

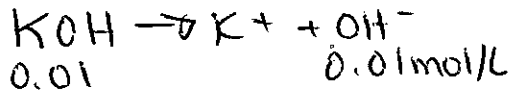
Acid-Base Water, pH and pOH Worksheet

Name _____

1. Assuming 100% ionization of HCl in dilute solutions, what is the pH of 0.010 M HCl?

$$\text{pH} = 2.00$$

2. Determine the $[\text{OH}^-]$, $[\text{H}_3\text{O}^+]$, pOH and pH of a 0.01 mol/L KOH solution.

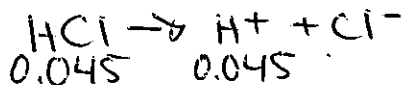


$$\hookrightarrow \text{pOH} = 2$$

$$\text{pH} = 12$$

$$[\text{H}_3\text{O}^+] = 1 \times 10^{-12}$$

3. Determine the $[\text{OH}^-]$, $[\text{H}_3\text{O}^+]$, pOH and pH of a 0.045 mol/L HCl solution.



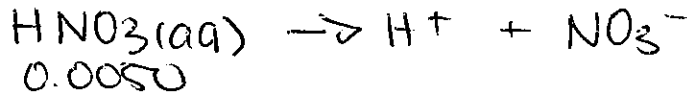
$$\text{pH} = 1.35$$

$$\text{pOH} = 12.65$$

4. What is the $[\text{H}_3\text{O}^+]$ of a solution having a pH of 3.4?

$$3.4 \quad 4 \times 10^{-4} \text{ mol/L}$$

5. If nitric acid is 100% ionized in a 0.0050 M solution, what is the pH of this solution?

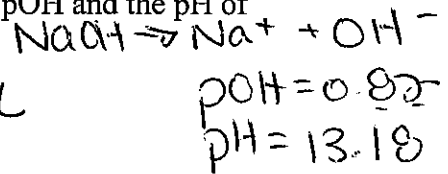


$$\text{pH} = 2.30$$

6. A sodium hydroxide solution is prepared by dissolving 6.0 g NaOH in 1.00 L of solution. Assuming that 100% dissociation occurs, what is the pOH and the pH of this solution? NaOH = 40 g/mol

$$\frac{40 \text{ g}}{1 \text{ mol}} = \frac{6.0 \text{ g}}{0.15}$$

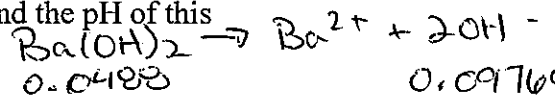
$$C = \frac{n}{V} = \frac{0.15}{1.0} = 0.15 \text{ mol/L}$$



7. A solution was made by dissolving 0.837 g Ba(OH)₂ in 100 mL final volume. If Ba(OH)₂ is fully broken up into its ions, what is the pOH and the pH of this solution?

Molar mass 171.35 g/mol

$$C = \frac{n}{V}$$



$$\frac{171.35 \text{ g}}{1 \text{ mol}} = \frac{0.837 \text{ g}}{0.00488}$$

$$= 0.00488$$

$$C = \frac{0.00488}{0.100} = 0.0488 \text{ mol/L}$$

$$\text{pOH} = 1.01$$

$$\text{pH} = 12.99$$

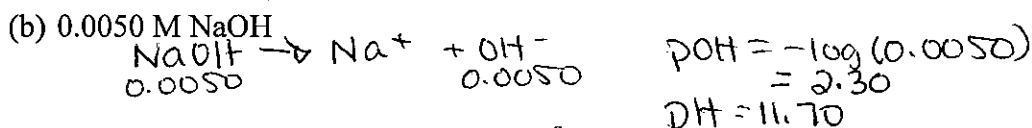
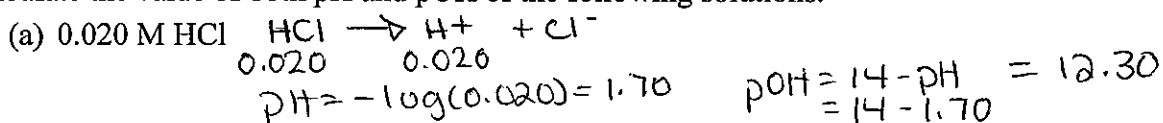
8. A certain brand of beer had a hydrogen ion concentration equal to 1.9×10^{-5} mol/L. What is the pH of this beer?

$$-\log(1.9 \times 10^{-5}) = 4.72$$

9. A soft drink was put on the market $[\text{H}^+] = 1.4 \times 10^{-5}$ mol/L. What is its pH?

$$\text{pH} = 4.85$$

10. Calculate the value of both pH and pOH of the following solutions.

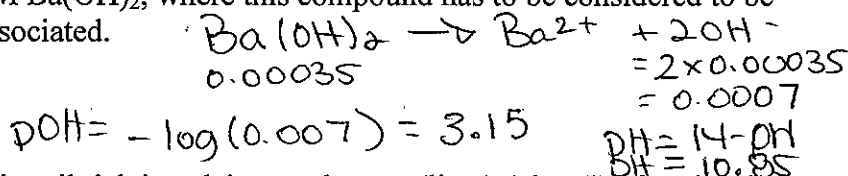


(c) A blood specimen containing 7.2×10^{-8} H⁺ mole/L. Is the blood specimen slightly acidic or slightly basic?

$$\text{pH} = -\log(7.2 \times 10^{-8}) = 7.14$$

↑ Slightly basic

(d) 0.00035 M Ba(OH)₂, where this compound has to be considered to be 100% dissociated.



