

WELCOME
TO Adda247

***“STEADY STATE
IS JUST AN
ILLUSION.”***



Chapter – 2

DC Transient and Steady State analysis

Passive Elements.

1. Inductor
2. Capacitor
3. Resistor

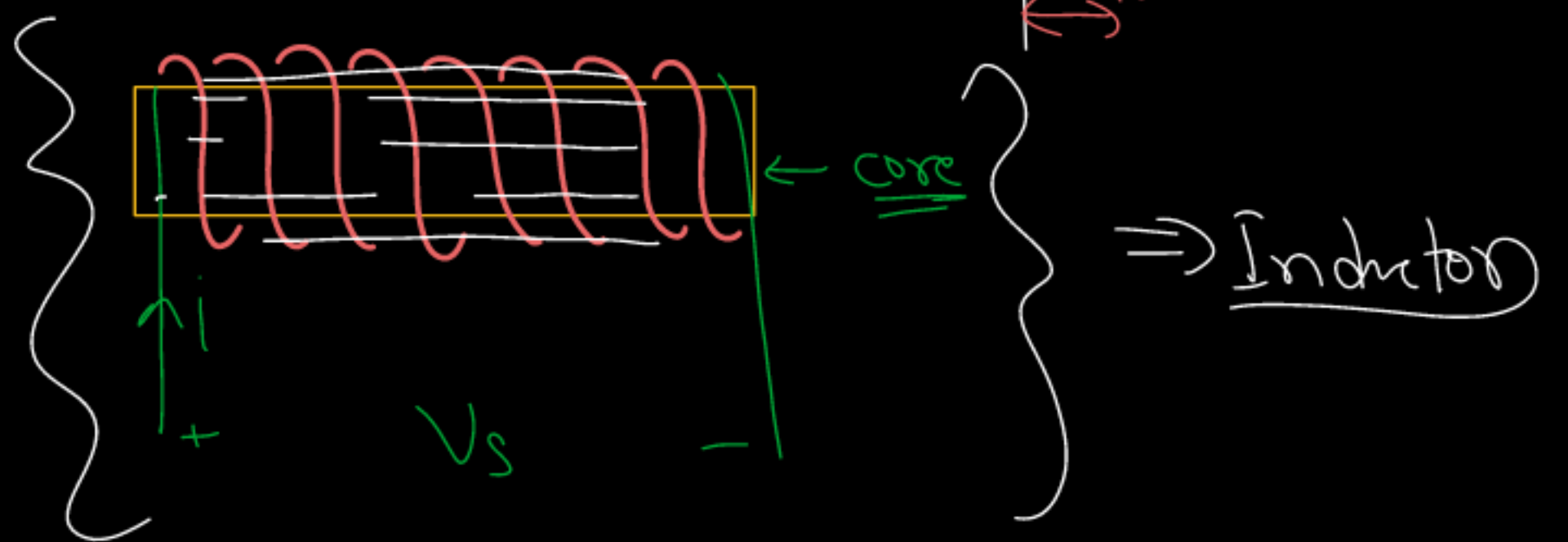
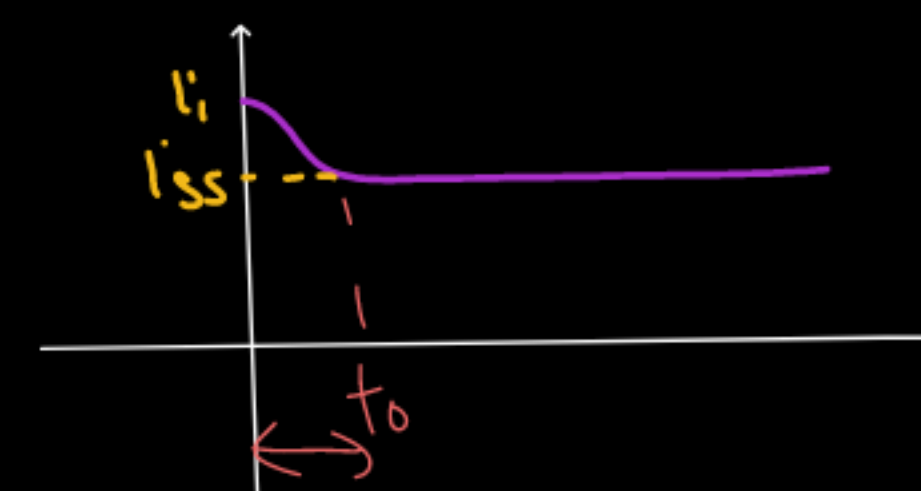
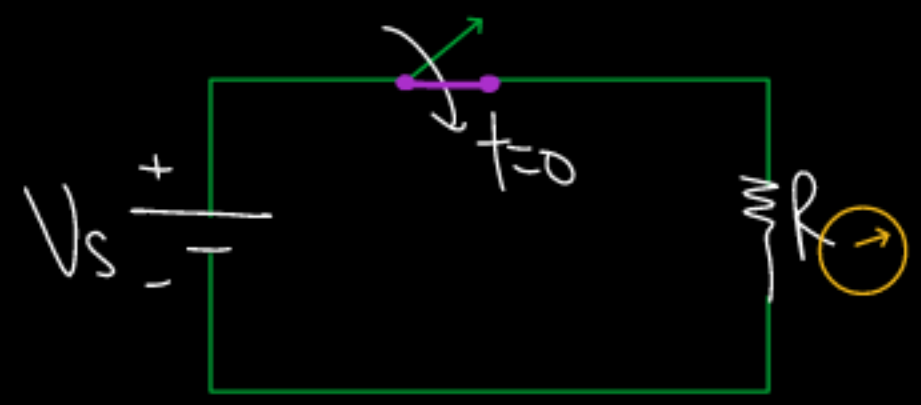
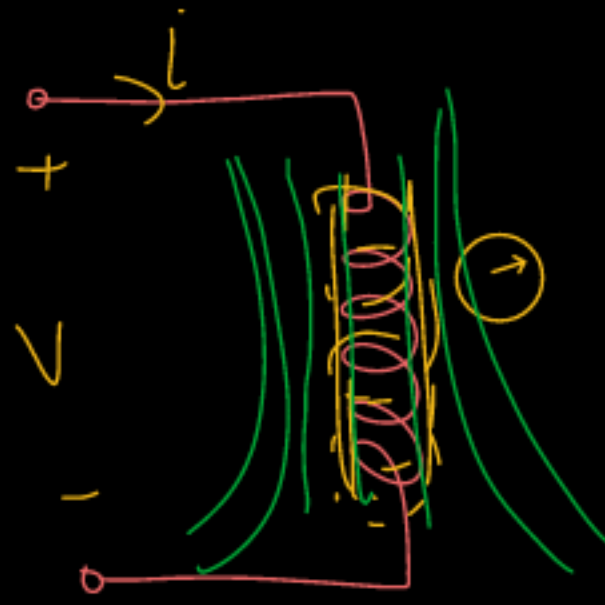
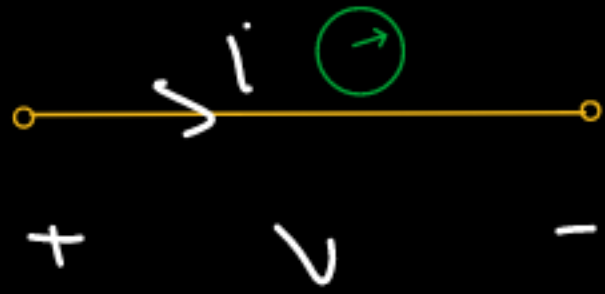
Adda-247 → APP

