Activity #2 – Atomic Builder

The stuff you scrape off burnt toast is made primarily of atoms of carbon. But what makes up a carbon atom -- or any other atom?

Here's a chance for you to construct a carbon atom. You'll start with a hydrogen atom, which contains one proton and one electron. Just add protons, neutrons, and electrons. By the way, you must also build each proton and neutron from two types of quarks -- up quarks and down quarks. Finally, some advice: try to keep the particles' charges balanced. You'll have a difficult time if you don't. Before you start, answer the questions below.

Read The Atom Builder Guide to Elementary Particles.

1. In activity #1, you learned about the three major subatomic particles. It turns out that protons and neutrons are made of even smaller particles. What are these particles called?

2. Record the color code in the picture of an atom on this page (you will need it later). What color represents the
   a. protons? _____
   b. neutrons? _____
   c. electrons? _____

3. Fill in the "recipes" for the nucleons (particles found in the nucleus) below:

   1 proton = ____ up quark(s) + ____ down quark(s)

   1 neutron = ____ up quark(s) + ____ down quark(s)

Read The Atom Builder Guide to Building a Stable Atom.

4. Fill in the blanks: A stable atom has a net charge of _____. In other words, it has an equal number of _____ and _____.

5. When is an atom **ionized**? Why don't you want this to happen in this activity?

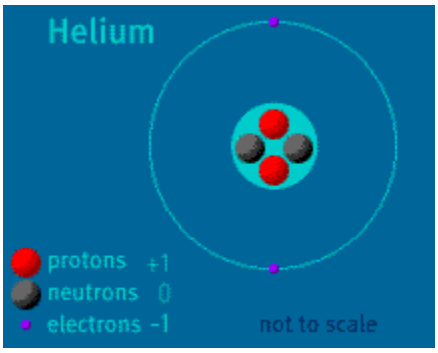
6. When does an atom become **radioactive**? Why don't you want this to happen in this activity?

7. Up to how many electrons can occupy
   a. the 1st shell _____?
   b. the 2nd shell _____?

Now you are ready to build a carbon atom! Open the Atom Builder.

8. Construct a **neutron** from the up and down quarks in the "Nucleon Assembly" area. Move this to the hydrogen nucleus on the right. Did adding a **neutron** change hydrogen into helium?

9. Construct another **neutron** from the up and down quarks in the "Nucleon Assembly" area. Move this to the nucleus on the right. What happened to the atom?



10. Construct a **proton** from the up and down quarks in the "Nucleon Assembly" area. Move this to the hydrogen nucleus on the right. Did adding a **proton** change hydrogen into helium? What else happened?

11. Add an electron to the atom. Try putting it in the 2nd energy level (the outer circle). What happens? Where does the electron end up?

12. At this point you should have a stable **helium** atom. How many electrons _____? Protons _____? Neutrons _____?

13. Add another electron to the atom. Try putting it in the 1st energy level (the inner circle). Are you allowed to do this? Why or why not?

14. Continue building your atom in this manner until you have constructed a stable **carbon** atom. Show your carbon atom to your teacher and have her initial below.

    Teacher's initials _____

    How many electrons _____? Protons _____? Neutrons _____?