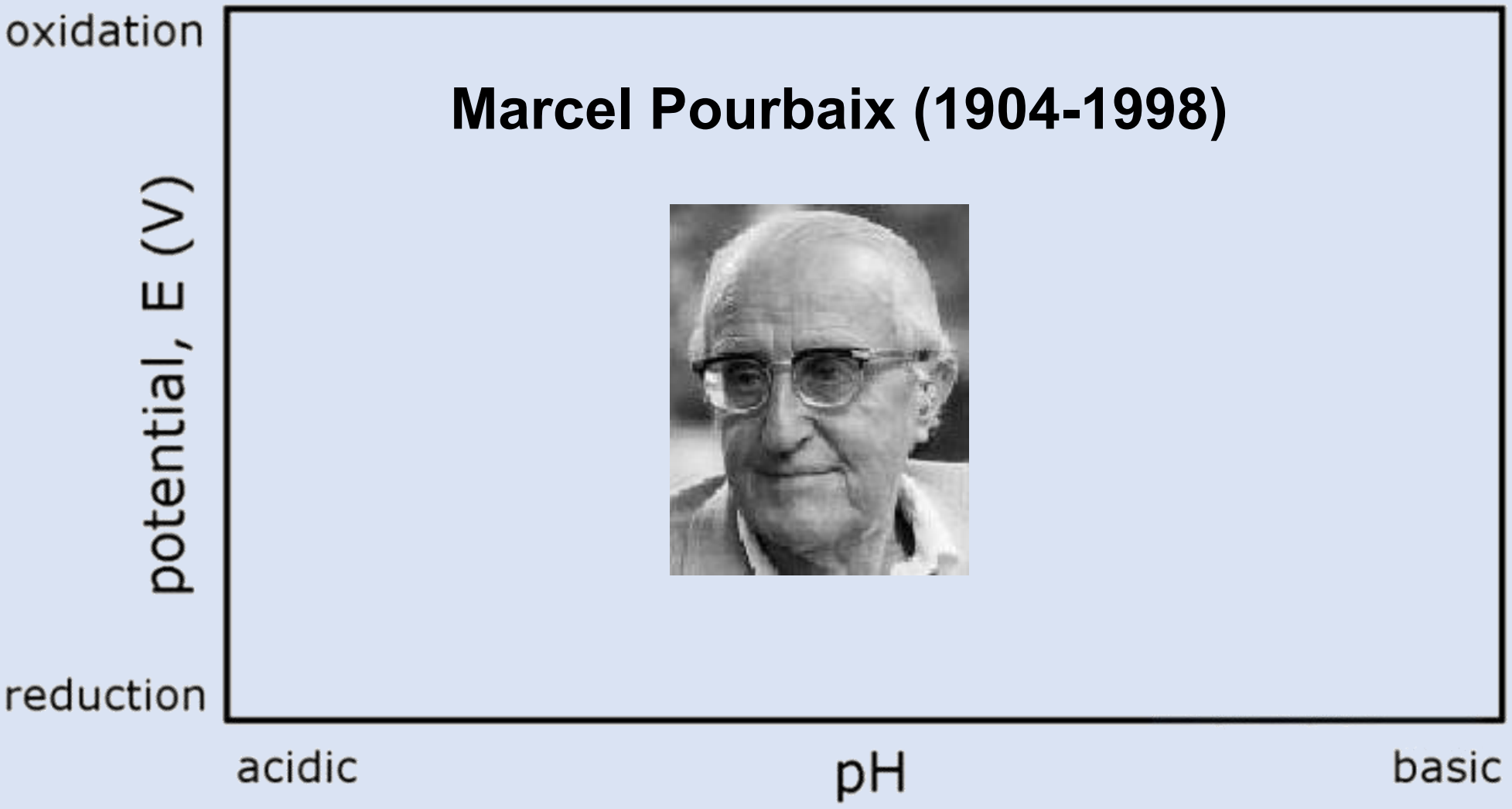
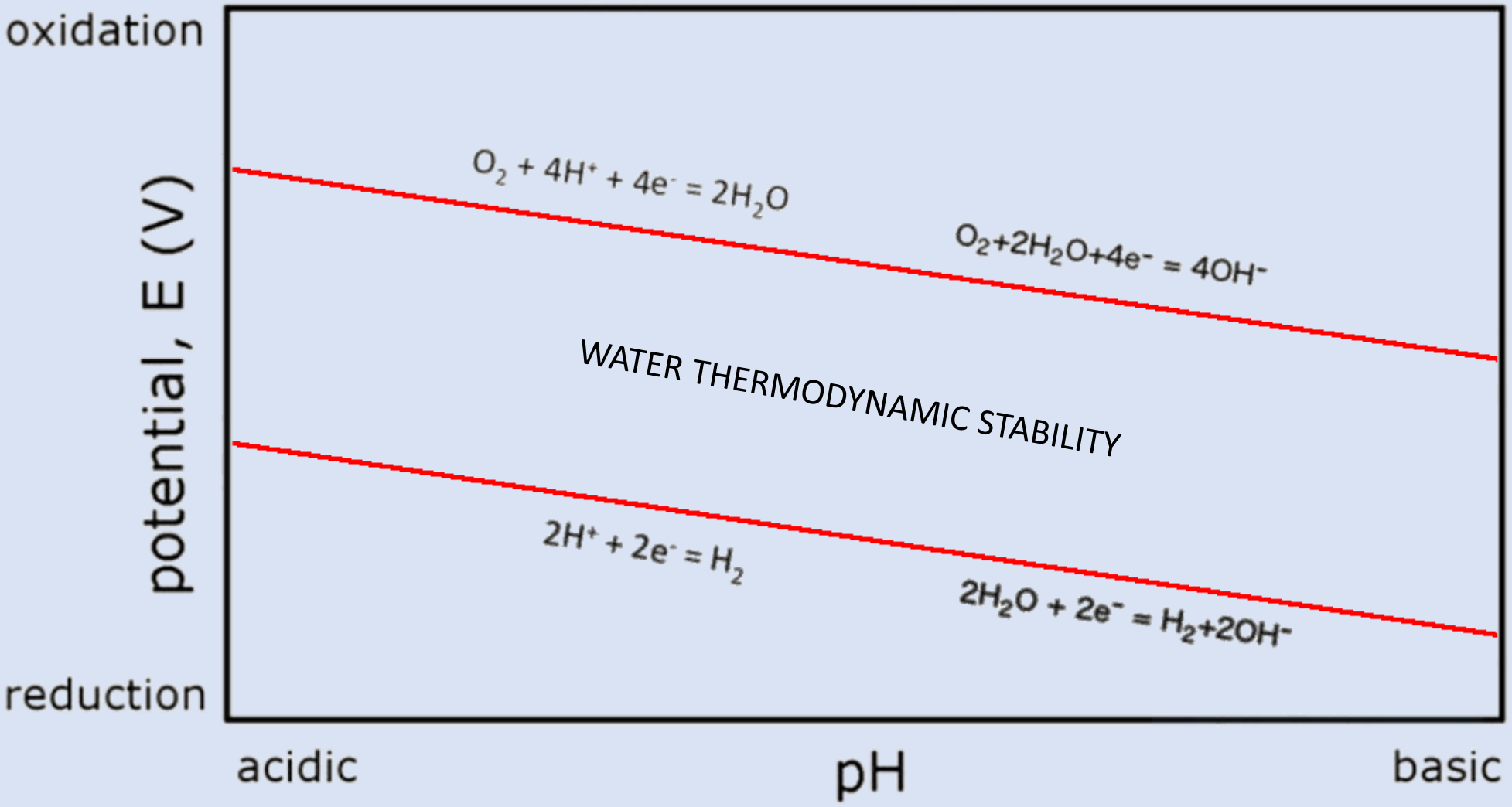
Pourbaix diagram

