Testing for Ions

Ions

- Atoms are normally electrically neutral because they have an equal number of positively charged protons and negatively charged electrons.
- When an atom gains or loses electrons, it becomes an ion. It may be

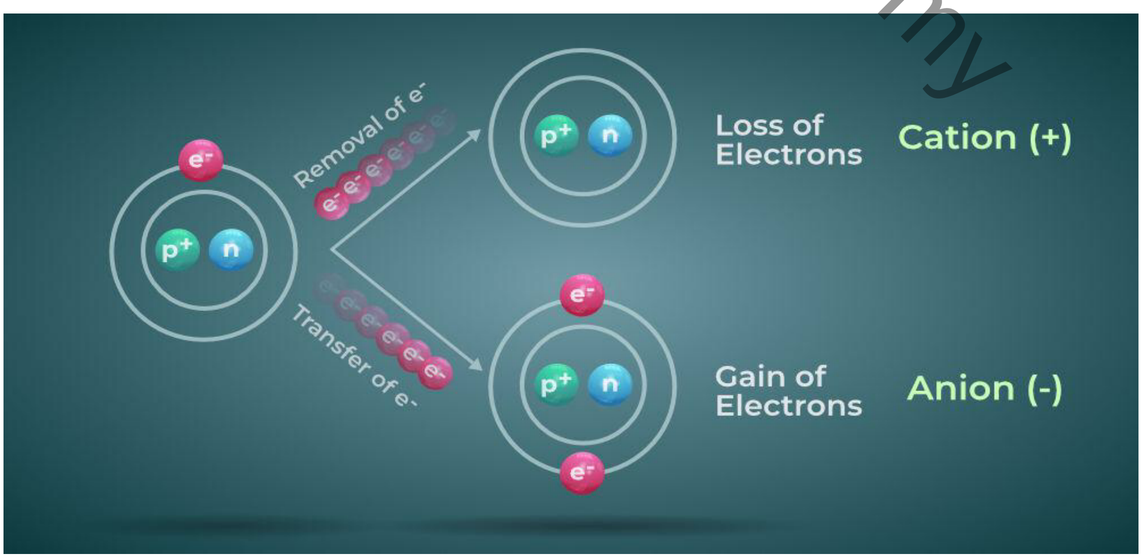
1. Cation
2. Anion

1. **Cations:**

- When an atom loses electrons, it has more protons than electrons, resulting in a positive charge. These positively charged ions are called cations.
- For example, a sodium atom (Na) can lose one electron to become a sodium cation (Na^+).

2. **Anions:**

- When an atom gains electrons, it has more electrons than protons, resulting in a negative charge. These negatively charged ions are called anions.
- For example, a chlorine atom (Cl) can gain one electron to become a chloride anion (Cl^-)



Testing For Cations

- Different test is used to identify cations

  I. Flame Test

  II. By Using Sodium Hydroxide

  III. Testing for ammonia

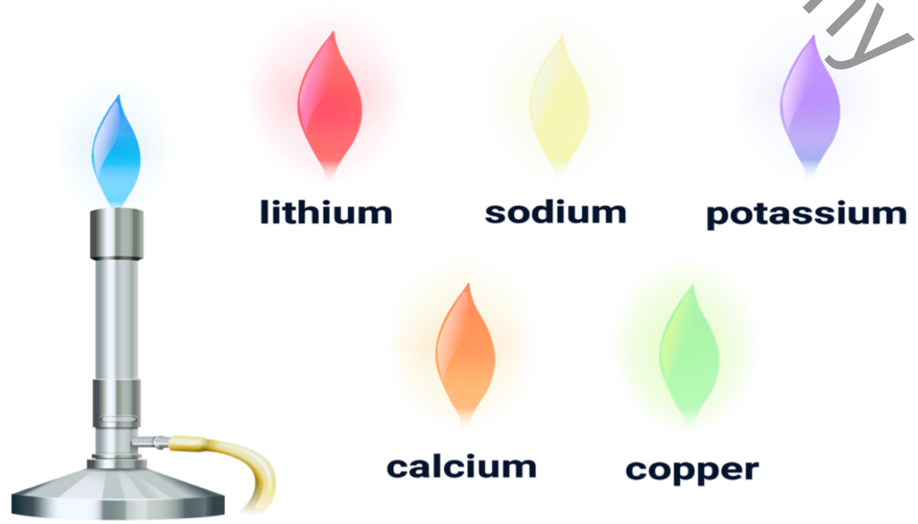
Flame Tests

- Flame tests can be used to identify metal ions (**cations**) in compounds. Steps to produce flame colours include:

  1. Wearing eye protection, clean a wire loop by dipping in hydrochloric acid, and then holding in a blue flame for a few seconds
  2. Dip the clean wire loop into a solid sample of the compound being tested, and then hold in a blue flame
  3. Observe and record the flame colour produced

- You need to know the colour of :

  - lithium ions, Li+ (**red**)
  - sodium ions, Na+ (**yellow**)
  - potassium ion, K+ (**lilac**)
  - calcium ions, Ca2+ (**orange-red**)
  - copper ions, Cu2+ (**blue-green**)



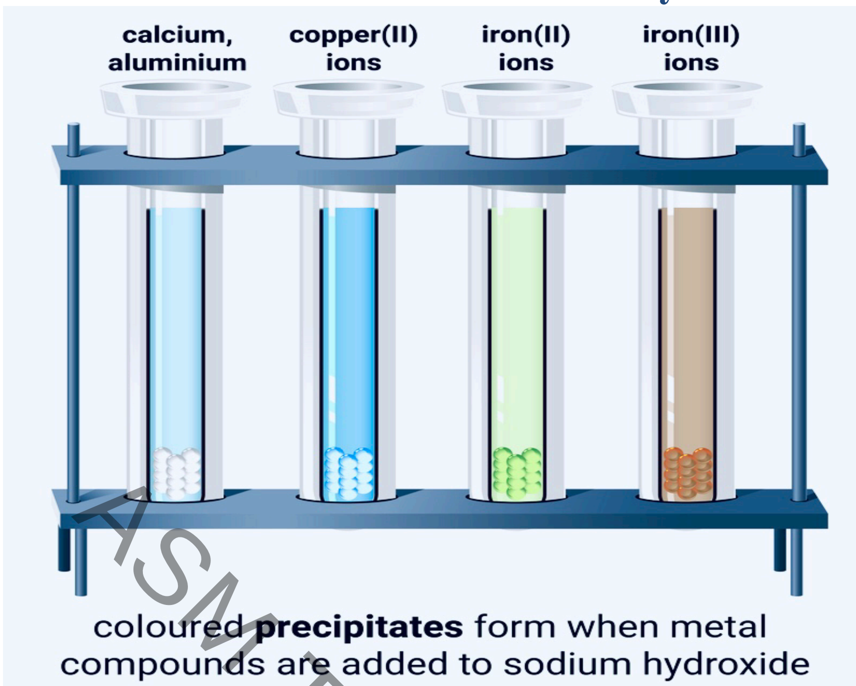
More Testing for Cations

- Compounds that contain **transition metals** are often coloured. If we react two chemicals together and a new solid is made (one that doesn't **dissolve** in the solution) we call it a **precipitation** reaction.
- Compounds can **dissociate** (split apart into ions) in solutions, and the positive ions are referred to as **cations**.

Using sodium hydroxide

- Dilute sodium hydroxide solution (NaOH) is used to test for some metal ions and can also be used to identify ammonium ions.

ion	**colour of precipitate**
Aluminium, Al3+	White *adding excess NaOH will cause the precipitate to dissolve*
Calcium, Ca2+	White *adding excess NaOH does not change the precipitate*
Copper, Cu2+	Blue
Iron(II), Fe2+	Green
Iron(III), Fe3+	Brown
Ammonium, NH4+	When warmed will release ammonia gas



Cation	Color in Aqueous Solution		Observation upon Adding a Few Drops of Dilute NaOH(*aq*)		Identity of Precipitate
Cu^{2+}	Blue		A pale-blue precipitate forms.		$Cu(OH)_2(s)$
Fe^{2+}	Green		A pale-green precipitate forms.		$Fe(OH)_2(s)$
Fe^{3+}	Yellowish-brown		A red-brown precipitate forms.		$Fe(OH)_3(s)$
Al^{3+}	Clear, colorless		A white precipitate forms.		$Al(OH)_3(s)$
Zn^{2+}	Clear, colorless		A white precipitate forms.		$Zn(OH)_2(s)$
Ca^{2+}	Clear, colorless		A white precipitate forms.		$Ca(OH)_2(s)$
Cr^{3+}	Dark green		A gray-green precipitate forms.		$Cr(OH)_3(s)$
NH_4^+	Clear, colorless		No precipitate forms, but bubbles and a pungent odor are given off.		-

Testing for ammonia

- Holding a piece of damp, red litmus paper over ammonia gas will turn the litmus paper blue if ammonia gas is present.

$NH_4^+ (aq) + OH^- (aq) \rightarrow$ **NH_3 (g) + H_2O (l)**