1/2

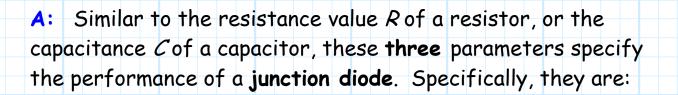
<u>The Junction</u> <u>Diode Equation</u>

The relationship between the current through a junction diode (i_D) and the voltage across it (v_D) is:

$$\dot{I_D} = I_s \left(e^{\frac{v_D}{n_T}} - 1 \right) \text{ for } v_D > -V_{ZK}$$

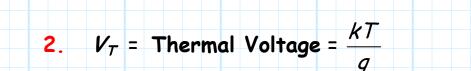
Note: this equation describes diode behavior in the forward **and** reverse biased region **only** (i.e., **not** valid for **breakdown**).

Q: Good **golly**! Just what do those **dog-gone** parameters *n*, *I*_s and *V*_T mean?



1. $I_s =$ **Saturation** (or scale) **Current**. Depends on diode material, size, and **temperature**.

Typical values range from 10⁻⁸ to 10⁻¹⁵ A (i.e., tiny)!



Where:

- k = Boltzman's Constant
- T = Diode Temperature ($^{\circ}$ K)
- q = Charge on an electron (coulombs)

At 20 $^{\circ}C$, $V_T \approx 25 mV$

IMPORTANT NOTE!: Unless otherwise stated, we will assume that each and every junction diode is at room temperature (i.e., $T = 20^{\circ}$ C). Thus, we will always assume that the thermal voltage V_T of all junction diodes is 25 mV (i.e., $V_T = 25$ mV)!

n = a constant called the ideality factor (i.e. a "fudge factor").

Typically,
$$1 \le n \le 2$$