E_H-pH diagrams (1938)



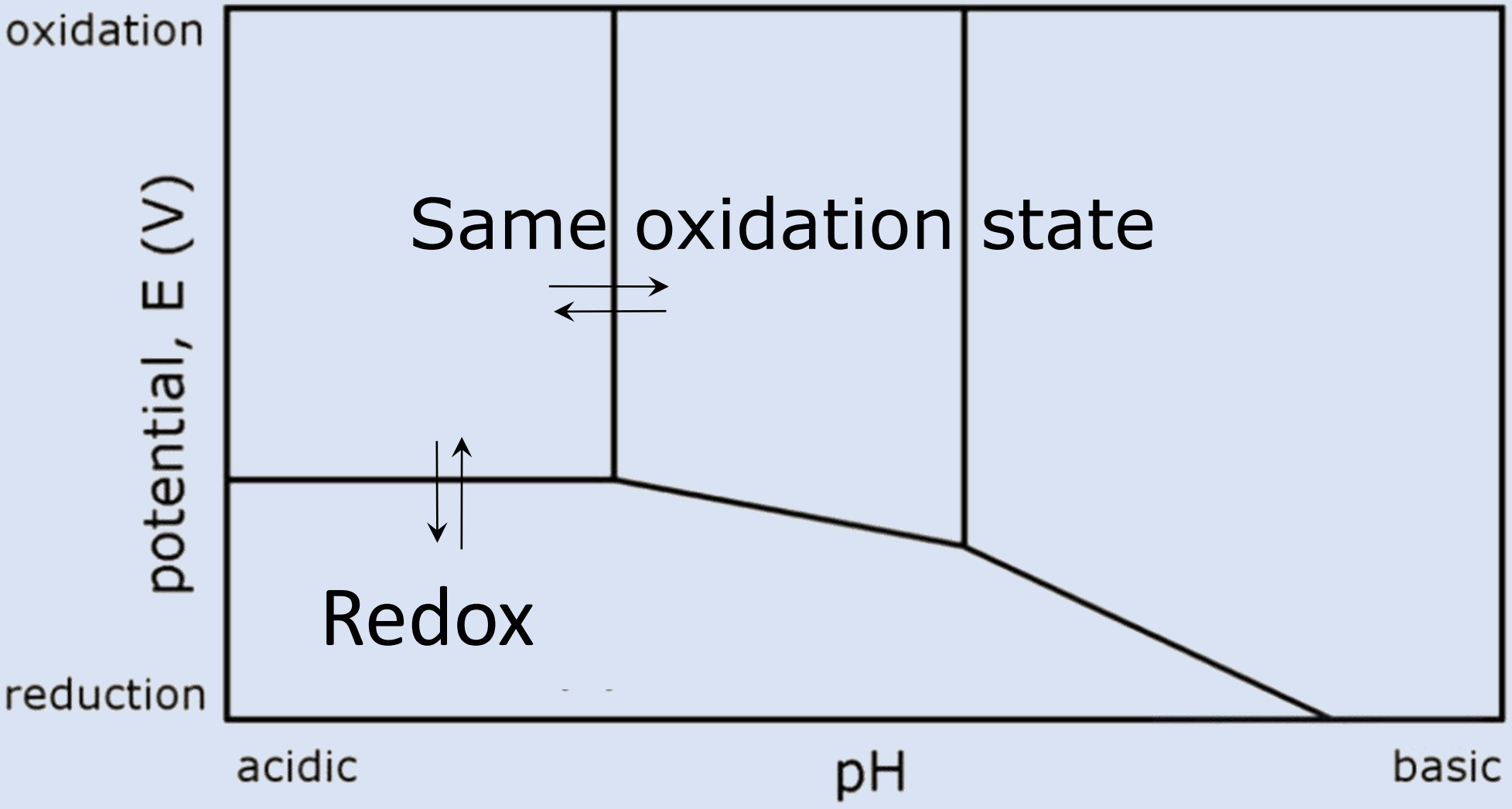
Pourbaix diagram

E_H-pH diagrams (1938)



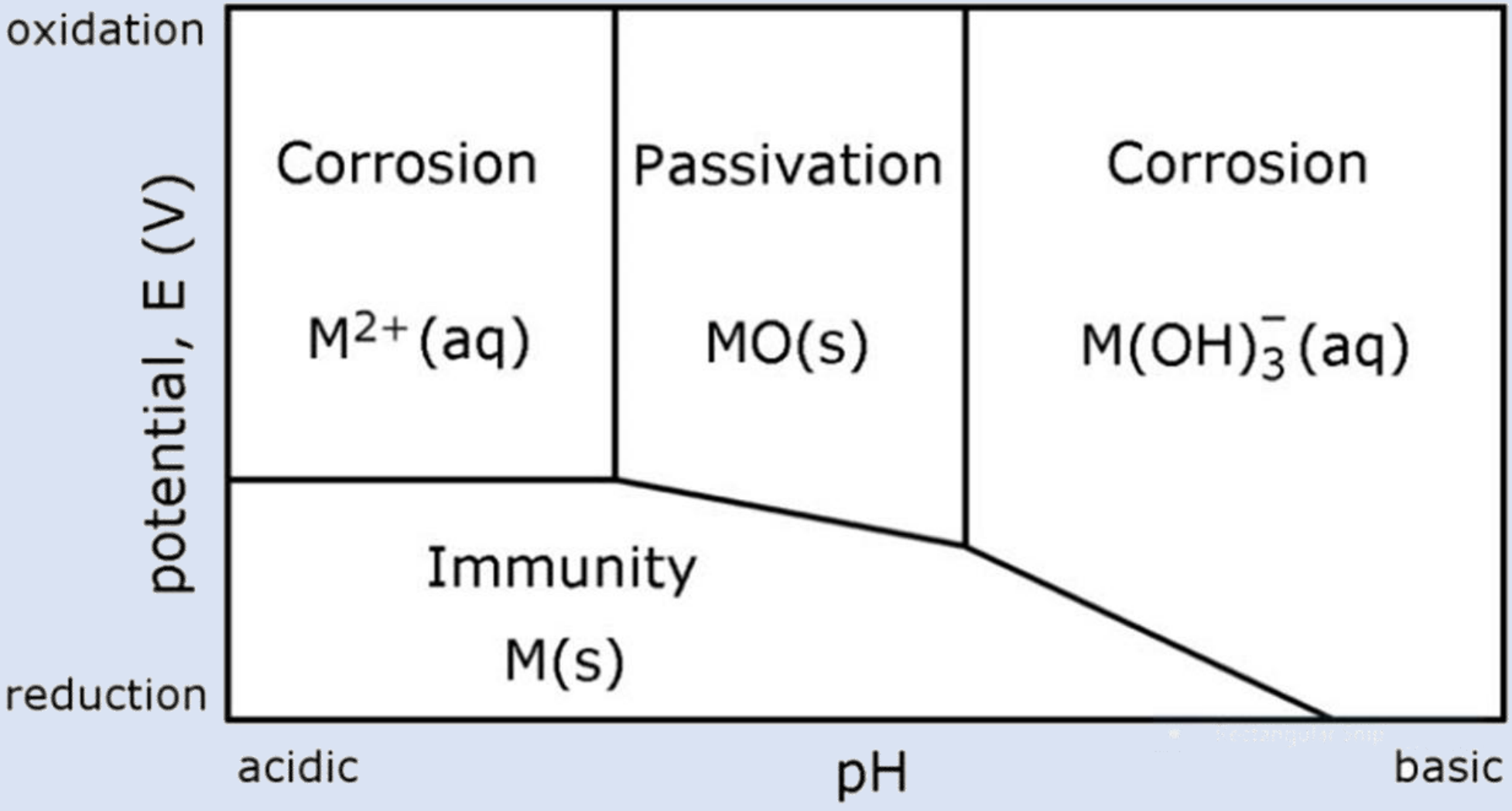
Pourbaix diagram

E_H-pH diagrams (1938)



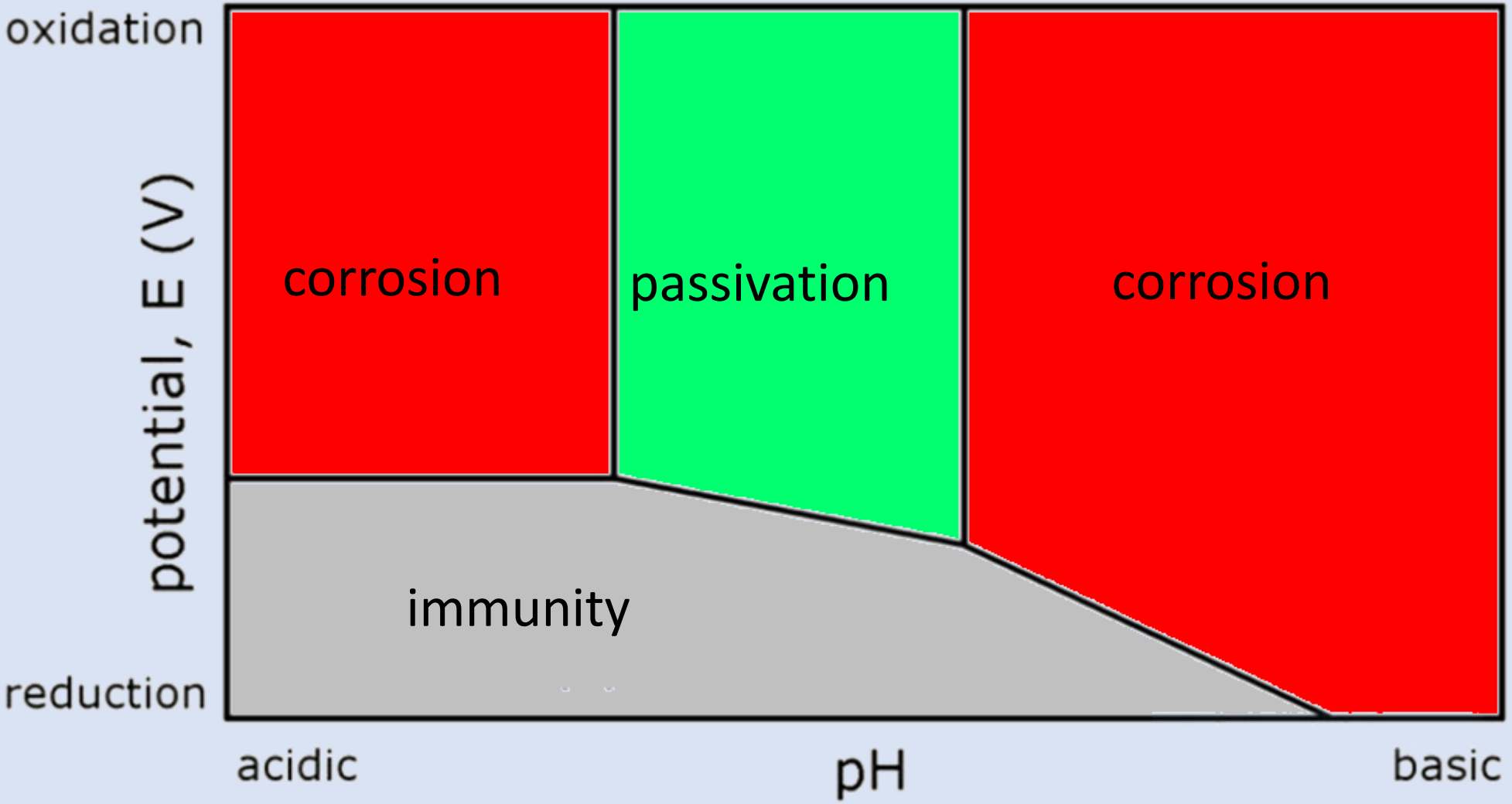
Pourbaix diagram

E_H-pH diagrams (1938)

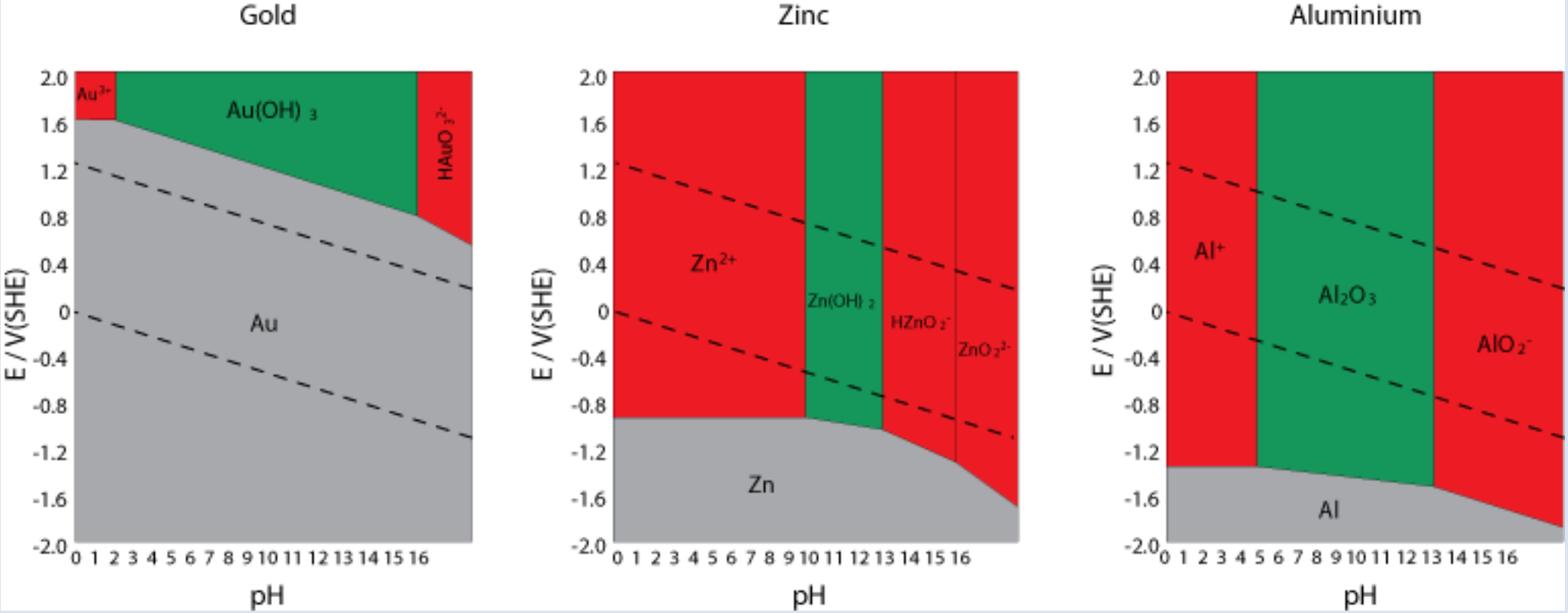


Pourbaix diagram

E_H-pH diagrams (1938)



