



Spoken Tutorial
IIT Bombay

SUMMER FELLOWSHIP REPORT 2022

Infographics

Submitted by

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Bombay

25th April - 27th June

Acknowledgement

I would like to thank and express my gratitude to **Prof. Kannan M. Moudgalya**, IIT Bombay, for making it possible for me to work on this project. I would like to appreciate the noble cause of FOSSEE, IIT BOMBAY, in promoting the use of freely available tools to improve the quality of education in our country and making it more accessible. I extend my sincere gratitude to **Ms. Sonal Khurana (Ex-Faculty, MAIT)**, for making me aware about this wonderful fellowship.

I would like to express my deep and sincere gratitude to my senior project advisor and mentor, Mr. Khushalsingh K. Rajput, Project lead (FOCAL) & Sr. Software Engineer (FOSSEE), IIT Bombay, for the enthusiasm and continuous support and guiding me throughout the project. His round the clock support and patience in sharing his immense knowledge without any limits or boundaries is admirable. His fatherly approach towards students combined with outstanding problem-solving and management skills are a euphoric treasure worth experiencing first hand. I also extend my thanks to my colleague from this fellowship, Ms. Syankita for her cooperation during the fellowship.

I extend my heartfelt thanks to my family who supported me and believed in me. Lastly, all my hosteller friends who helped me throughout the fellowship by reminding me of taking a break from time to time.

With Regards,

Prince

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Introduction

About Fellowship

I was selected as a 2D Graphic Designer in the Graphics and Animation category of the fellowship under FOCAL, and was placed under the mentorship of Mr. Khushalsingh K. Rajput.

FOCAL encourages the use of free and open source software for creating infographics. These infographics are then placed over the website under creative commons license thus, making the art available to everyone.

This series is created on class 12th Physics syllabus, with intentions to clarify important concepts through infographics that are otherwise difficult to understand and remember.

Duration of Fellowship

I chose the part time (6hrs per day) FOSSEE Summer Fellowship 2022 which spanned from 25th April 2022 to 27th June 2022.

Aim

To create Infographics on topics from class 12th Physics syllabus using software like Inkscape and Gimp.

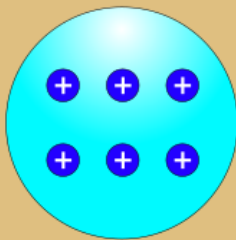
Software Used

- ◆ Inkscape - a professional quality vector graphics open source software
- ◆ Gimp - a professional quality graphics editing open source software

Artwork 1 – Basic Properties of Electric charges

Basic Properties of Electric Charges

QUANTISATION



Total Charge $q = +6e$

Total charge is an integral multiple of basic quantum of charge

$$q = ne$$

n is an integer
e is charge on one quantum

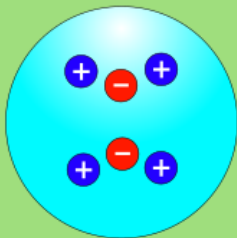


Negative Electric Charge



Positive Electric Charge

ADDITIVITY



Total Charge $q = (+4e) + (-2e) = +2e$

Total charge is the algebraic sum of all individual charges (with sign)

$$q = (p)e + (n)e$$

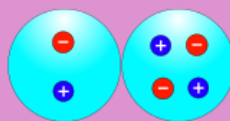
p is total no. of positive charges
n is total no. of negative charges

CONSERVATION

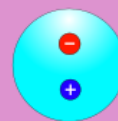
Total charge in isolated system remains unchanged with time



