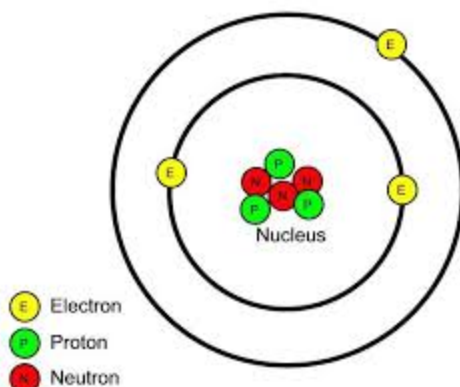


Atomic Notes and Practice

Parts of an atom:

Atoms contain a dense nucleus consisting of protons and neutrons.
Electrons surround the nucleus in energy levels of the electron cloud.



Atomic number: The atomic number is the number of protons in an atom. The number of protons determines the element, so *the number of protons in an atom of an element does not change*.

-Hydrogen (H) has an atomic number of 1, which means an atom of hydrogen ALWAYS has 1 proton.

-Carbon (C) has an atomic number of 6, which means an atom of carbon ALWAYS has 6 Protons.

-Gold (Au) has an atomic number of 79. How many protons are in a gold atom? _____

Charges:

Protons have a positive charge. (+)

Electrons have a negative charge. (-)

Neutrons have no charge. (neutral)

Generally, atoms are considered to be "*neutral*" or having no charge. As a result, if you know the atomic number (the number of protons), then that will be equal to the number of electrons.

-Hydrogen (H) has an atomic number of 1, which means it has 1 proton, so a neutral atom of hydrogen also has 1 electron.

-Carbon (C) has an atomic number of 6, which means it has 6 protons, so a neutral atom of carbon has 6 electrons.

-Oxygen (O) has an atomic number of 8, so how many electrons would a neutral atom of oxygen have? _____

However, atoms can gain or lose electrons, forming **ions** that are negatively or positively charged.

-Helium (He) has an atomic number of 2, which means a neutral atom would have 2 protons and 2 electrons. A helium ion with a charge of -1 gained 1 electron, so it has 2 protons and 3 electrons.

$$\begin{array}{c} (+2) + (-3) = -1 \leftarrow \text{charge} \\ \text{proton value } \uparrow \quad \quad \uparrow \text{electron value} \end{array}$$

-If a neutral atom of helium lost an electron, it would be left with 2 protons and 1 electron, so it would have a charge of +1.

$$(+2) + (-1) = +1$$

-If a neutral atom of helium gained 4 electrons, it would have a charge of -4.

$$(+2) + (-6) = -4$$

-If an atom of helium has 4 electrons, will it be a positively or negatively charged ion? _____

-If a helium ion has a charge of +2, how many electrons does it have? _____

Mass number: The mass number is the sum of the protons and neutrons in an atom. Remember that the number of protons in an atom of a certain element never changes. However, the number of neutrons can change. Atoms of the same element that have different numbers of neutrons are called **isotopes**.

For calculation purposes:

protons have a mass of 1 amu

neutrons have a mass of 1 amu

electrons have a mass of 0 amu

The number of neutrons in an atom can be calculated by subtracting the number of protons from the mass number.

C-12, C-13, and C-14 are all isotopes of carbon. Carbon always has 6 protons, so 6 can be subtracted from each of the mass numbers to determine the number of neutrons in each atom.

-C-12 has 6 neutrons

$$\begin{array}{ccc} 12 - 6 = 6 & \leftarrow \text{number of neutrons} \\ \text{mass number} \uparrow & \uparrow \text{atomic number (\# of protons)} \end{array}$$

-C-13 has 7 neutrons

$$13 - 6 = 7$$

-How many neutrons are in C-14? _____

Show your work.

Atomic mass/atomic weight: The atomic mass (sometimes called the atomic weight), is the weighted average of the masses of all of the naturally occurring isotopes of that element.

1. Multiply the mass number of each isotope by its percentage abundance in decimal form.
2. Add these amounts together to find the atomic mass. The unit will be amu.

-Chlorine-35 makes up 76% of all the chlorine in nature, and chlorine-37 makes up the other 24%.

What is the atomic mass of chlorine?

$$\begin{array}{ccc} (35 \times 0.76) = 26.60 \\ \text{mass number} \uparrow & \uparrow \text{abundance} \\ (37 \times 0.24) = 8.88 \\ \text{mass number} \uparrow & \uparrow \text{abundance} \\ 26.60 + 8.88 = 35.48 \text{ amu} & \leftarrow \text{weighted atomic mass} \end{array}$$

-Silicon-28 makes up 92% of all the silicon in nature, silicon-29 makes up 5%, and silicon-30 makes up the other 3%. What is the atomic mass of silicon? _____

Show your work.

More Practice:

Show your work in the space to the right or below each problem.

A neutral atom of lead has an atomic number of 82 and a mass number of 207.

How many protons does it have? _____

How many neutrons does it have? _____

How many electrons does it have? _____

An ion of aluminum has a charge of 3+. Aluminum has an atomic number of 13 and a mass number of 27.

How many protons does it have? _____

How many neutrons does it have? _____

How many electrons does it have? _____

An atom has 5 protons, 6 neutrons, and 6 electrons.

Draw and label this atom below.

What is its atomic number? _____

What is its mass number? _____

What is its charge? _____

Titanium has an atomic number of 22. Compare titanium-46 and titanium-50, in terms of atomic number, mass number, protons, neutrons, and electrons; and are they ions or isotopes?

Calculate the atomic mass of titanium, which occurs naturally as 8% titanium-46, 7.3% titanium-47, 73.8% titanium-48, 5.5% titanium-49, and 5.4% titanium-50.