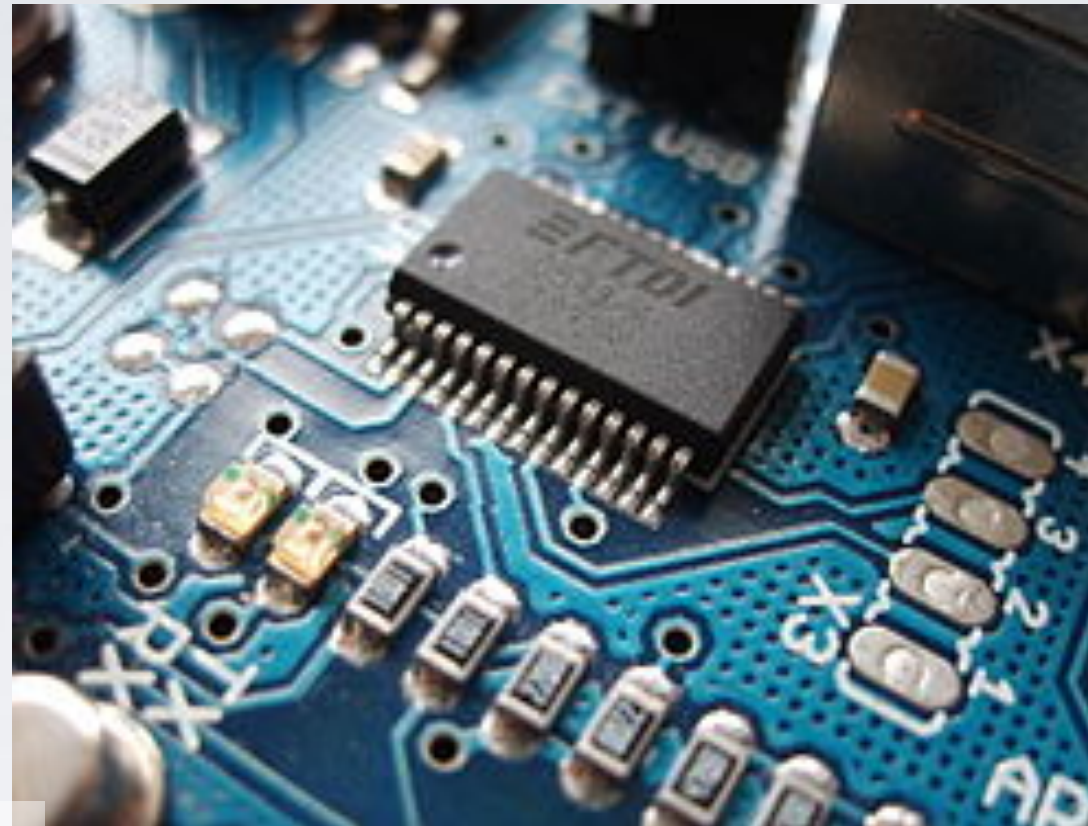


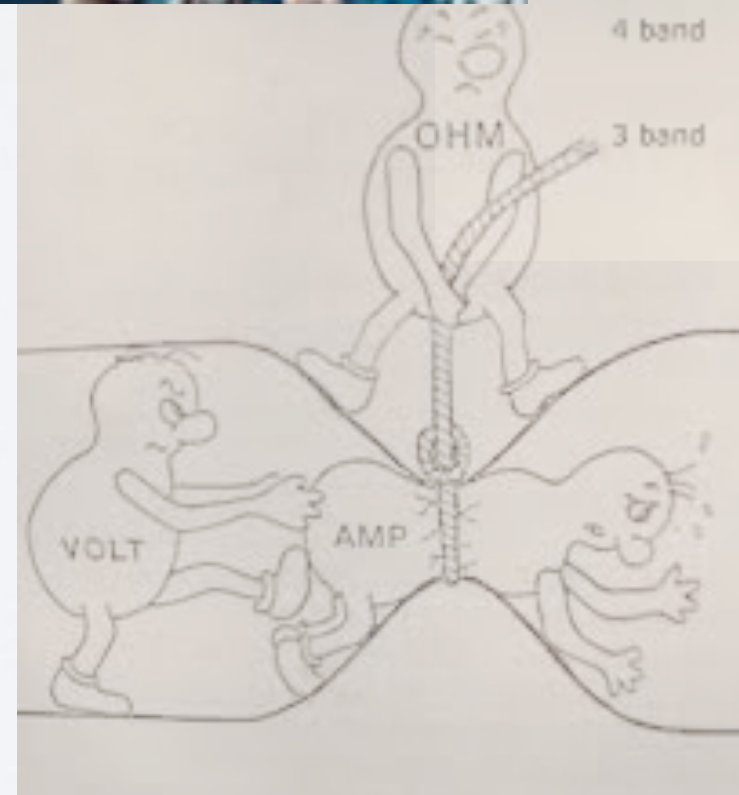
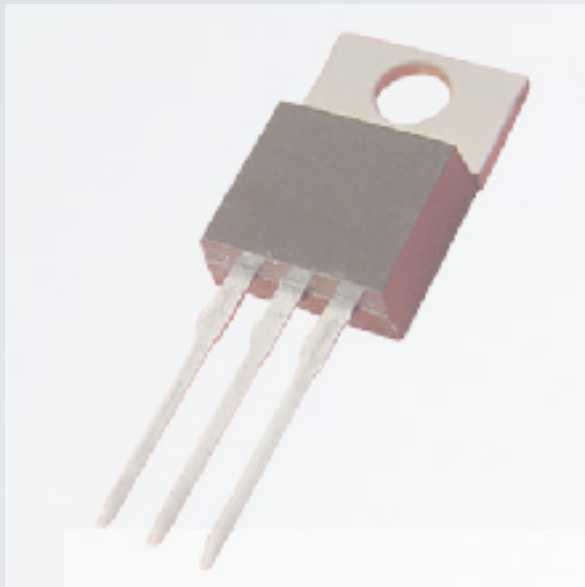
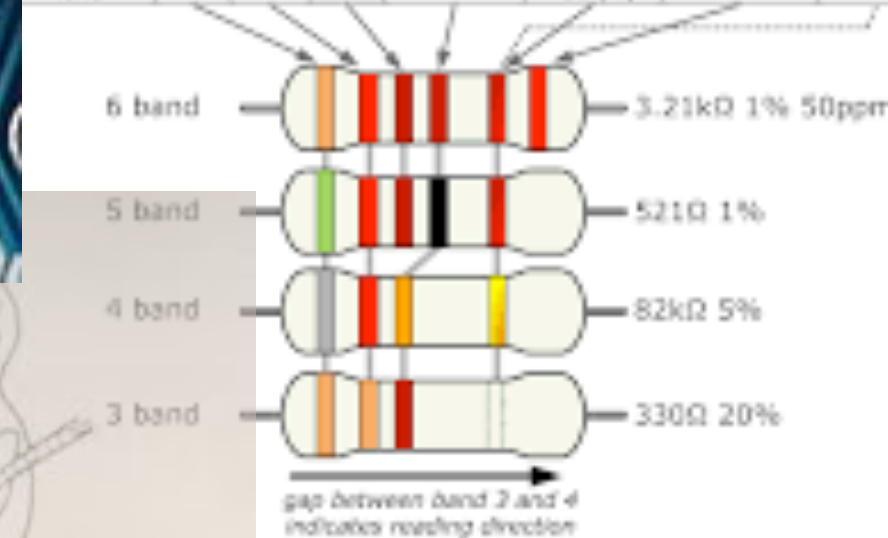
# Introduction to Electronics

## Artscience BA1 2019-2020



www.resistorguide.com

Color	Significant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/°C)	Fail R. (%)
black	0	0	0	x 1		250 (U)	
brown	1	1	1	x 10	1 (F)	100 (S)	1
red	2	2	2	x 100	2 (G)	50 (R)	0.1
orange	3	3	3	x 1K		15 (P)	0.05
yellow	4	4	4	x 10K		25 (Q)	0.005
green	5	5	5	x 100K	0.5 (D)	20 (Z)	
blue	6	6	6	x 1M	0.25 (C)	10 (Y)	
violet	7	7	7	x 10M	0.1 (B)	5 (M)	
grey	8	8	8	x 100M	0.05 (A)	1 (K)	
white	9	9	9	x 10			
gold	7th digit only for 5 and 6 bands			x 0.1	5 (J)		
silver				x 0.01	10 (H)		
none					20 (M)		



My name: Lex van den Broek

Head of the Electronics Workshop. Teacher introduction to Electronics.



<http://ewp.koncon.nl>

### **Borrowing of electronic equipment**

(recorders, microphones, interfaces, amplifiers, cables, speakers, ...)

### **Maintenance of all electronic studio's**

(Sonology, ArtofSound, Composition studio's ...)

### **Technical advice**

(repairs, electronic problem solving, ...)

### **Electronic development, guiding (exam) projects,**

(electronic design, prototyping, building, documenting ...)

### **Place for working on your own project**

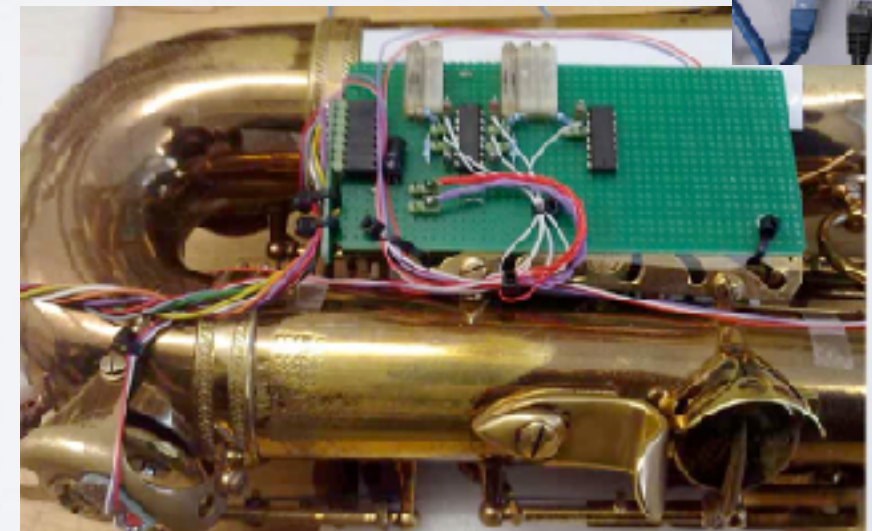
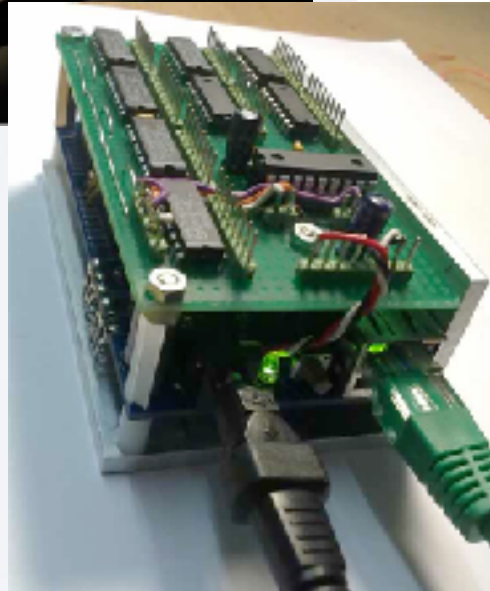
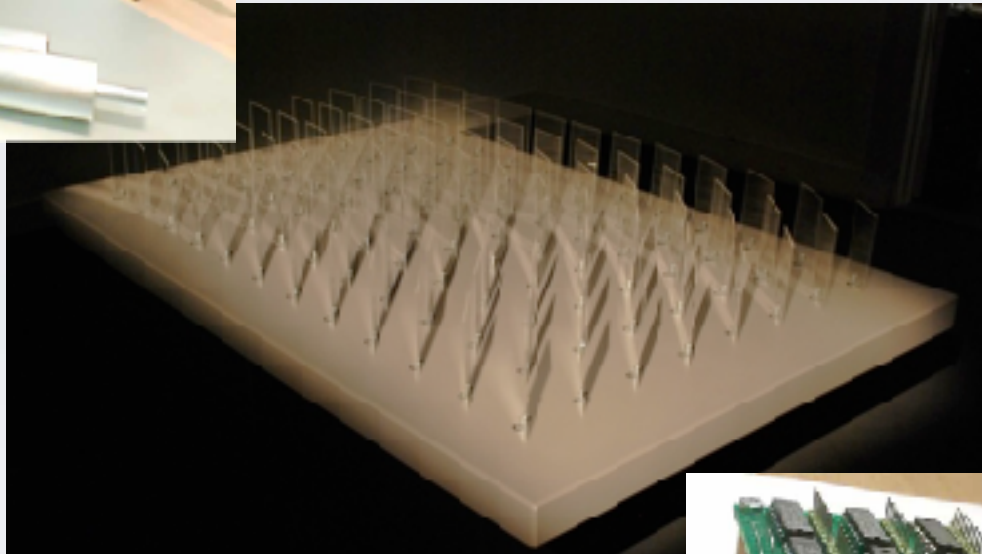
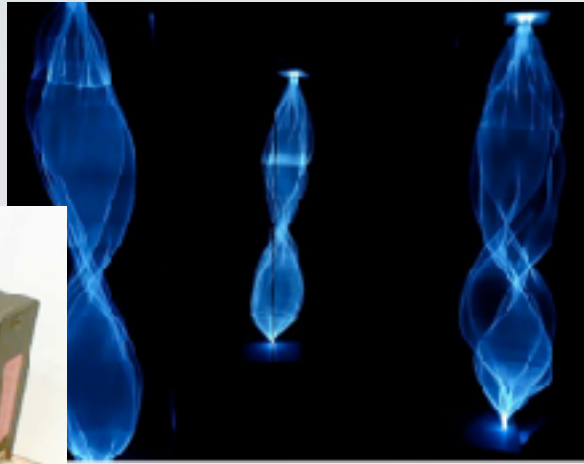
(building, testing and measuring your own electronics with expert help and good tools...)

### **Sound reinforcement for all concerts within the Conservatory**

(PA, digital mixing, stage, ...)



Some project examples:



# Introduction to Electronics



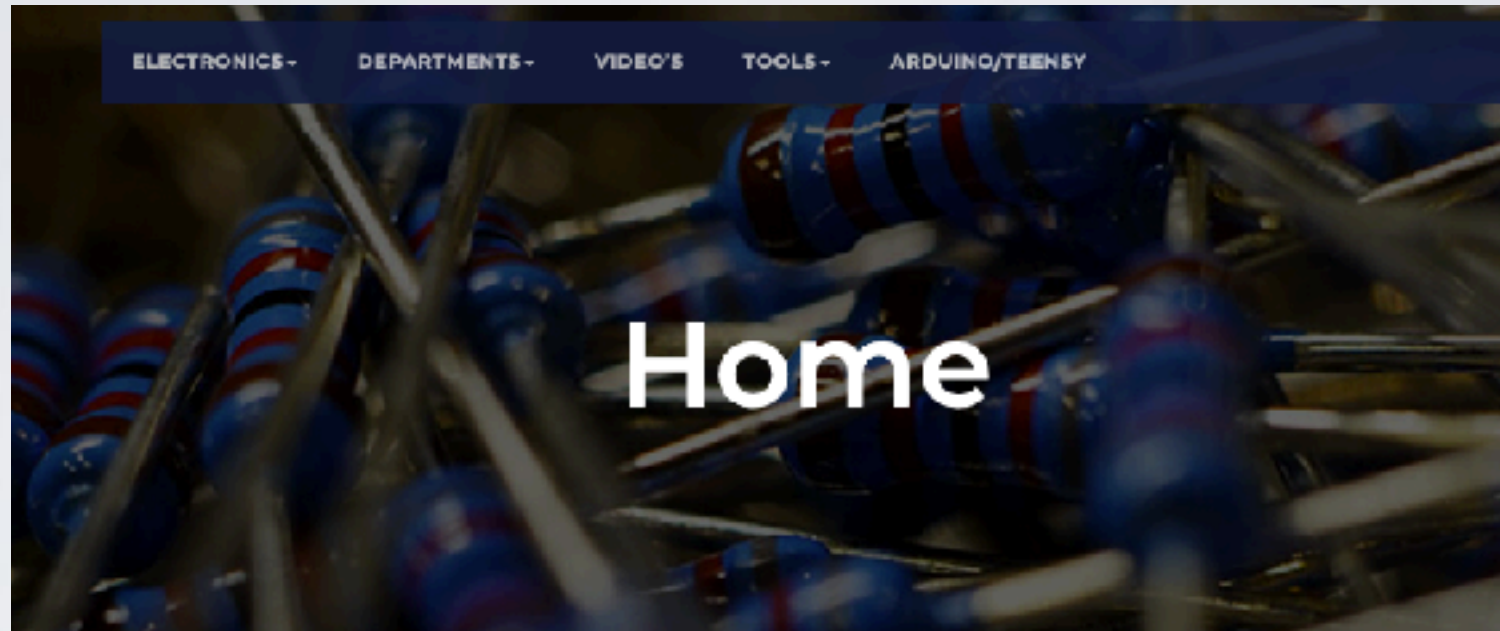
```
graph TD; A[Introduction to Electronics] --> B[4 lessons with the 2 groups (covid measures)]; B --> C[Theory and practice<br/>Ohms law, current,<br/>resistance, voltage, AC,<br/>DC and much more ...];
```

4 lessons with the 2  
groups (covid measures)

Theory and practice  
Ohms law, current,  
resistance, voltage, AC,  
DC and much more ...



# Introduction to Electronics



The header features a dark blue navigation bar with the following links: ELECTRONICS-, DEPARTMENTS-, VIDEO'S, TOOLS-, and ARDUINO/TEENSY. Below the navigation bar is a large image of various electronic components, primarily resistors, with the word "Home" overlaid in a large, white, sans-serif font.

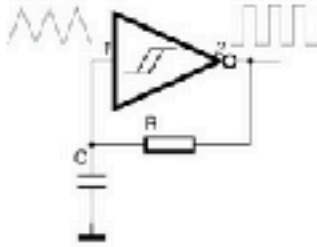
## Introduction to Electronics Music Technology Sound Reinforcement

**Welcome!**

This website is the landing-zone for content of multiple lessons within the Royal Conservatory in Den Haag. The departments Sonology, ArtofSound, and ArtScience all have subjects that relate to Electronics and technology used in Art and Music. The content will be created by multiple teachers from the different departments. On this website you will find mostly theory but also practical examples that are a guideline for the lessons.