Pourbaix diagram



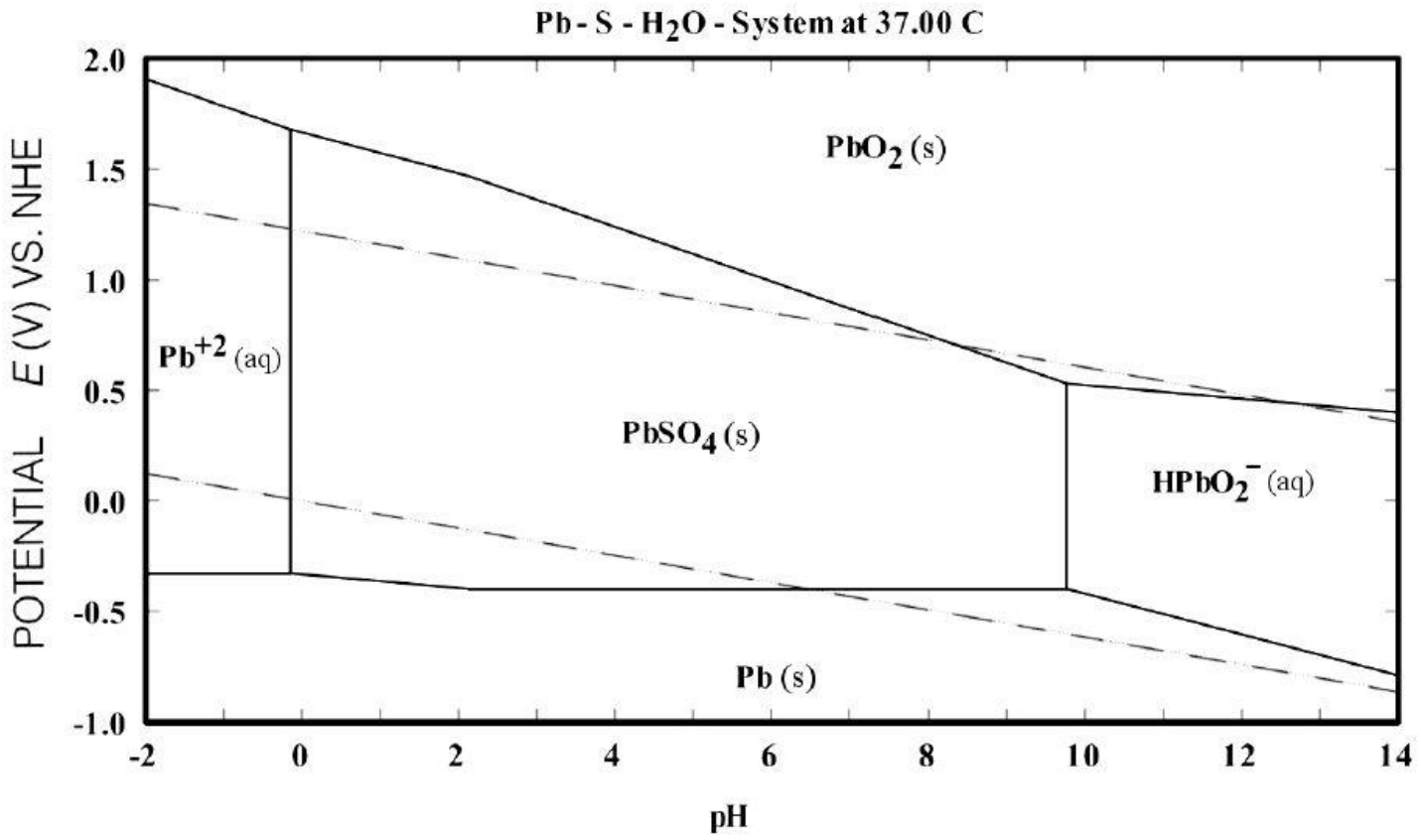
Source: https://www.doitpoms.ac.uk/tlplib/pourbaix/printall.php

Pourbaix diagram

Lead acid Planté in 1859.

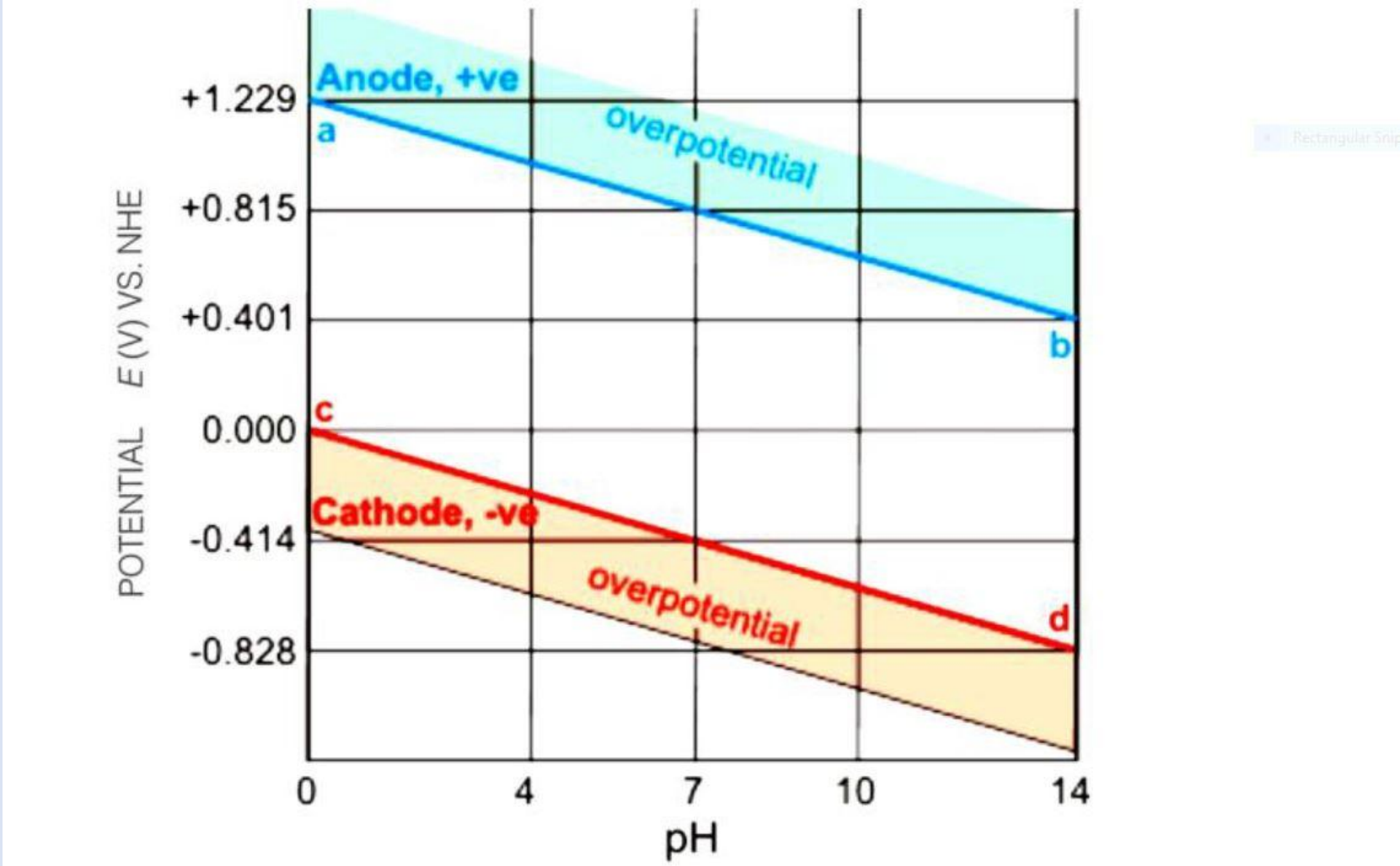
Charged cell: $Pb(s) \mid H_2SO_4(aq) \mid PbO_2(s)$ FEM° = 1.33 V

Discharged cell: $PbSO_4(s) \mid H_2SO_4(aq) \mid PbSO_4(s)$ FEM° = 0.00 V



Pourbaix diagram

E_H-pH diagrams (1938)



Overpotential (η) for the oxidation or reduction reaction of water.