↳ Instal

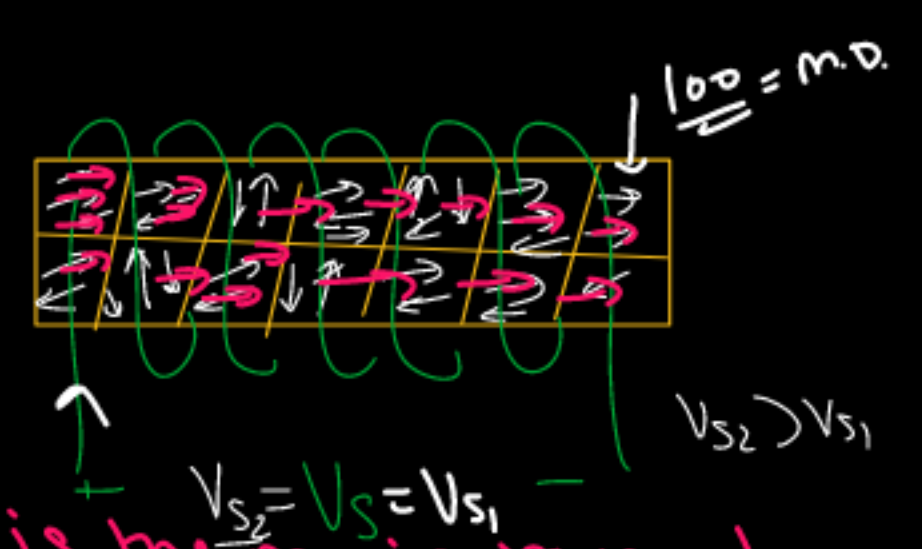
Passive Elements.

1. Inductor

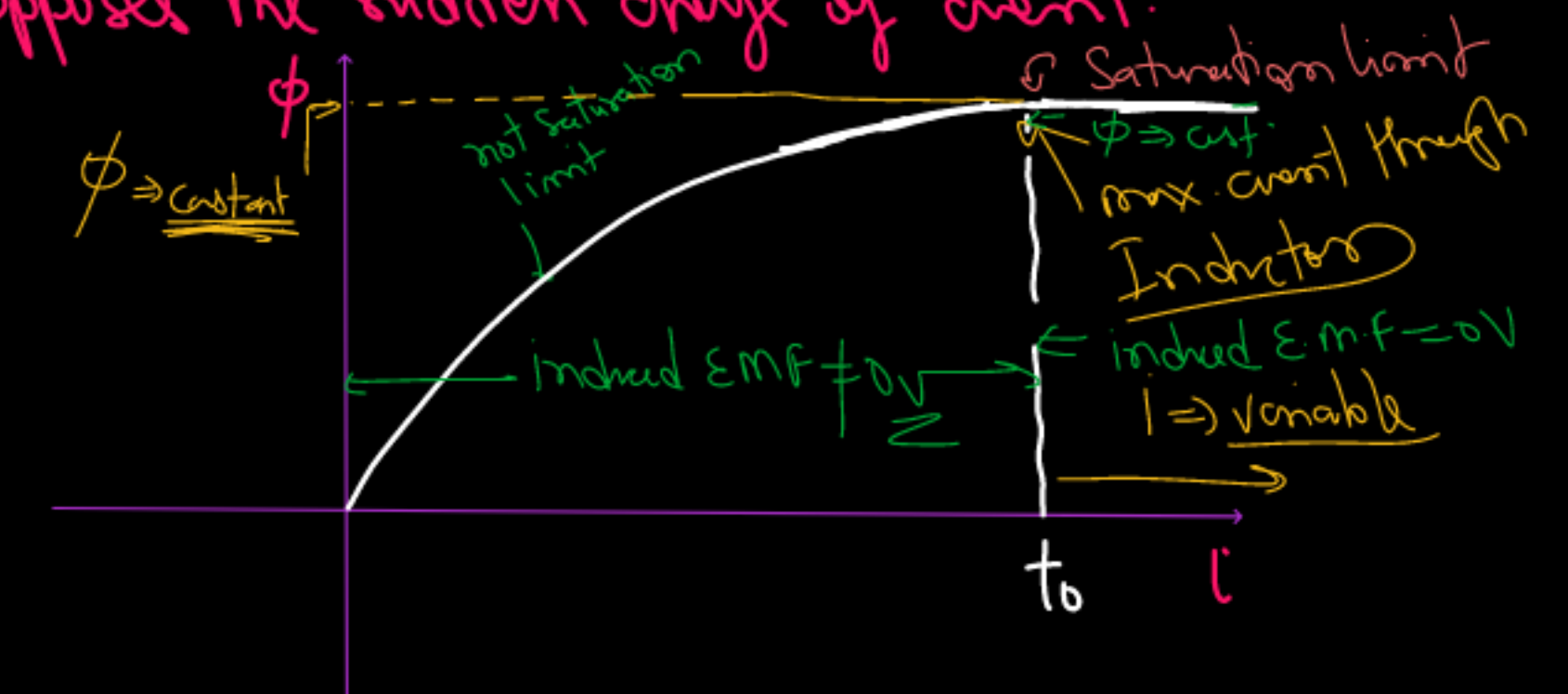
Faraday Law of induction:-



Inductor energized by D.C. supply.



* mag. dipoles Alignment, is the main reason to oppose the sudden change of current.



