

CHAPTER OVERVIEW

2: Model Problems That Form Important Starting Points

The model problems discussed in this Chapter form the basis for chemists' understanding of the electronic states of atoms, molecules, nano-clusters, and solids as well as the rotational and vibrational motions and energy levels of molecules.

In this Chapter, you should have learned about the following things.

1. Free particle energies and wave functions and their densities of states, as applied to polyenes, electron in surfaces, solids, and nanoscopic materials and as applied to bands of orbitals in solids.
2. The tight-binding or Hückel model for chemical bonding.
3. The hydrogenic radial and angular wave functions. These same angular functions occur whenever one is dealing with a potential that depends only on the radial coordinate, not the angular coordinates.
4. Electron tunneling and quasi-bound resonance states.
5. Angular momentum including coupling two or more angular momenta, and angular momentum as applied to rotations of rigid molecules including rigid rotors, symmetric, spherical, and asymmetric top rotations. Why half-integral angular momenta cannot be thought of as arising from rotational motion of a physical body.
6. Vibrations of diatomic molecules including the harmonic oscillator and Morse oscillator models including harmonic frequencies and anharmonicity.

[2.1: Free Electron Model of Polyenes](#)

[2.2: Bands of Orbitals in Solids](#)

[2.3: Densities of States in 1, 2, and 3 dimensions](#)

[2.4: Hückel or Tight Binding Theory](#)

[2.5: Hydrogenic Orbitals](#)

[2.6: Electron Tunneling](#)

[2.7: Angular Momentum](#)

[2.8: Rotations of Molecules](#)

[2.9: Vibrations of Molecules](#)

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