EXPLORING MAGNETIC FIELDS USING STEEL PINS

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Magnetism is a force exerted by magnets when they attract or repel each other and is caused by the motion of electric charges.
While, a *magnetic field is* the area surrounding a magnet where the force is acting on another magnet or magnetic material and was officially discovered by *Hans Christian Orsted.*

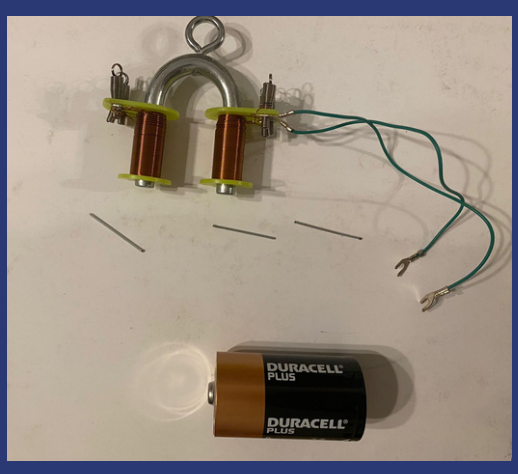
THE EXPERIMENT:

Exploring magnetic fields using steel pins can be done by suspending a steel pin above a magnet and observing how the pin is affected by the magnet's field.

The pin will be attracted to or repelled by the magnet, depending on the orientation of the magnet's poles and the direction of the steel pin. Or, you can place steel pins around the magnet in different orientations and observe how the field lines interact with the pins.

To perform this experiment, you will need :

a battery | a way to suspend the pin (if you want) | steel pins | a magnet



This photo illustrates what we are going to use to do this experiment:

STEPS:

1. Fit the coils onto the U-core and connect them to make a U-magnet using the full windings of each coil. (Figure 1)

2. Hold the U-magnet vertically by the eye hook, or ha g it from a stand with a cord.

3. Connect the battery, then place several steel pins on each of the core faces. Observe how the pins orient themselves as they hang from the magnet.

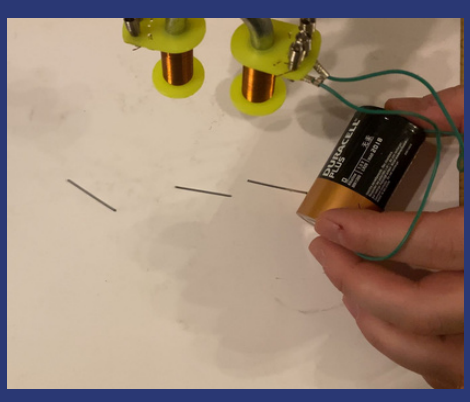


Figure 1:

What does this suggest for the shape of the magnetic field?

See how many steel pins you can hang underneath the magnet in a chain. (Figure 2, 3)

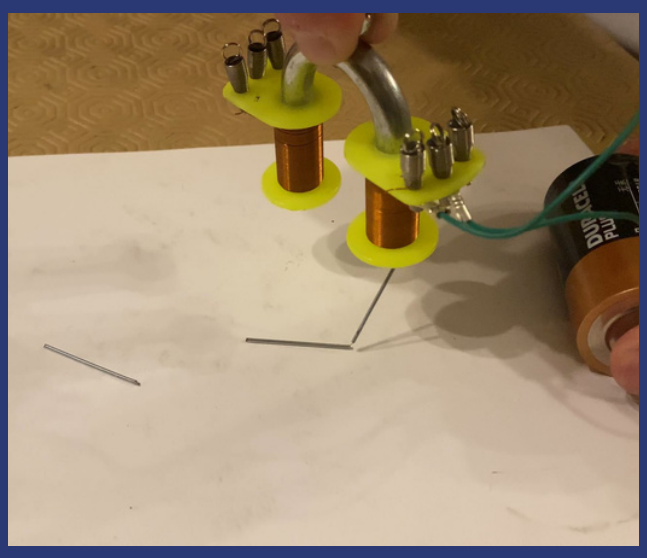


Figure 2:

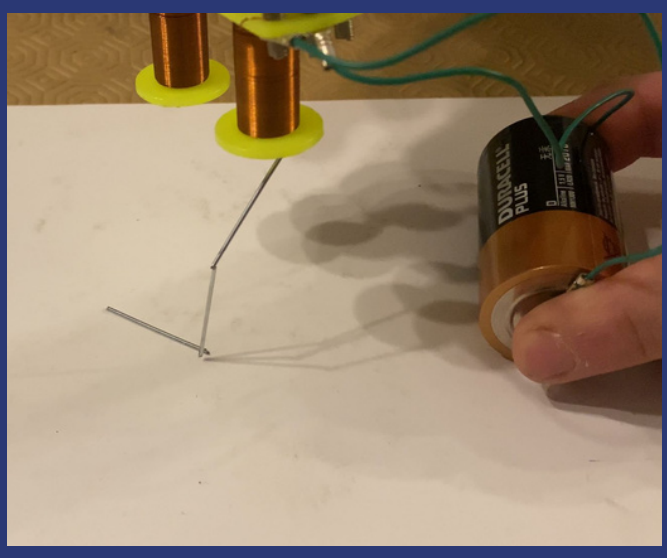


Figure 3:

4 Disconnect the battery as soon as you have made your observations.

5 The pins orient themselves along the magnetic field. (Figure 4)
They spread out, showing that the field of the U-magnet converges towards the core faces.

The number of pins that can be chained on the magnet face will depend on how fresh the battery is, but it may not change much between the various configurations, because when there are fewer windings engaged, the electrical resistance decreases and the current increases, compensating for the reduced number of windings.

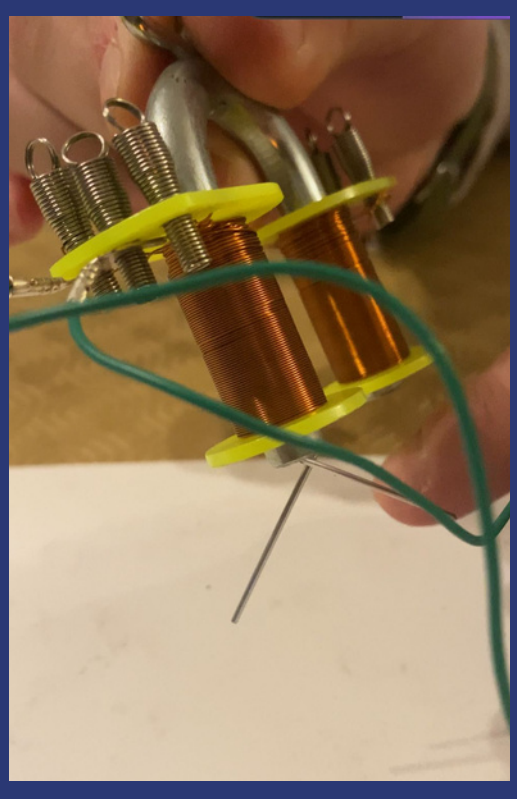
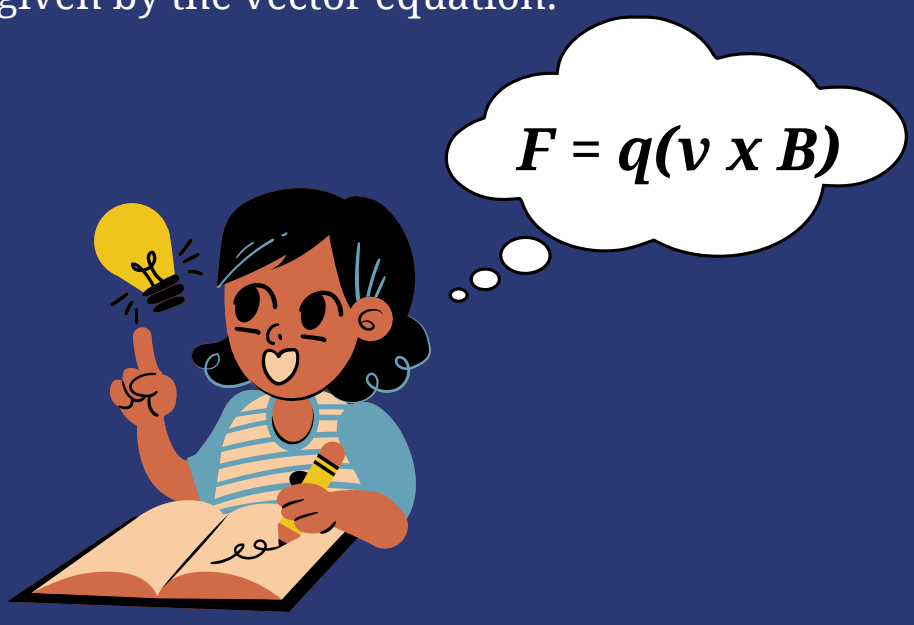


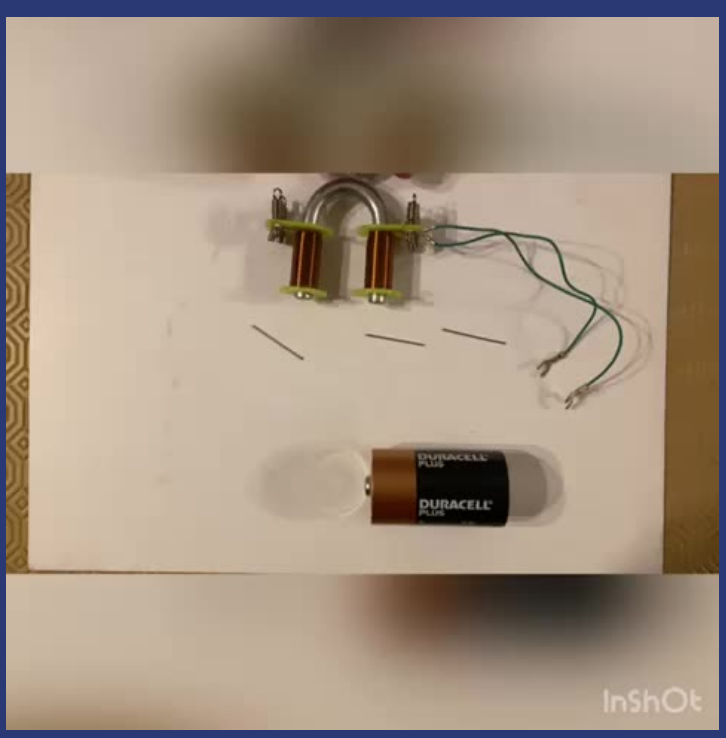
Figure 4:

DID YOU KNOW...?

The interaction of a magnetic field with a steel pin can be described mathematically by the *Lorentz force law*. This states that a moving charge (such as the electrons in the steel pin) will experience a force when placed in a magnetic field. The force experienced by a charge q moving with velocity v in a magnetic field B is given by the vector equation:



The direction of the force is given by the *right-hand rule*, which states that if you point your thumb in the direction of v and curl your fingers in the direction of B, your fingers will point in the direction of the force.



sources:
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