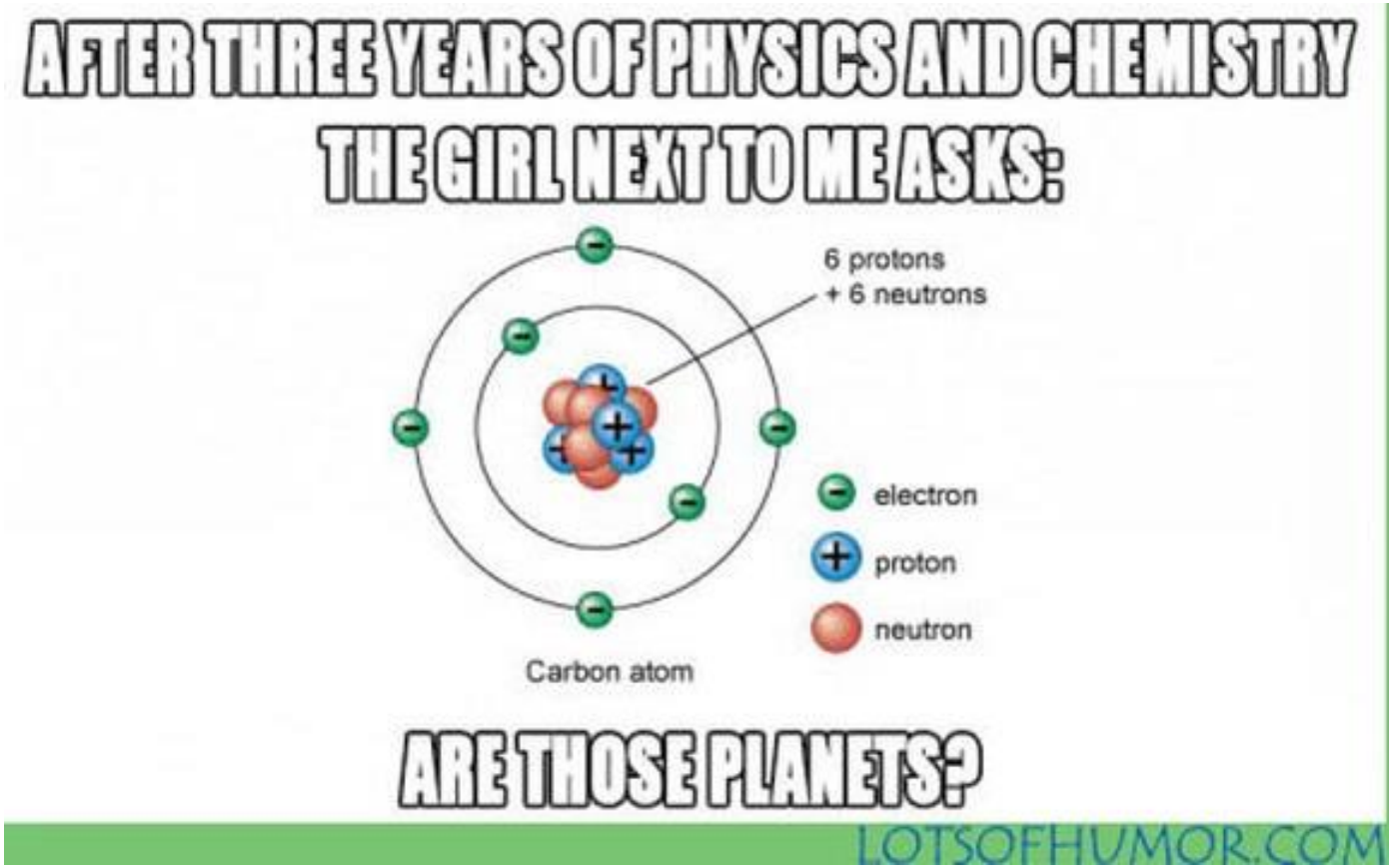
Atomic Structure



S1-2-04 Explain the atomic structure of an atom in terms of the number of protons, electrons, and neutrons, and explain how those numbers define atomic number and atomic mass.

Atomic Structure…

Question:

Most bikes are made of Aluminum and not Gold. Why?

Same **AMOUNTS** of different substances have different **MASSES**, as well as different **PROPERTIES** – there must be a reason for this!

The **ATOMS** of an **ELEMENT** have **PROPERTIES** that are **UNIQUE** to that element.

