Acids and Bases

For each of the following salts, predict if a 100 mM solution would be acidic, basic, or neutral.

NaCl KNO_2 sodium acetate sodium hydrogen sulfate

Strategy: Break the salt into ions. Is the cation an acid or base? How about the anion? NaCl → $Na^+ + Cl^-$. Na^+ is not a proton donor or acceptor. Cl^- is the conjugate base of a strong acid, so it is NOT a base. Neutral.

For each pair, identify which will be a more acidic solution:

10 mM HCl or 10 mM HF 10 mM H_2SO_4 or 10 mM HCl 10 mM HNO_2 or 20 μM HNO_2

Strategy: You need to consider all variables that can influence the amount of H_3O^+ that is produced: concentration, acid strength, monoprotic vs. diprotic. HCl vs. HF. Equal concentration of monoprotic acids. HCl is a strong acid and HF is a weak acid. HCl will be more acidic.

Order the following solutions by increasing acidity (lowest pH goes last). A table of pKa is attached.

100 mM HF, 100 mM HClO, 100 mM HSO_4^{-1}, 100 mM NH_4^+

HCO_3^{-1} can be an acid or a base. If you have a 100 mM $NaHCO_3$ solution, will it be acidic or basic?
Hint: Compare the Ka and Kb values. Is this molecule a stronger acid or base?

Hypochlorous acid (HClO) has a pKa of 7.53. What is the Ka? What is the conjugate base? What are the pKb and Kb of the conjugate base?

Calculate the pH of each of the following solutions:

650 μM HCl

650 μM HF

6.5 nM HF

1 mM $Mg(OH)_2$

650 mM MgF_2

For each of the following acids, determine what concentration is needed to have a pH of 5.5. Please answer in **micromolar**.

Hydrochloric acid

Ammonium chloride