

LESSON | What are oxidation 7 | numbers?

Atoms of metals link up with atoms of nonmetals. They form compounds. When a compound forms, the metal lends outer-ring electrons to the nonmetal. The nonmetal borrows the electrons.

How many electrons does an atom lend or borrow? It depends upon the atom. It also depends upon the compound being formed. Some atoms give up or take on more electrons than others. The number of electrons an atom can lend or borrow is called its **oxidation number**.

An oxidation number is a number with a plus (+) or minus (-) sign in front of it. The oxidation number is written next to the atom it describes, such as Al^{+3} , Mg^{+2} , Br^{-1} , and Se^{-2} .

The sign (+ or -) tells us whether the atom lends or borrows electrons.

- A plus (+) sign means that the atom lends electrons.
- A minus (-) sign means that the atom borrows electrons.

The number tells us how many electrons the atom lends or borrows.

Let's look at two oxidation numbers.

- Sodium has a oxidation number of +1 (Na^{+1}). This means that sodium can lend one electron.
- The oxidation number of oxygen is -2 (O^{-2}). Oxygen can borrow two electrons.

Metals have plus oxidation numbers. Metals lend electrons.

Nonmetals have minus oxidation numbers. Nonmetals borrow electrons.

A nonmetal will borrow enough electrons to complete its outer shell.

Many elements have more than one oxidation number. In fact, some elements have both plus and minus oxidation numbers. Sometimes they lend electrons. Sometimes they borrow electrons.

USING THE PERIODIC TABLE TO FIND OXIDATION NUMBERS

You can find the oxidation numbers of many elements by looking at the periodic table.

FINDING THE OXIDATION NUMBER OF A METAL

This is the simplest oxidation number to find. In many cases, the oxidation number of a metal is the same as the number of electrons in its outer shell.

A metal lends (loses) electrons. Therefore, its oxidation number is plus (+).

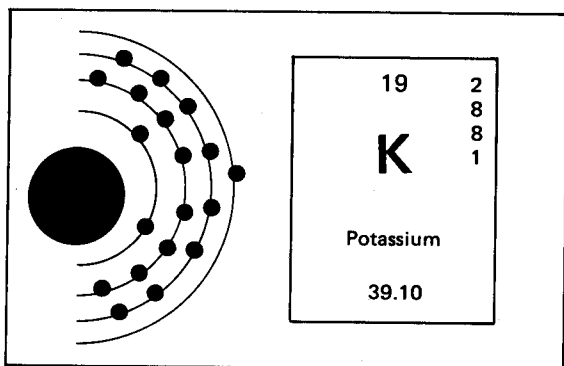


Figure A shows an example.

Potassium has 1 outer-shell electron.

Potassium lends this single electron.

The oxidation number of potassium is +1 (K^{+1}).

Figure A

FINDING THE OXIDATION NUMBER OF A NONMETAL

This is simple too. Here is what to do:

- Check the number of electrons in the outer shell.
- Figure out how many electrons that atom needs to make a stable outer shell (in most cases, 8 electrons). That number is the oxidation number.

A nonmetal will add, or borrow, these electrons. Therefore, its oxidation number is minus (-).

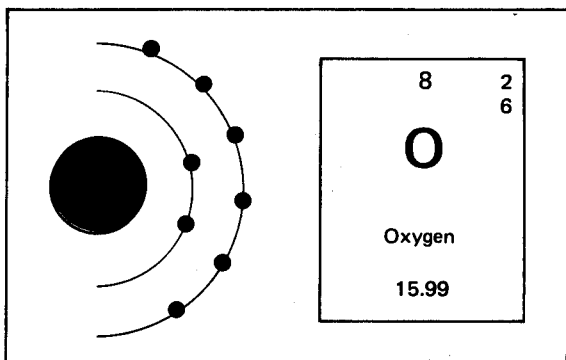


Figure B shows an example.

Oxygen has 6 outer-shell electrons.

Oxygen needs 2 more electrons to make its outer shell stable ($8 - 6 = 2$).

Oxygen will borrow (gain) these 2 electrons.

The oxidation number of oxygen is -2 (O^{-2}).

Figure B