

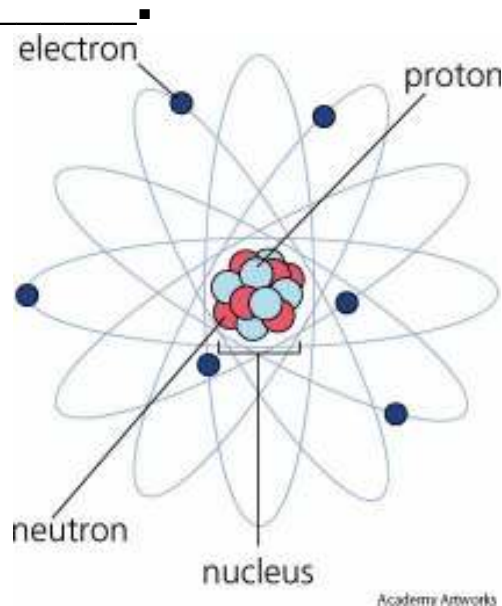
The Atom

What's Inside an Atom?

➤ **Atoms are made of three main particles:**

_____, _____, and

_____.



The Nucleus:

Protons – The _____ charged particles of the nucleus.

- **All protons are identical.**
- **Because the masses of protons and other subatomic particles are so small, scientists developed a new _____ to measure their mass.**

- **Atomic Mass Unit (_____)** – The SI unit used to express the masses of particles in atoms.
- Each proton has a mass of ____ amu.

Neutrons – The particles of the nucleus that have _____ charge.

- All neutrons are identical.
- Neutrons have a mass of ____ amu.
- Protons and neutrons are located in the _____ in the center of the atom. They account for most of the _____ of the atom, but the _____ of the nucleus is very small. Therefore the nucleus is extremely _____.

Outside the Nucleus:

Electrons – The _____ charged particles in atoms.

- Electrons are likely to be found around the nucleus in _____.
- The charges of electrons and protons are _____ and _____ in size (one proton cancels out one electron).
- Atoms have an _____ number of protons and electrons, so the overall charge of an atom is zero or _____.

- **If the number of electrons and protons in an atom are not equal, the atom becomes a charged particle called an _____.**
- **An ion is _____ if it has more protons than electrons.**
- **An ion is _____ if it has more electrons than protons.**
- **The mass of an electron is so small that it is considered to be _____.**

How do Atoms of Different Elements Differ?

Hydrogen Atom

Helium Atom

- ⊛ **The number of protons in the nucleus of an atom determines what element it is.**

Atomic Number – The number of _____
in the nucleus of an atom.

- **All atoms of an element have the same atomic number.**

EX: Every hydrogen atom has one proton, so hydrogen has an atomic number of one.

Are All Atoms of an Element the Same?

Isotopes – Atoms of the same element that have the same number of _____ but different numbers of _____.

- **Atoms that are isotopes of each other are always the same element because the number of protons in each atom is the _____.**

Isotopes of Hydrogen

With no neutrons

With one neutron

- **Some isotopes of elements are unstable, or _____, which means the nucleus changes on its own.**

- **However, isotopes of elements share most of the same chemical and physical _____.**
- **Isotopes of elements are distinguished from each other by their _____.**

Mass Number – The sum of the protons and _____ in an atom.

- _____ are not included in the mass number because their mass is so small that they have almost no effect on the atom's total mass.

EX: An atom of carbon with 6 protons and 6 neutrons has a mass number of 12.

An atom of carbon with 6 protons and 8 neutrons has a mass number of 14.

- **To identify a specific isotope of an element, you write the name of the element followed by a hyphen and the mass number of the isotope.**

EX: An atom of carbon with 6 protons and 6 neutrons would be referred to as carbon-12. An atom of carbon with 6 protons and 8 neutrons would be referred to as carbon-14.

- **Most elements found in nature contain a mixture of two or more stable _____.**
EX: All copper on Earth is made of copper-63 or copper-65 atoms.

Atomic mass – The weighted _____ of the masses of all the naturally occurring _____ of an element.

EX: Of all the copper on Earth, 69% is copper-63 and 31% is copper-65. The atomic mass of copper is 63.6 amu. If atomic mass were not a *weighted average*, the average would simply be 64.

Forces at Work in Atoms:

- ✓ **Gravity** – Acts between all objects all the time.
 - Depends on the _____ and _____ between the objects.
 - Because objects in atoms are very small, the force of gravity in atoms is very _____.
- ✓ **Electromagnetic Force** – Objects with like charges _____ each other

and objects with opposite charges _____ each other.

- **Holds the _____ (negative) around the nucleus (positive) in an atom.**

✓ **Strong Force – The force that holds particles of the _____ together.**

- **The _____ of the four forces, and the one with the _____ range.**

- **The addition of _____ to the nucleus adds enough strong force to keep the protons from repelling each other.**

✓ **Weak Force – The force that transforms quarks (particles that make up protons and neutrons) causing a _____ isotope to change.**