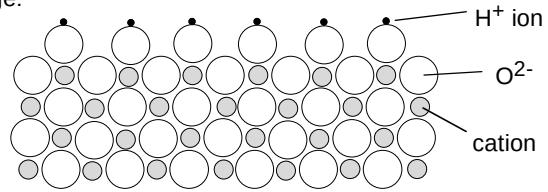
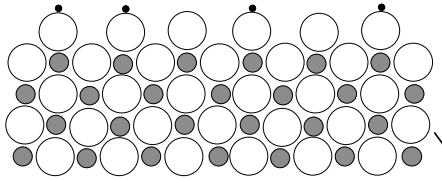
An explanation of "point of zero charge" - Part II

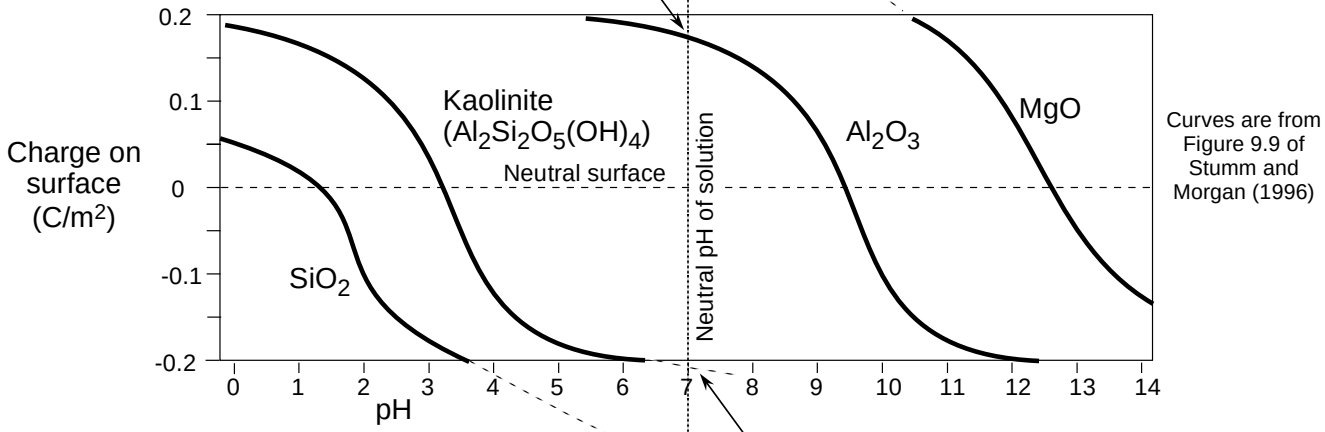
A plot for four minerals, and an explanation of why they vary:

Low ionic potential of Mg^{2+} fails to repel H+ ions from surface at neutral pH, resulting in surface of positive charge:



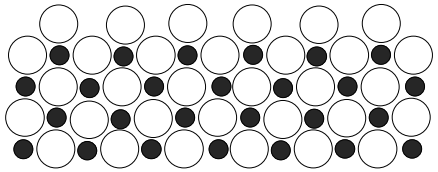
Moderate ionic potential of Al^{3+} repels some H+ ions from surface at neutral pH, resulting in surface of less positive charge than that of MgO:



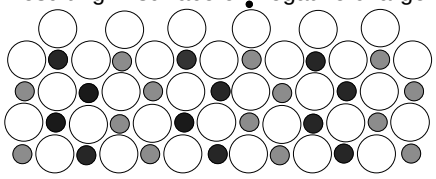


Curves are from Figure 9.9 of Stumm and Morgan (1996)

High ionic potential of Si^{4+} repels H+ ions from surface at neutral pH (and pH down to 2), resulting in surface of negative charge:



Combination of moderate ionic potential of Al^{3+} and high ionic potential of Si^{4+} repels most H+ ions from surface at neutral ph, resulting in surface of negative charge:



A bit of the periodic table:

Atomic number	*Ion*	*Icon*	*Ionic potential:* $(\frac{Charge}{radius})$
11	Na^{1+}	○	$\frac{1}{0.95}=1.1$
12	Mg^{2+}	○	$\frac{2}{0.65}=3.1$
13	Al^{3+}	○	$\frac{3}{0.50}=6.0$
14	Si^{4+}	●	$\frac{4}{0.41}=9.8$
15	P^{5+}	●	$\frac{5}{0.34}=14.7$
16	S^{6+}	•	$\frac{6}{0.29}=20.7$

Ions shown at left

The point: the greater the ionic potential of the cation(s) in the mineral, the greater the repulsion of H^+ ions from that mineral's surface to give a surface of negative charge that will adsorb cations.