



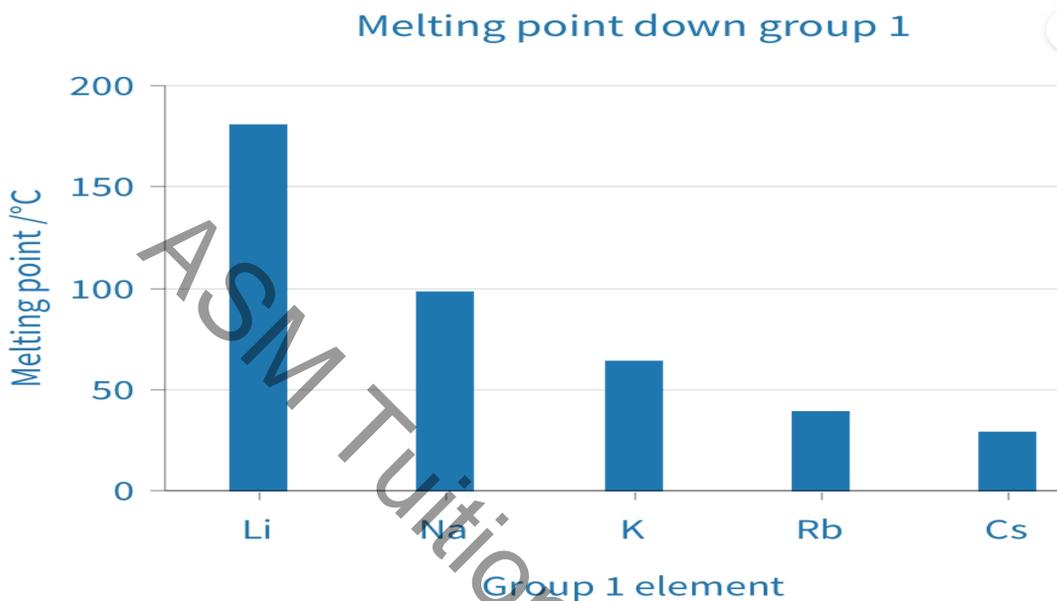
## C1: Atomic Structure

### And periodic table

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## Melting points

The graph shows the melting points of the alkali metals as you go down group 1.



## Reactivity

### 1. Reaction with Air:

- ▶ The alkali metals react with oxygen in the air to form metal oxides. For example, sodium reacts with oxygen to form sodium oxide:



You can see this happening when a piece of sodium is cut with a knife. The cut surface is silvery and shiny (as you would expect for a metal), but it rapidly becomes dull grey as sodium oxide forms.

The rate at which this happens to the alkali metals increases as you go down group 1.

### 2. Reaction with water:

- ▶ The alkali metals react with cold water to form soluble metal hydroxides. For example, sodium reacts with water to form aqueous sodium hydroxide and hydrogen gas:

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- The reactions of lithium, sodium and potassium have features in common:
  - all three metals are less dense than water, so they float
  - pieces of metal get smaller as the reaction carries on
  - bubbles are given off
  - their hydroxides dissolve in the water to produce alkaline solutions – these turn universal indicator solution purple.
  - The reactions become more vigorous and rapid as you go down the group.

### 3. Reaction with Chlorine :

- Group 1 vigorously react with chlorine gas when heated like Sodium(Na) react with Chlorine and form metal Chloride salt.

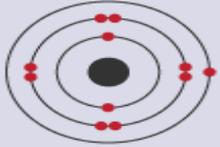
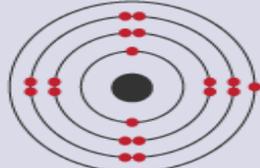


- As we go down in periodic table reactivity increases.

### Why does reactivity increase?

- The atoms of each group 1 element have one outer electron (one electron in the highest occupied energy level). They lose this electron in reactions. In general:



Atomic number	Name	Electronic configuration	Diagram of atom
3	Lithium	2.1	
11	Sodium	2.8.1	
19	Potassium	2.8.8.1	

