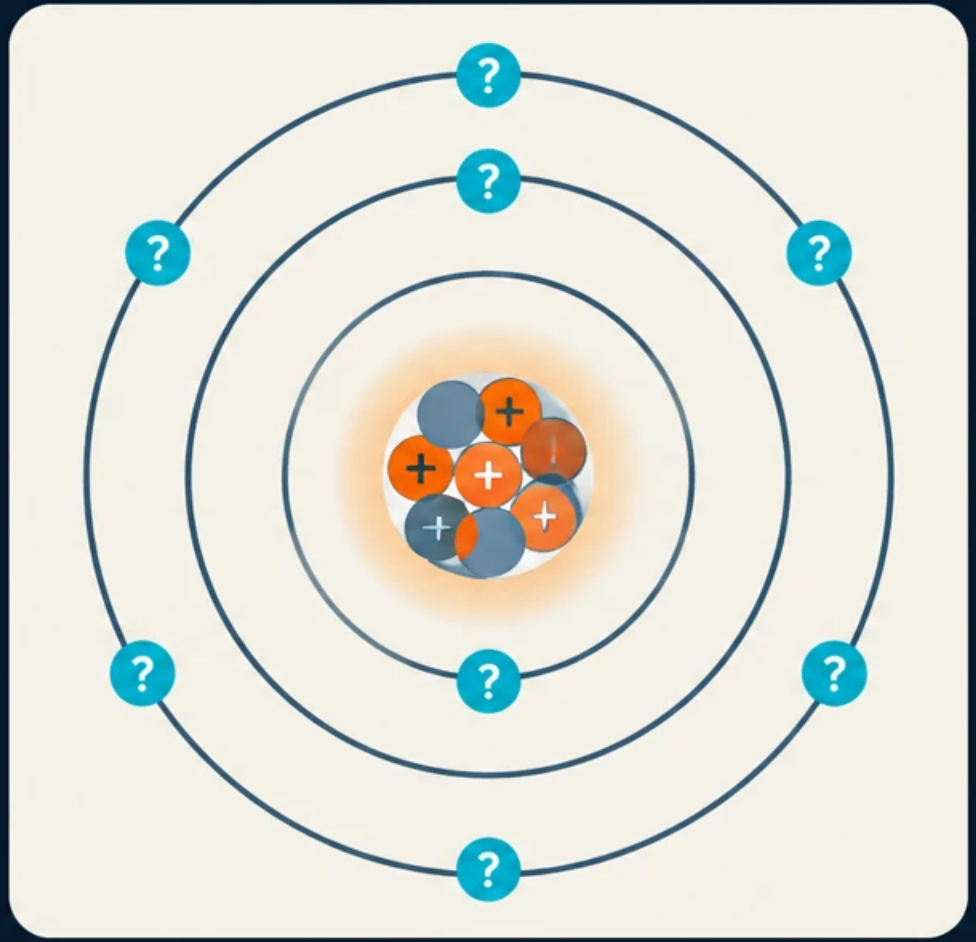
Atomic Structure

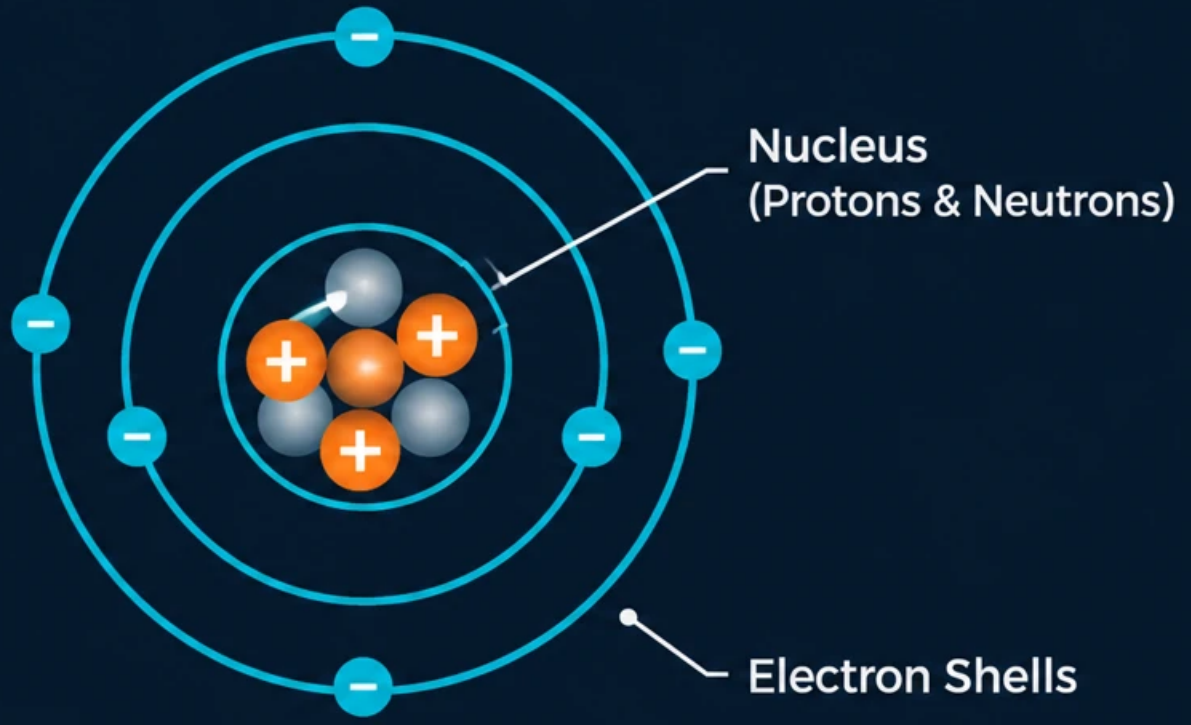
What three subatomic particles compose an atom, and where is each particle located within the atomic structure?



Atomic Structure: Answer

