Investigating electromagnets essay sample

In my following coursework, I will carry out an investigation on a variable, which affects the strength of an electromagnet. I tend to also create an accurate enough analysis, which will help me determine why the variable investigated, affected the strength of the electromagnet.

Background research:

An electromagnet is also known as a solenoid. An electromagnet usually consists of coils of wire wrapped around a magnetic core. The core could be Iron, nickel or cobalt, which are good electromagnets. Usually an electromagnet would consist of an iron core as this is the best at magnetising and proves readily available, because of these reasons I think the core, which I will use for the investigation would have to be an iron based core. Other cores that could be used prove ineffective as they become permanently magnetised so therefore are unuseful as they can only be used once.

Above we can see the magnetic field generated by a round wire carrying electricity (picture taken from encarta). This shows the way in which an electromagnet works.

If a solenoid is wound in the form of a helix, there will be a magnetic field. However, with the introduction of an iron core to go within the helix the strength of the field will be greatly increased. Microscopic domains in the core align themselves in the direction of the field thus increasing the strength of the field. When all the domains have aligned the core would have reached its saturation point.

Iron cores tend to have domains which are more jumbled up so when they are objected to a magnetic field or solenoid their domains become lined up but when the outside influence is removed the domains become jumbled up again.

Variables that affect the strength of an electromagnet:

Sources: physics matters (GCSE textbook), A-level textbooks, Microsoft Encarta 1999 and set knowledge

Current:

As the current is increased in a wire, the strength of the magnetic field becomes greater and therefore more effective. An A. C current would demagnetise the core while a D. C. current would magnetise a core. This is because the D. C. current is direct and therefore all the electrons are arranged in the same order creating a magnetic field. When the current is A. C, the electrons are free to move where they want so there is no magnetic field. When an electromagnet has a current induced in it, it becomes magnetised and the greater the current induced the greater the strength.

This is because the microscopic domains within the nail receive a greater current and so the strength and actions of these domains are increased. In addition, if the solenoid receives greater current then the field it generates will be stronger. . On the power pack, which I will be, using there is an option to change the voltage, which could be altered to change current with the aid of an ammeter.

Number of coil’s around a core:

A greater number of coils in the wire/solenoid around the core will increase the strength of the field produced by that electromagnet. This is because the amount of power given to the solenoid and core is increased so the core receives an increase in power, so the domains become aligned strongly, and more domains become aligned. In addition, with an increase in coils the coils cover a greater surface area of the core. This means the coil covers more domains and therefore more domains are influenced. Each turn has it’s own field so more turns mean more fields. The greater amount of turns causes constructive interference, Which increases the size and strength of the magnetic field.

Type of wire:

The type of wire may also affect the strength of the electromagnet. If a wire is thicker then current can flow more easily and the current will increase so the strength of the electromagnet will increase. In addition, the length of wire may also affect the strength of the electromagnet because as the wire becomes longer there is a greater amount of resistance so current may decrease.

Preliminary work:

In my preliminary work, I carried out the method shown later in the investigation to help me decide what to investigate and what range to use. The problem with investigating current is that the power pack would reset at higher voltages above six for 10 coils. The problem with investigating the affect of different types of wire is that this variable would be too hard too measure. Investigating the affect of number of coils is feasible because the

power pack does not reset and this variable could be easily measured through counting.

What I will investigate:

The variable that I will investigate will be the number of coils for the above reasons found in preliminary work. The range, which I decided to choose, from looking at, the preliminary work was from 10 to 100 coils.

Prediction:

I predict that with a greater number of coils around the nail that the strength of the electromagnetic field will increase. This is because when there are a greater number of coils around the nail then more of the microscopic domains in the nail are influenced to follow the same direction of the magnetic field produced by the solenoid and give the core a increase in it’s magnetic strength. In addition, an increase in coils will increase the size of the solenoid. With a larger solenoid there is bound to be a greater magnetic field because of the greater current and size of the solenoid. In addition, if the size of the solenoid is greater then the solenoid will have greater power aligning more domains. Each turn has it’s own magnetic field so more turns mean more fields. The greater amount of turns and fields in the solenoid causes constructive interference, Which increases the size and strength of the magnetic fields.

Fair test:

To ensure a fair test I will carry out the following precautions.

* Make sure that every time the core that I use will be iron to stop residual magnetism, which may affect the results.

* Use wire of same type to keep the same amount of resistance.

* Maintain the same voltage on the power pack.

* Measure the current not necessarily to keep a fair test rather than to reach a justified conclusion considering the changes in current.

* Use the same number of coils every time.

* Use the same equipment each time.

Above we can see an iron nail which is the core that will hopefully have no residual magnetism, which could affect the results. The wire wrapped around the core is the solenoid and it will mainly determine the strength of this electromagnet.

Safety:

All electric components should be handled carefully at all times, regardless of whether they are live or not. The iron nail and the core should be handled with great care because as electricity passes through them they become hotter, so electricity should always be turned off when not in use and only touch the nail wills it is unlikely to be hot.