11. "Calcareous soil is soil rich in calcium carbonate (lime). The pH of such soil generally ranges from just over 7 to as high as 8.3. What value of [H⁺] corresponds to a pH of 8.3? Is the soil slightly acidic or slightly basic?"

slightly basic

$$\text{pH} = 8.3$$

$$[\text{H}^+] = 10^{-8.3} = 5 \times 10^{-9} \text{ mol/L}$$

12. Find the values of [H⁺], pOH and [OH⁻] that correspond to each of the following values of pH.

(a) 2.90 (the approximate pH of lemon juice)
 $\text{pH} = 2.90$ $\text{pOH} = 14 - 2.90 = 11.10$

$$[\text{H}^+] = 10^{-2.90} = 1.3 \times 10^{-3} \text{ mol/L}$$

$$[\text{OH}^-] = 10^{-\text{pOH}} = 10^{-11.10} = 7.9 \times 10^{-12} \text{ mol/L}$$

(b) 3.85 (the approximate pH of sauerkraut)
 $\text{pH} = 3.85$ $\text{pOH} = 10.15$

$$[\text{H}^+] = 1.4 \times 10^{-4} \text{ mol/L} \quad [\text{OH}^-] = 7.1 \times 10^{-11} \text{ mol/L}$$

(c) 10.81 (the pH of milk of magnesia)

$$\text{pH} = 10.81 \quad \text{pOH} = 3.19$$

$$[\text{H}^+] = 1.5 \times 10^{-11} \text{ mol/L} \quad [\text{OH}^-] = 10^{-3.19} = 6.5 \times 10^{-4} \text{ mol/L}$$

(d) 4.11 (the pH of orange juice, on the average)

$$\text{pH} = 4.11 \quad \text{pOH} = 9.89$$

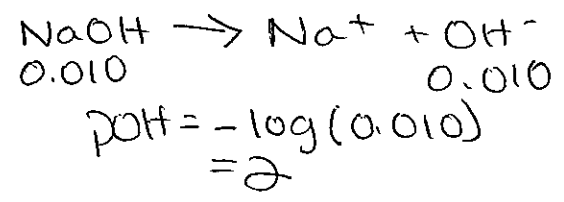
$$[\text{H}^+] = 7.8 \times 10^{-5} \text{ mol/L} \quad [\text{OH}^-] = 1.0 \times 10^{-10} \text{ mol/L}$$

→ weak acid

13. Estimate the percentage ionization of acetic acid in solutions with concentrations of (a) 0.010 M and (b) 0.0010 M.

1%

14. What is the pOH of a 0.010 M NaOH solution?

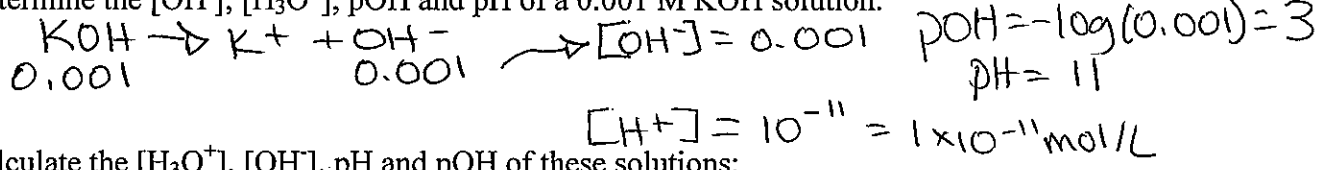


What is the pH of this solution?

$$\text{pH} = 14 - 2$$

$$\text{pH} = 12$$

15. Determine the [OH⁻], [H₃O⁺], pOH and pH of a 0.001 M KOH solution.



16. Calculate the [H₃O⁺], [OH⁻], pH and pOH of these solutions;

a) 1.0 M HCl,

b) 0.50 M HNO₃,

c) 0.0020 M HClO₄,

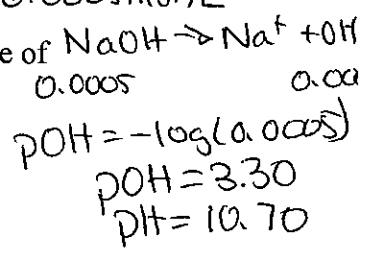
d) a solution prepared by dissolving 0.040 g NaOH in 2.0 L of solution,

Molar mass = 40 g/mol

$$\frac{40 \text{ g}}{1 \text{ mol}} = \frac{0.040 \text{ g}}{? \text{ mol}} \quad \text{mol} = 0.001 \text{ moles}$$

$$C = \frac{n}{V} = \frac{0.001 \text{ mol}}{2.0 \text{ L}} = 0.0005 \text{ mol/L}$$

e) a solution prepared by diluting 1.0 mL of 0.20 M HCl to a total volume of 5.0 L,



f) a solution made by dissolving 0.10 mol Na₂O in 1.0 L of solution.

$$[\text{H}^+] = 2 \times 10^{-11} \text{ mol/L}$$

find pH
 $\text{pH} = -\log[\text{H}^+]$
 then pOH
 $[\text{OH}^-] = 10^{-\text{pOH}}$