**Search & help:**

**Search**



The diagram shows an operational amplifier (op-amp) configured as a voltage follower (buffer). The non-inverting input (+) is connected to an input signal source (represented by a sine wave). The inverting input (-) is connected to the output of the op-amp through a resistor labeled 'R'. The output of the op-amp is also connected to a load resistor labeled 'R' and a capacitor labeled 'C' in parallel, which is then connected to ground. The output signal is shown as a square wave.

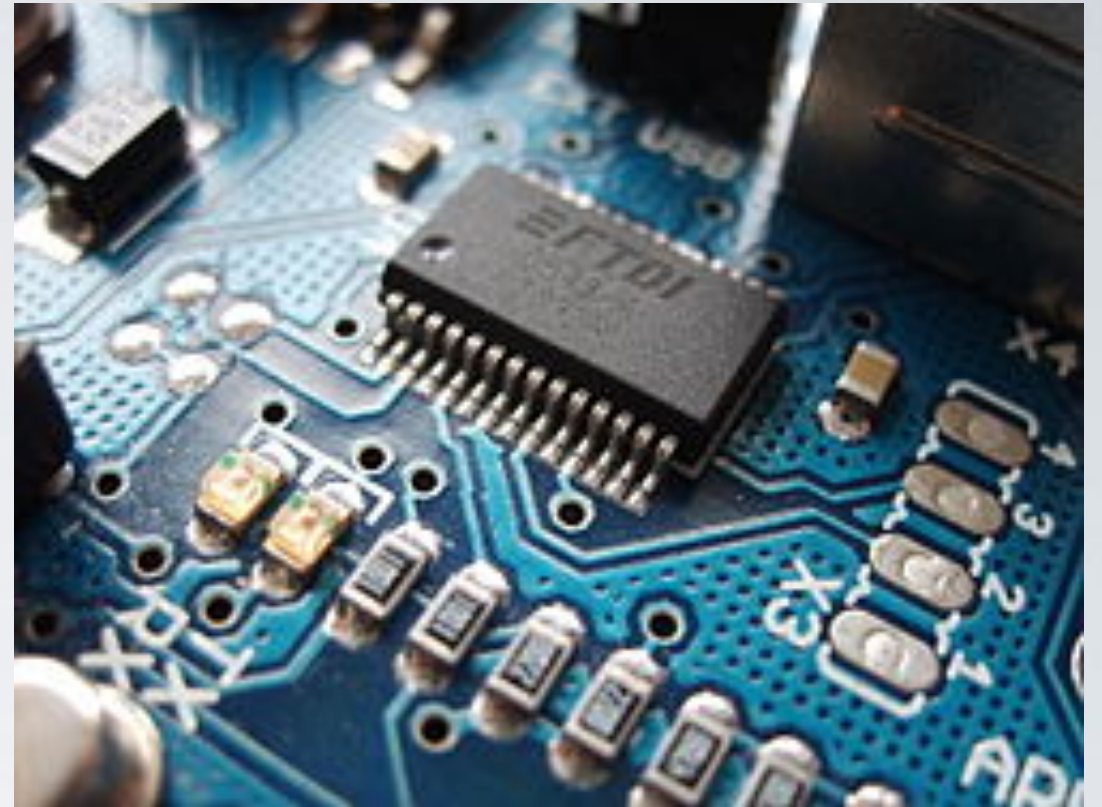
### CABLE CONNECTIONS



The diagrams illustrate two types of cable connections. The top diagram shows a balanced connection using a three-core cable, with labels for 'Balanced', 'Balanced', and 'Balanced'. The bottom diagram shows an unbalanced connection using a two-core cable, with labels for 'Unbalanced', 'Unbalanced', and 'Unbalanced'.

<https://electronics.koncon.nl>

# What is electronics: (Wikipedia)



Electronics deals with electrical circuits that involve active electrical components such as vacuum tubes, transistors, diodes and integrated circuits, and associated passive interconnection technologies. The nonlinear behaviour of active components and their ability to control electron flows makes amplification of weak signals possible and electronics is widely used in information processing, telecommunications, and signal processing.....

# Short history of Electronics

Some great names:



Marconi (Radio invention)



Thevenin (Thevenin's theorem)



Georg Ohm (Ohm's law)



Gustav Kirchhoff (Kirchoffs law)



# Short history of Electronics

1906

Invention of the vacuum tube :