P.L. of Induction \Rightarrow

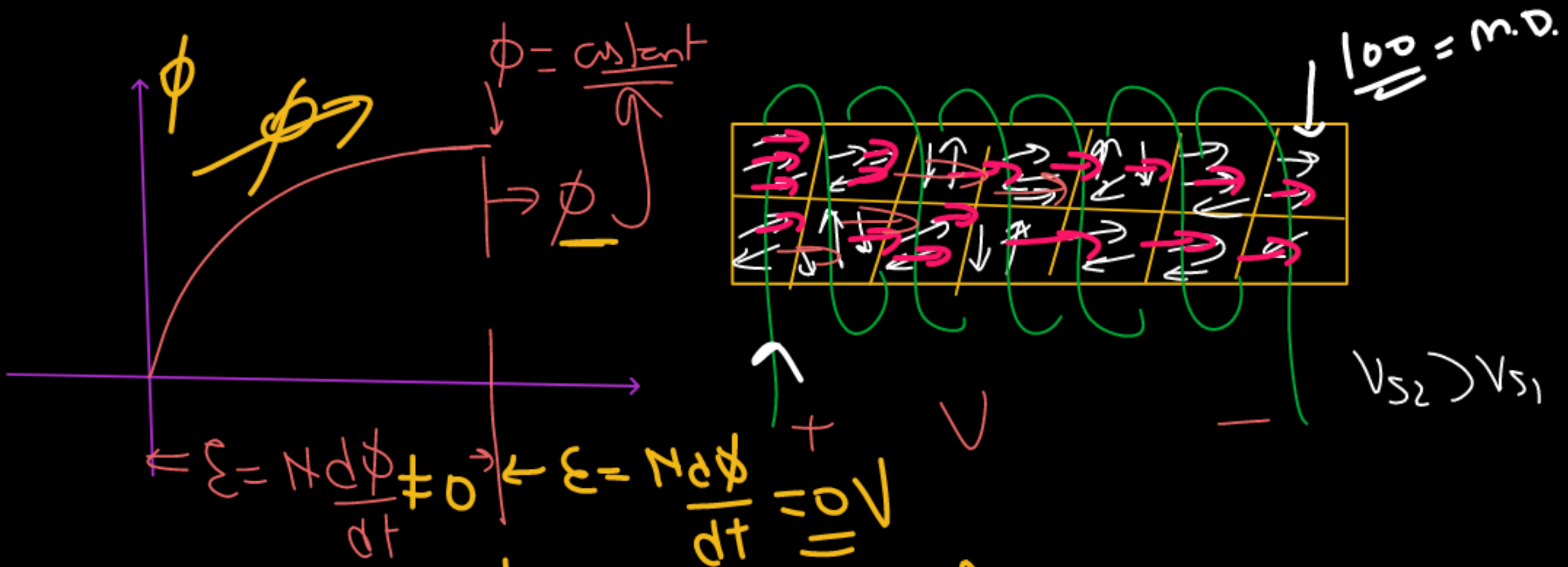
$$\left[\varepsilon = -N \frac{d\phi}{dt} \right] \rightarrow \text{Variable}$$

↑
induced EMF

if, $i \rightarrow$ the $\phi \rightarrow$

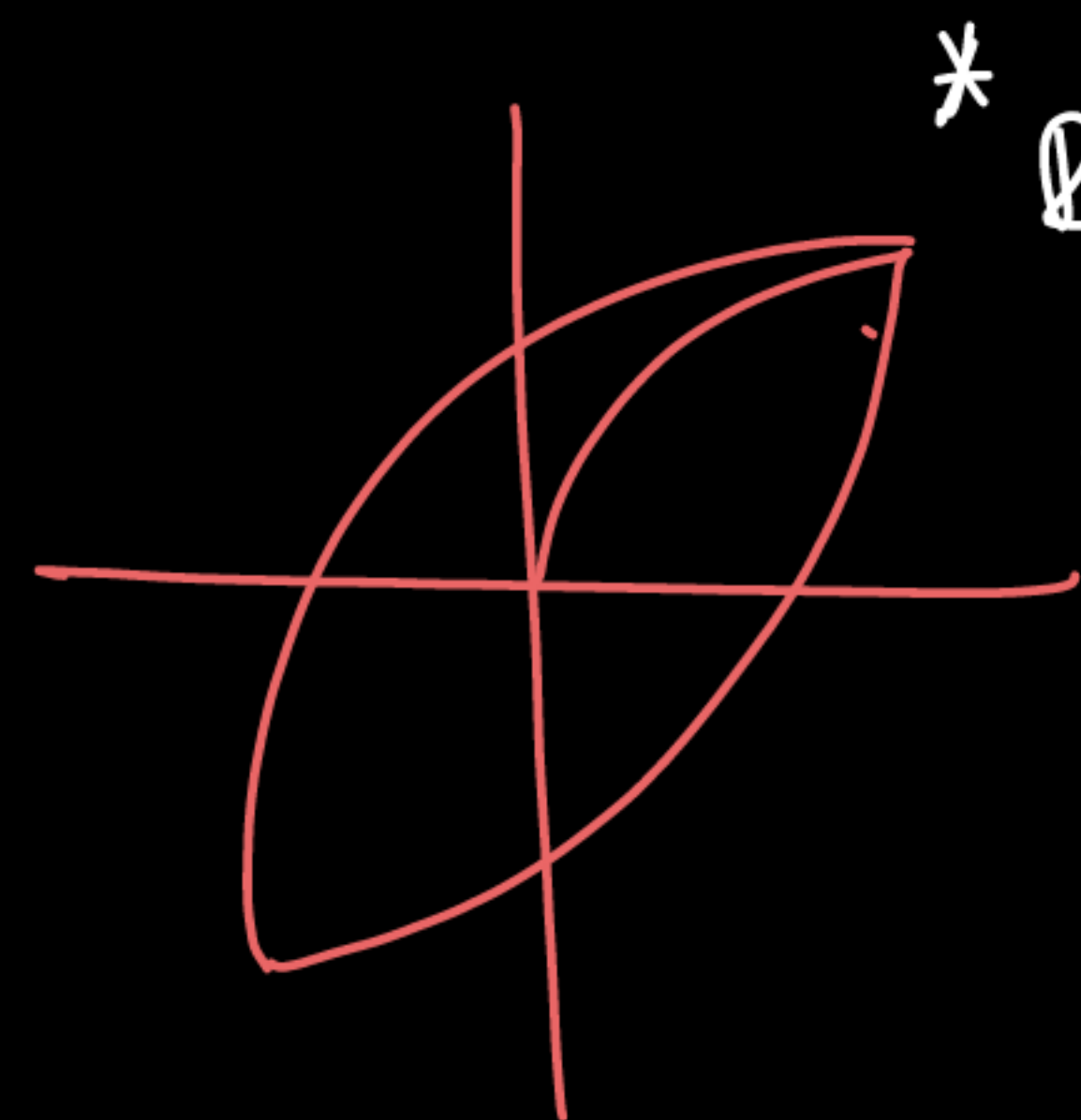
* if we will operate inductor beyond saturation limit, our inductor will get damaged.

Why inductor's will be S/C in D.C. ckt :-



= S/C case of inductor.

* A changed inductor will be S/C in D.C. ckt.



