

## Answers: Quasi-Fermi Levels Quiz

### Q1. Concept

**Answer: b) Because electrons and holes can have different carrier concentrations away from equilibrium**

• In non-equilibrium, electron and hole distributions may shift differently (e.g., under bias or illumination). Separate quasi-Fermi levels  $E_{Fn}$  and  $E_{Fp}$  capture these differences.

### Q2. Thermal Equilibrium vs. Non-Equilibrium

**Answer: a) They are equal and constant across the semiconductor**

• In equilibrium, a single Fermi level describes the entire carrier distribution. Two separate quasi-Fermi levels collapse into one.

### Q3. Carrier Concentration Expression

**Answer: b)  $n = N_c \exp(E_{Fn} - E_c / kT)$**

This comes directly from the Boltzmann approximation for electron occupancy in the conduction band using the electron quasi-Fermi level.

### Q4. Physical Interpretation

**Answer: b) Large deviation from equilibrium (e.g., under bias or illumination)**

• A wide separation between  $E_{Fn}$  and  $E_{Fp}$  means strong injection and non-equilibrium carrier populations.

### Q5. Band Diagram Representation

**Answer: b) Separate, continuous lines for electrons and holes, splitting across the junction**

• In forward-biased p-n junctions,  $E_{Fn}$  and  $E_{Fp}$  are drawn separately, indicating different “effective chemical potentials” for electrons and holes.