ANEXO NASVILLE SCHOOL

SCIENCE 9th GRADE **MRS FIGUEROA**

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Chapter 3 lesson 5

What Is Radioactivity?

Everything on Earth is made of atoms, but you can see that not everything on Earth is the same. This is because everything is made of different types of atoms called elements. Atoms are really, really, REALLY small, but each atom of an element is made of even smaller subatomic particles. These are the protons, neutrons, and electrons of the atom.

The number of protons determines what element that atom is. For example, an atom with 8 protons is always oxygen, and an atom with 80 protons is always mercury. If you change the number of protons, you change the element.

One thing that can change though is the number of neutrons. Let's look at carbon for example. A carbon atom will always have 6 protons, but it may have 6, 7, or 8 neutrons. These atoms are carbon isotopes, because they are atoms of the same element that have different numbers of neutrons.

When isotopes are unstable, meaning that they have an imbalance of neutrons and protons, they are radioactive. The carbon atom with 6 neutrons, also called carbon-12 since we just add up the number of protons and neutrons to get its name, and the carbon atom with 7 neutrons, also called carbon-13, are both stable. This is because the number of protons and neutrons is in good balance.

The carbon atom with 8 neutrons (you guessed it - carbon-14) is not stable, though. This atom is radioactive because it has too much energy, making it unstable. After a while, the extra energy will be released from the unstable atom. This process is called radioactive decay. After enough energy is released, the atom returns to a stable state and is no longer radioactive. All radioactive materials eventually decay, just not at the same rate.

Alpha, Beta, & Gamma Rays

The extra energy, or radiation, emitted by radioactive elements comes in three different types: alpha, beta, and gamma. Alpha radiation is a stream of alpha particles, which are positively charged. They're fairly large, which means they have a difficult time getting through materials like clothes and paper.

Beta radiation is a stream of beta particles, which are negatively charged. These particles can more easily penetrate materials like clothes, and they can even get deep into your skin where they can do harm to your cells. But they can be blocked with denser materials like aluminum.

Gamma radiation is high-frequency electromagnetic radiation. Gamma rays have no charge but have A LOT of energy; more energy than even visible light or X-rays. Because of this, they are able to pass right through most materials, making them quite dangerous. But they can't penetrate very dense materials like lead, which is why you may be given a lead vest for protection in a hospital or laboratory.

Chapter 4 lesson 1

Valence Electrons

The electrons in the outermost shell are the **valence electrons —** the electrons on an atom that can be gained or lost in a chemical reaction. Since filled *d* or *f* subshells are seldom disturbed in a chemical reaction, we can define valence electrons as follows: **The electrons on an atom that are not present in the previous rare gas, ignoring filled d or f subshells.**

A **chemical bond** is a lasting attraction between atoms, ions or molecules that enables the formation of chemical compounds. The bond may result from the electrostatic force of attraction between oppositely charged ions as in ionic bonds; or through the sharing of electrons as in covalent bonds. The strength of chemical bonds varies considerably; there are "strong bonds" or "primary bond" such as metallic, covalent or ionic bonds and "weak bonds" or "secondary bond" such as dipole–dipole interactions, the London dispersion force and hydrogen bonding.

Since opposite charges attract via a simple electromagnetic force, the negatively charged electrons that are orbiting the nucleus and the positively charged protons in the nucleus attract each other. An electron positioned between two nuclei will be attracted to both of them, and the nuclei will be attracted toward electrons in this position. This attraction constitutes the chemical bond. Due to the matter wave nature of electrons and their smaller mass, they must occupy a much larger amount of volume compared with the nuclei, and this volume occupied by the electrons keeps the atomic nuclei in a bond relatively far apart, as compared with the size of the nuclei themselves.

Calculate the valence electrons of these elements. Which of these elements complies with the octet rule?

- **Li**
- **Be**
- **B**
- **C**
- **N**
- **F**
- **Ne**
- **Na**
- **Mg**
- **Al**
- **Si**
- **Ar**
- **Xe**
- **Kr**

1. **What are valence electrons?**
2. **Why do the properties of elements change in a regular way across a period?**
3. **Explain the reactivity of the noble gases in terms of valence electros.**

Lesson 2

Ions are electrically charged particles formed when *atoms* lose or gain *electrons*. They have the same electronic structures as noble gases.

Metal atoms form positive ions, while non-metal atoms form negative ions. The strong *electrostatic* forces of attraction between oppositely charged ions are called ionic bonds.

***Ionic compounds* have high melting and boiling points.**

How ions form

Ions are electrically charged particles formed when atoms lose or gain *electrons*. This loss or gain leaves a complete highest energy level, so the electronic structure of an ion is the same as that of a noble gas - such as a helium, neon or argon.

Metal atoms and non-metal atoms go in opposite directions when they ionise:

- **Metal atoms** lose the electron, or electrons, in their highest energy level and **become positively charged ions**.
- **Non-metal atoms** gain an electron, or electrons, from another atom to **become negatively charged ions**.

Positively charged sodium and aluminium ions

Negatively charged oxide and chloride ions

How many charges?

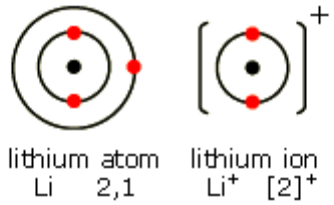
There is a quick way to work out what the charge on an ion should be:

- the number of charges on an ion formed by a **metal** is **equal to the group number** of the metal
- the number of charges on an ion formed by a **non-metal** is **equal to the group number minus eight**
- hydrogen forms H^+ ions

Metal ions

You need to be able to show the electronic structure of some common metal ions, using diagrams like these:

Lithium, Li



Ionic compounds and ionic bonding

When metals react with non-metals, *electrons* are transferred from the metal atoms to the non-metal atoms, forming *ions*. The resulting compound is called an *ionic compound*.

Consider reactions between metals and non-metals, for example,

- sodium + chlorine → sodium chloride
- magnesium + oxygen → magnesium oxide
- calcium + chlorine → calcium chloride

In each of these reactions, the metal atoms give electrons to the non-metal atoms. The metal atoms become positive ions and the non-metal atoms become negative ions.

There is a strong *electrostatic* force of attraction between these oppositely charged ions, called an **ionic bond**. The animation shows ionic bonds being formed in sodium chloride, magnesium oxide and calcium chloride.

1. **How do ions form?**
2. **What is an Ionic Bond?**
3. **Ionic form ot these elements**
    - **Na**
    - **Mg**
    - **K**
    - **Br**
    - **Cl**
    - **Li**
    - **F**
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