

Passive components:-

Passive elements absorb, dissipate or store energy in an electric field (or) a magnetic field. Passive devices do not provide gain (or) amplification.

Some passive elements are Resistors, inductors and capacitors.

Resistor:-

Resistors oppose the flow of electric current, converting electrical energy into heat.

symbol :- 

The voltage drop across the resistor depends on the current at that instant.

It does not store energy.

$$V(t) = R i(t) \quad [\text{in Time domain}]$$

②

Inductors: Inductor store energy in a magnetic field when current flows through them

symbol: 

$$i(t) = \frac{1}{L} \int v(t) dt$$

$$v = L \cdot \frac{di}{dt}$$

Capacitor: store energy in an electric field

$$v(t) = \frac{1}{C} \int i(t) dt + v_0 \text{ (or) } v = \frac{1}{C} \int i dt + v_0$$

For parallel plate capacitor

$$C = \frac{\epsilon A}{d}$$

$\downarrow$
initial
voltage

③

Energy sources:-

Energy sources are classified into two types.

They are,

1. Voltage source
2. Current source.

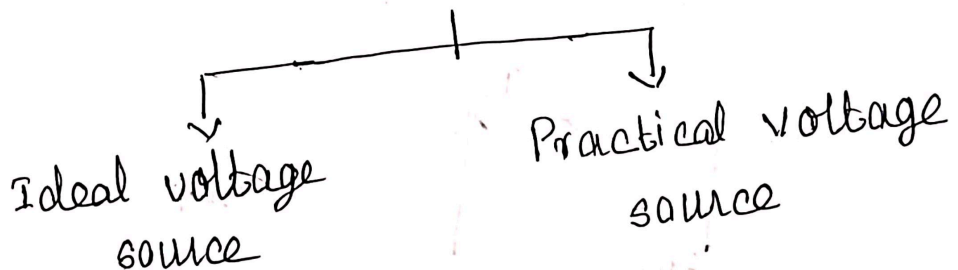
These two sources are further classified as

1. Ideal source
2. Practical source.

Voltage source:-

It is a two terminal electrical component that maintains a constant voltage across its terminals, regardless of the current flowing through it.

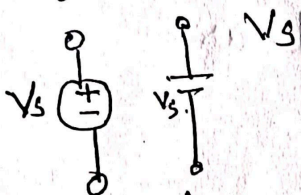
voltage source.



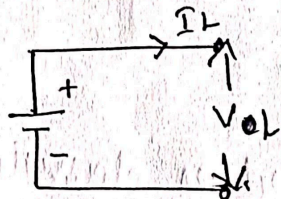
④ Ideal voltage source:-

An ideal voltage source provides a constant output voltage regardless of the current flowing through it. It has zero internal resistance.

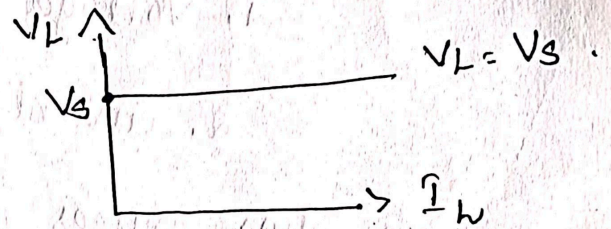
Symbol.



symbol:



circuit



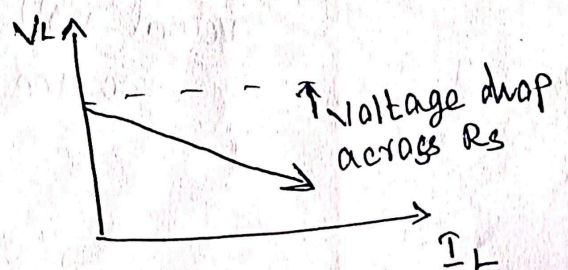
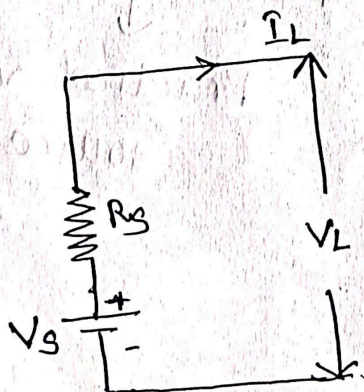
output graph.

For ideal circuit $V_L = V_s$

Practical voltage source

Practically every voltage source has a low internal resistance (R_s). R_s is in series with V_s .

