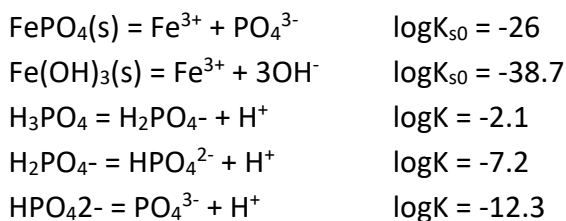


Precipitation and dissolution, redox

1) Iron precipitation

A wastewater contains 10^{-4} M phosphate. Fe(III) is added to the system to precipitate phosphate. Is $\text{FePO}_4(\text{s})$ or $\text{Fe}(\text{OH})_3(\text{s})$ precipitated at $\text{pH}=7$?



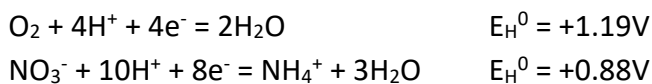
2) Oxidation numbers

Assign the oxidation numbers to each atom in the following compounds:

NO_3^- , N_2O , SCN^- , SO_3^{2-} , SO_4^{2-} , CH_4 , CO_2 , CH_3OH , C_6H_6 , $\text{C}_6\text{H}_5\text{OH}$

3) Reduction potentials

Derive the overall reaction and the direction of the reaction from the following half reactions:



a) Calculate the ΔE^0 for the overall redox reaction.

b) The E_{H}^0 values are given for $\text{pH} = 0$. Calculate the standard reduction potentials at $\text{pH}=7$. What is $\Delta E^0(\text{W})$ for the overall reaction at $\text{pH} 7$?

c) What is the Gibbs free energy of this process at $\text{pH} 7$? Is this reaction thermodynamically feasible?

d) What is this process called? Where does this process occur and what effects does it have on the environment?

4) pe-pH diagram for As

Construct the pe-pH diagram for the following As species:

As species	Reaction	$\log(K)$
As(5)	$\text{H}_2\text{AsO}_4^- = \text{HAsO}_4^{2-} + \text{H}^+$	-6.76
As(3)	$\text{H}_3\text{AsO}_3 = \text{H}_2\text{AsO}_3^- + \text{H}^+$	-9.23
As(5)/As(3)	$\text{H}_3\text{AsO}_3 + \text{H}_2\text{O} = \text{H}_2\text{AsO}_4^- + 3\text{H}^+ + 2\text{e}^-$	-21.14

