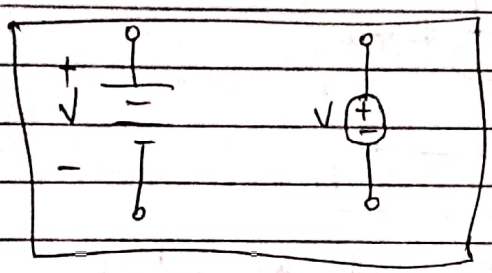
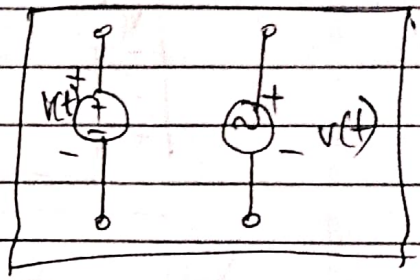
Series and Parallel Connected Independent Sources

Independent Sources are two terminal devices whose voltage remains constant irrespective of all circuit conditions.

Symbol of independent Voltage Sources

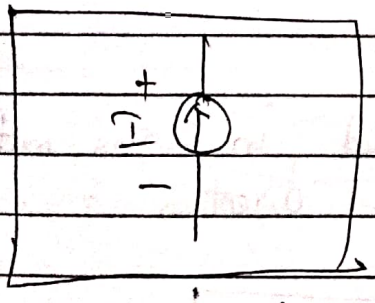


Direct Voltage Source.

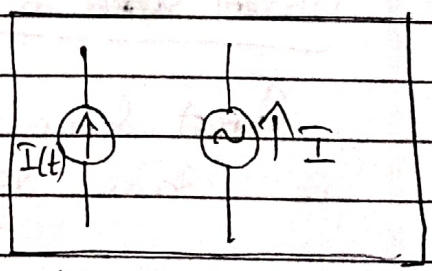


Alternating Voltage Source.

Symbol of independent Current Sources



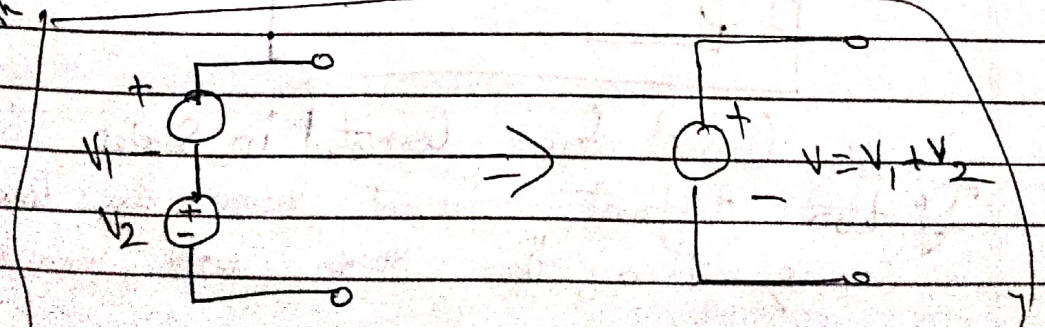
Direct Current Source



Alternating Current Source.

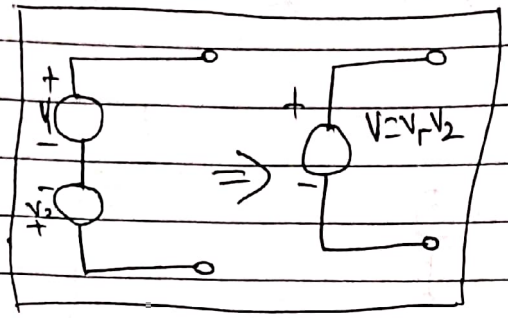
Voltage Sources in Series

Voltage Source with same polarity connected in Series



* Voltage Sources in Series which is of the same polarity can be added algebraically.
* Start at the top terminal & move towards the Voltage Sources, if we reach + terminal, then the polarity is +ve & if we reach -ve terminal, then the polarity is -ve.

(b)

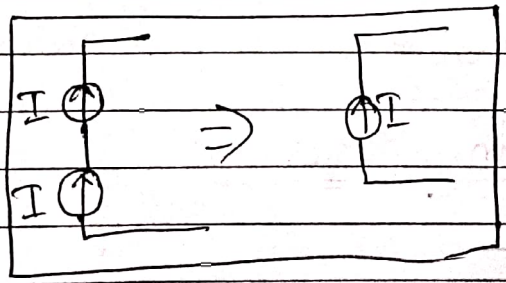


Voltage Source with different polarity Connected in Series.

* -ve Sign in V_2 since -ve terminal of voltage source is connected to top terminal.

Current Sources in Series

Current Sources Connected in Series must be the same value & direction.

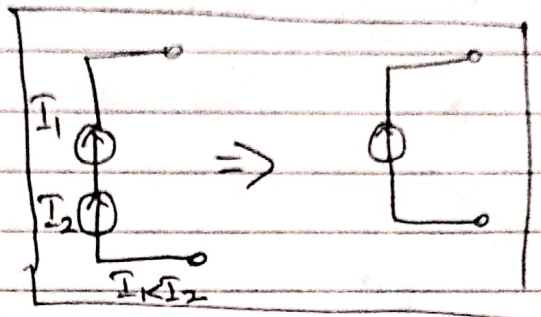


Current Source Connected in Series

If two different Current Sources are Connected in Series, then the source with lower value

will act upon & the other source will become redundant.