# Short history of Electronics

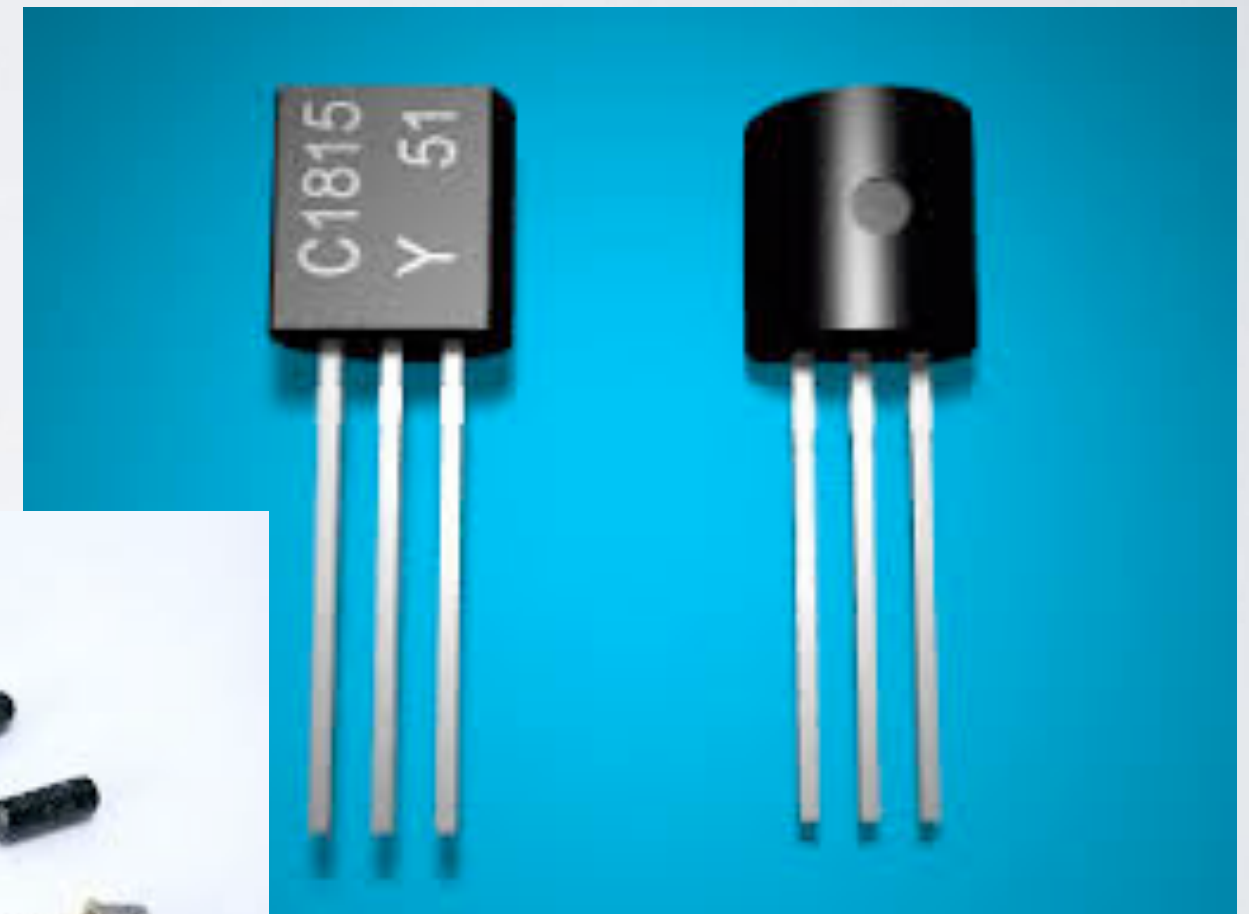
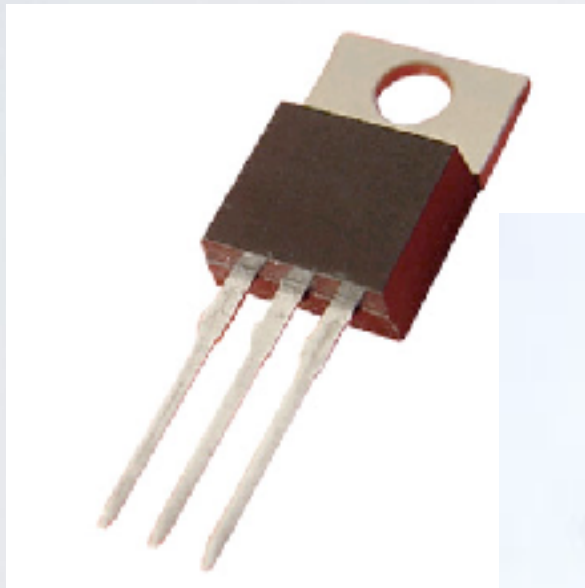
1906

Invention of the vacuum tube



1925-1948

The transistor was invented



# Short history of Electronics

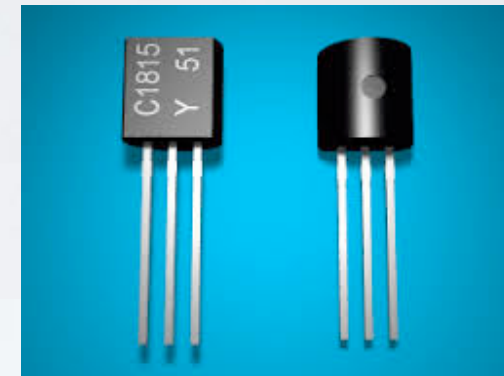
1906

Invention of the vacuum tube



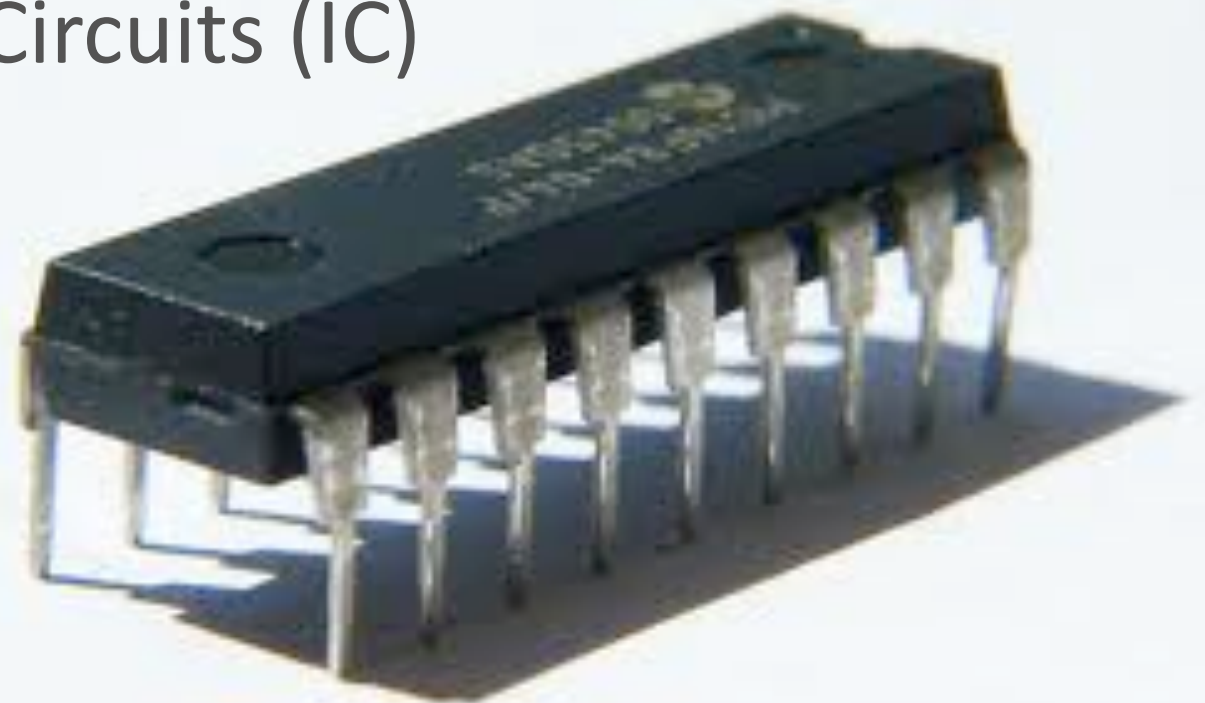
1925-1948

The transistor was invented



1950

Introduction of the Integrated Circuits (IC)