* In A.C. ckt, Inductor will not be o/c or S/C



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Gate Adda247

YouTube Channel

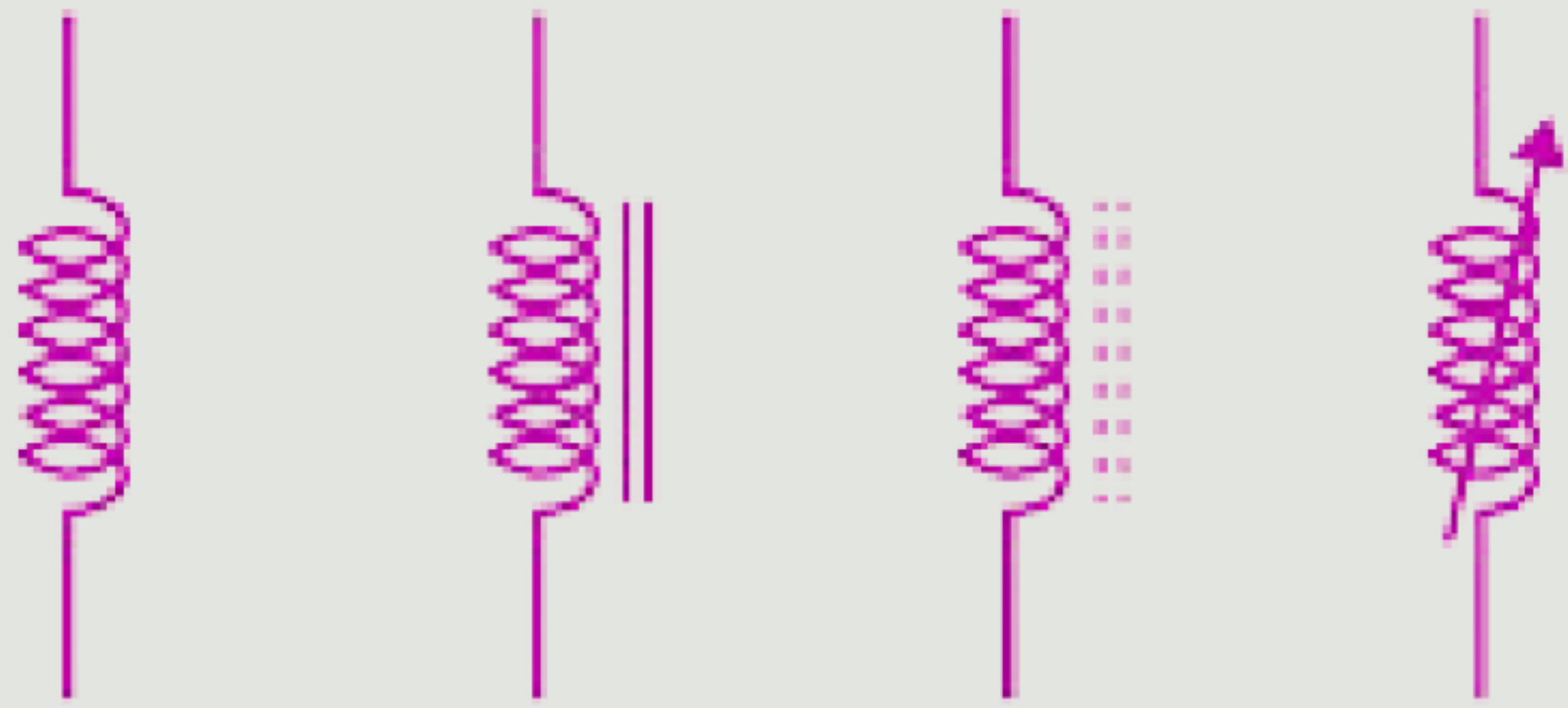
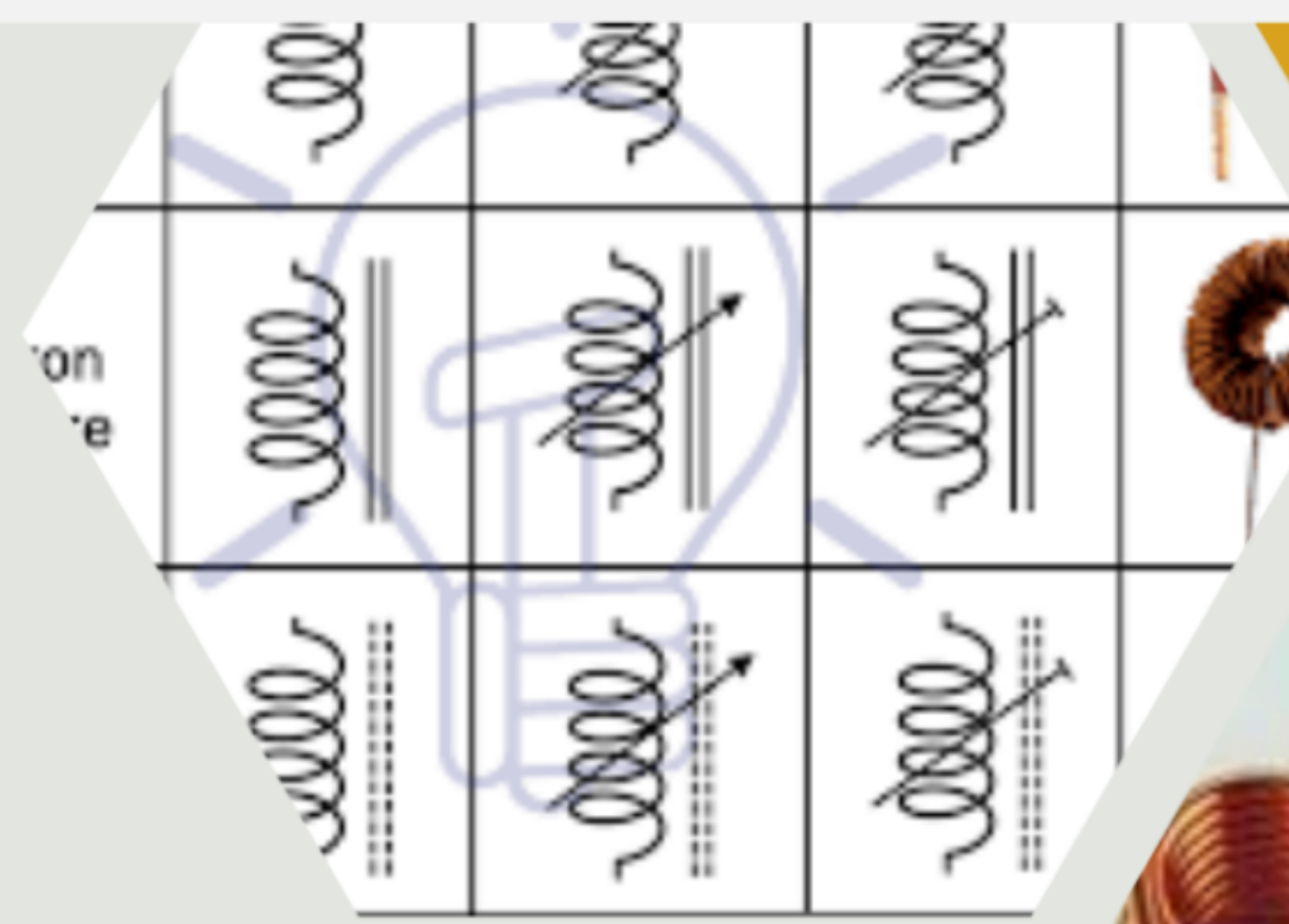
GATE 2023 RESULT



**Congratulations
FROM ADDA 247 FAMILY**

AIR 03 ME KUSHAGRA DUTT	AIR 05 PI HARSHIT KUMAR	AIR 07 ME RUSHI PRADIPKUMAR KARIYA	AIR 11 CE VINEET JAIN	AIR 30 CE RITIK BANSAL	AIR 36 ECE SUMIT KUMAR
AIR 64 CE UTKARSH MISHRA	AIR 71 EE SOMESH SANJAY PAWAR	AIR 76 CE DIPANKAR DAS	AIR 87 EC SURAJIT RABI DAS	AIR 91 EE RISHABH GUPTA	AIR 111 ES ANIL GUPTA
AIR 130 EE SAURAV PATEL	AIR 136 CE RUPESH SACHDEVA	AIR 200 ECE WASIUZZAMA	AIR 212 IN WASIUZZAMA	AIR 217 ME VISHAL KUMAR	AIR 219 ME NITISH KUMAR
AIR 258 EE MANAV	AIR 348 EE AMAN NAMDEV	AIR 392 EE GAURAV MAHAJAN	AIR 403 EC MOHAN KUMAR SINGH	AIR 567 EE SHANKAR JHA	AIR 571 ME VIJENDER MEENA

