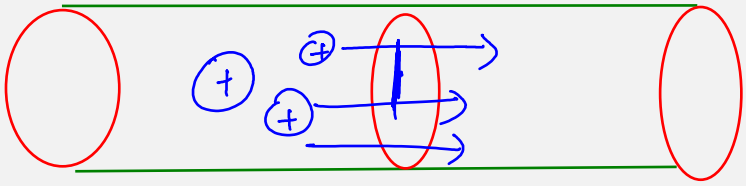
4.2.2 Electrical Current

The charge passing a point per unit time

$I = \frac{Q}{t}$



$A = \frac{C}{S}$

$Q = 20C$

$t = 2min$

$I = \frac{20}{120} = 0.17s$

$2.5A = I \quad Q = ?$

$t = 5s$

$\frac{Total\ charge}{time}$

Unit of Current

$2.5 = \frac{Q}{5}$ → Ampere (A)

$7.5C = Q$

$A = C/s$

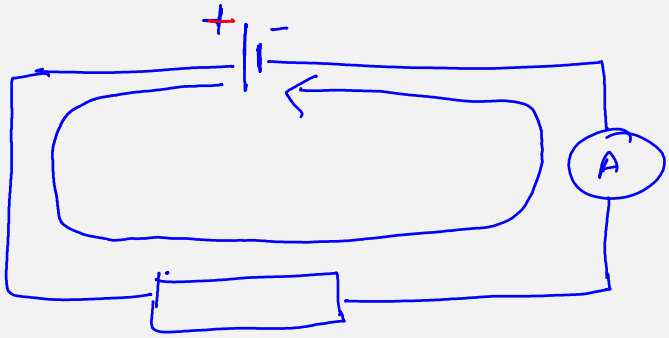
$unit\ of\ current = \frac{unit\ of\ charge}{unit\ of\ time}$

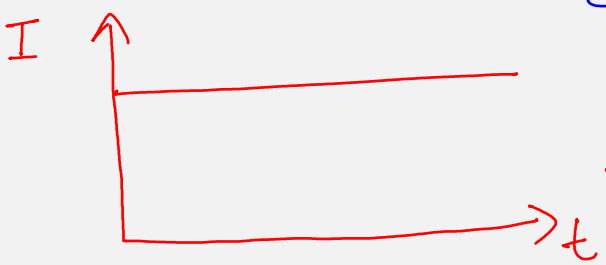
$A = \frac{C}{s}$

$5A \rightarrow \frac{5C}{1s}$

If one coulomb charge passes through a point in one second then current will be 1 Ampere

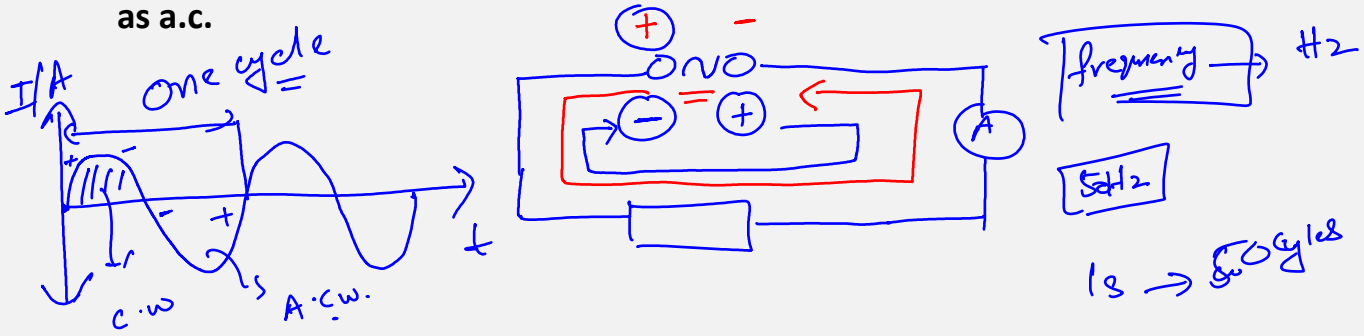
→ **Direct Current: Current that flows only on one direction is called as d.c.**



