

## What are Acids & Bases?

## Practice Problem set

1. List four characteristic properties of acids and four characteristic properties of bases.

Acids	Bases

2. Fill in the chart below by providing simple definitions.

	Acid	Base
Arrhenius's Definition		
Brønsted-Lowry Definitions		

3. a. Write the correct symbol for the hydrogen ion: \_\_\_\_\_  
b. Write the correct symbol for a hydronium ion: \_\_\_\_\_
4. Define the term ***amphiprotic***.
5. