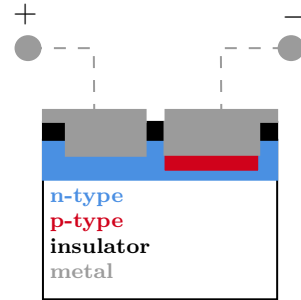# Q 1:

1.1: When we have an equilibrium, the Fermi level must be constant throughout the system. When we connect two systems with different Fermi levels, their bands will shift in order to have the Fermi level constant, resulting in the built-in voltage V_{bi}. This voltage is a barrier that maintains equilibrium between majority and minority carriers.
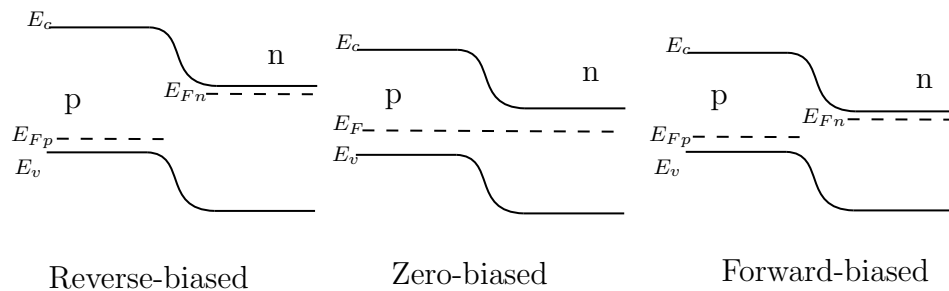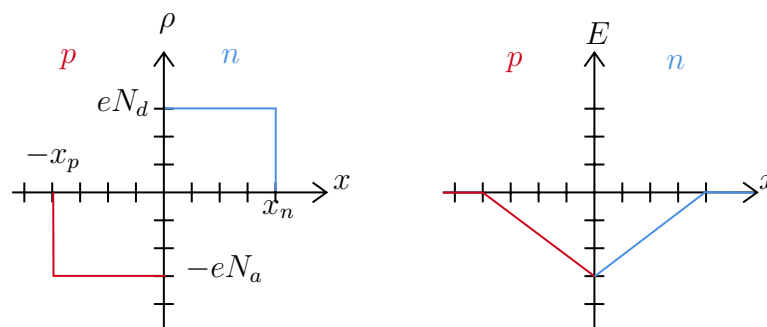
1.2:

We fabricate a p-n diode by first implanting an n-type layer, then implant a p-type piece inside it. Then, we grow an insulator, e.g. **oxidizing** SiO_2. And finally, deposit a metal as shown in the picture to wire it.

$$1.3: \ E_{Fip} - E_{Fp} = k_B T \ln \frac{p_0}{n_i} = 0.465 \ eV$$

Q 2:

Q 3:

$$\forall n \in \mathbb{N}; \ 2n \ mod \ 2 = 0 \implies True$$
$$\forall n \in \mathbb{W}; \ 2n \ mod \ 2 = 0 \implies True$$
$$\forall n \in \mathbb{Z}; \ 2n \ mod \ 2 = 0 \implies True$$
$$\forall n \in \mathbb{Q}; \ 2n \ mod \ 2 = 0 \implies False$$