

# Orbital Diagrams

## (Chem Worksheet 1-8)

Name: \_\_\_\_\_

An orbital diagram uses boxes with arrows to represent the electrons in an atom. Each box is an orbital diagram representing an orbital. Orbitals have a capacity of two electrons. Arrows are drawn inside the boxes to represent electrons. Two electrons in the same orbital must have opposite spin (↑ or ↓) and the arrows are drawn pointing in opposite directions. The following is an orbital diagram for carbon.



In writing an orbital diagram the first step is to determine the number of electrons. Usually this is the value on the number of protons, which is known as the atomic number. Therefore there are 6 electrons for the carbon. Arrows are drawn in the boxes starting from the lowest energy orbital and working up. This is known as the **Aufbau rule**. The **Pauli exclusion principle** requires that electrons in the same orbital have opposite spins. **Hund's rule** states that orbitals in a given subshell are half-filled before they are completely filled.

Boxes shown for various orbitals		
orbital	<input type="checkbox"/>	1 orbital
orbital	<input type="checkbox"/> <input type="checkbox"/>	2 orbitals
orbital	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	4 orbitals
orbital	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	6 orbitals



Write the name and symbol for the elements with the following orbital diagrams.

- |   |  |
|---|--|
| 1. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow$ | 4. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 3s \uparrow \downarrow$ |
| 2. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow$  | 5. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow$   |
| 3. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow$                              | 6. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow$                              |

There is an error with each of the following orbital diagrams. Explain the error.

- |   |   |
|---|---|
| 7. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow \quad 2p \uparrow \downarrow$ | 8. $1s \uparrow \downarrow \quad 2s \uparrow \downarrow \quad 2p \uparrow \downarrow$ |
|---|---|

Write orbital diagrams for the following. Do they alternate using a noble gas?

- |                |               |
|----------------|---------------|
| 9. Helium      | 13. cadmium   |
| 10. Neon       | 14. cobalt    |
| 11. calcium    | 15. platinum  |
| 12. Argon      | 16. platinum  |
| 17. aluminum   | 18. copper    |
| 18. phosphorus | 19. potassium |