3 (+e) charges
3 (-e) charges



Transfer of charges



3 (+e) charges
3 (-e) charges

Pattern of Field Lines

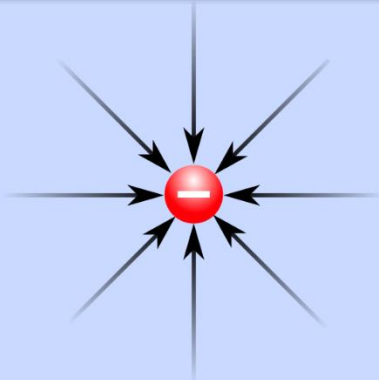


Negative Electric Charge

Positive Electric Charge

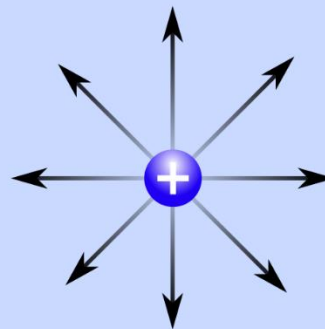


SINGLE NEGATIVE CHARGE



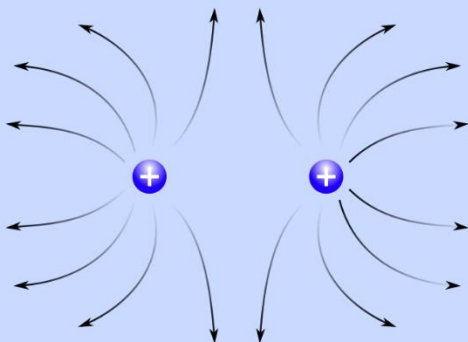
Converging on the negative charge

SINGLE POSITIVE CHARGE



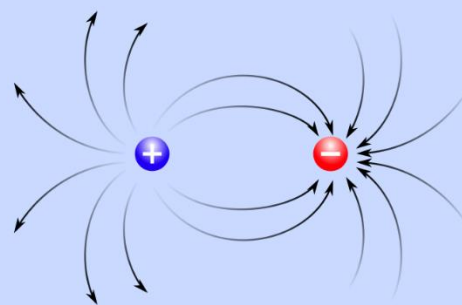
Diverging from the positive charge

DOUBLE POSITIVE CHARGE



Bulging away from each other

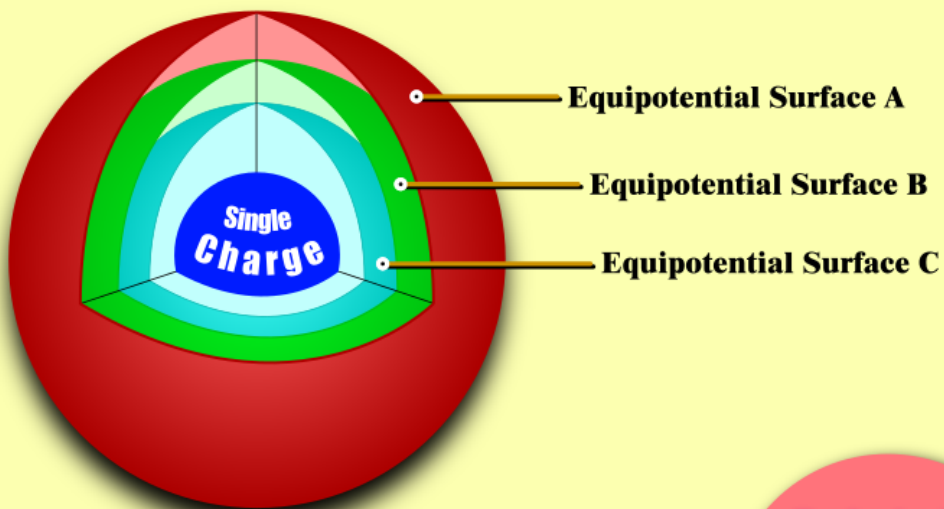
DIPOLE OF CHARGES



Converging on Negative charge

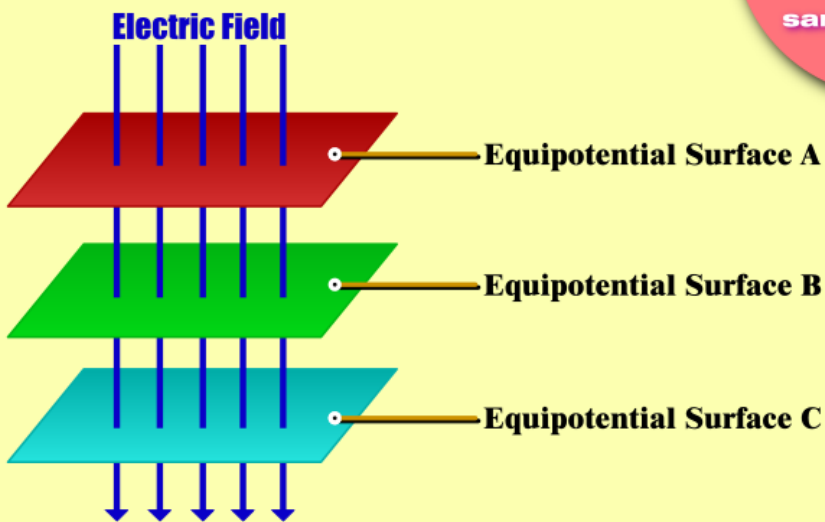
Artwork 3 – Equipotential Surfaces

Equipotential Surfaces



(i) For single charge - Concentric spheres

Equipotential surfaces are a collection of points that are at the same potential

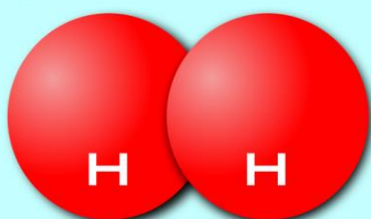


(ii) For uniform electric field - Normal to the electric field

Artwork 4 – Polarity of Molecules

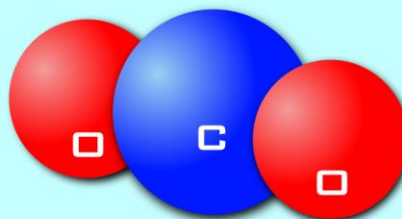
Polarity of Molecules

H₂



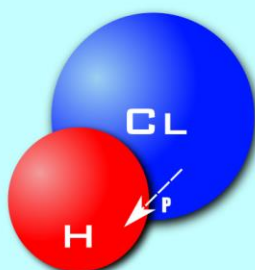
Since Hydrogen atoms share their electrons equally hence, H₂ is **Non-polar**

CO₂



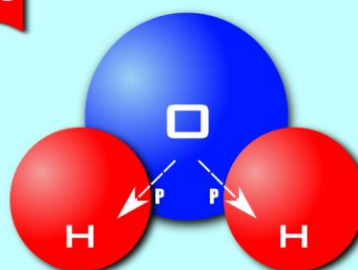
Since, CO₂ is symmetric, pull of both oxygen atoms cancel each other hence, CO₂ is **Non-polar**

