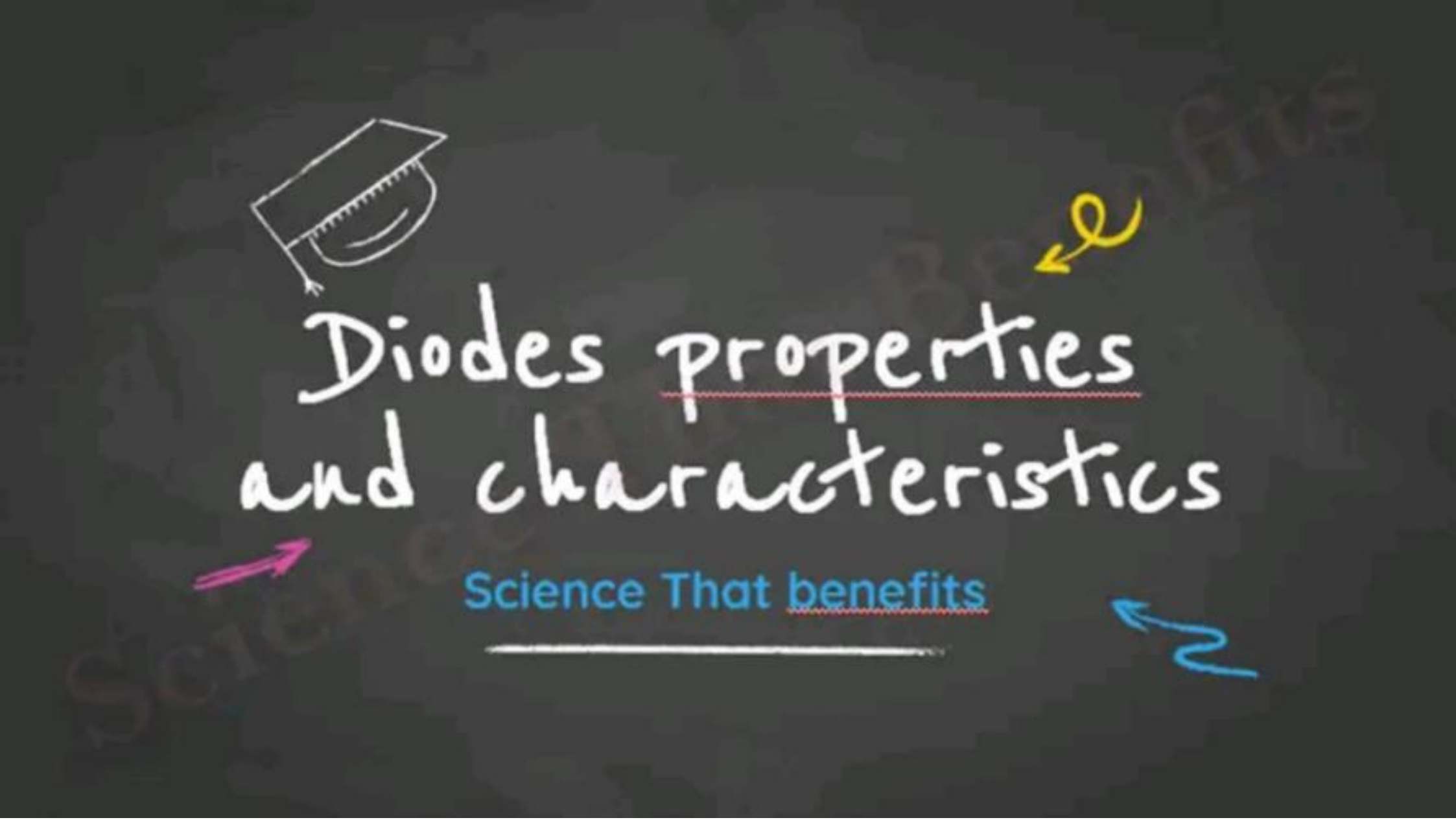

Diodes properties
and characteristics
Science That benefits

01
تذكير

02
شرح منحنى ميزة الدايود

03
الدايود المثالي و الدايود الحقيقي

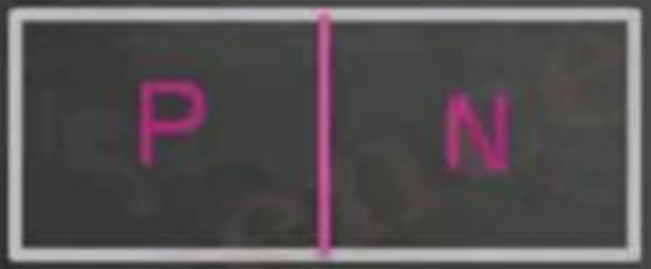
04
سلوك الدايود في دائرة التيار المستمر

خواص الدايود Diode:

الصمام المثالي :IDEAL DIODE

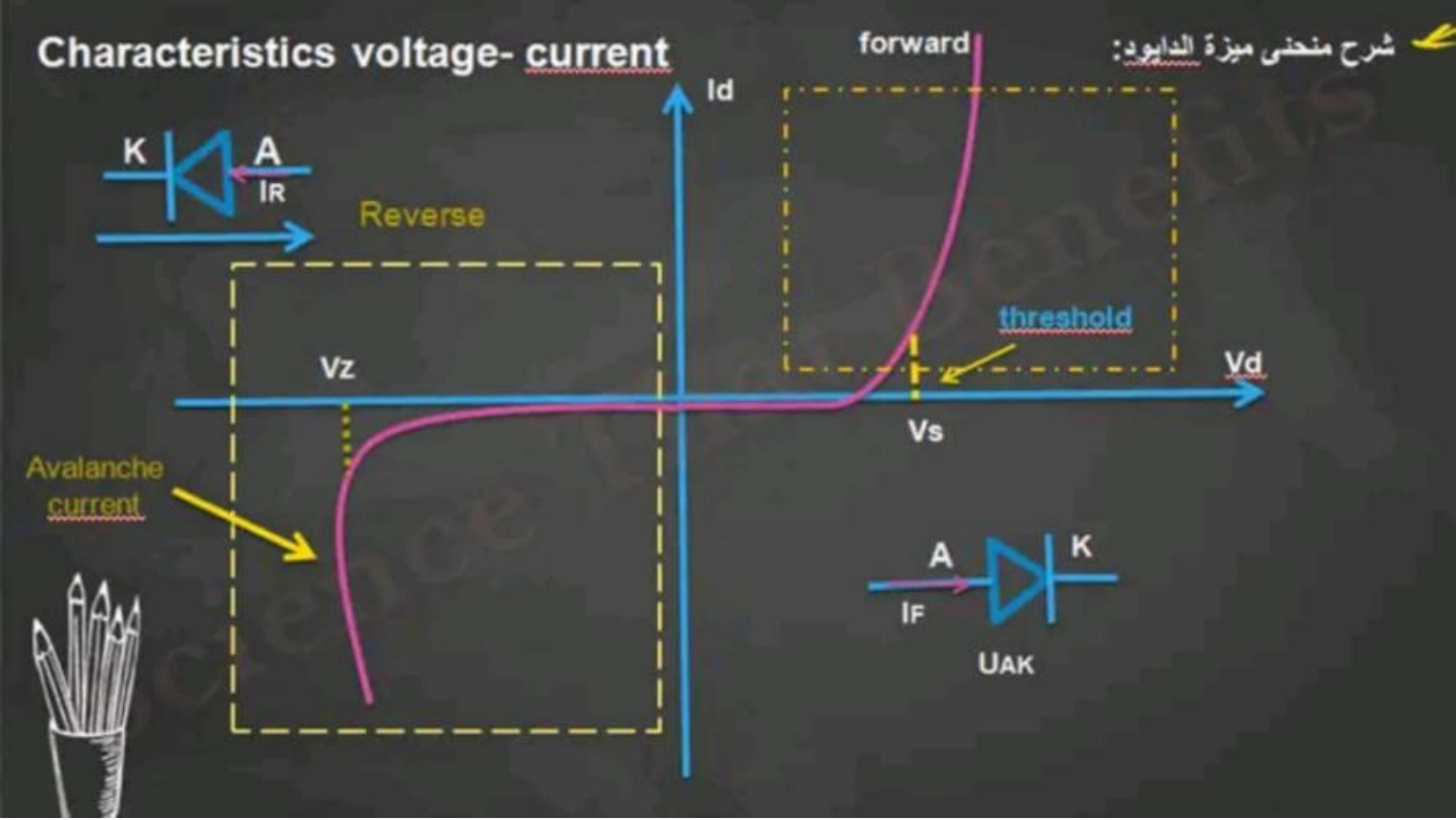
Passive

If VA anode potential and VB cathode potentiel
The diode is forward biased
The diode is Reverse Biased