# Short history of Electronics

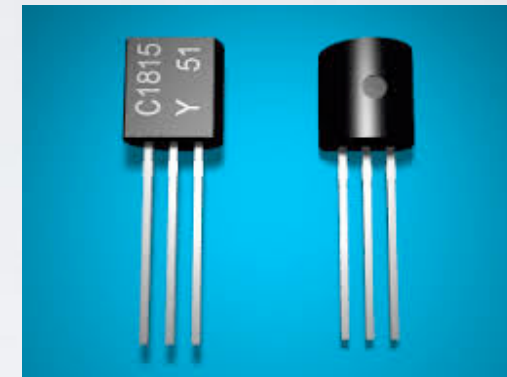
1906

Invention of the vacuum tube



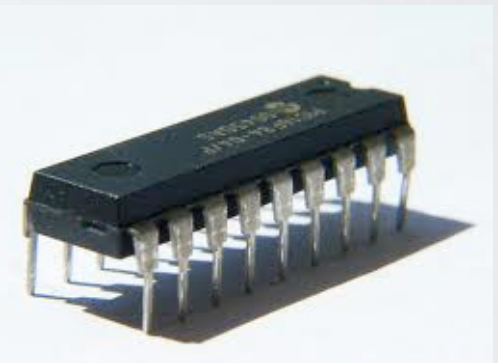
1925-1948

The transistor was invented



1950

Introduction of the Integrated Circuits (IC)

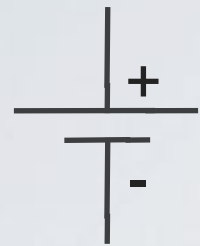


Now:

about **2.300.000.000** transistors are placed onboard of **one** 8 core Xeon processor!



# Basic components and symbols (european):



= Battery

*Provides energy*



= Plus

*Plus connection of a power source*



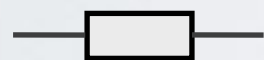
= Ground

*Ground connection*



= Wire

*Makes connections (resistance = 0 Ohm)*



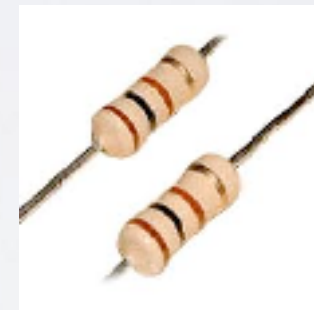
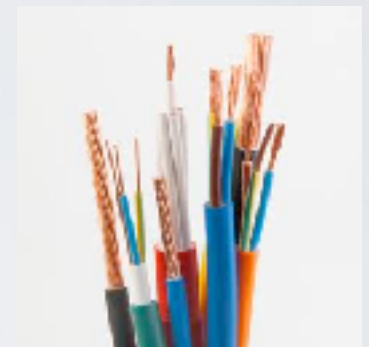
= Resistor

*Limits the current*



= Capacitor

*Can 'hold' charge.*



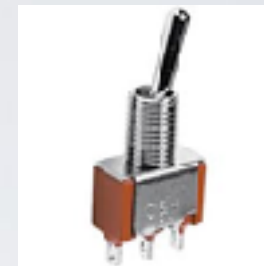


# Basic components and symbols (european):



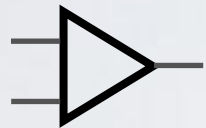
= Switch

*Switch On/Off*



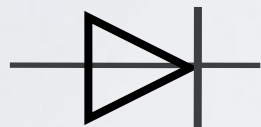
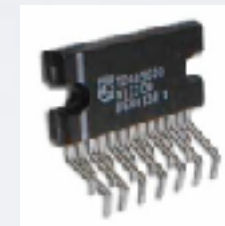
= Connector

*Connection point in circuit*



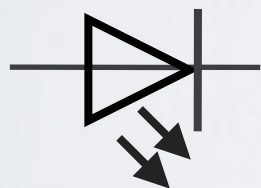
= Amplifier

*Generic symbol for Amplifiers*



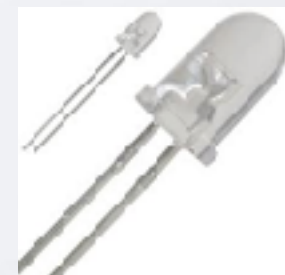
= Diode

*Current flow one direction only*



= Led

*Light Emitting Diode, like diode but will light up*



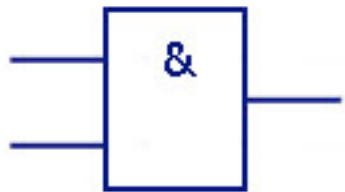
# Basic components and symbols (european):