GATE 2024



Adda 247



WELCOME TO GATE ADDA 247

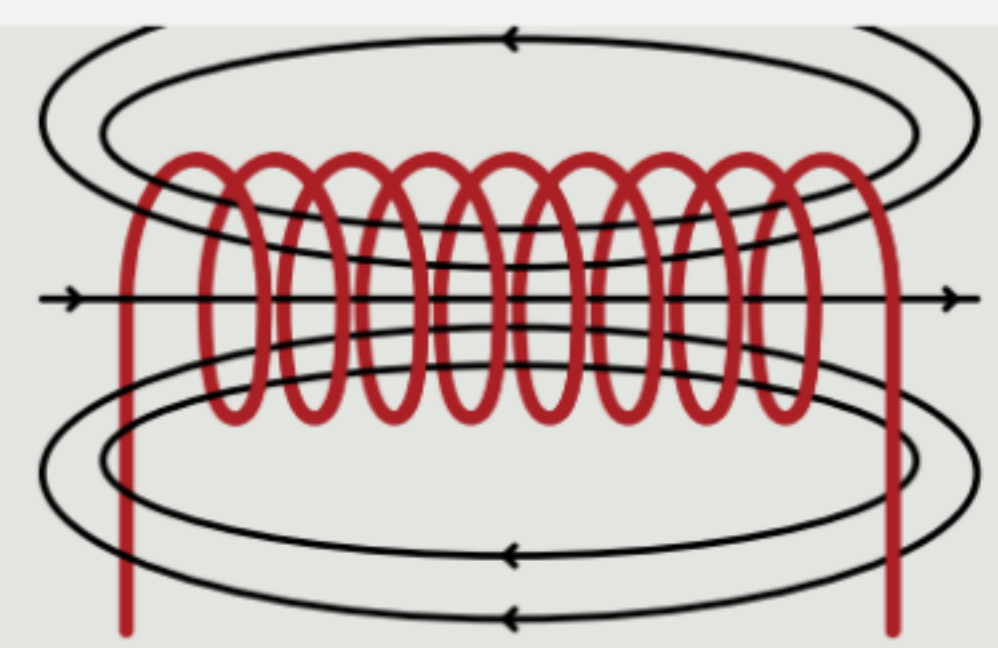
TODAY TOPIC IS

INDUCTOR

-
-
-
-
-
-



PROPERTIES OF INDUCTOR

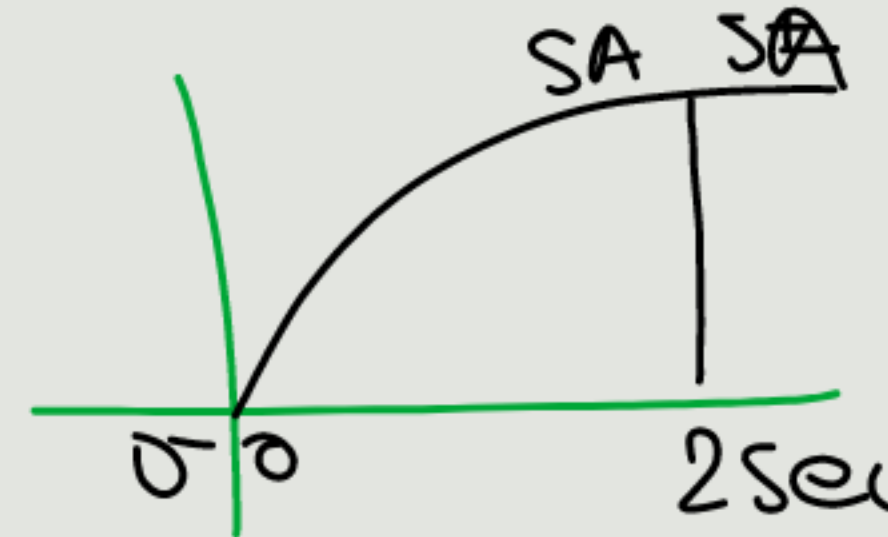


1

INDUCTOR IS PASSIVE & ENERGY STORING ELEMENT

2

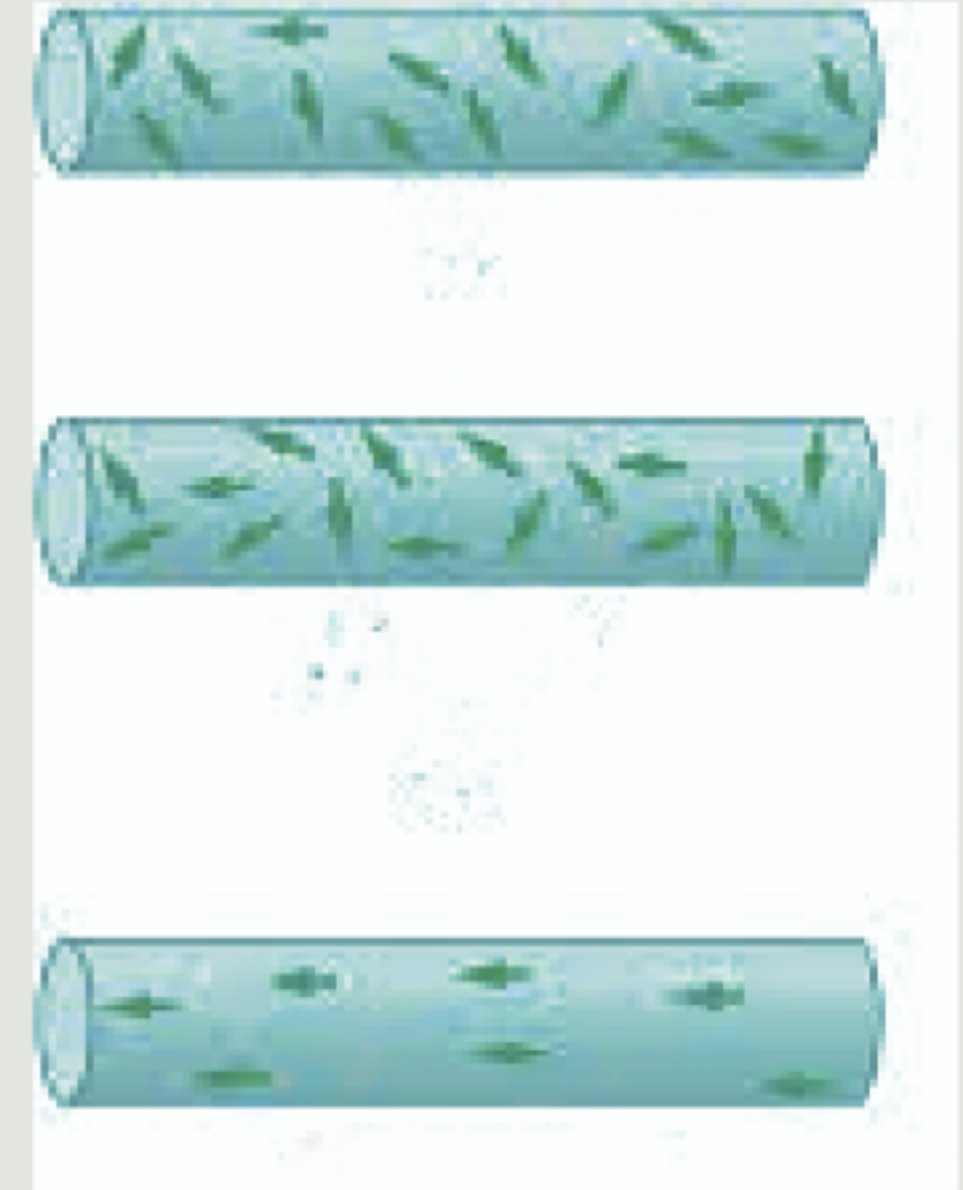
IT IS BILATERAL ELEMENT



3

INDUCTOR DOES NOT ALLOW SUDDEN CHANGE OF MAGNITUDE OF CURRENT

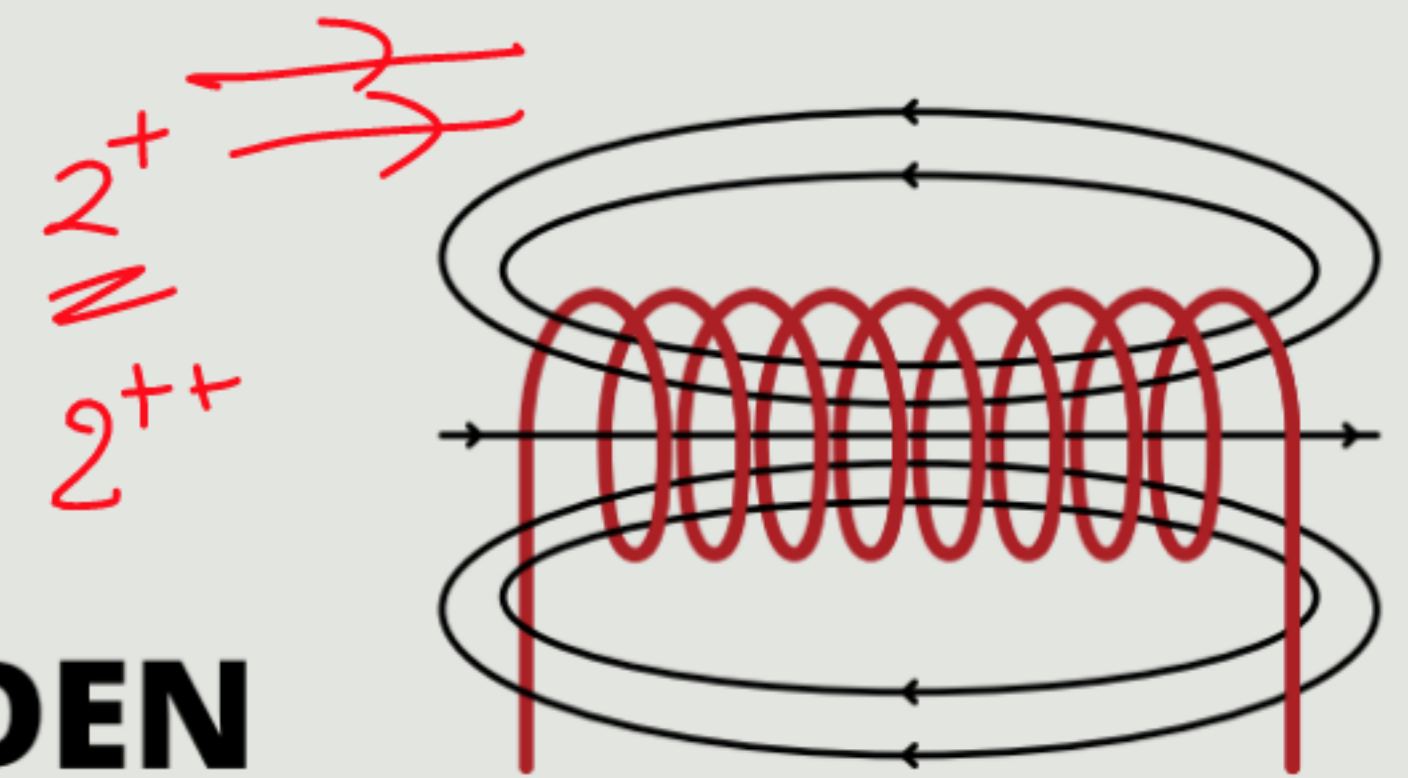
