Tuesday, May 14, 2019

Go over last night's homework:

pH and pOH WORKSHEET

Part 1 - Calculate the pH and identify as acidic, basic, or neutral.

1.)	$[H^{+1}] = 1.0 \times 10^{-6}$ M	pH = 6.00	**A** B N
2.)	$[H^{+1}] = 2.61 \times 10^{-2}$ M	pH = 1.58	**A** B N
3.)	$[H^{+1}] = 4.0 \times 10^{-9}$ M	pH = 8.40	A **B** N
4.)	$[H^{+1}] = 5.9 \times 10^{-12}$ M	pH = 11.23	A **B** N
5.)	$[H^{+1}] = 1.0 \times 10^{-7}$ M	$-\log[H^+]$ pH = 7.00	A B **N**

Part 2 - Calculate the $[H^{+1}]$ and identify as acidic, basic, or neutral

$[H^{+1}] = 10^{-pH}$

6.)	pH = 4.00	$[H^{+1}] = 1.00 \times 10^{-4}$ M	**A** B N
7.)	pH = 5.89	$[H^{+1}] = 1.29 \times 10^{-6}$ M	**A** B N
8.)	pH = 7.00	$[H^{+1}] = 1.00 \times 10^{-7}$ M	A B **N**
9.)	pH = 12.25	$[H^{+1}] = 5.62 \times 10^{-13}$ M	A **B** N
10.)	pH = 9.11	$[H^{+1}] = 7.76 \times 10^{-10}$ M	A **B** N

Part 3 - Calculate the missing $[H^{+1}]$ or $[OH^{-1}]$ and identify as acidic, basic, or neutral.

11.)	$[H^{+1}] = 4.2 \times 10^{-6}$ M	$[OH^{-1}] = 2.38 \times 10^{-9}$ M	(A) B N
12.)	$[H^{+1}] = 1.15 \times 10^{-10}$ M	$[OH^{-1}] = 8.7 \times 10^{-5}$ M	A (B) N

$$[H^+][OH^-] = 1 \times 10^{-14}$$

$$\frac{4.2 \times 10^{-6} \cdot x}{4.2 \times 10^{-6}} = \frac{1 \times 10^{-14}}{4.2 \times 10^{-6}}$$

$$x = 2.38 \times 10^{-9} \text{ M}$$

Rest of the chart from the homework:

pH	pOH	$[H^{+1}]$	$[OH^{-1}]$
3.68	14-3.68= 10.32	$10^{-3.68}$ = 2.09×10^{-4} M	$10^{-10.32}$ = 4.79×10^{-11} M
14-4.07 9.93	-log[OH-]= 4.07	$10^{-9.93}$ = 1.17×10^{-10} M	8.60×10^{-5} M
-log[H+]= 12.74	14-12.74= 1.26	1.80×10^{-13} M	$10^{-5.26}$ = 5.50×10^{-2} M
14-3.72= 10.28	3.72	$10^{-10.28}$ = 5.25×10^{-11} M	$10^{-3.72}$= 1.91×10^{-4} M
10.84	14-10.84= 3.16	$10^{-10.84}$ = 1.45×10^{-11} M	$10^{-3.16}$= 6.92×10^{-4} M
-log[H+] = 9.42	14-9.42= 4.58	3.82×10^{-10} M	$10^{-4.58}$= 2.63×10^{-5} M
14-2.85= 11.15	2.85	$10^{-11.15}$= 7.08×10^{-12} M	$10^{-2.85}$= 0.00141 M

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

$pOH = -\log[OH^-]$
$[OH^-] = 10^{-pOH}$

$pH + pOH = 14$

$[H^+] \cdot [OH^-] = 1 \times 10^{-14}$

New Material:

ACID - BASE TITRATION NOTES

TITRATION: process used in Chemistry lab to determine the concentration of an acid or a base; use a base or an acid with a known concentration to neutralize the acid or base with the unknown concentration
Titration problems are stoichiometry problems in disguise.

What is the molarity of a H_2SO_4 solution if 190 mL of the acid is required to exactly neutralize 150 mL of a 2.5 M NaOH solution? Eqn for neutralization: $H_2SO_4 + \mathbf{2}\ NaOH \rightarrow \mathbf{2}\ H_2O + Na_2SO_4$

Reminder! Steps for stoichiometry:
1) Find moles of given substance. 2) Use mole ratio from balanced equation. 3) Find answer.

The problem says that there are 150 mL of a 2.5 M NaOH solution.

Molarity (M) = $\dfrac{\text{moles of solute}}{\text{Liters of solution}}$ Use the molarity definition equation to calculate the number of moles of the given substance (in this case, NaOH).

Step 1 = $2.5 = \dfrac{x}{0.15}$ x = 0.375 moles NaOH

Step 2 = $\dfrac{0.375 \text{ moles NaOH}}{2} = \dfrac{x \text{ moles } H_2SO_4}{1}$ x = 0.1875 moles H_2SO_4

Step 3 = $M = \dfrac{0.1875 \text{ moles } H_2SO_4}{0.19 \text{ L}}$ M = 0.99 M H_2SO_4

Because titrations always involve an acid and a base neutralizing each other, we don't have to go through all of these steps, the process can be shortened…

EQUATION TO USE FOR SOLVING TITRATION PROBLEMS: $n_A \cdot M_A \cdot V_A = n_B \cdot M_B \cdot V_B$

n_A = number of Hs at the beginning of the formula for the acid
M_A = molarity of the acid
V_A = volume of the acid

n_B = number of OHs in the formula for the base
M_B = molarity of the base
V_B = volume of the base

EXAMPLE PROBLEM:
What is the molarity of a H_2SO_4 solution if 190 mL of the acid is required to exactly neutralize 150 mL of a 2.5 M NaOH solution? (Same problem as above. Just so you can see that we get the same answer…)

$n_A \cdot M_A \cdot V_A = n_B \cdot M_B \cdot V_B$
$2 \cdot M \cdot 190 = 1 \cdot 2.5 \cdot 150$
$380\ M = 375$
$M = 0.99\ M$

What is the volume of a sample of 0.25 M HCl that requires 26.15 mL of 0.58 M NaOH to neutralize it?

$$n_A \cdot M_A \cdot V_A = n_B \cdot M_B \cdot V_B$$

$$1 \cdot 0.25 \cdot x = 1 \cdot 0.58 \cdot 26.15$$

$$x = 61 \text{ mL}$$

Homework is “Titration Problems” wksht.