Electromagnetic Fields – Laboratory 02

Power of Motors – Magnetic Field of wires and coils

#	Student ID	Student Name	Grade (10)	Instructor signature
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Delivery Date	

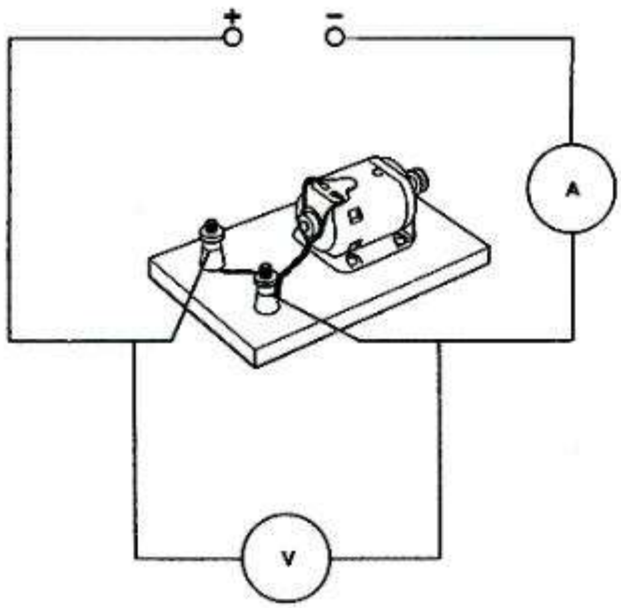
Electric Motor power

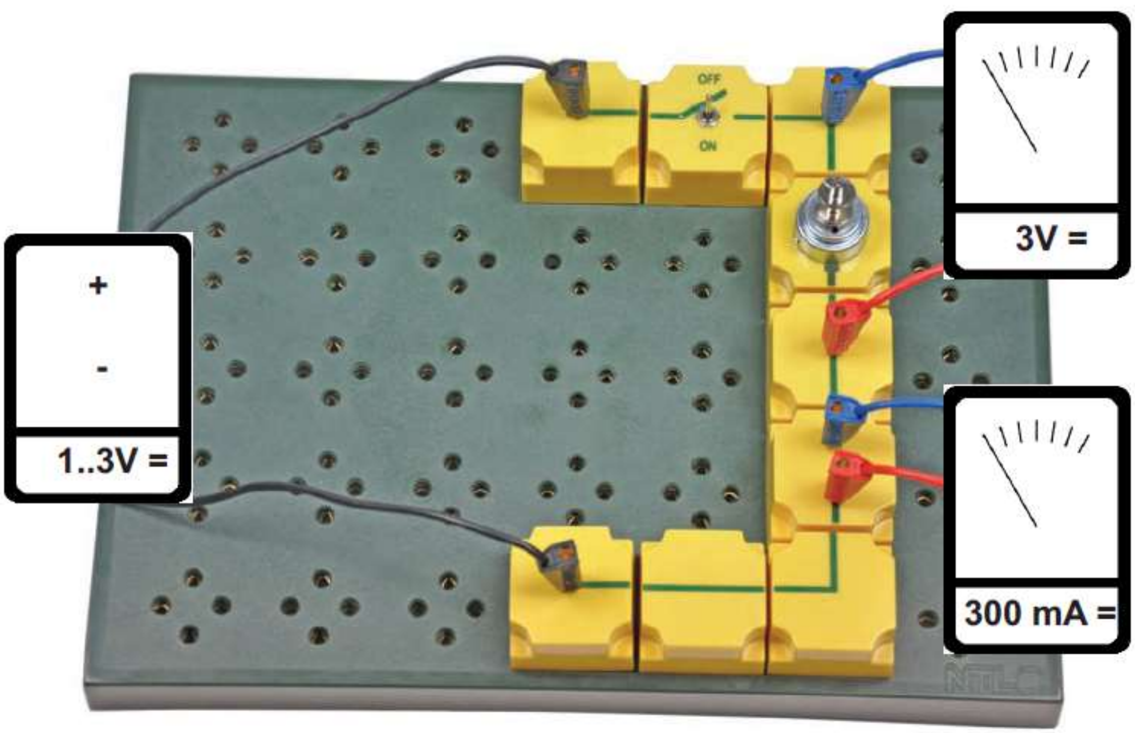
Objective

Experiment aims to calculate the power consumption of a small DC motor

Theory Overview

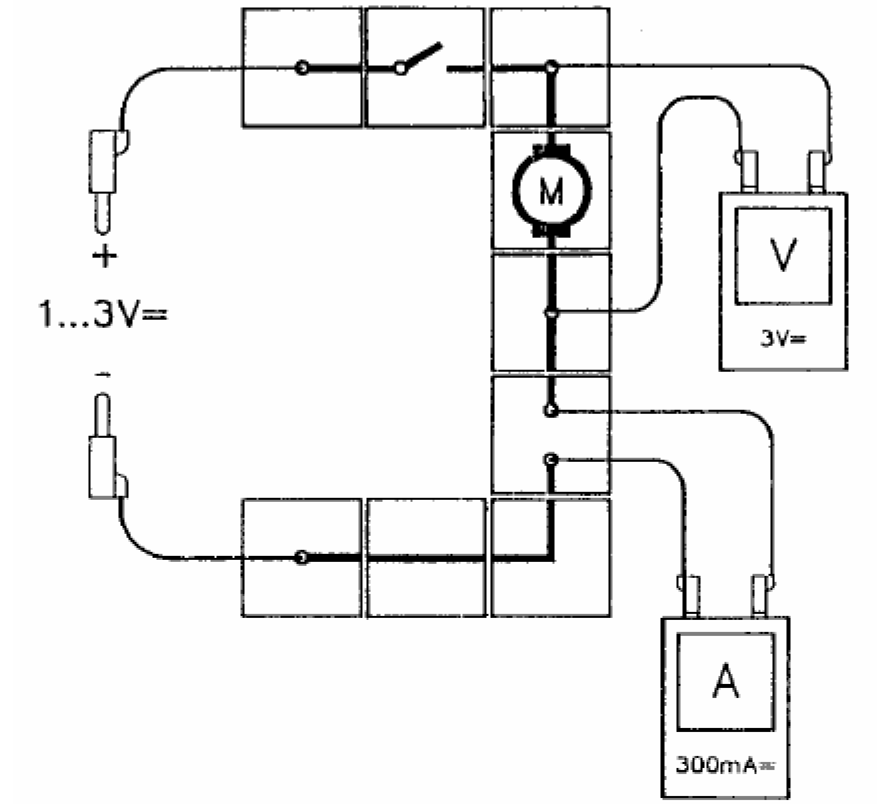
The power transferred to the motor is calculated by measuring the current in the circuit for various potential differences across the motor.





Procedure

Arrangement of the wiring according to the illustration.
2 volts DC is applied to the circuit.
The voltage at the motor is measured by a voltmeter, It is used with a measuring range of 3 V
The ammeter measures the current intensity at the electric motor.
It is used with a measuring range of 300 mA.



1. Close the switch, intensity read the voltage and the current from the measuring devices. Calculate the he power consumption of the motor is the product of voltage and current intensity (watt).

2. Use your hand to stop the motor from turning for a short time (stress the motor). The current intensity increases. Consequently the motor consumes more power. The increased consumption of power should not last too long so that no harm is done to the motor.

Results and data analysis

Motor condition	V	I	Power
Free running			
Stressed			

Questions and Conclusions

1. Consumed power by motor varies according to its load condition. Discuss regarding the experiment results?

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2. Calculate the motor power in horse power?

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Watts (W)	Electric horsepower ($hp_{(E)}$)
1 W	0.001340 hp

Magnetic Field of a wire carrying DC current

Objective

In this experiment you will investigate the interaction between current and magnetic fields

Theory Overview

When a current I exists in a long straight wire, a magnetic field B is generated around the wire. The field lines are concentric circles surrounding the wire, as shown in Figure

