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

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

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

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

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

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

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

$pH = 11.2 = 11$

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

$HCl \longrightarrow H^+ + Cl^-$

from stoichiometry

$[H^+] = [HCl]$

so

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

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

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

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

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

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

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

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

Same calculations as above. then:

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

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

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

What is the pH of a 2.5 E-4 M HNO_3 solution? Ka = 2.9E6

	HNO_3	$\rightarrow$	H^+	+	NO_3^-
I	2.5E-4		0		0
C	−x		x		x
E	2.5E4 − x		x		x

since Ka >> 1, strong acid → all reactant forms products.

so no HNO_3 left and:

$$2.5E{-}4 - x = 0$$

$$x = 2.5E{-}4$$

so $[H^+]$ at eq. = x = 2.5 E-4

$$pH = -\log(2.5E{-}4)$$

$$= 3.6$$

What is the pH of a 7.2E-2 M NaOH solution? ⓑ

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

so $[OH^-] = 7.2E-2$ M

$(NaOH \rightarrow Na^+ + OH^-)$

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

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

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

$[H^+] = 1.4E-13$

$pH = -\log(1.4E-13) = 12.9$

$= \underline{13}$

What is the pH of a 5.5 M HF solution? $K_a = 7.2E-4$

$K_a << 1$ so weak acid

	HF	$\longrightarrow$	H^+	F^-
I	5.5M		0	0
C	$-x$		x	x
E	$5.5-x$		x	x

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

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

$$x^2 = 3.96E-3 - 7.2E-4\,x$$

$$x^2 + 7.2E-4\,x - 3.96E-3 = 0$$

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

$= 0.063$

or -0.063 ← not possible. would give negative molarity

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