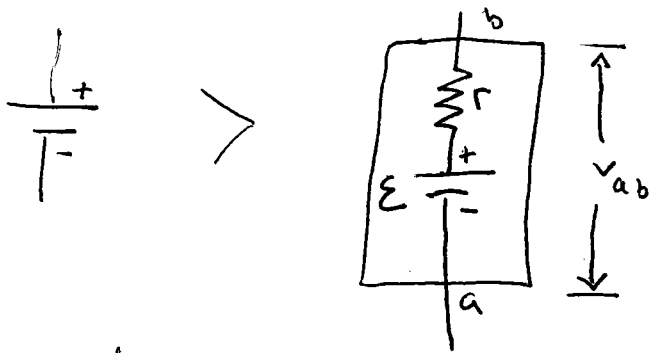
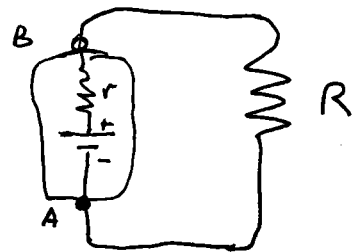
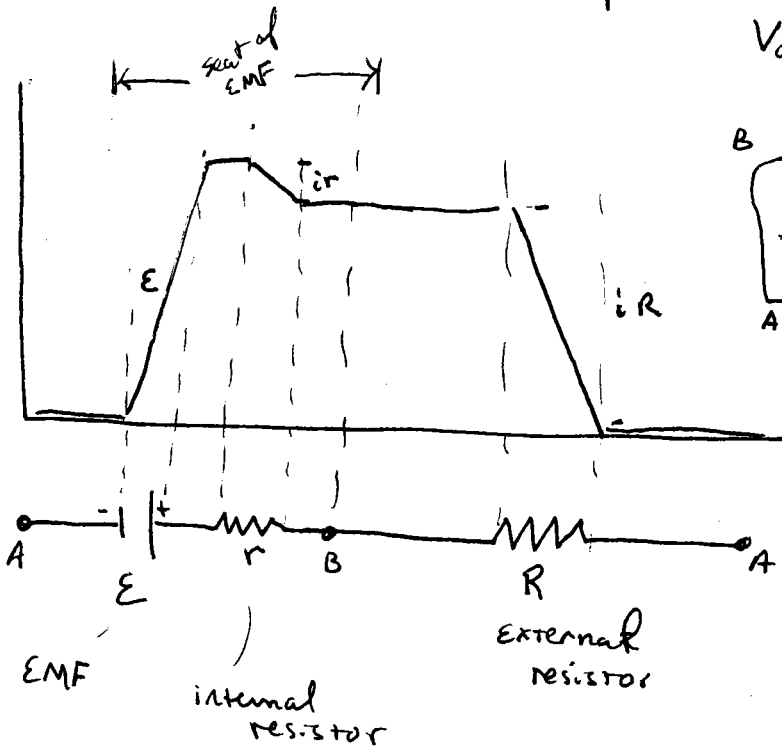


All batteries + Motors have a little internal resistance



$$V_{ab} = \epsilon - ir$$

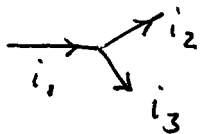
(Volts Potential)



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. $\Sigma \text{ current in} = \Sigma \text{ current out}$

e.g.

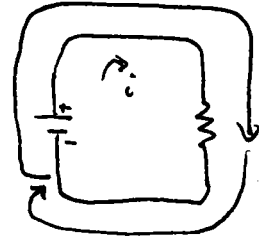


$$i_1 = i_2 + i_3$$

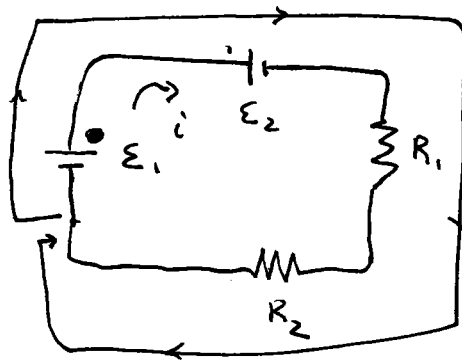
$\sum V$ across closed loop in circuit = 0

$\therefore V - iR = 0$

$V = iR$



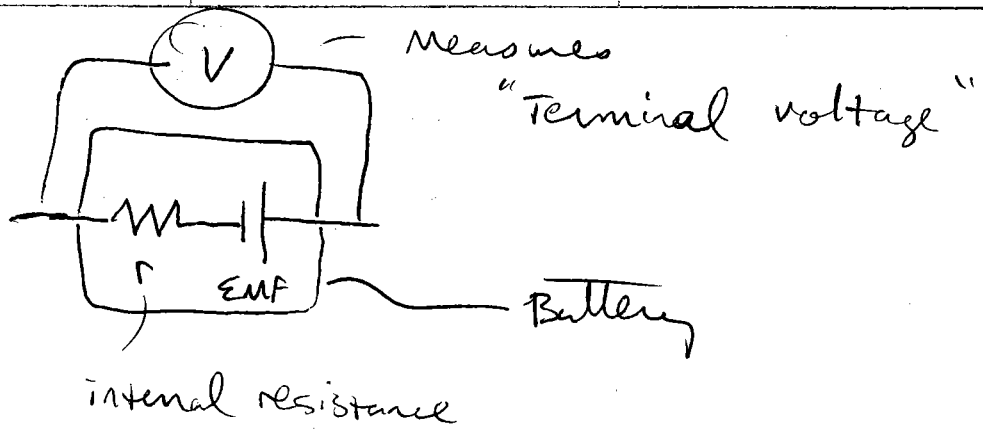
- if Emf traversed in direction of emf during \sum sign is +
- " " " " " " " " " " " " -
- if resistor traversed in direction of current
- The sign of change in potential is -
- otherwise it is +



$E_1 - E_2 - iR_1 - iR_2 = 0$

19-782 500 SHEETS, FILLER, 5 SQUARE
 42-381 50 SHEETS, EYE-EASER, 5 SQUARE
 42-382 100 SHEETS, EYE-EASER, 5 SQUARE
 42-383 200 SHEETS, EYE-EASER, 5 SQUARE
 42-384 100 SHEETS, EYE-EASER, 5 SQUARE
 42-385 100 RECYCLED WHITE, 5 SQUARE
 42-386 200 RECYCLED WHITE, 5 SQUARE
 MADE IN U.S.A.

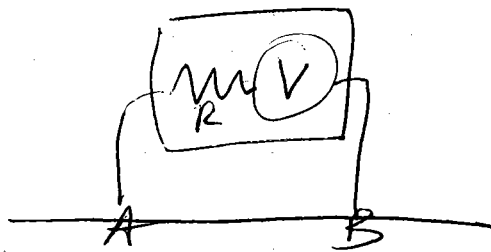




Voltmeter measures drop in potential across two points

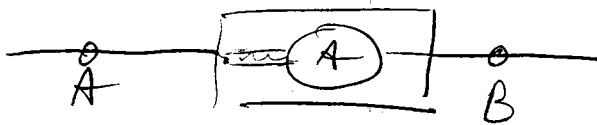
Always connected in Parallel!

Large R keeps current flow negligible



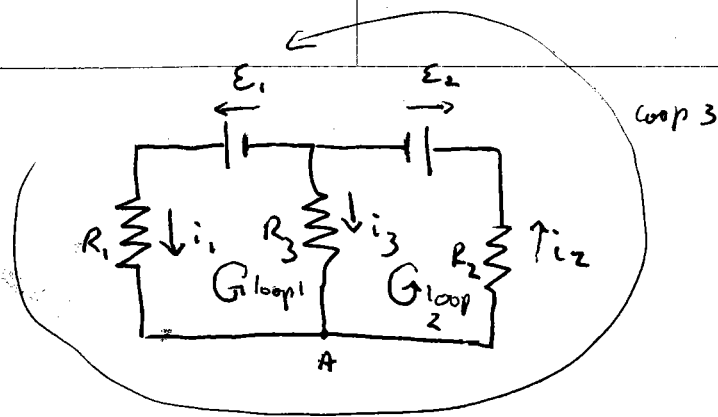
Ammeter measures current through a segment of wire.

Always connected in Series



All current goes thru it
(low resistance)

Can burn up Voltmeter if you hook it up in series.



Know values of E_1, 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:

$$E_1 - i_1 R_1 + i_3 R_3 = 0$$

I eqn

loop 2:

$$-E_2 - i_3 R_3 - i_2 R_2 = 0$$

II eqn

loop 3:

$$E_1 - i_1 R_1 - i_2 R_2 - E_2 = 0$$

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