MAGNET AND MATCHSTICK

REPORT

GREECE-RAPTOU

HELLENIC PHYSICAL SOCIETY

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PROBLEM TO BE INVESTIGATED

A matchstick is is not attracted to a magnet, however the head of a burned matchstick is attracted by a strong magnet. Investigate the reasons and the role of relevant parameters.

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- Theoretical explanation
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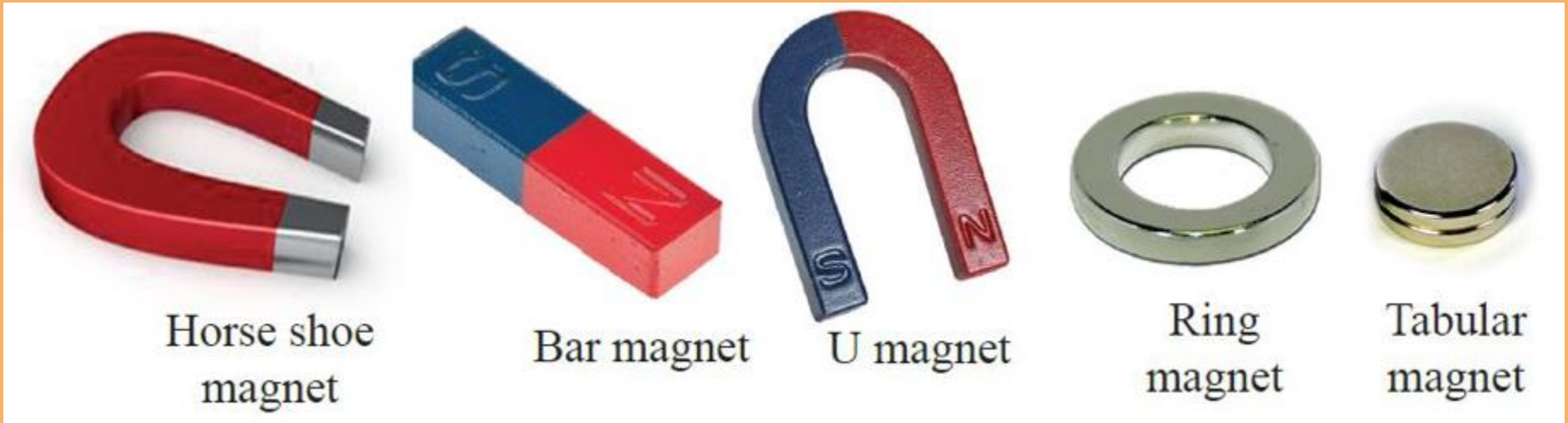
THEORETICAL EXPLANATION

WHAT ARE MAGNETS?

- A magnet is a material or object that produces a magnetic field. This magnetic field is invisible but is responsible for the most notable property of a magnet: a force that pulls on other ferromagnetic materials, such as iron, and attracts or repels other magnets.
- A permanent magnet is an object made from a material that is magnetized and creates its own persistent magnetic field. An everyday example is a refrigerator magnet used to hold notes on a refrigerator door.
- Permanent magnets are made from "hard" ferromagnetic materials such as alnico and ferrite that are subjected to special processing in a strong magnetic field during manufacture to align their internal microcrystalline structure, making them very hard to demagnetize.
- An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. Electromagnets usually consist of wire wound into a coil. A current through the wire creates a magnetic field which is concentrated in the hole, denoting the center of the coil. The magnetic field disappears when the current is turned off.

TYPES OF MAGNETS



WHAT ARE FERROMAGNETIC MATERIALS?

- Materials that can be magnetized, which are also the ones that are strongly attracted to a magnet, are called ferromagnetic (or ferrimagnetic). These include the elements iron, nickel and cobalt and their alloys, some alloys of rare metals, and some naturally occurring minerals such as Lodestone.

- Ferromagnetic materials can be divided into magnetically "soft" materials like annealed iron, which can be magnetized but do not tend to stay magnetized, and magnetically "hard" materials, which do.

WHAT IS A MAGNETIC FIELD?

A magnetic field is a vector field that describes the magnetic influence of electric charges in relative motion and magnetized materials.

WHY A BURNED MATCHSTICK IS ATTRACTED TO A MAGNET?

- The red matchstick head is made from iron oxide and under normal circumstances it is not magnetic. But when the matchstick is struck and burnt, it produces pure iron, which is magnetic.
- So when the matchstick is burnt, it undergoes a chemical reaction, turning the red head (iron oxide and carbon) into iron and carbon dioxide gas.
- The iron produced is what causes the matchstick head to attract to the magnet.
- A simple equation for the reaction would be:

