

# AIM | How are electrons arranged 26 | around the nucleus?

Electrons spin very fast. They spin in *orbits* around the nucleus. The spinning is so fast that they seem to form a solid *shell* around the nucleus. All atoms except hydrogen and helium atoms have more than one shell.

We label the shells of electrons. Each shell is labeled with a capital letter. The first shell is the "K" shell. It is the shell closest to the nucleus. The next shell is the "L" shell. After that comes the "M" shell. And so on.

Each shell can hold only a certain number of electrons.

The "K" shell can hold 2 electrons.

The "L" shell can hold 8 electrons.

The "M" shell can hold 8 electrons.\*

The number of shells an atom has depends on the number of electrons for that atom. Each shell must have its full number of electrons before a new shell starts. If there are more electrons than a shell can hold, a new shell starts.

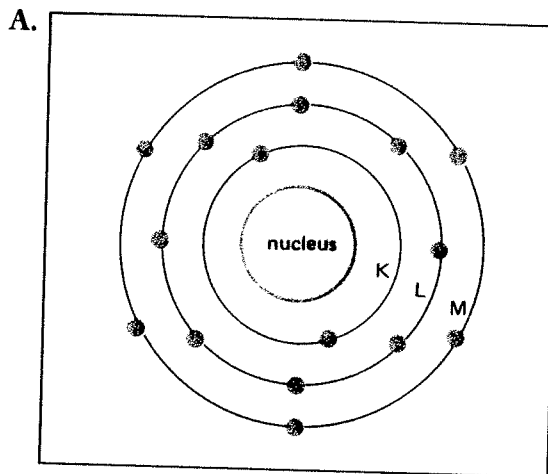
The outer shell of most atoms is not full. Only the atoms in the elements of Group O on the Periodic Table have full outer shells.

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\*through atomic number 20.

## WHAT DO THE PICTURES SHOW?

The pictures below show how electrons are arranged in two atoms. Look closely at each figure. Then answer the questions.

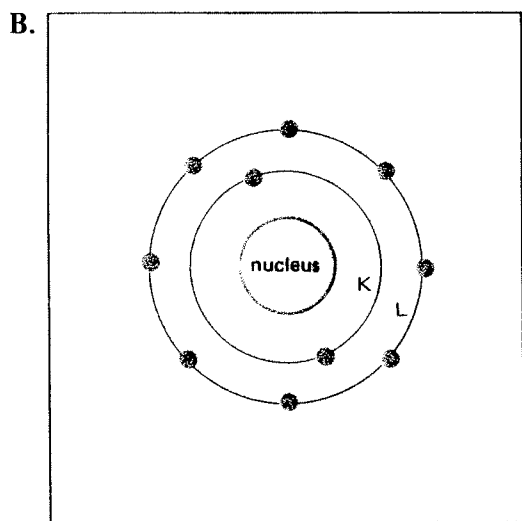


1. This figure shows a sulfur atom. The atomic number of sulfur is 16.

1. How many *shells* of electrons does sulfur have? \_\_\_\_\_
2.
  - a) What is the first shell called? \_\_\_\_\_
  - b) How many electrons does the first shell have? \_\_\_\_\_
  - c) Is this first shell full? \_\_\_\_\_
  - d) The first shell is \_\_\_\_\_ the nucleus.  

closest to, farthest from
3.
  - a) What is the second shell called? \_\_\_\_\_
  - b) How many electrons does the second shell have? \_\_\_\_\_
  - c) Is this second shell full? \_\_\_\_\_
4.
  - a) What is the third shell called? \_\_\_\_\_
  - b) How many electrons does the third shell have? \_\_\_\_\_
  - c) Is this third shell full? \_\_\_\_\_
5. Altogether, how many *electrons* does sulfur have? \_\_\_\_\_
6. Is another shell needed? \_\_\_\_\_
7. Circle the answer that best completes the sentence. Another shell is not needed because:
  - a) the last shell is full.
  - b) this atom has no more electrons.

ii. This figure shows a neon atom. The atomic number of neon is 10.