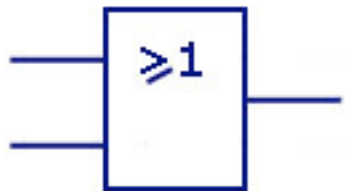
*Transistor (NPN)*



*FET (Field Effect Transistor)*



*Logic gate (AND)*



*Logic gate (OR)*



*Voltmeter (voltage)*



*Amp meter (current)*



*Microphone*

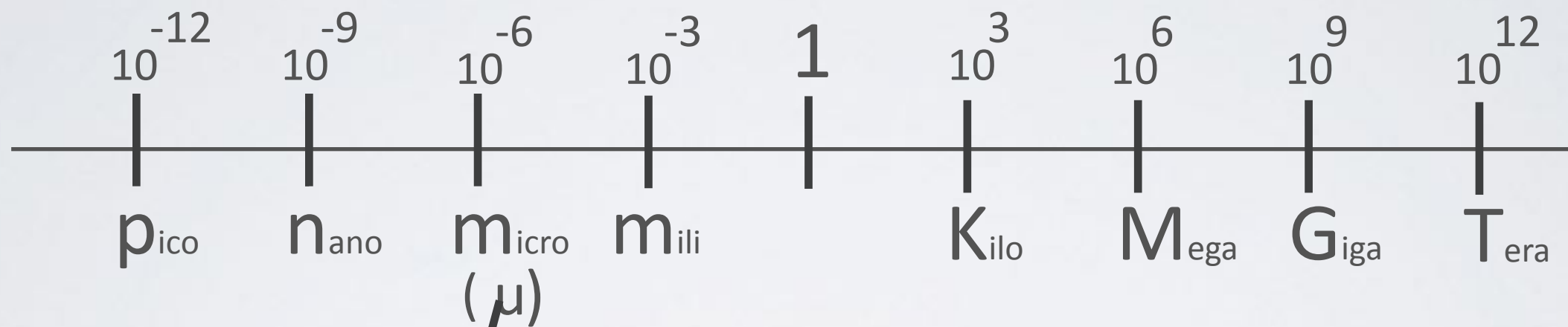


*Loudspeaker*

<http://www.circuitstoday.com/electronic-circuit-symbols>



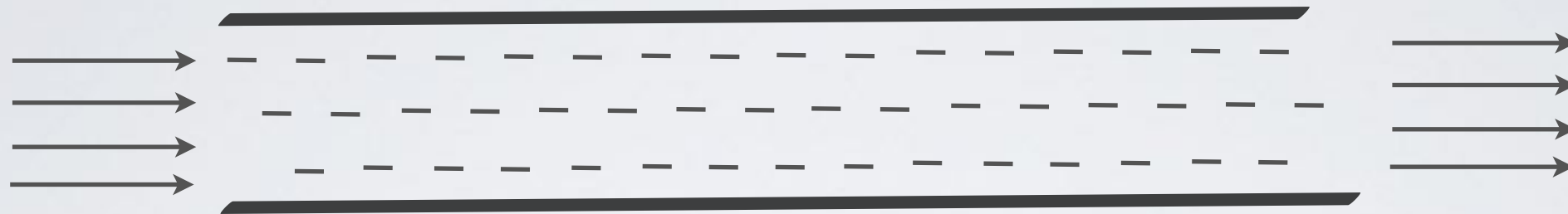
# Unity line (engineering values)



*Calculation Refresh:*  $\frac{1}{1000} = \frac{1}{10 \times 10 \times 10} = \frac{1}{10^3} = 10^{-3} = 0,001 \text{ (milli)}$

<http://htwins.net/scale2/>

Around  **$6.242 \times 10^{18}$**  electrons passing a given point  
each second, equals **one ampere (=1A)**



With voltage and current is like water: the **less resistance**, the **more current** (with a constant pressure/voltage). The **higher the voltage**, the **higher the current** at a given resistance.

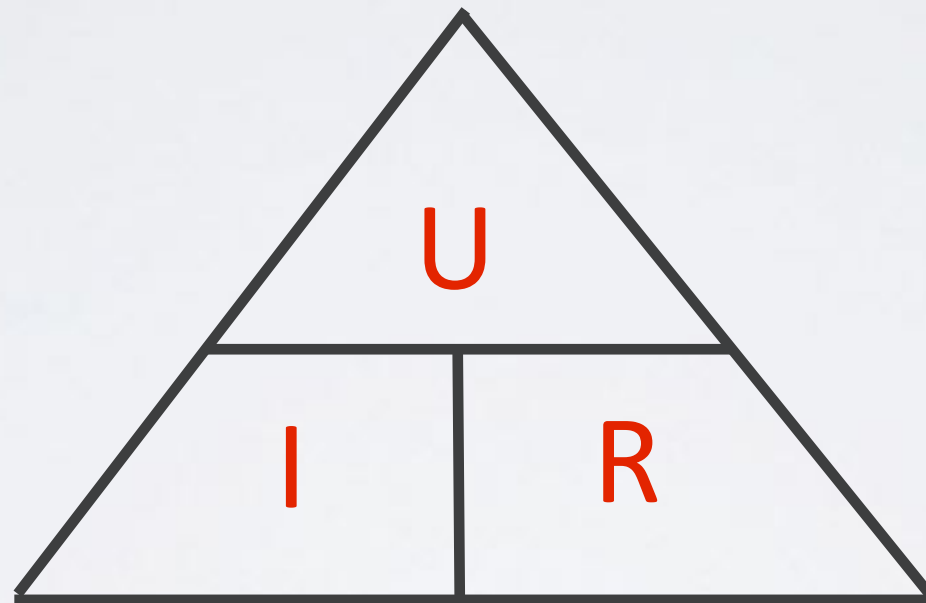
Ohm's law!



# Ohm's Law:

$$U = I * R$$

(Volt)

