

What is the pH if $[H^+] = 1.5E-3M$?

$$pH = -\log[H^+] = -\log(1.5E-3) = 2.8$$

What is the pH if $[OH^-] = 1.5E-3M$?

$$[H^+][OH^-] = 1.00E-14$$

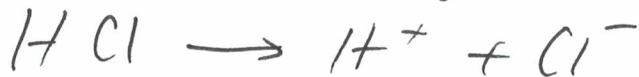
$$[H^+] = \frac{1.00E-14}{[OH^-]} = \frac{1.00E-14}{1.5E-3M}$$

$$[H^+] = 6.7E-12M$$

$$pH = -\log[H^+] = -\log(6.7E-12M)$$

$$pH = 11.2 = 11$$

What is the pH of a 0.012M HCl solution (a strong acid)?



from stoichiometry

$$[H^+] = [HCl]$$

so

$$pH = -\log(0.012) = 1.9$$

What is $[H^+]$ if $pH = 3.6$?

$$pH = -\log [H^+]$$

$$3.6 = -\log [H^+]$$

$$-3.6 = \log [H^+]$$

$$10^{-3.6} = 10^{\log [H^+]} = [H^+]$$

$$\underline{[H^+] = 2.5E-4 M}$$

What is $[OH^-]$ if $pH = 3.6$

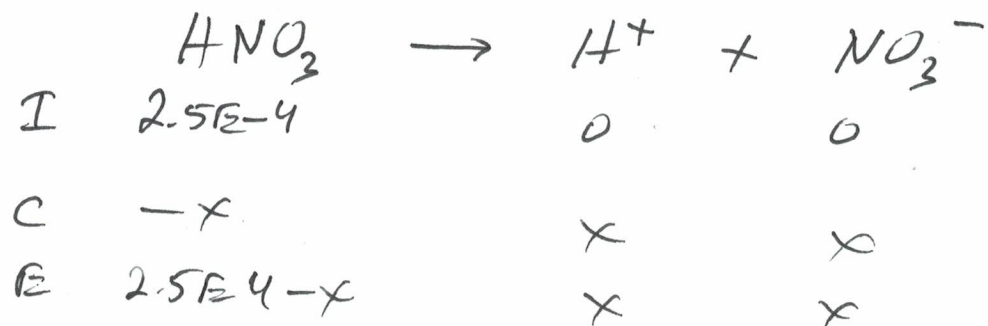
Same calculations as above. then:

$$[H^+][OH^-] = ~~1.0E-14~~ 1.00E-14$$

$$[OH^-] = \frac{1.00E-14}{2.5E-4}$$

$$\underline{[OH^-] = 4.0E-11 M}$$

What is the pH of a $2.5 \times 10^{-4} \text{ M}$
 HNO_3 solution? $K_a = 2.9 \times 10^6$



Since $K_a \gg 1$, strong acid \rightarrow all reactant
forms products

so no HNO_3 left and:

$$2.5 \times 10^{-4} - x = 0$$

$$x = 2.5 \times 10^{-4}$$

$$\text{so } [\text{H}^+] \text{ at eq.} = x = 2.5 \times 10^{-4}$$

$$\text{pH} = -\log(2.5 \times 10^{-4})$$

$$= 3.6$$

What is the pH of a $7.2 \times 10^{-2} \text{ M}$ NaOH solution? ①

NaOH - soluble metal hydroxide
- fully dissociates (strong base)

$$\text{so } [\text{OH}^-] = 7.2 \times 10^{-2} \text{ M}$$



$\text{pH} = -\log [\text{H}^+]$ so we need $[\text{H}^+]$

$$[\text{H}^+][\text{OH}^-] = 1.00 \times 10^{-14}$$

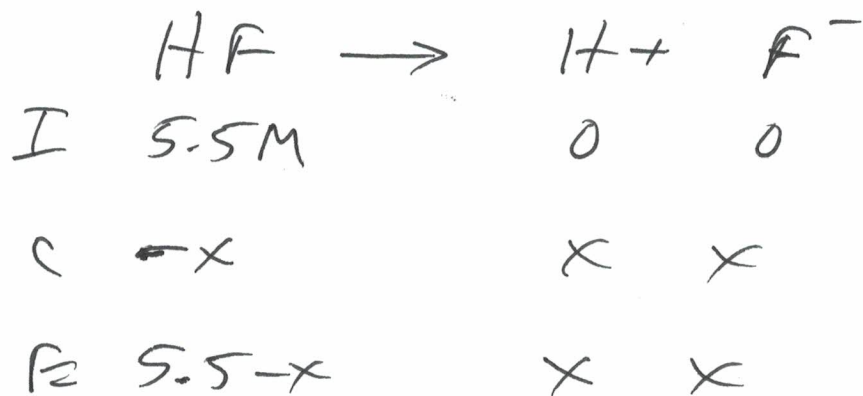
$$[\text{H}^+] = \frac{1.00 \times 10^{-14}}{[\text{OH}^-]} = \frac{1.00 \times 10^{-14}}{7.2 \times 10^{-2}}$$

$$[\text{H}^+] = 1.4 \times 10^{-13}$$

$$\text{pH} = -\log (1.4 \times 10^{-13}) = 12.9$$
$$= \underline{\underline{13}}$$

What is the pH of a 5.5 M HF solution? $K_a = 7.2 \times 10^{-4}$

$K_a \ll 1$ so weak acid



$$K_a = \frac{[H^+][F^-]}{[HF]} = \frac{(x)(x)}{(5.5-x)} = 7.2 \times 10^{-4}$$

$$(5.5-x) \cdot \frac{x^2}{(5.5-x)} = 7.2 \times 10^{-4} \cdot (5.5-x)$$

$$x^2 = 3.96 \times 10^{-3} - 7.2 \times 10^{-4} x$$

$$x^2 + 7.2 \times 10^{-4} x - 3.96 \times 10^{-3} = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= 0.063$$

$$\text{or } -0.063$$

not possible.
would give
negative molarity

$$\text{pH} = -\log(0.063) = \underline{1.2}$$