1. How many electron shells does this atom have? \_\_\_\_\_

2. a) What is the first shell called? \_\_\_\_\_  
\_\_\_\_\_

b) How many electrons does this shell have? \_\_\_\_\_

c) Is this shell full? \_\_\_\_\_

3. a) What is the second shell called? \_\_\_\_\_  
\_\_\_\_\_

b) How many electrons does it have? \_\_\_\_\_  
\_\_\_\_\_

c) Is this second shell full? \_\_\_\_\_

4. Altogether, how many electrons does this atom have? \_\_\_\_\_

5. Is another shell needed? \_\_\_\_\_

Why? \_\_\_\_\_  
\_\_\_\_\_

**MATCHING** Match the two lists. Write the correct letter on the line next to each number.

1. \_\_\_\_\_ between electrons

a) closest shell

2. \_\_\_\_\_ 5 electrons

b) path

3. \_\_\_\_\_ orbit

c) need three shells

4. \_\_\_\_\_ 12 electrons

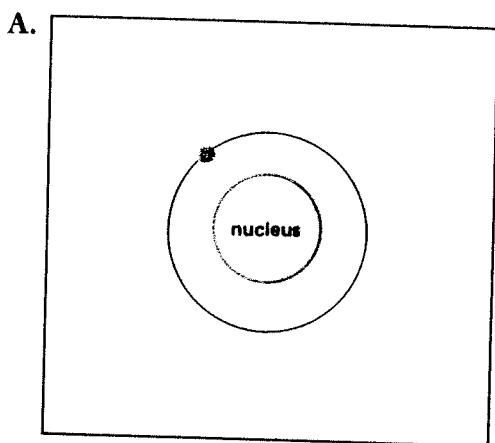
d) empty space

5. \_\_\_\_\_ "K" shell

e) need two shells

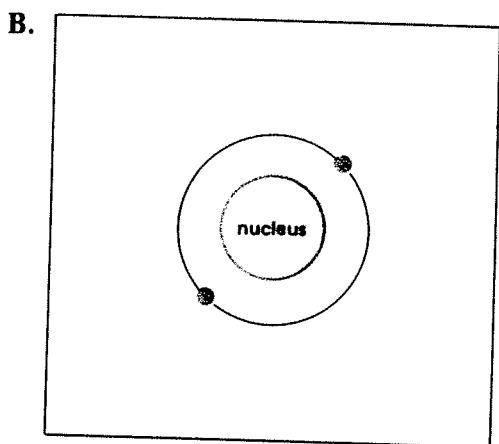
## MORE ABOUT ELECTRONS

Each picture below shows how electrons are arranged in certain atoms. Look at each diagram. Then answer the questions.



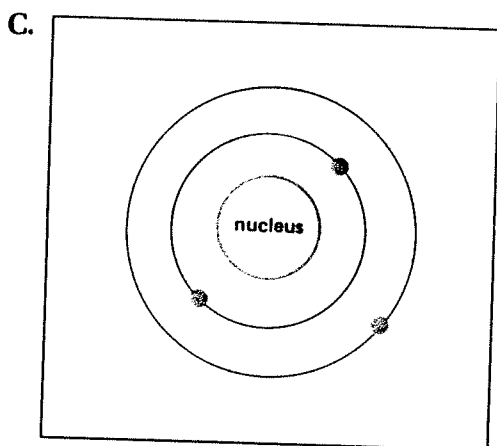
A. The atomic number of hydrogen is 1. Hydrogen is the simplest atom. It has only one electron.

1. How many electron shells does a hydrogen atom have? \_\_\_\_\_
2. What is this shell called? \_\_\_\_\_
3. Is this shell complete? \_\_\_\_\_



B. The atomic number of helium is 2. A helium atom has two electrons.

1. How many electron shells does a helium atom have? \_\_\_\_\_
2. What is this shell called? \_\_\_\_\_
3. Is the shell full? \_\_\_\_\_



C. The atomic number of lithium is 3. A lithium atom has three electrons.

1. How many electron shells does a lithium atom have? \_\_\_\_\_
2. What are these shells called? \_\_\_\_\_
3. Which one is the inner shell? \_\_\_\_\_
4. Is the inner shell full? \_\_\_\_\_
5. Which is the outer shell? \_\_\_\_\_
6. Is the outer shell full? \_\_\_\_\_

## HOW MANY SHELLS?

How many shells are needed for each of the following? Write your answer in the space.

1. How many shells do 2 electrons need? \_\_\_\_\_
2. 4 electrons need \_\_\_\_\_ shells.
3. 10 electrons need \_\_\_\_\_ shells.
4. 16 electrons need \_\_\_\_\_ shells.
5. 20 electrons need \_\_\_\_\_ shells.