Pourbaix diagram

Some metals used in electrochemistry

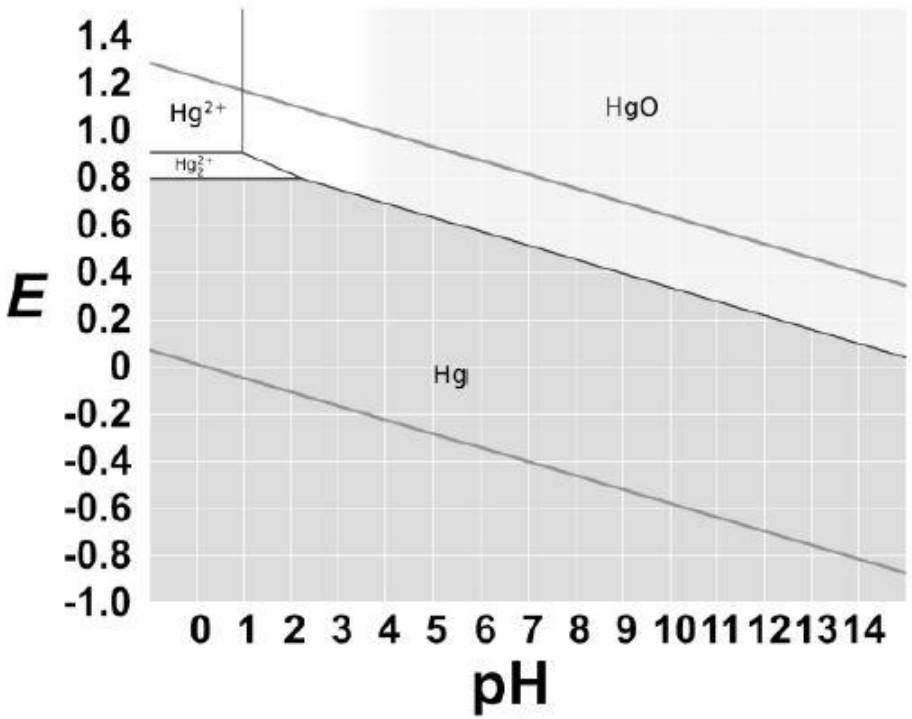


Figure 7. Mercury

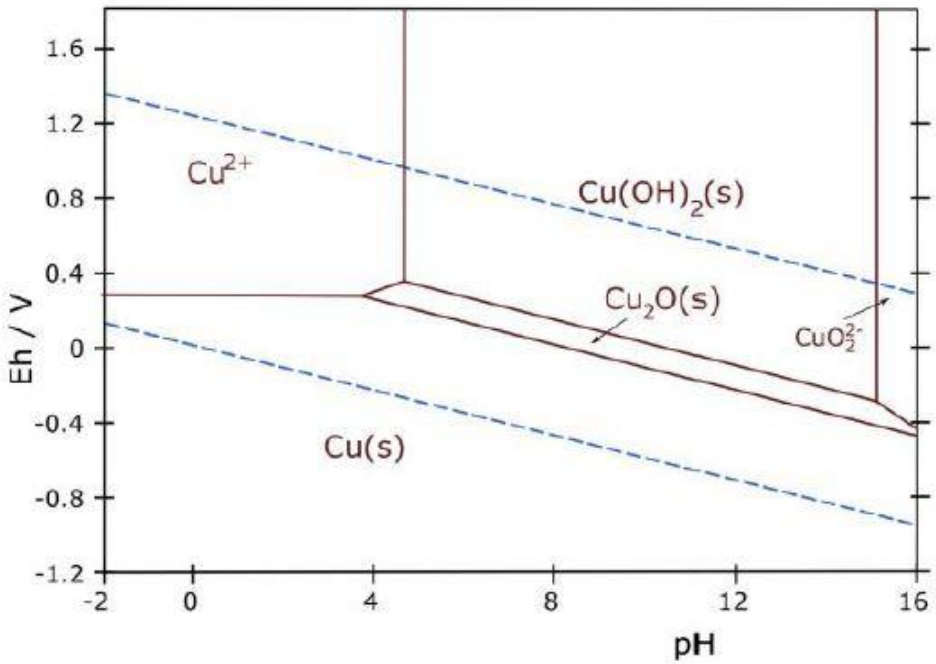


Figure 8. Copper

In reduction, the mercury electrode is an excellent material for metal analysis. Copper is also an interesting choice in reduction, however, it forms alloys with several metals (Zn, Ni, Fe, Al, Sn, etc.).