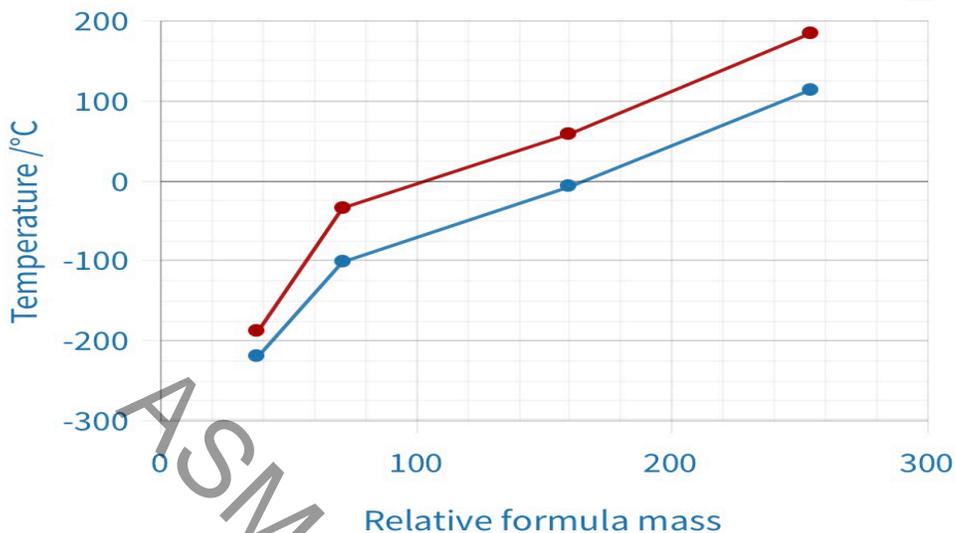


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Melting and boiling points down group 7 



- You can use this graph to predict the state of each halogen at room temperature and pressure, rtp (20 °C, 1 atm):
- fluorine and chlorine are in the gas state because their melting and boiling points are less than 20 °C
  - bromine is in the liquid state because its melting point is less than 20 °C but its boiling point is greater than 20 °C
  - iodine is in the solid state because its melting and boiling points are greater than 20 °C.

## Reactivity

### 1. Reactions with hydrogen

- Hydrogen reacts with halogens to form hydrogen halides. For example, hydrogen reacts with chlorine to form hydrogen chloride:



- Hydrogen halides dissolve in water to form acidic solutions. In this example, hydrogen chloride dissolves in water to form hydrochloric acid, HCl(aq).
- The reactions between hydrogen and halogens become less vigorous as you go down group 7:
- fluorine reacts explosively in the cold and dark

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- chlorine reacts when heated or in sunlight
- bromine reacts in burning hydrogen
- iodine reacts slowly during continuous heating.

## 2. Reactions with metal

- Metals react with the halogens to form salts. For example, sodium reacts with chlorine to form sodium chloride:



- These reactions become less vigorous as you go down group 7.

## 3. Displacement reactions

- A displacement reaction occurs when an element replaces another element in a compound. In the case of the halogens:

- a more reactive halogen will displace a less reactive halogen from its compounds.

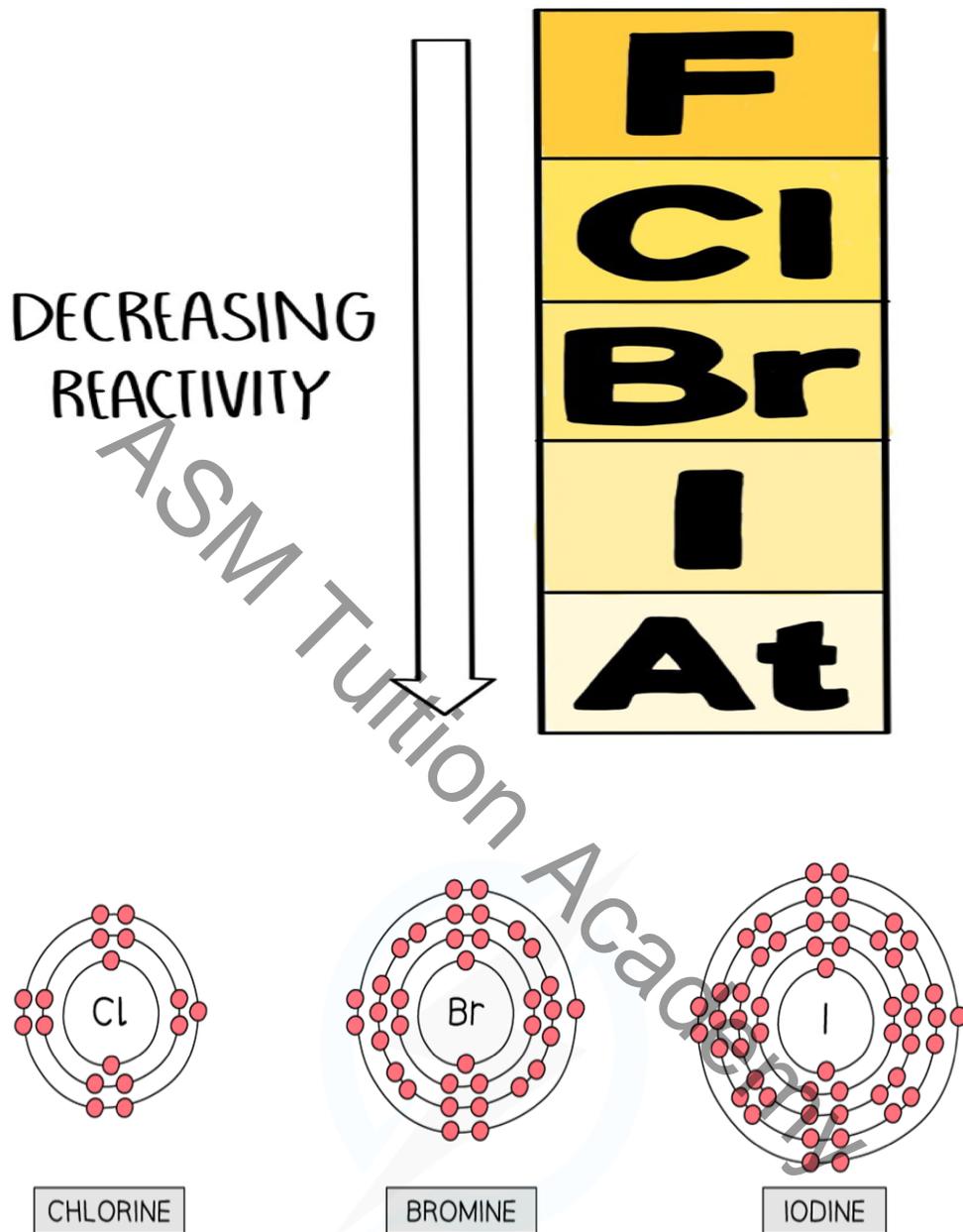
- For example, chlorine can displace iodine from potassium iodide:



