

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

বিস্মিল্লাহির রাহমানির রাহীম



উদ্দান

একাডেমিক এন্ড এডমিশন কেয়ার

Class 10: Physics 1st Paper (Chapter-12)

Magnetic effect of current

Lecture-31

DC MOTOR

An electric motor is an electrical machine that converts electrical energy into mechanical energy. As example Fan

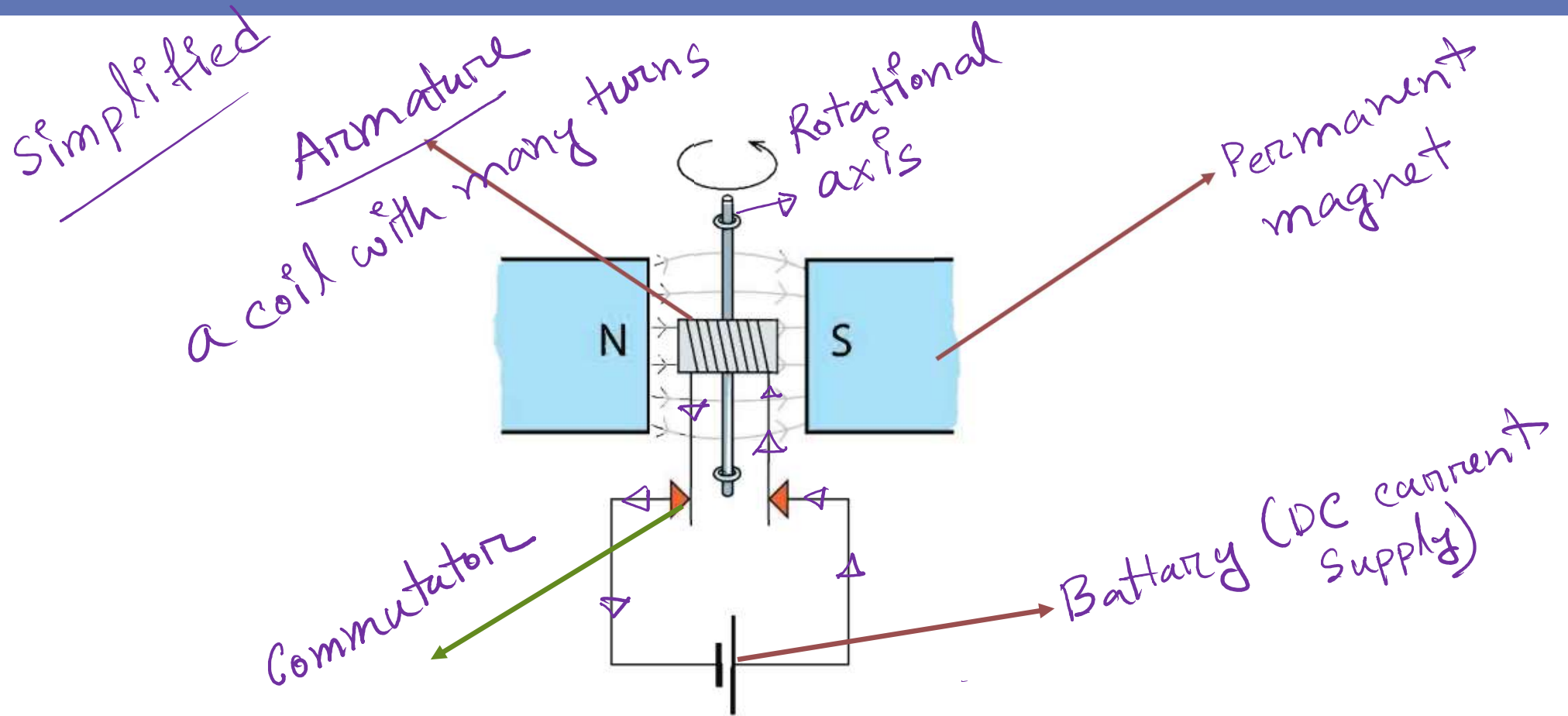
A DC motor is any of a class of rotary electrical motors that converts (direct current) electrical energy into mechanical energy.



unchanged
Magnitude
Direction

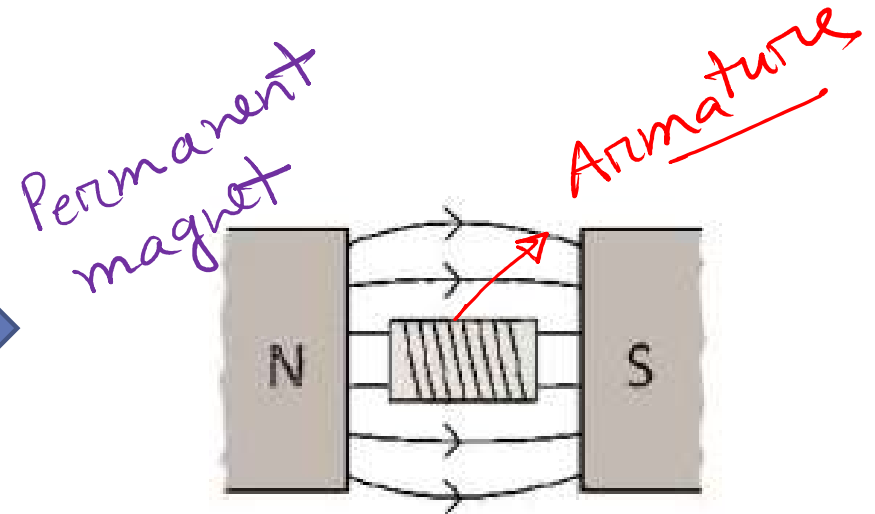
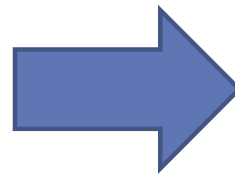
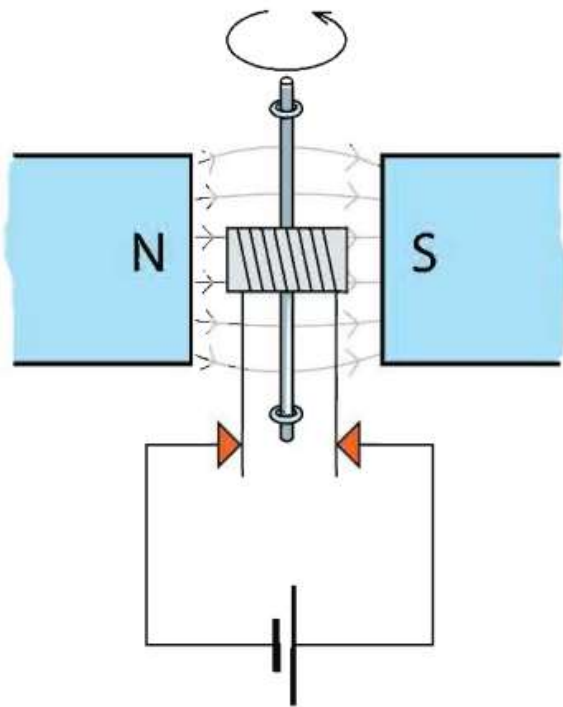
DC MOTOR

