

Name: \_\_\_\_\_

# Skill Sheet 18-A

# Atoms, Isotopes, and Ions

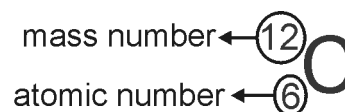


You have learned that atoms contain three smaller particles called protons (positive charge), neutrons (no charge) and electrons (negative charge). You have also learned that the number of protons determines the type of atom. In this skill sheet, you will learn about atoms that have the same number of protons, but different numbers of neutrons (isotopes) and different numbers of electrons (ions).

## 1. What are isotopes?

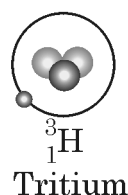
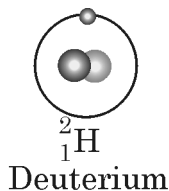
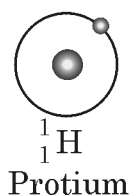
In addition to the atomic number, every atom can also be described by its **mass number**. The mass number is equal to the number of protons and neutrons in the nucleus of an atom. Recall that atoms of the same element have the same number of protons. Atoms of the same element *can* have different numbers of neutrons. These different forms of the same element are called **isotopes**.

Sometimes the mass number for an element is included in its symbol. When the symbol is written in this way, we call it **isotope notation**. The isotope notation for carbon-12 is shown to the right. You can determine the number of neutrons by subtracting the atomic number (bottom) from the mass number (top).



How many neutrons does an atom of carbon-12 have? To find out, simply take the mass number and subtract from it, the atomic number:  $12 - 6 = 6$ .

Hydrogen has three isotopes as shown below.



1. How many neutrons does protium have? How about deuterium and tritium?

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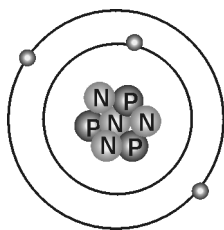
2. Use the diagram of an atom to answer the questions:

a. What is the atomic number of the element?

b. What is the name of the element?

c. What is the mass number of the element?

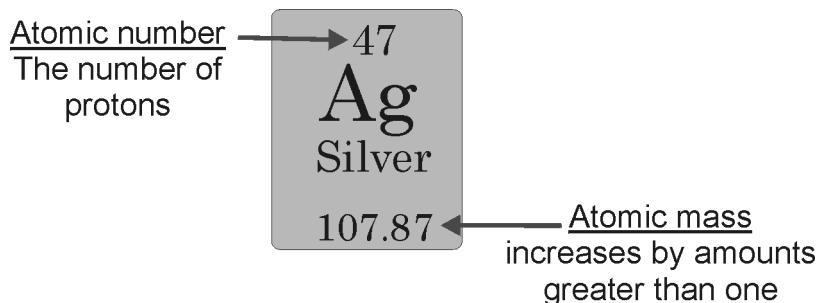
d. Write the isotope notation for this isotope.



## 2. What is the atomic mass?

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If you look at a periodic table, you will notice that the atomic number increases by one whole number at a time. This is because you add one proton at a time for each element. The **atomic mass** (see diagram below) however, increases by amounts greater than one. This difference is due to the neutrons in the nucleus. The value of the atomic mass reflects the abundance of the stable isotopes for an element that exist in the universe.



Since silver has an atomic mass of 107.87, this means that most of the stable isotopes that exist have a mass number of 108. In other words, the most common silver isotope is “silver-108.” To figure out the most common isotope for an element, round the atomic mass to the nearest whole number.

1. Look up bromine on the periodic table. What is the most common isotope of bromine?

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2. Look up potassium on the periodic table. How many neutrons does the most common isotope of potassium have?

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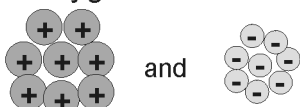
## 3. What are ions?

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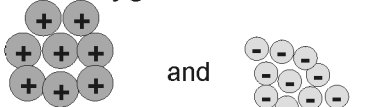
Many atoms tend to gain or lose some of their electrons. When atoms gain or lose electrons, they are no longer neutral, but have an electrical charge that is either positive or negative. Atoms that have a positive or negative charge are called **ions**.

You can determine the electric charge of an ion by simply comparing the number of protons and electrons. If there are more protons than electrons, then the ion has a *positive* charge that is equal to the number of extra protons. If there are more electrons than protons, then the ion has a *negative* charge that is equal to the number of extra electrons. For example:

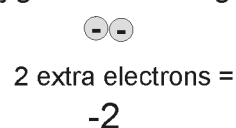
An oxygen atom has...



An oxygen ion has...



An oxygen ion's charge is...



1. A sodium ion has 11 protons and 10 electrons. What is its charge?

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2. A magnesium ion has 12 protons and 10 electrons. What is its charge?

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