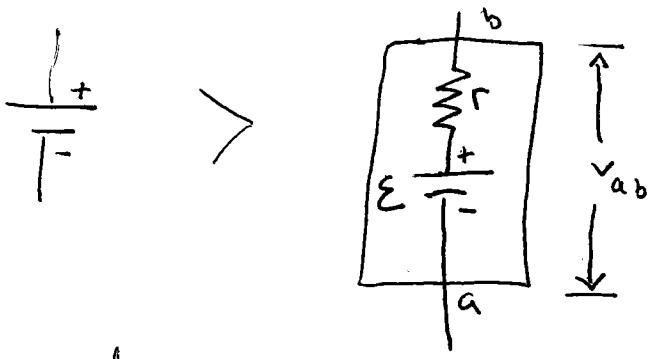
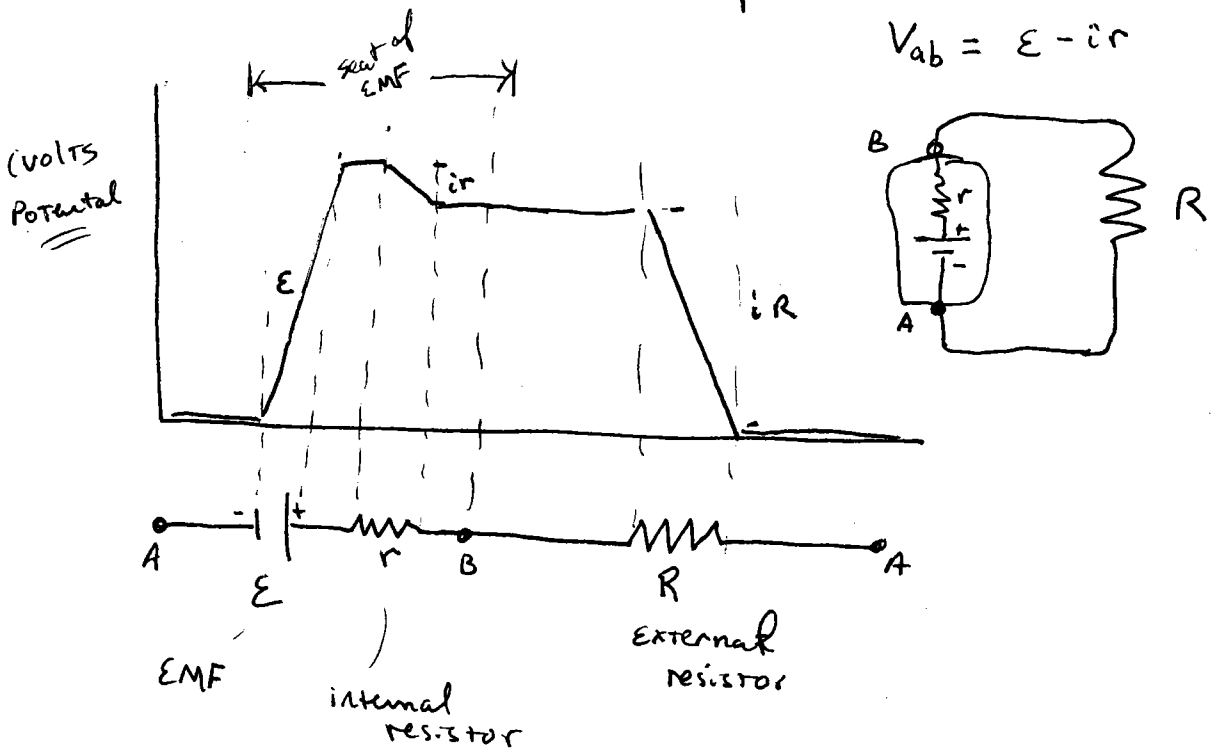
All batteries + Motors have a little internal Resistance



$V_{ab} = \varepsilon - ir$

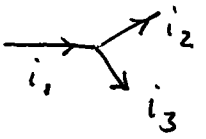


Kirchoff's Rules Apply to circuits:

1) When any closed-circuit loop is traversed, the Algebraic Σ of the changes in potential is zero.

2) At any junction point where the current can divide Current is conserved, i.e. Σ current in = Σ current out

e.g.

