

Summary: Electrons and Holes in Semiconductors 1. Conclusion Mastering semiconductor physics is crucial for understanding electronic devices, including transistors and integrated circuits. Applications Photodetectors: Absorption of photons excites carriers, altering conductivity. Introduction Semiconductors are materials with electrical properties between conductors and insulators. Silicon Crystal Structure Silicon (Si) forms a crystalline solid where each atom bonds covalently with four neighbors, creating a repeating structure. Conductors, Semiconductors, and Insulators Conductors: Overlapping bands or partially filled bands (e.g., metals). Bond Model of Electrons and Holes Electrons: Mobile charge carriers generated when covalent bonds break. Energy Band Model Valence Band: Fully occupied by electrons at 0 K. Conduction Band: Empty at 0 K, partially filled at higher temperatures. Band Gap ( $E_g$ ): Energy gap between conduction and valence bands (1.1 eV for Si). Fermi Level and Carrier Concentration Fermi Function ( $f(E)$ ): Probability of an energy state being occupied by an electron. 2. 4. 5. 6. 7. 8. 9