

Acids and Bases Workbook 1

Unit 5 - Acids and Bases Learning outcomes

1. Defining acids and bases based on Arrhenius and Bronsted and Lowry
2. Write balanced acid/base chemical equations (Conjugate acid/base pairs and amphoteric behavior)
3. Describe the relationship between $[H^+]$ and $[OH^-]$ in water (K_w)
4. Describe how acid/base indicator works in terms of Le Chatelier's
5. Solve problems involving pH
6. Distinguish between weak and strong aqueous solutions (base and acids)
7. Write equilibrium expression (K_a or K_b) from a balanced chemical equation
8. Use K_a or K_b to solve problems for pH, percent dissociation and concentration.
9. Titration
10. Predict whether an aqueous solution of a given ionic compound will be acidic, basic or neutral given the formula.
- 11.

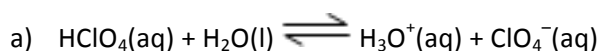
Classify each of the following as either an acid or a base:

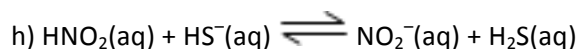
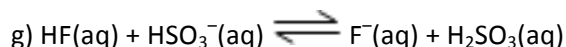
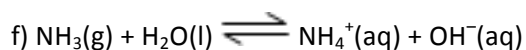
a. The substance has a bitter taste	
b. H_2SO_4	
c. HNO_3	
d. litmus paper dipped in this turns red	
e. reacts with active metals to produce hydrogen gas	
f. KOH	
g. NH_3	
h. has a slippery feel	
i. has a sour taste	
j. a proton donor	
k. a proton acceptor	

Arrange the following $[H^+]$ from the weakest to strongest acid

1. 4.6×10^{-4} , 6.3×10^{-7} , 7.2×10^{-1} , 6.6×10^{-5}
2. 7.4×10^{-13} , 6.4×10^{-2} , 6.8×10^{-10} , 5.3×10^{-4}

Identify the acid, base, conjugate acid and conjugate base for each of the following.





Calculating Kw and concentrations

1. What is the hydroxide ion concentration in a solution with an hydronium concentration of 6.80×10^{-10} mol/L?
2. What is the $[\text{H}_3\text{O}^+]$ in a solution with $[\text{OH}^-]$ of 5.67×10^{-3} ?
3. If the $[\text{H}_3\text{O}^+]$ in a nitric acid solution is 0.0020 mol/L, what is the $[\text{OH}^-]$?
4. If the $[\text{OH}^-]$ in a sodium hydroxide solution is 0.050 mol/L, what is $[\text{H}_3\text{O}^+]$?
5. 0.25 moles of hydrogen chloride gas is dissolved in 2.0 L of water. Write the dissociation equation for this gas and calculate both $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$.
6. 10.0 g of lithium hydroxide is dissolved in 750 mL of water. Write the dissociation equation and calculate both $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$.
7. 10.0 g of calcium hydroxide is dissolved in 400.0 mL of solution. Write the dissociation equation and calculate both $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$.
8. If the $[\text{H}_3\text{O}^+]$ of a barium hydroxide solution is 1.0×10^{-13} mol/L, calculate the $[\text{OH}^-]$. How many grams of barium hydroxide must have been used to make a Litre of this solution?

9. Calculate the $[H_3O^+]$ in milk of magnesia (magnesium hydroxide) that has an $[OH^-]$ of 1.43×10^{-4} mol/L.

Calculating pH and concentrations

Answer the following questions. Be sure to show all your work.

1. Determine the pH of each of the following values

- a. $[H^+] = 1.0 \times 10^{-6}$
- b. $[H^+] = 1.0 \times 10^{-8}$
- c. $[OH^-] = 1.0 \times 10^{-2}$
- d. $[OH^-] = 1.0 \times 10^{-5}$
- e. $[H^+] = 2.0 \times 10^{-3}$
- f. $[H^+] = 3.5 \times 10^{-4}$
- g. $[OH^-] = 7.50 \times 10^{-7}$
- h. $[OH^-] = 9.0 \times 10^{-9}$

2. Determine the concentration of $[H^+]$ of each of the following.

- a. pH = 7.00
- b. pOH = 5.00
- c. pH = 13.00
- d. pOH = 11.00
- e. pH = 3.40
- f. pOH = 6.10
- g. pH = 8.90
- h. pOH = 13.80

3. Determine the pOH of the following if the pH is given

- a. pH = 5.40
- b. pH = 8.60
- c. pH = 2.90

d. pH = 12.60

4. Determine the concentration of the OH^- ions in the solutions with the following pH values.

a. pH = 4.10

b. pH = 5.10

c. pH = 1.60

d. pH = 9.20

5. Calculate pH of each of the following solutions.

a. 0.0020 mol/L HCl

b. 0.050 mol/L NaOH

c. 4.0×10^{-4} mol/L $\text{Ba}(\text{OH})_2$

d. 0.50 mol/L HNO_3

6. Calculate pH and pOH of the following solutions

a. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-5}\text{M}$

b. $[\text{OH}^-] = 7.53 \times 10^{-3}\text{M}$

c. $[\text{OH}^-] = 4.9 \times 10^{-6}\text{M}$

d. $[\text{H}_3\text{O}^+] = 12.5\text{M}$

e. $[\text{OH}^-] = 0.0125\text{M}$

f. $[\text{H}_3\text{O}^+] = 1.0\text{M}$

7. What are the $[\text{H}^+]$ and $[\text{OH}^-]$ in a healthy person's blood that has a pH of 7.40? Assume that the temperature is 298K.