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15.112 The fact that fluorine attracts electrons in a molecule more strongly than hydrogen should cause NF_3 to be a poor electron pair donor and a poor base. **NH_3** is the stronger base.

15.113 Because the P–H bond is weaker, there is a greater tendency for PH_4^+ to ionize. Therefore, PH_3 is a weaker base than NH_3.

15.114 The autoionization for deuterium-substituted water is: $D_2O \rightleftharpoons D^+ + OD^-$

$$[D^+][OD^-] = 1.35 \times 10^{-15} \qquad (1)$$

(a) The definition of pD is: $\mathbf{pD} = -\log[D^+] = -\log\sqrt{1.35 \times 10^{-15}} = \mathbf{7.43}$

(b) To be acidic, the **pD** must be **< 7.43**.

(c) Taking –log of both sides of equation (1) above:

$$-\log[D^+] + -\log[OD^-] = -\log(1.35 \times 10^{-15})$$

$$\mathbf{pD + pOD = 14.87}$$

15.115 **(a)** HNO_2 **(b)** HF **(c)** BF_3 **(d)** NH_3 **(e)** H_2SO_3
(f) HCO_3^- and CO_3^{2-}

The reactions for **(f)** are: $HCO_3^-(aq) + H^+(aq) \rightarrow CO_2(g) + H_2O(l)$

$CO_3^{2-}(aq) + 2H^+(aq) \rightarrow CO_2(g) + H_2O(l)$

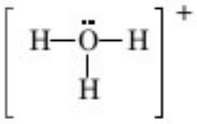
15.116 First we must calculate the molarity of the trifluoromethane sulfonic acid. (Molar mass = 150.1 g/mol)

$$\text{Molarity} = \frac{0.616\ \cancel{g} \times \dfrac{1\ \text{mol}}{150.1\ \cancel{g}}}{0.250\ \text{L}} = 0.0164\ M$$

Since trifluoromethane sulfonic acid is a strong acid and is 100% ionized, the $[H^+]$ is 0.0165 *M*.

$$\mathbf{pH} = -\log(0.0164) = \mathbf{1.79}$$

15.117 **(a)** The Lewis structure of H_3O^+ is:



Note that this structure is very similar to the Lewis structure of NH_3. The geometry is **trigonal pyramidal**.

(b) H_4O^{2+} does **not** exist because the positively charged H_3O^+ has no affinity to accept the positive H^+ ion. If H_4O^{2+} existed, it would have a **tetrahedral** geometry.

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