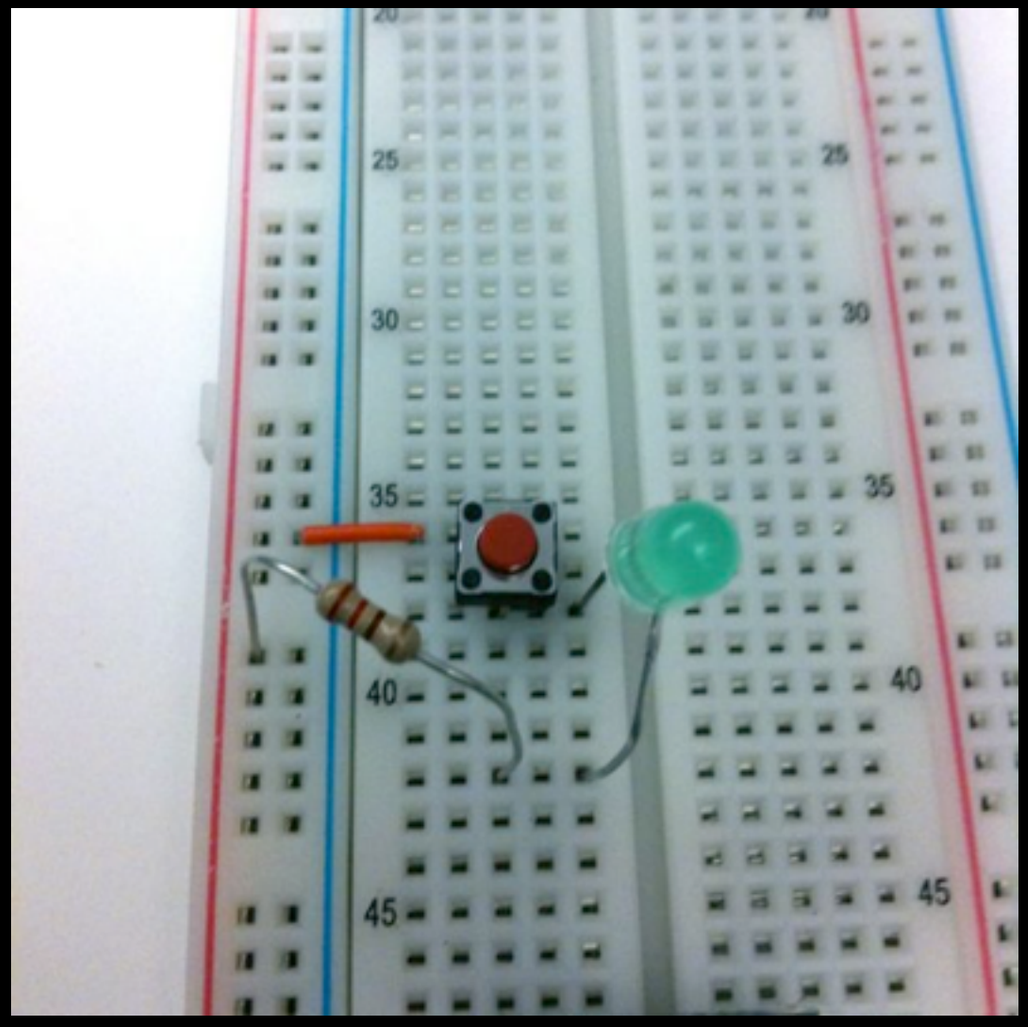
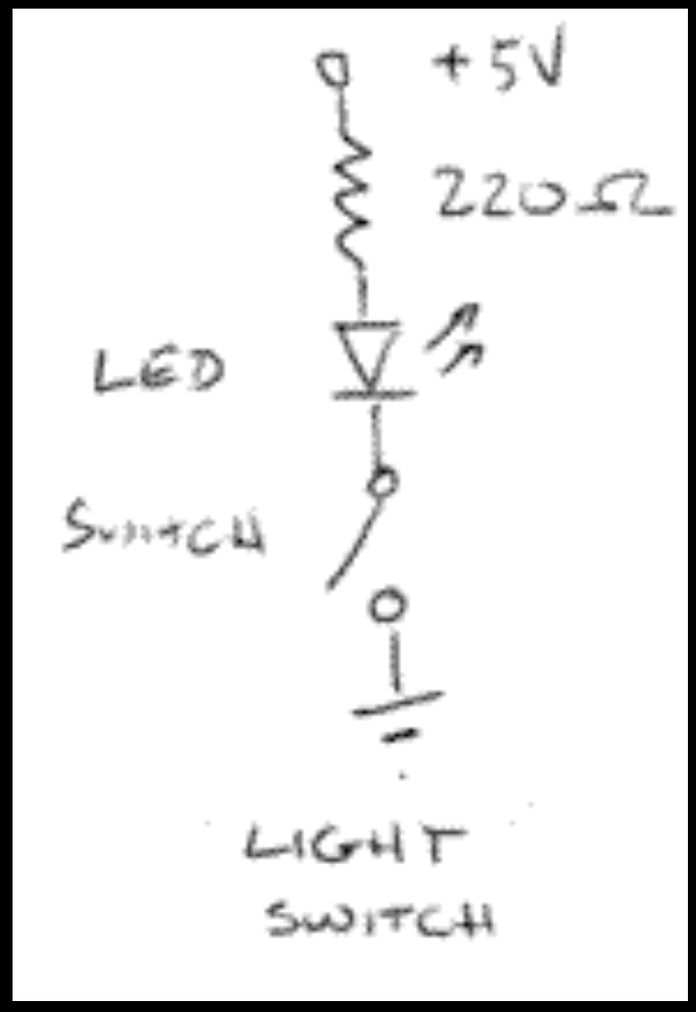
Power, Circuits & Schematics