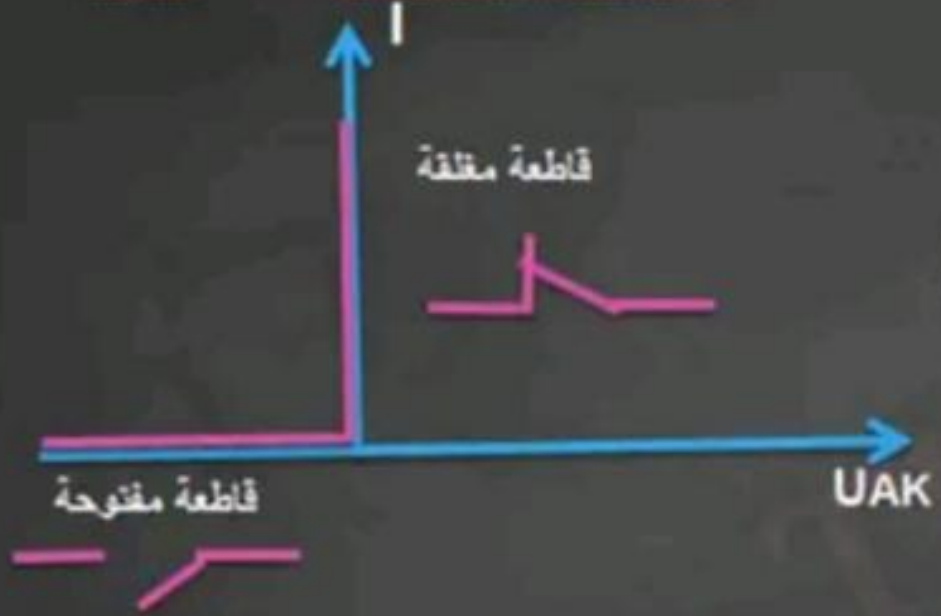


PN - junction

Active


Characteristics voltage- current
شرح منحنى ميزة الدايود:
forward
Id
K
A
IR
Reverse
threshold
Vz
Vd
Vs
Avalanche
current
A
K
IF
UAK