HCl



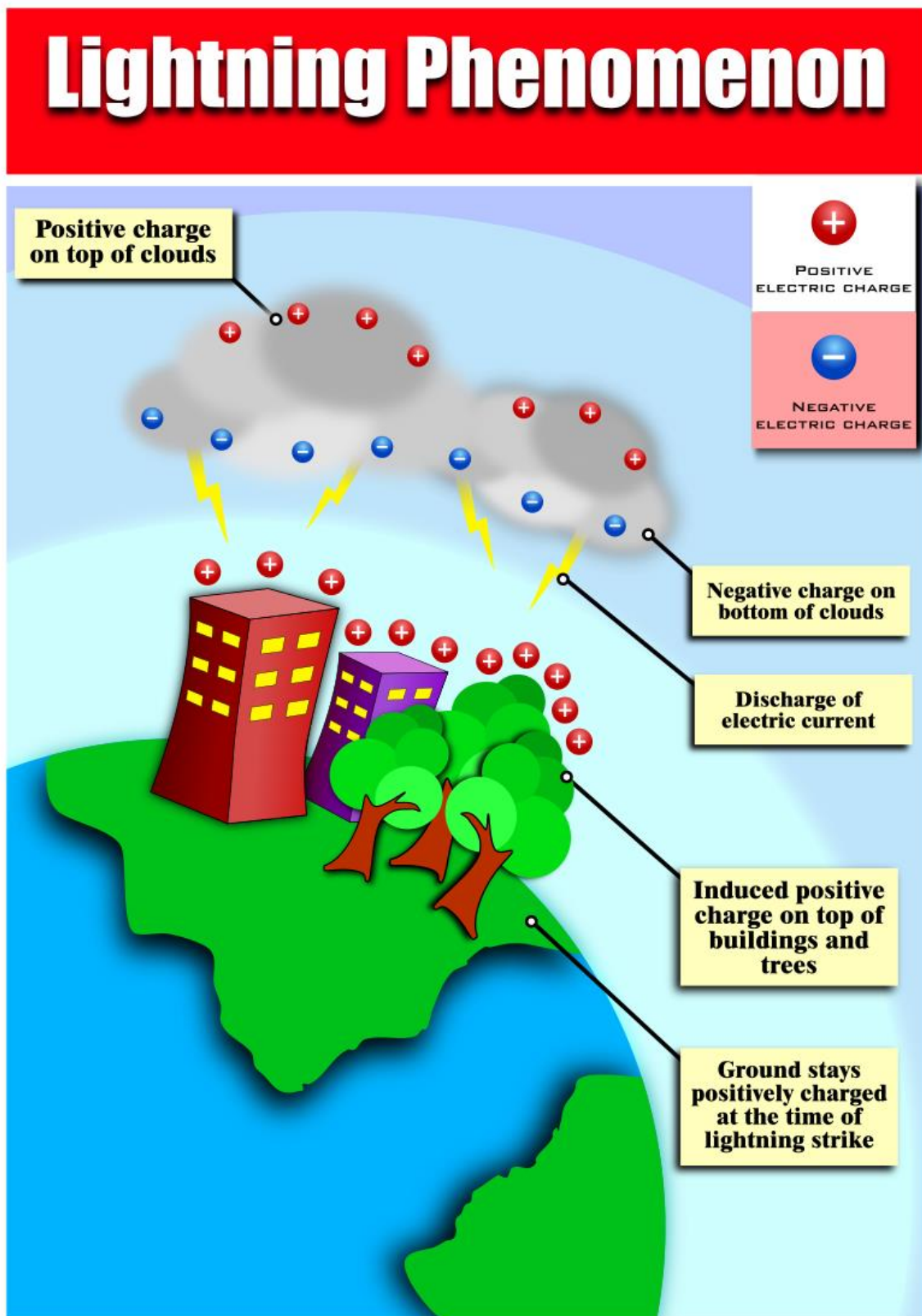
Due to insufficient attraction of Cl on H, their bond is shared unequally, hence HCl is **Polar**

H₂O



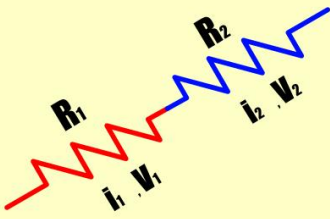
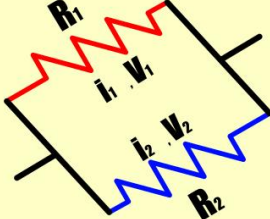
Due to unequal sharing of electrons and unsymmetrical shape, H₂O molecule is **Polar**

Artwork 5 – Lightning Phenomenon



Artwork 6 – Combination of Resistors

Combination of Resistors

Series	Parallel
	
<p>Current through the resistors in series combination remains same</p> <p>$i_1 = i_2$</p>	<p>Voltage through the resistors in parallel combination remains same</p> <p>$V_1 = V_2$</p>

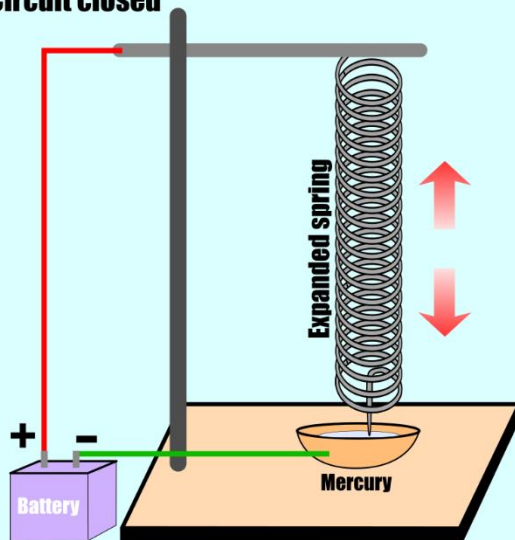
**i = Current
R = Resistor
v = Voltage**

Artwork 7 – Roget's Spiral Experiment

Roget's spiral experiment

To show attraction between parallel currents

Circuit closed



The circuit is set up as shown and is switched on.

