Object of the experiment

Determine the efficiency of a DC motor

Setup

Safety instructions:

Since the motor shaft continues to rotate after it is switched off (motor without gears), for safety reasons it is recommended the load used be a rubber stopper.

Preparation of Joule and wattmeter:

- Use the *U, I, P* button to set the measured variable to be voltage.
- Apply a voltage of 1.5 V to the INPUT.
- Use the *U, I, P* button to set the measured variable to be current.
- Use the RANGE button to select a measuring range of 0.00 mA.
- Afterwards, use the *U, I, P* button to set the measured variable to be electrical work, measured in mWs. Then, with the toggle switch at the OUTPUT closed, press the *t* START/STOP button.

Apparatus

1 Motor and tachogenerator, STE 4/19/50	579 43
1 Set of 2 fishing lines	309 48ET2
1 Rubber stopper, one 7-mm hole,.	667 265
1 Plug-in board section, STE	576 71
1 Push button (NO), STE 2/19	579 10
1 Joule and wattmeter	531 831
1 AC/DC power supply, 0...±12 V	521 49
1 Metal ruler, 1 m	311 02
1 Single pan balance	315 07
1 Stand base, V-shaped, large	300 01
1 Stand rod, 150 cm, 12 mm diam.	300 46
1 Support block	301 25
1 Pair of pointers	301 29
2 Connecting leads, 32 A, 200 cm, blue	501 36
2 Connecting leads, 32 A, 100 cm, red	501 30
1 Connecting lead, 32 A, 50 cm, blue	501 26

Procedure

- Use the single pan balance to determine the mass of the load.
- Position pointer 1 on the stand in such a way that it points to the bottom edge of the stopper.
- Position pointer 2 at a distance 1 m from pointer 1
- Start the measurement by pressing the toggle switch at the OUTPUT.
- When the lower edge of the stopper passes pointer 2, stop the measurement of electrical work by pressing the *t* START/STOP button and use the toggle switch at the OUTPUT to break the circuit again.
- Read off the electrical work *W* from the Joule and wattmeter and enter it into the table.

Measurement results

$g = 9{,}81 \frac{\text{m}}{\text{s}^2}$

Electrical work *W* in Ws	Distance *s* in m	Mass *m* in kg
0.51	1	0.027

Evaluation

$E_{El} = 0.51\ \text{Ws}$

$E_{Mec} = m \cdot g \cdot h = 0{,}027\ \text{kg} \cdot 9{,}81 \frac{\text{m}}{\text{s}^2} \cdot 1\,\text{m} = 0{,}13\ \text{Nm} = 0{,}26\ \text{Ws}$

$\eta = \frac{E_{Mec}}{E_{El}} = \frac{0{,}26\ \text{Ws}}{0{,}51\ \text{Ws}} = 0{,}5$

The efficiency η of the DC motor used here is 0.5.

That means that only half the electrical energy supplied to the motor is converted into mechanical energy.

The rest is converted into thermal energy and emitted from the motor in the form of heat.

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