

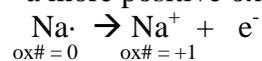
## OXIDATION AND REDUCTION

### Oxidation is (with examples):

- a loss of electrons (OIL)



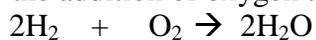
- a more positive oxidation number



- a loss of hydrogen atoms (see carbon or oxygen)



- the addition of oxygen atoms (see oxygen)

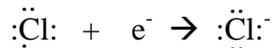


- more bonds to oxygen (see carbon)

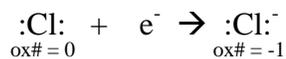


### Reduction is (with examples):

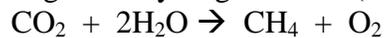
- a gain of electrons (RIG)



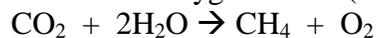
- a less positive oxidation number  
(*more negative*)



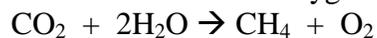
- a gain of hydrogen atoms (see carbon)



- the loss of oxygen atoms (see carbon)



- the loss of bonds to oxygen (see carbon)



## HOW TO DETERMINE OXIDATION NUMBERS

The determination of the oxidation number (or oxidation state) of chemical compounds can be made by following a few simple rules.

1. The oxidation numbers of an atom (an element, e.g., Fe) or the atoms in a neutral molecule must add up to zero.
2. If an atom (Cl<sup>-</sup>) or molecule is ionic its oxidation number must add up to its overall charge. Cl<sup>-</sup> = -1
3. Alkali metal atoms (Group I) have an oxidation number equal to +1 within compounds. Alkali earth atoms (Group II) have an oxidation number of +2 within compounds.
4. All halogens in compounds have a -1 oxidation number.
5. Hydrogen is always assigned a +1 oxidation number in compounds.
6. Oxygen is assigned an oxidation number of -2 in compounds.

Examples:

What is the oxidation numbers for all the atoms in CH<sub>3</sub>OH

A) Using *Rules 5 and 6* hydrogen is +1 and oxygen is -2.

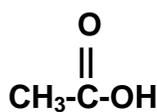
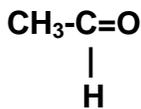
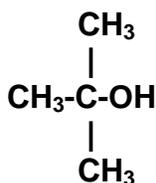
B) Using *Rule 1*: 4H = +4 and 1O = -2; therefore C must be -2 because all the oxidation numbers must add to zero:

$$4\text{H} + 1\text{O} + 1\text{C}$$
$$(+4) + (-2) + (-2) = 0$$

Oxidation numbers for carbon atoms can also be determined as follows:

- (a) **Carbon oxidation numbers: each C-C = 0, C-H = -1 and each C-O = +1**  
(b) **Add them up to determine the oxidation number of the carbon atom.**

**What are the oxidation numbers for the carbons in the following compounds?**



**Try these:**

