Edexcel GCSE Chemistry

Topic 6: Groups in the periodic table

Group 7

Notes

6.6 Recall the colours and physical states of chlorine, bromine and iodine at room temperature

- Chlorine is a yellow-green gas
- Bromine is a red-brown liquid
- Iodine is a purple solid

6.7 Describe the pattern in the physical properties of the halogens, chlorine, bromine and iodine, and use this pattern to predict the physical properties of other halogens

- There is a trend in state from gas to liquid to solid down the group
- this is because the melting and boiling points increase as you go down the group
- from this, you can predict that any halogens above chlorine will be gases (their boiling points will be even lower), and any below iodine will be solids (their melting points will be even greater)

6.8 Describe the chemical test for chlorine

- When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white

6.9 Describe the reactions of the halogens, chlorine, bromine and iodine, with metals to form metal halides, and use this pattern to predict the reactions of other halogens

- 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

6.10 Recall that the halogens, chlorine, bromine and iodine, form hydrogen halides which dissolve in water to form acidic solutions, and use this pattern to predict the reactions of other halogens

- halogen + hydrogen $\rightarrow$ hydrogen halide (HCl, HBr, HI)
- reaction becomes less vigorous down group: chlorine reacts in sunlight, but bromine will react in a flame (higher temperature)
- hydrogen halides dissolve in water to produce acidic solutions- in solution the hydrogen halide will fully dissociate into H^+ and halide$^-$ ions

6.11 Describe the relative reactivity of the halogens chlorine, bromine and iodine, as shown by their displacement reactions with halide ions in aqueous solution, and use this pattern to predict the reactions of astatine

- 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

6.12 (HT only) Explain why these displacement reactions are redox reactions in terms of gain and loss of electrons, identifying which of these are oxidised and which are reduced

- OILRIG- oxidation is loss, reduction is gain (of electrons)
- More reactive halogen which displaces the less reactive one, forms a negative ion itself, therefore being reduced as it has gained electrons
- The less reactive halogen that is displaced is oxidised as it loses these electrons to go from a negative ion to an atom with 0 charge
- e.g. for the equation: chlorine + potassium bromide → potassium chloride + bromine
  - the symbol equation without potassium is: $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$
  - so for chlorine the half equation is: $Cl_2 + 2e^- \rightarrow 2Cl^-$, chlorine has gained electrons, so it has been reduced
  - for bromine the half equation is: $2Br^- \rightarrow Br_2 + 2e^-$, bromine has lost electrons, so it has been oxidised

6.13 Explain the relative reactivity of the halogens in terms of electronic configurations

- electronic configurations of the halogens:
  - fluorine: 2,7
  - chlorine: 2,8,7
- these show clearly the extra shell of electrons gained as you move down group 7, which lead to greater shielding and weaker attraction, leading to reduced reactivity