Press Play: Interactive Device Design | March 30, 2011

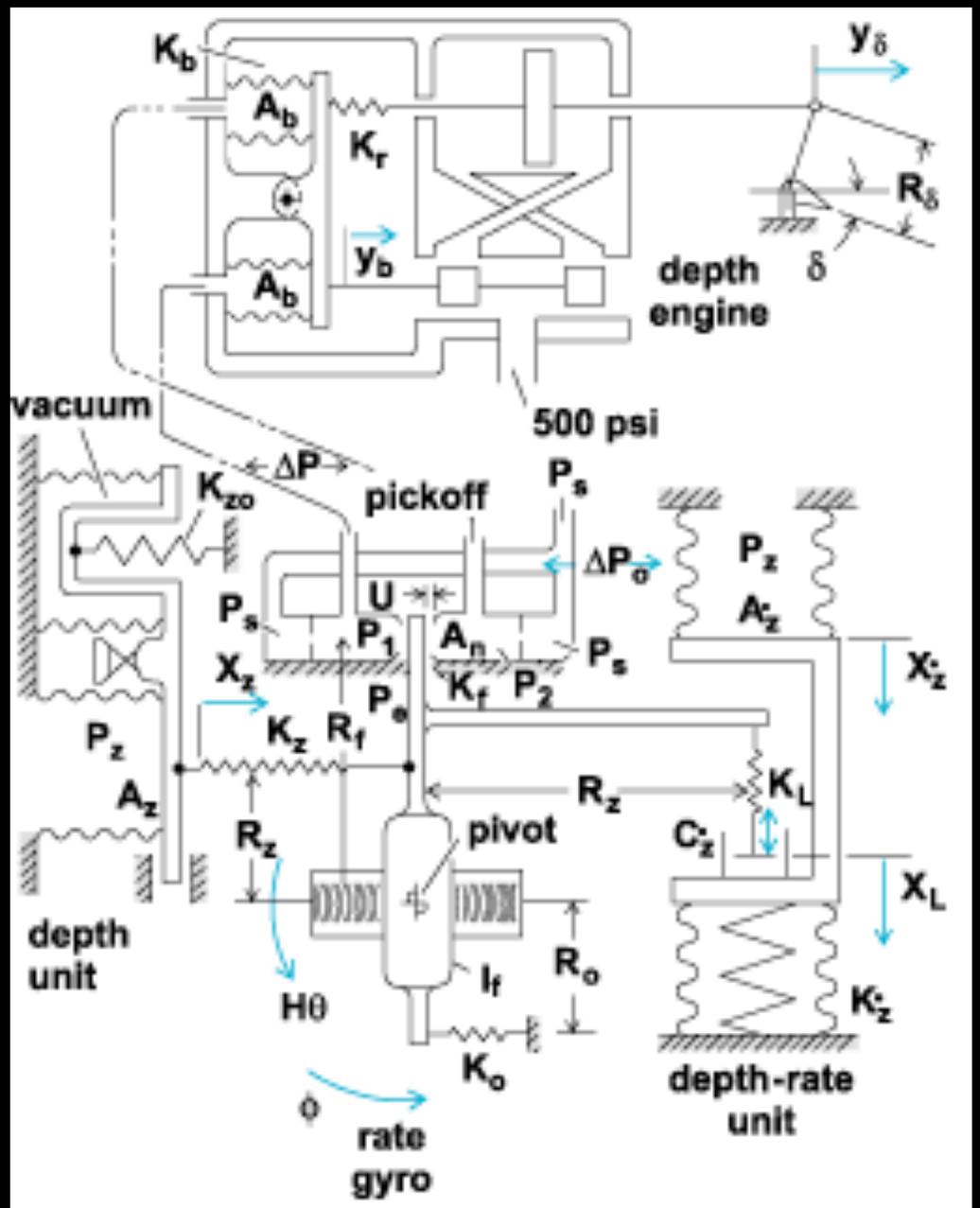
Abstraction

images from solo2.abac.com/themole/geo_tubemap.gif





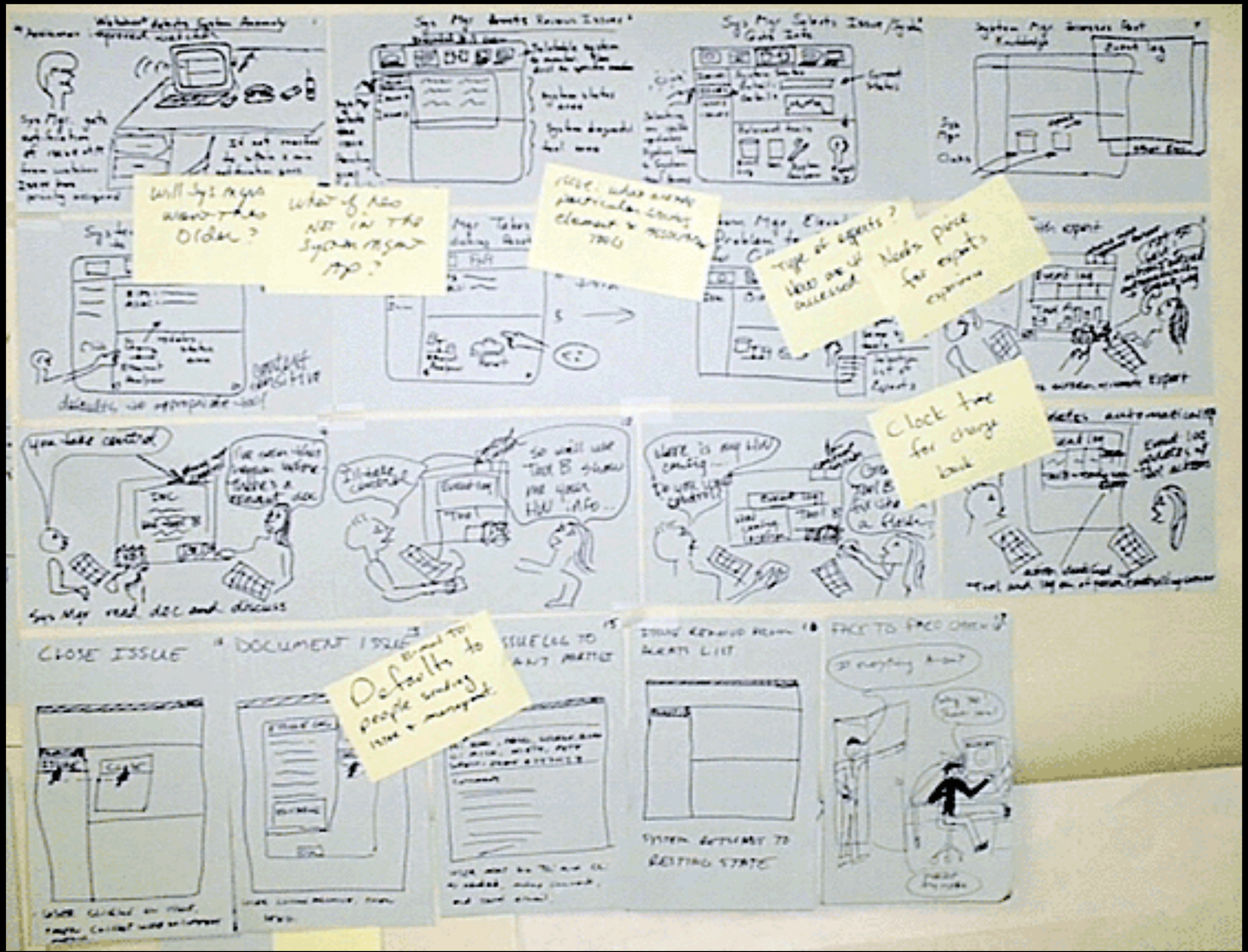
images from http://gizmolab.pbworks.com/Arduino-Tutorial-1%3A-Buttons-and-LEDs



Subscripts:

b = differential–pressure bellows
e = environment
f = flapper
L = depth-rate linkage
n = nozzles
