Electric Circuit :- Circuit may be define is the combination of active, and passive elements are called circuit.

→ **Linear Elements :-** It is the circuit whose parameter remain constant with change in applied voltage and current.
Ex.- Resistance, inductance or capacitance.

→ **Non-Linear Elements :-** It is the circuit whose parameter change with voltage or current.
Ex. Semi-conductor resistor.

Note : The linear circuit obey the ohm's law i.e. current is directly proportional with applied voltage.
But non-linear circuit, ohm's law is not satisfied.

→ **Unilateral circuit :-** When the direction of current is changed, the characteristic or property of the circuit may be

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change. In this case unilateral circuit.
Ex :- Diode, Transistor etc.

→ **Bilateral circuit** :- When the change in direction of current, the direction of characteristic or properties of the circuit may not change., it is called Bilateral circuit. Ex:- Mostly, element made of high conductivity material are Bilateral ckt.

→ **Active Element** :- The active element are those element which delivered energy called Active element.
Ex: Battery, source of e.m.f.

→ **Passive Element** :- The passive element are those element which absorbed energy. called passive element.
Ex: Resistance, Inductance, capacitance etc.

Resistance :- The electrical resistance is the property of a material due to which it opposes the flow of electron through the material or it opposes the flow of electric current. The unit of resistance is Ohm (Ω).

$$R = \frac{V}{I}$$

Power absorbed by the resistors is

$$P = VI = (IR) \cdot I = I^2 R \text{ watt.}$$

Energy lost in the form of heat is

$$W = \int_0^t P \cdot dt = Pt.$$

$$= I^2 R \cdot t$$

$$\boxed{W = \frac{V^2}{R} \cdot t}$$

Inductance :- The inductance is the property of material due to which it opposes any change of magnitude or direction of electric current passing through the conductor. The unit of inductance is Henry (H).

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

In case of pure inductive

$$V + V_L = 0$$

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

Power absorbed by the inductor.

$$P = V\,I = L\,I\,\frac{di}{dt} \text{ Watt}$$

Energy absorbed by the inductor

$$W = \int_0^t P\,dt = \int_0^t Li\frac{di}{dt}\,dt$$

$$\boxed{W = \frac{1}{2}Li^2}$$

Capacitance :- The capacitance is a property of material due to which store the charges i.e. electric charges. The unit of capacitance is farad (F).

$$Q = CV, \quad C = \frac{q}{V}$$

$$i = C\frac{dV}{dt} \qquad \left[\because i = \frac{dq}{dt}\right]$$

Power absorb by the capacitor

$$P = V\,i = V \cdot C\,\frac{dV}{dt} \text{ watt.}$$

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Energy absorb by the capacitor is

$$W = \int_0^t p \cdot dt = \int_0^t vC\frac{dv}{dt} \cdot dt$$

$$\boxed{W = \frac{1}{2}CV^2}$$

Circuit elemt.	Voltage (volts)	Current (amps)	Power (watt)
$R(\Omega)$	$V = Ri$	$i = \frac{V}{R}$	$P = i^2R$
$L(H)$	$V = L\frac{di}{dt}$	$i = \frac{1}{L}\int v\,dt$	$P = Li\frac{di}{dt}$
$C(F)$	$V = \frac{1}{C}\int i\,dt$	$i = C\frac{dv}{dt}$	$P = CV\frac{dv}{dt}$

Ques A 100Ω resistance is directly switched on across a 10V battery. What is the current through the resistor? How much the power losses? Also find the energy consumed in 5 sec.

Soln:- Given that $V = 10V$, $R = 100\,\Omega$

$$I = \frac{V}{R} = \frac{10}{100} = 0.1\,A$$

Power loss $= I^2R = (0.1)^2 \times 100 = 1$ Watt.

Energy consumed $= I^2Rt = 1 \times 5$ watt sec.

$= 5$ Joules

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Qus: The strength of current in 1H inductor changes at a rate of 1A/sec. find the vtg across it and determine the magnitude of energy stored in the inductor after 2 sec.