Different Parts of a DC motor



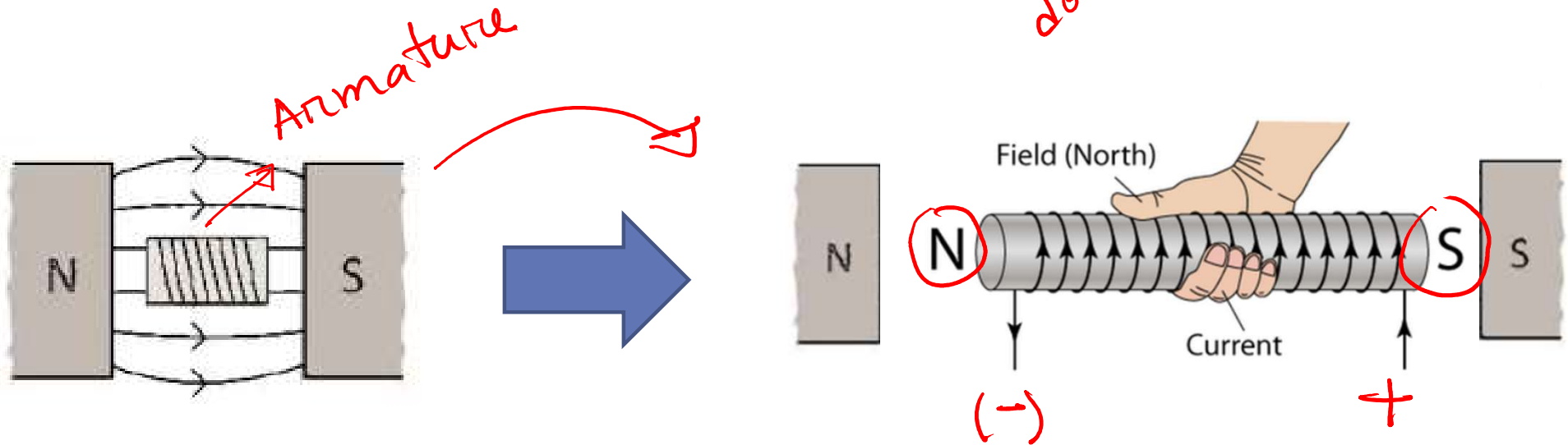
How does a dc motor works ?

To better understand this matter at this level lets simplify it !

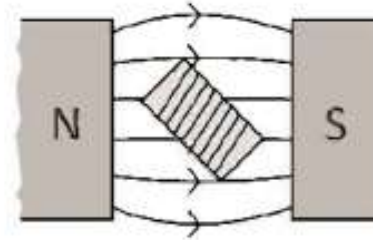
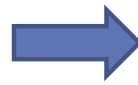
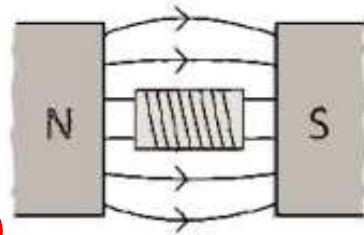


How does a dc motor works ?

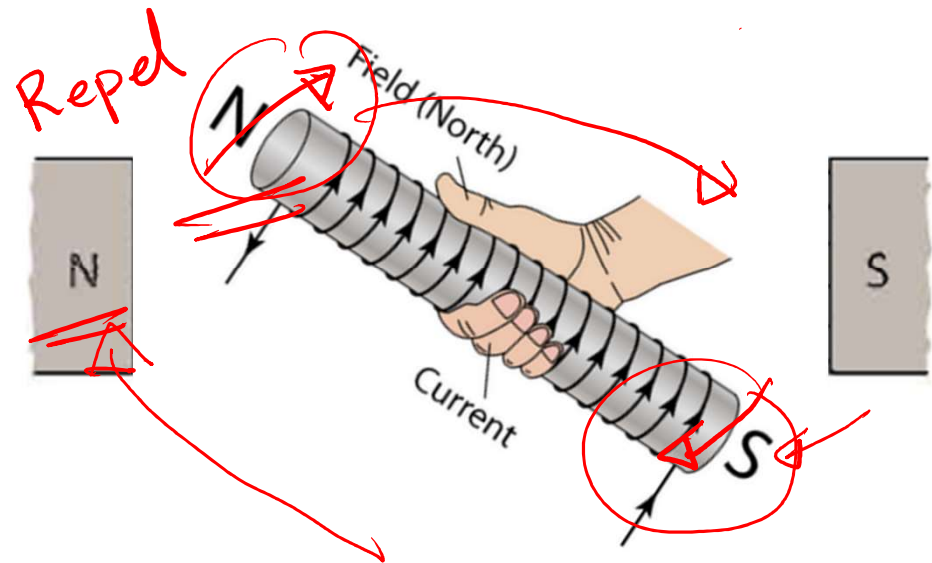
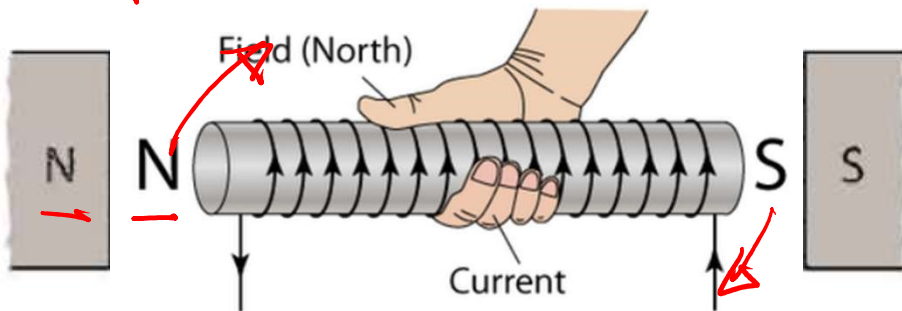
In last class we discussed about solenoid and electro-magnet !



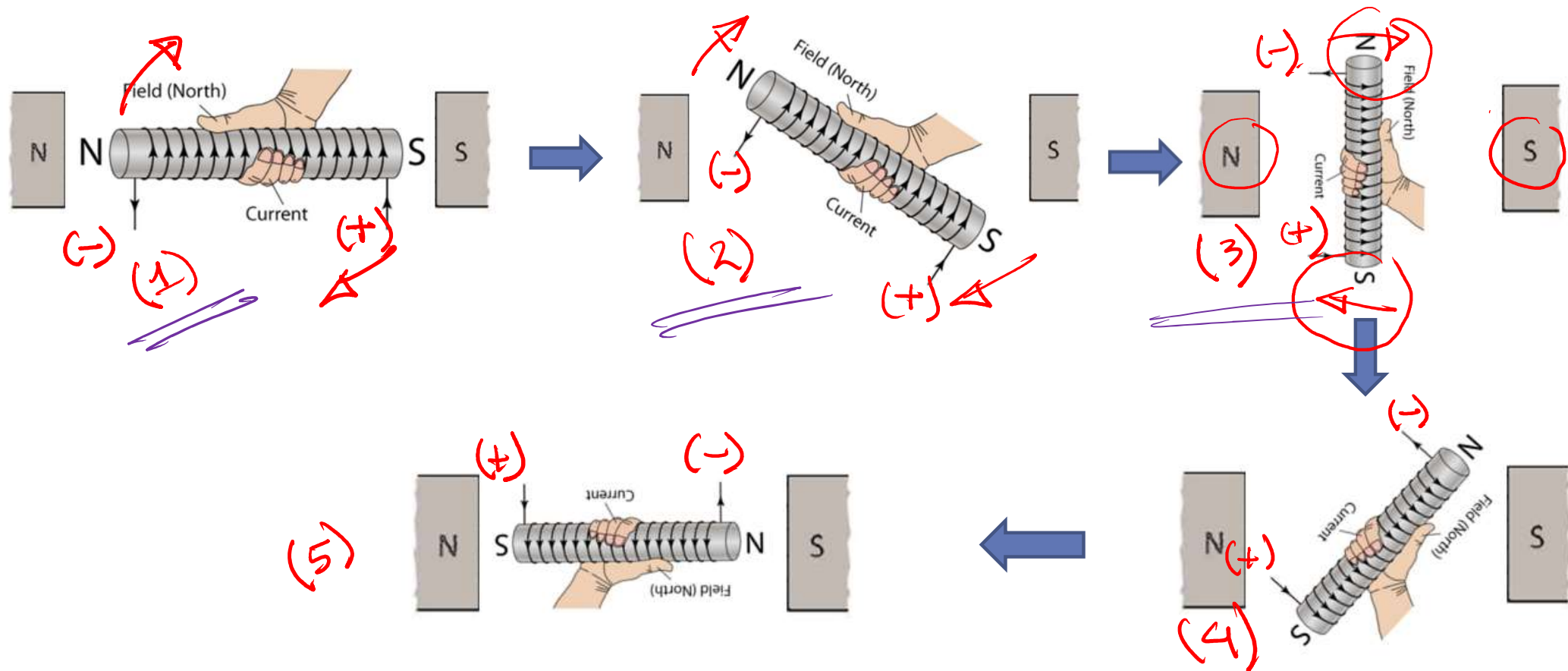
How does a dc motor works ?