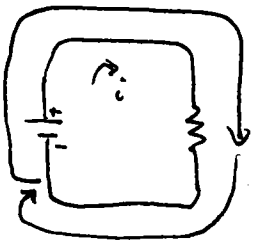


$i_1 = i_2 + i_3$

ΣV across closed loop in Circuit $= 0$

$\therefore \quad V - iR = 0$

$V = iR$



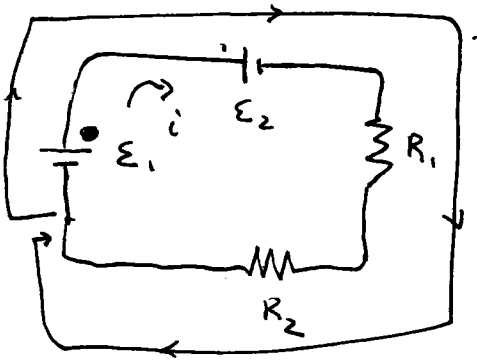
if Emf Traversed in direction of EMF during Σ Sign is +

" " " against " " " " " −

if resistor Traversed in direction of current

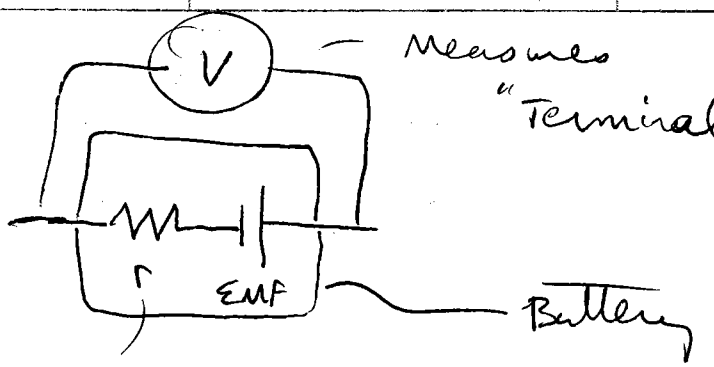
The sign of change in potential is −

Otherwise it is +



~ Path of Σ

$\mathcal{E}_1 - \mathcal{E}_2 - iR_1 - iR_2 = 0$



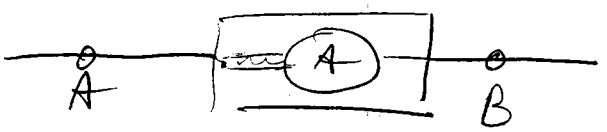
Voltmeter measures drop in potential across two points

Always connected in Parallel!

Large R keeps current flow negligible

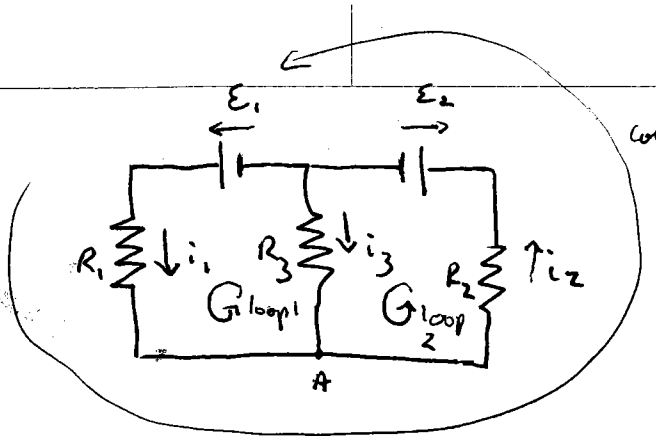
Ammeter measures current through a segment of wire.

Always connected in Series



All current goes thru it (low resistance

CAN burn up Voltmeters if you hook it up in series.



know values of $\mathcal{E}_1, \mathcal{E}_2, R_1, R_2, R_3$

Find i_1, i_2, i_3

NOTES:

→ Sometimes (like above) problem ignores internal resistance of battery

Flow with it ... but be on lookout for it

→ Choose directions for currents. It does NOT matter that you don't know actual directions (if you get it wrong at the start i will come out negative)

loop 1: $\mathcal{E}_1 - i_1 R_1 + i_3 R_3 = 0$ — I eqn

loop 2: $-\mathcal{E}_2 - i_3 R_3 - i_2 R_2 = 0$ — II eqn

loop 3: $\mathcal{E}_1 - i_1 R_1 - i_2 R_2 - \mathcal{E}_2 = 0$ NOT independent just sum of 1st two eqns

at pt A $i_1 + i_3 - i_2 = 0$ — III Eqn

3 equations, 3 unknowns can solve for i_1, i_2, i_3

[if one of the i's comes out negative then it tells you that your initial choice of direction for that i was incorrect]

With just i's and R's will get steady currents and voltages