Ideal Diode behavior modelling

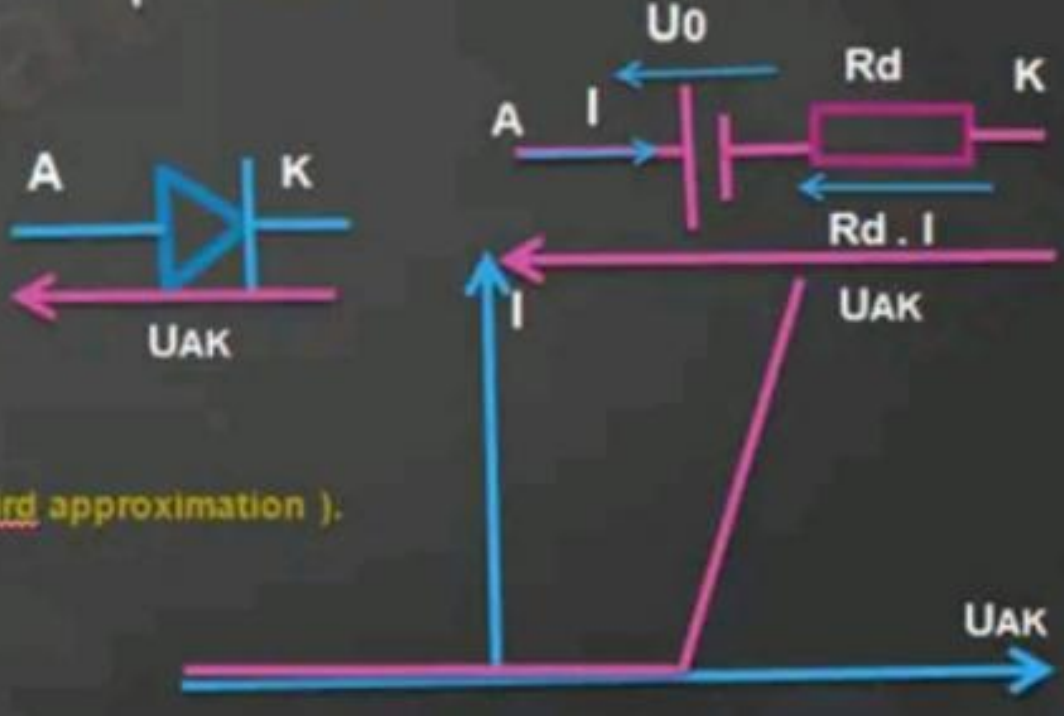


في حالة الدايود مثالي :

VS = 0

RS مقاومة الدايود معدومة ، يعتبر كقاطعة مغلقة

Rs مقاومة الدايود كبيرة جدا ، يعتبر كقاطعة مفتوحة



real Diode behavior modelling :

The dynamic resistor assumed to be constant r_D

Ideal Diode : rd =0 ; Vs =0 short circuit (first approximation).

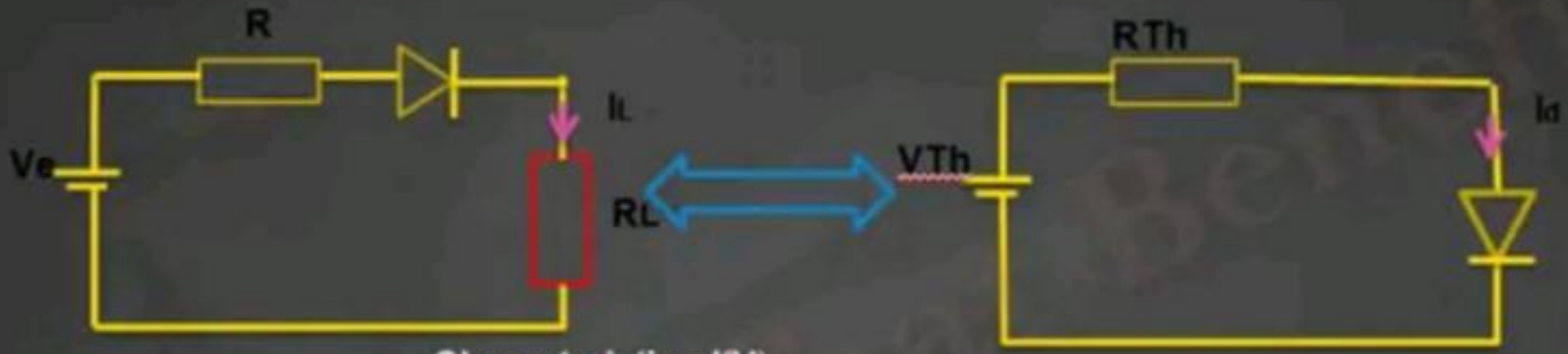
Real Diode :

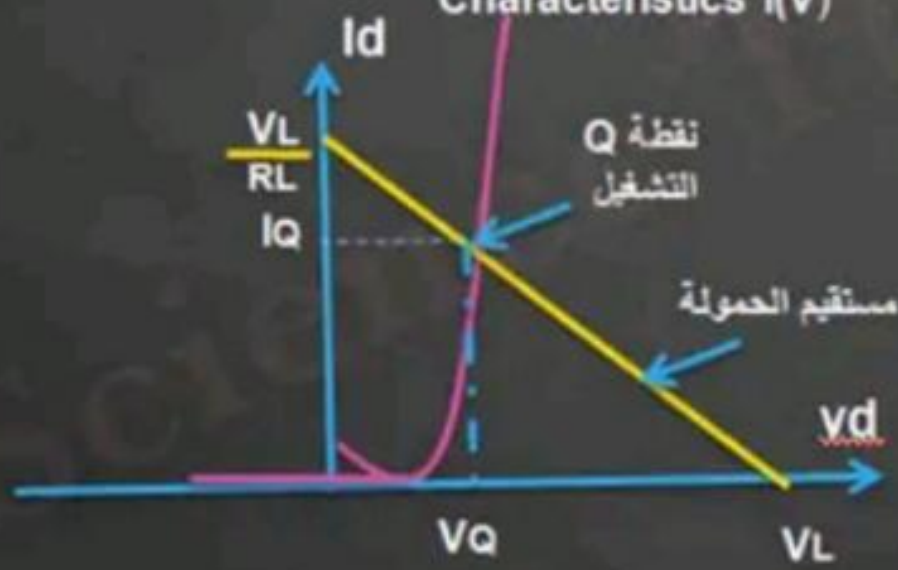
rd=0; Vs≠0 ; Vs voltage generator (second approximation) .