like pole (repel)



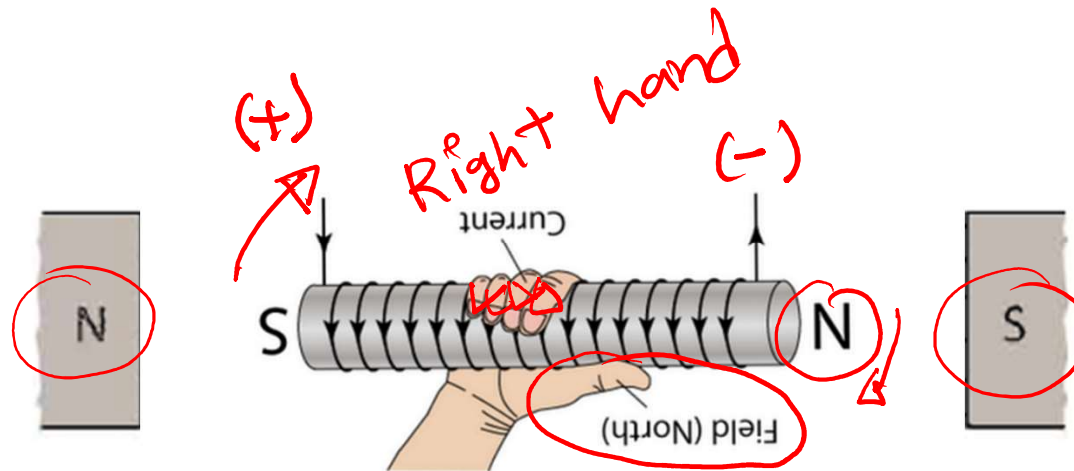
How does a dc motor works ?



How does a dc motor works ?

Now the problem is it won't rotate anymore! How can we fix it ?

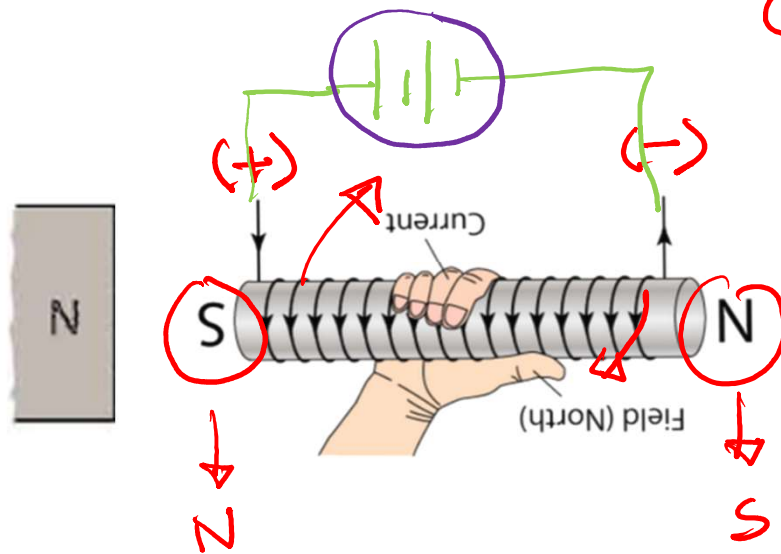
Last class



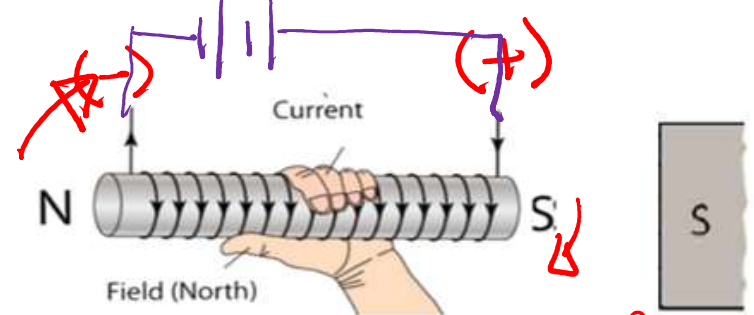
How does a dc motor works ?

The solution is simple ! We just have to change the direction of the current !

But how can we do that ?



Commutator — reverse the direction of the current



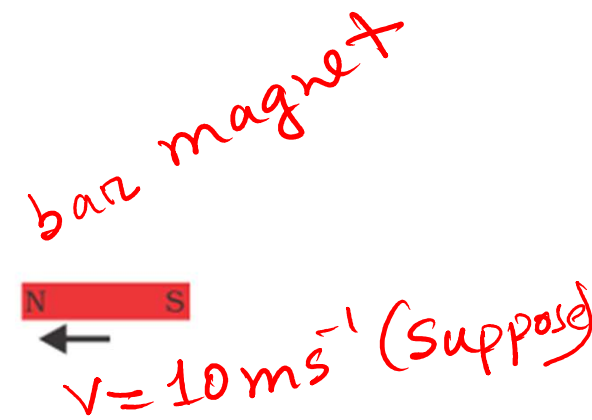
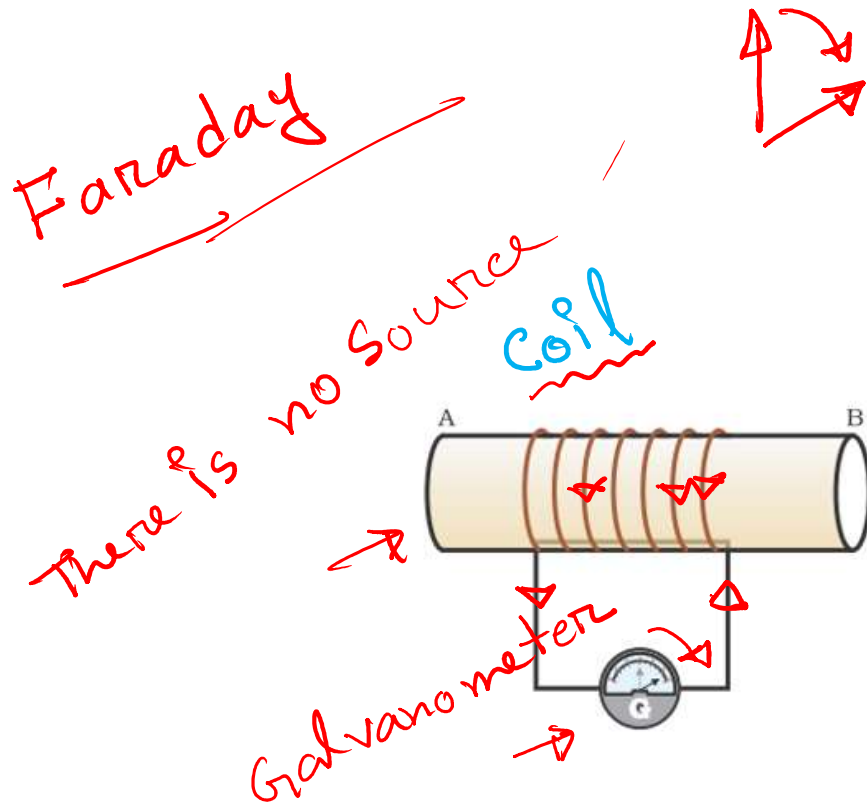
By reversing the direction of the current

Poll Question 01

Which part of a dc motor actually rotates ?

