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# Completing the Model of the Atom CHAPTER 7

## Reviewing Vocabulary

**For each item in Column A, write the letter of the matching item in Column B.**

| Column A | Column B |
|---|---|
| _____ **1.** electron configuration | **a.** *s, p, d*, or *f* within an energy level |
| _____ **2.** Heisenberg uncertainty principle | **b.** can hold a maximum of two electrons |
| _____ **3.** inner transition element | **c.** $1s^2 2s^2 2p^6 3s^2 3p^6$ |
| _____ **4.** orbital | **d.** lanthanide or actinide |
| _____ **5.** sublevel | **e.** discovery led to electron cloud model |

**Complete each statement using the terms in Column A above. Some terms will be used more than once.**

**6.** Energy _____ have only slight differences in energy.

**7.** According to the _____, the position and energy of an electron cannot both be measured accurately at the same time.

**8.** Within a sublevel, electrons fill the *s* _____ first.

**9.** The most stable arrangement of electrons in an atom is a(n) _____.

**10.** Orbitals in the *d* _____ are called *d* orbitals.

**11.** The last electron of a(n) _____ occupies an inner-level 4*f* orbital in the sixth period or a 5*f* orbital in the seventh period.

**12.** You can write _____ by interpreting the periodic table using *s, p, d,* and *f* blocks.

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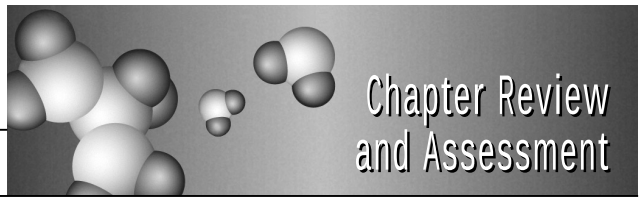


# Completing the Model of the Atom CHAPTER 7

## Understanding Concepts Part A

**Place a *T* for true or an *F* for false on the blank for each of the following statements. Change the underlined word or phrase in each false statement to make it true. Write your correction on the blank.**

**1.** _____ The Bohr model of the atom could be correctly applied to only one atom, the helium atom.

**2.** _____ The higher the frequency of electromagnetic radiation is, the lower its wavelength is.

**3.** _____ In moving from a lower energy level to a higher energy level in an atom, an electron emits energy.

**4.** _____ The designations used to represent electron energy sublevels in an atom are *a*, *b*, *c*, and *d*.

**5.** _____ The 1*s* orbital is farther from the nucleus than is the 2*s* sublevel.

**6.** _____ The maximum number of electrons in any *p* sublevel is six.

**7.** _____ All *s* orbitals are spherical.

**8.** _____ The three *p* orbitals in an energy level are arranged at right angles to each other.

**9.** _____ The maximum number of electrons in any *f* sublevel is 18.

**10.** _____ The symbol [He] stands for the electron configuration $1s^2 2s^2 2p^6$.

**11.** _____ The configuration [He]$2s^2 2p^4$ is an abbreviated form of the configuration $1s^2 2s^2 2p^4$.

**12.** _____ In general, the closer an orbital is to the nucleus, the more energy an electron possesses.

**13.** _____ When an electron absorbs a specific amount of energy, the electron can jump to a higher energy level.

**14.** _____ The results of Rutherford's gold foil experiment suggested that most of an atom is solid.

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# Completing the Model of the Atom CHAPTER 7

## Understanding Concepts Part B

**From its position in the periodic table, write the electron configuration of each of the following elements. Use noble-gas inner-core abbreviations wherever possible.**

**1.** nitrogen _____

**2.** sodium _____

**3.** boron _____

**4.** carbon _____

**5.** beryllium _____

**6.** aluminum _____

**Briefly explain why each of the following electron configurations is incorrect or impossible for atoms in their most stable arrangement.**

**7.** $1s^2 2s^1 2p^6 3s^2$ _____

_____ .

**8.** $1s^2 2s^2 2p^6 s^2 3p^4$ _____

_____ .

**9.** $1s^2 2s^2 3s^2 3p^5$ _____

_____ .

**10.** $1s^2[\mathrm{He}]2s^2 2p^6 3s^1$ _____

_____ .

**11.** $1s^1 2s^1$ _____

_____ .

**12.** $1s^2 2s^2 2p^5 3s^1$ _____

_____ .

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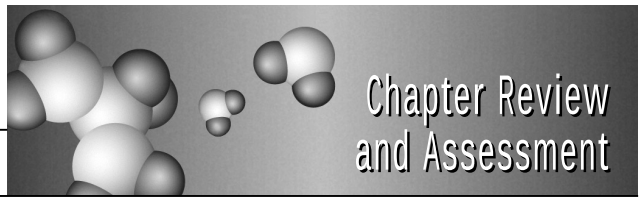


