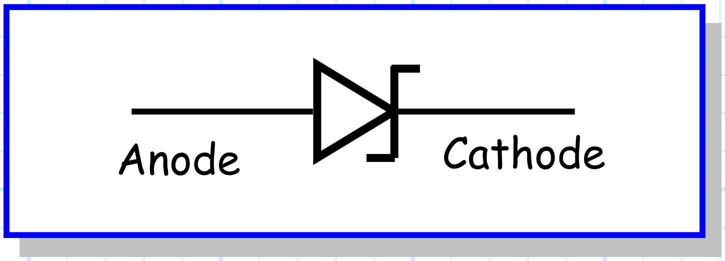
Zener Diode Notation

To distinguish a **zener** diode from conventional junction diodes, we use a modified diode **symbol**:



Generally speaking, a **zener** diode will be operating in either **breakdown** or **reverse bias** mode.

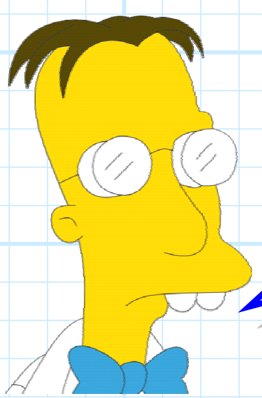
For both these **two** operating regions, the cathode **voltage** will be greater than the anode voltage, i.e.,:

$$v_D < 0 \quad \text{(for r.b. and bd)}$$

Likewise, the diode **current** (although often tiny) will flow from cathode to anode for these two modes:

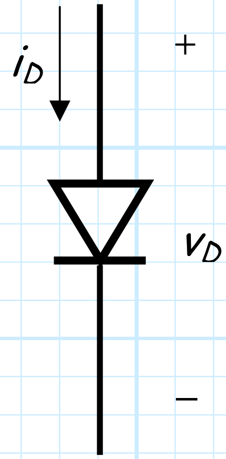
$$i_D < 0 \quad \text{(for r.b. and bd)}$$

Q: *Yikes! Won't the the numerical values of both i_D and v_D be* ***negative*** *for a zener diode (assuming only rb and b.d. modes).*

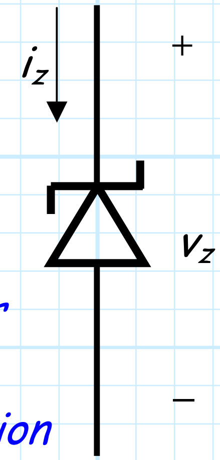


A: *With the standard diode notation, this is true. Thus, to avoid* ***negative*** *values in our circuit computations, we are going to* ***change*** *the definitions of diode current and voltage!*