- ☒ (a) Armature
- (b) Permanent Magnet
- (c) Outside shell
- (d) None

Electromagnetic Induction



Electromagnetic Induction

Case (3)

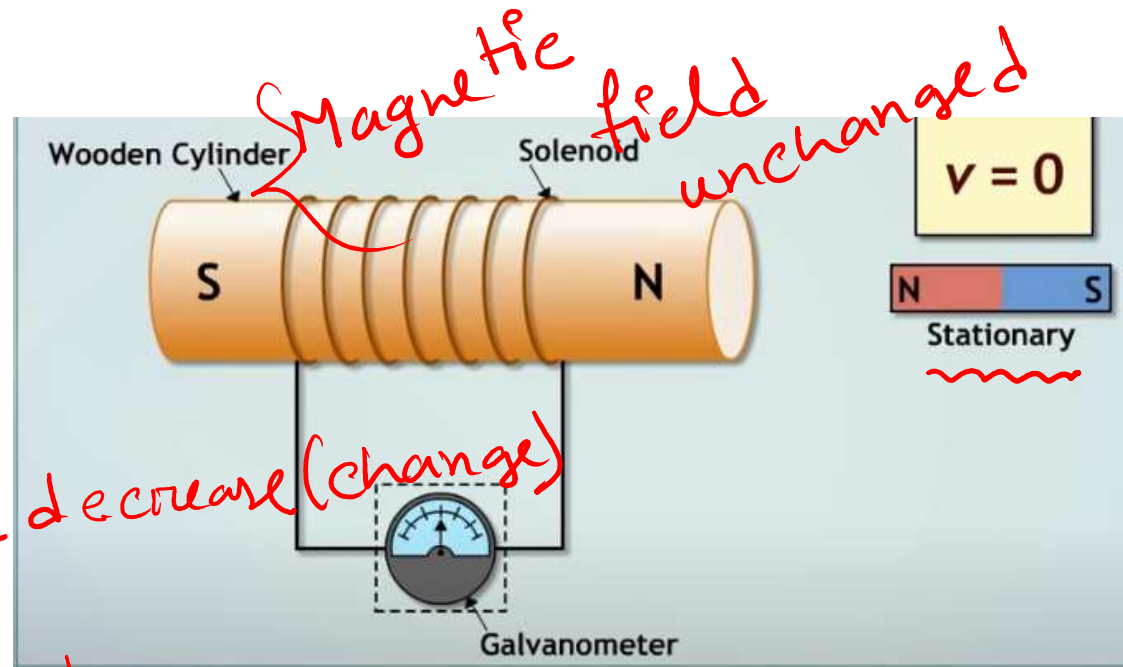
$I \times$

magnetic field
Increase or decrease

$I \checkmark$

unchanged

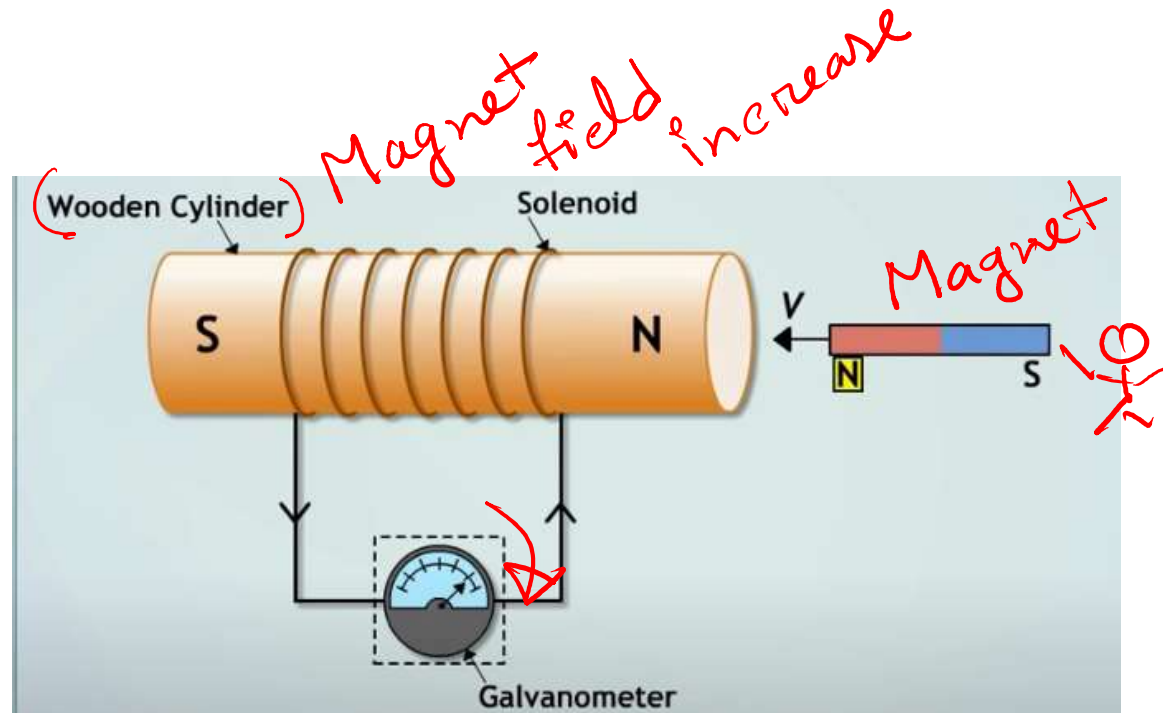
$I = 0$



Electromagnetic Induction

Case (1)