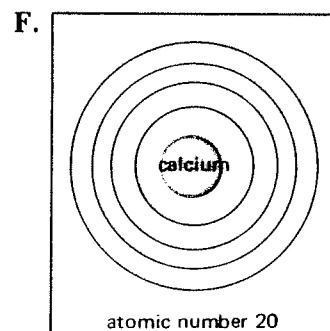
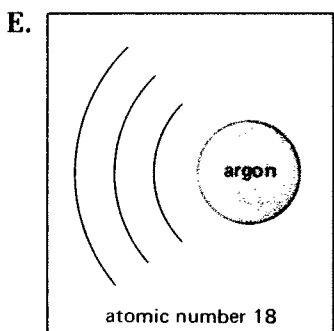
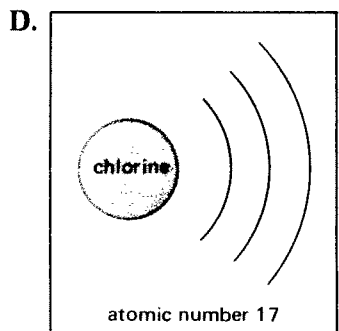
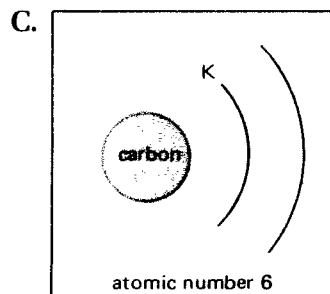
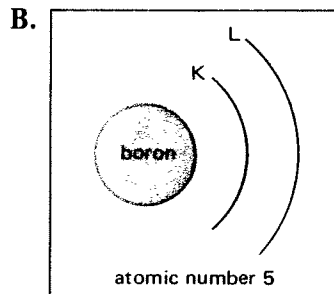
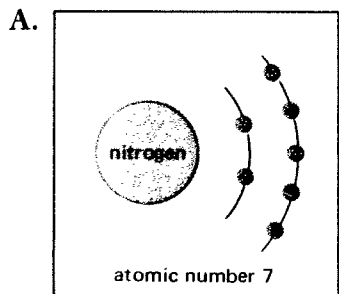
## FILL IN THE ELECTRONS.

Figure out how many electrons each of these atoms has. Then draw them in their proper shells. Make a small ball [●] to show an electron.

Remember P E N

Label each shell that is not already labeled.

An example



One of these atoms has a full outer ring. Which atom is it? \_\_\_\_\_

**MULTIPLE CHOICE** In the space on the right, write the letter that best completes each sentence.

- 
1. Electrons move 1. \_\_\_\_\_
    - a) inside the nucleus.
    - b) very slowly.
    - c) outside the nucleus.
  2. Electrons move in paths called 2. \_\_\_\_\_
    - a) roads.
    - b) orbits.
    - c) electrical charges.
  3. An electron shell 3. \_\_\_\_\_
    - a) is solid.
    - b) only seems to be solid.
    - c) is tightly packed.
  4. Electron shells seem to be solid because the electrons 4. \_\_\_\_\_
    - a) move very fast.
    - b) have a minus charge.
    - c) balance the protons.
  5. Which shell is the "M" shell? 5. \_\_\_\_\_
    - a) first
    - b) second
    - c) third

**TRUE OR FALSE** Write T on the line next to the number if the sentence is true.  
Write F if the sentence is false.

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1. \_\_\_\_\_ Every atom has at least one electron.
  2. \_\_\_\_\_ Every atom has at least two electron shells.
  3. \_\_\_\_\_ The first electron shell is the "L" shell.
  4. \_\_\_\_\_ The "L" shell can hold 8 electrons.
  5. \_\_\_\_\_ The "L" shell always has 8 electrons.
  6. \_\_\_\_\_ If there is an "L" shell, it means that the "K" shell is full.
  7. \_\_\_\_\_ A full "K" shell has three electrons.
  8. \_\_\_\_\_ A helium atom (atomic number 2) is a "full" atom.
  9. \_\_\_\_\_ A shell must be full before a new shell is started.
  10. \_\_\_\_\_ The heavier the atom, the fewer the electrons.

**COMPLETE  
THE CHART**

Fill in the missing information in this chart. The first element, magnesium, has already been done for you. ("e " means electrons.)

Atom	Atomic Number	Number of Electrons	Number of Electrons in Each Shell	Is the Last Shell Complete? (Yes or No)
magnesium	12	12	K = 2e <sup>-</sup> L = 8e <sup>-</sup> M = 2e <sup>-</sup>	no
carbon	6		K = ___e <sup>-</sup> L = ___e <sup>-</sup> M = ___e <sup>-</sup>	
oxygen	8		K = ___e <sup>-</sup> L = ___e <sup>-</sup> M = ___e <sup>-</sup>	
phosphorus	15		K = ___e <sup>-</sup> L = ___e <sup>-</sup> M = ___e <sup>-</sup>	
argon	18		K = ___e <sup>-</sup> L = ___e <sup>-</sup> M = ___e <sup>-</sup>	
beryllium	4		K = ___e <sup>-</sup> L = ___e <sup>-</sup>	