Pourbaix diagram

Electroanalytical stable electrode material

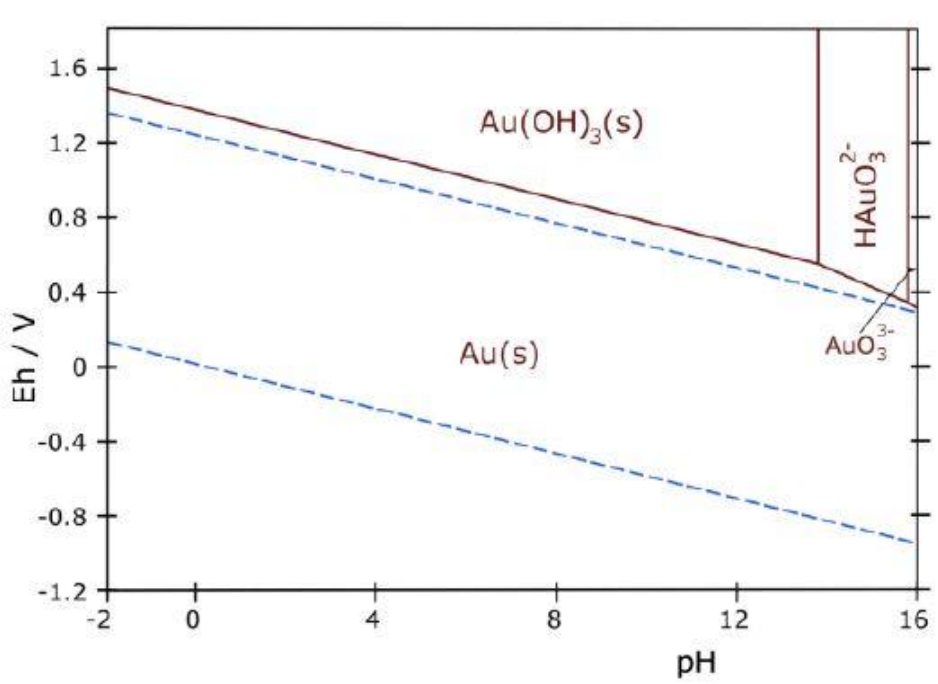


Figure 5. Gold

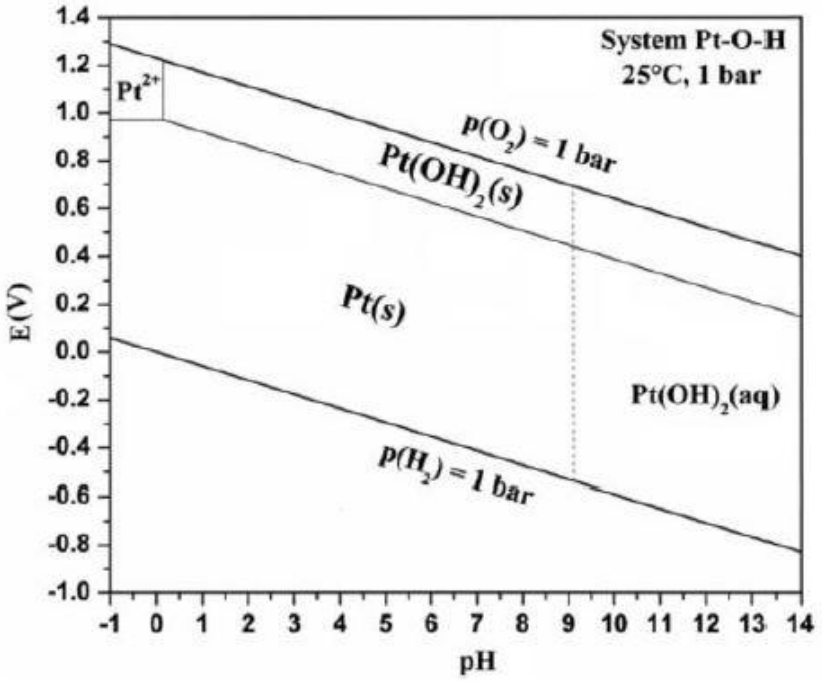


Figure 6. Platinum

The gold and platinum metals are the best materials to use as electrodes in electroanalytical chemistry.

Pourbaix diagram

Amphoteric metals

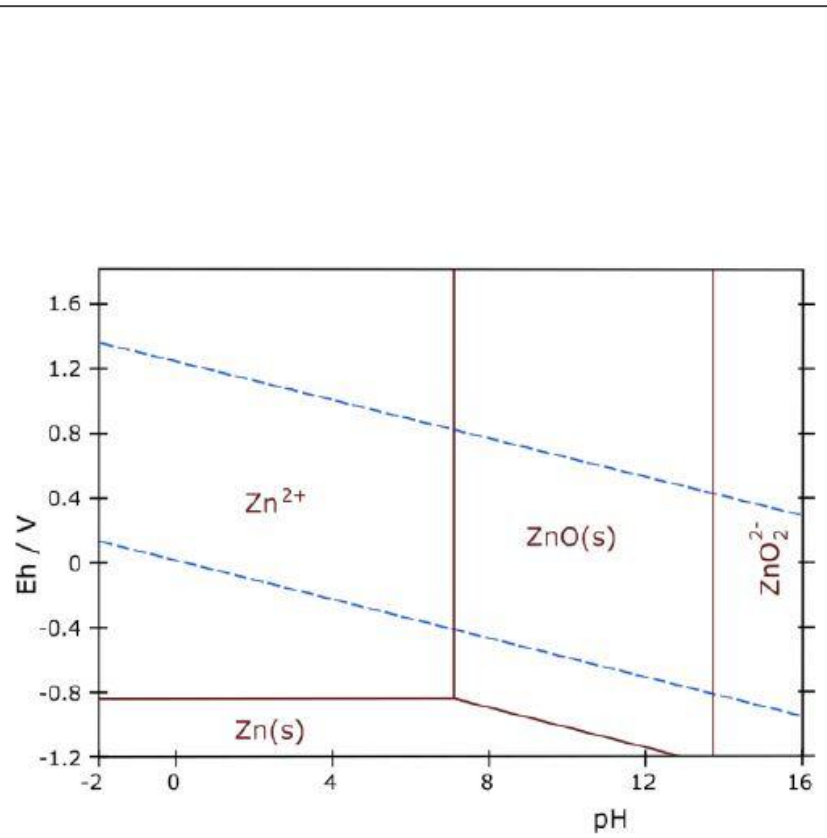


Figure 9. Zinc

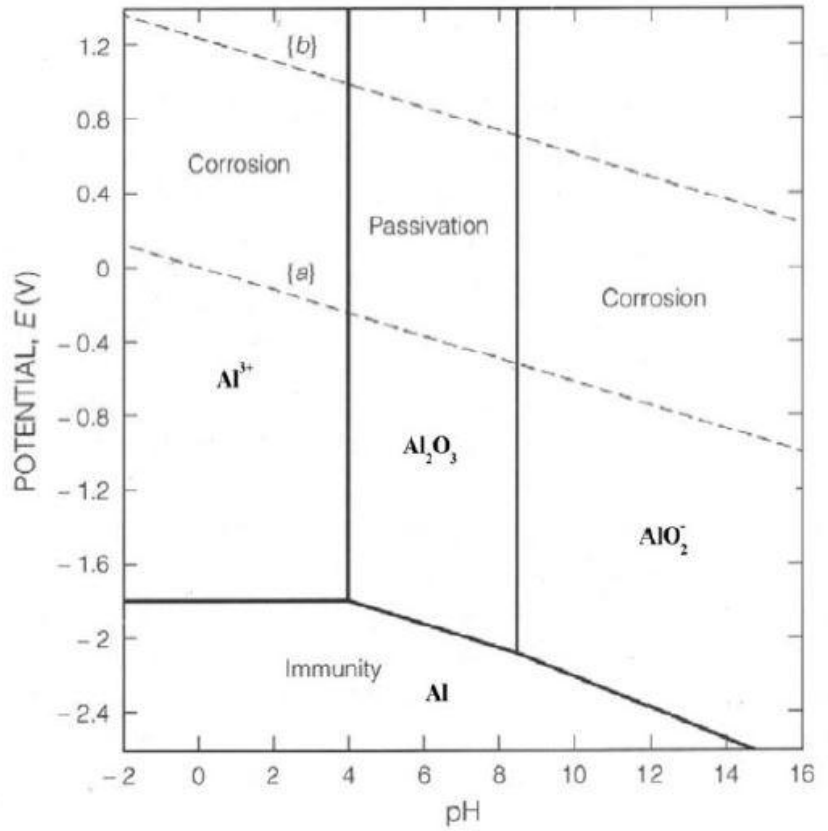


Figure 10. Aluminum

Zinc and aluminum are both amphoteric compounds. They can react with strong acids or strong bases to produce water soluble compounds, regardless of the potential.

