**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Build an Atom**

**Website:**

https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom\_en.html

* + Click on the “Atom” box on the left hand side of the screen.
  + Click the “Green Plus” next to “Net Charge” and “Mass Number” to expand each box.
  + Make sure all 3 boxes in the bottom right hand corner are checked (the 3 under “Show”)

**Directions:**

Play around for 1-2 minutes.

1. What subatomic particle(s) go in the center of the atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What subatomic particle(s) go in the rings around the nucleus? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**HINT:** Every time you want to clear the board, Hit the Yellow “Reload Button” in the bottom right hand corner. **Don’t forget to then click the “Green Plus” and check the bottom right check boxes:**

* 1. Play around, and write down two examples of atoms that have a **stable nucleus** and include a drawing of your nucleus. In terms of electrons, just create a **neutral atom**.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Number of particles in  your nucleus:** | **Draw  your atom** | **What element  is it?** |
| 1. | *Make a* ***He*** *atom:*  Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ |  |  |
| 2. | *Make a* ***Be*** *atom:*  Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ |  |  |

* 1. Everything around us is made up of different elements. The air has Oxygen (**O**) and Nitrogen (**N**). Plants and people have lots of Carbon (**C**). Helium (**He**) is in balloons. Hydrogen (**H**) is in water.

Play until you discover which **particle (or particles)** determines the name of the **element** you build. What did you discover?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Test your idea by identifying the element for the 3 cases.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Particles** | **What Element?** | **What Determines the Element?** | **Circle the Element** |
| 1. | Protons: 6  Neutrons: 6 Electrons: 6 |  | ☐ Proton  ☐ Neutron  ☐ Electron |  |
| 2. | Protons: 7  Neutrons: 6 Electrons: 6 |  | ☐ Proton  ☐ Neutron  ☐ Electron |  |
| 3. | Protons: 6  Neutrons: 7 Electrons: 7 |  | ☐ Proton  ☐ Neutron  ☐ Electron |  |

1. Play until you discover what affects the **charge** of your atom or ion.  
   What is a rule for making...
   1. A atom **neutral** (one with 0 extra charge)?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. A **+ion** (positive ion, one with extra positive charge)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. A **- ion** (negative ion, one with extra negative charge)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Show a neutral atom, a positive ion, and a negative ion. (These examples should be consistent with the rules you discovered.) All of your examples should also have a **stable nucleus**.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Number of Particles?** | **Draw Your Atom or Ion**  **(Include all protons, neutrons, and electrons)** | **What is  the Charge?** |
| Neutral | *Make a* ***N*** *atom:*  Protons: \_\_\_  Neutrons:\_\_\_  Electrons:\_\_\_ |  |  |
| + Ion | *Make a* ***N*** *atom:*  Protons: \_\_\_  Neutrons:\_\_\_  Electrons:\_\_\_ |  |  |
| - Ion | *Make a* ***N*** *atom:*  Protons: \_\_\_  Neutrons:\_\_\_  Electrons:\_\_\_ |  |  |

1. Play until you discover what affects the **mass** of your atom or ion.  
     
   Which particles are heavy and which particles are light? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
     
   What is a rule for determining the mass?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Using all of your rules, figure out what changes for each of these actions to an atom or ion. You can test your ideas with the simulation. If you have new ideas, rewrite your rules.

**START WITH AN ATOM OF CARBON**. Make sure that the atom is STABLE and that it has the correct number of electrons to be neutral.

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change? (If it does not change, write “No Change”)** |
| Add a Proton | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

**Reset back to the original ATOM OF CARBON**. Make sure that the atom is STABLE and that it has the correct number of electrons to be neutral.

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change? (If it does not change, write “No Change”)** |
| Remove a Neutron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

**Reset back to the original ATOM OF CARBON**. Make sure that the atom is STABLE and that it has the correct number of electrons to be neutral.

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change? (If it does not change, write “No Change”)** |
| Remove an Electron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

**Reset back to the original ATOM OF CARBON**. Make sure that the atom is STABLE and that it has the correct number of electrons to be neutral.

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change? (If it does not change, write “No Change”)** |
| Add a Electron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

1. Challenges!

**Design a positive ion with a charge of +2:**

|  |  |
| --- | --- |
| **Element you created:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | |
| **Particles** | **Properties** |
| Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ | Element:\_\_  Mass:\_\_  Charge:\_\_  Stable Nucleus: ☐ Yes ☐ No |

**Design a neutral, atom with a mass of 8:**

|  |  |
| --- | --- |
| **Element you created:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | |
| **Particles** | **Properties** |
| Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ | Element:\_\_  Mass:\_\_  Charge:\_\_  Stable Nucleus: ☐ Yes ☐ No |