The output voltage V_L across the load changes with change in load current. It is due to the voltage drop across R_s .



$$V_L = V_s - I_L R_s$$

(5)

Current source:-

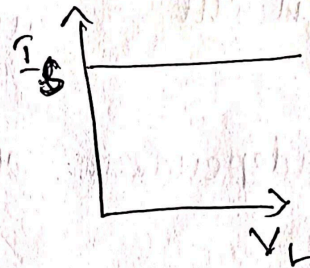
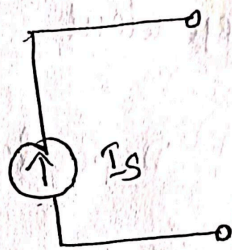
A current source provides a constant electric current, regardless of the voltage across it.

Ideal current source

Practical current source.

Ideal current source:-

It provides constant output current to any load connected to it regardless of the voltage across the source.

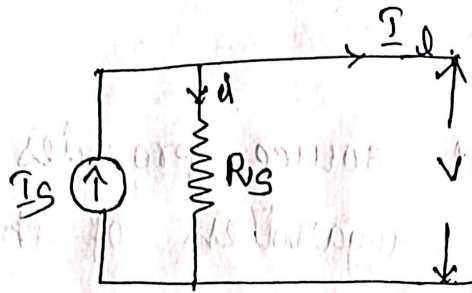


The internal resistance of an ideal current source is zero.

Practical current source:-

Practically all current source will have a high resistance in parallel with it, called the internal resistance.

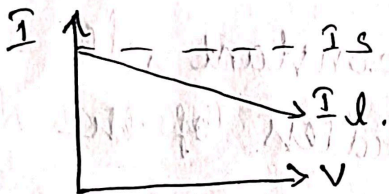
⑥



$$I_s = I_l + i \quad I_l = I_s - i$$

$$= I_s - \frac{V}{R}$$

As $V \uparrow$ $I_l \downarrow$. This is shown in graph



Independent and Dependent sources.

Independent sources

Dependent sources.

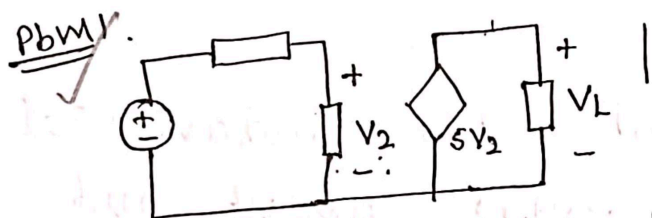
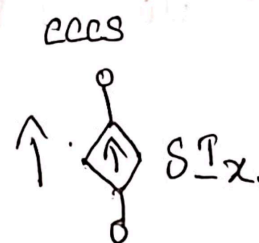
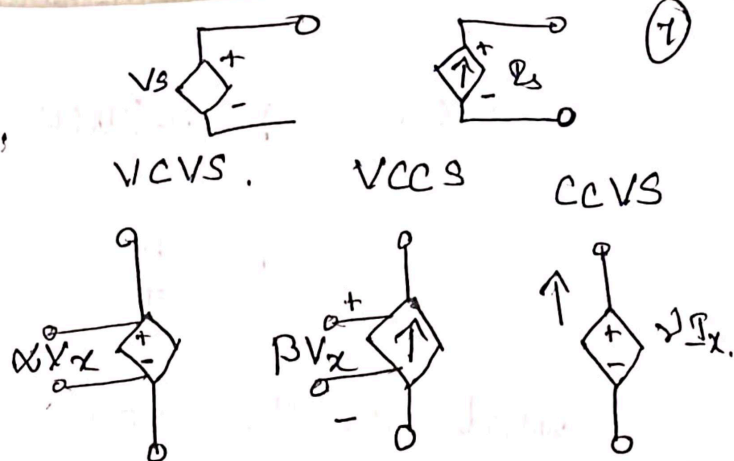
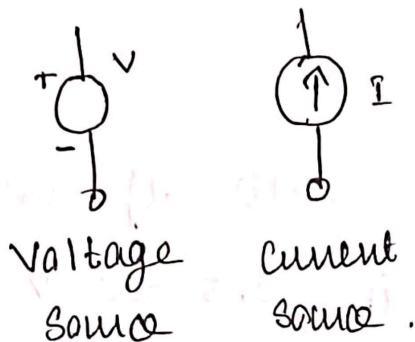
1. Ideal sources are called as independent sources.

2. Provide a constant o/p voltage or current irrespective of other components in circuit.

Dependent sources are also called as controlled sources.

o/p voltage or current depends on the other components in the circuit.

3) Symbolic Rep.



For the given circuit diagram if $V_2 = 3V$, what is the output voltage V_L .

Soln

$$V_L = 5V_2$$

$$= 5 \times 3V = 15V$$

* VCVS - Voltage controlled voltage source.

* VCCS - V_{tg} controlled current source - FET

* CCCS - Current control current source.

* CCVS - current control voltage source. (op-amp)