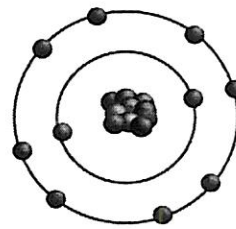


SCIENCE 9: VALENCE SHELLS AND IONS

Valence Shells and Valence Electrons:



- **Valence shell** is the outermost shell containing electrons
- **Valence electrons** are electrons in the valence shell

1. Atoms in the same group have the same number of valence electrons.
2. Atoms in the same period have the same number of energy shells.

During a chemical reaction, atoms gain, lose, or share valence electrons with other atoms until they have a full valence shell and are stable.

Noble gases are unreactive because their valence shells are already full.

Ion: a charged 'atom' that is formed when a neutral atom gains or loses electrons

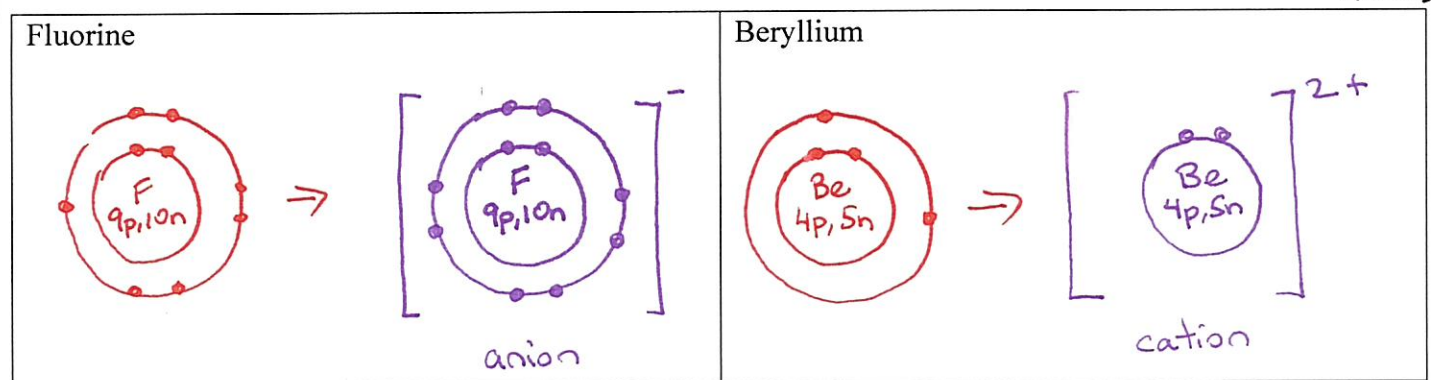
Cation: positively charged ion (e.g. Ca^{2+} , Na^+), formed when atom *loses* electrons

Anion: negatively charged ion (e.g. O^{2-} , P^{3-}), formed when atom *gains* electrons

Bohr models of ions are very similar to Bohr models of atoms. Two key differences:

- Valence shell is full
 - (Note: the fewer electrons that have to move, the better. E.g. oxygen with 6 valence electrons will gain two electrons to form its 2- ion instead of losing six electrons.)
- Square brackets and ion charge

Examples: Draw the Bohr models of fluorine and magnesium atoms and their ions. Are the ions cations or anions?



Practice:

1. Explain why metals tend to lose electrons and non-metals tend to gain them when forming ions.
Metals have few (1, 2, or 3) valence electrons: easiest way to be stable is to lose their valence electrons.

Non-metals have more valence electrons and need a few more to complete their valence shells: they will gain electrons and form negatively charged anions.

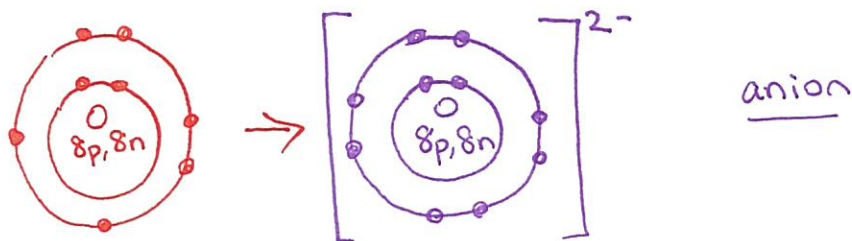
2. On your periodic table, the ion charge of neon is listed as "0". Why is this the case?

