Cambridge IGCSE Chemistry

Topic 9: The Periodic Table

Group properties

Notes

Describe lithium, sodium and potassium in Group I as…

- A collection of relatively soft metals showing a trend in melting point, density and reaction with water

(Extended only) Identify trends in Groups, given information about the elements concerned

- Similar chemical properties due to the fact that they have the same number of outer shell electrons
- Once you are given information regarding more than one element in a group, look at each of their positions in the group (i.e. near the top or bottom) and identify the trend shown by the elements with given information (e.g. reactivity or boiling point could increase down the group)
    - Going down a group means going up in number of electron shells, more electron shielding and so less attraction between the nucleus and outer shell electrons

Predict the properties of other elements in Group I, given data, where appropriate

- Melting point
    - Low melting points compared to most other metals
        - As you go down the group, melting points decrease
- Density
    - Low densities – they will float on water
        - As you go down the group, densities increase
- Reaction with water
    - All react vigorously with water to create an alkaline solution and hydrogen (i.e. you will see bubbling/effervescing due to the production of a gas)
    - More bubbles with reaction with water = more vigorous reaction = more reactive alkali metal (Group I metal)
        - Reactivity increases down the group (so reaction becomes more vigorous)
        - Down the group – easier to lose electrons and form positive metal ions (cations), these are formed when metals react
        - It is easier to lose electrons due to the increase in electron shells and therefore there is more electron shielding and easier to lose electrons due to the decrease in attraction between the positively charged nucleus and the negatively charged outer shell electrons

Describe the halogens, chlorine, bromine and iodine in Group VII, as…

- A collection of diatomic non-metals showing a trend in colour and density

… and state their reaction with other halide ions

- reactivity decreases going down the group:
  - outer shell becomes further from nucleus and there is more shielding from inner electrons
  - attraction between nucleus and outer electrons decreases
  - electrons are gained less easily (which is how halogens react)
- a more reactive halogen will displace halide ions of a less reactive halogen
- chlorine will displace both bromide and iodide ions:
  - chlorine + sodium bromide → sodium chloride + bromine
  - chlorine + sodium iodide → sodium chloride + iodine
- bromine will displace iodide but not chloride ions
  - bromine + potassium iodide → potassium bromide
- iodine will not displace chloride or bromide ions

Predict the properties of other elements in Group VII, given data where appropriate

- Colour
  - Darker in colour as you go down the group
    - Fluorine is very pale yellow
    - Chlorine is yellow-green
    - Bromine is red-brown
    - Iodine is purple
- Density
  - Density increases as you go down the group
    - Chlorine is a gas
    - Bromine is a liquid
    - Iodine is a solid
- reactivity
  - decreases down the group
  - outer shell becomes further from nucleus and there is more shielding from inner electrons, attraction between nucleus and outer electrons decreases, electrons are gained less easily (which is how halogens react)
  - A more reactive halogen can displace a less reactive one in an aqueous solution of its salt