o = ground, or reference
r = ram feedback
s = supply
z = depth unit
$\dot{z}$ = depth-rate unit
δ = elevator

images from http://www.answers.com/topic/schematic-diagram-graphic-arts



images from www.sapdesignguild.org/

Circuits

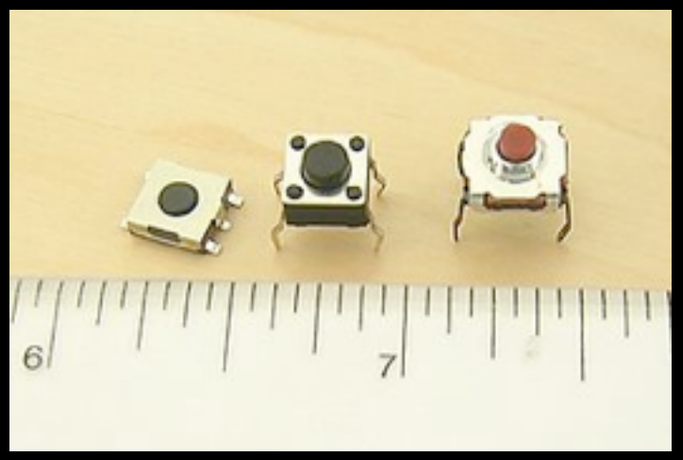
Common Components | Voltage | Current | Resistance

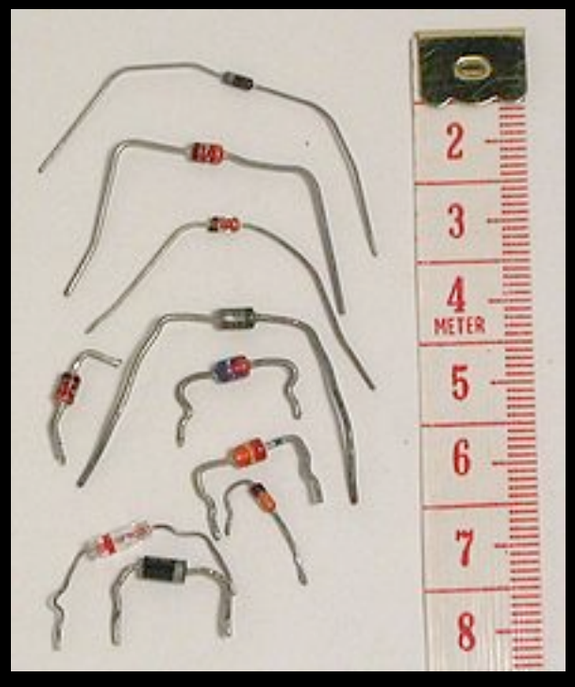
Ohms Law | Watt's Law | Series and Parallel Circuits

