



Tt



## Note 2



P-type

It is doped with trivalent  
impurities e.g. boron

Conduction is mainly due  
to holes

n-type

It is doped with  
pentavalent impurities  
e.g. phosphorus

Conduction is mainly due  
to electrons



forward Bias: The positive terminal of the battery is connected to the P-side; and the negative to the N-side.  
There is high current flow carried across the sides

Reverse Bias: The positive terminal is connected to N-side, and the negative to the P-side. Current is effectively zero, except for a very tiny reverse saturation current caused by minority carriers



Tt



Paste

(3)

An ideal device is a theoretical model that performs its function perfectly without any losses or real-world limitations

(4)

Given

$$V_T \approx \frac{kT}{q}$$

where  $k = 1.38 \times 10^{-23} \text{ J/K}$ 

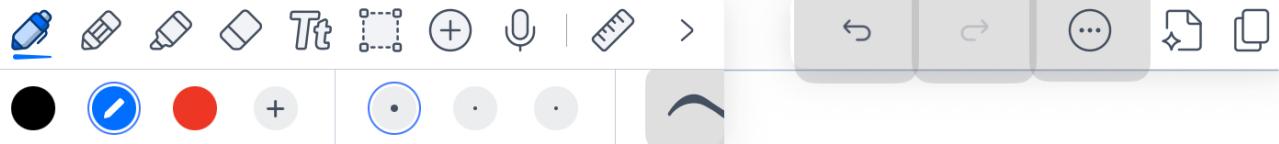
$$q = 1.6 \times 10^{-19} \text{ C}$$

$$T_k = T_c + 273 = 25 + 273 = 298 \text{ K}$$

$$V_T = \frac{1.38 \times 10^{-23}}{1.6 \times 10^{-19}} \times 298 \neq 298$$

$$V_T \approx 0.00257 \text{ V}$$

$$V_T \approx 25.67 \text{ mV}$$



(4b)

Given

$$I_D = I_s (e^{v_D / nV_T} - 1)$$

$$I_D = (40 \times 10^{-9}) (e^{0.5 / (2 \times 0.025 + 9)} - 1)$$

$$I_D = (40 \times 10^{-9}) (e^{9.731} - 1)$$

$$I_D = (40 \times 10^{-9}) (16851 - 1)$$

$$I_D = 0.673 \text{ mA}$$