Pourbaix diagram

complex diagrams

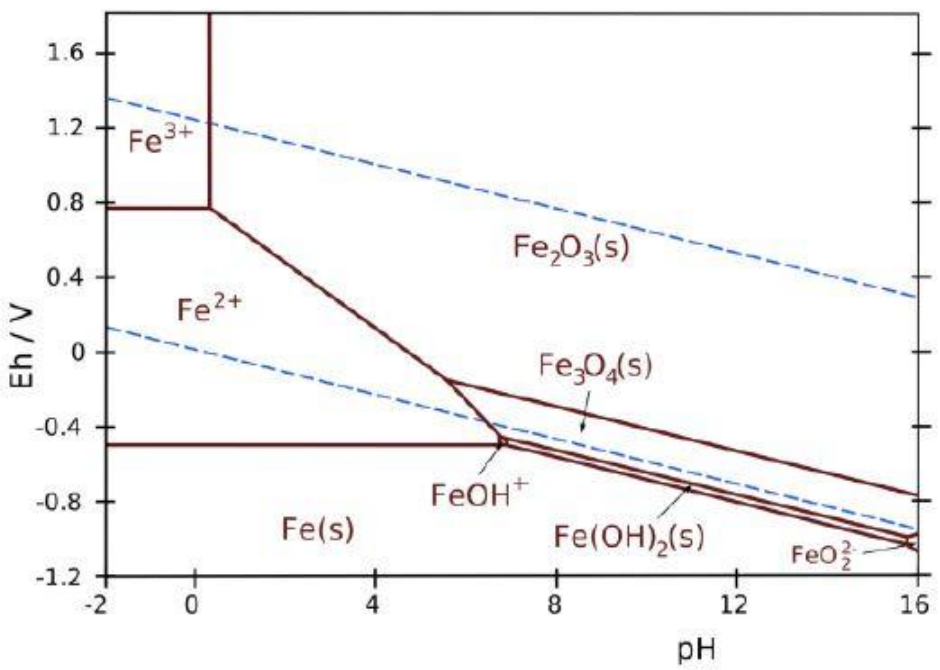


Figure 11. Iron

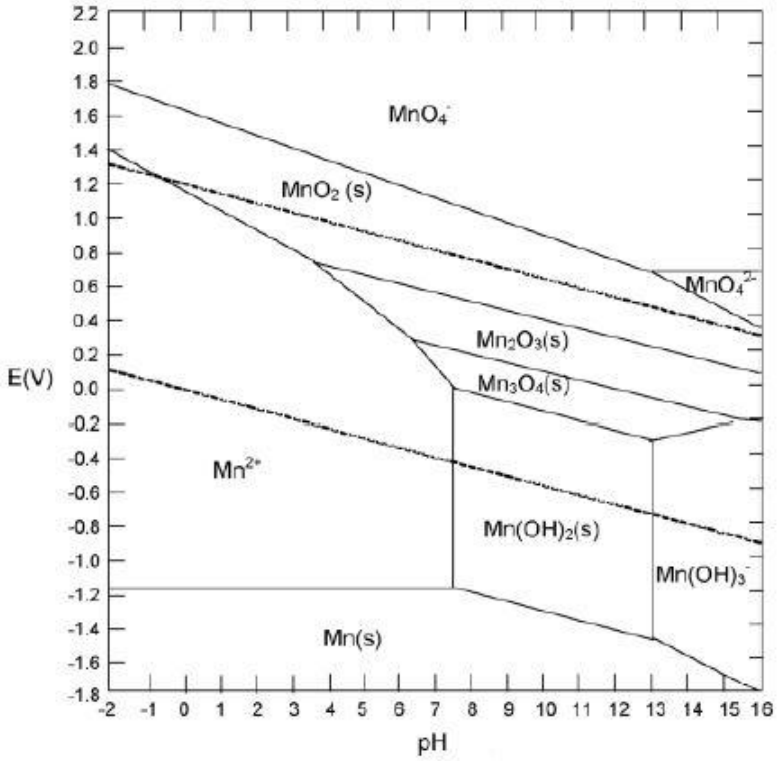


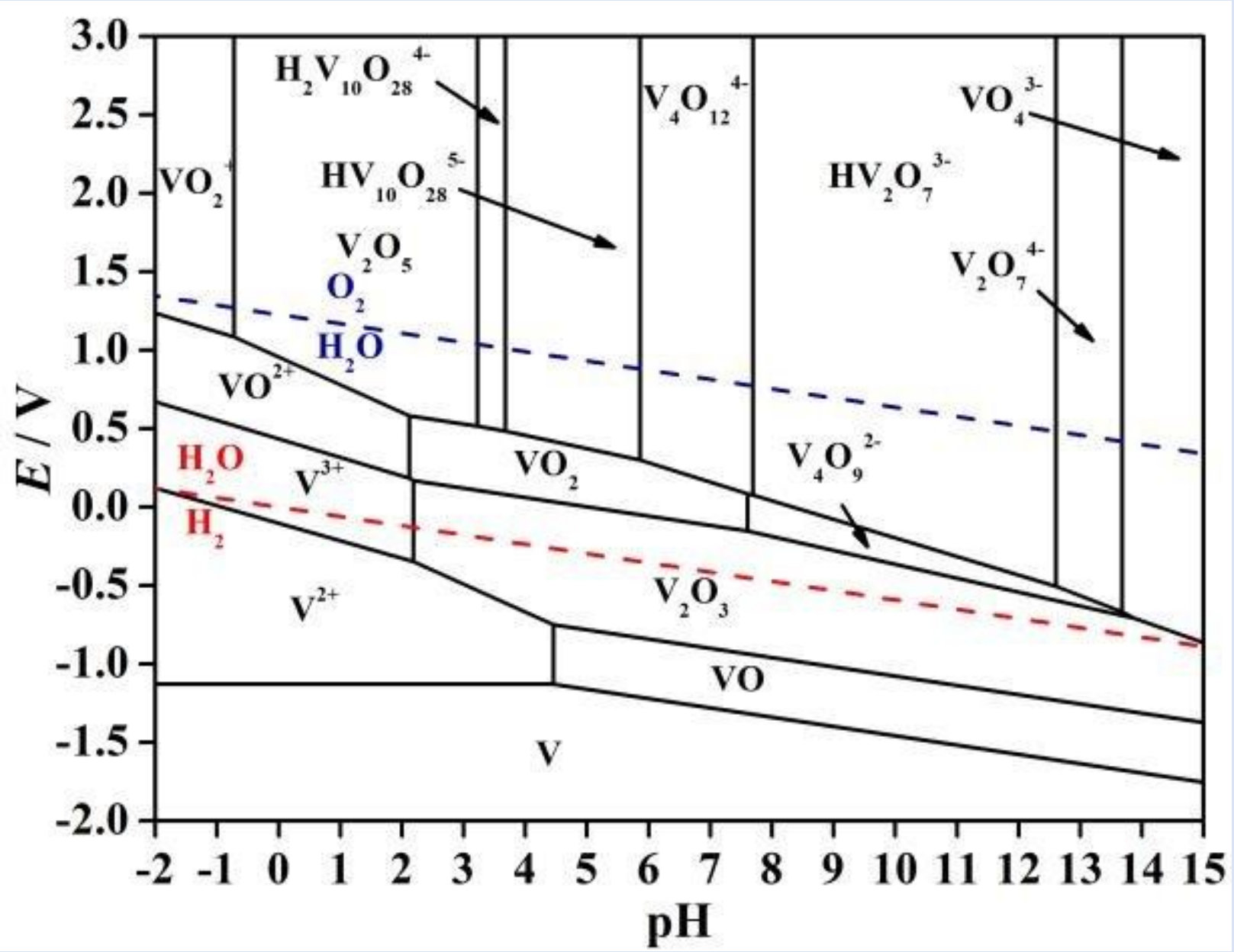
Figure 12. Manganese

There is no immunity for iron in water regardless of the pH of the solution.

Manganese can have several oxidation states. In this case, it gives a complex Pourbaix diagram.

Pourbaix diagram

A complex diagram

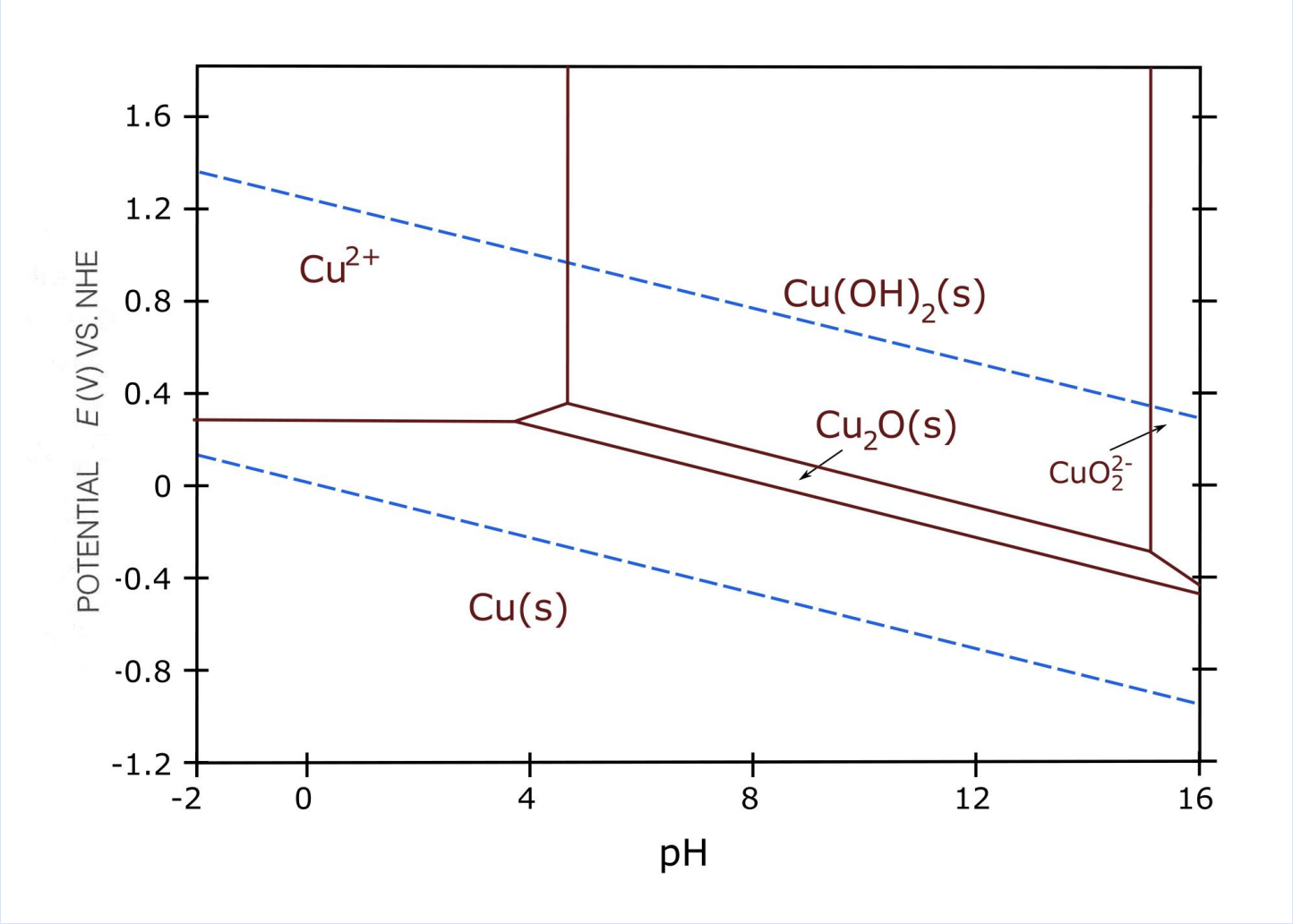


Pourbaix diagram

You want to plate (reduce) copper or Cu(s) on an electrode from a $CuSO_4$(aq) solution.

a. What should be the pH of the solution?

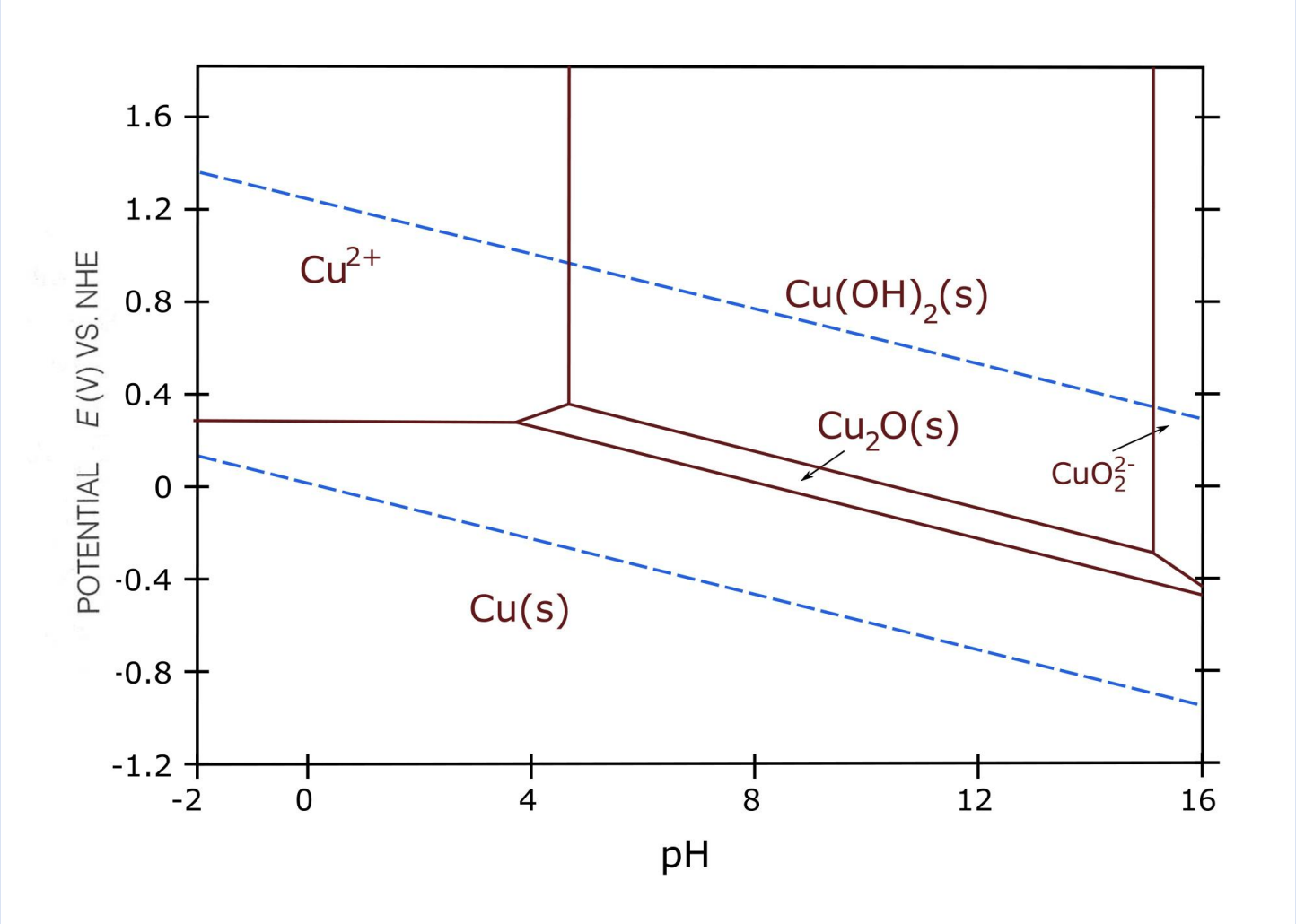
b. What is the required potential to perform the copper reduction at pH = 3.0?



Pourbaix diagram

Can a copper electrode be used to:

a. reduce water and produce hydrogen gas?
b. oxidize water and produce oxygen gas?



Pourbaix diagram

Aluminum is soluble in a 1.0 M acidic solution.
If sodium hydroxide (NaOH) is added to this solution, at what pH will the aluminum ion begin to precipitate?