Sol?:- $L = 1\,H, \quad \frac{di}{dt} = 1\,A/sec.$

$$V = L\frac{di}{dt} = 1 \times 1 = 1\,V$$

Energy stored $W = \frac{1}{2} \cdot Li^2 = \frac{1}{2} \times 1 \times 2^2$ $\quad (\because t = 2\,sec, \; i = 2A)$

$$\boxed{W = 2 \text{ Joules}}$$

Qus A capacitor has a capacitance of 5μf. calculate the stored energy in it if a d.c. vtg of 100V is applied across it.

Sol?: $V = 100V, \quad C = 5 \times 10^{-6}\,F$

$$W = \frac{1}{2}CV^2 = \frac{1}{2} \times 5 \times 10^{-6} \times (100)^2$$

$$\boxed{W = 2.5 \times 10^{-2} \text{ Joules}}$$

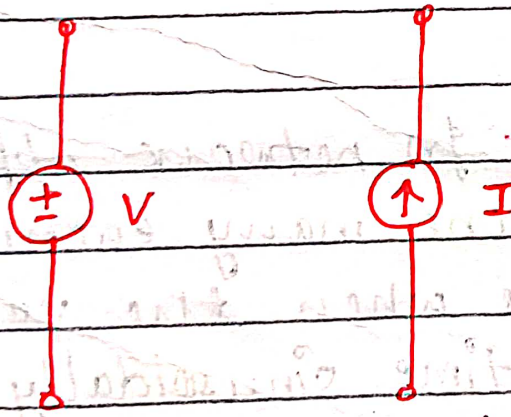
Energy Sources :- There are many two type of energy sources.

① Direct source ② Alternating source.

And this two sources are further subclassified as dependent source and independent source.

① **Direct source** :- Independent voltage and current source have been shown in fig.

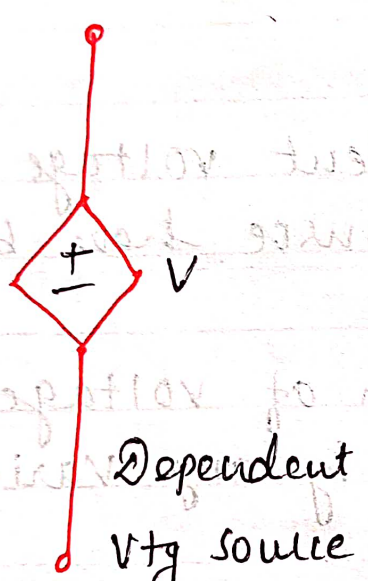
The strength of voltage or current is not changed by any variation in a connected network.



Independent voltage source

Independent current source.

When strength of voltage or current changes in the source for any change in the connected network they are called Dependent source. Dependent voltage or current sources are shown in fig.



Dependent Vtg source

Dependent current source.

(2) Alternating Sources :- In network application one many encounter other type of sources when the voltage or current vary with time sinusoidally, exponentially etc..

Basis For Comparison	Electrical Device	Electronics Device
Definition	It is defined as the device which uses the electrical energy for performing the work.	The device which controls the flow of electrons for performing the particular task is known as the electronics devices.
Material Used	Metals like copper and aluminum are used for the conduction of current.	Semiconductor material like silicon, germanium etc.
Operating Principle	Convert the electrical energy into other forms of energy.	Uses the electrical energy for performing the particular task.
Current	Alternating Current	Direct Current
Voltage	Works on high voltage.	Works on low voltage
Power consumption	More	Less
Manipulation	Do not manipulate the data	It manipulates the data.
Response Time	Fast	Slow
Required Space	More	Less
Safe	Less	More
Uses	For doing mechanical work.	For amplifying the weak signal or for coding and decoding the information.
Examples	Transformer, motor, generator etc.	Transistor, diode, microprocessor, flip-flop, amplifier, etc.