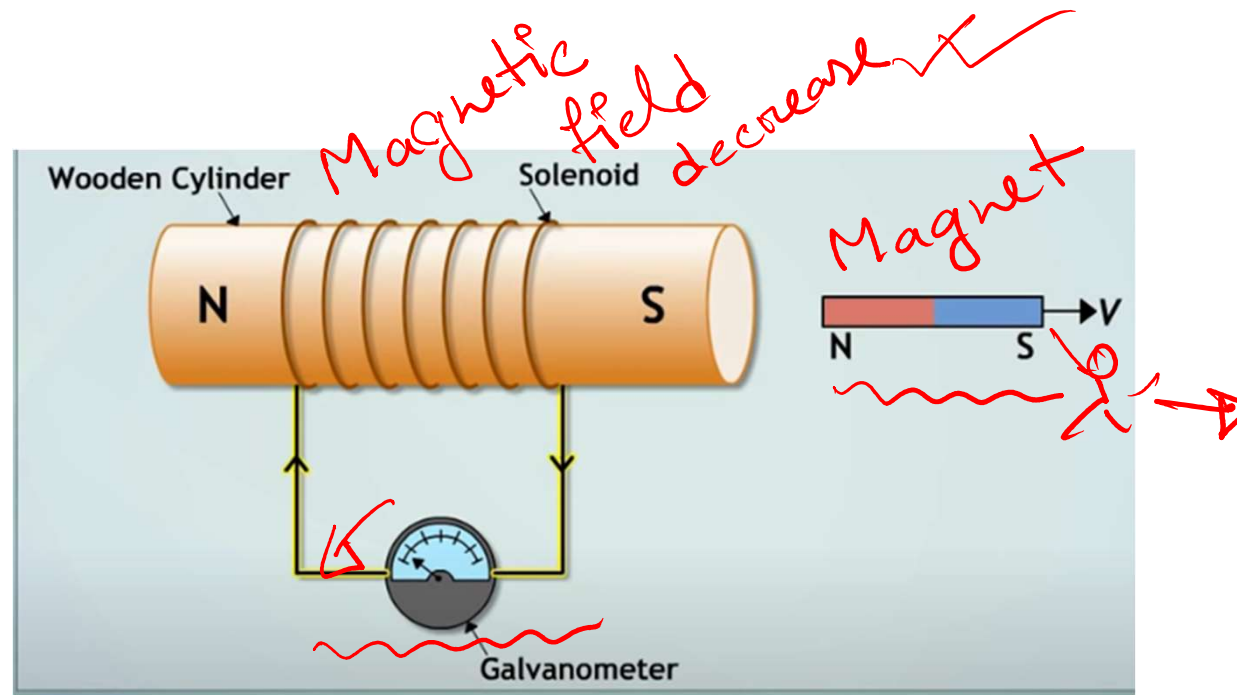
I ✓



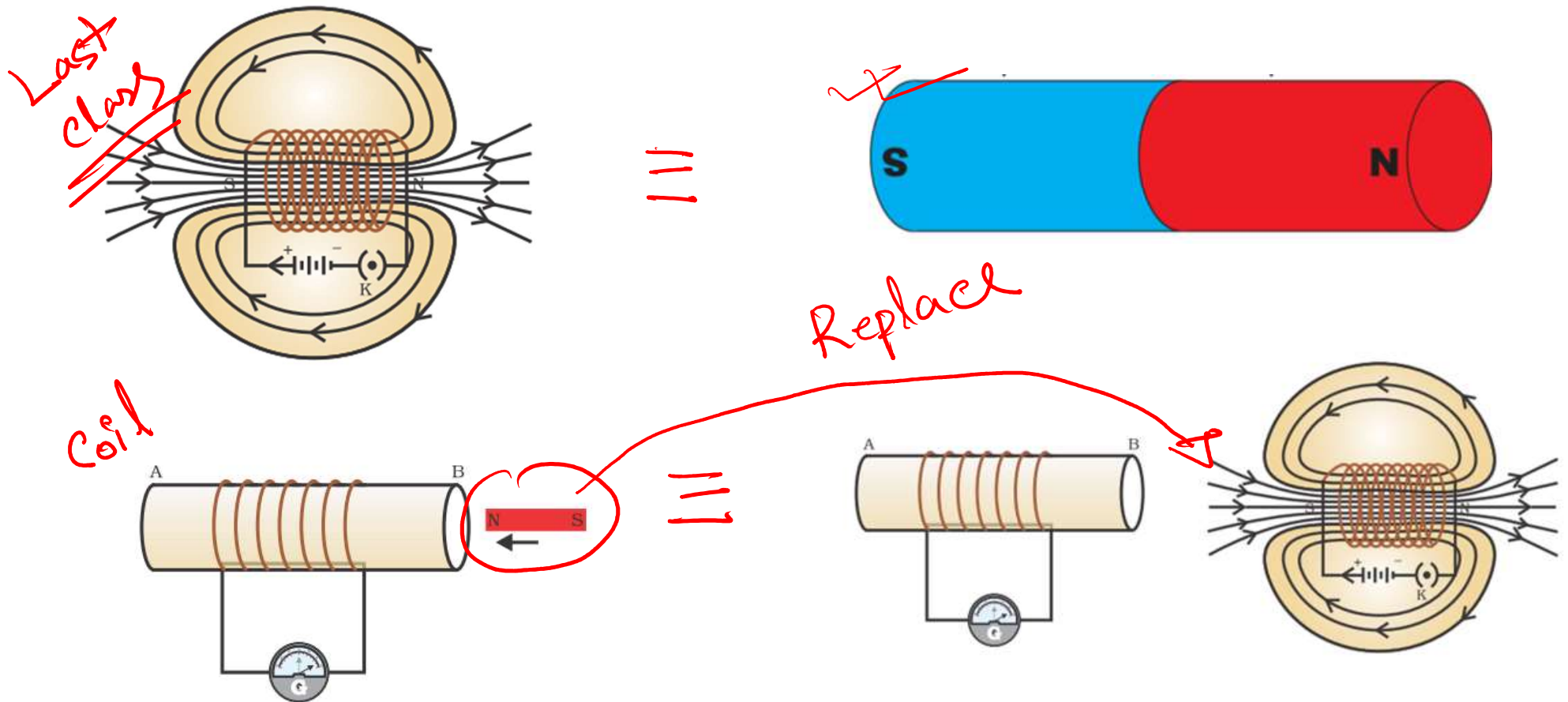
Electromagnetic Induction

Case (2)