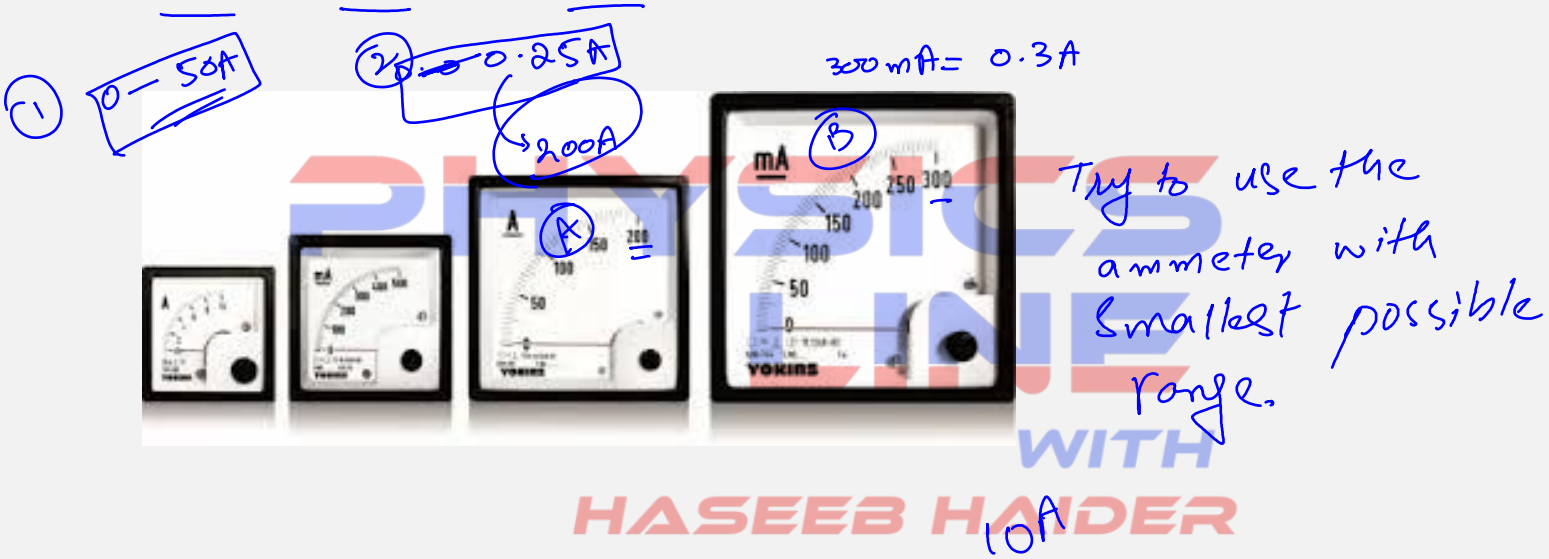


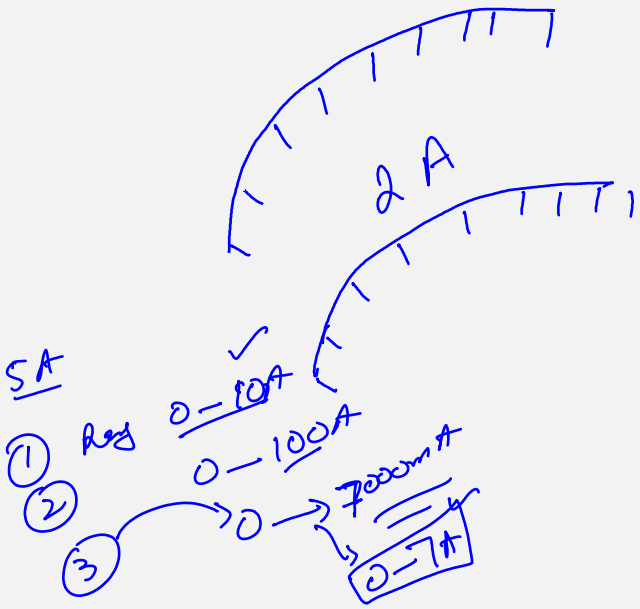
↑ always above x-axis

Alternating Current: Current that reverses its direction of flow regularly is called as a.c.



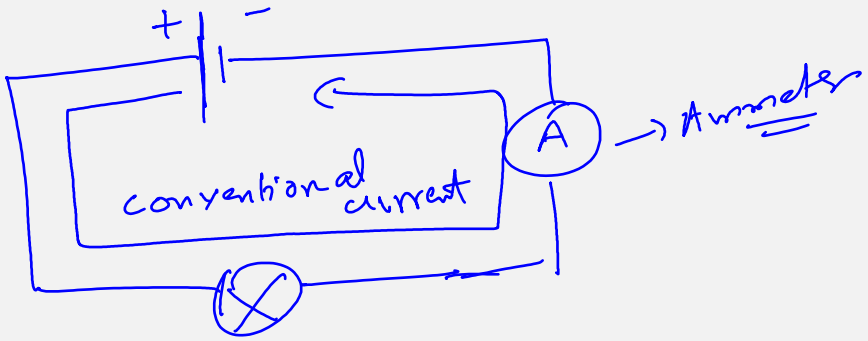
Ammeters (Analogue and Digital)