Rd≠0; Vs ≠ 0; voltage generator Vs and rd dynamic resistor (third approximation).

$$VD = VS + rd \cdot I$$

سلوك الصمام الثنائي في دوائر التيار المستمر:





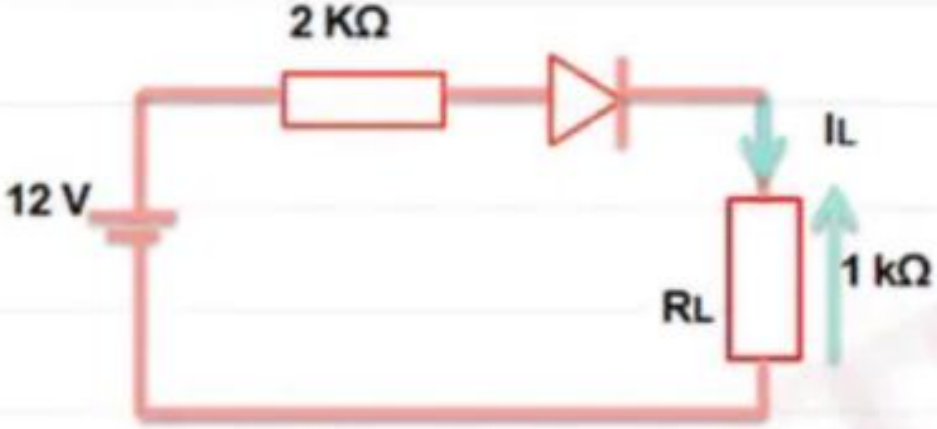
$V_{Th} = V_S$

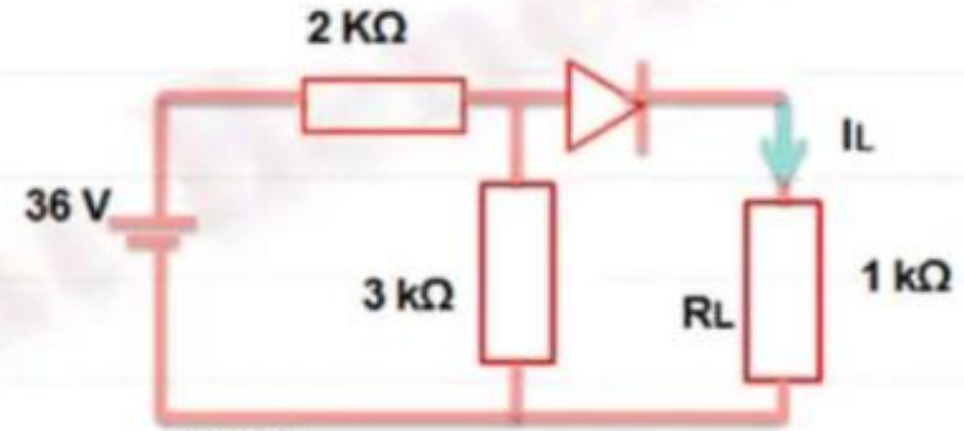
$R_{Th} = R_s + R_L$

$r_s = \frac{V_D}{I_D}$

EXAMPL : Determine the current and the voltage in the Load RL , in the follwing circuits .

