Parts of the Atom POGIL Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Read this**

There are two parts of the atom- the **nucleus** and the electron **orbitals/shells/energy levels**. The nucleus contains the positive **protons** and the neutral **neutrons**, while the energy levels contain the negative **electrons**. The proton and the neutron are about the same mass, while the electron is about 1/2000th the mass of the other particles.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Number of Protons** | **Number of Neutrons** | **Number of Electrons** | **Number of orbitals/ energy levels** |
| Carbon | 6 | 6 | 6 | 2 |
| Lithium  | 3 | 4 | 3 | 2 |
| Neon  | 10 | 10 | 10 | 2 |
| Sulfur | 16 | 16 | 16 | 3 |
| Argon | 18 | 22 | 18 | 3 |
| Sodium | 11 | 12 | 11 | 3 |
| Iodine | 53 | 74 | 53 | 5 |
| Silver | 47 | 61 | 47 | 5 |
| Zirconium | 40 | 51 | 40 | 5 |
| Hydrogen  | 1 | 0 | 1 | 1 |

**Model 1-** Use with the Periodic Table to answer the questions that follow.

**Periodic Table Key**

Atomic Mass

2

He

Helium

4.003

Atomic Number

1. How many positive protons does carbon have?\_\_\_\_ How many does neon have?\_\_\_\_
2. How do you find the number of positive protons using the Periodic Table?
3. The number of positive protons for atoms of the same element is always the same. Give the number of positive protons for these elements- nitrogen\_\_\_\_ copper\_\_\_\_ chromium\_\_\_\_ uranium\_\_\_\_ tin\_\_\_\_
4. How many neutral neutrons does sodium have?\_\_\_\_ How many does zirconium have?\_\_\_\_
5. Which elements does not have neutrons?
6. How do you find the number of neutral neutrons using the Periodic Table?
7. The number of neutral neutrons can change, but we can find the most common number of them using the Periodic Table. Give the number of neutral neutrons for the following elements-

oxygen\_\_\_\_\_ fluorine\_\_\_\_\_ aluminum\_\_\_\_\_ nickel\_\_\_\_\_ cobalt\_\_\_\_\_

1. How many negative electrons does zirconium have?\_\_\_\_ How many does argon have?\_\_\_\_
2. How do you find the number of negative electrons using the Periodic Table?
3. The number of negative electrons is equal to the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ in the stable atoms of the Periodic Table. Give the number of negative electrons for these elements-

Calcium\_\_\_\_\_ barium\_\_\_\_\_ helium\_\_\_\_\_ gold\_\_\_\_\_ silicon\_\_\_\_\_

1. How many energy levels/orbitals does sulfur have?\_\_\_\_\_ How many does silver have?\_\_\_\_\_
2. How do you find the number of energy levels/orbitals/shells using the Periodic Table?
3. Give the number of energy levels/orbitals for these elements-

potassium\_\_\_\_ calcium\_\_\_\_\_ nitrogen\_\_\_\_\_ oxygen\_\_\_\_\_ helium\_\_\_\_\_

**Think about it**

1. What kind of charge (positive, negative, or zero) would an atom of phosphorus have?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. How many orbitals/energy levels would an atom of cerium (atomic number is 58) have?\_\_\_\_
3. Now that you know how to use the Periodic Table to get information about an atom, fill in the missing parts of this chart.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Number of Protons** | **Number of Neutrons** | **Number of Electrons** | **Number of orbitals/ energy levels** |
| Potassium |  |  |  |  |
| Chlorine |  |  |  |  |
|  | 27 |  |  |  |
|  |  | 5 |  |  |

1. Which particle is used to identify an atom because it never changes for that atom?\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Which part of the Periodic Table box represents this unchanging particle?\_\_\_\_\_\_\_\_\_\_\_\_
3. What kind of charge does this unchanging particle have?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. The atomic number is the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. The atomic mass is the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Look at #6 for help)
6. The atomic mass is a decimal number because it is actually an average (mean) of different forms/isotopes of an atom. Use the table to find what the atomic mass should be for the given elements. DO NOT use the Periodic Table to do this part!

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of protons** | **Number of neutrons** | **Number of electrons** | **Atomic mass** | **Element\*** |
| 6 | 6 | 6 |  |  |
| 6 | 8 | 6 |  |  |
| 52 | 58 | 52 |  |  |
| 52 | 59 | 52 |  |  |
| 52 | 60 | 52 |  |  |

 \*Remember what identifies the element. Look back at #17 if you are not sure.

**Model 2**- Picture of an atom of carbon Picture of an atom of sodium

 **e- e- nucleus e-**

 **e-** 6**+ e- e- e-**

 6**n** **e-** orbitals**/ e-** 11**+ e-**

 **e-** energy levels 12**n**

 **e- e- e- e-**

**Key**

 **e- e-**

**+** = protons **n** = neutrons **e-** = electrons = nucleus = orbital

23. Now that you know how to find information about an atom by using the Periodic Table, you should be able to place the correct number of particles and draw the correct number of orbitals/energy levels for these two atoms.

 boron neon

**Read This**

The positive **protons** identify the element, so we use the **Atomic Number** to represent this important information. Because the neutral **neutrons** have about the same mass as protons, we combine the positive protons and neutral neutrons to get the **Atomic Mass**. The negative **electrons** add very little mass, so we are not really interested in all of them. We are most interested in the negative electrons that allow atoms to combine with one another. Thinking about how negative electrons are spread across different orbitals/energy levels, the ones that would be most important when combining atoms would be the ones that are closest to the other atoms, the electrons on the outermost orbital. We call these negative electrons **valence electrons**.

**Model 3**- valence numbers for various elements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Valence electrons** |  | **Element** | **Valence electrons** |  | **Element** | **Valence electrons** |
| Magnesium | 2 |  | Lead | 4 |  | Sulfur | 6 |
| Calcium | 2 |  | Silicon | 4 |  | Selenium | 6 |
| Radium  | 2 |  | Carbon | 4 |  | Oxygen | 6 |
| Boron | 3 |  | Antimony | 5 |  | Astatine | 7 |
| Gallium | 3 |  | Nitrogen | 5 |  | Chlorine | 7 |
| Thallium | 3 |  | Bismuth | 5 |  | Fluorine | 7 |

24. Find these elements on the Periodic Table and label each with its valence number.

25. How are elements with the same valence number arranged?

26. Name three elements that you think would have 1 valence electron. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

27. Name three elements that you think would have 8 valence electrons. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

28.Which groups of elements do you notice were skipped when giving valence electrons?

 These elements are called Transition Metals because the negative electrons transition between different energy levels. **Label the Transition Elements on the Periodic Table**.

29. Use the information in the gray boxes on the Periodic Table to **EXPLAIN** how to determine the number of valence electrons for an element.

30. Use all you know about atoms and the Periodic Table to fill out this chart.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Atomic Number** | **Atomic Mass** | **Protons** | **Neutrons** | **Electrons** | **Number of orbitals** | **Number of valence electrons** |
| Strontium |  |  |  |  |  |  |  |
|  | 35 |  |  |  |  |  |  |
|  |  |  | 84 |  |  |  |  |
|  |  |  |  |  |  | 5 | 8 |