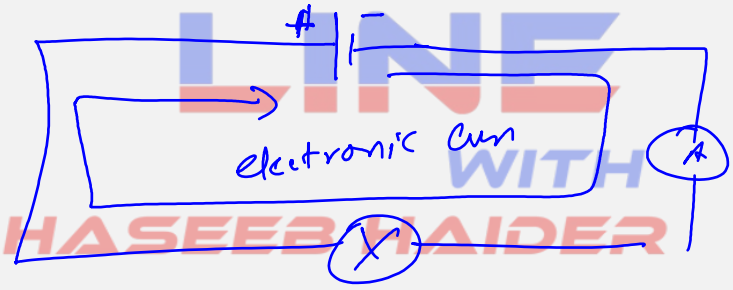
Conventional Current vs Flow of Electrons

Conventional Current is the flow of positive charges from the positive terminal of the source towards the negative terminal.



Electronic current

Is flow of electrons



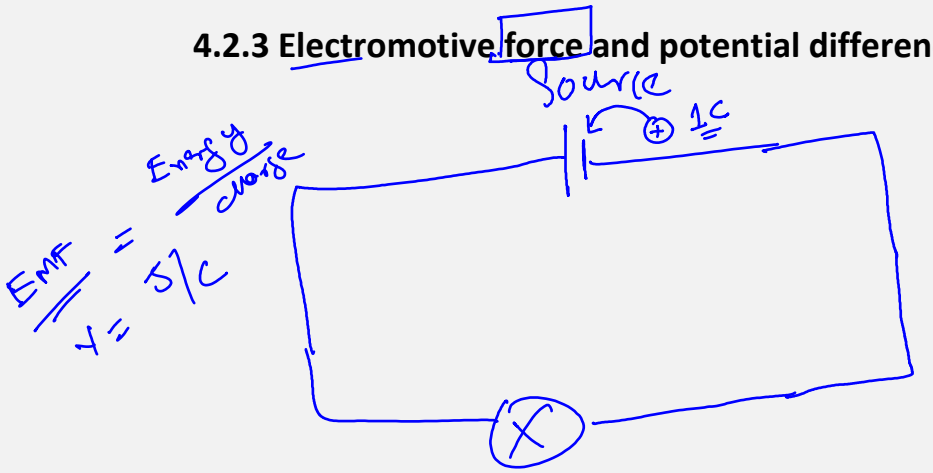
10 mA

effect of ne⁻ passing through a point

is the same

as of n protons flowing through the same point in same amount of time.

4.2.3 Electromotive force and potential difference



EMF is the electrical work done by a source in moving a unit charge around a complete circuit.

Source → charge

EMF

$$E = \frac{W}{Q}$$

Energy transferred

charge

unit => Volts (V)

$V = \frac{1J}{1C}$

EMF = 20V

Q = 2C

Energy = ?

$E = \frac{W}{Q}$

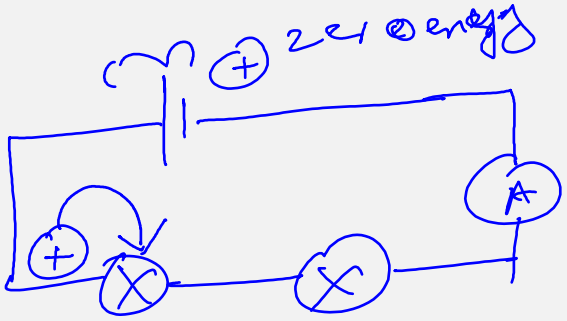
$20 = \frac{W}{2}$

W = 40J

Potential Difference is the work done by a unit charge passing through a component