A soft spring just touches mercury surface and completes the circuit.

Coils of spring act as parallel conductors as current is flown.

An attractive force pulling the coils closer is developed between coils.

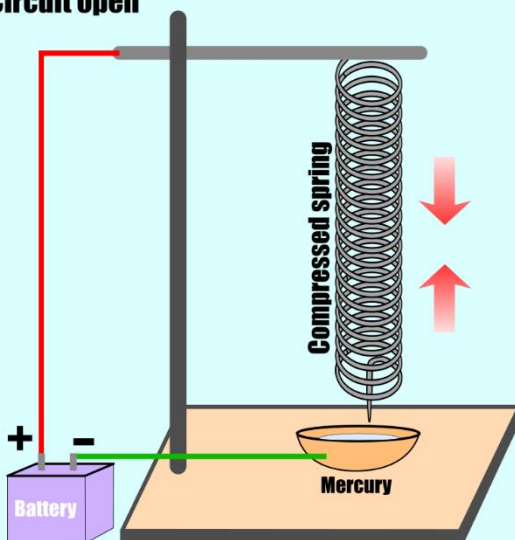
Due to this attractive force, spring shrinks.

Warning



Keep your face away from mercury vapours as they are poisonous

Circuit open



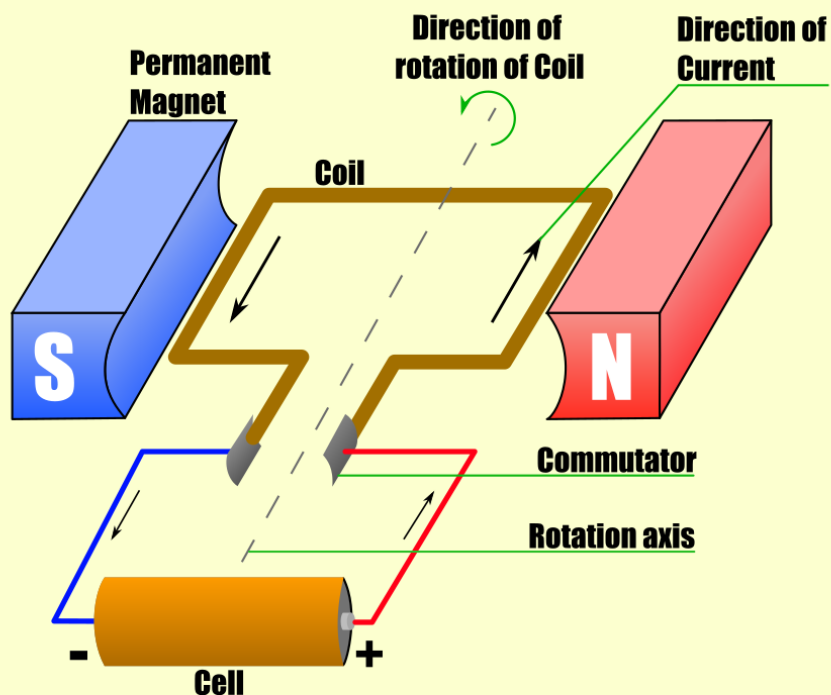
Shrinking of spring breaks the circuit.

With circuit open, no current passes through the coils of the spring.

When coils stop attracting each other, the spring comes back to its original shape.

This completes the circuit again, resulting in up-down movement of spring.

Inside a DC Motor

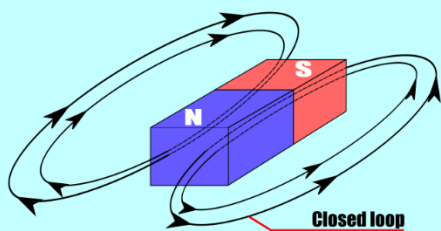


How does it spin?

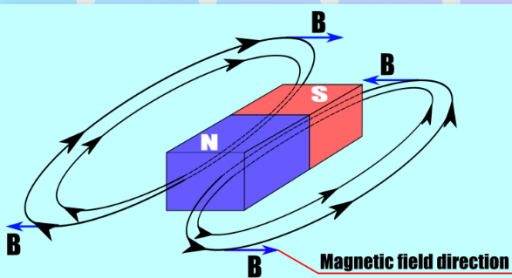
The current in coil points in opposite directions at opposite ends of the coil, with the magnetic field pointing at one direction. Thus, the magnetic force on the wire at opposite ends of the loop points in opposite directions, causing it to spin.

Artwork 9 – Properties of Magnetic Field Lines

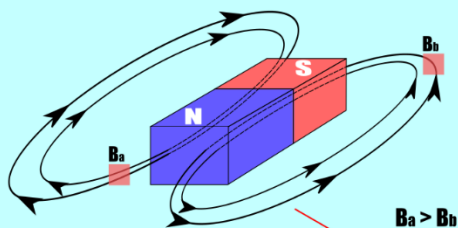
Properties of Magnetic Field Lines



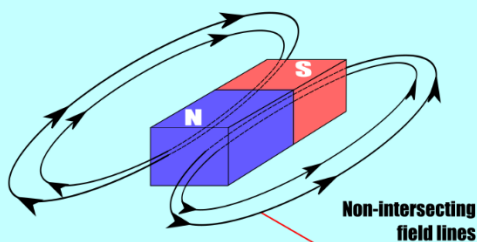
1 **Magnetic field lines of a magnet form continuous closed loop.**