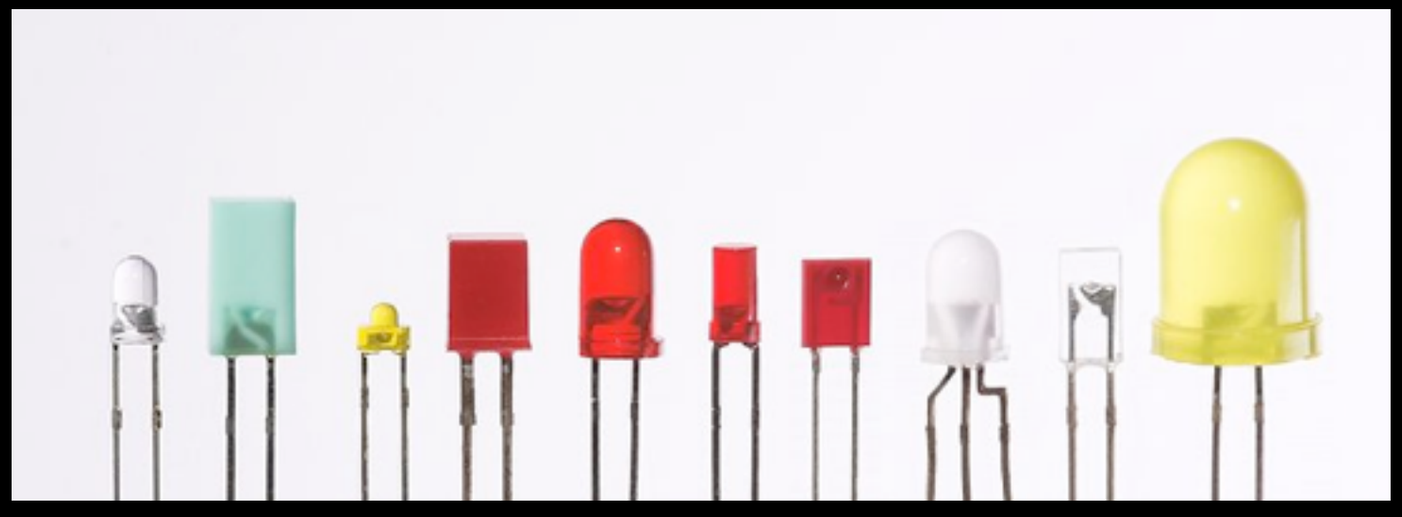
Voltage Divider | Pull-up and Pull-down circuits

Electrical circuits are networks of electrical elements that contain a closed loop which allows electrons to flow through the elements.

Examples of Electrical Components







images from Wikipedia

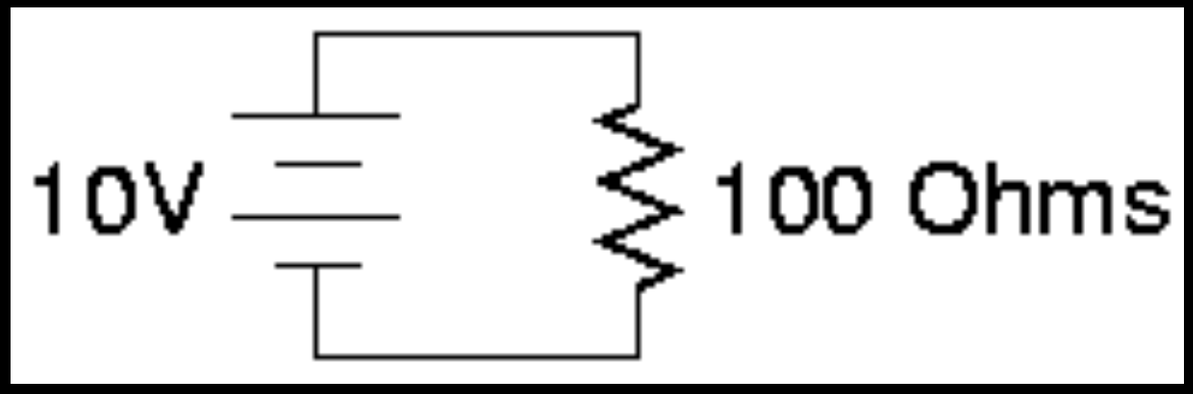
Current (measured in Amperes or Amps) is the quantity of electrons passing through a point in a circuit.

Voltage (measured in Volts) is the potential difference in electrical charge between two points in a circuit.

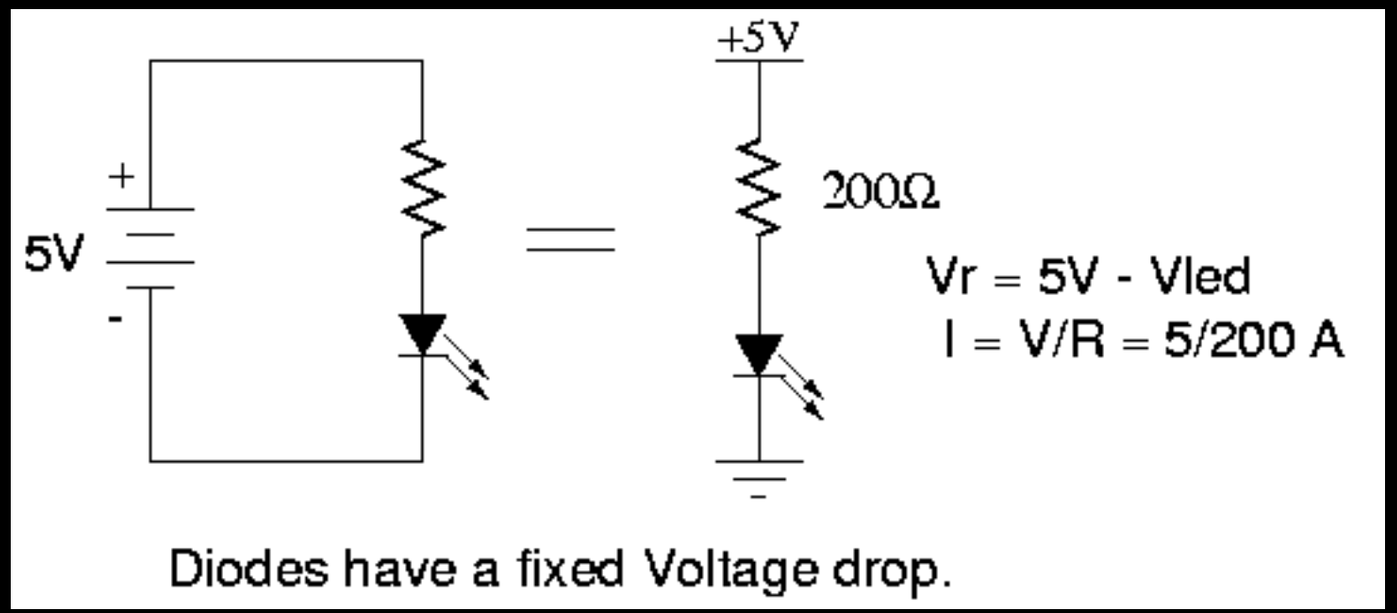
Resistance (measured in Ohms) is the capacity of a circuit element to impede the flow of electrons in an electrical circuit.

