Name:

Periodic Table and Atomic Structure	**Objectives**
4. The Periodic Table	-describe the periodic table as a list of elements arranged so as to demonstrate trends in their physical and chemical properties -define the term element -associate the first 36 elements with their elemental symbols -distinguish between elements and compounds -state the principle resemblances of elements within each main group, in particular alkali metals, alkaline earth metals, halogens and noble gases -describe the reaction between water and lithium, sodium and potassium having seen the reaction demonstrated -describe by means of a chemical equation the reaction between water and lithium, sodium and potassium having seen the reaction demonstrated -outline the history of the idea of elements, including the contributions of the Greeks, Boyle, Davy and Moseley -outline the contributions of Mendeleev to the structure of the modern periodic table -compare Mendeleev's with the modern periodic table -arrange elements in order of relative atomic mass and note differences with modern periodic table -define atomic number (Z) and mass number (A) -define relative atomic mass (A_r) using ^{12}C scale -define isotope -describe the composition of isotopes using hydrogen and carbon as an example -describe the organisation of particles in atoms of elements numbers 1-20 -classify the first twenty elements in the periodic table on the basis of the number of outer electrons -list the numbers of electrons in each main energy level in atoms of numbers 1-20

Elements:

1. The Greeks: 4 elements – earth, air, fire and water.
2. Robert Boyle: *Def^n:* An **element** is a substance that cannot be split into simpler substances by chemical means.

History of the Periodic Table:

1. Mendeleev: Arranged the elements in order of increasing weight.
   Def^n: **Mendeleev's Periodic Law**: When elements are arranged in order of increasing atomic weight, the properties of the elements recur periodically, i.e. the properties displayed by the element are repeated at regular intervals in other elements.
   - He left gaps for undiscovered elements
   - He switched some pairs of elements in his table so they would fit in the with the properties expected in that group
   - Transition metals did not have a separate block
2. Modern Table: Arranged elements in order of increasing atomic number.
   Def^n: The **atomic number** of an atom is the number of protons in the nucleus of the atom.

Def^n: **Modern Periodic Law**: When elements are arranged in order of increasing atomic number, the properties of the elements recur periodically, i.e. the properties displayed by the element are repeated at regular intervals in other elements.

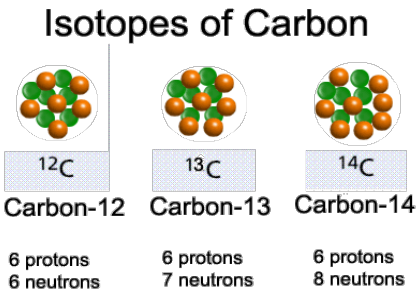
- No gaps
- Transition metals are in a separate block

Mass Numbers and Isotopes:

Def^n: The **mass number** of an element is the sum of the number of protons and neutrons in the nucleus of an atom of that element.

No. of neutrons in an atom = Mass Number (A) – Atomic Number (Z)

Def^n: **Isotopes** are atoms of the same element (i.e. they have the same atomic number) which have different mass numbers due to the different number of neutrons in the nucleus.



Def^n: **Relative atomic mass (A_r)** is the average of the mass numbers of the isotopes of an element, as they occur naturally, taking their abundances into account and expressed on a scale relative to $1/12^{th}$ the mass of ^{12}C.

Electron Configuration of Atoms:

When building up the electron configuration of an atom, the electrons occupy the lowest available energy level.

The lowest energy level (n=1) can hold up to 2 electrons.

The next lowest energy level (n=2) can hold up to 8 electrons. n=3 and n=4 can also hold 8 electrons.

Examples:

1. *Write the electron configuration of Ar.*

Argon: 18 e^- → from the Periodic Table

Solution : 2,8,8,

3 Energy levels occupied (2 electrons in n=1, 8 in n=2 and 8 in n=3)

2. *Write the electron configuration of O^-*

O^- : 8+1 = 9 e^- → O^- has a negative charge, meaning it has an extra electron.

Solution : 2,7

2 Energy levels occupied

3. *Write the electron configuration of K:*

K: 19 e^-

Solution: 2,8,8,1

4 Energy levels occupied

Note: You need to be able to write the electron configurations of the first 20 elements from the Periodic Table.

G. Galvin