Vs= 0.7 V , rd= 0.23 Ω





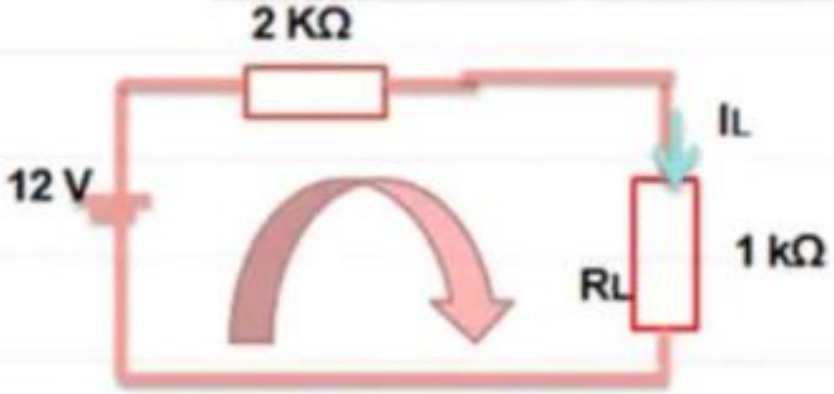
Solution

1 in the first circuit :

VD > 0.7 V the threshold voltage , the diode is ON (short circuit)

USING the first approximation ⇔

Replace the Diode (short circuit)



1. THE current ACROSS R_L

V_{cc}-2 kΩ x I_L – V_D – R_L .I_L =0

12V – 2 kΩ x I_L –R_L . I_L = 0

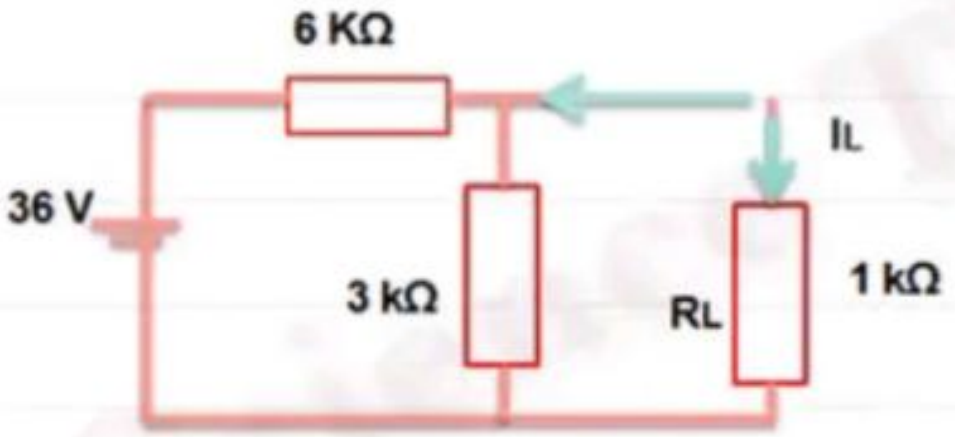
12 = I_L .(2000+1000) => I_L= 12/ 3000 = 4m A

2. the voltage Between R_L:

V_L = R_L . I_L

V_L= 1 K Ω x 0.004 = 4 V

VD ?



1. Using voltage divider :

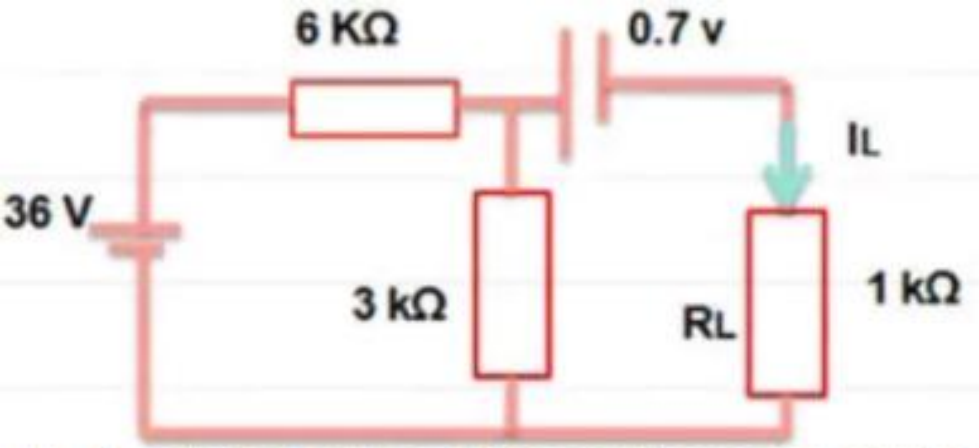
$V_D = \frac{3}{3+6} \times 36 = 12\ V$

V_D > VS => Diode is forward Bias (passante)

