

Ion Notes (2/19/19)

Bellringer (3 minutes)

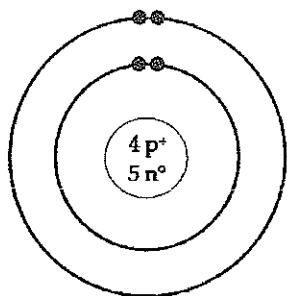
1. How many valence electrons do most atoms have when they are stable? 8

Previously, we have learned that atoms have the same number of protons and electrons, thus having a no charge. They are neutral (net zero charge). However, this isn't always the case. Many atoms will gain or lose electrons in order to have 8 valence electrons and be stable. This is known as the octet rule (exceptions are Beryllium, Hydrogen, Boron, and Aluminum).

When an atom gains or loses electrons, they become ions. Ions are formed in order to achieve stability.

Example:

Be

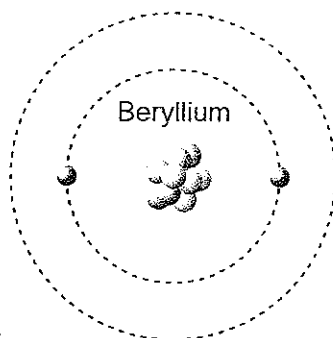


Beryllium

Neutral Atom: 4p, 5n, 4e

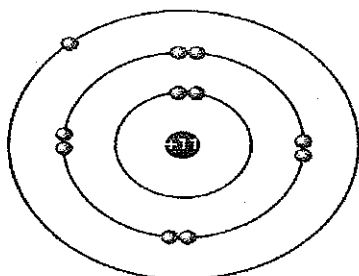
(loses 2 electrons = positive 2 charge)

Be<sup>2+</sup>



Cation: 4p, 5n, 2e

Na

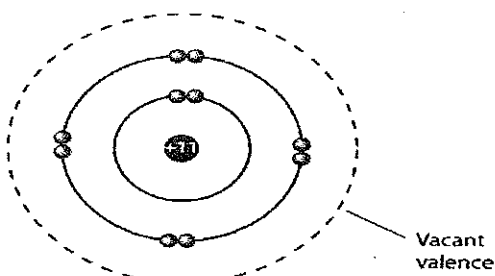


Na

11	protons
11	electrons
<hr/>	
0	net charge

© 2011 Pearson Education, Inc.

Na<sup>1+</sup> or Na<sup>+</sup>



Na<sup>1+</sup> (positive ion)

11	protons
10	electrons
<hr/>	
+1	net charge

Vacant  
valence  
shell

Cation: 11p, 12n, 10e (loses

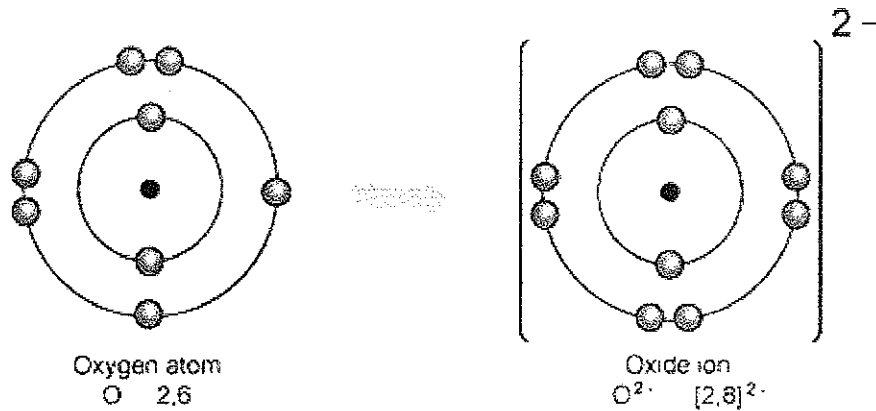
1 electron = positive 1 charge)

These examples are known as cations. A cation is when electrons are lost causing the ion to have a positive charge.

How do you think that negative ions are formed? Negative ions are formed when electrons are gained causing the ion to have a negative charge. They are known as anions.

O

O<sup>2-</sup>



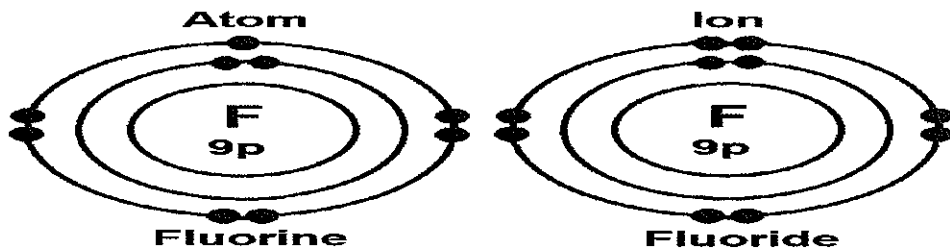
Neutral: 8p, 8n, 8e

Anion: 8p, 8n, 10e (Gains 2 electrons = negative charge)

Fluorine

F

F<sup>1-</sup> or F<sup>-</sup>



Neutral: 9p, 10n, 9e

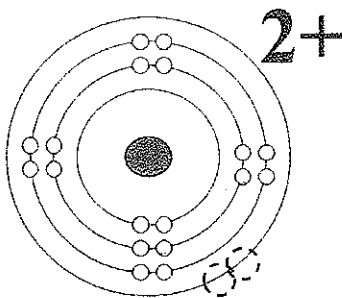
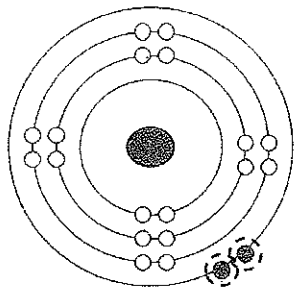
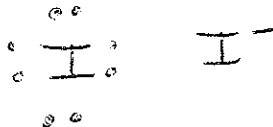
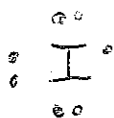
Anion: 9p, 10n, 10e (gained 1 electron = negative 1 charge)

Would there be a simpler way to determine becoming a cation or anion? Yes. We can use the Lewis Dot and draw only the valence electrons.

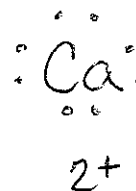
F



I



Ca:



**Calcium atom:**

**20 p<sup>+</sup>**

**20 e<sup>-</sup>**

**Ca**

**Calcium ion:**

**20 p<sup>+</sup>**

**18 e<sup>-</sup>**

**Ca<sup>2+</sup>**

Metals typically form cations because it would take more energy to gain the 5 to 7 electrons needed to fill their shell, therefore it is easier to lose the electrons to reach the Noble gas configuration.

Nonmetals typically form anions because it doesn't require much energy to gain the 1 to 3 electrons needed to fill their shell.

Groups 1, 2, and 3 = cations

Group 4 = can go either way

Groups 5, 6, and 7 = anions

Group 8 = noble gases; 8 electrons (exception He); stable

The octet rule can help predict reactivity. If we know the electron configuration, then we can predict how many electrons it must gain/lose to achieve noble-gas configuration and therefore its reactivity.

Roman Numerals written after an element will tell you what? The charge

Atomic radius tends to increase when it is an anion, because the new electron and the already present electrons repel and the shell increases. Atomic radius of a cation is smaller because it loses a shell.

Ionic Bonds – example here is Sodium and Chloride (salt)