Ohm's Law states that Voltage = Current X Resistance

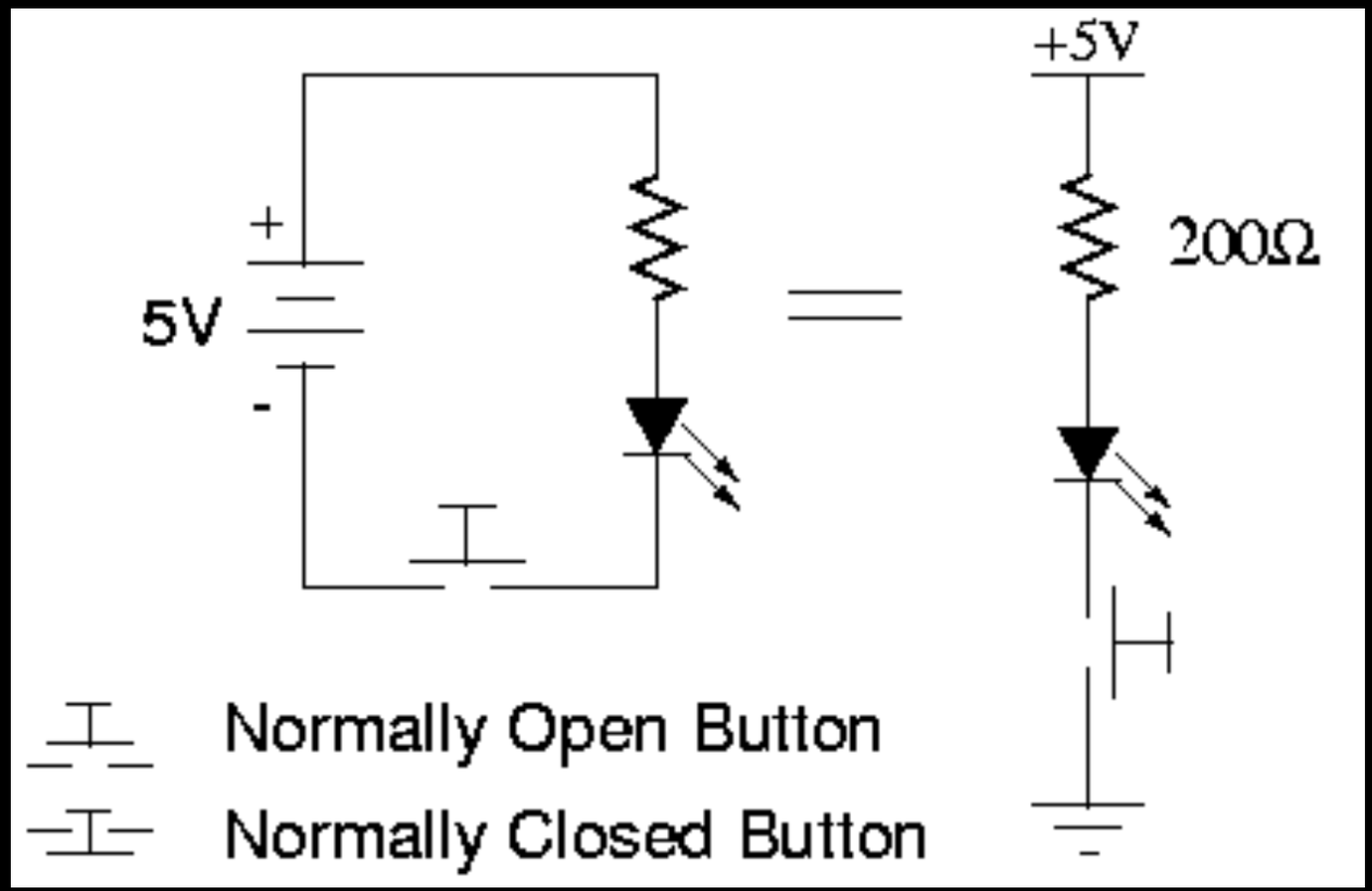
$$V=IR$$



Example: Button LED circuit



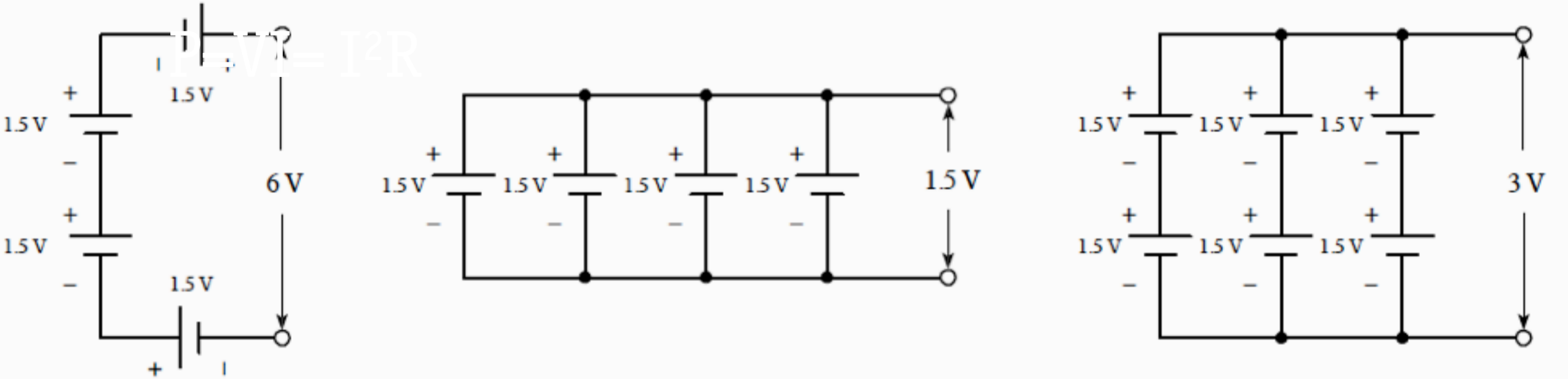
Example: Button LED circuit



Watt's Law states that Power = Voltage x Current

$P=VI= I^2R$

Power can come from supplies or batteries.



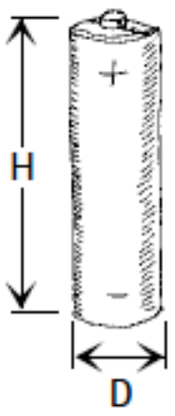
Increasing the voltage

Increasing the capacity

Increasing both voltage and capacity

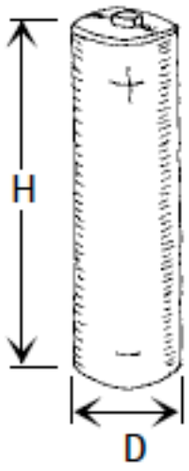
Common Alkaline and Carbon Zinc Cells

1.5V "AAA"



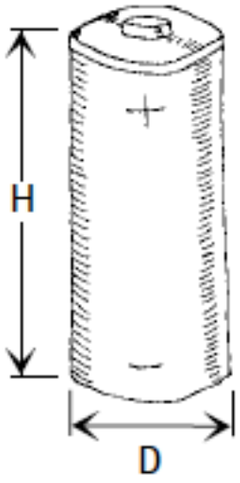
D	H
