The Periodic Table

Adam Kelly

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http://leaving-cert-notes.weebly.com/the-periodic-table.html

Summary

You will need to know:

- What an element is
- The work of some scientists
- Be able to use the periodic table

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1 The Elements

DEFINITION

Element.

An element is a substance that can't be split into simpler substances by chemical means.

1.1 Historical Background

- **Robert Boyle**: First accurate definition of an element (above)
- **Humphry Davy**: Found when you get a compound and pass electricity through it, you break it down into it's elements (electrolysis).

2 The Periodic Table

2.1 History of the Periodic Table

- **Dobereiner**: Saw trends and similarities in elements, and grouped into threes (triads). These had similar properties, and the atomic weight of the middle was the average of the other two. This didn't work for all elements.
- **John Newlands**: Arranged elements in order of increasing atomic weight. Every eighth element had similar properties (the *Law of Octaves*). This didn't work as some elements were missing and he didn't use atomic number.
- **Dmitri Mendeleev**: Ordered by increasing weight and properties. Using properties, he left gaps (assuming elements hadn't been discovered). He put forward the *Periodic Law*. Worked as he switched some elements and left gaps - properties of elements over weights

2.2 The Modern Periodic Table

Henry Mosely devised a method to determine atomic number using x-rays.
With this, Mendeleev found that if you order by atomic number, you don't need to reverse, hence the modern periodic table.
Differences between Mendeleev's table and the modern one:

Mendeleev's Table	**Modern Table**
Elements arranged by atomic weight	Elements arranged by atomic number
Gaps present	More elements
Transition elements in a separate block	Transition elements in a separate block

3 Using The Periodic Table

You will need to be able to:

- Obtain atomic numbers and mass numbers
- Obtain relative atomic masses
- Writing electron configurations

3.1 Mass number & Atomic Number

- Mass number is always the bigger number.
- Atomic number gives the number of protons
- Every atom is neutral, thus there is the same number of protons and electrons.
- To get the number of neutrons, take the number of protons from the mass number.
- The mass number is the sum of the protons and neurons in the element. (the electron mass can be ignored).

3.2 Relative Atomic Mass

Relative atomic mass is the average atomic mass of the isotopes of an elements.
Francis William Aston developed the **mass spectrometer**. He found that neon consisted of two varieties of neon atoms. One type had a mass number of 20, the other had 22. He called these **isotopes**.

DEFINITION

Isotopes.

Isotopes are atoms of the same element which have different mass numbers due to the different number of neutrons in the nucleus.

4 Mass Spectrometer

DEFINITION

Principle of Mass Spectrometry.

*Positively charged ions are separated on the basis of their **relative** masses when*

moving in a magnetic field

The mass spectrometer has a few stages:

1. Vaporization: Non-gaseous samples are vaporised by a heater
2. Ionisation: An electron gun produces a beam of high energy electrons. When an atom is bombarded by the beam it can loose an electron to form a positive ion.

$$EgNg + e^- \rightarrow Ne^+ + 2e^-$$

3. Acceleration: The ions are accelerated to a high speed using an electric field. (Negatively)
4. Separation: The ions are then separated by using a magnetic field, which deflects according to the masses. Lighter particles are deflected more.
5. Detection:

You can remember these with the mnemonic: **V**iagra **i**s **a** **s**ex **d**rug.

4.1 Uses:

- Identify the presence of isotopes
- Tells how many of each isotope is present
- measures relative atomic masses and relative molecular masses
- Identifies unknown compounds - Detection of banned substances, forensic science

You should know the principle and the names of the stages.

5 Arrangement Of Electron In Orbitals Of Equal Energy

DEFINITION

Hund's Rule of Maximum Multiplicity.

When two or more orbitals of equal energy are available, the electrons occupy them singly before filling them in pairs.