

7.1 Isotopes & Ions

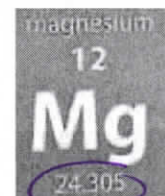
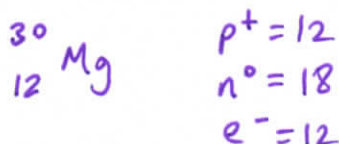
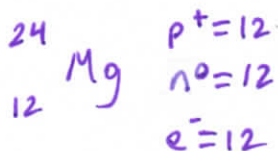
Learning Goals/Success Criteria: At the end of this lesson, I will be able to:

- Define isotopes, ions, octet rule
- Describe applications of isotopes
- Draw Bohr Rutherford diagrams for the first twenty ions

Isotopes - Changing the Atomic Mass

- Remember: There are 3 sub-atomic particles; nucleons protons, neutrons, and electrons.
 - Change the number of p^+ and you change the element.
 - Change the number of e^- and you create an ion.
 - What happens when you change the number of **neutrons**?
 - Sometimes atoms either gain or lose neutrons because their nucleus is unstable.
 - Since neutrons have no charge this does not affect the charge of the atom.
 - Neutrons have about the same mass as protons, so a change in the number of neutrons results in a change in the mass #.
 - Any time an atom has a different mass than is listed on the periodic table, we call it an isotope. This means it has gained or lost neutrons.

- Consider: Magnesium-24 and Magnesium-30
 - ← mass #
 - most common



average atomic mass

- These two atoms of Mg have the same number of electrons and protons, but a different number of neutrons.
- Which one is the isotope? Magnesium-30

Why are Isotopes Useful? Make jot-notes as you are watching the videos on the applications of isotopes. Isotopes and Half-Life: What are medical Isotopes? & Strontium: It Knows Where You've Been

Research

Ions - Charged Atoms

- The identity of an element is determined by the number of protons in its nucleus.
- Therefore, if we change the number of protons we change the element.
- HOWEVER, If we change the number of electrons we do not change the element, instead, we have simply changed the overall charge of the atom.
- Atoms can either gain or lose electrons.
- Any time an atom becomes charged, we call it an ion.
 - If an atom **gains** electrons, it becomes a negatively charged ion. (anion)
 - If an atom **loses** electrons, it becomes a positively charged ion. (cation) cations



How Many Electrons Gained or Lost?

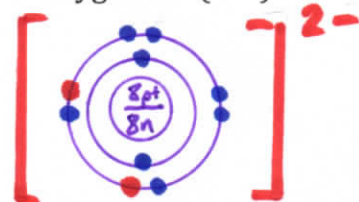
- Atoms can become stable with a full valence shell of electrons. (last or outer orbit)
- Therefore, atoms will gain or lose the fewest number electrons possible to achieve a full valence
 - Metals** tend to lose electrons to become positive ions (cations).
 - Non-metals** tend to gain electrons to become negative ions (anions).
- Example: Magnesium (Mg) is a metal with 2 valence electrons
 - To get a full outer shell it can either gain 6 electrons or lose 2 electrons.
 - Therefore, it is more likely to lose 2 electrons and form the positive ion. $\rightarrow \text{Mg}^{2+}$

Bohr Diagrams for Ions

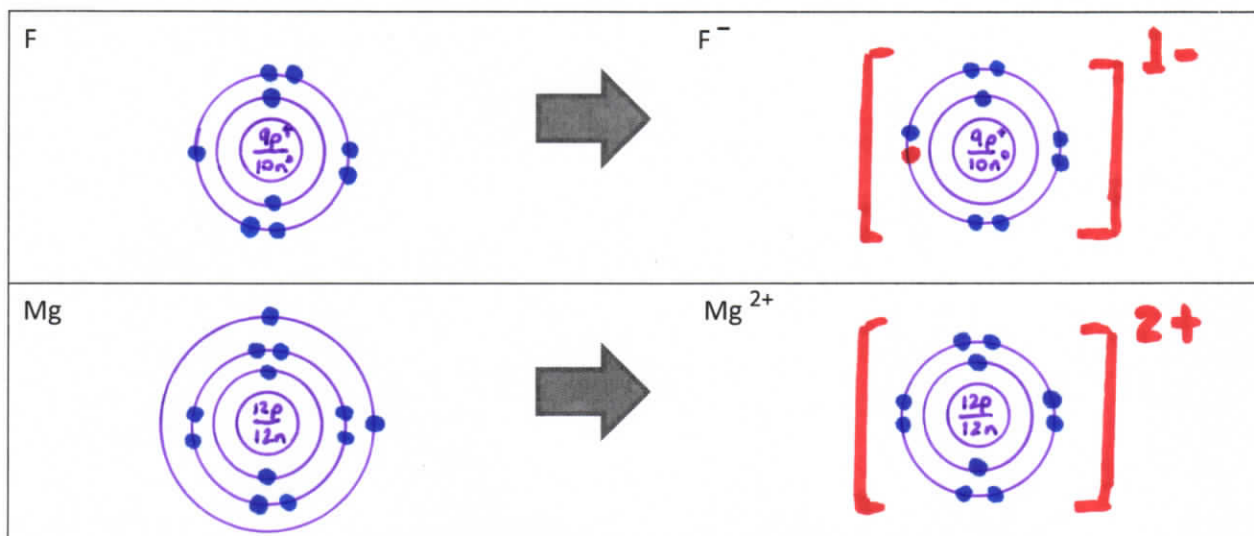
- Bohr diagrams for ions have two modifications:
 - place **square brackets** around the whole diagram
 - write the **charge** in the top right corner, outside the brackets

$$\begin{aligned} p^+ &= 8 \\ n^0 &= 8 \\ e^- &= 10 \end{aligned}$$

Oxygen Ion (O^{2-})



Practice: Draw Bohr-Rutherford diagrams for the following atoms and ions:



Practice: Use your periodic table to help complete the table's below:

Element	Number of protons	Number of electrons	Net charge	Ion? (Y/N)	Symbol
Neon	10	10	0	N	Ne
Aluminum	13	10	3+	Y	Al ³⁺
chlorine	17	18	1-	Y	Cl ⁻
Nitrogen	7	10	3-	Y	N ³⁻

Name of Element	Symbol	Atomic Number	Relative Atomic Mass	# p+	# n ⁰	# e ⁻	Net Charge	Ion? (Y/N)	Isotope? (Y/N)
Copper	⁶² / ₂₉ Cu ⁺	29	62	29	33	28	1+	Y	Y
Oxygen	¹⁵ / ₈ O	8	15	8	7	8	0	N	Y
Calcium	⁴¹ / ₂₀ Ca ²⁺	20	41	20	21	18	2+	Y	Y
Bromine	⁸⁰ / ₃₅ Br ⁻	35	80	35	45	36	1-	Y	N

Practice: Try drawing the Bohr diagrams for the following ions.

K ⁺	Be ²⁺	N²⁻ N ³⁻	H ⁺