# Completing the Model of the Atom

CHAPTER 7

## Thinking Critically

**State the total number of electrons in an atom that has each of the following electron configurations.**

**1.** [He]$2s^2$ _____

**2.** [Ne]$3s^2 3p^1$ _____

**3.** [Ar]$4s^1$ _____

**The same electron configuration can represent more than one entity. For each configuration shown below, name one atom and one ion that has that configuration.**

**4.** [He]$2s^2 2p^6$ _____

_____

**5.** $1s^2$ _____

_____

**Tell which orbital in each of the following pairs has the higher energy level.**

**6.** 1*s* and 2*s* _____

**7.** 2*p* and 2*s* _____

**8.** 2*p* and 4*s* _____

**9.** 5*d* and 3*p* _____

**10.** 4*s* and 3*d* _____

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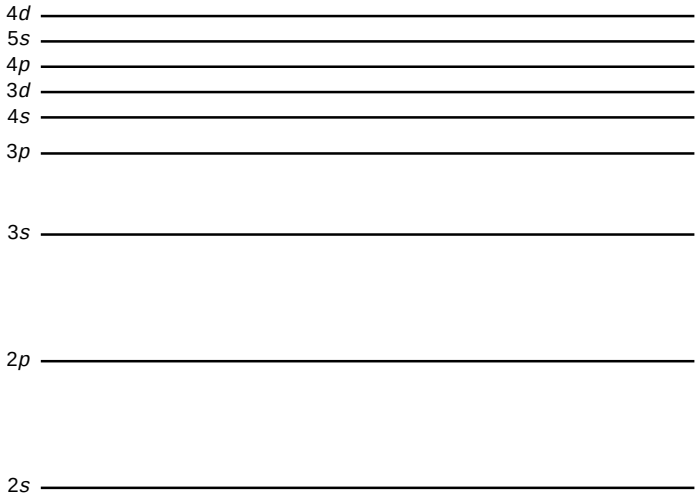
# Completing the Model of the Atom

CHAPTER 7

## Interpreting Data and Lab Skills

**A diagram like the one below is sometimes used to illustrate the relative energies of the orbitals in an atom.**




**Based on this diagram, rank each of the following electron transitions in order of increasing energy change, lowest to highest.**

**Transitions**

**a.** 4*s* to 1*s*

**b.** 4*d* to 1*s*

**c.** 2*s* to 1*s*

**d.** 4*p* to 4*s*

**e.** 5*s* to 4*s*

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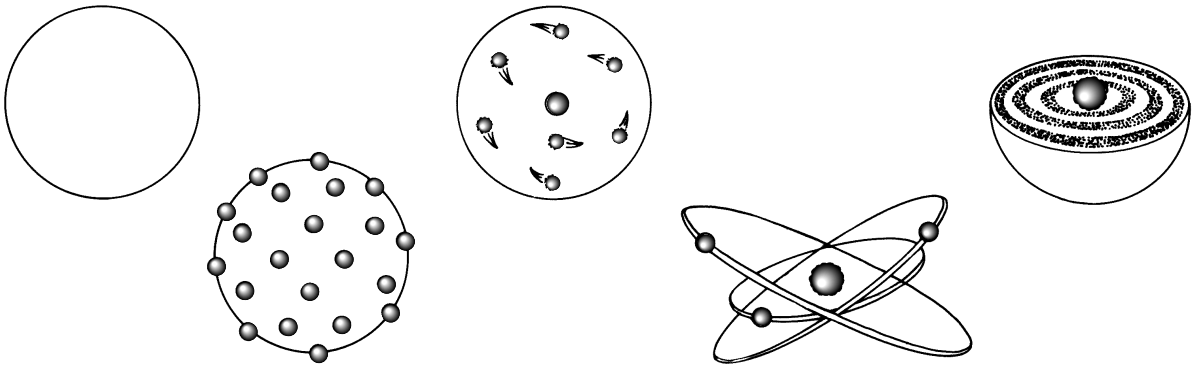
# Completing the Model of the Atom CHAPTER 7

## Performance Assessment

Use a long piece of butcher paper to construct a time line of the development of the atomic theory. Start with the Dalton model of the atom and include the other important steps listed below. Place each of these steps in their correct chronological position on the time line by writing in the name of the person who made the discovery and the date on which it was made. If possible, find a photograph or drawing of the discoverer, a piece of his or her apparatus, or some other object that you can tie in with the discovery.



Above the line, record events from other fields of science (biology, physics, astronomy, earth science, etc.) that occurred at about the same time as the events shown on the atomic model line. Below the line, record historical events from literature, the arts, military or political history, or other fields that also occurred at about the same time as the discoveries in atomic science.

**Steps in the development of the atomic theory are**

(1) Dalton model;
(2) discovery of the electron: Thomson model;
(3) discovery of the nucleus: Rutherford model;
(4) discovery of the neutron;
(5) discovery of energy levels: Bohr model;
(6) discovery of energy sublevels: Schrödinger model;
(7) other steps found during your research

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