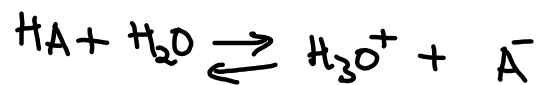


Questions-Q & A

Worksheet

2.  $\text{pH} = 5.2 \rightarrow [\text{H}_3\text{O}^+] = 6.3 \times 10^{-6}$



I	1.0	}		0	0
C	$-6.3 \times 10^{-6}$			$6.3 \times 10^{-6}$	$6.3 \times 10^{-6}$
E	$\sim 1.0$			$6.3 \times 10^{-6}$	$6.3 \times 10^{-6}$

$$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

$$K_a = \frac{(6.3 \times 10^{-6})(6.3 \times 10^{-6})}{1.0}$$

$$K_a = 4.0 \times 10^{-11}$$

4.  $\% \text{ ioniz} = \frac{[\text{H}_3\text{O}^+]}{[\text{HZ}]} \times 100\%$

$$7.5 = \frac{[\text{H}_3\text{O}^+]}{0.50 \text{ mol/L}} \times 100\%$$

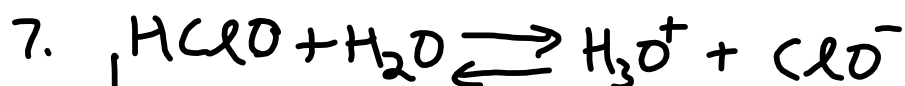
$$\frac{7.5 \times 0.50}{100\%} = [\text{H}_3\text{O}^+]$$

$$0.0375 = [\text{H}_3\text{O}^+]$$



I	0.5000	}		0	0
C	0.0375			0.0375	0.0375
E	0.4625			0.0375	0.0375

$$K_a = \frac{(0.0375)(0.0375)}{0.4625} = 3.04 \times 10^{-3}$$



I	0.75	}		0	0
C	-x			x	x
E	0.75-x			x	x

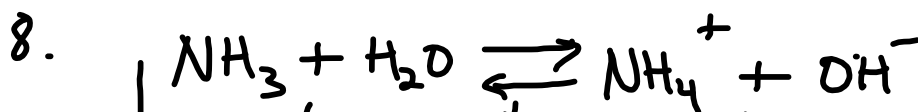
$$4.0 \times 10^{-8} = \frac{x \cdot x}{0.75-x}$$

$$4.0 \times 10^{-8} \times 0.75 = x^2$$

$$\sqrt{3.0 \times 10^{-8}} = \sqrt{x^2}$$

$$1.73 \times 10^{-4} = x = [\text{H}_3\text{O}^+]$$

$$\text{pH} = 3.76$$



I	1.4	}		0	0
C	-x			x	x
E	1.4-x			x	x

$$K_b = \frac{x^2}{1.4-x}$$

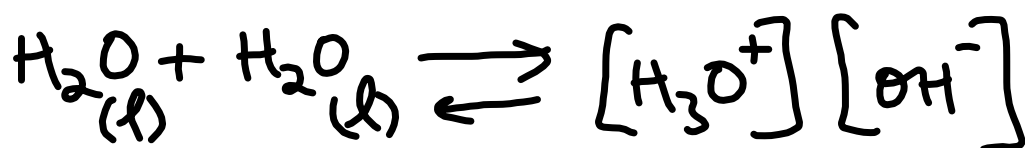
$$\sqrt{2.5 \times 10^{-5} \times 1.4} = \sqrt{x^2}$$

$$5.9 \times 10^{-3} = x = [\text{OH}^-]$$

$$\begin{aligned} \% \text{ ion.} &= \frac{5.9 \times 10^{-3}}{1.4} \times 100\% \\ &= 0.42\% \end{aligned}$$

## Ionization of Water - Kw

Recall -  $\text{H}_2\text{O}$  is amphoteric



$$K_{eq} = \frac{[\text{H}_3\text{O}^+] [\text{OH}^-]}{[\text{H}_2\text{O}] [\text{H}_2\text{O}]}$$

new  
constant

$$K_w = [\text{H}_3\text{O}^+] [\text{OH}^-]$$

for all  
dilute  
solutions

pure  $\text{H}_2\text{O}$

$$[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} = [\text{OH}^-]$$

$$K_w = (1.0 \times 10^{-7}) (1.0 \times 10^{-7})$$

$$K_w = 1.0 \times 10^{-14}$$

Examples- What is  $[\text{OH}^-]$  of a solution with  $\text{pH} = 2.5$ ?

$$(i) \quad \text{pH} = -\log [\text{H}_3\text{O}^+]$$

$$2.5 = -\log [\text{H}_3\text{O}^+]$$

$$0.0032 = [\text{H}_3\text{O}^+]$$

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$$

$$1.0 \times 10^{-14} = 0.0032 [\text{OH}^-]$$

$$3.1 \times 10^{-12} = [\text{OH}^-]$$

Text p. 566

# 12, 14

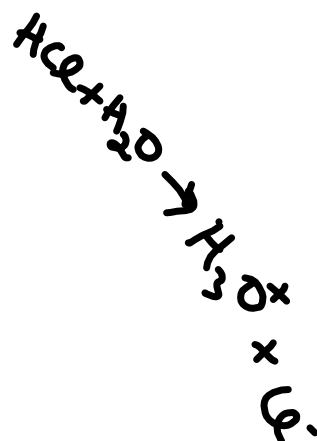
$$14. \quad K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$$

$$1.0 \times 10^{-14} = x \cdot 5.6 \times 10^{-14}$$

$$\frac{1.0 \times 10^{-14}}{5.6 \times 10^{-14}} = x$$

$$0.18 = x$$

$$0.18 \text{ mol/L} = x$$



Ionization of Water - Continued

Example - weak acid or base

An acid, HX, has  $K_a = 4.6 \times 10^{-8}$ .

What is  $[OH^-]$  if initial  $[HX]$  is  $0.10 \text{ mol/L}$ ?



I	0.10	}		0	0
C	x	}		x	x
E	0.10-x	}		x	x

$$K_a = \frac{[H_3O^+][X^-]}{[HX]}$$

$$4.6 \times 10^{-8} = \frac{x \cdot x}{0.10 - x}$$

$$(4.6 \times 10^{-8})(0.10) = x^2$$

$$\sqrt{4.6 \times 10^{-9}} = \sqrt{x^2}$$

$$6.8 \times 10^{-5} = x = [H_3O^+]$$

$$K_w = [H_3O^+][OH^-]$$

$$1.0 \times 10^{-14} = 6.8 \times 10^{-5} [OH^-]$$

$$\frac{1.0 \times 10^{-14}}{6.8 \times 10^{-5}} = [OH^-] = 1.6 \times 10^{-10}$$

Worksheet  
#516

Ionization - general problems

Text p. 591 #5-10

p. 595 #11-16

Acid/Base Indicators