Cycle 7 Chemistry 2 Lesson 2

AGENDA – Calculating Oxidation Numbers

Lab day is THURSDAY

Warmup: Some bacteria can convert sulfur (S_8) into sulfide (S^{-2}). Is the sulfur oxidized or reduced in this reaction? Why?

Classwork: (ONLEVEL) p. 607 #1 (a-h)
(HONORS) Oxidation Number WS

HONORS: Oxidation numbers in NH_4NO_3 (hint – this is an ionic cmpd of NH_4^+ and NO_3^-)

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Oxidation Numbers

- To identify whether atoms are oxidized or reduced, chemists use a model of **oxidation numbers,** which can help them identify differences in an atom of an element in different compounds.
  - The **oxidation number** is the number of electrons that must be added to or removed from an atom in a combined state to convert the atom into the elemental form.
  - By following the set of rules, you can assign an oxidation number to each atom in a molecule or in an ion.

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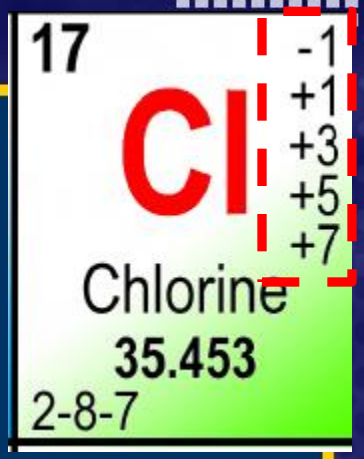

How to assign oxidation numbers!

Your PT gives most of the common oxidation states of elements in the upper-right corner!

1) Any uncombined element has oxidation number 0!

2) The sum of the oxidation numbers in a neutral compound must be ZERO! The sum of the oxidation numbers in an ion must equal the CHARGE!

3) Metals in compounds: positive ox #. Group I metals always +1, Group II is +2.

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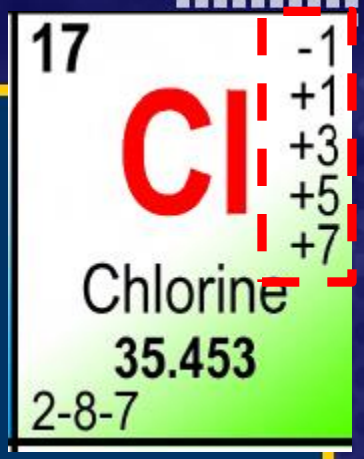

How to assign oxidation numbers!

4) Oxygen usually has oxidation number of -2.
Exception: peroxides where it is -1.

5) Hydrogen usually has oxidation number of +1.
Exception: -1 in binary compound with metal.

6) Halogen usually has oxidation number of -1.
Exception: when combined with oxygen or other halogen.

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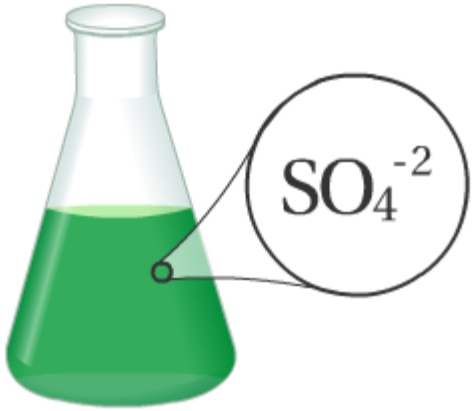
Rules for Assigning Oxidation Numbers



Sulfate ion, SO_4^{-2}

Oxidation number of oxygen: –2

Oxidation number of sulfur: +6

$-2 = 6 + (4 \times (-2))$

Replay

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Determining Oxidation Numbers

Sample Problem A

Assign oxidation numbers to the sulfur and oxygen atoms in the pyrosulfate ion, $S_2O_7^{2-}$.

Determining Oxidation Numbers

Sample Problem A Solution

The oxidation number of the O atoms is −2.

Because the oxidation number of the sulfur atoms is unknown, *x* is written above the S symbol.

$$\overset{x}{S_2}\ \overset{-2}{O_7^{2-}}$$

The S atoms contribute 2*x* to the total oxidation number.

The O atoms contribute 7(−2) = −14 to the total oxidation number.

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Determining Oxidation Numbers

Sample Problem A Solution

To come up with the correct total charge,

$$2x + (-14) = -2$$

$$x = +6$$

The oxidation number of the S atoms is +6.
The oxidation number of the O atoms is −2.

The sum of the total oxidation numbers for each element is 2(+6) + 7(−2) = −2, which is the charge on the ion.

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p. 607 a-h HINTS

e) H_2 is not a compound of hydrogen

f) $PbSO_4$ contains SO_4^{-2} ion (“Sulfate”!)

g) $KClO_3$ contains ClO_3^- ion (“Chlorate”!)

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