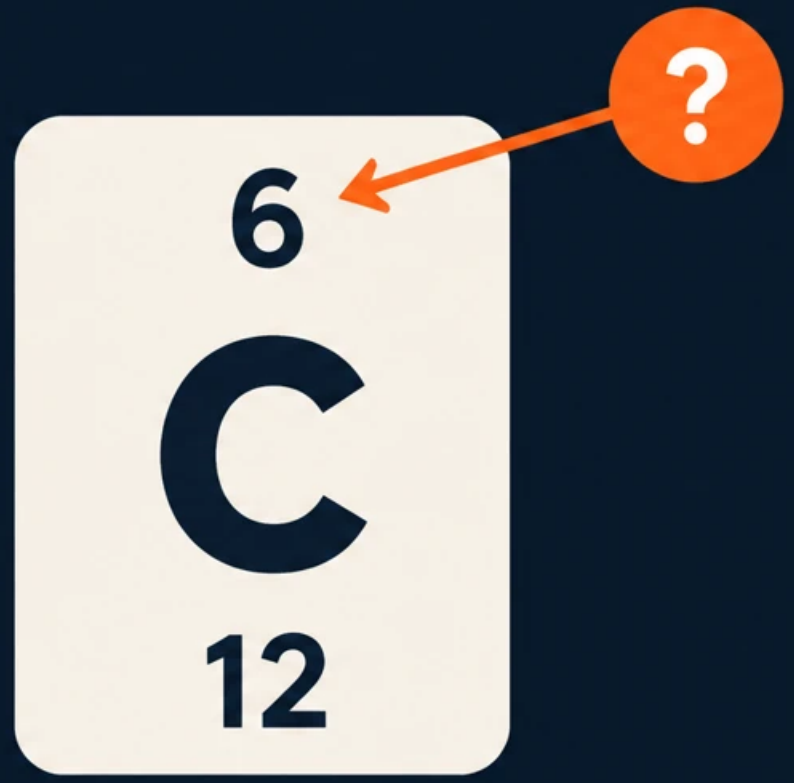
Protons, neutrons, and electrons.

Protons (positively charged) and neutrons (neutral, uncharged) are tightly packed in the central nucleus. Electrons (negatively charged) orbit the nucleus in specific energy levels or electron shells.



