

CH1. BASIC SEMICONDUCTOR DEVICES

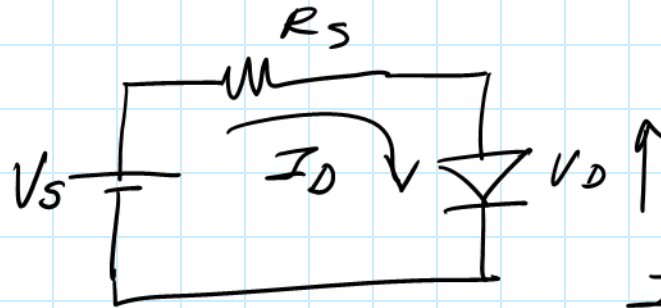
1. Of the following statements about the PN junction diode in static regime, select which is the **FALSE**:

[A] The load line is not dependent on the characteristic curve of the device. ✓

[B] In direct region, small increases in voltage V_{AK} cause large increases of I_D . ✓

[C] Is a nonlinear device. ✓

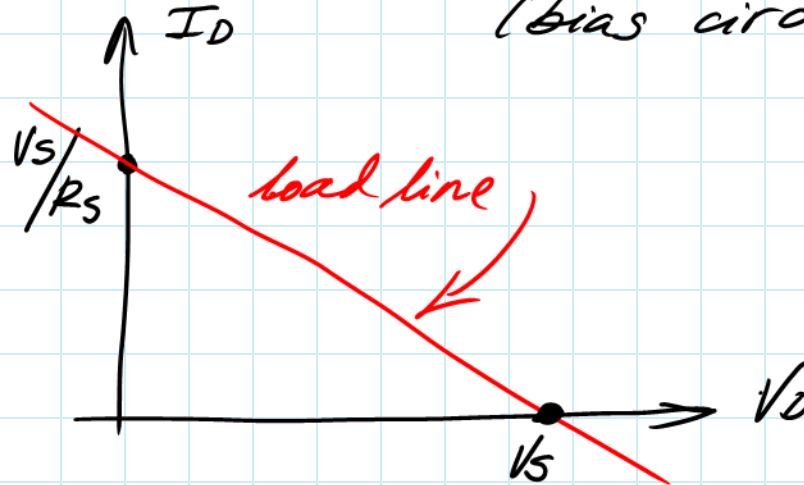
[D] The operating point does not depend on bias circuit. ✗



$$V_S - I_D R_S - V_D = 0$$

$$I_D = \frac{V_S}{R_S} - \frac{V_D}{R_S}$$

I_D depends on V_S, R_S
(bias circuit)



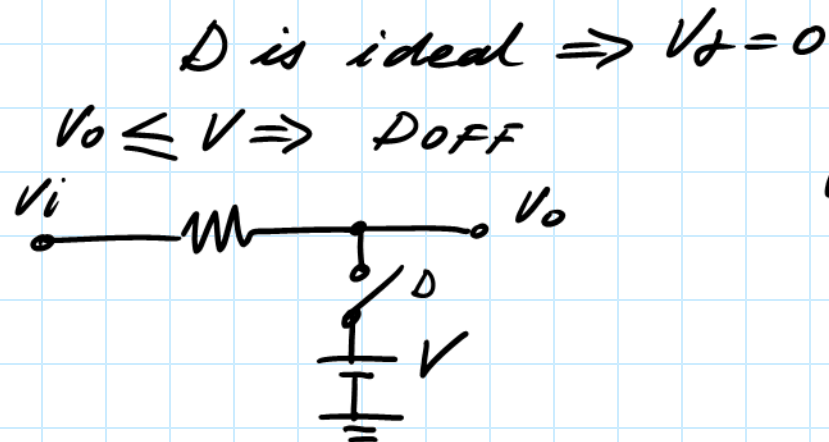
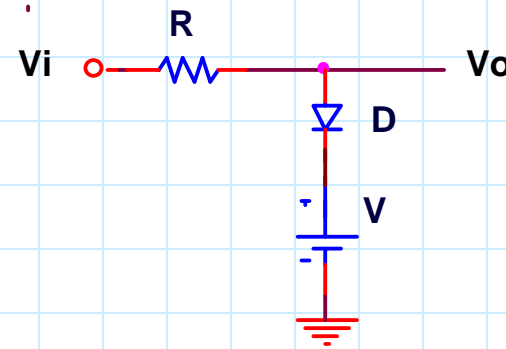
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2. Analyzing the diode circuit of the figure and assuming an ideal diode approximation, we can **ASSERT** that:

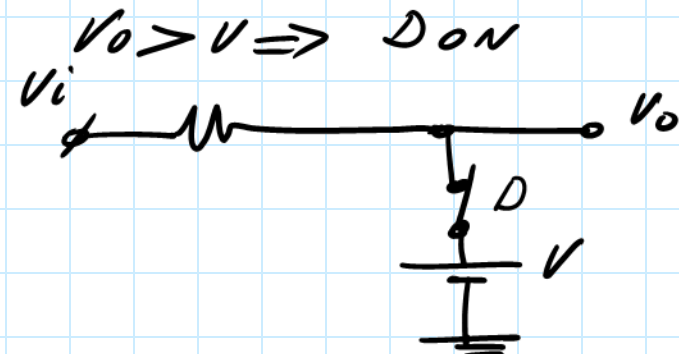
[A] If the input voltage V_i is positive, the diode conducts and the output voltage is equal to V . ~~✗~~

[B] If the input voltage V_i is negative, the diode does not conduct and the output voltage is 0V. ~~✗~~

[C] When the input voltage V_i is lower than V , the output is V_i . ✓



$V_o = V_i \Rightarrow$
 $V_i \leq V \Rightarrow D \text{ OFF}$



$V_o = V$

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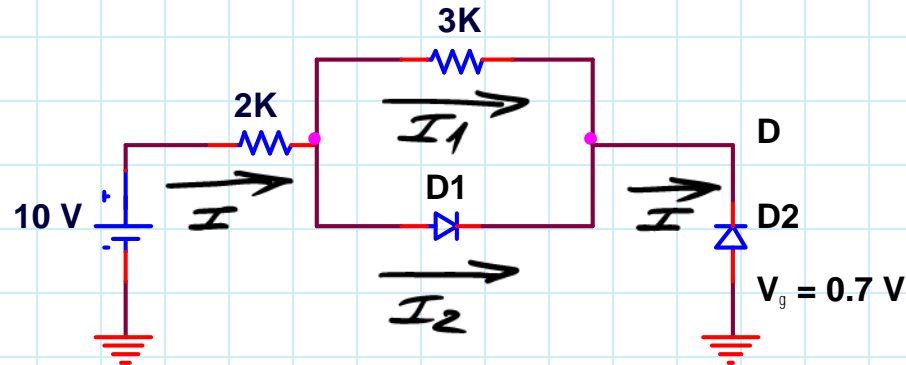
3. By solving the circuit of figure can be said that the voltage at point D is:

[A] 0V

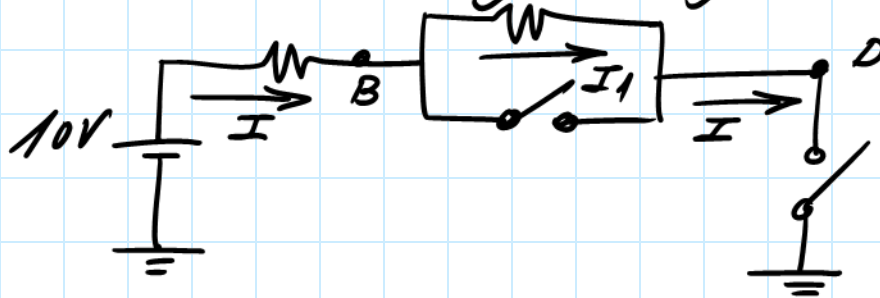
[B] 10V

[C] 9.3V

[D] -0.7V



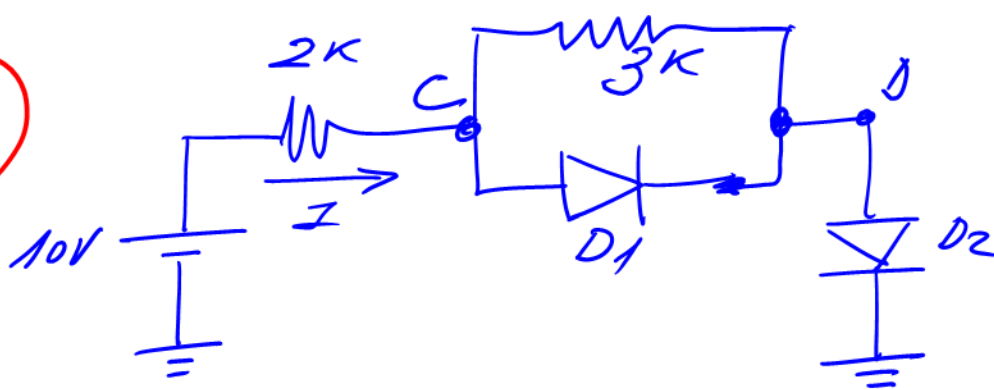
*D₁ and D₂ are in opposition
No current can flow from source to ground*



$$V_B = 10V; (I=0)$$

$$V_D = 10V; (I_1=0)$$

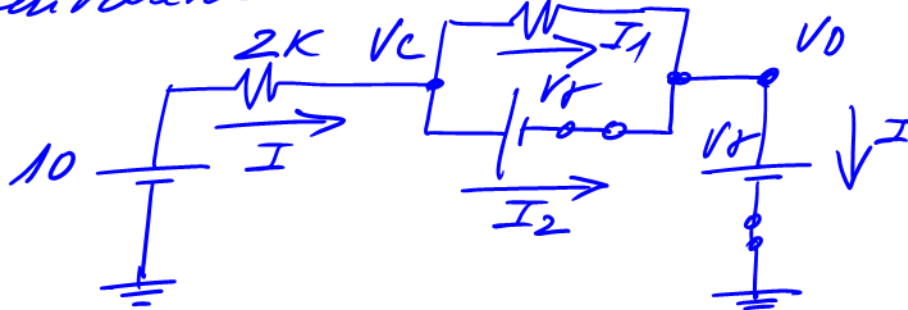
3b.



