Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_ NOTES

**Chemistry Notes: Atomic Structure**

|  |  |
| --- | --- |
| **What is matter?** | Matter is anything that as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_. It can be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| **What is an element?** | A substance that is made of \_\_\_\_\_\_\_\_\_\_\_ of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ type. Each element is made of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ type of atom. There are over \_\_\_\_\_\_\_\_\_\_\_\_ known naturally occurring elements.  |
| **What is an atom?** | The smallest particle that makes up any type of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. All \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is made of atoms. Atoms are very very \_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **What makes up an atom?** | An atom is made up of 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ particles:1. Protons—have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (+) charge
2. Neutrons—have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (o) charge (think: neutral)
3. Electrons—have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (-) charge
 |
| **How do charged particles interact?**  | Particles with the same type of charge \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ each other—they push away from each other. Particles with different/opposite charges \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ each other—they are drawn toward one another. (This is where the saying “opposites attract” came from.) |
| **What is the structure of an atom?**  | * The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are grouped together in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the atom.
* The center of the atom is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Electrons move around \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the nucleus in what we call an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* The nucleus has an overall \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge (because it contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
* The electron cloud has a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charge (because it contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
 |
| **What is the relationship between a proton and a neutron?** | A neutron has about the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ as a proton. They are grouped together in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **How big is an atom?** | Atoms are extremely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The electron cloud is about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ times the size of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| **What is special about electrons?** | * Electrons are much smaller than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2000 times smaller).
* Electrons move around the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ very quickly. Scientists have found that it is not possible to determine the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of any single electron in an atom because they \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This is why we picture electrons as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ around the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
 |
| **How do atoms stay together?** | Atoms do not have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or anything else separating them from the rest of the world. The negatively charged \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are attracted to the positively charged \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. However, electrical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that are alike (such as two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charges) \_\_\_\_\_\_\_\_\_\_\_\_ each other. This is why electrons remain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ in the electron cloud. |
| **What are neutral atoms?** | Atoms that have no overall electrical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because they have an equal number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **What is an atomic number?**  | The atomic number is the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the nucleus of an atom. This determines the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the atom.**Example:** Oxygen has an atomic number of \_\_\_\_\_\_\_\_\_\_, while Carbon has an atomic number of \_\_\_\_\_\_\_\_\_\_. This means that Oxygen has \_\_\_\_\_\_\_\_ protons, and Carbon has \_\_\_\_\_\_\_\_ protons.  |
| **What is an atomic mass number?**  | Atomic mass number is the total number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the nucleus. Atoms of the same element will always have the same number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but may have different numbers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **What is an isotope?** **(D12)** | Isotopes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the same element that have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Some elements have \_\_\_\_\_\_\_\_\_\_\_\_\_ isotopes, while other only have a \_\_\_\_\_\_\_\_\_.  |
| **How do we show that something is an isotope? (D13)** | An isotope is described by the name of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the total number of its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (atomic mass number). **Ex: Chlorine-35 (name-atomic mass number)** |
| **What is an ion? (D14)** | An ion is an **atom** that has an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The charge can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Ions have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ numbers of protons and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **How is an ion formed? (D14)** | An ion is formed when an atom \_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ one or more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |
| **How do we show that something is an ion?** | An ion is described by its \_\_\_\_\_\_\_\_\_\_\_\_ (or symbol) and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Ex: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or O2- |
| **How do I find the number of protons in an atom?**  | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the number above the element’s symbol on the periodic table) |
| **How do I find the number of neutrons in an atom?** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ minus (-) the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **How do I find the number of electrons in an atom?** | * In a neutral atom, the # of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* In an \_\_\_\_\_\_\_\_\_ (with a positive or negative charge), the number of electrons is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the number of protons. To find the number of electrons, \_\_\_\_\_\_\_\_\_\_\_\_\_ the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the atom has
	+ # protons – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = # electrons
 |

**Questions:**

1. What particles are found in the nucleus of an atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What particles move around outside the nucleus? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. If all atoms are composed of the same particles, how can there be more than 100 different elements? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

1. Why do electrons stay in an electron cloud around the nucleus? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

1. What particles are counted to determine the atomic number? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Use your knowledge of atomic numbers to fill in the chart below. If an atom is an ion, I have written its charge in parenthesis after the element name. Ex: Oxygen (-2) has a charge of -2.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Atomic Number**  | **Atomic Mass #** | **# Protons** | **# Neutrons** | **# Electrons** |
| Hydrogen (+1) |  |  | 1 | 1 |  |
| Oxygen (-2) | 8 | 16 |  |  |  |
| Carbon-12 |  | 12 | 6 |  |  |
| Carbon-14 |  | 14 | 6 |  |  |
| Gold | 79 | 197 |  |  |  |
| Iron | 26 |  |  | 30 |  |
| Nitrogen (+3) |  | 14 | 7 |  |  |

1. Which of the elements in the table above are ions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Which of the elements in the table above are isotopes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What particles are counted to determine the atomic mass number? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. If oxygen has 8 protons and 8 neutrons, what is its atomic mass number? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Why do you think neutrons are necessary in the nucleus of an atom?
6. Draw a picture of an atom: