**History of Atomic Theory**

**Important Scientists in atomic theory:**

|  |  |  |
| --- | --- | --- |
| **Researcher** | **Idea** | **Model** |
|  **Ancient Greeks** | **Democritus 460 BC –** matter was made up of atomos- the smallest pieces of matter.**Aristotle -** didn’t believe empty space could exist; believed matter was made of different combinations of earth, air, fire, and water. | **(n/a)** |
|  **John Dalton** **(1766-1844)** | All matter is made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Atoms cannot be \_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into smaller particles.Atoms of same element are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |  |
|  **J. J. Thomson** **(1856-1940)** | Atoms contained \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.These particles are found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.The atom is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. |  |
|  **Ernest**  **Rutherford (1871-1937)** | Atoms is mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Most of mass \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.Nucleus contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
|  **Neils Bohr**  **(1885- 1962)** | Electrons surround \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  |  |

**What is an atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Atoms are composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that are WAY too small for us to see.

Particles with a **positive** **charge** are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Particles with a **negative charge** are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Particles with **no charge** are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**What does an atom look like? Label the diagram below:**

**WHAT DOES THE PERIODIC TABLE TELL US ABOUT ELECTRONS PROTONS AND NEUTRONS?**

The **atomic number** of an element = number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the nucleus

Ex. Atomic number of oxygen: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number of protons: \_\_\_\_\_\_\_\_\_\_\_

PRACTICE:

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Symbol** | **Atomic Number** | **# of protons** |
| Hydrogen |  |  |  |
| Beryllium |  |  |  |
| Carbon |  |  |  |
| Cobalt |  |  |  |
| Krypton |  |  |  |

The **mass number** = # of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ + # of \_\_\_\_\_\_\_\_\_\_\_\_\_\_in the nucleus.

(Since electrons are VERY light and don’t add much to the mass of the atom)

\*\*\*\* So # of electrons = **mass number – atomic number**

PRACTICE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Symbol** | **Mass #** | **# Protons** | **# Neutrons** |
| Hydrogen |  |  |  |  |
| chromium |  |  |  |  |
| Carbon |  |  |  |  |
| Barium  |  |  |  |  |
| Iron |  |  |  |  |

The **number of electrons** in a neutral atom = # of protons (atomic number)

Ex. Carbon has: atomic number= 6 🡪 # of protons = 6 🡪 # of electrons = 6

ATOMIC STRUCTURE PRACTICE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ELEMENT** | **ATOMIC #** | **ATOMIC MASS** | **# PROTONS** | **# ELECTRONS** | **# NEUTRONS** |
| Lithium |  |  |  |  |  |
| Boron |  |  |  |  |  |
| Oxygen |  |  |  |  |  |
| Phosphorous |  |  |  |  |  |
| Argon |  |  |  |  |  |
| Nickel |  |  |  |  |  |
| Bromine |  |  |  |  |  |
| Cobalt |  |  |  |  |  |
| Platinum |  |  |  |  |  |
| Lead |  |  |  |  |  |
| Barium |  |  |  |  |  |
| Iron |  |  |  |  |  |
| Nitrogen |  |  |  |  |  |
| Neon |  |  |  |  |  |
| Sulphur |  |  |  |  |  |
| Magnesium |  |  |  |  |  |
| Potassium |  |  |  |  |  |
| Copper |  |  |  |  |  |

**What kinds of elements are there?**

* The Periodic Table groups elements into **\_\_\_\_\_\_\_\_\_\_** (vertical groups)
* A chemical family is a group of elements that share similar \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Most elements are either **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (**on the left)
* or **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (**on the right)
* Some elements called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** that have some similar properties to
* metals and/or non-metals

**CHARACTERISTICS OF METALS and Non Metals**

|  |  |
| --- | --- |
| **Metals** | **Non-metals** |
| * Are \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ at room temperature (except for mercury, which is a liquid)
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Good \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of heat and electricity
* High \_\_\_\_\_\_\_\_\_\_\_\_ (heavy for their size)
* High \_\_\_\_\_\_\_\_\_\_\_\_strength (resist being stretched)
* High Melting points

Eg. Gold, Silver, Copper | * Are gases or brittle solids at room temperature (except bromine, which is a liquid)
* Not shiny
* Not malleable
* Not ductile
* Not good conductors of heat and electricity.
* Eg. Carbon, Oxygen, Sulfur
 |

Most Elements are Metals.