2 **Tangent to the field line at a point shows direction of net magnetic field at that point.**

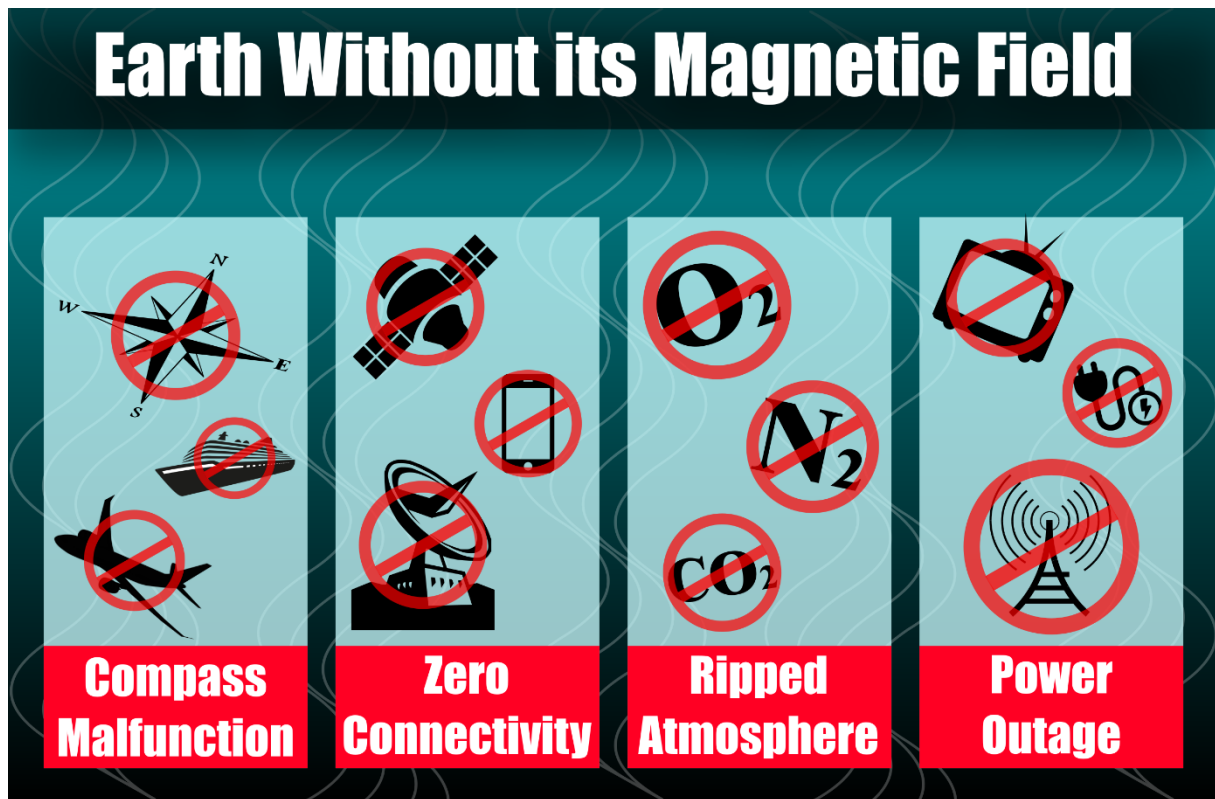


3 **Larger the number of field lines per unit area, stronger the magnetic field.**



4 **Magnetic field lines don't intersect, as there cannot be two resultant magnetic fields at a single point.**

Artwork 10 – Earth Without its Magnetic Field



Artwork 11 – Lenz's Law

LENZ'S LAW

The diagram illustrates Lenz's Law in two scenarios. In the first scenario, a bar magnet with a red North (N) pole and a blue South (S) pole is moving towards a coil from the right. An arrow labeled "GOING IN" points left towards the coil. The coil has a counter-clockwise current flow indicated by curved arrows. Below the coil, a circuit diagram shows current flowing clockwise, with a label "Direction of induced electric current". In the second scenario, the bar magnet is moving away from the coil to the right. An arrow labeled "COMING OUT" points right away from the coil. The coil has a clockwise current flow indicated by curved arrows. Below the coil, a circuit diagram shows current flowing counter-clockwise, with a label "Direction of induced electric current".

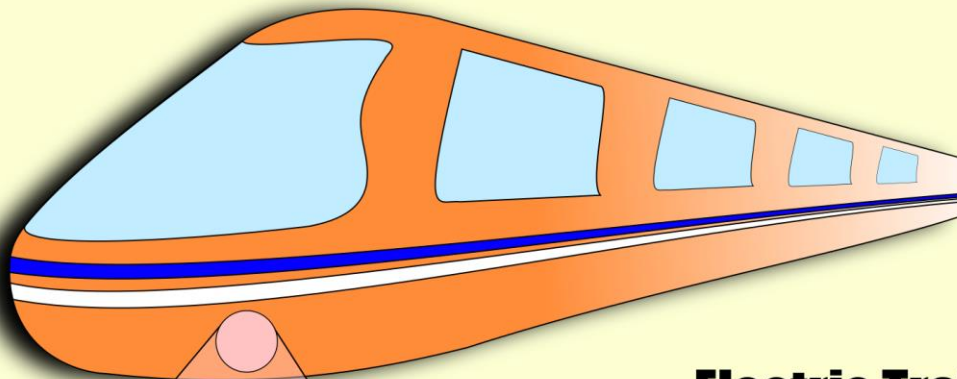
When the North Pole of the magnet is moved towards the coil, face of the coil facing the magnet acts like North Pole