Atomic Number vs Mass Number

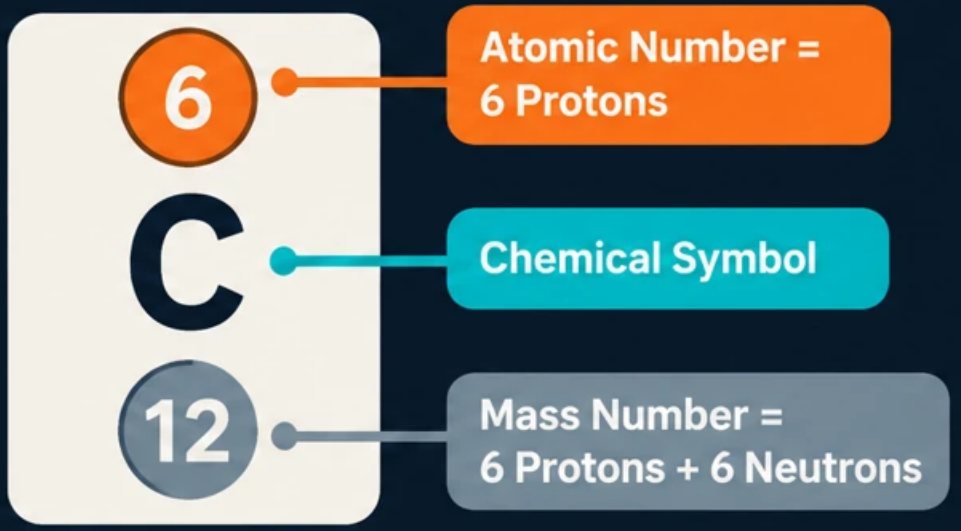
On a standard periodic table entry for an element (such as Carbon, C, with numbers 6 and 12), what fundamental property does the atomic number define?



Atomic Number vs Mass Number: Answer

The atomic number represents the number of protons in the nucleus.

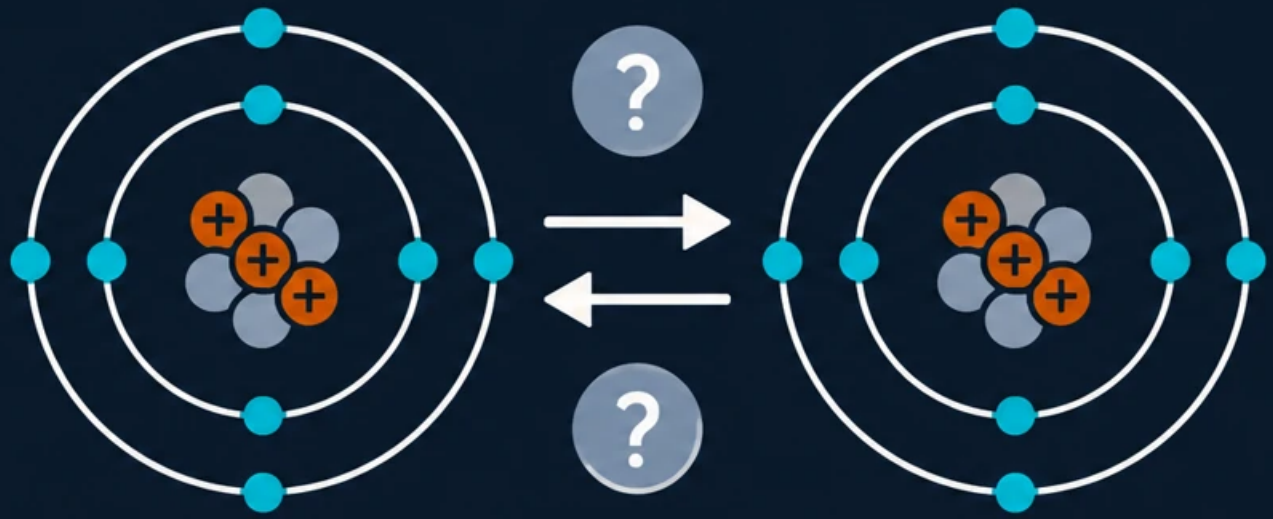
Because every element has a unique number of protons, the atomic number determines the element's identity. In a neutral atom, it also equals the total number of electrons. The mass number (12) represents the combined total of protons and neutrons.