$$i_L|_{t^-} = i_L|_{t^+}$$



PROPERTIES OF INDUCTOR

4

INDUCTOR DOES NOT ALLOW SUDDEN CHANGE OF DIRECTION OF CURRENT



5

INDUCTOR'S VOLTAGE MAGNITUDE CAN CHANGE SUDDENLY

$$V_L|_{t^-} \neq V_L|_{t^+}$$

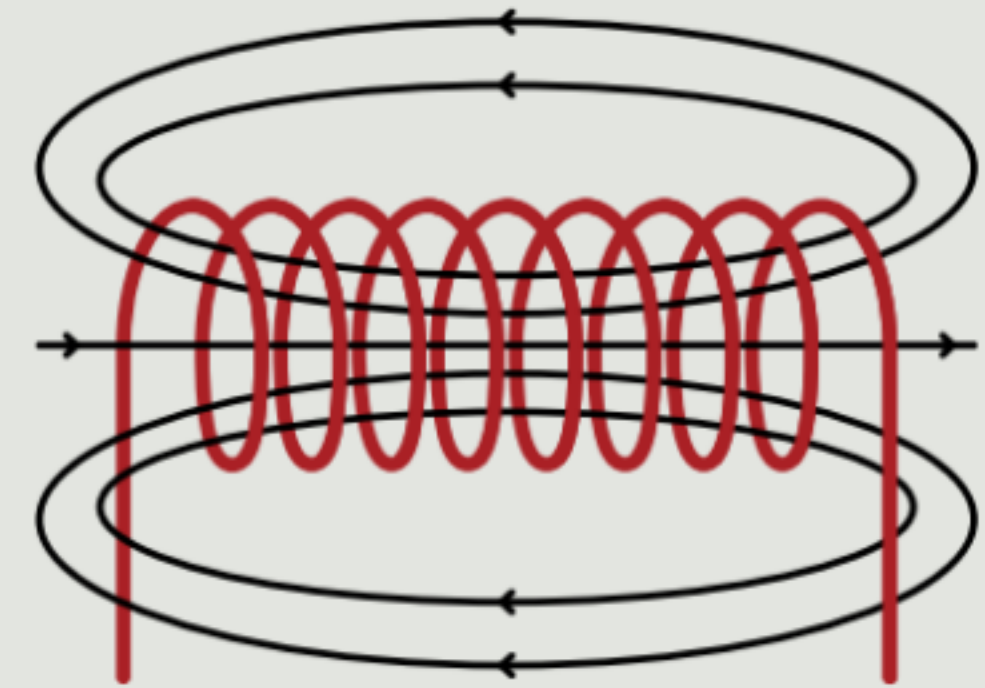
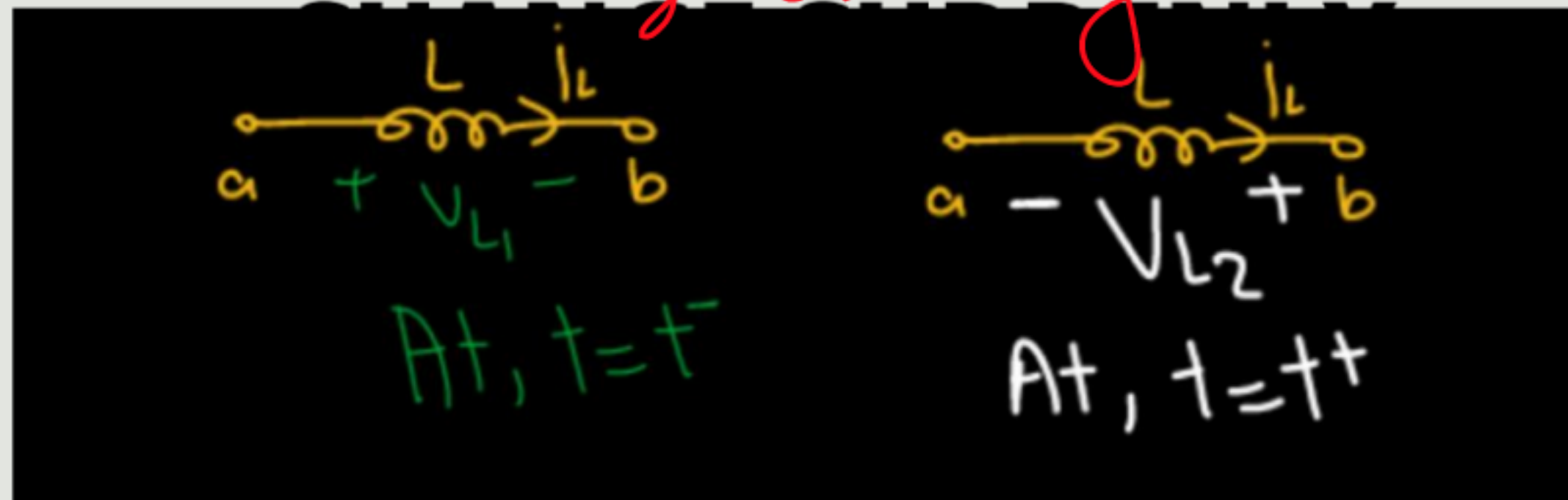
$$V_L|_{t=2\text{sec}} = 10\text{V}, \quad V_L|_{t=2\text{sec}^+} = +1000\text{V}$$

PROPERTIES OF INDUCTOR

6

INDUCTOR'S VOLTAGE POLARITY CAN

change suddenly.



7