0.41" ($\frac{13}{32}$")	1.75" ($1\frac{31}{32}$")

1.5V "AA"



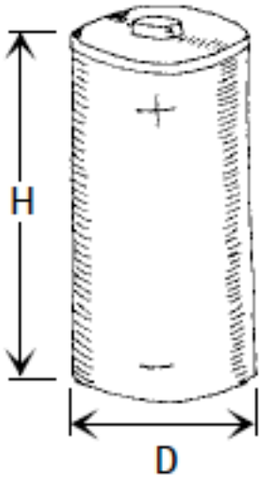
D	H
0.56" ($\frac{9}{16}$")	1.97" ($1\frac{31}{32}$")

1.5V "C"



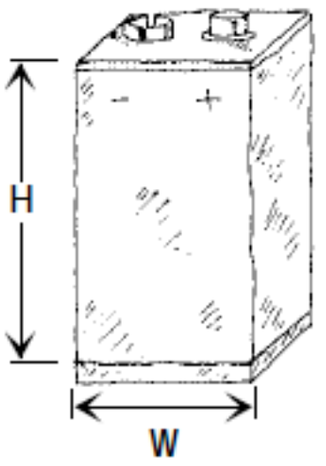
D	H
1.02" ($1\frac{1}{64}$")	1.97" ($1\frac{31}{32}$")

1.5V "D"



D	H
1.32" ($\frac{11}{32}$")	2.39" ($2\frac{27}{64}$")

"9V"



W	L	H
1.03" ($\frac{13}{32}$")	0.65" ($\frac{11}{16}$")	1.91" ($1\frac{15}{16}$")

Lithium

Voltage:
1.55 to 6V
Diameter:
0.460 t0 0.965"
Thicknesses:
0.079" to 0.990"
mAh:
60 to 250 mAh
Label:
Given in I.E.C. number (e.g., CRXXXX or BRXXXX)

