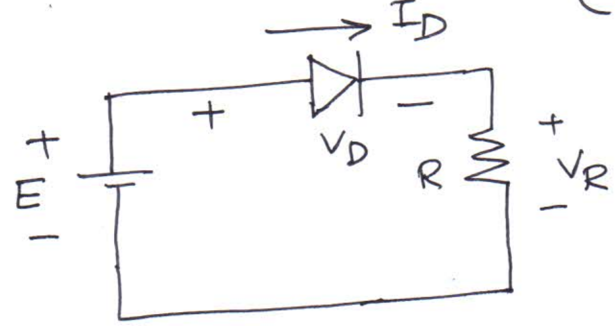
Load Line analysis for Diode

(Quiescent point, Q-pt)



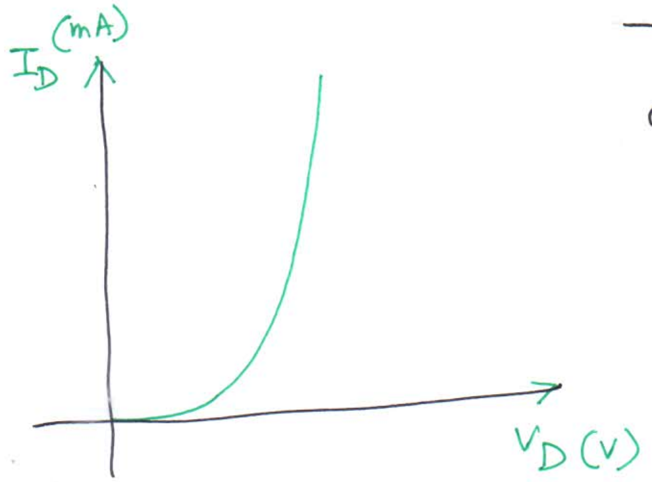
Applying Kirchhoff's voltage Law to the ckt

$$-E + V_D + V_R = 0$$

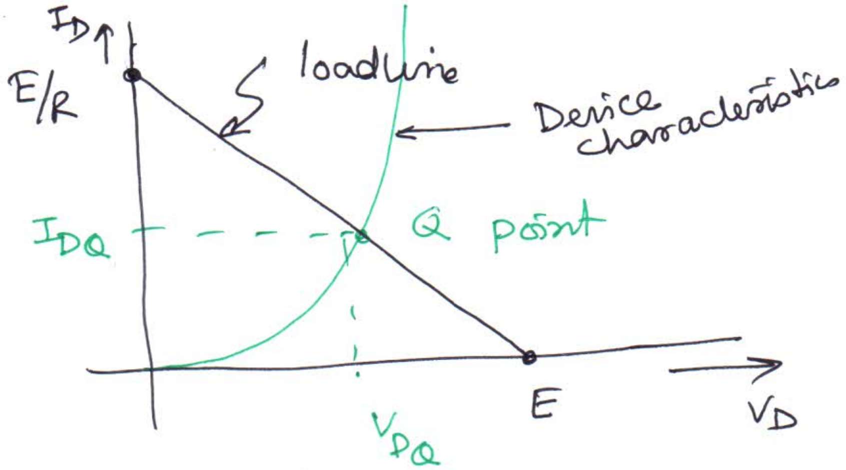
or $$E = V_D + V_R$$

$$V_R = I_D \cdot R$$

so $$E = V_D + I_D R.$$



Diode characteristic



$I_D = 0$

$E = V_D$

$V_D = 0,$

$I_D = E/R$

$$V_D = E \big|_{I_D = 0}$$

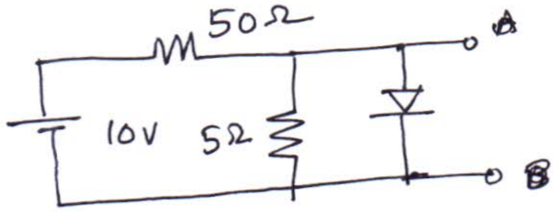
$$I_D = E/R \big|_{V_D = 0}$$

Slope of the load line ~~is~~ depends on R.

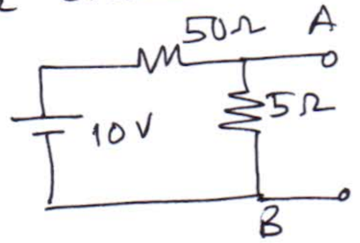
point of intersection of load line and device characteristic is the Q point.

Problems

Ex : 1. Find the current through the diode in the ckt shown in the Fig. Assume the diode as ideal.

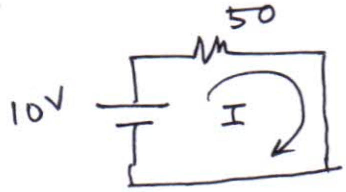


The diode will be forward biased.



$$V_{AB} = \frac{10 \times 5}{50+5} = \frac{10}{11}$$

when the Diode is forward biased (S.C).



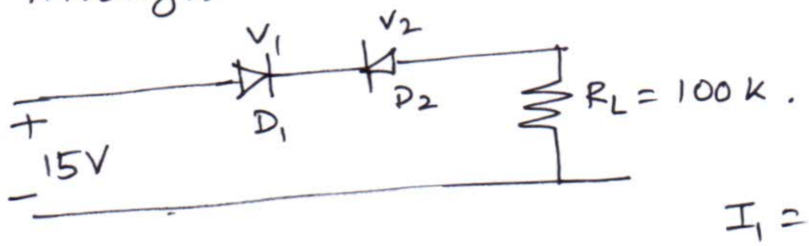
$$I = \frac{10\,V}{50\,\Omega} = 0{\cdot}2\ A.$$

Ex:-2. Two identical diodes are connected as shown, with following characteristics

$I_S = 0{\cdot}1\ \mu A$ $V_T = 26\ mV$ $\eta = 2$

Supply voltage $= 15V$ $R_L = 100K$

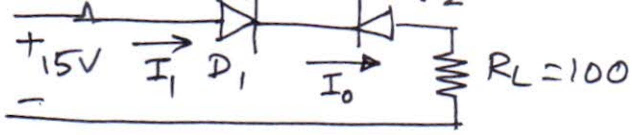
Find the voltage across each diode and ct through the ckt.



D_1 : fwd biased

ct through D_1 is I_1

$$I_1 = I_0 \left(e^{qV_1/\eta KT} - 1 \right)$$



D_2 is reverse biased, so ct through it is I_0.

$$I_1 = I_0$$

$$I_0\left(e^{\frac{qV_1}{\eta KT}} - 1\right) = I_0$$

or. $$e^{qV_1/\eta KT} = 2$$

or. $$V_1 = \left(\frac{\eta KT}{q}\right) \ln 2$$

$$= 2 \times 26 \times \ln 2 \text{ mV} = 0{\cdot}036\text{V}$$

$$V_2 = V - V_1 = 15 - 0.036 = 14{\cdot}964\text{ V}.$$