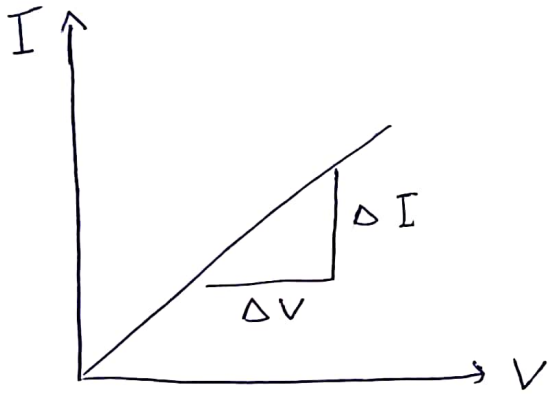
# Exp 1 : Linear and non-linear Circuit Components :

## Circuit components

### Linear

- components with Straight-line I-V Characteristic (ohm's law)




$$\text{Slope} = \frac{1}{R}$$

Example :

* Carbon resistors.

### Non-linear

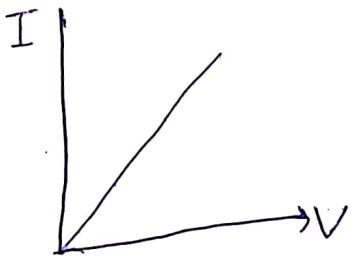
- components that don't possess Straight line I-V Characteristic.

Example :

( light bulb, diode )

* Light bulb

at low current has linear I-V




at high current

$$R = R_0[1 + \alpha(T - T_0)]$$

$R_0$ = the resistance at temp = $T_0$

$\alpha$ : temp coefficient of resistivity

∴ So since the temp of the tungsten increase by increasing the current passing through it, one expects the light bulb to have a non-linear I-V characteristic and R that depends on the value of the current.

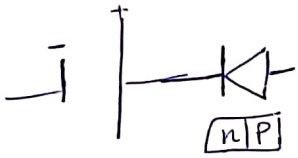
Light bulb

as I ↑ T ↑ ∴ R change

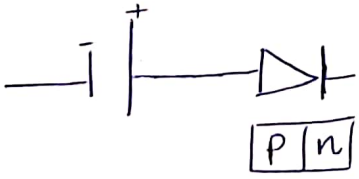
# Diode

- A semiconducting Diode: Consists of 2 pieces, P-type piece (Anode) semiconducting material and n-type (Cathod) piece of the same material joined together

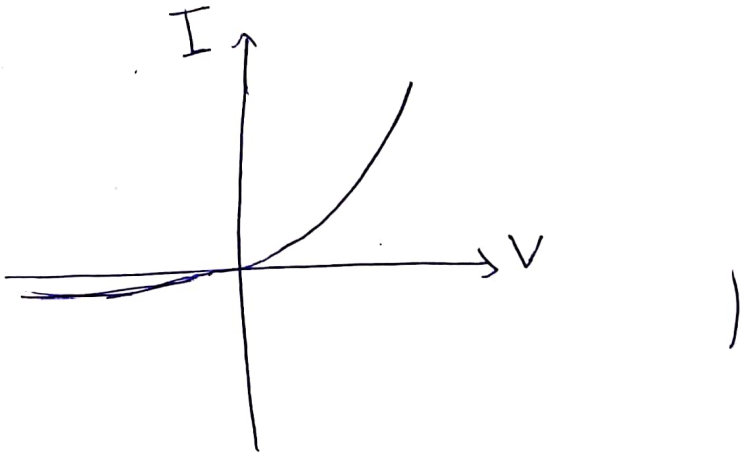

* (P, n) components, one of them allow current to pass through in one direction only which is the P-type, while the n-type terminal connected to the battery, it blocks the current so that a very small current flow throughout the circuit.




Reverse biased




Forward biased




$$I = I_o\left(e^{V/K} - 1\right)$$

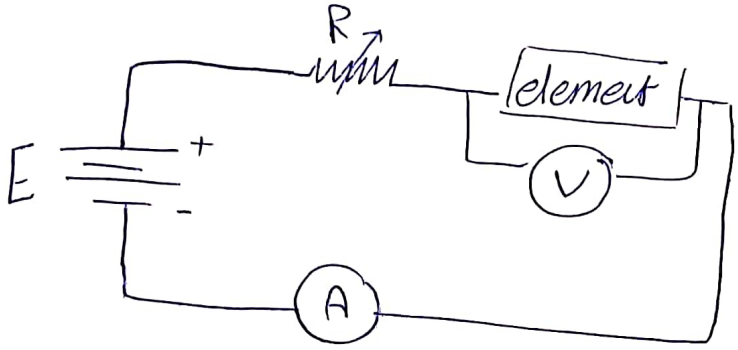
∴ When the diode has variable R that depends on the value of the current passes through it

$I_o$ = Saturation Current

K = function of temp. only

## procedure

1. Connect the circuit as shown:




2. Chang R, take eight different values for I, V according to the data sheet (for carbon resistor)

3. repeat (2) with a forward-biased diode.
(Current shouldn't exceed 30mA)

4. Reverse-bias your diode and check if it conducts or not, Register the current flowing, this is $I_o$

5. repeat (2) using the light bulb
[high current needed to light the bulb ~100mA]
[Don't exceed ~300 mA]

[start with high R, then decrease it gradually]

⇒ $R_2$ , $V = 10V$