Protons = Atomic Number

Ion Formation

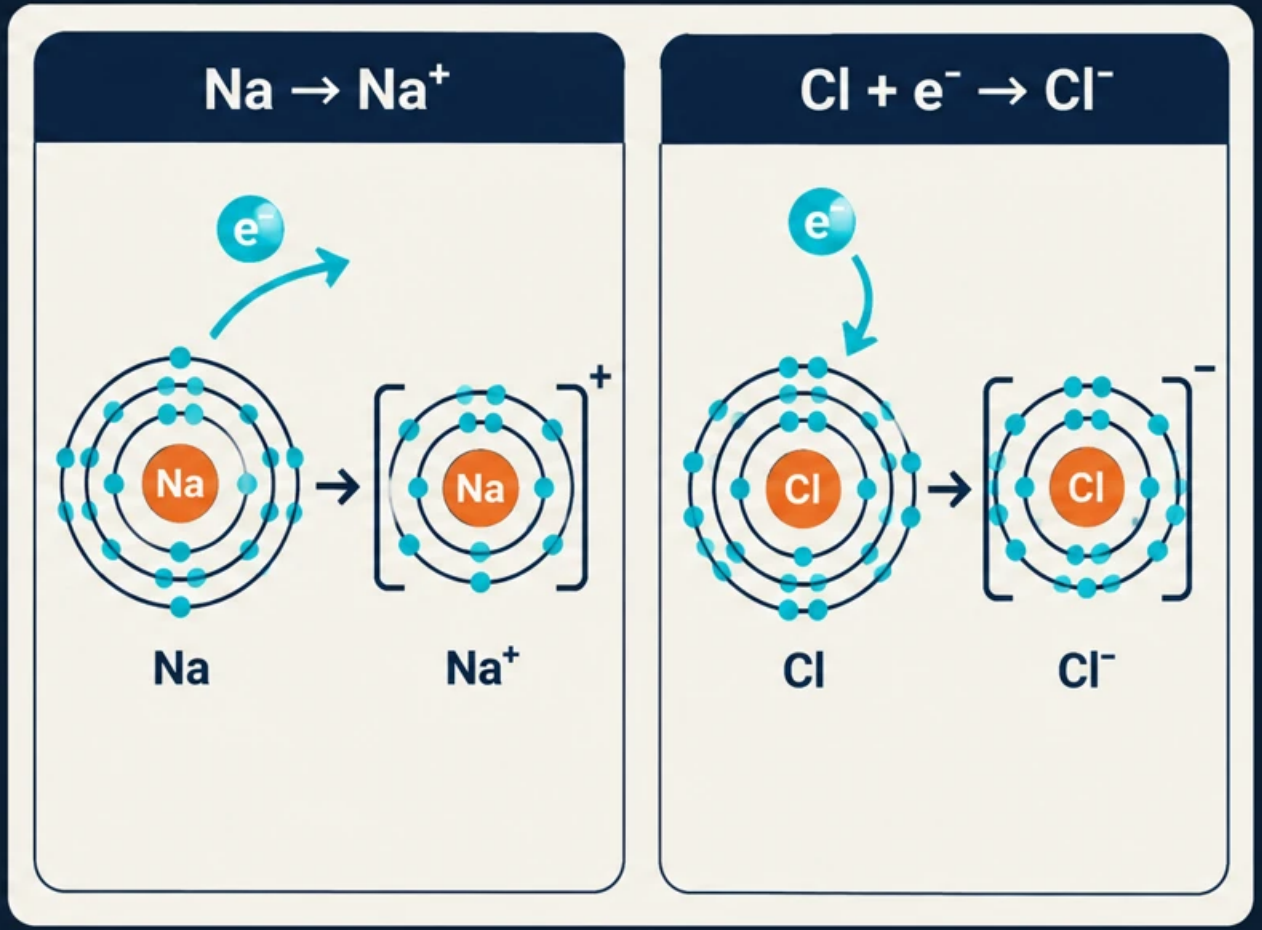
What occurs to a neutral atom in terms of subatomic particles when it transforms into a cation (positive ion) versus an anion (negative ion)?



