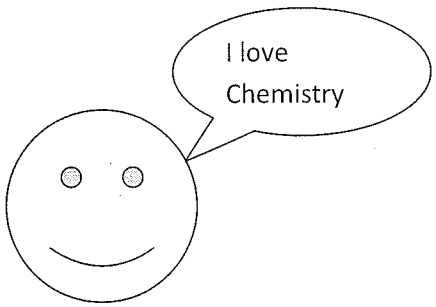
pH Problems



1. Determine the pH of a 0.50 M solution of nitric acid, a strong acid.

$[H^+]=[HNO_3]$ $pH=-\log[.50]=0.30$

2. Determine the pH of a 12.0 M solution of hydrochloric acid, a strong acid.

$[H^+]=[HCl]$ $pH=-\log[12.0]=-1.079$

3. Given the $[H_3O^+] = 1.8 \times 10^{-5}$, calculate the pH, pOH and $[OH^-]$ of the solution. Is the solution acidic or basic?

$pH < 7$

$pH=-\log[H_3O^+]$ $pH=4.74$

$pOH=14-pH$ $pOH=9.26$

$[OH^-]=10^{-pOH}$ $5.5\times10^{-10}\ M$

4. The pH of coca-cola is 2.9. Calculate the $[H^+]$, $[OH^-]$, and pOH of coca-cola. Is it acidic or basic?

$pH < 7$

$[H^+]=10^{-pH}$ $[H^+]=1.3\times10^{-3}\ M$

readily (1) s.f.

$[OH^-]=\frac{1.0\times10^{-14}}{1.3\times10^{-3}}$ $[OH^-]=7.7\times10^{-12}$

$pOH=14-pH$ $pOH=11.1$

5. The pOH of bleach is 2.10. Calculate the $[H^+]$ in the bleach solution. Is it acidic or basic?

$pH > 7$

$pH=14-pOH$ $pH=11.90$

$[H^+]=10^{-pH}$ $[H^+]=1.3\times10^{-12}\ M$

6. Calculate the pH of the following HCl solutions: 0.10 M, 1.0×10^{-5} M, and 1.0×10^{-11} M

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

.10 M HCl

$pH=-\log[H^+]$ $pH=1.00$

1.0×10^{-5} M HCl

$pH=-\log[H^+]$ $pH=5.00$

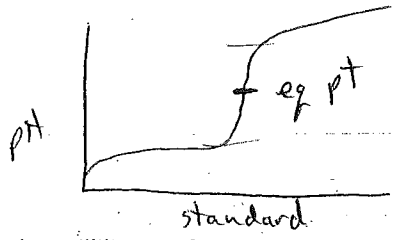
1.0×10^{-11} M HCl

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

~~$pH=11.00$~~ what? If I adda S.A. to neutral H_2O I make a base. No $pH=7$ or just below

Titrations

1. Draw the titration curve for a weak acid being titrated with a strong base. Label the equivalence point, pH axis and standard axis. How were you able to determine where the equivalence point was located?



It is halfway up the vertical part of the line.

2. Calculate the milliliters of 0.30 M sulfuric acid needed to titrate 75.0 mL of 0.20 M potassium hydroxide.

$$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$$

? mL, .30 mol/L — 75.0 mL, .20 mol/L

$$75.0\text{mL} \times \frac{.20\text{mol KOH}}{\text{L}} \times \frac{1\text{mol } H_2SO_4}{2\text{mol KOH}} \times \frac{\text{L}}{.30\text{mol } H_2SO_4} = 25 \text{ mL}$$

3. If 14.23 mL of 0.030 molar nitric acid are needed to neutralize 25.0 mL of barium hydroxide, what is the molarity of the barium hydroxide?

$$2HNO_3 + Ba(OH)_2 \rightarrow Ba(NO_3)_2 + 2H_2O$$

14.23 mL, .030 mol/L — 25 mL, ? M

$$14.23\text{mL} \times \frac{.030\text{mol } HNO_3}{\text{L}} \times \frac{1\text{mol } Ba(OH)_2}{2\text{mol } HNO_3} \times \frac{1}{25.0\text{mL}} = 8.54 \times 10^{-3} \text{M } Ba(OH)_2$$

4. If takes 37.93 mL of sodium hydroxide to neutralize 2.04 g of potassium hydrogen phthalate, $KHC_8H_4O_4$, what is the concentration of sodium hydroxide in moles per liter?

$$NaOH + KHC_8H_4O_4 \rightarrow H_2O + NaKC_8H_4O_4$$

37.93 mL, ? M — 2.04 g

$$2.04\text{g KHP} \times \frac{1\text{mol KHP}}{204.2\text{g KHP}} \times \frac{1\text{mol NaOH}}{1\text{mol KHP}} \times \frac{1}{.03793\text{ L}} = 0.263\text{M NaOH}$$

5. A 100.0 mL sample of 0.50 molar solution hydrochloric acid is titrated with 0.10 molar solution of sodium hydroxide. What volume of sodium hydroxide is needed to reach the equivalence point?

$$HCl + NaOH \rightarrow H_2O + NaCl$$

100.0 mL, .50 mol/L — .10 mol/L, ? mL

$$100.0\text{mL} \times \frac{.50\text{mol HCl}}{\text{L}} \times \frac{1\text{mol NaOH}}{1\text{mol HCl}} \times \frac{\text{L}}{.10\text{mol NaOH}} = 500 \text{ mL}$$

or 5.0×10^2 mL