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