

CAIE IGCSE Chemistry

8.3 Group VII properties

Notes

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Describe the Group VII halogens, chlorine, bromine and iodine, as diatomic non-metals with general trends down the group, limited to:

- Elements in group VII (7) are known as the halogens
- The halogens are diatomic nonmetals, meaning they form molecules consisting of 2 atoms chemically bonded:
 - E.g. chlorine Cl_2 , bromine Br_2 and iodine I_2
- Group VII elements have 7 electrons in their outer shell, so gain one electron from another element to form ions with a -1 charge, known as halide ions.

(a) Increasing density

- The density of group VII elements increases going down the group

(b) Decreasing reactivity

- The reactivity of group VII elements decreases going down the group
- Group VII elements gain an electron when they react. As you go down Group VII, atomic radius and electron shielding increase. This means that the attraction between the nucleus and outer electrons decreases so it is harder for the atom to gain an electron.

Melting and boiling points

- The melting and boiling point of group VII elements increases going down the group
- The molecules get bigger down the group so there are stronger intermolecular forces to overcome during melting / boiling so more energy is required to change state.
- The trend in melting and boiling points explains the change in appearance and state of the halogens going down the group

State the appearance of the halogens at r.t.p. as:

- At room temperature and pressure, the halogens appear as:
 - Chlorine Cl_2 is a pale green gas
 - Bromine Br_2 is a red-brown liquid
 - Iodine I_2 is a grey-black solid



Describe and explain the displacement reactions of halogens with other halide ions

- The reactivity of group VII elements decreases going down the group
- A more reactive halogen will displace a less reactive halogen (A) in an ionic substance.
 - E.g. Bromine can displace iodine in potassium iodide since it is more reactive than iodine, but cannot displace chlorine in potassium chloride
- E.g. Write the word and symbol equation for the displacement reaction between chlorine and sodium bromide:
Chlorine + Sodium bromide → Sodium chloride + Bromine
 $\text{Cl}_2 + 2\text{NaBr} \rightarrow \text{Br}_2 + 2\text{NaCl}$
- The displacement of halogens are visible by colour of the solutions formed by halogens
 - Chlorine solution: colourless
 - Bromine solution: orange
 - Iodine solution: brown
- E.g. Predict what colour solution will form from the displacement reaction between chlorine and potassium iodide:
A brown solution will form as chlorine displaces iodine in potassium iodide, so iodine is displaced.

Predict the properties of other elements in Group VII, given information about the elements

- The properties of elements in group VII can be predicted using their position in the group
- E.g. Using the trend in reactivity, predict the element in group VII with the highest reactivity
 - Fluorine is the most reactive element in group VII, since the reactivity increases going up the group.

