13. What is the S^{2-} concentration in a saturated solution (0.10 M) of H_2S, in which the pH has been adjusted to 6.00 by the addition of HCl? For H_2S, $K_{a1} = 1.1 \times 10^{-7}$ and $K_{a2} = 1.0 \times 10^{-14}$.
a) 1.1×10^{-16} M
b) 1.1×10^{-10} M
c) 1.0×10^{-2} M
d) 3.2×10^{-8} M
e) 3.2×10^{-6} M

#13 Combine the two dissociations:

$H_2S \rightleftharpoons H^+ + HS^-$ $K_{a_1} = 1.1 \times 10^{-7}$

$HS^- \rightleftharpoons H^+ + S^{2-}$ $K_{a_2} = 1.0 \times 10^{-14}$

$H_2S \rightleftharpoons 2H^+ + S^{2-}$ $K = K_{a_1} \cdot K_{a_2} = 1.1 \times 10^{-21}$

$$K = \frac{[H^+]^2[S^{2-}]}{[H_2S]}$$

$$[S^{2-}] = \frac{K[H_2S]}{[H^+]^2} = \frac{(1.1 \times 10^{-21})(.10)}{(1 \times 10^{-6})^2} = \boxed{1.1 \times 10^{-10}\ M}$$

14. Which of the following salts will result in a basic solution when it is dissolved in water?
a) KCl pH 7
b) NH_4I acidic
c) NaCN basic
d) $MgBr_2$ neutral
e) none of these

15. What is the pH of a 0.50 M solution of $NaNO_2$? For HNO_2, $K_a = 4.5 \times 10^{-4}$.
a) 12.18
b) 5.48
c) 1.82
d) 8.52
e) 7.00

NO_2^- HYDROLYSIS conjugate base of HNO_2

$NO_2^- + H_2O \rightleftharpoons HNO_2 + OH^-$

.50 M		0	0
$-x$		$+x$	$+x$
$.50 - x$		x	x

$$K_b = \frac{K_w}{K_a} = \frac{[HNO_2][OH^-]}{[NO_2^-]} = 2.22 \times 10^{-11}$$

assume....

$$\frac{x^2}{.50} = 2.22 \times 10^{-11}$$

$x^2 = 1.11 \times 10^{-11}$

$x = [OH^-] = 3.33 \times 10^{-6}$

$pOH = -\log[OH^-] = 5.477$

$pH = 14 - pOH = \boxed{8.52}$

16. What is the pH of a 1.0 M solution of NaOCl? For HOCl, $K_a = 3.1 \times 10^{-8}$.
a) 10.75
b) 3.25
c) 3.75
d) 10.25
e) 7.00

$K_b = \frac{K_w}{K_a} = 3.23 \times 10^{-7}$

SHORTCUT: $x^2 = (1.0)(3.23 \times 10^{-7})$

$[OH^-] = x = 5.679 \times 10^{-4}$ $pOH = 3.246$

$pH = 14 - pH = 10.75$