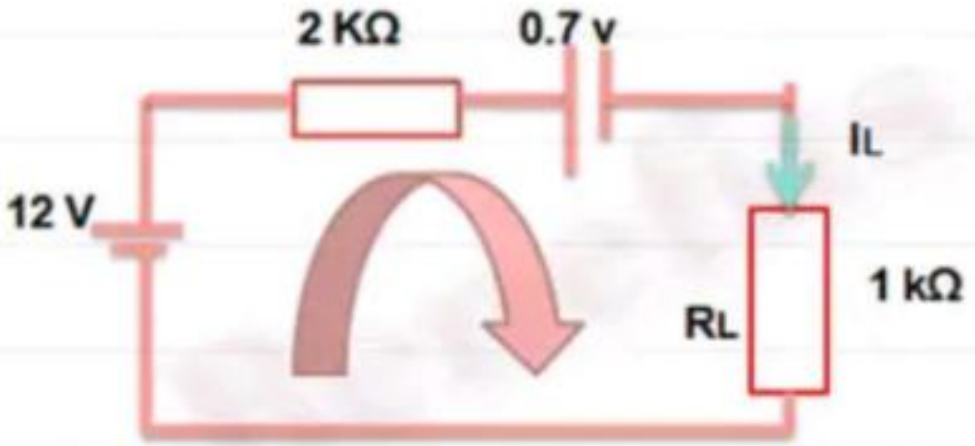
2. Using thevenin's theorem :

$V_{th} = \frac{3}{3+6} \times 36 = 12\ V$

$R_{th} = \frac{6 * 3}{6+3} = 2\ k\Omega$



The Diode is replaced by a voltage generator



Using KVL :

$V_{th} - R_{th} \cdot I_L - V_d - R_L \cdot I_L = 0$

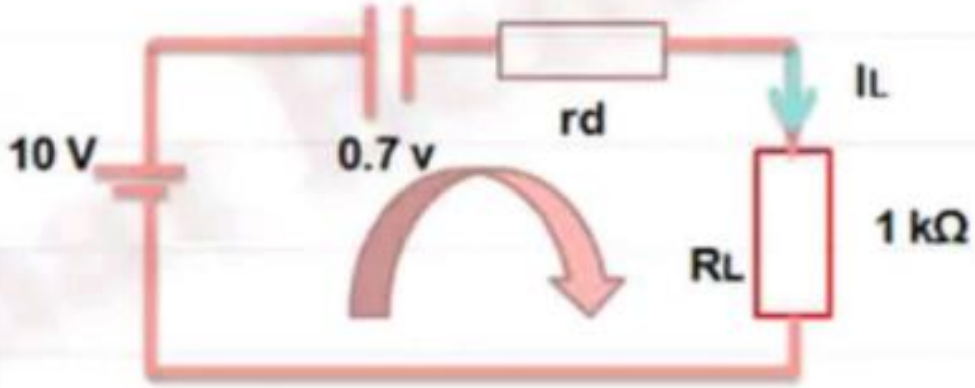
$12 - 2 \times I_L - 0.7 - 1000 \cdot I_L = 0$

$11.3 = I_L (2000+1000) \Rightarrow I_L = \frac{11.3}{3000} = 3.7 \text{ m A}$

$V_L = I_L * R_L = 3.7 * 1000 * 1 = 3.7 \text{ V}$

VD = 10 V => the diode is forwad biased

Using the third approximation (diode replaced by voltage generator 0.7 v and dynamic resistor rd = 0.23 Ω



Using KVL:

10- 0.7 V – rd .IL – Rl .IL =0

9.3 = IL .(rd+ RL)

IL= 9.3 = 9.29 mA

0.23+1000

VL= 9.29 x 1000 = 9.29 V

1000