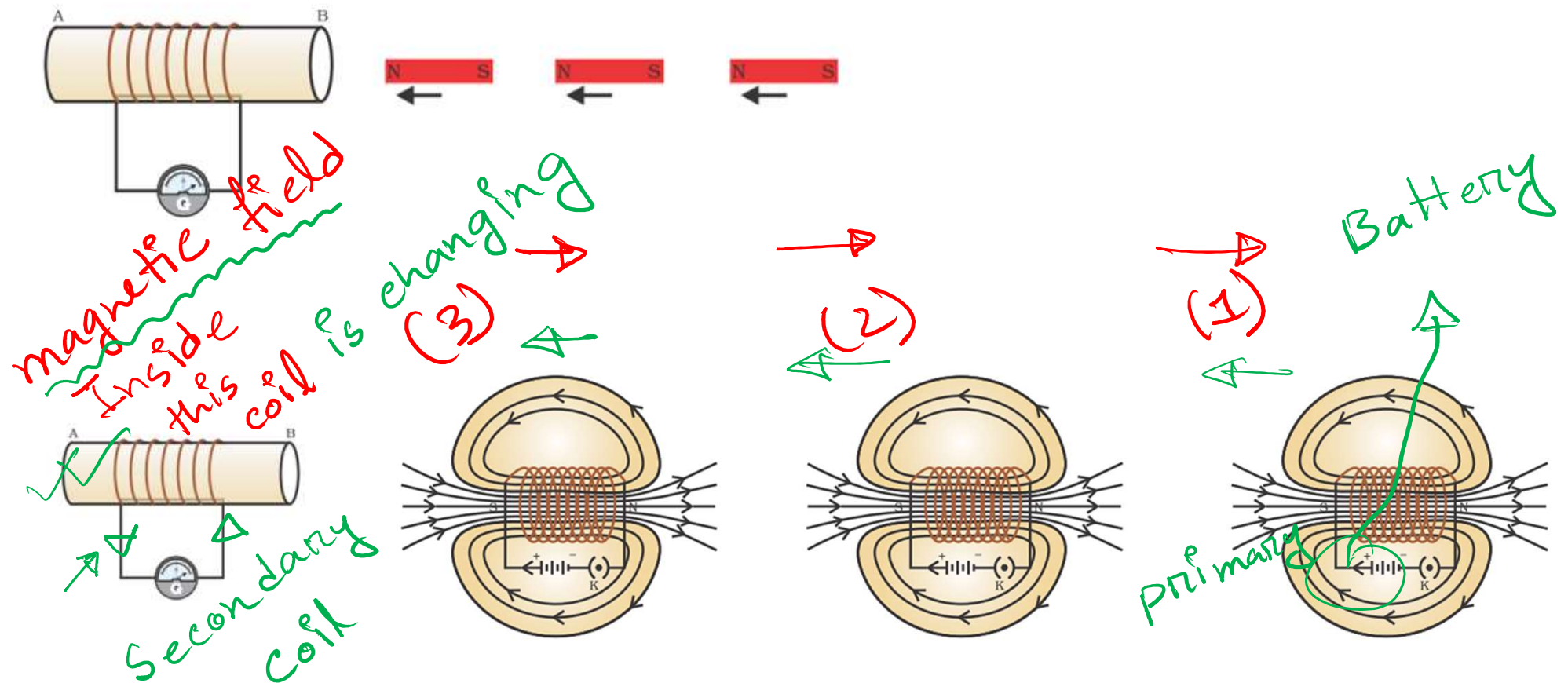
$I \checkmark$



Electromagnetic Induction

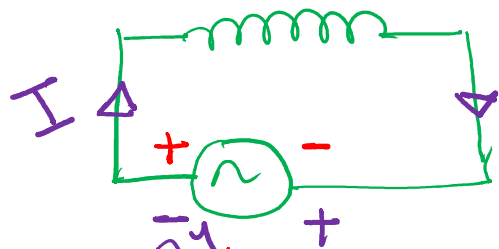


Electromagnetic Induction



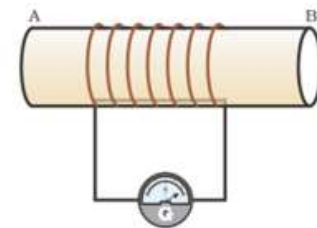
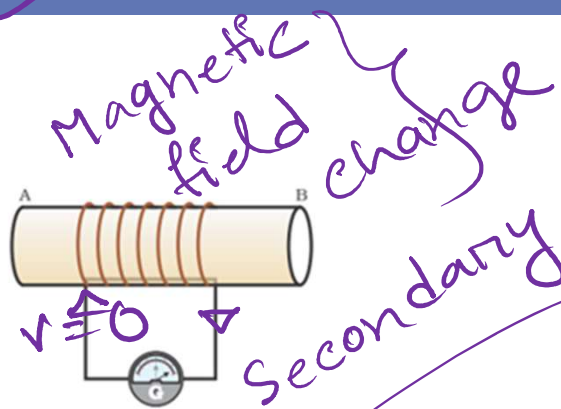
Electromagnetic Induction

$\mathcal{E} = 0$



primary AC

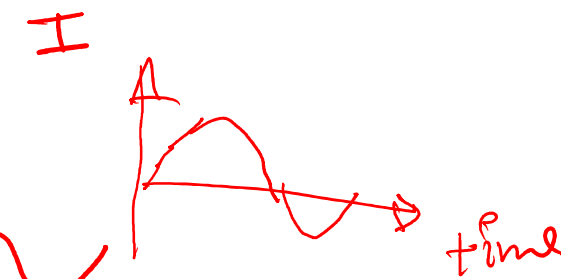
Faraday's law
(no proof)



$I \uparrow$ Magnetic field \uparrow
 $I \downarrow$ " \downarrow

AC (I value & direction)

$0A \rightarrow 1A \rightarrow 2A \rightarrow 3A \rightarrow 2A \rightarrow 1A \rightarrow 0A$
 $\rightarrow -1A \rightarrow -2A \rightarrow -3A$



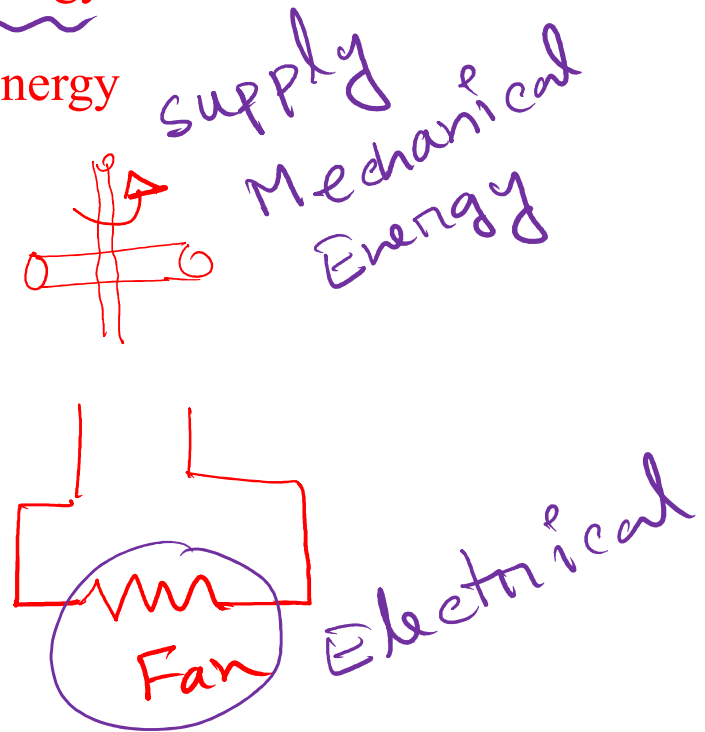
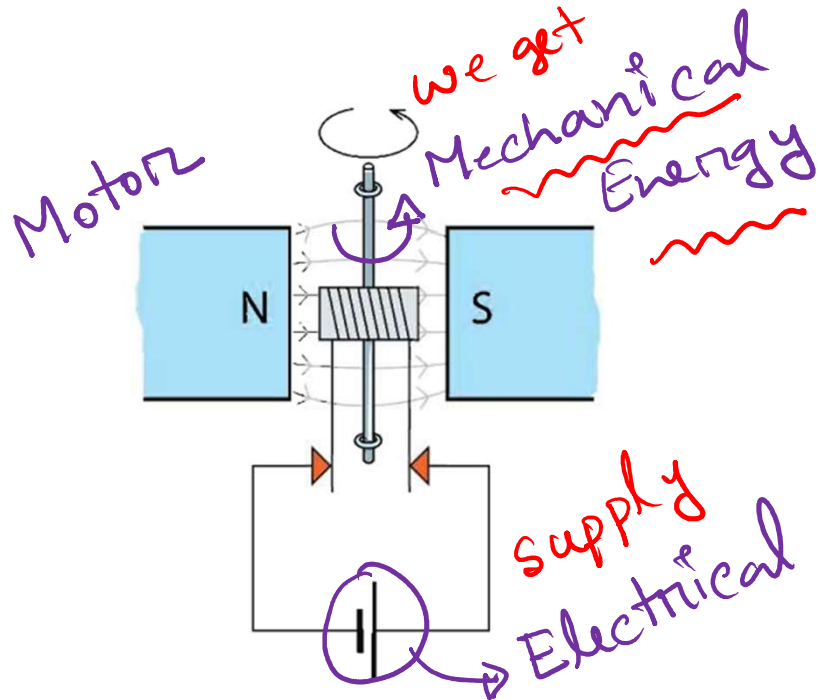
GENERATOR

A generator is a device that converts motive power (mechanical energy) into electrical power for use.

