

بعل

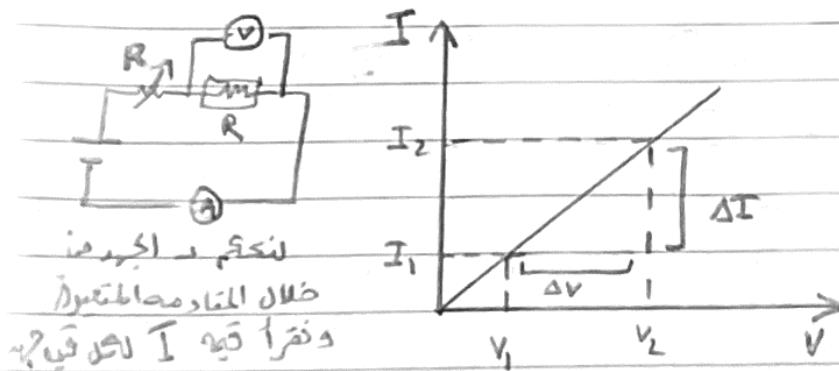
Experiment 1

Linear and non-linear circuit components

* The relation between the current (I) passing through a circuit component and the voltage difference (V) between its terminals is called the I - V characteristic of the component.

* Linear components: components that have straight line I - V characteristics. Ex: (carbon resistors)
 ↳ obey ohm's law ($V=IR$)

The slope of the line is $\frac{1}{R}$ of that component.



$$\text{slope} = \frac{\Delta I}{\Delta V} = \frac{1}{R} = R^{-1}$$

* Find the value of R from color code and compare it with the value from the slope

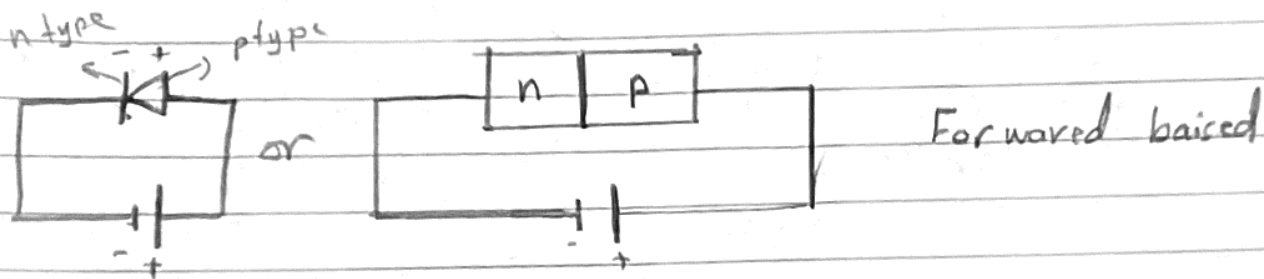
* Non-linear components: components that do not possess straight line I - V characteristics. Ex (diode, light bulb)
 ↳ do not obey ohm's law

* 2: Semiconductor diode consists of two pieces, a p-type piece of a semiconducting material and n-type piece of the same material joined together.

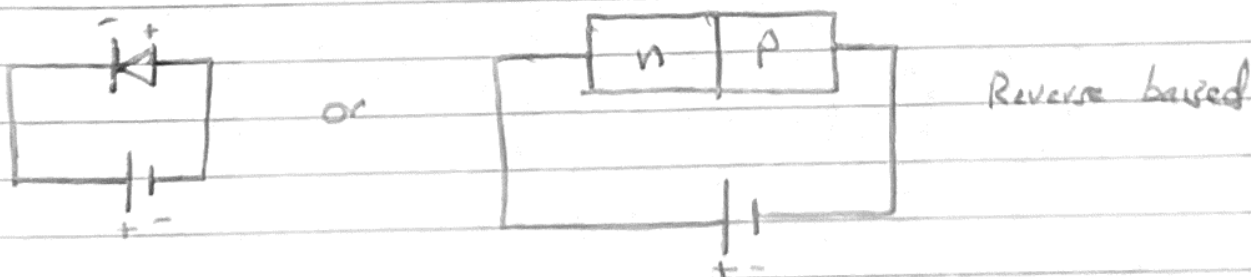
②

- Diodes: two terminal components that allow current to pass through in one direction only $\Rightarrow$ almost no current passes through in the other direction (part of micro-amperes).
 $\Rightarrow$ according to that the way the diode is connected to a battery is crucial.

* Forward biased: when the p-type terminal of the diode is connected to the positive terminal of the battery, in this case it allows current to pass through the diode.



* Reverse biased: when the n-type terminal of the diode is connected to the positive terminal of the battery. In this case it blocks the current so that a very small current flows through the circuit and diode.



* The relation between (I) and (V) for diode is

$$I = I_0 (e^{eV/kT} - 1)$$

I_0 : saturation current

V : the applied voltage

e : the electron charge

k : Boltzmann constant

(9)

Isa

according to the relation $I = I_0(e^{\frac{eV}{kT}} - 1)$

✓ a semiconducting diode has a variable resistance that depends on the value of the current passing through it.

في تجربتنا سنقوم بوضع diode مع الدارة Forward biased

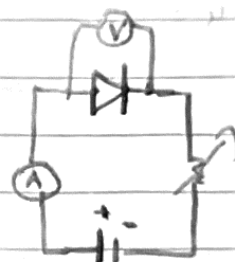
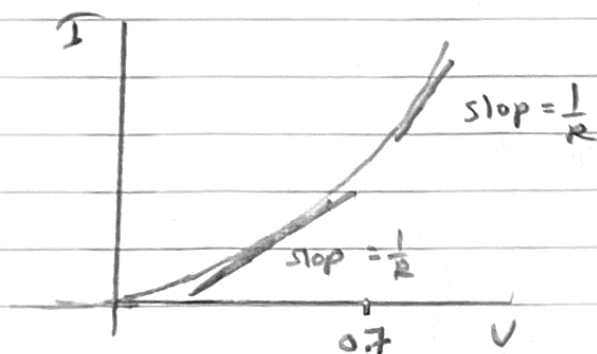
من خلال المقادير المتغيرة نلاحظ بقية الجهد ونقوم بقراءة التيار المار في الدارة

Voltage (0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0)

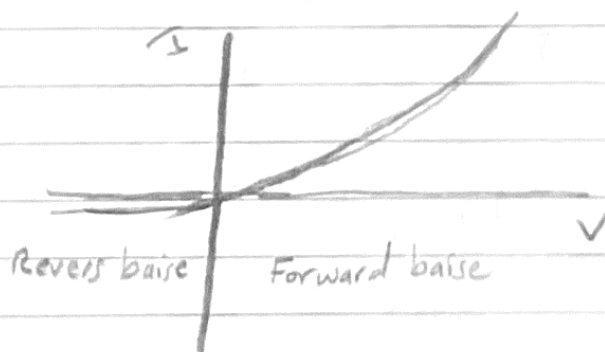
Reverse bias your diode and check if it conducts or not

=> Register the current flowing, this is I_0

draw I vs V



Warning: current passing through the diode should not exceed 30 mA in all measurements.



3 light bulb

The tungsten wire in a bulb converts electrical power to heat energy $\Rightarrow$ the wire glows and emits light

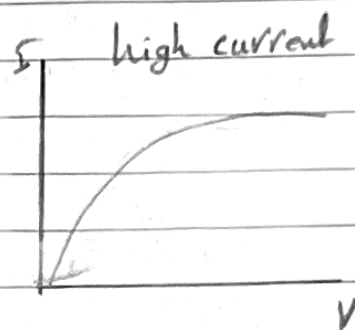
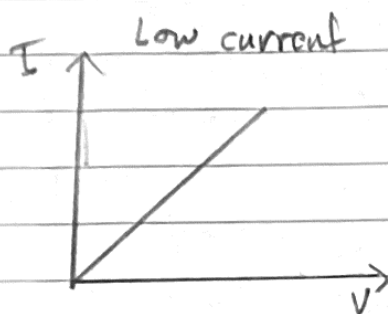
$$R = R_0 [1 + \alpha(T - T_0)]$$

R_0 : the resistance at temperature T_0

α : the temperature coefficient

كلما زاد كمية التيار المار بالسلك (معدن التنجستن) كلما زادت درجة الحرارة للسلك بالسلك R وبالتالي يتغير قيمة التيار المار لاحقاً $\Rightarrow$ فننتوقع ان تكون الصفة للتيار غير خطية.

Since the temperature of the tungsten increases by increasing the current passing through it, one expect the light bulb to have a non-linear I - V characteristic and a resistance that depends on the value of the current.



نفس الخطوط السابقة لكن بدء من جهد عالي تيار منخفض و نمرق على تيار عالي

[start with high R , then decrease it gradually]