Neon is a noble gas and has a full valence shell. It will not form an ion.

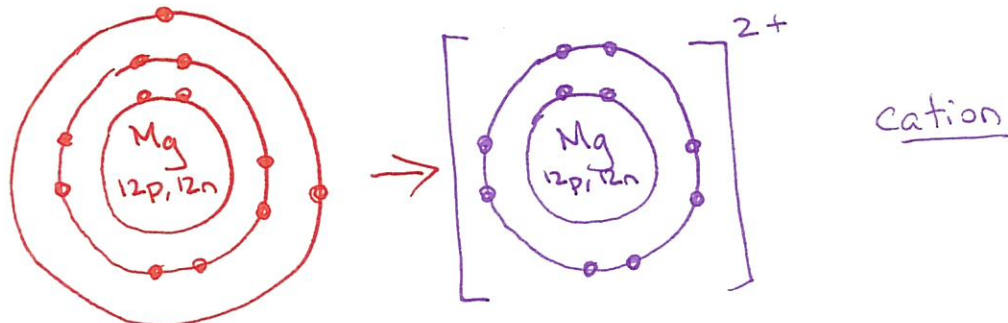
3. On the back of this page, draw the Bohr models of: a) oxygen atom and ion; b) magnesium atom and ion; c) nitrogen atom and ion; d) chlorine atom and ion. Identify them as cations or anions.

4. What is the relationship between the ion charge and the number of electrons gained or lost when forming the ion?

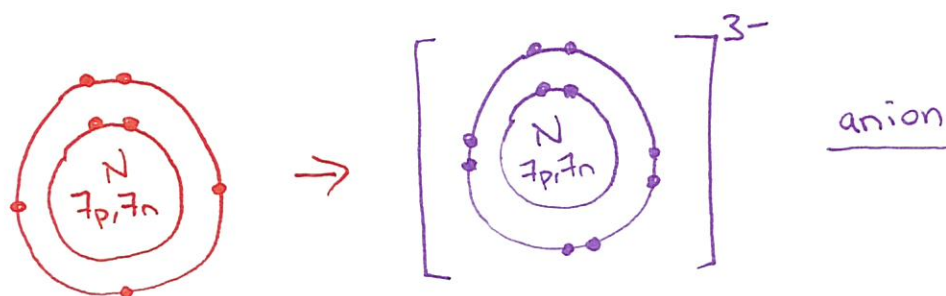
3a)



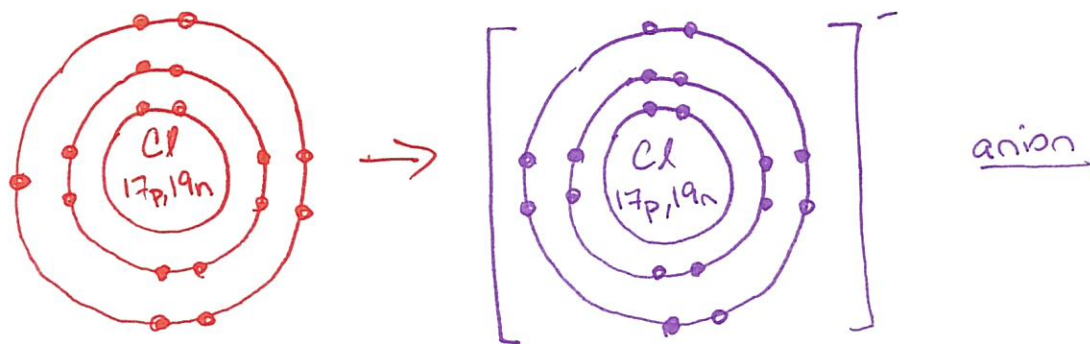
b)



c)



d)



4) • A negative ion charge means the atom has gained electrons to form the ion. A positive ion charge means the atom has lost electrons to form the ion.

• The numerical value of the ion charge tells you how many electrons have been gained or lost.

• E.g. O^{2-} : oxygen gained 2 electrons.

• E.g. Al^{3+} : aluminium lost 3 electrons.