Ion Formation: Answer

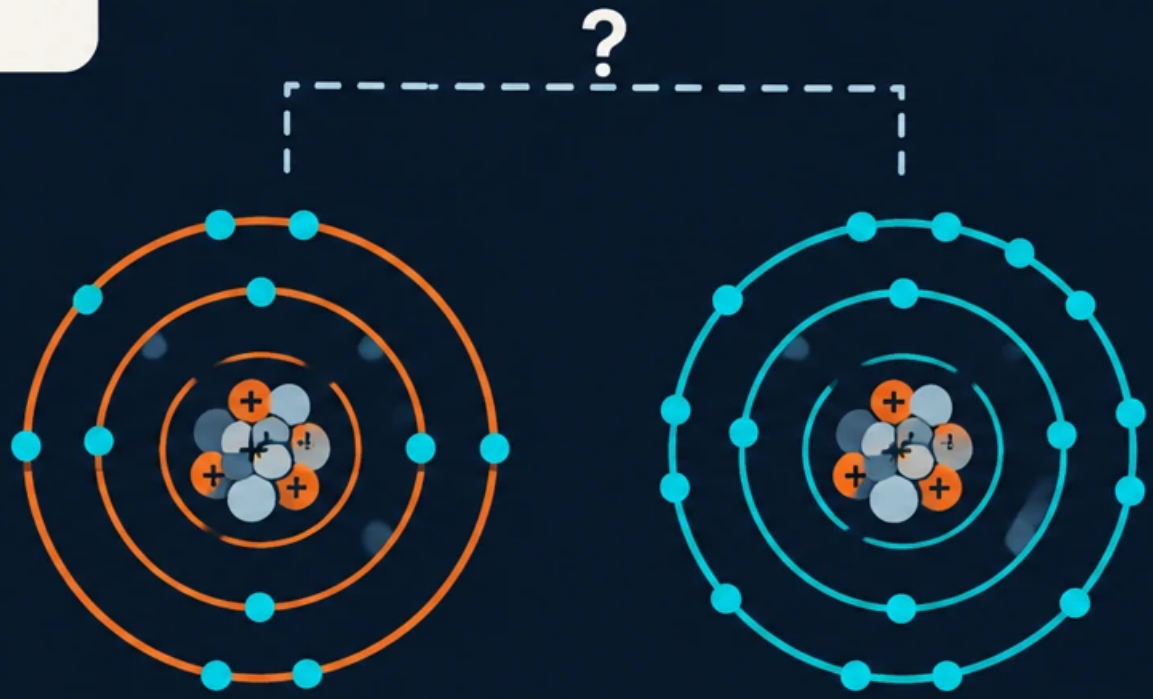
Electrons are lost to form cations, and gained to form anions.

- **Cation (+):** Losing negatively charged valence electrons leaves more protons than electrons, creating an overall positive charge (e.g., Na loses 1 electron to become Na^+).
- **Anion (-):** Gaining electrons results in more electrons than protons, creating an overall negative charge (e.g., Cl gains 1 electron to become Cl^-).



