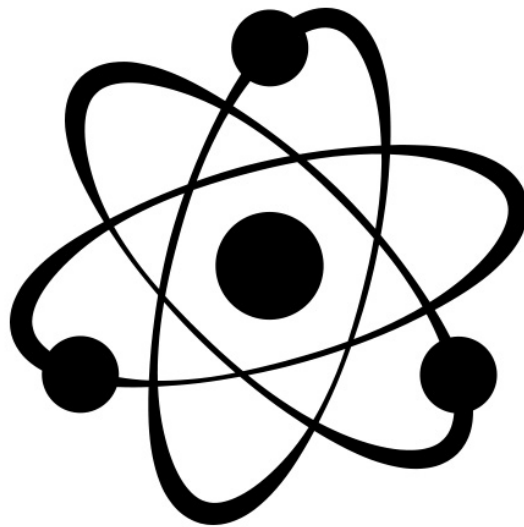


Atomic Physics



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1 'What do you know about atoms?' - 5min

The goal of this section is to see what every kid knows about atoms and to allow them to get progressively into the subject by thinking about it by themselves. At the end of these five minutes, the following explanation should be given to the whole group so that they have a good idea about what the activities are going to be related with: Atoms are the building block of matter. They have an internal structure in which the most important elements are the nucleus and the electrons turning around it. Atoms group together forming molecules, which form solids. The chair you are sitting on is made of millions of atoms put together!

2 A bit of hystory, from ancient Greece to our days - 10min

The word 'Atom' comes from the greek 'Atomos' which means **without division**. Its existance was proposed by Democritus, an ancient Greek philospher. The meaning of the word was given to it because it was thought to be an elementary building block of matter, which means that it is not composed of other particles. We now know that it is not the case but, as we have seen in the definition of what an atom is, it remains a very important building block for matter.

In the begining of the 20th century, **when scientists started to accept the existance of Atoms**, a great debate existed in the scientific comunity about the inner structure of the atom. In 1909, **Ernest Rutherford** realized an experiment that showed which of the two proposed structures was the real one, let's talk about it!

3 Electrons, nucleus and... Vacuum! - 20min - [Activity]

Electrons are made of three important elements. The first and most important is the nucleus. The second element are electrons, that orbit around the nucleus. Can you guess the third element? - Let the kids think about it.

That third element is in fact **vacuum!** Actually a very big part of the atom is vacuum. If we took away all the vacuum from the atoms of the universe, they would all fit in less that a cubic meter.

Let's begin with the activity. Every kid should get one balloon and draw on it with a colour pen several dots. These dots represent the different electrons of the atom. Now that the kids have done so, let them inflate the balloons. They therefore will get an aproximate representation of the atom.

Here are some questions that the kids should think about, alone or in groups, as you consider it:

If a ballon is an atom, where should its nucleus be? - It should be in the middle of the baloon. Ask them why it is an *approximate* representation. The 'main' reason (there are indeed many others) is that all the electrons are at the same distance of the atom, which is not the case in general. There are different orbits in which electrons can stay.

Knowing that electrons can stay at different orbits, what would be a more accurate representation of an electron with the material we have used? - There are, for sure, many answers to that

question. the one that should be given is: Different ballons inside eachother, all of them being centered around the same point, its nucleus.

4 Lets talk about the nucleus - 10min

What is the nucleus composed of? Actually, is it even composed of other particles or is it an elementary aprticle, as the electron? Let the kids think about this in groups.

In fact, the nucleus of an atom is composed of two types of particles, **protons** and **neutrons**. The difference in the composition of two nucleus is what determines the element of the atom. In the powerpoint are given examples with different elements and the composition of their nucleus.

To transition to the next part, ask the kids if they think that the links that bind together the different elements of the nucleus are hard or easy to break.

The answer is: **hard, really hard!**

Now, if you tell the kids that a bound that is hard to break frees a lot of energy when is broken, what do they thing Atoms can be useful for? - The idea is that they think about nuclear power, that will be developped in the last part.

5 From nuclear reactions to billiard - 15min - [Video]

Let's explain how the basic principle of nuclear reactions to the kids and then show them a video of a billiard so that they can make the analogy.

A lot of big atoms, containing a lot of neutrons and protons in their nucleus, are put together in what we call a reactor. Then, a single neutron is shot to one of the atoms. This will break its nucleus, freeing a lot of energy and other neutrons. The energy is stored by the experimental material and transformed into electric current.

Ask the kids what they think it happens whit the neutrons that are freed from the 'explosion' of the first nucleus. The answer is that they make explode other nucleus of atoms close to them. The reaction goes **on and on** until no more atoms are there. That is why it is called a **chain reaction**

To end this module, let's show the kids a short video of a billiard that gives a fair idea of how a nuclear reaction works. (see video in the powerpoint)