Zinc air

Voltage:
1.15 to 1.4V
mAh:
70 to 600 mAh
Labels:
ZAXXX

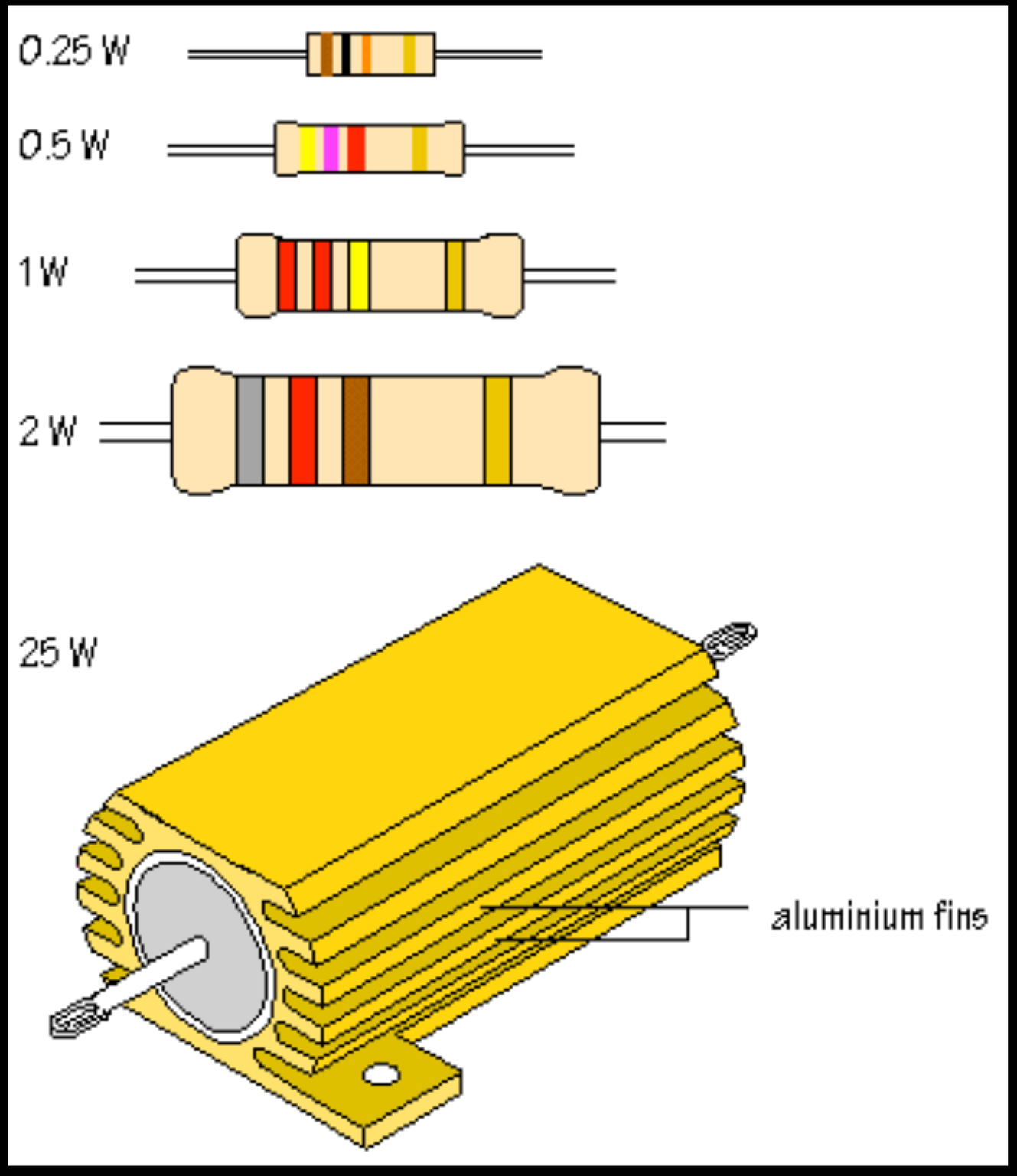
Mercury

Voltage:
1.35 to 5.6V
Diameter:
0.5 to 0.695"
Thicknesses:
0.135" to 0.845"
mAh:
80 to 1000 mAh

Silver oxide

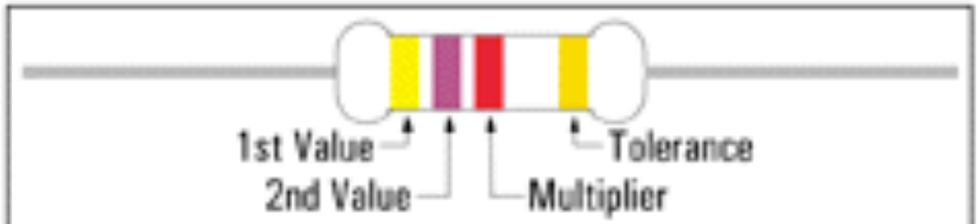
Voltage:
1.55V
Diameter:
0.267 to 0.610"
Thicknesses:
0.81" to 0.210"
mAh:
15 to 250 mAh
Label:
Given in I.E.C. number (e.g., SRXX)

5V DC to DC Step Up - 1xAA



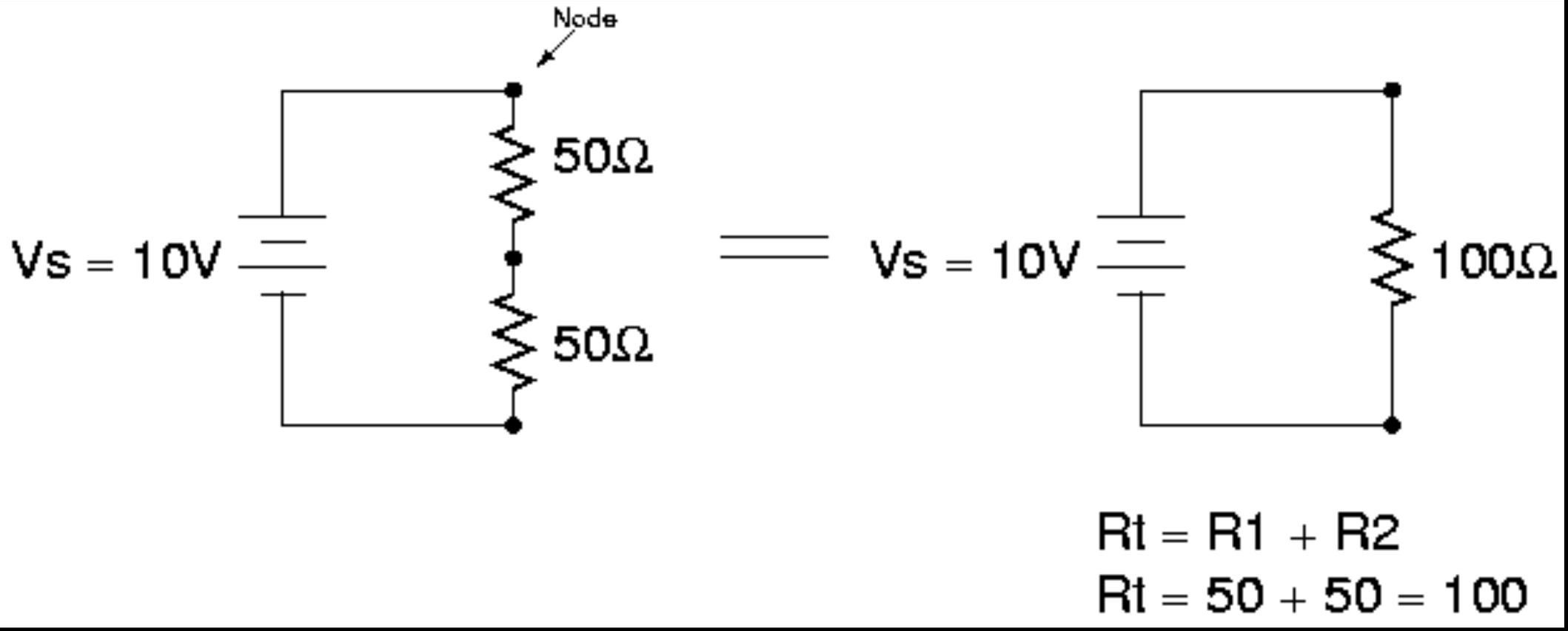
images from www.steiniche.dk/.../resistors-filer