## Why does reactivity decrease?

- The atoms of each group 7 element have seven outer electrons (seven electrons in the highest occupied energy level). They gain one more outer electron in reactions. In general:
- As you go down group 7:
  - there are more occupied shells (energy levels)
  - the force of attraction between the nucleus and the outer shell decreases
  - an outer electron is gained less easily.
- Fluorine is the most reactive halogen because there is only one shell of electrons between the nucleus and outer shell, so its atoms gain an outer electron most easily.

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This is because, going down group 0:

- the atoms become larger
- the intermolecular forces between the atoms become stronger
- more energy is needed to overcome these forces

## Physical properties of Noble gases

### properties of Noble gases

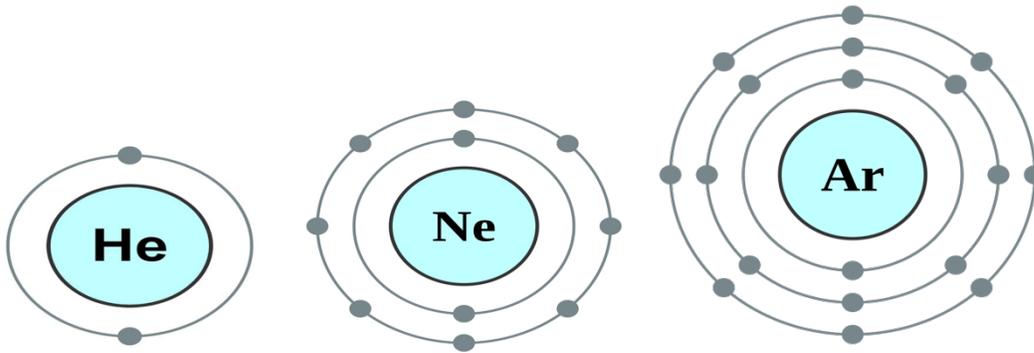
- ▶ 1. Show as gases in room conditions.
- ▶ 2. No color and no smell.
- ▶ 3. Have 8 electrons equivalent.
- ▶ 4. Produce vehicles only in special circumstances.
- ▶ 5. It is drawn from the air in liquefaction and distillation.
- ▶ 6. Found in the form of single-atom gases.
- ▶ 7. Very weak internal attraction between their atoms.
- ▶ 8. It has very low melting and boiling grades.

## Why are noble gases un-reactive?

The atoms of each group 0 element have a full outer shell (highest occupied energy level). They have stable electronic configurations – they have no tendency to lose, gain or share electrons

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the electronic configurations of the noble gases:

- all group 0 elements have 8 electrons in their outer shell, **except**
- helium, which has 2 electrons.