Ionic Bonding

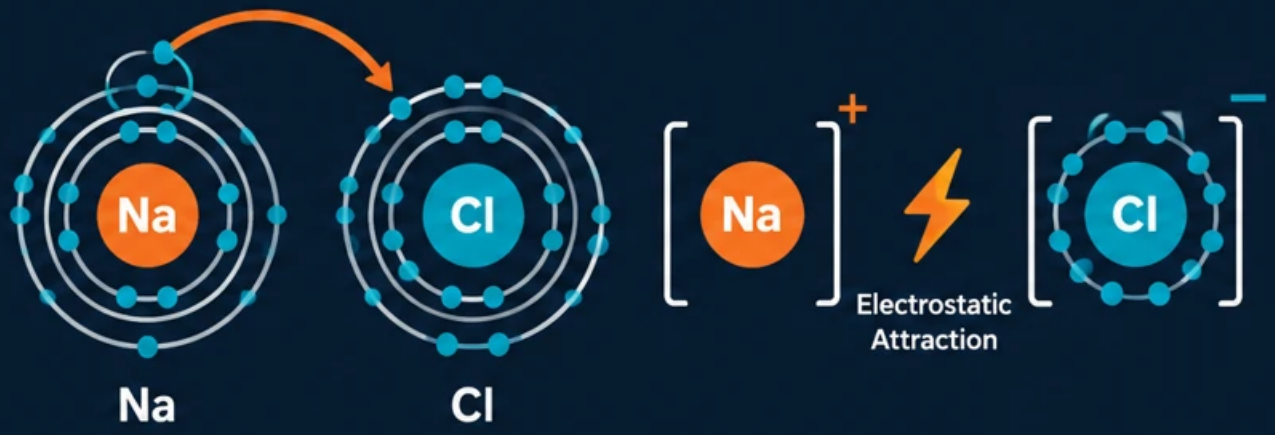
How does an ionic bond form between a metal and a non-metal atom, and what primary force holds the resulting compound together?



Ionic Bonding: Answer

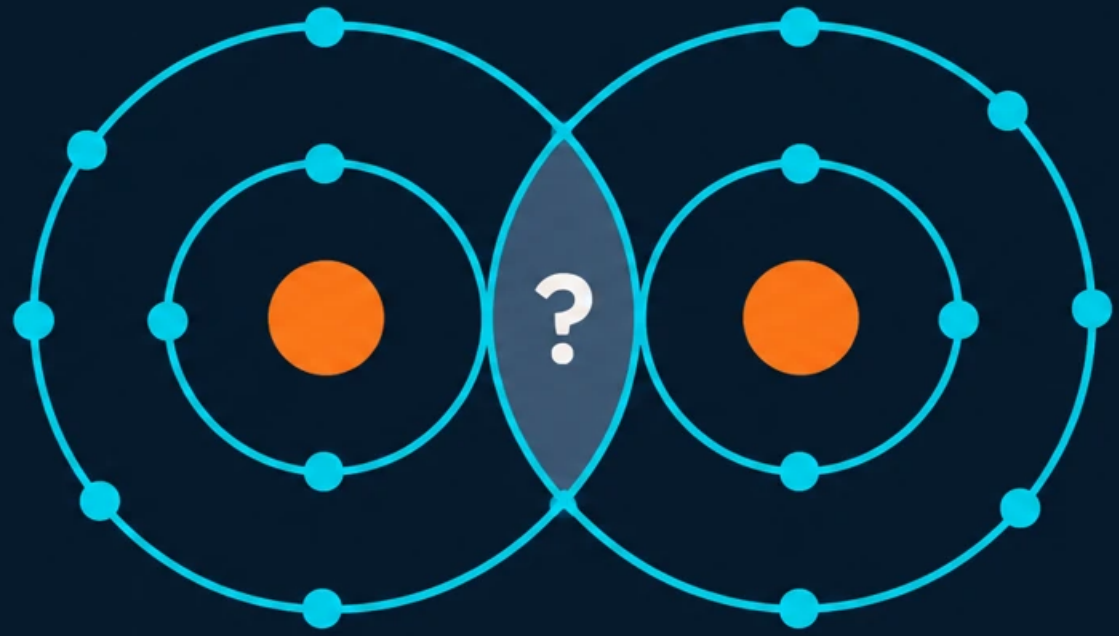
Through the complete transfer of valence electrons and electrostatic attraction.

The metal atom transfers one or more valence electrons to the non-metal atom, allowing both to attain stable full outer electron shells. The resulting oppositely charged ions (positive cation and negative anion) are strongly held together by electrostatic attraction in a crystal lattice.



Covalent Bonding

How do non-metal atoms achieve stable valence electron shells when forming a covalent bond, such as in a molecule of water (H_2O) or chlorine (Cl_2)?



Covalent Bonding: Answer

By sharing pairs of valence electrons.

Non-metal atoms share one or more pairs of valence electrons so that each participating atom achieves a stable, full outer electron shell (a duet for hydrogen, an octet for most others). The shared pair orbits both atomic nuclei simultaneously, binding the atoms into a stable molecule.

