

ChemQuest 13

Electron Configurations

Name: _____

Date: _____

Hour: _____

Information: Energy of Sublevels

Each sublevel has a different amount of energy. For example, orbitals in the 3p sublevel have more energy than orbitals in the 2p sublevel. The following is a list of the sublevels from lowest to highest energy:

1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d...

To help you, here is the above list with the orbitals included. Recall that each blank represents an orbital:

1s², 2s², 2p⁶, 3s², 3p⁶, 4s², 3d¹⁰, 4p⁶, 5s², 4d¹⁰, 5p⁶, 6s², 4f¹⁴.....

Note that d and f sublevels appear to be out of place. This is because they have extra high energies. For example, the 3d sublevel has a higher energy than a 4s sublevel and the 4f sublevel has a higher energy than the 6s sublevel.

When electrons occupy orbitals, they try to have the lowest amount of energy possible. (This is called the *Aufbau Principle*.) An electron will enter a 2s orbital only after the 1s sublevel is filled up and an electron will enter a 3d orbital only after the 4s sublevel is filled. Recall that only two electrons can fit in each orbital. (This is called the *Pauli Exclusion Principle*.) When two electrons occupy the same orbital they must spin in opposite directions—one clockwise and the other counterclockwise.

Critical Thinking Questions

- a) How many electrons would an atom need to have before it can begin filling the 3s sublevel?
10. Before the 3s can be filled, all these orbitals must be filled with two electrons in each orbital: 1s² 2s² 2p⁶.....

b) What is the first element that has enough electrons to have one in the 3s sublevel? (Use your periodic table.)
The 11th electron goes into the 3s sublevel. The atom with 11 electrons is sodium.
- a) How many electrons would an atom need to have before it can begin filling the 3d sublevel?
20 electrons because all of these orbitals need to be filled: 1s² 2s² 2p⁶ 3s² 3p⁶ 4s².....

b) What is the first element that has enough electrons to begin placing electrons in the 3d sublevel?
The 21st electron goes into the 3d sublevel. The atom with 21 electrons is scandium.

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Prove that $X \text{ solute} + X \text{ solvent} = 1.2$ The answer from question 12 + answer to question 13 = 115. In a certain salt water solution, the mole fraction of salt is 0.18. Find the mole fraction of water. $1.00 - 0.18 = 0.82$ Information: Mass Percent Composition Mass percent composition is similar to the mole fraction except the amounts of solute and solvent are in grams instead of moles. Here is the ...

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