

# Quantum Mechanical Model Electron Configurations

Ch 5

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## Objectives

- ▶ Understand how electrons are arranged in the quantum mechanical model of the atom
- ▶ Be able to write electron configurations

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## Quantum Mechanical Model of the Atom

- ▶ Electrons have different energies, like in Bohr model
- ▶ Electrons cannot exist between energy levels
  - Ladder

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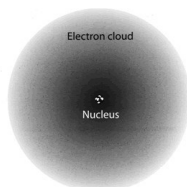
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## Quantum Mechanical Model of the Atom

- ▶ The electron is found inside a blurry “electron cloud”
- ▶ An area where there is a *chance* of finding an electron.
- ▶ Think of fan blades



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- ▶ Principle energy levels
  - $n = 1, 2, 3$ , etc
- ▶ Sublevels (shapes of orbitals, number of orbitals)
  - s (sphere, 1)
  - p (dumbbell, 3)
  - d (clover leaf, 5)
  - f (don't need to know, 7)

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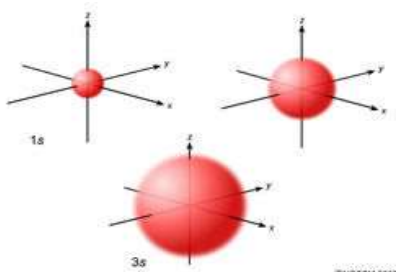
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## s orbitals



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<https://socratic.org/chemistry/electron-configuration-of-atoms/arrangement-of-electrons-in-orbitals-spd-and-f>

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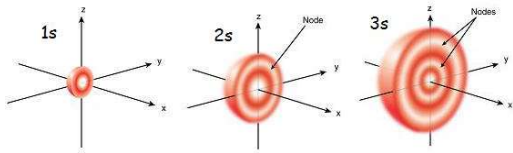
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## s orbitals



<https://socratic.org/chemistry/the-electron-configuration-of-atoms/arrangement-of-electrons-in-orbitals-spd-and-f>

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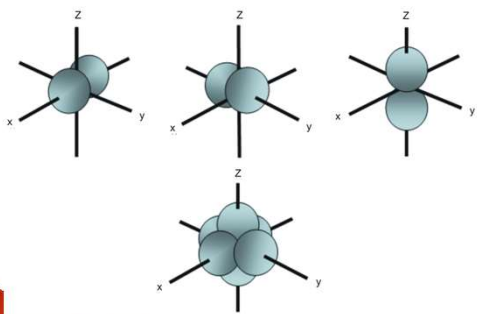
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## p orbitals



<https://socratic.org/chemistry/the-electron-configuration-of-atoms/arrangement-of-electrons-in-orbitals-spd-and-f>

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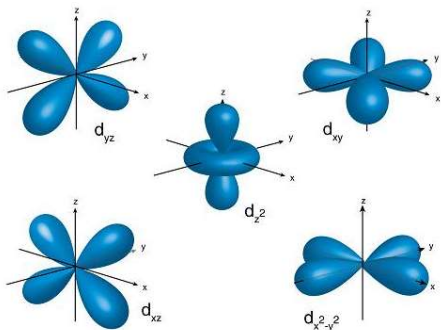
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## d orbitals



<https://socratic.org/chemistry/the-electron-configuration-of-atoms/arrangement-of-electrons-in-orbitals-spd-and-f>

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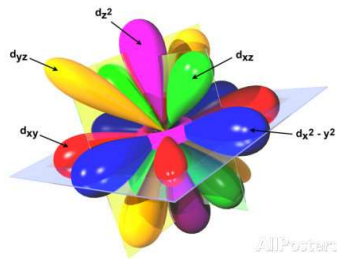
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## d orbitals



<http://www.artbrock.com> / consciousness-consciousness-and-language

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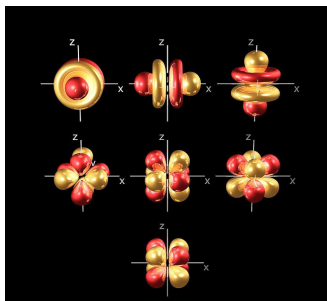
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## f orbitals



<https://socratic.org>

s-p-d-and-f

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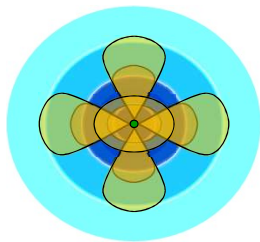
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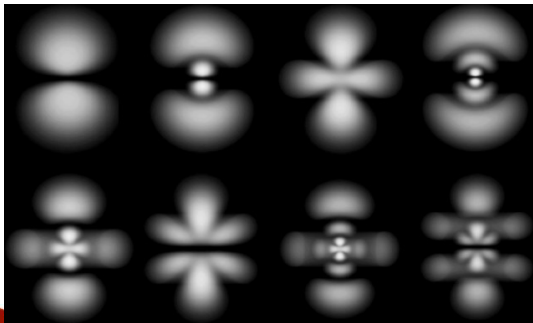
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<http://www.chemeddl.org/chemeddl.cgi?it=possible-for-an-atomic-orbital-to-exist-beyond-the-s-p-f-and-d-orbitals-they-taught-about-in-school-like-could-there-be-s-orbitals-beyond-that/> 13

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- ▶ Energy level  $n = 1$  can only have s orbitals
- ▶  $n = 2$  can only have s, p
- ▶  $n = 3$  can only have s, p, d
- ▶  $n = 4$  can only have s, p, d, f

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### Electrons in Orbitals

- ▶ Aufbau principle:  $e^-$  completely occupy lowest levels first

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## Electrons in Orbitals

- ▶ Pauli exclusion principle: Each orbital can only contain 2 e<sup>-</sup> at most
  - e<sup>-</sup> in same orbital have opposite spins ↑↓

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## Electrons in Orbitals

- ▶ Hund's rule: e<sup>-</sup> go into separate orbitals with same spin until forced to double up
- ▶ Think boys in hotel beds

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## Electron Configurations

- ▶ Determine the number of electrons in:
  - Na
  - Zn
  - Mo
- ▶ Using boxes worksheet, draw in the arrows (e<sup>-</sup>) for the elements above

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▶ Use your periodic table to write the electron configs for:

- Ag
- Te
- F
- Ba

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### Noble gas abbreviation

- ▶ Start at noble gas
- ▶ Abbreviation for Os:
  - Start at noble gas just before
    - [Xe]
  - Continue e<sup>-</sup> configuration
    - [Xe]6s<sup>2</sup>5d<sup>1</sup>4f<sup>14</sup>5d<sup>4</sup>
- ▶ Now try mercury, tin, and terbium

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