$Fe_2O_3+3CO \longrightarrow 2Fe+3CO_2$

Iron oxide + carbon  Iron + carbon dioxide

HYPOTHESIS AND RESEARCH QUESTIONS

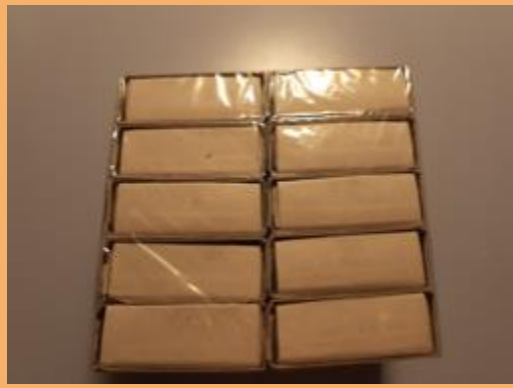
- The burned matchstick will be attracted quicker by two magnets.
- The more the burned matchsticks will exist, the bigger will the magnetism be.
- The horse- shoe magnet will attract the burned matchsticks quicker than the bar magnet.
- The horse-shoe magnet will attract more burned matchsticks than the bar magnet.
- The tabular magnet will not attract any burned matchsticks.

EXPERIMENTAL SETUP

Two horse-shoe magnets.

One tabular magnet.

1 bar magnet.



Ten packs of matchsticks

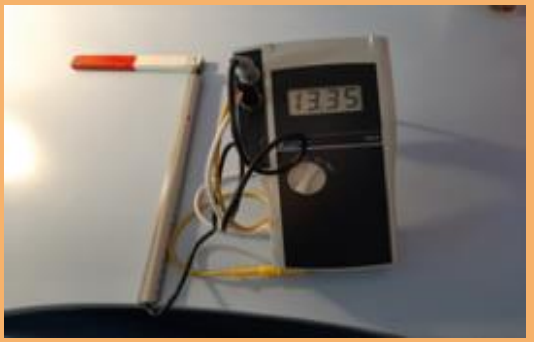
EXPLANATION OF THE EXPERIMENTAL PROCEDURE

- ➔ I used a magnetometer to measure the intensity of the magnetic fields of the magnets.
- ➔ The original indication of the magnetometer inside my room was 0,00 mT.
- ➔ I measured the intensity of the magnetic fields of each magnet separately but I also did the same thing with every possible magnet combinations.
- ➔ All the measurements were taken in distance <0,5cm.
- ➔ I burnt some matches and I placed them in front of the poles of each magnet or a combination of magnets.
- ➔ The biggest number of matches that I used was five.
- ➔ They were attracted by the most of the magnets.


0.00


3.52


13.51


13.35

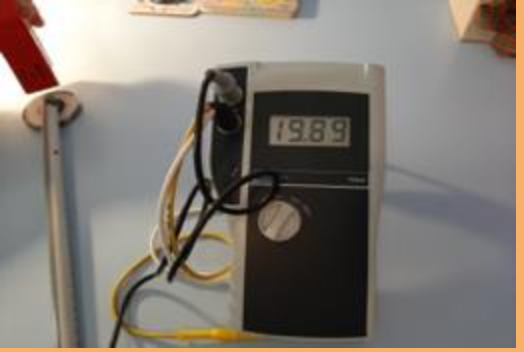

0.16


19.61


2.49


5.15


5.14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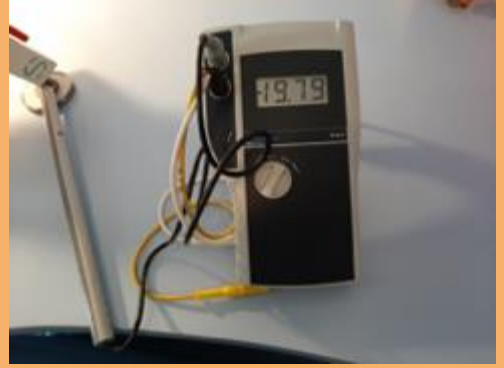
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PARAMETERS

Variables

- Kind of magnets
- Power of the magnets
- Quantity of the burned matchsticks.

Constants

- Temperature of the room(23℃)
- Kind of matchsticks

RESULTS

Horses hoe magnet	Bar Magnet	Tabular magnet	Horses hoe with bar magnet	South pole of horses hoe with tabular magnet	North pole of horses hoe with tabular magnet	South people of bar magnet with tabular magnet	North pole of bar magnet with tabular magnet	2 Horses hoe magnets
3 burnt matchsticks were needed.	-	-	2 burnt matchsticks were needed	4 burnt matchsticks were needed.	4 burnt matchsticks were needed.	5 burnt matchsticks were needed	5 burnt matchsticks were needed	1 burnt matchstick was needed.

CONCLUSION 1

CONCLUSIONS

CONCLUSION 1

The 2 horse-shoe magnets combined have the strongest magnetic field.

CONCLUSION 2

The tabular magnet couldn’t attract any burnt matchsticks.

CONCLUSION 3

The magnets or the combination of magnets that have strong magnetic fields can attract even one burnt matchstick.

REFERENCES

- Wikipedia
- Why do matches stick to a magnet after being burnt, but not before ...https-//www.reddit.com › comments › why_d...
- Magnetic Match Sticks | Mad About Sciencehttps-//www.madaboutscience.com.au › post
- What is behind of the attraction between a burned matchstick with ...https-//chemistry.stackexchange.com › what-i...

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THANK YOU FOR YOUR ATTENTION