Calculating pH and pOH worksheet

1) What is the pH of a 0.0235 M HCl solution?

2) What is the pOH of a 0.0235 M HCl solution?

3) What is the pH of a 6.50×10^{-3} M KOH solution? (Hint: this is a basic solution – concentration is of OH^-)

4) A solution is created by measuring 3.60×10^{-3} moles of NaOH and 5.95×10^{-4} moles of HCl into a container and then water is added until the final volume is 1.00 L. What is the pH of this solution?

5) What is the pH of a 6.2×10^{-5} M NaOH solution? (Hint: this is a basic solution – concentration is of OH^-)

6) A solution with a H^+ concentration of 1.00×10^{-7} M is said to be neutral. Why?

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) What is the pH of a 0.0235 M HCl solution?

$pH = -log[H^+] = -log(0.0235) = 1.629$

2) What is the pOH of a 0.0235 M HCl solution?

$pH = -log[H^+] = -log(0.0235) = 1.629$

$pOH = 14.000 - pH = 14.000 - 1.629 = 12.371$

3) What is the pH of a 6.50×10^{-3} M KOH solution?

$pOH = -log[OH^-] = -log(6.50 \times 10^{-3}) = 2.187$

$pH = 14.000 - pOH = 14.000 - 2.187 = 11.813$

4) A solution is created by measuring 3.60×10^{-3} moles of NaOH and 5.95×10^{-4} moles of HCl into a container and then water is added until the final volume is 1.00 L. What is the pH of this solution?

Since there is both acid and base we will assume a 1 mole acid:1 mole base ratio of neutralization. There is more base than acid so the leftover base is what will affect the pH of the solution.

3.60×10^{-3} moles - 5.95×10^{-4} moles = 3.01×10^{-3} moles NaOH

$$\frac{3.01 \times 10^{-3} \text{ moles NaOH}}{1.00 \text{ L soln}} = 3.01 \times 10^{-3} \text{ M NaOH}$$

$pOH = -log[OH^-] = -log(3.01 \times 10^{-3}) = 2.521$

$pH = 14.000 - pOH = 14.000 - 2.521 = 11.479$

5) What is the pH of a 6.2×10^{-5} M NaOH solution?

$pOH = -log[OH^-] = -log(6.2 \times 10^{-5}) = 4.21$

$pH = 14.00 - pOH = 14.00 - 4.21 = 9.79$

6) A solution with a H^+ concentration of 1.00×10^{-7} M is said to be neutral. Why?

$pH = -log[H^+] = -log(1.00 \times 10^{-7}) = 7.000$

$pOH = 14.000 - pH = 14.000 - 7.000 = 7.000$

$pOH = -log[OH^-] = -log(OH^-) = 7.000$ we can use this to find the OH^- concentration

$$-log[OH^-] = 7.000$$
$$log[OH^-]^{-1} = 7.000$$

$$10^{log[OH^-]^{-1}} = 10^{7.000}$$

$$[OH^-]^{-1} = 10^{7.000}$$

$$\frac{1}{[OH^-]} = 10^{7.000}$$

$$[OH^-] = 1.00 \times 10^{-7} \text{ M}$$

The concentrations of H^+ and OH^- are equal, as are the pH and pOH, so the solution must be neutral.