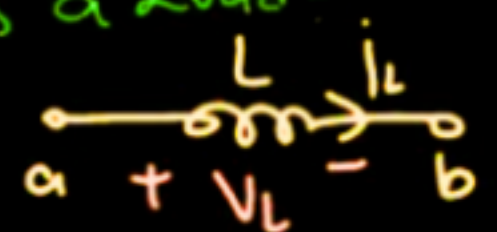
**AN INDUCTOR CAN STORE ENERGY AND IT CAN DELIVER
ACCORDING TO CIRCUIT NEED. SO INDUCTOR CAN BEHAVES AS A
SOURCE OR LOAD DEPENDING UPON CIRCUIT CONDITION**

PROPERTIES OF INDUCTOR

8

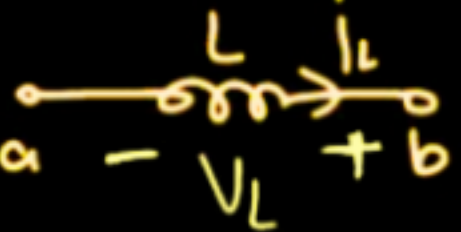
INDUCTOR'S POWER

Inductor as a Load -

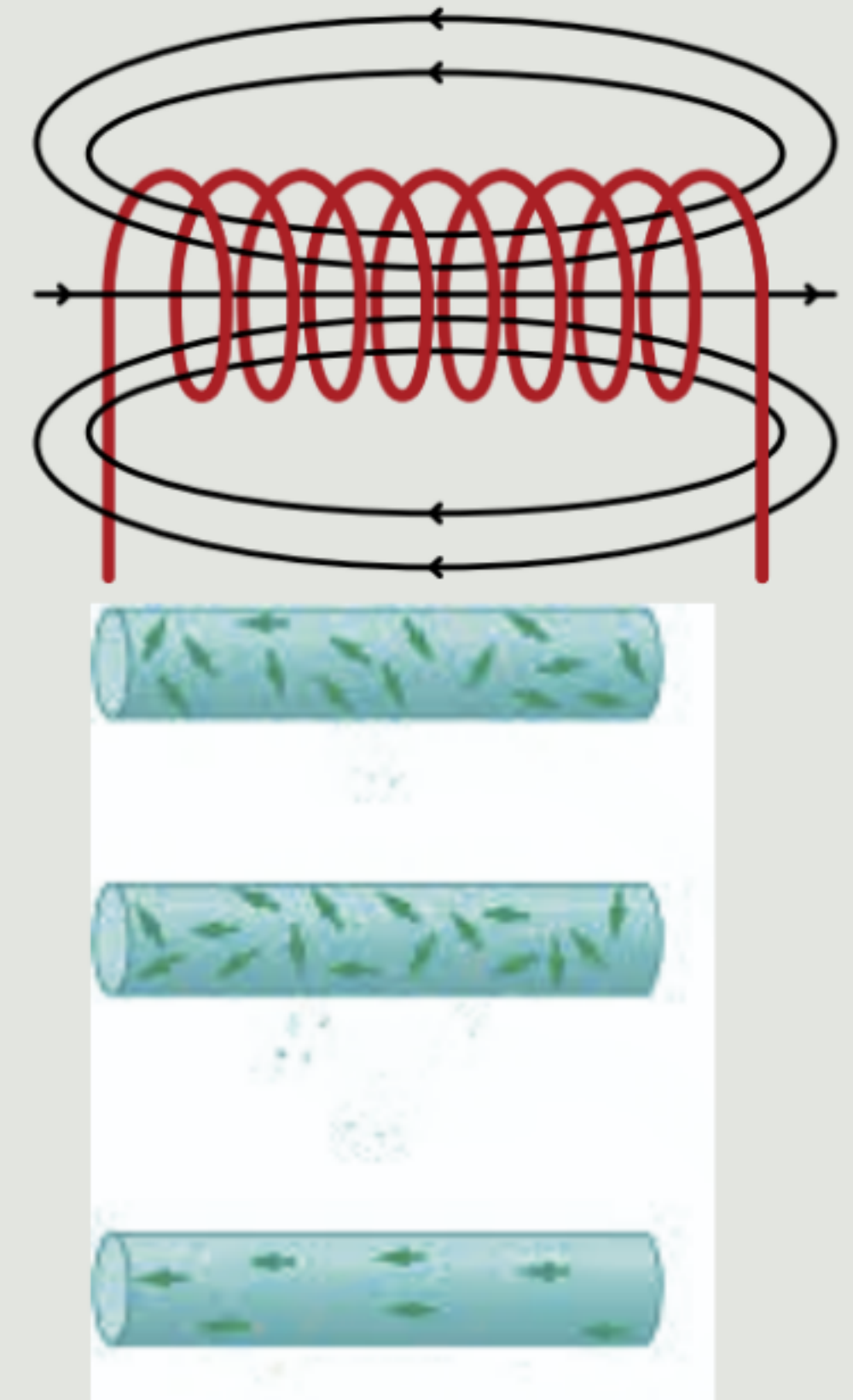


Absorbing power $= p(t) = V_L(t) \times i_L(t)$
 $W_{\text{stored}} = \int_t p(t) dt$
load