Proposed in class

In this configuration D_1 and D_2 are ON
 (Suppose $I = 0 \Rightarrow V_C = 10V > V_{fD1} + V_{fD2} \Rightarrow D_1 \text{ ON}, D_2 \text{ ON}) \Rightarrow$

Equivalent circuit: $3K$



$$V_D = V_f = 0.7V$$

$$V_C = V_D + V_f = 1.4V$$

$$I = \frac{10 - V_C}{2K} = \frac{10 - 1.4}{2} = 4.3mA$$

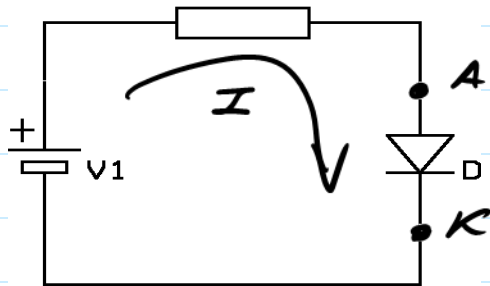
$$I_1 = \frac{V_C - V_D}{3} = \frac{V_f}{3} = \frac{0.7}{3} = 0.23mA$$

$$\underline{I_2 = I - I_1 = 4.07mA}$$

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4. Calculate the operating point Q (V_{DQ} , I_{DQ}) of diodes in the following circuits:

DATA: $V_1 = 5V$; $R = 220\Omega$; Diode: $V_\gamma = 0.6V$

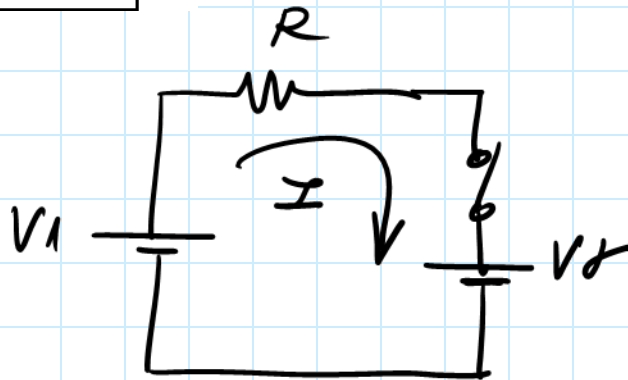


D is forward biased because

$$V_1 > V_\gamma$$

Don

A)

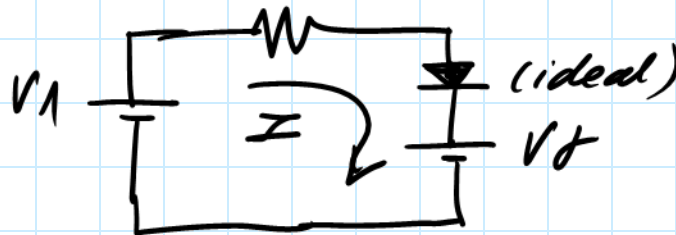


$$I = \frac{V_1 - V_\gamma}{R} = \underline{20mA = I_{DQ}}$$

$$\underline{V_{DQ} = V_\gamma = 0.6V}$$

$$\boxed{Q(0.6V, 20mA)}$$

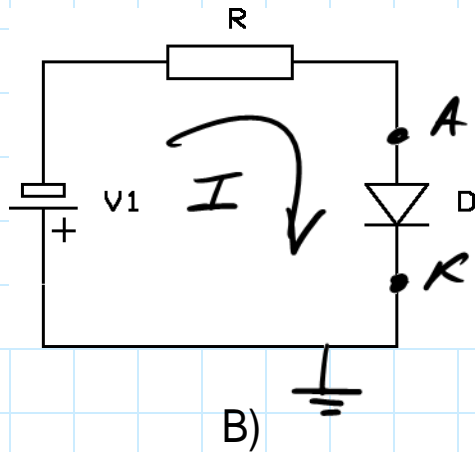
OR



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4. Calculate the operating point Q (V_{DQ} , I_{DQ}) of diodes in the following circuits:

DATA: $V_1 = 5V$; $R = 220\Omega$; Diode: $V_\gamma = 0.6V$



$Q(-5V, 0mA)$

$$\text{If } I=0 \Rightarrow \left. \begin{array}{l} V_A = -V_1 \\ V_K = 0 \end{array} \right\} \begin{array}{l} V_{AK} = -V = -5V \\ V_{DQ} = -5V \end{array}$$

D is reverse biased $\Rightarrow I = 0mA$
 $I_{DQ} = 0mA$

~~X~~

