

## pH Answers

1. Convert the following Hydrogen ion concentrations (all in mol dm<sup>-3</sup>) into pHs.

a)  $-\log(0.01) = 2$

b)  $-\log(7.50 \times 10^{-10}) = 9.12$

c)  $-\log(3.00 \times 10^{-4}) = 3.52$

2. Convert the following pHs into Hydrogen ion concentrations in mol dm<sup>-3</sup>

a)  $10^{-1.20} = 0.0631$

b)  $10^{-8.40} = 3.98 \times 10^{-9}$

c)  $10^{-13.0} = 1 \times 10^{-13}$

3. What is the pH of 0.01 mol dm<sup>-3</sup> Sulphuric Acid, H<sub>2</sub>SO<sub>4</sub>.

$$2 \times 0.01 = 0.02$$

$$-\log(0.02) = 1.7$$

4. Calculate the pH of pure Water at 15°C. ( $K_w = 4.52 \times 10^{-15}$  mol<sup>2</sup> dm<sup>-6</sup>).

$$4.52 \times 10^{-15} = [\text{H}^+] [\text{OH}^-] \text{ OR } 4.52 \times 10^{-15} = [\text{H}^+]^2$$

$$\sqrt{4.52 \times 10^{-15}} = [\text{H}^+] \quad [\text{H}^+] = 6.72 \times 10^{-8}$$

$$-\log(6.72 \times 10^{-8}) = 7.17$$

5. What is the pH of 0.10 mol dm<sup>-3</sup> Sodium Hydroxide solution, NaOH. ( $K_w = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ ).

$$\begin{aligned}K_w &= [\text{H}^+][\text{OH}^-] & 1 \times 10^{-14} &= [\text{H}^+] (0.10) \\1 \times 10^{-14} / 0.10 &= [\text{H}^+] & [\text{H}^+] &= 1 \times 10^{-13} \\-\log(1 \times 10^{-13}) &= 13\end{aligned}$$

6. What is the pH of 0.0150 mol dm<sup>-3</sup> Calcium Hydroxide solution, Ca(OH)<sub>2</sub>. ( $K_w = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ ).

$$\begin{aligned}K_w &= [\text{H}^+][\text{OH}^-] & 1 \times 10^{-14} &= [\text{H}^+] (0.0150 \times 2) \\1 \times 10^{-14} / 0.030 &= [\text{H}^+] & [\text{H}^+] &= 3.33 \times 10^{-13} \\-\log(3.33 \times 10^{-13}) &= 12.48\end{aligned}$$

7. What is the pH of 0.01 mol dm<sup>-3</sup> Ethanoic acid. ( $K_a = 1.74 \times 10^{-5} \text{ mol dm}^{-3}$ )

$$\begin{aligned}K_a &= [\text{H}^+] [\text{CH}_3\text{COO}^-] / [\text{CH}_3\text{COOH}] & 1.74 \times 10^{-5} &= [\text{H}^+]^2 / 0.01 \\1.74 \times 10^{-5} \times 0.01 &= [\text{H}^+]^2 & [\text{H}^+]^2 &= 1.74 \times 10^{-7} \\\sqrt{1.74 \times 10^{-7}} &= [\text{H}^+] & [\text{H}^+] &= 4.17 \times 10^{-4} \\-\log(4.17 \times 10^{-4}) &= 3.38\end{aligned}$$

8. What is the pH of 0.05 mol dm<sup>-3</sup> Methanoic acid, HCOOH, if its pK<sub>a</sub> is 3.75?

$$\begin{aligned}10^{-3.75} &= K_a & K_a &= 1.778 \times 10^{-4} \\K_a &= [\text{H}^+] [\text{HCOO}^-] / [\text{HCOOH}] & 1.778 \times 10^{-4} &= [\text{H}^+]^2 / 0.05 \\1.778 \times 10^{-4} \times 0.05 &= [\text{H}^+]^2 & [\text{H}^+]^2 &= 8.89 \times 10^{-6} \\\sqrt{8.89 \times 10^{-6}} &= [\text{H}^+] & [\text{H}^+] &= 2.98 \times 10^{-3} \\-\log(2.98 \times 10^{-3}) &= 2.53\end{aligned}$$