Inductor as a source:-



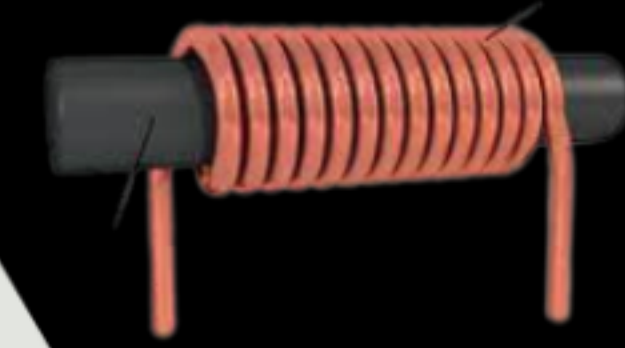
del. power \Rightarrow SOURCE.
 $p(t) = V_L(t) i_L(t)$
 $W_{\text{del}} = \int_t p(t) dt$



9

**WHEN CHARGED INDUCTOR BEHAVES AS A SOURCE , GURANTEED
IT WILL CHANGE ITS OWN VOLTAGE POLARITY**

PROPERTIES OF INDUCTOR



10 ✓ A FULLY CHARGED INDUCTOR BEHAVES AS A SHORT CIRCUIT IN DC CIRCUIT

11 ✓ AN UNCHARGED INDUCTOR BEHAVES AS AN OPEN CIRCUIT *in D.C. CKT.*

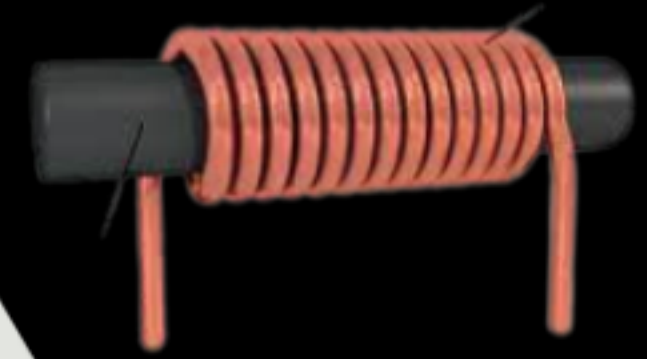
12 IN DC CIRCUIT INDUCTORS ARE NOT RESPONSIBLE FOR REACTIVE POWER, THEY ARE RESPONSIBLE FOR REAL POWER

13 IN AC CIRCUIT INDUCTORS ARE RESPONSIBLE FOR REACTIVE POWER, THEY ARE NOT RESPONSIBLE FOR REAL POWER



PROPERTIES OF INDUCTOR

$$V_L = L \frac{di}{dt}$$



14

INDUCTOR CAN ALSO MAINTAIN ALMOST CONSTANT CURRENT FOR VARIABLE VOLTAGE.

15

INDUCTOR'S VOLTAGE MAY/MAYNOT BE ZERO FOR CONSTANT CURRENT.

16

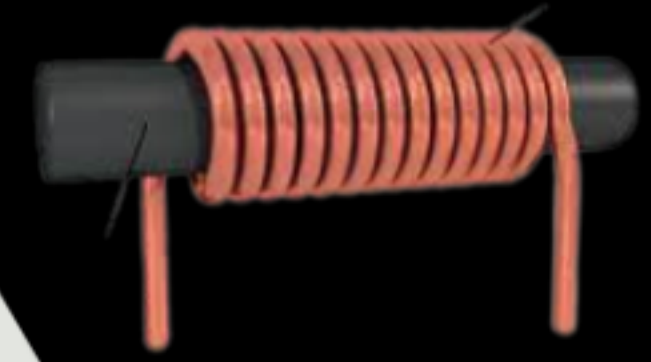
IT IS GURANTEED THAT INDUCTOR WILL BEHAVE AS AN OPEN CIRCUIT AT

$$t = \infty$$

Always



PROPERTIES OF INDUCTOR



17

AN INDUCTOR MAY BE SHORT CIRCUIT OR OPEN CIRCUIT IN STEADY STATE IN DC CIRCUIT .

18

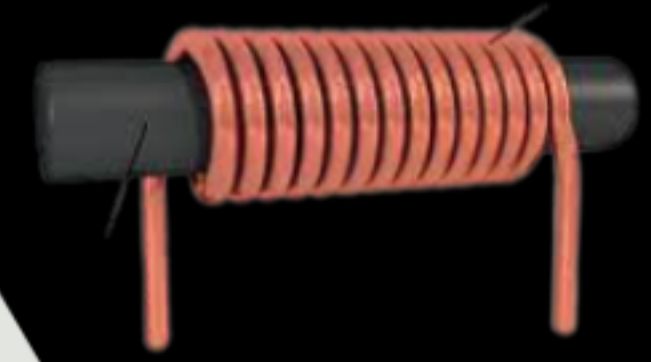
IN AC CIRCUIT INDUCTOR'S WILL NOT BE SHORT OR OPEN CIRCUIT .

19

TIME CONSTANT τ PLAYS VERY IMPORTANT ROLE TO DEFINE TRANSIENT TIME



PROPERTIES OF INDUCTOR



20

A FULLY CHARGED INDUCTOR IN DC CIRCUIT , CAN BEHAVE AS A CONSTANT DC CURRENT SOURCE.

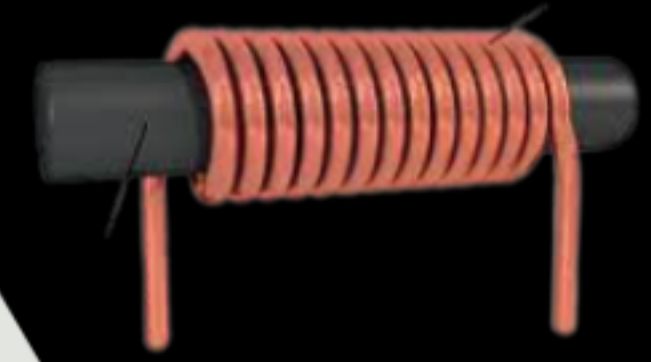
21

ENERGY STORED BY INDUCTOR

$$\text{Energy stored} = \int_0^I P dt = \int_0^I Li' di' = \frac{1}{2} LI^2$$



PROPERTIES OF INDUCTOR



21

AN INDUCTOR CAN WORK AS SOURCE , BUT FOR A VERY VERY SMALL TIME INTERVAL .

22

AN INDUCTOR CAN DEVELOP A VERY HIGH VOLTAGE (IN TERMS OF KV/MV) BUT FOR VERY SHORT TIME DURATION

23

if impulse vol. applied across inductor, then inductor's current can change instantaneously.

