# OCR B GCSE Chemistry

## Topic 2: Chemical patterns

### What does the Periodic Table tell us about the elements?

**Notes**

## *1. Explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atoms and hence to its atomic number*

- Elements are arranged in order of increasing atomic number, in rows called periods and elements, with similar properties are placed in the same vertical columns called groups
    - Period number refers to the number of shells of electrons
    - Group number refers to the number of outer shell electrons
    - atomic number=number of protons (same as number of electrons for uncharged elements)

## *2. Describe how Mendeleev organised the elements based on their properties and relative atomic mass*

- Ordered his table in order of atomic mass, but not always strictly – i.e. in some places he changed the order based on atomic weights.
- Left gaps for elements that he thought had not been discovered yet.
- Elements with properties predicted by Mendeleev were discovered and filled the gaps
- Knowledge of isotopes made it possible to explain why the order based on atomic weights was not always correct.

## *3. Describe how discovery of new elements and the ordering elements by atomic number supports Mendeleev's decisions to leave gaps and reorder some elements*

- see 2

## *4. Describe metals and non-metals and explain the differences between them on the basis of their characteristic physical and chemical properties, including melting point, boiling point, state and appearance, density, formulae of compounds, relative reactivity and electrical conductivity*

- Metals = elements that react to form positive ions.
- Non-metals = elements that react to form negative ions or react by sharing electrons.
- Physical differences:
    - Metals are generally electrically conductive, non metals (excluding graphite) are not conductive
    - Metals have higher melting and boiling points generally
    - Metals are shiny and are normally solids (because of the above statement – except Mercury), whereas non metals are generally dull
    - Metals are denser than nonmetals

## *5. Recall the simple properties of Group 1 elements including their reaction with moist air, water, and chlorine*

group one- alkali metals

- They have characteristic properties due to the single electron in their outer shell.
- Metals in group one react vigorously with water to create an alkaline solution and hydrogen.
- They all react with oxygen/moist air to create a metal oxide.
- They all react with chlorine to form a white precipitate (a metal chloride)
- The reactivity of the elements increases going down the group:
    - as you go down the group, number of electron shells increases
    - electrons in inner shells shield the outer electron, reducing attraction between it and the nucleus
    - this means the outer electron can be lost more easily, so reactivity has increased

## *6. Recall the simple properties of Group 7 elements including their states and colours at room temperature and pressure, their colours as gases, their reactions with Group 1 elements and their displacement reactions with other metal halides*

- States and colours at room temperature and pressure
    - Fluorine pale yellow gas
    - Chlorine pale green gas
    - Bromine orangey-brown liquid
    - Iodine grey-black solid
- colours as gases:
    - bromine forms an orange-brown gas
    - iodine forms a purple gas
- Similar reactions due to their seven electrons in their outer shell.
- Non-metals and consist of molecules made of pairs of atoms.

- They react with metals to form ionic compounds in which the halide ion carries a -1 charge. e.g. NaCl or $MgBr_2$ (as Mg has a +2 charge so you need two $Br^-$ to cancel this out)
- Reaction is less vigorous as you move down group 7, but they still all react to form metal halides

- A more reactive halogen can displace a less reactive in an aqueous solution of its salt.
- E.g. Chlorine will displace bromine if we bubble the gas through a solution of potassium bromide:

    Chlorine + Potassium Bromide → Potassium Chloride + Bromine

- chlorine will displace bromine and iodine
- bromine will displace iodine but not chlorine
- iodine can replace neither chlorine or iodine

- This happens because as you go down the group, the reactivity of halogens decreases.
- The halogens react by gaining an electron in their outer shell, as you go down the group:
    - outer shell becomes further from the nucleus
    - electron shielding increases
    - attraction decreases between nucleus and outer electrons
    - electrons are gained less easily
    - halogens become less reactive

## *7. Predict possible reactions and probable reactivity of elements from their positions in the Periodic Table*

- use above information- look at which group they're in to see how many electrons they'll lose
- for groups 1-3 which lose electrons, reactivity increases down the group
- for groups 5-7 which gain electrons, reactivity decreases down group

## *8. Describe experiments to identify the reactivity pattern of Group 7 elements including displacement reactions*

- Do a displacement reaction to identify the reactivity pattern of group 7 elements e.g. Chlorine + Potassium Bromide -> Potassium Chloride + Bromine
- To test & see that chlorine is more reactive than bromine, because it replaces it forming potassium chloride, you must test for the chloride ions

*Tests*

- Test for: chloride ions, $Cl^-$, bromide ions, $Br^-$, iodide ions, $I^-$, using dilute nitric acid and silver nitrate solution
    - First add dilute nitric acid, followed by silver nitrate solution
    - Chloride gives a white precipitate
    - Bromide gives a cream precipitate
    - Iodide gives a yellow precipitate

## *9. Describe experiments to identify the reactivity pattern of Group 1 elements*

- React each separately with water – the more vigorous a reaction, the more bubbles/effervescence there is and therefore, the more reactive a metal