Converting a motor to generator

Generator: Mechanical Energy → Electrical Energy

Motor: Electrical Energy → Mechanical Energy



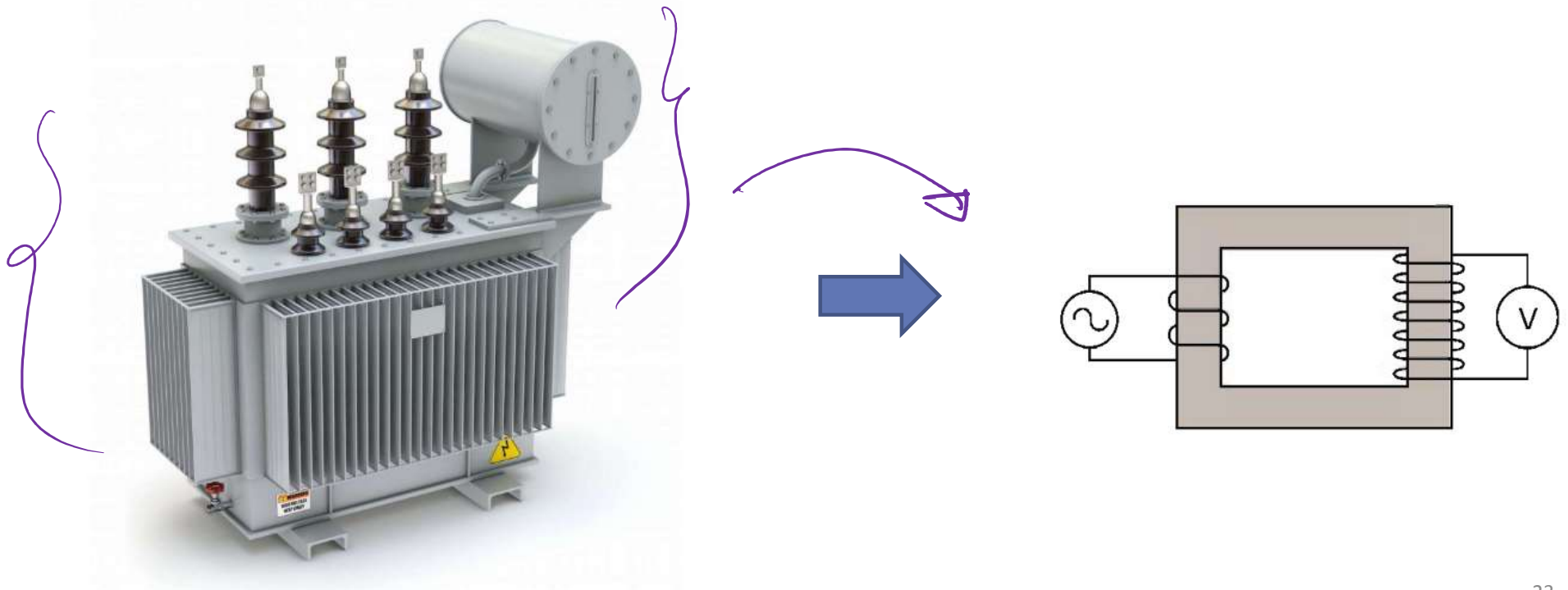
TRANSFORMER

A transformer is a device that is used to either raise or lower voltages and currents in an electrical circuit.



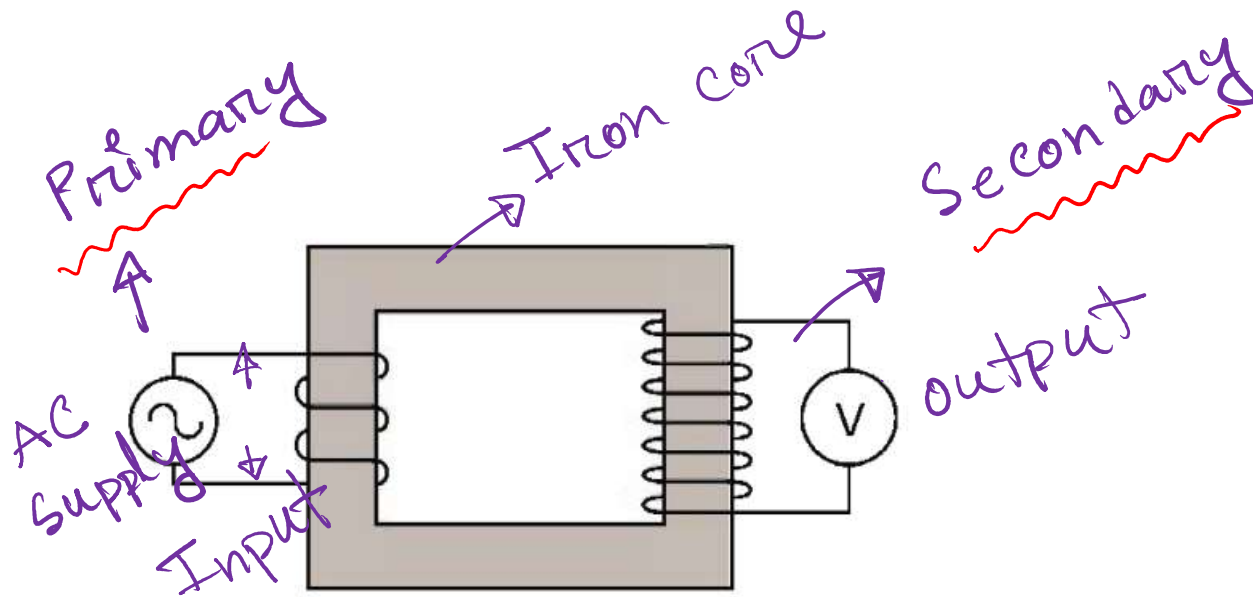
TRANSFORMER

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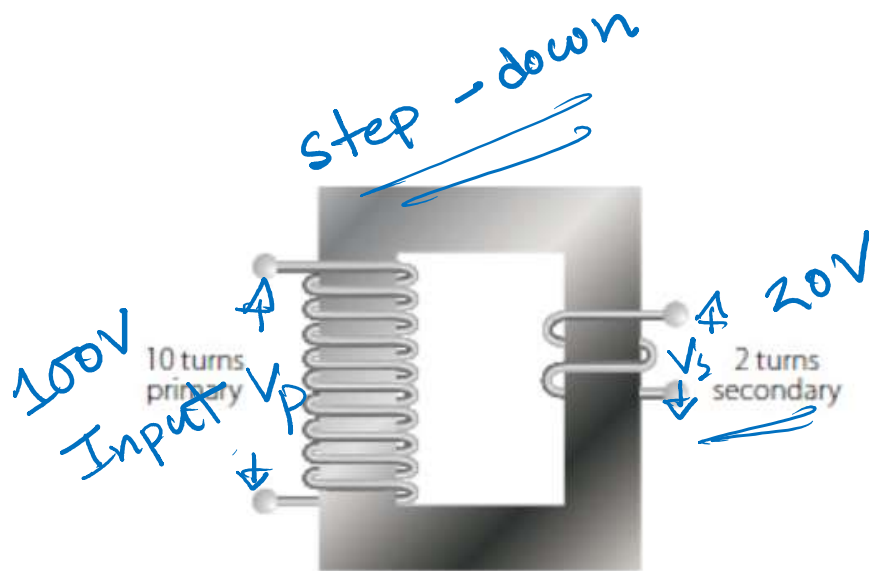
TRANSFORMER

A transformer basically consists of two electrical coils of wire, one called the “Primary Winding” and another called the “Secondary Winding”

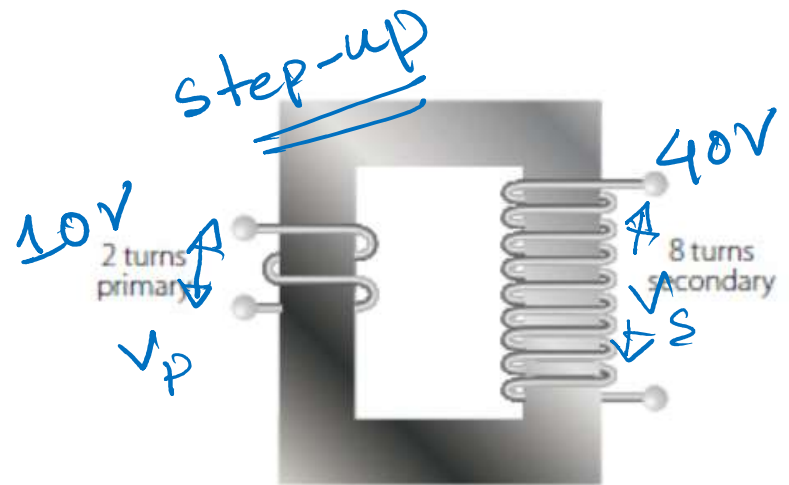


TRANSFORMER

When a transformer is used to “decrease” the voltage on its secondary winding with respect to the primary, it is called a Step-down transformer. When it is used to “increase” the voltage on the secondary winding with respect to the primary it is called a Step-up transformer.