When the North Pole of the magnet is moved away from the coil, face of the coil facing the magnet acts like South Pole

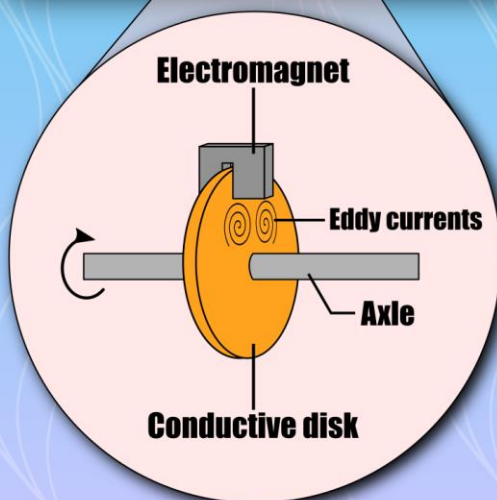
Magnetic braking in Trains

What are Eddy currents?

Eddy currents are created when a conductor passes through a magnetic field, which creates opposing forces that spin inside the conductor



Electric Train



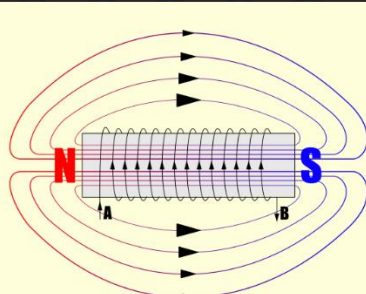
How it Works...

When the electromagnets are activated, the eddy currents induced in the rails oppose the motion of the train. As there are no mechanical linkages, the braking effect is smooth

Artwork 13 – Magnetisation and Demagnetisation of an Inductor

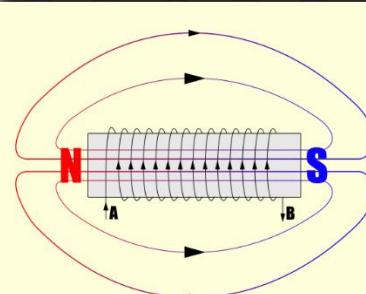
Magnetisation & Demagnetisation of an Inductor

0-1

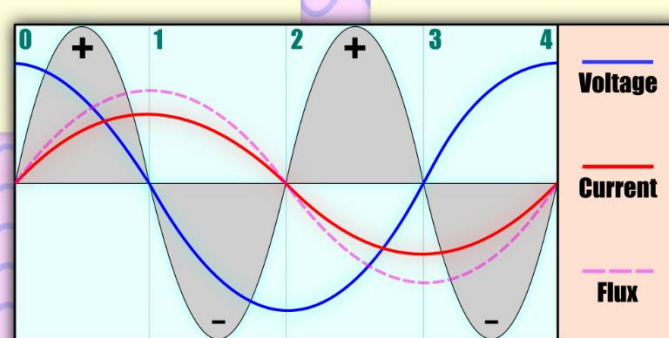


Energy is absorbed from the source and core is magnetised

1-2

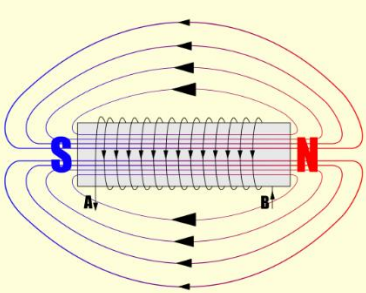


Energy is returned to the source and core is demagnetised



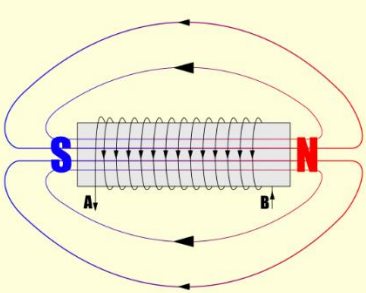
One complete cycle of Voltage / Current

2-3



Energy is absorbed from the source and polarity of magnet changes

3-4



Energy is returned to the source and core is demagnetised

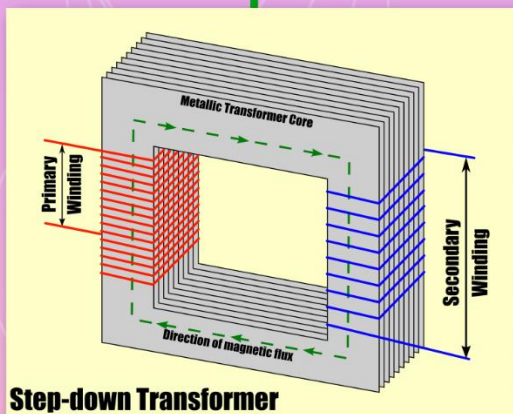
Energy losses in Transformers

Flux leakage

There is always some flux leakage, not all of the flux from primary passes through the secondary due to poor design of the core or the air gaps in the core

Winding Resistance

The wire used for the windings has some resistance hence energy is lost due to heat produced in wires. In high current, low voltage windings, it can be minimised by using thick wire



Hysteresis

The magnetisation of the core is repeatedly reversed by alternating magnetic field. The resulting expenditure of energy in the core appears in the form of heat, to prevent it we use magnetic material

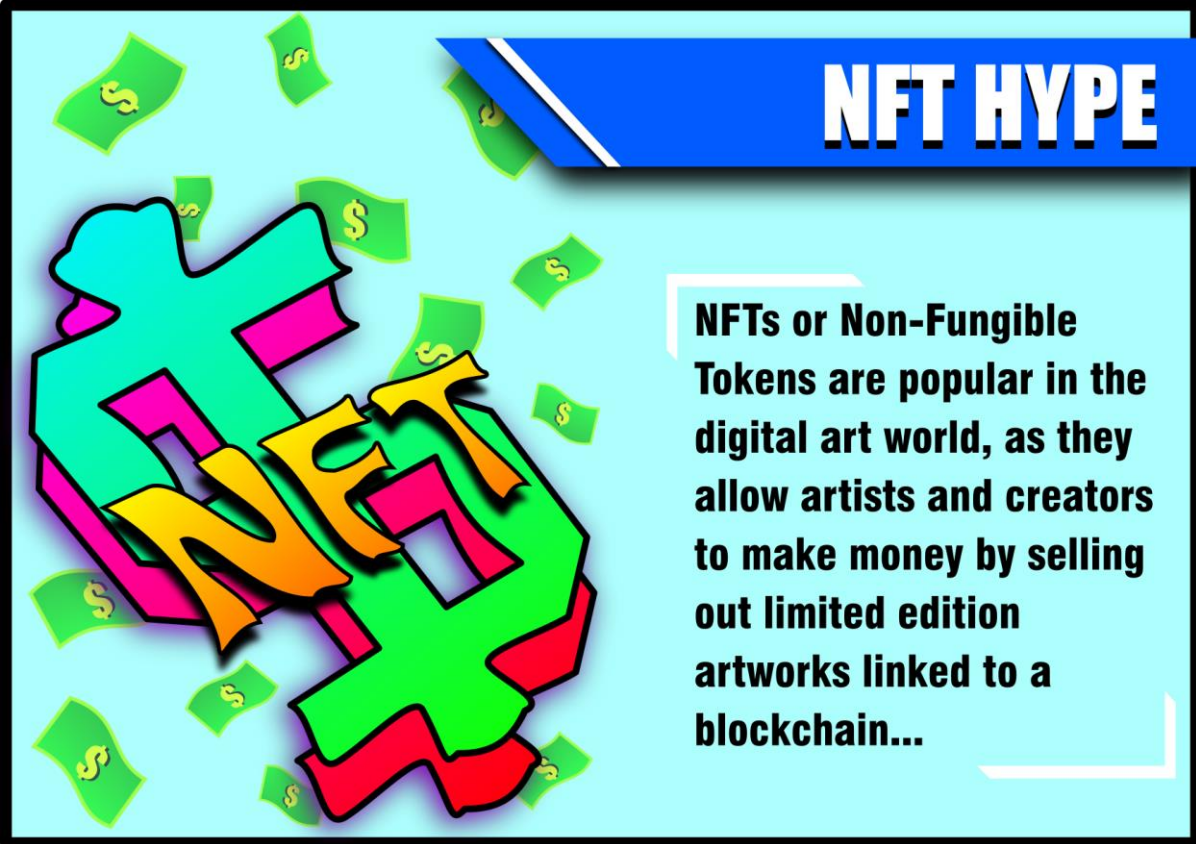
Eddy currents

The alternating magnetic flux induces eddy currents in the iron core and causes heating. Which can be reduced by using a laminated core

