10/12/2018

Ex: We have 7.500 mL of $Sr(OH)_2(aq)$ of unknown conc.

It takes 13.82 mL of 0.250 M $HCl(aq)$ to fully neutralize.

Q: What is $[Sr(OH)_2]$ ?

Plan: ① $[Sr(OH)_2] = \frac{\#\text{mol } Sr(OH)_2}{\#\text{L } Sr(OH)_2}$ ??

$7.500\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = 0.007500\text{L}$

② Write the balanced chem eq:

$$Sr(OH)_2(aq) + 2HCl(aq) \longrightarrow 2H_2O(l) + SrCl_2(aq)$$

$Sr^{2+}$ $OH^-$ $OH^-$ $H^+$ $Cl^-$

$$Sr(OH)_2 + 2HCl \longrightarrow 2H_2O + SrCl_2$$

? mol $Sr(OH)_2$ ← coeff. ? mol HCl

↑ molar conc HCl (0.250 M)

vol HCl

$$13.82\text{mL HCl} \times \frac{1\text{L}}{1000\text{mL}} \times \frac{0.250\text{mol HCl}}{1\text{L}} \times \frac{1\text{mol } Sr(OH)_2}{2\text{mol HCl}} = 1.7275 \times 10^{-3} \text{ mol } Sr(OH)_2$$

$$[Sr(OH)_2] = \frac{\#\text{mol } Sr(OH)_2}{\#\text{L } Sr(OH)_2} = \frac{1.7275 \times 10^{-3}\text{mol}}{0.007500\text{L}}$$

$$= 0.230\text{ M}$$

# Oxidation-Reduction rxns (Redox)

- involve $e^-$ transfer
  - important for battery tech.
  - rust prevention.
  - aging
- often involve $O_2$ ... but not always

ex: $2Na + Cl_2 \longrightarrow 2NaCl$

($2Na + Cl_2$: atoms/molecules; $2NaCl$: ionic)

can think of this as occuring via two half-rxns:

$$2Na \longrightarrow 2Na^+ + 2e^-$$
$$2e^- + Cl_2 \longrightarrow 2Cl^-$$

$2Na^+ + 2Cl^- = 2NaCl$

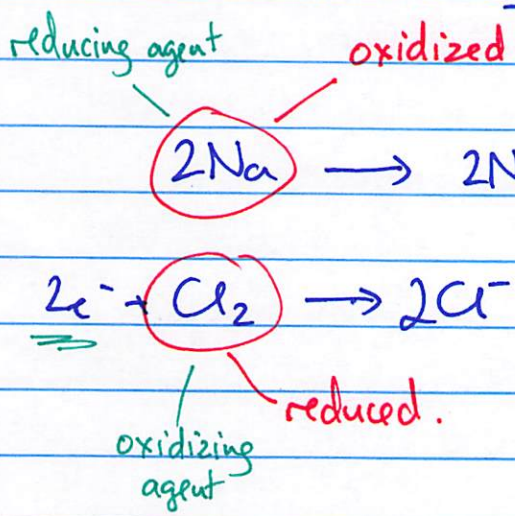
Na loses $e^-$s, $Cl_2$ gains $e^-$s } we say { Na was oxidized, $Cl_2$ was reduced

Mnemonic: OIL-RIG : oxidation is loss
reduction is gain

LEO goes GER : loss of electrons is oxidation
gain of electrons is reduction.

We can think of the $Cl_2$ as "taking" $e^-$s from Na.
⇒ $Cl_2$ is "causing" the Na to be oxidized
⇒ $Cl_2$ is the oxidizing agent.

We can say the Na "gave" e⁻s to $Cl_2$
- caused Cl to be reduced.
- Na is the reducing agent.




## Oxidation State (oxidation #s)

- a 'hypothetical' charge given to each atom in a substance
  - writen as ±# (ex: -1, +2, -3, +7, ...)

charge: #±  ex: 3+, 2−, 7+
ox #:  +3, −2, +7

- If the atom loses e⁻s, then the ox. state is increased.
  (oxidized)
- If the atom gains e⁻s, then the ox. state is reduced.
  (reduced)

Simple set of rules used to assign ox. states:

1. Ox state of atom in element = 0 $\overset{0}{Cu}$, $\overset{0}{O_2}$, $\overset{0}{P_4}$

2. Ox. state of atom in monatomic ion = charge $\overset{+1}{Na^+}$, $\overset{-2}{O^{2-}}$, $\overset{+3}{Al^{3+}}$

3. Sum of all ox. states for all atoms = charge

$\overset{x}{H}_2\overset{y}{O}$ , $\overset{x}{N}\overset{y}{O_3^-}$

$2x + y = 0$ $\quad$ $x + 3y = -1$

4. In cpds, metals always have +ve ox. state

gp IA: +1
2A: +2
(in general, ox state = charge)

$\overset{+1}{NaCl}$ $\quad$ $\overset{+2}{CaF_2}$

~~$NaCl_2$~~