**ALKALI METALS**

* found in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ column (Group \_\_\_\_\_)
* does not include the element \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* They all have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in their outer shell,
* shiny, soft (malleable) and have low \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Not found freely in nature because they all\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**ALKALINE EARTH METALS**

* Group \_\_\_\_\_ of the Periodic Table.
* They have \_\_\_\_\_ valence electrons.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ most reactive family.
* silvery, shiny, and relatively soft metals.

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**TRANSITION METALS**

* Shiny
* high melting and boiling points.
* Eg. Gold, silver, platinum

**NON-METALS**

* Hydrogen, Halogens, Noble Gases
* Generally, gases or brittle, dull-looking solids

**HALOGENS**

- Group \_\_\_\_\_\_ of the Periodic Table.

-Have \_\_\_\_\_\_\_ electrons in valence shell

-They are not found freely in nature because they are very \_\_\_\_\_\_\_

Typically found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_



**NOBLE GASES**

-Group \_\_\_\_\_\_\_

-Valence shell is \_\_\_\_\_\_\_\_\_\_\_.

-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(nonreactive) because they already have a **stable octet**.

-Colorless, odorless gases

**HYDROGEN**

* often called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Lightest element,
* Colourless, tasteless, highly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gas
* Most \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ element in the universe (over 90% of all atoms)

**METALLOIDS OR SEMI-METALS**

* Act like **both** metals and non-metals
* Mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in their **physical** appearance:
	+ Eg \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ solids at room temperature
* mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in their **chemical** behavior.
	+ Eg. brittle, not ductile
	+ Poor conductors or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Examples include: boron, silicon, arsenic.

Modelling Atoms: Bohr Model

* A Bohr Model is a simplified diagram of number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in each of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (shells) around an atom.
* Each shell can only hold a certain number of electrons.
* First shell can only hold a maximum of \_\_\_ electrons.
* 2nd shell = \_\_, 3rd shell = \_\_\_\_\_\_, 4th = \_\_\_\_\_\_\_.

The outermost shell is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



**PATTERNS IN THE PERIODIC TABLE REGARDING ELECTRON ARRANGEMENT**

1. Elements of the same \_\_\_\_\_\_\_\_\_\_\_\_have the same number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Elements that are in the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have their valence electron in the same shell
3. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ number = the number of occupied **energy shells**.

**How do atoms for ions?**

* An ion is an atom with an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it has gained or lost electrons from its valence shell.
* An atom that \_\_\_\_\_\_\_\_\_\_\_\_ one or more electrons 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion (cation)
* An atom that \_\_\_\_\_\_\_\_\_\_\_ one or more electrons 🡪 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ion (anion)

**Why would an atom become an ion?**

* Elements are more \_\_\_\_\_\_\_\_\_\_\_\_ when their valence shell is \_\_\_\_\_\_\_\_\_\_ (like the noble gases).
* When this is achieved it is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



**Periodic Table and Ion Formation:**

* + Metals tend to \_\_\_\_\_\_\_\_\_\_\_\_\_ electrons and become positive ions (cations)
	+ Non-metals \_\_\_\_\_\_\_\_\_\_\_ electrons and become negative ions (anions)

**Representing Ions**

* Show the **charge** on an ion with a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ “+ or –“ to the **right** of the symbol.
	+ Eg Lithium ion = \_\_\_\_\_\_\_\_\_\_\_\_\_ chlorine ion = \_\_\_\_\_\_\_\_\_\_\_\_\_
* The charge on the ion is equal to the sum of its \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Eg. Lithium ion has three protons and two electrons, giving it a charge of “plus one”
	+ (3+) protons + (2-) electrons = +1

**Bohr Model of an Ion**

* Remember, an ion is an atom that has gained a charge (by either losing or gaining one or more electrons)
* The Bohr model indicates the charge with a “+ or –” and \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Draw the Bohr model diagram for an **aluminium atom** and **aluminium ion**.