Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |
| --- |
| **Atomic Structure** |

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| --- |
| **Your Tasks (Mark these off as you go)** |
| * Explore what makes an atom stable * Explore what make an atom neutral * Explore atoms with charges * Identify the particles that contribute to the mass of an atom * Interpret nuclear notation * Test your understanding * Receive credit for this lab |

* + **Explore what makes an atom stable**

|  |  |
| --- | --- |
| Navigate to the “Build an Atom” simulator  <https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html?screens=1> |  |
| Check the Stable/Unstable option |  |
| Drag and drop all 10 protons to the “x”.  Then, drag and drop neutrons until the atom is “Stable”.  Record the number of neutrons required to stabilize an atom with 10 protons.  Repeat this process with the different numbers of protons. Record your results below. |  |

|  |  |
| --- | --- |
| **Number of protons** | **Neutrons required to make a “stable” atom** |
| 10 |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |
| --- |
| What particles go in the center of the atom. What is the center of the atom called? |
|  |

|  |
| --- |
| What changes the identity of at the atom? Changing the number of protons or changing the number of neutrons? |
|  |

|  |
| --- |
| What makes an atom “stable” |
|  |

* + **Explore what makes an atom neutral**

|  |  |
| --- | --- |
| Drag and drop all 10 protons to the “x”.  Then, drag and drop neutrons until the atom is “Stable”.  Now, drag and drop electrons until the at is “Neutral”. Record how many electrons are required to make an atom with 10 protons neutral.  Repeat this process for stable atoms with different numbers of protons. |  |

|  |  |  |
| --- | --- | --- |
| **Number of protons** | **Neutrons required to make a “stable” atom** | **Electrons required to make a neutral atom** |
| 10 |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

|  |
| --- |
| What particles surround the center of the atom? |
|  |

|  |
| --- |
| What is the charge on a proton? |
|  |

|  |
| --- |
| What is the charge on an electron? What makes an atom neutral? |
|  |

* + **Explore atoms with charges**

|  |  |
| --- | --- |
| Create an atom by dragging and dropping 5 protons, 5 neutrons, and 5 electrons.  Display the “Net Charge” window.  Add more electrons so the atom has more than 5. Record the number of protons, neutrons, electrons, and the net charge.  Remove electrons so the atom has less than 5. Record the number of protons, neutrons, electrons, and the net charge.  Repeat the above process for different numbers of protons, neutrons, electrons. Each time record the Net Charge and the identity of the atom. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Atom** | **Protons** | **Neutrons** | **Electrons** | **Net Charge** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |
| --- |
| What is a rule for making an atom with a positive charge? |
|  |

|  |
| --- |
| What is a rule for making an atom with a negative charge? |
|  |

|  |
| --- |
| Do neutrons affect the overall charge of the atom? |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| Consider the atoms with the following protons and electrons. For each atom, determine its identity and the net charge. | | | |
| **Atom** | **Protons** | **Electrons** | **Charge** |
|  | 3 | 2 |  |
|  | 4 | 2 |  |
|  | 5 | 2 |  |
|  | 7 | 10 |  |
|  | 8 | 10 |  |
|  | 9 | 10 |  |
|  | 10 | 10 |  |

* + **Identify the particles that contribute to the mass of an atom**

|  |  |
| --- | --- |
| Reset the simulator |  |
| Create a stable, neutral Boron atom by dragging and dropping 5 protons, 5 neutrons, and 5 electrons.  Display the “Mass Number” window.  Record the mass of Boron in the table below.  Add an electron to your Boron atom, re-record the mass.  Take away two electrons from your Boron atom, re-record the mass  Take away a neutron. Indicate the atom, then record the number of protons, neutrons, electrons, and the mass.  Take away a proton. Indicate the atom, then record the number of protons, neutrons, electrons, and the mass.  Drag and drop different amounts of protons, neutrons, and electrons, to create at least 3 more additional atoms. Record the identify of the atom, along with the number of protons, neutrons, electrons, and mass for each. |  |

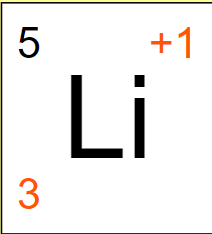
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Atom** | **Protons** | **Neutrons** | **Electrons** | **Mass** |
| Boron | 5 | 5 | 5 | 10 |
| Boron | 5 | 5 | 6 |  |
| Boron | 5 | 5 | 4 |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

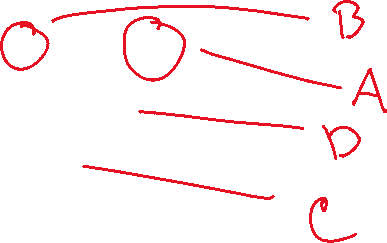
|  |
| --- |
| Which particles determine the mass of the atom? |
|  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Complete the table below by filling in the boxes shaded red. Assume each atom is neutral. | | | | |
| **Atom** | **Protons** | **Neutrons** | **Electrons** | **Mass** |
| Carbon | 6 |  |  | 12 |
| Carbon | 6 |  |  | 14 |
|  | 12 |  |  | 25 |
|  | 11 | 12 |  |  |
| Argon |  |  |  | 40 |
| Zinc |  |  |  |  |

* + **Interpret nuclear notation**

|  |  |
| --- | --- |
| Open the Symbol screen  <https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html?screens=2> |  |
| Create some atoms by dragging and dropping protons, neutrons, and electrons.  Indicate what each part of the symbol represents below.  Describe how you can determine the value of each part. For example, to find the mass number you can add the protons and neutrons. |  |





|  |  |  |
| --- | --- | --- |
|  | Representation | Describe how you can determine its value |
| A |  |  |
| B |  |  |
| C |  |  |
| D |  |  |

* + **Test your understanding**

|  |  |
| --- | --- |
| Navigate to the Build an Atom game  <https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html> |  |
| Play levels 1, 2, 3, 4. Once you have completed all four levels, take a screenshot of your results and paste it below. | A drawing of a cartoon character  Description automatically generated |

|  |
| --- |
| Paste a screenshot of your game results below. |
|  |

* + **Receive Credit for this lab**

Each group member must complete and submit their own lab to receive credit