

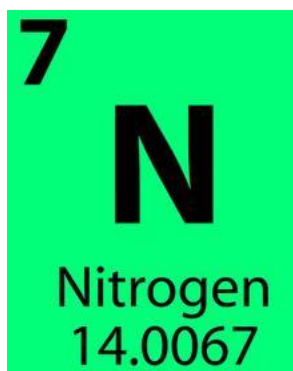
Chemistry Lecture #19: Atomic Number, Isotopes, and Mass Number.

Protons occupy the nucleus of the atom. English physicist Henry Moseley (1887-1915) found a way to count the number of protons in an atom. He exposed elements to x-rays. The elements would then give off energy. The type of energy emitted by the elements could then be analyzed to reveal the number of protons in the nucleus.

It was found that different elements had different numbers of protons. Thus, atoms are identified by the number of protons in the nucleus, or the atomic number.

The periodic chart can be used to find the atomic number of all elements. Periodic tables can be found in any chemistry textbook. You can also find and print one off the internet.

Try and find the element nitrogen on the periodic chart. Look near the top right hand side. If you look at the box for nitrogen, you should see a large letter "N." You should also see two types of numbers. One number will be a whole number (with no decimals) and another number will have decimals.



For now, ignore the 14.0067 (I'll explain what this number is in another lecture). The number 7 is the atomic number of nitrogen. Thus, nitrogen has 7 protons in the nucleus.

In a neutral atom, the number of protons in the nucleus is equal to the number of electrons. Thus, nitrogen has 7 protons and also has 7 electrons.

Use your periodic chart to find the atomic number of the following elements:

Element	<u>Atomic number</u>
Carbon	6
Sodium	11
Hydrogen	1

Atoms with the same number of protons but a different number of neutrons are called isotopes.

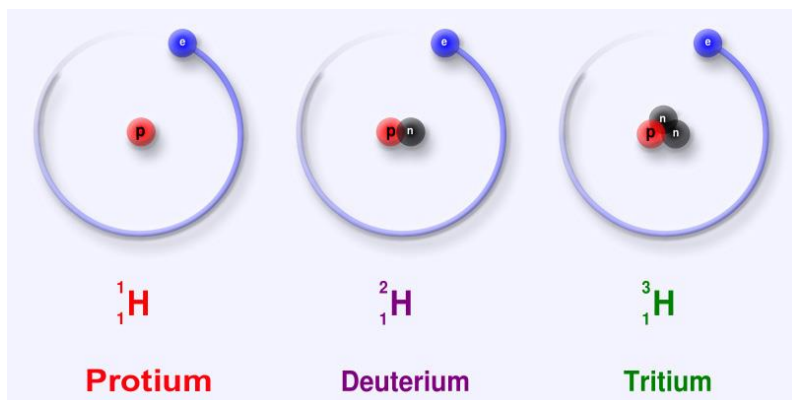
For example, there are 3 types of hydrogen: protium, deuterium, and tritium.

Protium has 1 proton in its nucleus.

Deuterium has 1 proton and 1 neutron in its nucleus.

Tritium has 1 proton and 2 neutrons in its nucleus.

All 3 types of atoms have one proton in the nucleus. Thus, all of them are isotopes of hydrogen.



An atom containing a specific number of protons and neutrons is a nuclide.

For example, all nuclides of tritium contain one proton and two neutrons.

The total number of protons and neutrons in a nuclide is the mass number. The mass number of tritium is 3 since it has 1 proton and 2 neutrons ($1 + 2 = 3$).

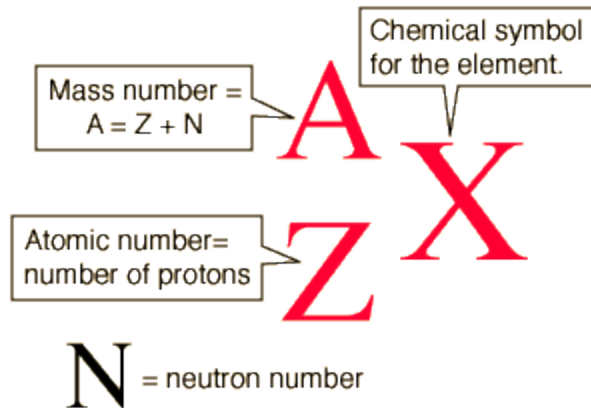
The number of neutrons in an nuclide can be calculated from

$$N = A - Z \quad \text{where } N = \text{number of neutrons}$$

$$A = \text{mass number}$$

$$Z = \text{atomic number}$$

The notation showing the mass number and atomic number of a nuclide looks like



How many protons, neutrons, and electrons are in nuclide below?



$A = 14$ (protons and neutrons) $Z = 6$ (atomic number)
Thus, the nuclide has 6 protons, 6 neutrons, and $14 - 6 = 8$ neutrons.

Sometimes the atomic number of the element is not given. In this case, you'll need to look up the atomic number on the periodic chart.

How many protons, neutrons, and electrons are in the nuclide below?



On the periodic chart, lithium has an atomic number of 3. So, this nuclide has 3 protons, 3 electrons, and $7 - 3 = 4$ neutrons.

And sometimes the nuclide is written like this:

U-235 or uranium -235.

The number 235 represents the mass number.

How many protons, neutrons, and electrons are in Cu-65?

Cu is copper. On the periodic chart, copper has an atomic number of 29. Thus, copper-65 has 29 protons, 29 electrons, and $65 - 29 = 36$ neutrons.