Artwork 15 – Advantages of Social Media

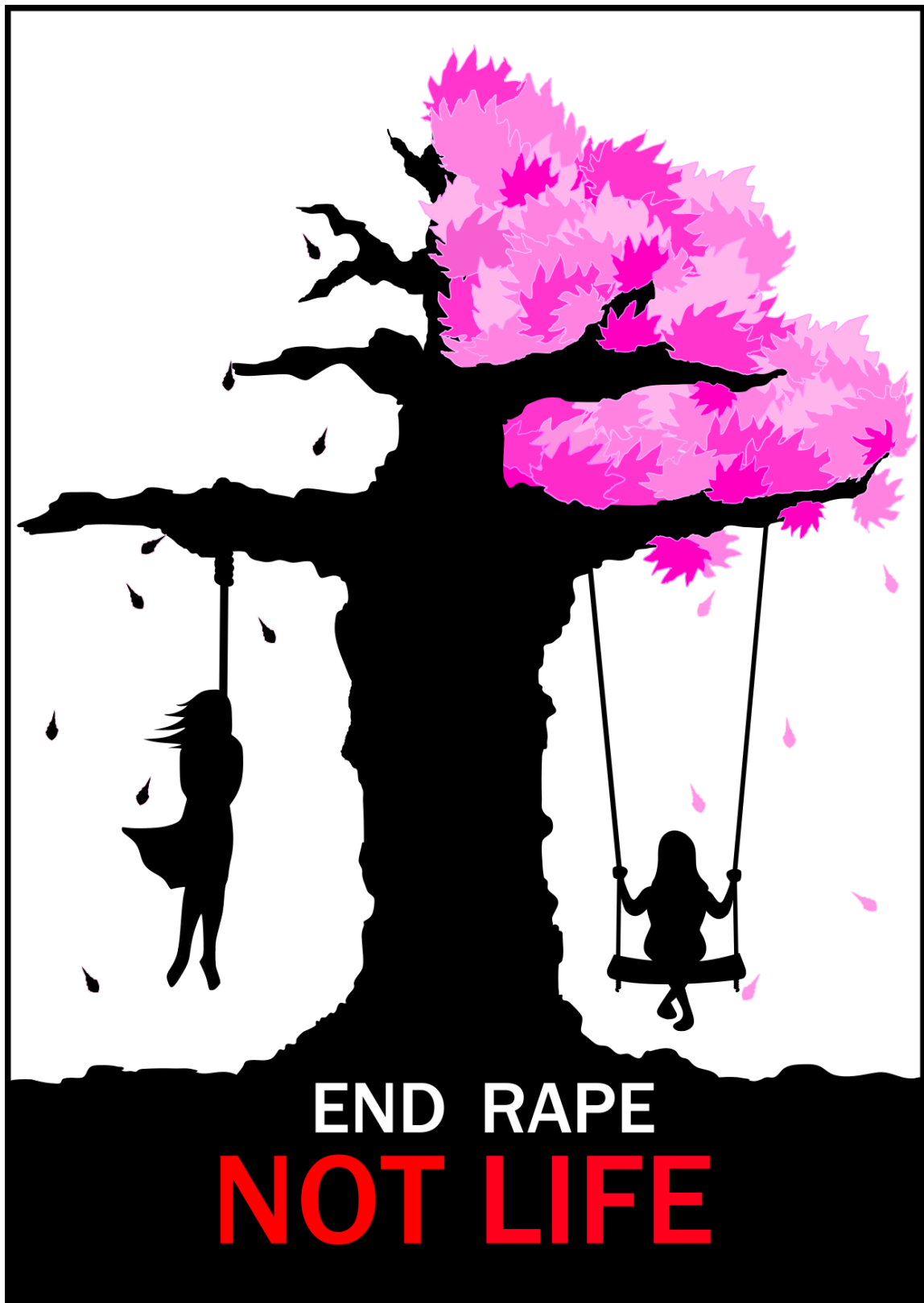


Artwork 16 – NFT Hype

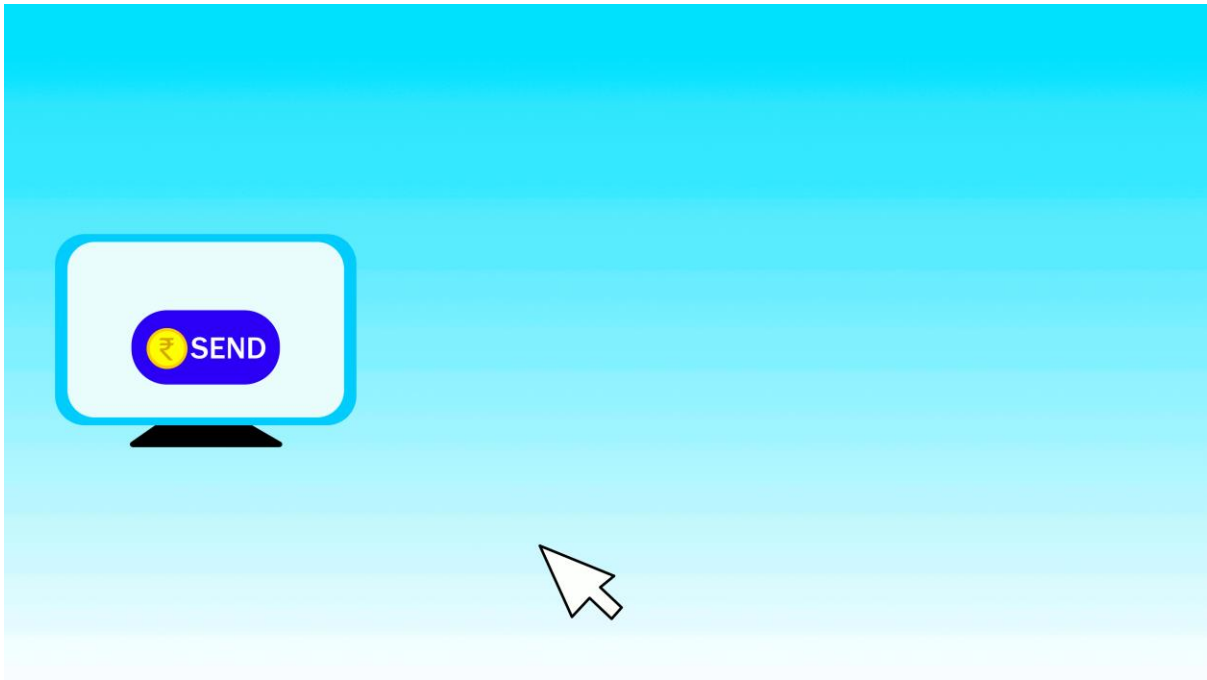
The graphic features the text 'NFT HYPE' in a large, stylized, multi-colored font (cyan, yellow, green, red) with a 3D effect. The letters are set against a light blue background with several green dollar bills falling around them. A dark blue banner at the top right contains the text 'NFT HYPE' in white, bold, sans-serif font. To the right of the main text, a white-bordered box contains a paragraph of text.

NFTs or Non-Fungible Tokens are popular in the digital art world, as they allow artists and creators to make money by selling out limited edition artworks linked to a blockchain...

Artwork 17 – A4 Poster



Artwork 18 – Secure payment GIF for websites



Artwork 19 – App Icons



Artwork 20 – Social Media Post (Advertisement)



What Lies Ahead.....

Future Plans and Follow up

This has been a big milestone in my life. Being a student, I plan to combine the skills gained from the FOSSEE project with knowledge to encourage more and more people to use the free alternatives. The skilled that I learned during my fellowship will be very useful in my engineering career ahead.

I see many possibilities with this. I am always glad to join hands and work for FOSSEE projects in future. I admire the FOSSEE team as well as their initiative to make knowledge accessible for all.

Thank You

Prince

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