pH Worksheet

1) Find the pH of a solution that contains 85 grams of hydrochloric acid (HCl) dissolved in 2.5 L of water.

2) Find the pH of a solution that contains 2.95 grams of nitrous acid (HNO_2) dissolved in 550 mL of water.

3) Find the pH of a solution that contains 2.5 moles of hydrochloric acid (HCl) and 1.4 moles of acetic acid ($HC_2H_3O_2$) dissolved in 110 L of water.

4) A solution has a $[H^+]$ concentration of 5.3×10^{-6} M. Is this an acidic or basic solution? Why?

5) If an acidic solution having a pH of 3.95 is diluted from 15 mL to a final volume of 100. mL, what would be the pH of the resulting solution?

Solutions

Note: The significant figures in the concentration of $[H^+]$ or $[OH^-]$ is equal to the number of decimal places in the pH or pOH and vice versa.

1) Find the pH of a solution that contains 85 grams of hydrochloric acid (HCl) dissolved in 2.5 L of water.

$85\text{ g HCl} \times \frac{1\text{ mole HCl}}{36.5\text{ g HCl}} = 2.3\text{ mole HCl}$

$\frac{2.3\text{ mole HCl}}{2.5\text{ L } H_2O} = 0.92\text{ M HCl}$

$pH = -\log(0.92) = 0.03$

2) Find the pH of a solution that contains 2.95 grams of nitrous acid (HNO_2) dissolved in 550 mL of water.

$2.95\text{ g } HNO_2 \times \frac{1\text{ mole } HNO_2}{47\text{ g } HNO_2} = 0.0628\text{ mole } HNO_2$

$\frac{0.0628\text{ mole } HNO_2}{0.55\text{ L } H_2O} = 0.11\text{ M } HNO_2$

$pH = -\log(0.11) = 0.96$

3) Find the pH of a solution that contains 2.5 moles of hydrochloric acid (HCl) and 1.4 moles of acetic acid ($HC_2H_3O_2$) dissolved in 110 L of water.

$2.5\text{ mole HCl} + 1.4\text{ mole } HC_2H_3O_2 = 3.9\text{ mole acid}$

$\frac{3.9\text{ mole acid}}{110\text{ L } H_2O} = 0.035\text{ M solution}$

$pH = -\log(0.035) = 1.46$

4) A solution has a $[H^+]$ concentration of 5.3×10^{-6} M. Is this an acidic or basic solution? Why?

$pH = -\log(5.3 \times 10^{-6}) = 5.28$

This solution is slightly acidic because its pH < 7.

5) If an acidic solution having a pH of 3.95 is diluted from 15 mL to a final volume of 100. mL, what would be the pH of the resulting solution?

$3.95 = -\log x$

$3.95 = \log x^{-1}$

$10^{3.95} = 10^{\log x^{-1}}$

$8912.5 = x^{-1}$

$x = \frac{1}{8912.5} = 1.1 \times 10^{-4}\text{ M}$

$M_1V_1 = M_2V_2$

$M_2 = \frac{M_1V_1}{V_2} = \frac{(1.1 \times 10^{-4}\text{ M})(15\text{ mL})}{(100.\text{ mL})} = 1.7 \times 10^{-5}\text{ M}$

$pH = -\log(1.7 \times 10^{-5}) = 4.77$