→ ***this means that different elements look and behave differently!***

Remember that atoms of every element are made of:

- **Protons** p^+
- **Electrons** e^-
- **Neutrons** n^0

Atomic Structure…

The different properties of elements are determined how these particles are **PUT TOGETHER**.

Standard Notation

Shows an elements **SYMBOL**, atomic **MASS**, and atomic **NUMBER**:

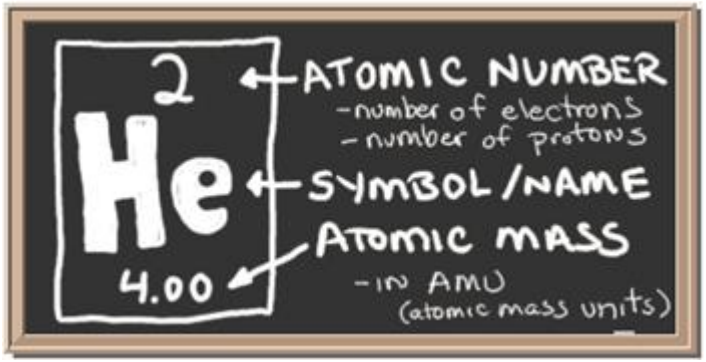
Chemical Symbol → C

12 ← Atomic Mass

6 ← Atomic Number

Note: Atomic Mass rounded to nearest whole number.

Your periodic table may show the atomic number on top of the symbol, and the atomic mass below



Atomic Structure…

Atomic Number:

The **NUMBER** of **PROTONS** in the **NUCLEUS** of an atom:

Carbon → Atomic number = **6**

→ so it has **6 PROTONS**

Lead →Atomic number = **82**

→ so it has **82 PROTONS**

On the periodic table, the **ATOMIC NUMBER** is basically the number that **IDENTIFIES** the **ELEMENT**.

Elements are **ARRANGED** from **LEFT** to **RIGHT**, **TOP** to **BOTTOM** in the order of their **ATOMIC NUMBERS**.

Atomic Structure…

Atomic Mass (Mass Number):
The **AVERAGE MASS** of an atom of an element

Is the **TOTAL** of the **NUMBER** of **NEUTRONS** and **PROTONS** in the **NUCLEUS** of an atom.

(# of p^+) + (# of n^0) = atomic mass

Notice that the **MASS of an atom **DOES NOT INCLUDE** the # of **ELECTRONS**, since the mass of an electron is so **SMALL**.

Example: #7 MASS = 14
Nitrogen has:

- *7 protons*
- *7 neutrons*

Its mass would be: $7p^+ + 7n^0 = 14$ *amu.*

We can use this information to determine how many protons, electrons and neutrons an atom contains…

Counting Protons, Electrons & Neutrons

What are the number of p+, n^0, and e- that carbon has?

Steps

Look up carbon on the periodic table. It has:

Atomic # = 6

Atomic Mass = 12.0amu

The **ATOMIC NUMBER** tells us the number of **PROTONS**:

→ ***6 protons***

If the atom is **NEUTRAL** (**SAME** # of **POSITIVES** as **NEGATIVES**), the # of **PROTONS** and **ELECTRONS** will be **EQUAL**.

→ ***6 electrons.***

Since **ATOMIC MASS** is the **NUMBER** of $\mathbf{p^+}$ and $\mathbf{n^0}$:

Mass − # p^+ = 6 n^0

List the number of protons electrons and neutrons

p^+ = 6 protons

e^- = 6 electrons

n^0 = 6 neutrons

Try this one…

What are the number of p+,n, and e- that ***Potassium*** has?

Steps

Look up potassium on the periodic table. It has:

Atomic # = 19

Atomic Mass = 39

The atomic number tells us the number of protons:

→ 19 protons

If the atom is ***neutral*** (same # of positives as negatives), the # of protons and electrons will be the same.

→ 19 electrons.

Since atomic mass is the number of p+ and n:

Atomic Mass = (# protons) + (# neutrons)

mass − # p^+ = n^0

39 − 19 = 20

→ 20 neutrons

List the number of protons electrons and neutrons

p^+ = 19 protons

e^- = 19 electrons

n^0 = 20 neutrons

Try this one…

Fill in the Chart for the first 18 elements on the periodic table.

Element & Symbol	Atomic #	# of Protons	# of Electrons	Atomic Mass	# of Neutrons