

CHAPTER 3 SELF-QUIZ

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1. False: The region in space where an electron is most likely to be found is called an orbital.
2. False: Electron configurations are often condensed by writing them using the previous noble-gas core as a starting point. In this system, $[\text{Ar}] 3d^3 4s^2$ would represent vanadium.
3. False: The f sublevel is thought to have seven orbitals.
4. True
5. True
6. False: Rutherford knew the nucleus had to be very small because very few alpha particles were deflected when fired through a layer of gold atoms.
7. False: Electrons shifting to lower levels, according to Bohr, would account for emission spectra.
8. True
9. True
10. True
11. False: The Pauli exclusion principle states that no more than two electrons may occupy the same orbital, and that they must have opposite spins.
12. (b)
13. (d)
14. (a)
15. (c)
16. (c)
17. (b)
18. (b)
19. (d)

CHAPTER 3 REVIEW

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Understanding Concepts

- (a) Rutherford interpreted the deflection of alpha particles travelling through a thin foil to mean that atoms had tiny, massive nuclei.
(b) Bohr interpreted the bright-line spectrum of hydrogen to mean that electrons exist only at specific energy levels.
- The Rutherford model explained nothing about the nature of electrons. The Bohr model did not make acceptable predictions for atoms larger than hydrogen.
- Orbit and orbital are terms that both refer to electrons within atoms. An orbit is a simplistic representation of a small particle in a circular path, used in the Bohr–Rutherford model. An orbital is a probability density for a wave function that “occupies” a volume of space, used in the visualizing of the quantum mechanical model.
- The main kind of experimental work used to develop the concepts of quantum mechanics was spectroscopy, specifically the analysis of bright-line spectra.
- (a) Quantum is a term referring to a smallest unit or part of something.
(b) Orbital is a term describing a volume of space that is “occupied” by an electron.
(c) Electron probability density describes the calculated likelihood of locating an electron at any point within a given volume of space.
(d) Photon is a quantum of electromagnetic energy— a smallest “piece” or “package” of light.

oxygen atom, O

- (a) the main/principal energy level is the first number: 1, 2, ...
- (b) the energy sublevel (subshell) is the letter following: *s*, *p*, ...
- (c) the orbital orientation (*x*, *y*, or *z* axis) is the respective __ line
- (d) the spin of the electron (up or down) is the arrow: \uparrow or \downarrow

7. The idea of electron spin comes from observations of line spectra influenced by a magnetic field as well as evidence from different kinds of magnetism.