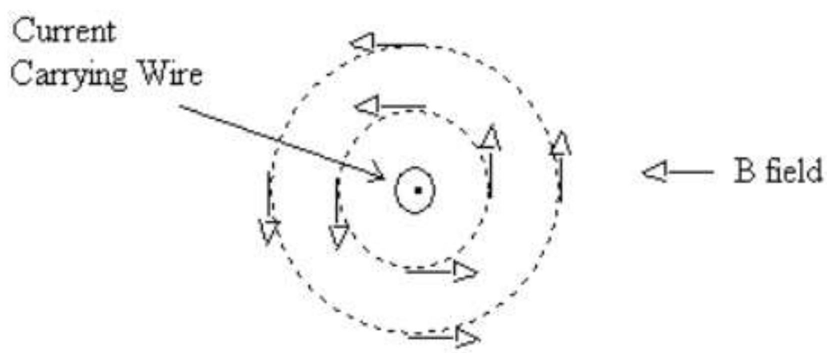
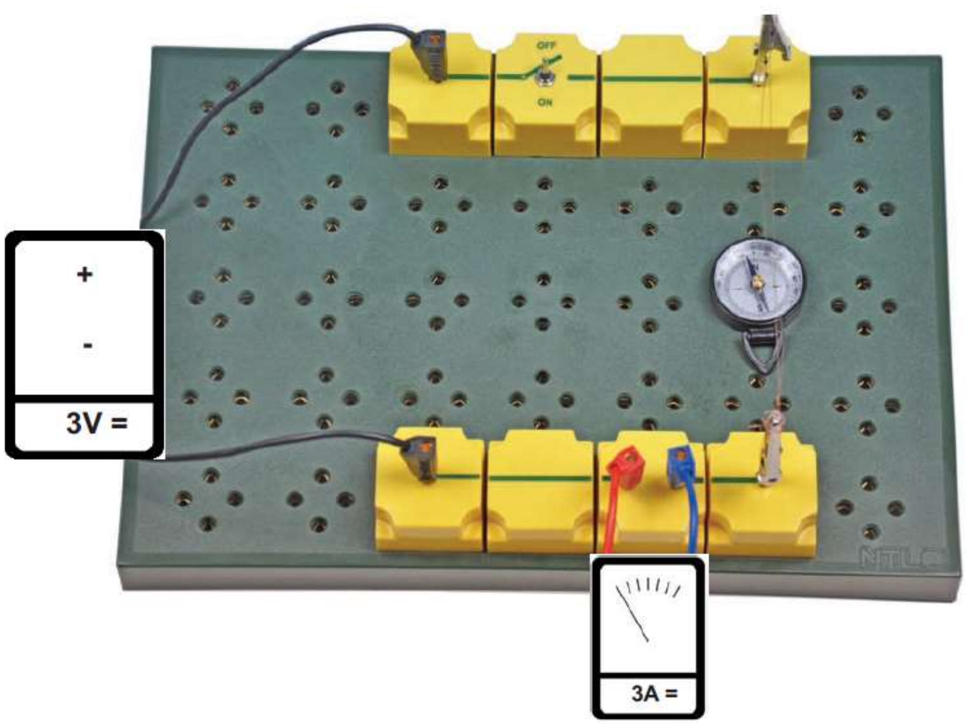


Figure : B field near a current-carrying wire.

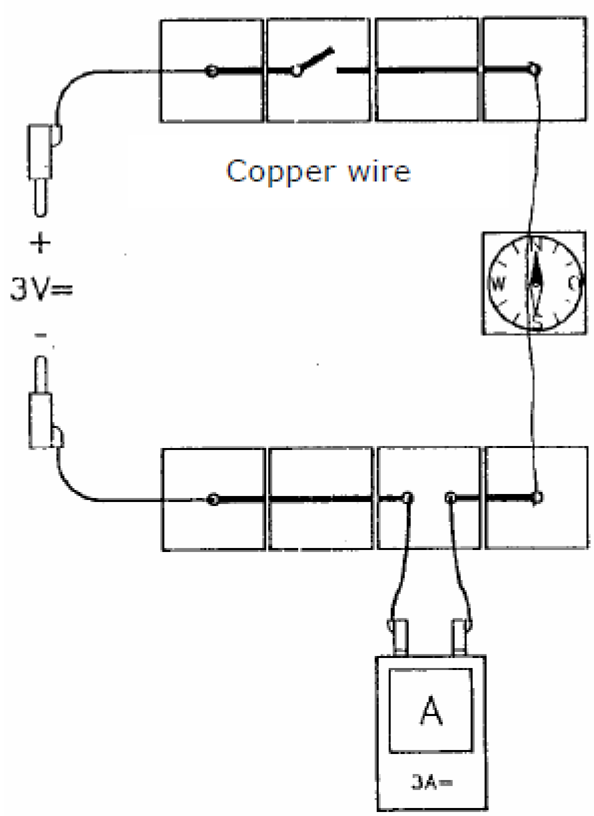
In Figure , the current I is shown coming out of the page toward you. The magnitude of the magnetic field (B) as a function of I and the distance (r) away from the wire is given by:

$$B = \frac{\mu_0 I}{2\pi r},$$



Procedure

Arrangement of the wiring according to the illustration.
Crocodile clips with plug pins are inserted in the sockets A and B of the two right PIB connectors.
A piece of copper wire (18 cm) is clamped in these crocodile clips. Below that a PIB-lead straight is inserted in the circuit board and the compass with the magnetic needle is placed on it.
The circuit board is turned so that the piece of wire is situated in north-south direction (the needle of the compass is parallel to the wire).
The ammeter with the measuring range of 1 A= is used. 3 volts DC is applied.



The switch is closed for a short period (the wire has a very small resistance so that a short-circuit is caused!).
The compass with the magneitc needle is elevated to such an extent that the magnetic needle is first situated at a small distance below the piece of wire and then at the same distance above the piece of wire.
Switch off the power as soon as possible!
The poles are changed by exchanging the connections at the voltage source and the experiment is repeated

Results and data analysis

V	I	Needle deflection (degree)

Questions and Conclusions

1. Explain how the earth's magnetic field could affect your res?

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2. use the direction of the compass needles and the right hand rule to determine whether the current in the wire is going up or down ?

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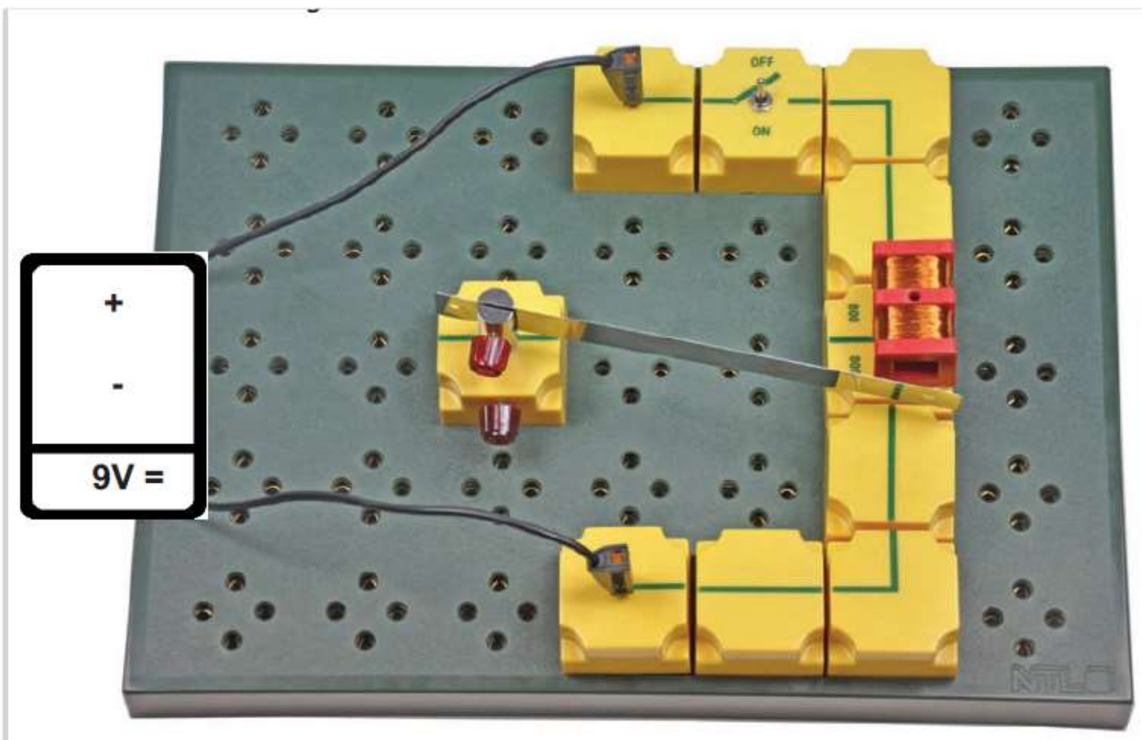
Magnetic Field of a coil carrying DC current

Objective

To test magnetic field produced by electric current passing through the coil.