Conventional diode notation



Zener diode notation

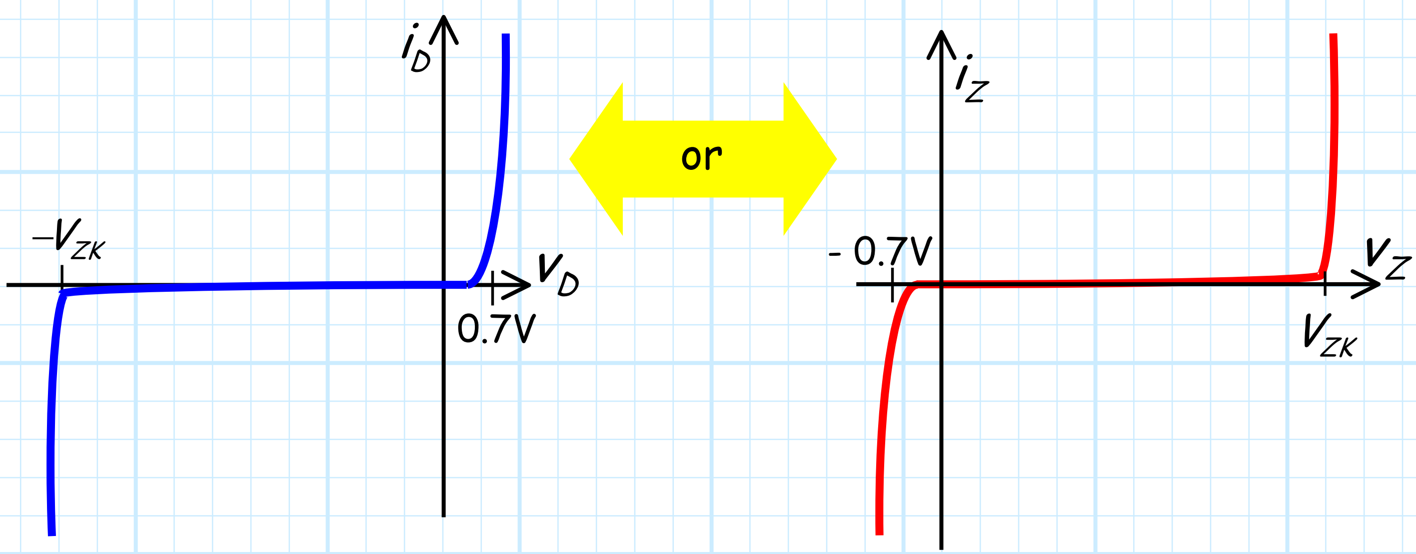


* In other words, for a Zener diode, we denote current flowing from **cathode to anode** as positive.

* Likewise, we denote diode voltage as the potential at the **cathode** with respect to the potential at the **anode**.

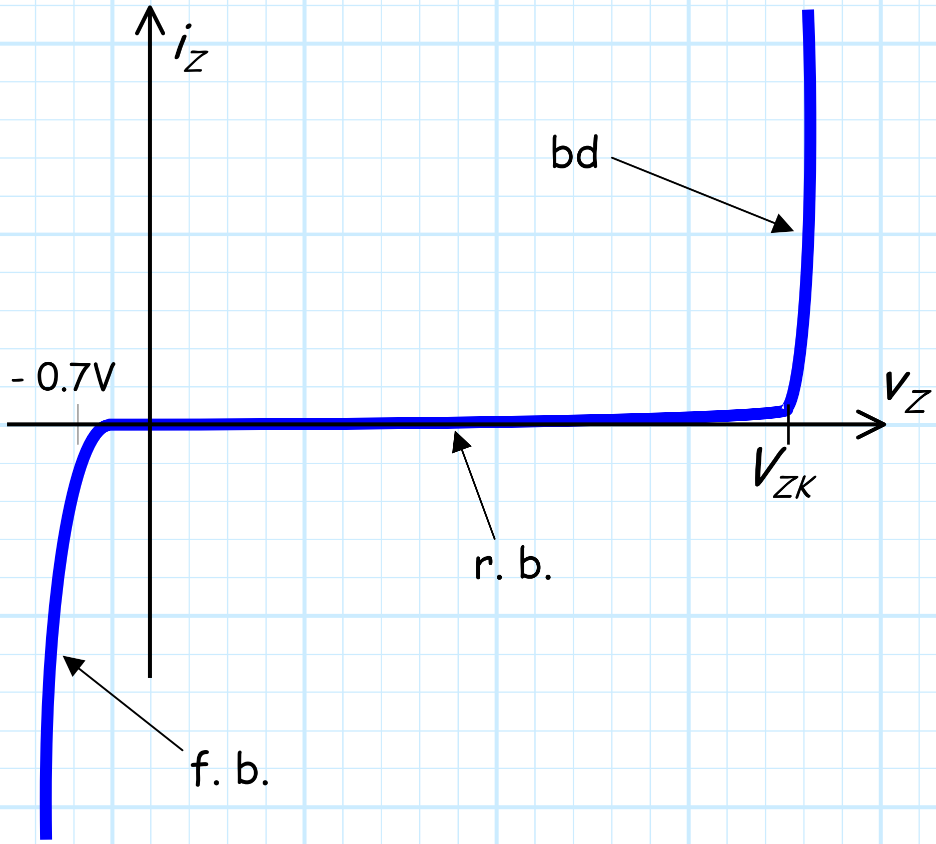
Note that each of the above two statements are precisely **opposite** to the "conventional" junction diode notation that we have used thus far:

$$v_Z = -v_D \quad \text{and} \quad i_Z = -i_D$$



Two ways of expressing the **same** junction diode curve.

The i_Z versus v_Z curve for a zener diode is therefore:



Thus, in **forward bias** (as unlikely as this is):

$$i_Z = -I_s \exp\left(\frac{-v_Z}{nV_T}\right)$$

or approximately:

$$v_Z \approx -0.7 \text{ V} \quad \text{and} \quad i_Z < 0$$

Likewise, in **reverse bias**:

$$i_Z \approx I_s \quad \text{and} \quad 0 < v_Z < V_{ZK}$$

And finally, for **breakdown**:

$$i_Z > 0 \quad \text{and} \quad v_Z \approx V_{ZK}$$