

# The Periodic Table | Topic Notes

## What is the periodic table?

- It is a list of elements arranged so as to demonstrate trends in their physical and chemical properties.

## History of the Idea of Elements

### Ancient Greeks

- the basic substances from which other materials are made
- 4 elements: earth, air, fire, water

### Boyle

- first reasonably accurate defn.
- a substance which cannot be broken down into simpler materials by chemical means.
- compounds: combinations of elements which can be formed from and broken down into these elements.

### Davy

- new electrochemical techniques for breaking compounds down into elements.
- electrolysed a moist solid sample of potassium hydroxide producing small pieces of a shining metal (potassium) which rapidly burnt with a lilac flame.
- sodium from sodium hydroxide in a similar manner
- also isolated barium, strontium, calcium and magnesium

### Moseley

- discovered a characteristic positive charge in the atomic nucleus of each element
- called this charge the atomic number
- advancement of defn: a substance all of whose atoms have the same atomic number

# History of the Periodic Table

## Dobereiner's Triads

- groups of three elements
- similar chemical properties
- atomic weight of the second is midway between that of the first and the third
- example: Li, Na, K
- restricted to a small number of elements

## Newlands' Octaves

- when in order of atomic weight, properties repeat every eight elements
- worked for first 17 elements
- forced all known elements - Cu & Ag with Li, Na, K
- principle: periodic reoccurrence of properties when elements are arranged in order of increasing atomic weight.

## Mendeleev's Sub-Groups

- principle: periodic reoccurrence of properties when elements are arranged in order of increasing atomic weight.
- in order of increasing atomic weight
- listed separately elements who did not fit in with the properties of the main groups - Cu & Ag.
- I and Te out of correct order because of their properties
- left gaps which represented elements not yet discovered
- choosing 3 gaps, he predicted the properties of the elements

## Moseley

- discovery of characteristic positive charge / atomic number
- table in order of increasing atomic number

Compare Mendeleev's and the modern periodic table.

Mendeleev's	Modern
inc. atomic weight (mass)	inc. atomic number
reversed some pairs (Te & I)	no reversed pairs
left gaps for undiscovered elements	gaps filled
no noble gases	noble gases present
fewer elements	more elements
did not put transition elements / lanthanides / actinides in separate block	transitions / lanthanides / actinides in separate block

## The different groups

### The Alkali Metals

- increasing reactivity going down the group
- soft metals - can be cut with a knife
- low densities
- shiny but tarnish quickly

- sodium + oxygen  $\rightarrow$  sodium oxide
- react vigorously with water to form basic soln. and hydrogen
  - sodium + water  $\rightarrow$  sodium hydroxide + hydrogen

### **The Alkaline Earth Metals**

- increasing reactivity going down the group
- harder than the alkali metals
- less reactive than their corresponding alkali metals
- react with water but less vigorously than their corresponding alkali metals
  - calcium + water  $\rightarrow$  calcium hydroxide + hydrogen

### **The Halogens**

- nonmetals
- decreasing reactivity going down the group
- low melting/boiling points
- react with hydrogen to form acidic soln.s
  - hydrogen + chlorine
- react vigorously with alkali metals forming white salts
  - sodium + chlorine  $\rightarrow$  sodium chloride

### **The Noble Gases**

- all gases at room temp.
- boiling point and density increase going down the group
- least reactive