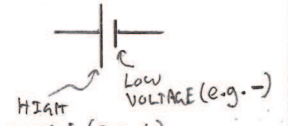
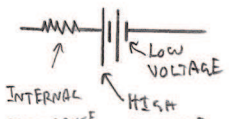
CIRCUITS

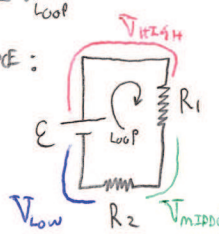
ELEMENT	SYMBOL	FUNCTION	RATING
IDEAL BATTERY		• SUPPLY A CONSTANT SOURCE OF VOLTAGE	"ELECTROMOTIVE FORCE" $\frac{[M][L]^2}{[T]^3[A]} \equiv \mathcal{E}$ MEASURED IN VOLTS "V"
REAL BATTERY		• SUPPLY A CONSTANT SOURCE OF VOLTAGE FOR A GIVEN CURRENT DRAW	• "ELECTROMOTIVE FORCE" $\equiv \mathcal{E}$ MEASURED IN VOLTS "V" WHEN NO CURRENT IS DRAWN • "INTERNAL RESISTANCE" $\equiv r \approx$ CONSTANT
RESISTOR		• CONTROL AMOUNT OF CURRENT IN A CIRCUIT • U^E OF CHARGE CARRIERS TRANSFORMS INTO E^{TH} OF RESISTOR	RESISTANCE $\frac{[M][L]^2}{[A]^2[T]^3} \equiv R$ MEASURED IN OHMS "Ω"
LIGHT BULB		• PRODUCE VISIBLE LIGHT • U^E OF CHARGE CARRIERS TRANSFORMS INTO $E^{TH} + E^{LIGHT}$ • THE INCREASE IN TEMP OF THE FILAMENT ENSURES VISIBLE LIGHT IS EMITTED VIA THERMAL RADIATION	POWER $\frac{[M][L]^2}{[T]^3} \equiv P$ MEASURED IN WATTS "W" AT A SPECIFIC ΔV ◦ IDEAL LIGHT BULB ASSUME R = CONST.
CAPACITOR		• STORES U^E FOR LATER USE	CAPACITANCE $\frac{[A]^2[T]^4}{[M][L]^2} \equiv C$ MEASURED IN FARADS "F" • RATIO OF CHARGE ON 2 CONDUCTORS TO THE VOLTAGE DIFFERENCE ACROSS THEM $C = \frac{Q}{\Delta V}$
WIRE		• PATHWAY FOR CHARGE CARRIERS TO MOVE	• IDEAL WIRE : $R = 0$ • REAL WIRE : $R = \frac{\rho L}{A}$
SWITCH		• MOVABLE WIRE IN CIRCUIT CONTROLLED BY USER TO COMPLETE OR BREAK A CIRCUIT	
GROUND		• THE COMMON CONDUCTOR IN A CIRCUIT WHERE THE CHANGE IN VOLTAGE IS REFERENCED TO • RECALL THAT U^E AND V ARE ARBITRARY, ONLY CHANGES IN THEM ARE MEANINGFUL, THUS GROUND IS ANALOGOUS TO SETTING A ZERO POINT	

CIRCUIT TOOLS

• KIRCHOFF'S VOLTAGE LOOP LAW (CONSERVATION OF ENERGY)

◦ $\sum \Delta V_{LOOP} = 0$

◦ EXAMPLE :



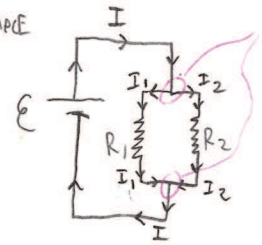
$\Delta V_{BATTERY} + \Delta V_{R1} + \Delta V_{R2} = 0$

$+\mathcal{E} - IR_1 - IR_2 = 0$

• KIRCHOFF'S JUNCTION RULE (CONSERVATION OF CHARGE)

◦ $\sum I_{IN} = \sum I_{OUT}$

◦ EXAMPLE



2 JUNCTIONS

BUT ONLY ONE UNIQUE EQUATION

$I = I_1 + I_2$

• OHM'S LAW

◦ $\Delta V = IR$

• POWER DISSIPATED OR SUPPLIED BY ELEMENTS IN A CIRCUIT

RESISTORS, LIGHT BULBS — BATTERIES

• POWER $= \frac{\text{ENERGY}}{\text{TIME}} \equiv P$

◦ RECALL $I = \frac{\Delta Q}{\Delta t}$ AND $\Delta U^E = Q \Delta V$

$I = \frac{\Delta U^E}{\Delta V \, \Delta t} \rightarrow \frac{\Delta U^E}{\Delta t} = I \Delta V$

$$P = I\Delta V = \frac{\Delta V^2}{R} = I^2 R$$

USEFUL WHEN ΔV = CONSTANT

USEFUL WHEN I = CONSTANT