

Name: _____

Atoms

Atoms are the building blocks of matter. They are made of a central, dense nucleus. The nucleus is positively charged. The nucleus is surrounded by negatively charged particles. Different types of atoms and combinations of atoms make up all the different substances found on Earth.

Subatomic Particles

Atoms are composed of three subunits. We called them **subatomic particles**. The three subatomic particles are protons, neutrons and electrons.

1. **Protons** are positively charged. They have a mass of 1 atomic mass unit (amu). Protons are found in the nucleus of an atom.
2. **Neutrons** are also found in the nucleus of an atom and have a mass of 1 amu. They have no charge. Neutrons are neutral.
3. **Electrons** have negligible mass. To simplify, electrons have no mass. They are negatively charged and surround the nucleus of an atom.

Structure of an Atom

Protons and neutrons make up the center of the atom. This is called the nucleus. The nucleus of an atom is not an enclosed structure like the nucleus of a cell. It is the center region of the atom made of protons and neutrons.

Electrons surround the nucleus in specific orbits or shells. Electrons "fill" the shell closest to the nucleus first. This shell holds two electrons. Then electrons fill outer shells. The outermost shell can only contain 8 electrons. These electrons are called **valence electrons**.

Elements

We classify different types of atoms based on the number of protons in an atom. The number of protons is called **atomic number**. An **element** is an atom with the same atomic number or number of protons. We list all the different elements in the periodic table. We organize elements by atomic number.

Atomic Mass

The weight of an atom is called **atomic mass**. Atomic mass is equal to the number of protons and neutrons found in an atom. It is measured in atomic mass units (amu). For example, an atom with 2 protons and 2 neutrons has a mass of 4 amu. Electrons have no mass and are not important to calculating atomic mass.

Isotopes

Elements can have different numbers of neutrons. Atoms with the same number of protons but different number of neutrons are called **isotopes**. Isotopes are of the same element. Some elements have many different isotopes. In other words, an element can have atoms with a wide range in the number of neutrons.

Some isotopes are radioactive. **Radioactive** isotopes are unstable. They are usually unstable because there are many more neutrons than protons in the atom. Most atoms have the same number of neutrons and protons or have a difference of only one or two. When the difference in protons and neutrons is more than three, the isotope is often unstable. If radioactive, the isotope will emit radiation and break down into a more stable atom. This process is called **radioactive decay**.

Ions

Neutral atoms have the same number of protons and electrons. When an atom has the same number of positive and negative particles, the charges cancel each other out. The atom as a whole is neutral. Atoms with different numbers of protons and electrons are called **ions**. When an atom has more electrons than protons, it is negatively charged. It is called a negative ion. When an atom has fewer electrons than protons, it is positively charged. It is called a positive ion.

An atom can only lose or gain electrons. It cannot gain or lose protons. Gaining electrons makes an atom negatively charged. Losing electrons makes an atom positively charged. Atoms gain and lose electrons to form bonds or to have a complete set of valence electrons.

Some atoms are more likely to lose electrons to have a complete outer shell. These atoms have very few valence electrons. For atoms with only a few valence electrons, it's easier to lose one or two electrons than it is to gain six or seven electrons. Losing electrons means their full, inner shell because the outermost shell.