

20. a. What is the relationship between  $n$  and the total number of orbitals in a main energy level?  
b. How many total orbitals are contained in the third main energy level? in the fifth?
21. a. What information is given by the spin quantum number?  
b. What are the possible values for this quantum number?
22. How many electrons could be contained in the following main energy levels with  $n$  equal to the number provided?  
a. 1  
b. 3  
c. 4  
d. 6  
e. 7
31. Write the orbital notation for the following elements. (Hint: See Sample Problem A.)  
a. P  
b. B  
c. Na  
d. O
32. Write the electron-configuration notation for the element whose atoms contain the following number of electrons:  
a. 3  
b. 6  
c. 8  
d. 13
33. Given that the electron configuration for oxygen is  $1s^2 2s^2 2p^4$ , answer the following questions:  
a. How many electrons are in each oxygen atom?  
b. What is the atomic number of this element?  
c. Write the orbital notation for oxygen's electron configuration.  
d. How many unpaired electrons does oxygen have?  
e. What is the highest occupied energy level?  
f. How many inner-shell electrons does the atom contain?  
g. In which orbital(s) are these inner-shell electrons located?

### PRACTICE PROBLEMS

23. Sketch the shape of an  $s$  orbital and a  $p$  orbital.
24. How does a  $2s$  orbital differ from a  $1s$  orbital?
25. How do a  $2p_x$  and a  $2p_y$  orbital differ?

## Electron Configurations

### SECTION 3 REVIEW

26. a. In your own words, state the Aufbau principle.  
b. Explain the meaning of this principle in terms of an atom with many electrons.
27. a. In your own words, state Hund's rule.  
b. What is the basis for this rule?
28. a. In your own words, state the Pauli exclusion principle.  
b. What is the significance of the spin quantum number?
29. a. What is meant by the highest occupied energy level in an atom?  
b. What are inner-shell electrons?
30. Determine the highest occupied energy level in the following elements:  
a. He  
b. Be  
c. Al  
d. Ca  
e. Sn
34. a. What are the noble gases?  
b. What is a noble-gas configuration?  
c. How does noble-gas notation simplify writing an atom's electron configuration?
35. Write the noble-gas notation for the electron configuration of each of the elements below. (Hint: See Sample Problem B.)  
a. Cl  
b. Ca  
c. Se
36. a. What information is given by the noble-gas notation  $[\text{Ne}]3s^2$ ?  
b. What element does this represent?
37. Write both the complete electron-configuration notation and the noble-gas notation for each of the elements below. (Hint: See Sample Problem C.)  
a. Na  
b. Sr  
c. P