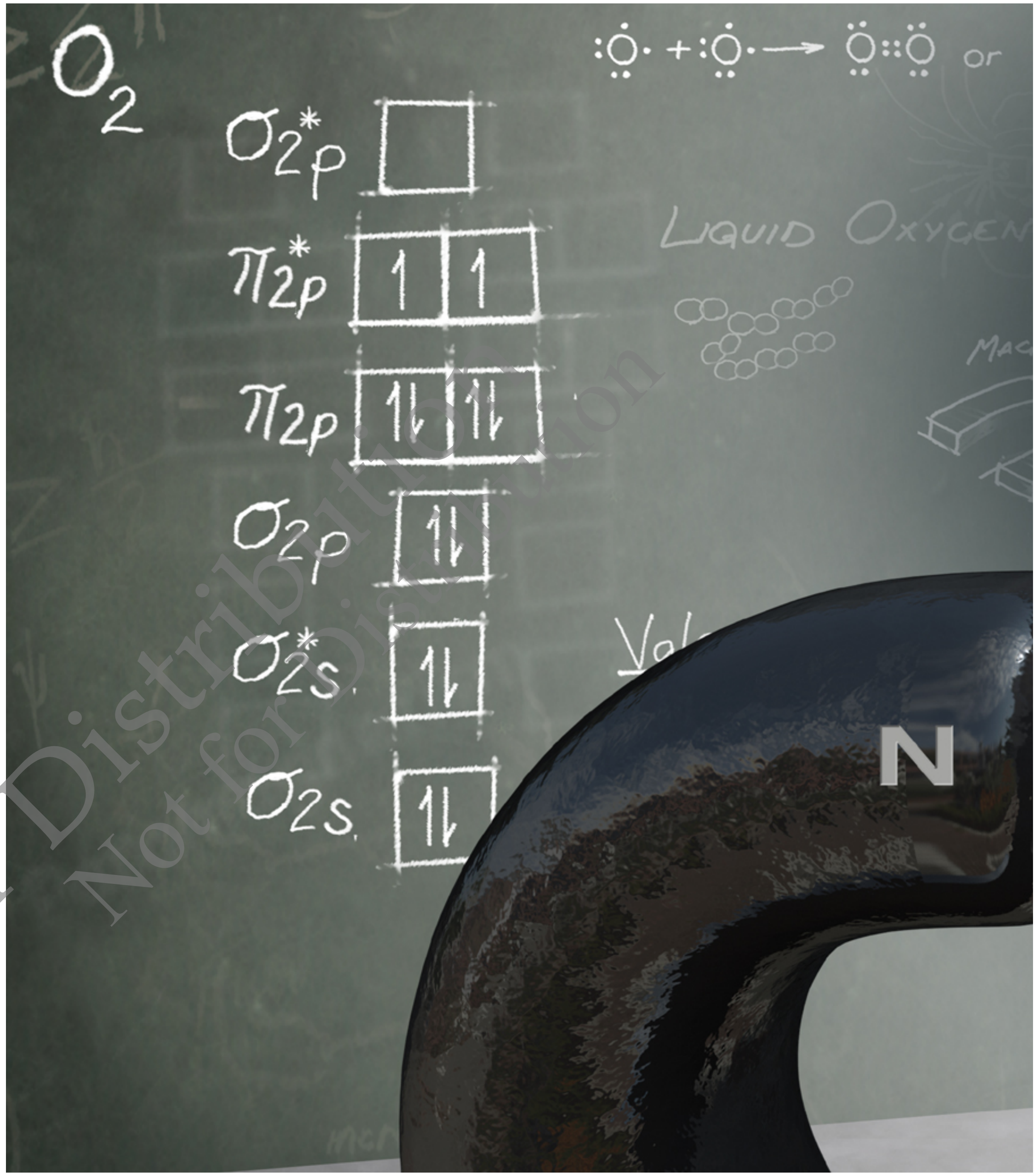
Pearson

Chapter 6
Chemical Bonding II: Valence Bond Theory and Molecular Orbital Theory



Liquid oxygen is magnetic. This image shows how liquid oxygen can be suspended between the poles of a magnet.

> "It is structure that we look for whenever we try to understand anything. All science is built upon this search…."
>
> —*Linus Pauling (1901–1994)*

Learning Outcomes

IN CHAPTER 5 WE EXAMINED a simple model for chemical bonding called the Lewis model. When we combine the Lewis model with valence shell electron pair repulsion (VSEPR), we can predict the shapes of molecules. In spite of the success of the Lewis model and VSEPR, however, we know that electrons do not act like dots. Instead, electrons exist within quantum-mechanical orbitals, as we discussed in Chapter 2. In this chapter, we examine two additional bonding theories—valence bond theory and molecular orbital theory—that treat electrons quantum mechanically. These theories are more sophisticated than the Lewis model and are also highly quantitative—they numerically predict quantities such as bond angles, bond strengths, and bond lengths. In other words, these theories make accurate predictions about the structure of molecules. As Linus Pauling points out in this chapter's opening quote, understanding structure is central to understanding anything. In chemistry, that is especially true.