

4.5.1: Ions - Differences in Electrons

Learning Objectives

- Distinguish the difference between the two types of ions.
- Describe ion formation using electron configurations.
- Predict ionic charge.

Ions

As seen in prior sections, atoms contain a nucleus with neutrons and positively charged protons, surrounded by negatively charged electrons. In an atom, the total number of electrons, negative charge, *equals* the total number of protons, positive charge, and therefore, atoms are electrically neutral or uncharged. If an atom loses or gains electrons, it will become a positively or negatively charged particle, called an **ion**. The *loss* of one or more electrons results in more protons than electrons and an overall positively charged ion, called a **cation**. For example, a sodium atom with one less electron is a cation, Na^+ , with a +1 charge (Figure 4.5.1.1).

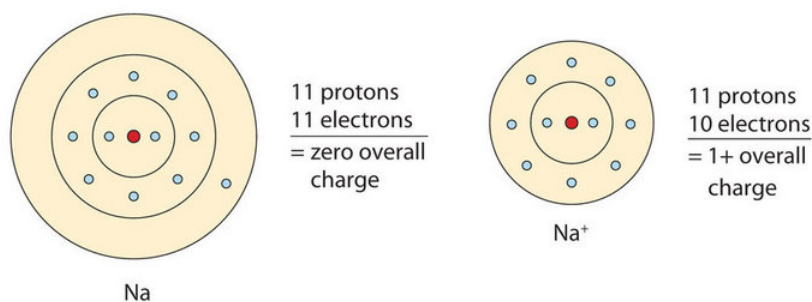


Figure 4.5.1.1: On the left, a sodium atom has 11 electrons. On the right, the sodium ion only has 10 electrons and a 1+ charge.

When an atom *gains* one or more electrons, it becomes a negatively charged **anion**, because there are more electrons than protons. When chlorine gains one electron it forms a chloride ion, Cl^- , with a -1 charge (Figures 4.5.1.2)

The names for positive and negative ions are pronounced CAT-eye-ons (cations) and ANN-eye-ons (anions), respectively.

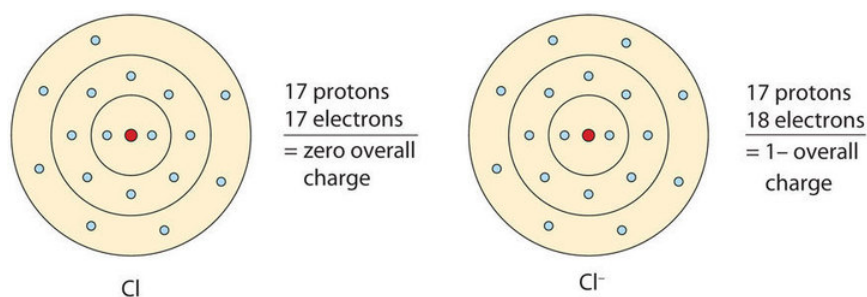


Figure 4.5.1.2: The Formation of a Chlorine Ion. On the left, the chlorine atom has 17 electrons. On the right, the chloride ion has 18 electrons and has a 1- charge.

Key Takeaways

- Ions can be positively charged or negatively charged.
- Ionic charge relates to valence electrons and valence shells.

Exercises

1. What are the two types of ions?
2. When the following atoms become ions, what charges do they acquire?
 - a. Li
 - b. S

- c. Ca
- d. F

4. Identify each as a cation, an anion, or neither.

- a. H^+
- b. Cl^-
- c. O_2
- d. Ba^{2+}
- e. CH_4
- f. CS_2

5. Identify each as a cation, an anion, or neither.

- a. NH_3
- b. Br^-
- c. H^-
- d. Hg^{2+}
- e. CCl_4
- f. SO_3

Answers

1. Cations (positive charged) and anions (negative charged)

- 2.
 - a. 1+
 - b. 2-
 - c. 2+
 - d. 1-

4.

- a. cation
- b. anion
- c. neither
- d. cation
- e. neither
- f. neither

5.

- a. neither
- b. anion
- c. anion
- d. cation
- e. neither
- f. neither

Contributors

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