(A)



(B)

How does it work?

$V \propto n$

1) $V_s = \frac{n_s}{n_p} \times V_p$

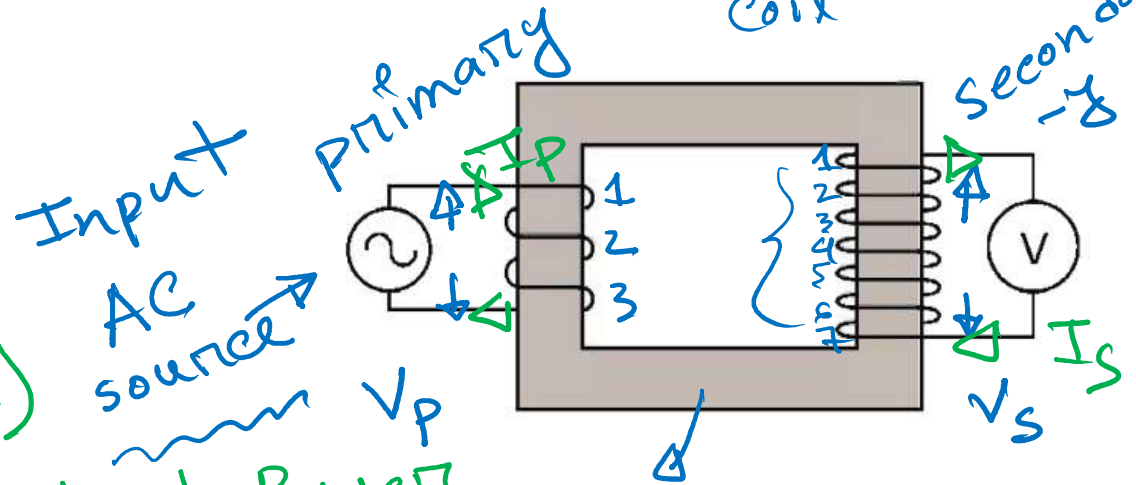
2) Ideal (without any loss)

Input Power = Output Power

$\Rightarrow V_p I_p = V_s I_s$

$\Rightarrow \frac{I_p}{I_s} = \frac{V_s}{V_p} = \frac{n_s}{n_p}$

n_s = number of turns in secondary coil



Formulas

$$\frac{V_s}{V_p} = \frac{n_s}{n_p} = \frac{I_p}{I_s}$$

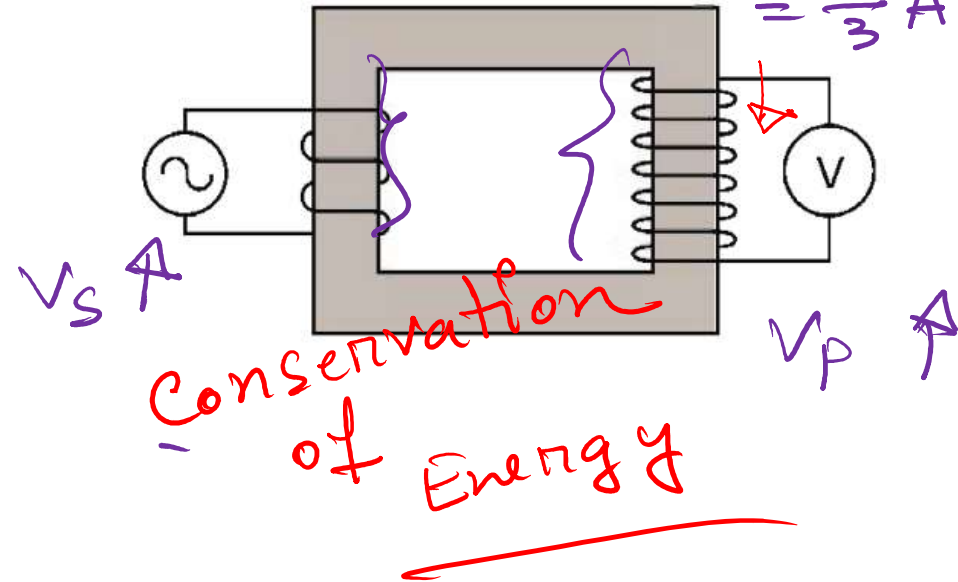
$$\frac{I_p}{I_s} = \frac{n_s}{n_p}$$

$$I_s = 8A$$

$$I_p = \frac{n_s}{n_p} \times I_s = \frac{500}{1500} \times 8A = \frac{8}{3}A$$

$$\begin{cases} V_s = 2V & I_s = 1A \\ V_p = 4V & I_p = 0.5A \end{cases}$$

$$\begin{cases} V_s = 4V & I_s = 2A \\ V_p = 8V & I_p = 1A \end{cases}$$



Mathematical Problem

A voltage transformer has 1500 turns of wire on its primary coil and 500 turns of wire for its secondary coil. If 240 volts AC is applied to the primary winding of the same transformer above, what will be the resulting secondary winding ⁽¹⁾ voltage and ⁽²⁾ current? [given that resistance of secondary is 10 ohm]. What will be the current in the primary winding?

(a) 24 A

☒ (b) 8/3 A

(c) 0 A

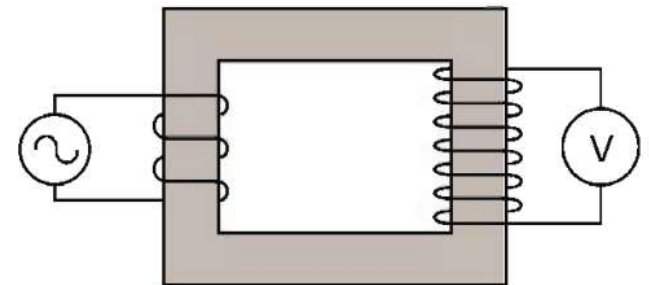
(d) None

$$n_p = 1500 \quad V_p = 240V$$

$$n_s = 500$$

$$V_s = \frac{n_s}{n_p} \times V_p = \frac{500}{1500} \times 240V = 80V(1)$$

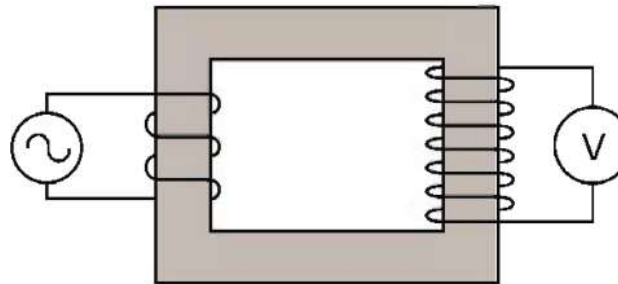
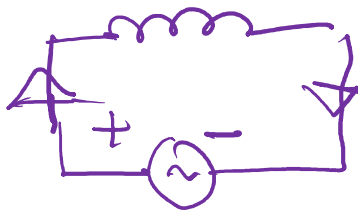
$$(2) \quad I_s = \frac{V_s}{R_s} = \frac{80V}{10\Omega} = 8A$$



Poll Question 02

A voltage transformer has 1500 turns of wire on its primary coil and 500 turns of wire for its secondary coil. If 240 volts DC is applied to the primary winding of the same transformer above, what will be the resulting secondary voltage?

- (a) 80 V DC
- (b) 80 V AC
- (c) 0 V
- (d) 720 V DC



লেগে থাকো সৎভাবে,
স্বপ্ন জয় তোমারই হবে

ঔদ্যম-উন্মেষ শিক্ষা পরিবার