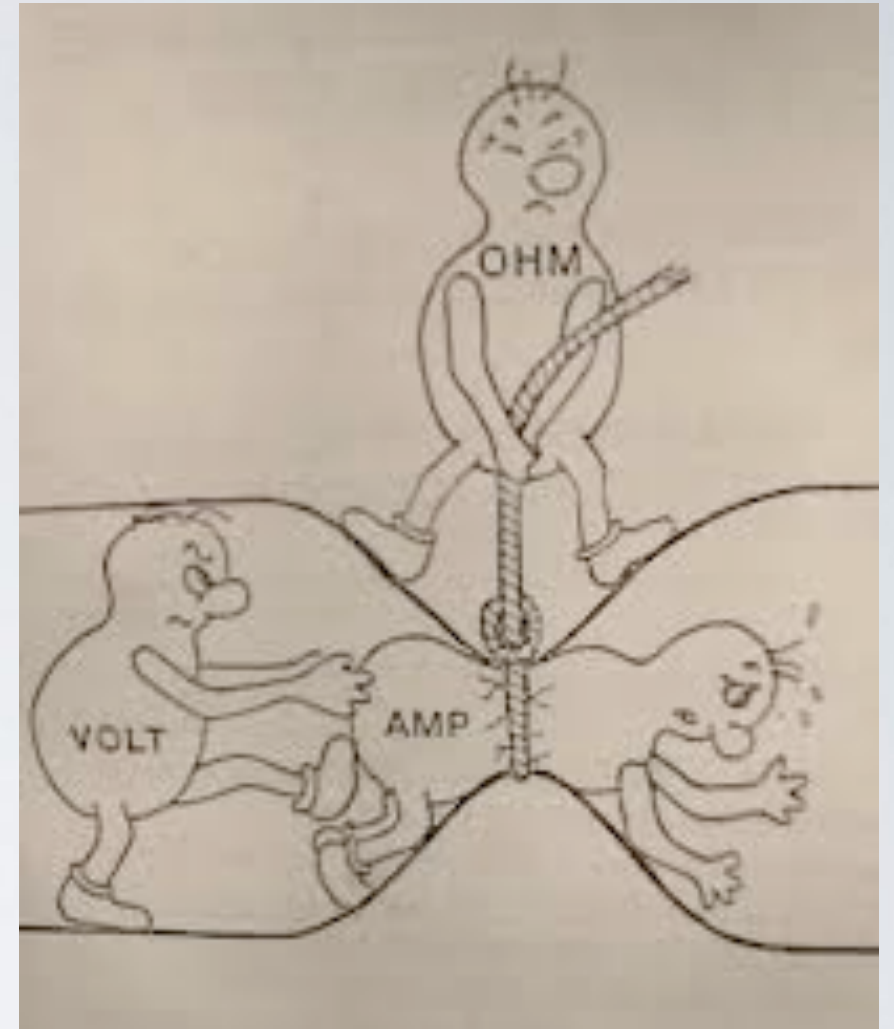


$$I = \frac{U}{R}$$

(Ampere)

$$R = \frac{U}{I}$$

(Ohm )



PowerSupply (= constant pressure)

$U = \text{Voltage}$

$U = \text{constant}$

Ohm's Law:

$$U = I * R$$

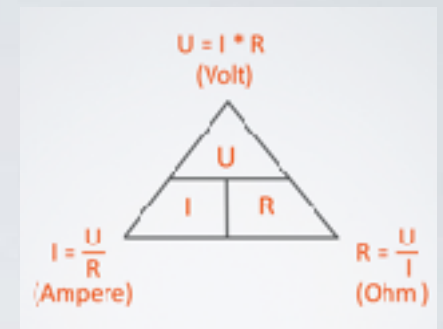


Resistance  $R = \text{infinite}$

Current  $I = 0\text{A}$  (nul!)

# Ohm's Law:

$$U = I * R$$



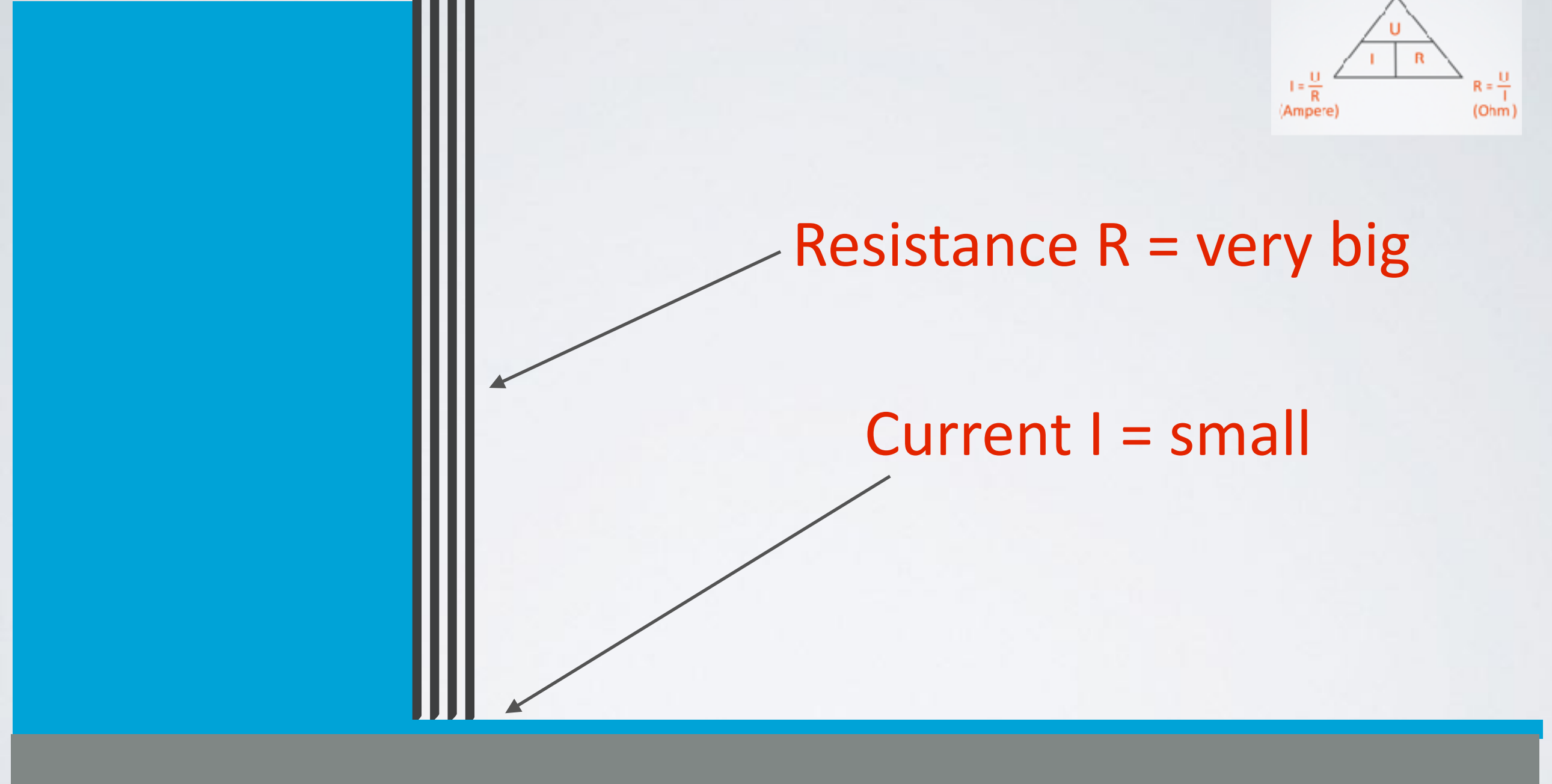
PowerSupply (constant pressure)



$$U = \text{constant}$$

Resistance  $R = \text{very big}$

Current  $I = \text{small}$





PowerSupply (constant pressure)



$U = \text{constant}$

$U = \text{constant}$



Resistance  $R = \text{small(er)}$

Current  $I = \text{big(ger)}$



# PowerSupply (constant pressure)



fuse is blown!

$$R = 0$$

I not defined

# Introduction to Electronics

Let's start experimenting:

