In Class 10: pKa and pKb values, acidity of metal ions, and predominance diagrams

1. Write a reaction that shows how the polyatomic ion, HPO_4^{2-} could act as an acid in aqueous solution.

Write a reaction that shows how the polyatomic ion HPO_4^{2-} could act as a base in aqueous solution.

For each of the processes above, look up and /or calculate the appropriate pK_a or pK_b value from the table that is relevant and write the corresponding values next to the appropriate equation above.

Consider the pK_a and pK_b values for those equations. Which reaction will occur to a greater extent in pure water? Explain and indicate whether you expect the solution to be acidic or basic overall.

Of all the HPO_4^{2-} based species in the equations above (products or reactants), which would be the strongest acid? The strongest base?

Draw a predominance diagram for these species based on the pKa and pKb values on the table provided.

2. Consider the two metal ions, Be^{2+} and Al^{3+} dissolved in aqueous solution. For each of them, write a series of reaction showing how they can act as acids in aqueous solution.

Draw a predominance or ladder diagram for each showing which species will dominate at various pH's ranging from 0-14 (you can assume that there are just small areas of predominance for intermediate charged hydroxide species).

If toxic Be^{2+} (used for hardening steel and a variety of (secret) military and nuclear applications) were accidentally released into a stream with a slightly acidic normal pH of about 5.0, would you expect it to be present as a soluble or insoluble form? Explain.