$V = \frac{E}{Q}$

$PD = \frac{\text{Energy transferred}}{\text{charge}}$



Unit of EMF and PD

Volts = J/C

EMF vs W.D by the charge

PD W.D by the charge

Voltmeters

Range important

Fan 12V

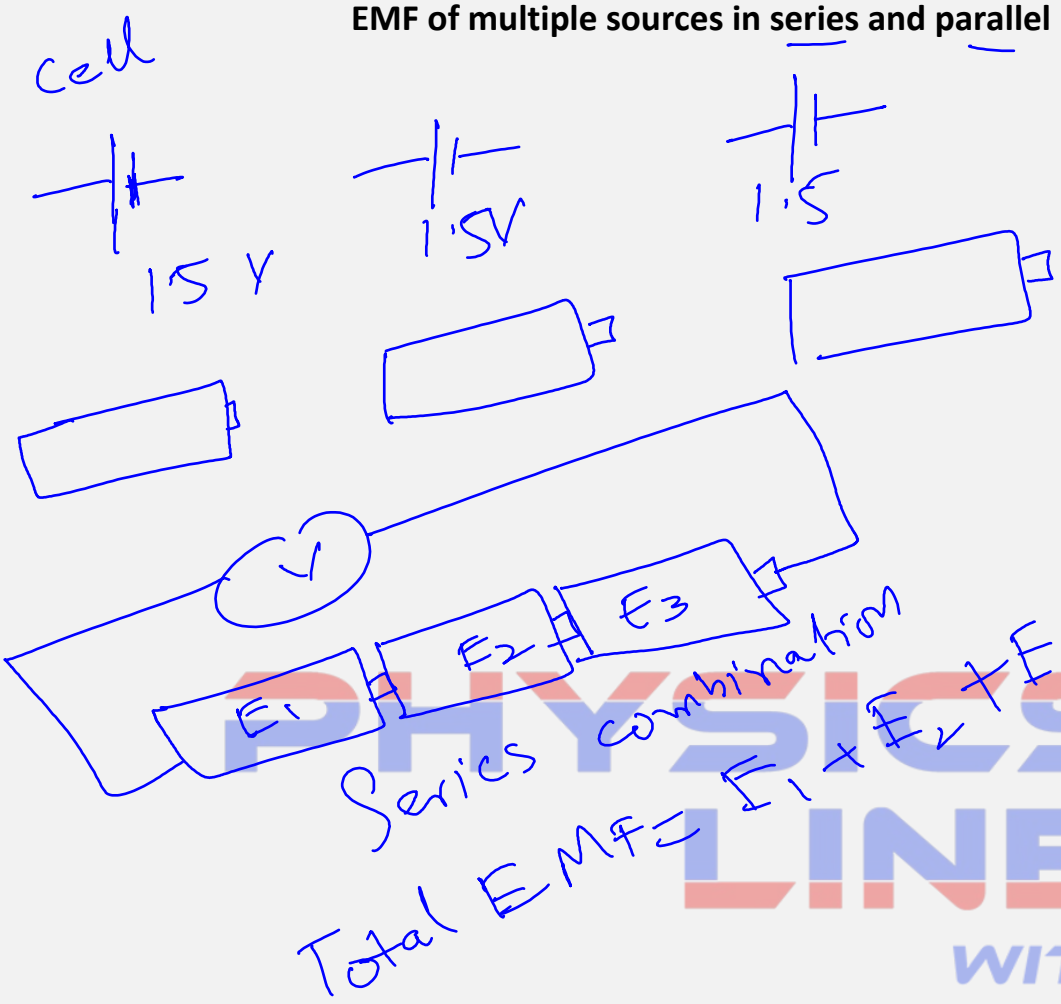
IC → 12V

F 2

220V

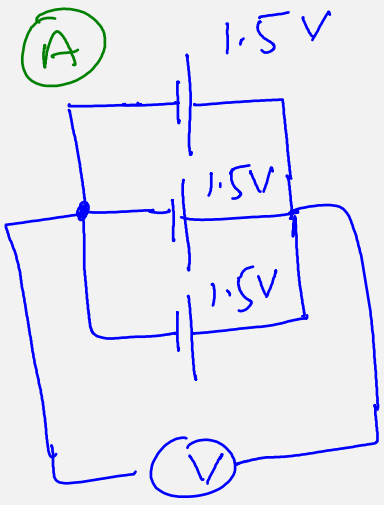
IC → 220V

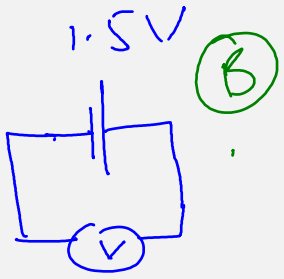
EMF of multiple sources in series and parallel