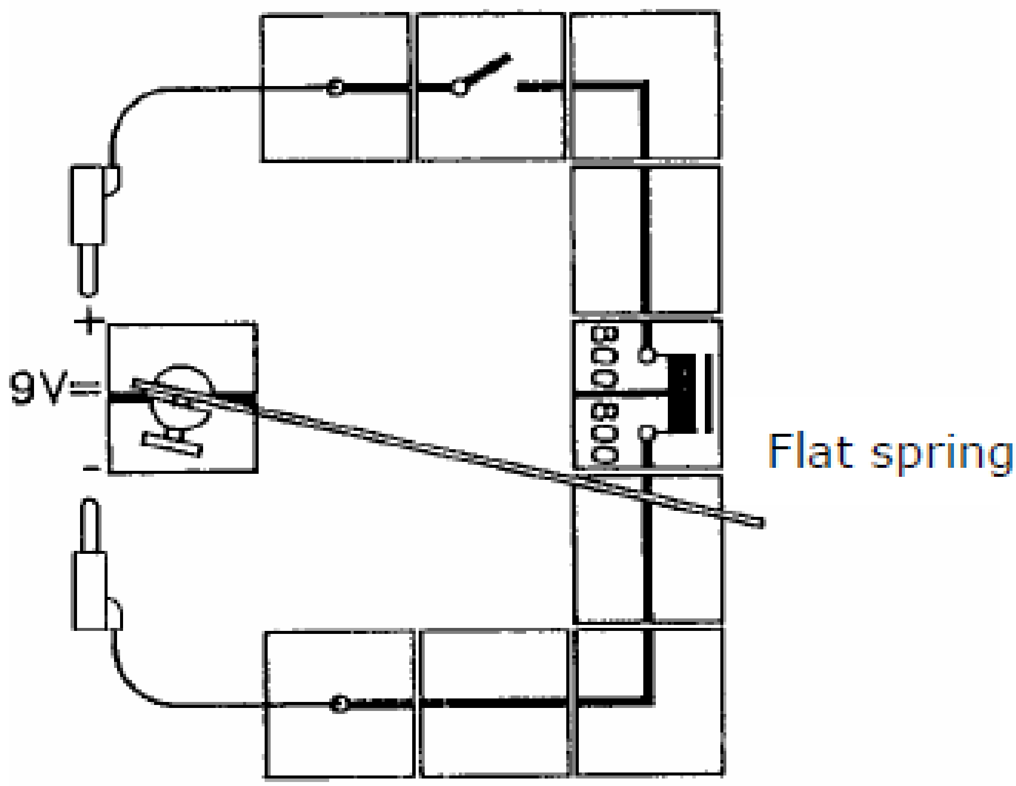
Theory Overview

When a current I exists in a long straight wire, a magnetic field B is generated around the wire. A long straight coil of wire can be used to generate a nearly uniform magnetic field similar to that of a bar magnet. Such coils, called solenoids, have an enormous number of practical applications. The field can be greatly strengthened by the addition of an iron core. Such cores are typical in electromagnets.



Procedure

Arrangement of the wiring according to the illustration. 9 volts DC is applied to the PI-coil with 2 x 800 turns. At first no iron core is used. The PIB adapter bush with the flat spring is not yet inserted.



The space around the coil is scanned by the magnaprobe.
The magnetic needle of the probe is not deflected. Then the switch is closed.
The space around the coil is scanned again by the magnaprobe.
The coil has become magnetic.
The north pole is at the side which is connected to the positive pole.

The switch is reopened. The PIB-adapter bush with holder and flat spring is inserted in the place indicated in the diagram.
The flat spring made of steel ought to be placed about 1 cm from the coil.
The switch is closed.
Is the magnetic effect of the coil strong enough to attract the flat spring?

The cylindrical iron core is inserted in the coil and the second experiment is repeated.
The flat spring is now attracted by the coil bearing current.

Since some magnetism remains in the iron core after opening the switch, the flat spring does not always move back to its neutral position on its own. But this can be caused by correctly adjusting the distance from the coil.

After closing the switch a chain of paper clips is to be formed from one end of the iron core to the other end.
What happens when the switch is opened?

Questions and Conclusions

1. Sketch the magnetic field flux produced by magnetic field coil?

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2. An iron core intensifies the magnetic field of a coil to a multiple., considering the following rule $B = k\mu_0 nI$?

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