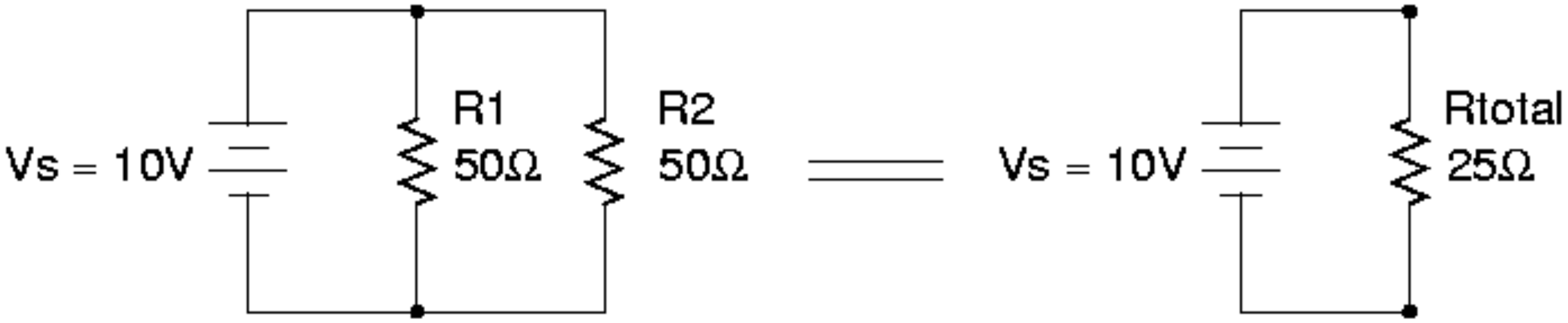
READING RESISTANCE VALUES



Example: 4 7 x100 –5%
4700Ω–5%

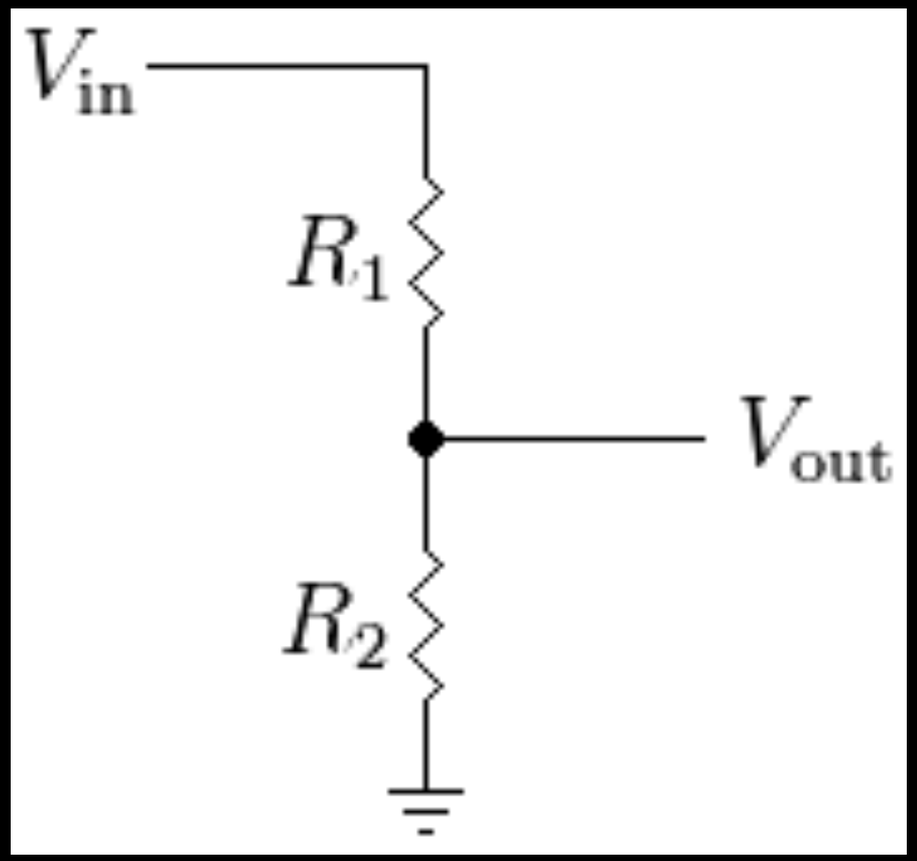
COLOR	VALUE	MULTIPLIER	TOLERANCE
Black	0	1	-
Brown	1	10	–1%
Red	2	100	–2%
Orange	3	1K	-
Yellow	4	10K	-
Green	5	100K	–.5%
Blue	6	1M	–.25%
Violet	7	10M	–.1%
Gray	8	100M	–.05%
White	9	1000M	-
Gold	-	1/10	–5%
Silver	-	1/100	–10%
None	-	-	–20%


Node
50Ω
Vs = 10V
50Ω
Vs = 10V
100Ω
Rt = R1 + R2
Rt = 50 + 50 = 100



For Parallel Circuits:

Rtotal = (R1 * R2) / (R1 + R2)


V_{in}
R_1
V_{out}
R_2