**

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

**Build an Atom PhET Simulation Activity**

**Learning Objectives:**

1. Draw models that show atoms or ions.
2. Use information about the number of protons, neutrons, and electrons to

* Identify an element and its position on the periodic table
* Draw models of atoms
* Determine if the model is for an atom or an ion.

1. Predict how changing the number protons, neutrons, or electrons will change the element, the charge, and the mass of an atom or ion.

**GO TO:** [**http://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom\_en.html**](http://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html)

**Directions:**

1. Explore the ***Build an Atom*** simulation with your partner (about 5 minutes). As you explore, talk about what you find with your partner.
2. Using ***Build an Atom,*** talk with your partner as you play with the parts of atoms to find:
   1. What parts go in the center of the atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. You can call the center of the atom, the **nucleus**. Most atoms in our environment have a **stable** nucleus.
   3. Play around, and write down three examples of atoms that have a **stable nucleus** and include a drawing of your nucleus.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Number of particles in  your nucleus:** | **Draw  your nucleus** | **What element  is it? Write its symbol** |
| 1. | Protons: \_\_  Neutrons:\_\_ |  |  |
| 2. | Protons: \_\_  Neutrons:\_\_ |  |  |
| 3. | Protons: \_\_  Neutrons:\_\_ |  |  |

* 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? Symbol:** | **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** | **What is  the Charge?** | **Symbol** |
| Neutral | Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ |  |  |  |
| + Ion | Protons: \_\_  Neutrons:\_\_  Electrons:\_\_ |  |  |  |
| - Ion | 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.

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change?** |
| Add a Proton | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change?** |
| Remove a Neutron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change?** |
| Remove an Electron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

|  |  |  |
| --- | --- | --- |
| **Action** | **What Changes?** | **How Does it Change?** |
| Add a Electron | ☐ Element |  |
| ☐ Charge |  |
| ☐ Mass |  |

1. **Challenges!** **Design a positive ion with a charge of +2:**

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

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

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

**Analysis Questions**

1. Ions are atoms of the same element with different numbers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Isotopes are atoms of the same element with different numbers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. Adding or removing protons from an atom does what to the atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. An atom with the same number of protons and electrons has a charge of \_\_\_\_\_\_\_\_\_.
5. Adding two electrons to a neutral atom produces an ion with a charge of \_\_\_\_\_\_\_\_\_.
6. An atom with six protons and five electrons would have a charge of \_\_\_\_\_\_\_\_\_.
7. What atom is created with nine protons, nine neutrons, and nine electrons?
8. Show the full symbol for the above atom in the box at the right
9. What does the upper-left number in the symbol represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. What does the lower-left number in the symbol represent? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **The Game**

**With remaining class time, play a few games. Who in your lab group can get the highest score? WINNER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

***Complete the table below******after class*** *as homework/practice.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Protons | Neutrons | Electrons | Atomic Number | Mass Number | Charge | Element | **Full** Symbol |
| **4** | **4** | **4** | **4** | **8** | **0** | **Be** |  |
| **5** | **5** | **6** | 1. | 2. | 3. | 4. | 5. |
| **8** | **8** | **7** | 6. | 7. | 8. | 9. | 10. |
| 11. | 12. | 13. | **7** | **13** | **-3** | 14. | 15. |
| 16. | 17. | 18. | **9** | **20** | **-1** | 19. | 20. |