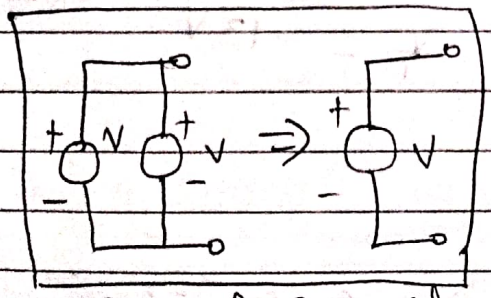
* Practically Current Sources are not allowed to be Connected in Series.



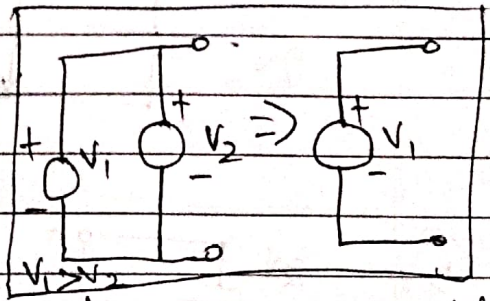
Current Sources with different values Connected in series.

Voltage Sources in parallel

* Voltage Sources Connected in parallel should be same value and same polarity.
* If two different voltage sources are Connected, then the voltage source with higher value will appear across the o/p terminal.



Voltage Sources of same value in parallel



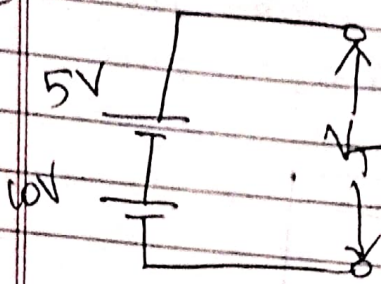
Voltage Sources Connected in parallel with different values

Current Sources in Parallel

* If the arrow mark face towards the top terminal, then +ve value.
* Arrow mark face towards ground, then Consider -ve value.

Problems on Sources Series-Parallel.

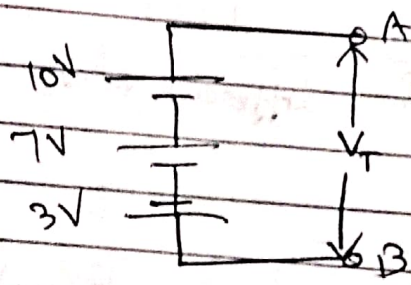
(1)



$\Rightarrow 5+10 = 15V$

$V_T = 15V$

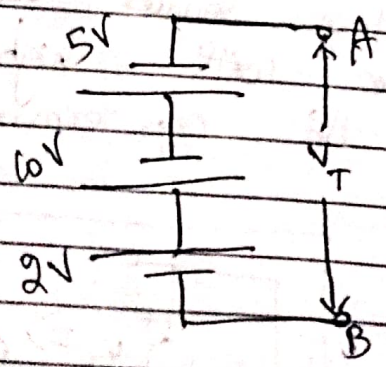
(2)



$\Rightarrow 10+7-3$

$V_T = 14V$

(3)

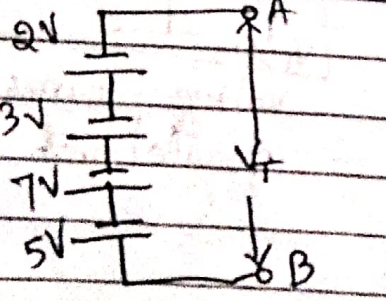


$\Rightarrow -5-10+2$

$\Rightarrow -15+2$

$V_T = -13V$

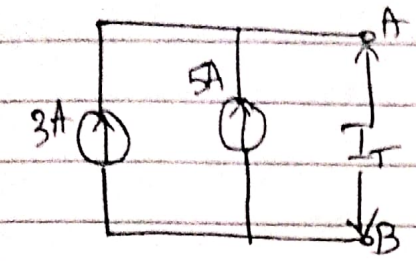
(4)



$\Rightarrow -2-3-7-5$

$V_T = -17V$

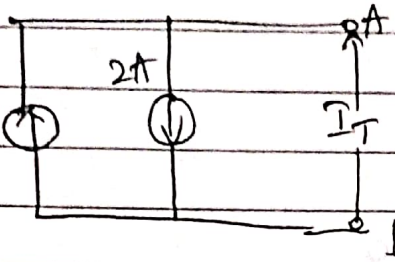
(5)



$I_T = 3 + 5 = 8$

$I_T = 8A.$

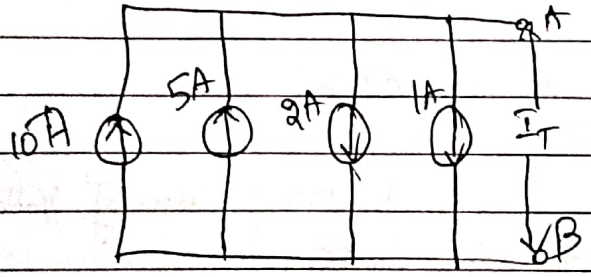
(6)



$I_T = 5 - 2$

$I_T = 3A$

(7)

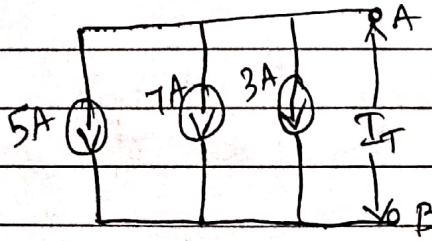


$\Rightarrow 10 + 5 - 2 - 1$

$\Rightarrow 15 - 3$

$I_T = 12A$

(8)



$I_T = -5 - 7 - 3$

$I_T = -15A$

(a) Kirchhoff's Current Law — KCL

(Current is not stored anywhere in a circuit)

* KCL States that the Sum of the Currents entering & leaving a node at any instant is equal to Zero.

(or)

* The Sum of Currents flowing towards a node is equal to Sum of the Currents flowing away from it.