Parallel combination

Total EMF = EMF of one cell





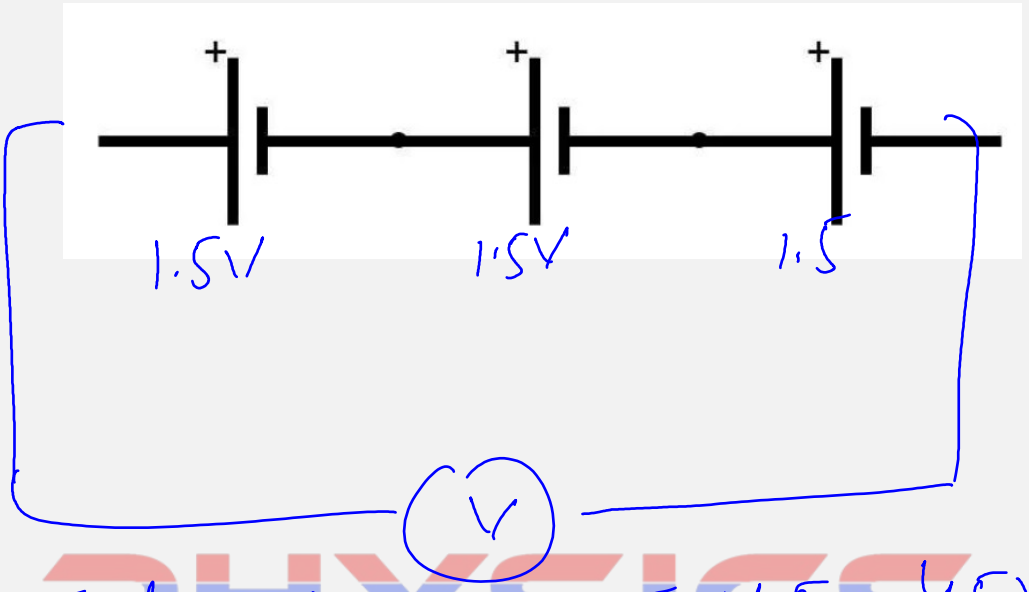
Benefit of connecting cells in parallel??

Takes longer to exhaust or provides maximum potential for longer period of time than a single cell of same emf

EMF in both A and B will be 1.5 V.

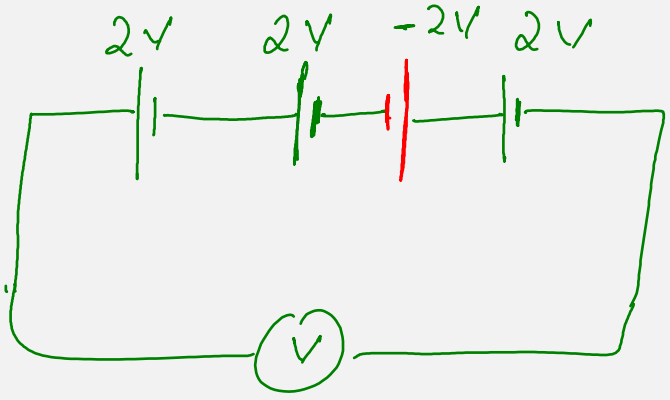
But Circuit A will last longer as only one of three cell will be used during one cycle.

When cells are connected in series we add the individual EMFs to get the total EMF



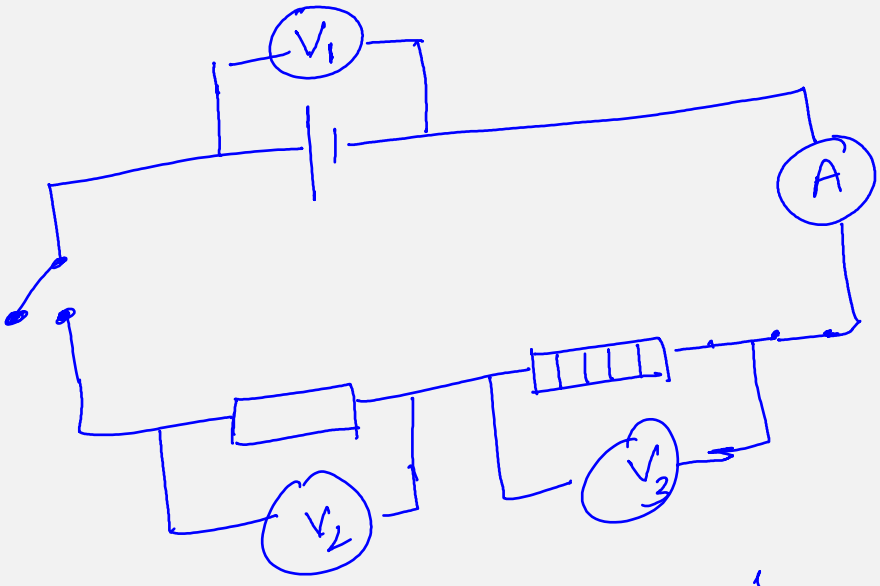
Total EMF = 1.5 + 1.5 + 1.5 = 4.5V

If one of the cells is connected the other way around then that cell causes a decrease in overall EMF



Total EMF = 2 + 2 - 2 + 2

= 4V



Series

V_1 → EMF → P.D across two components

$V_2 \& V_3$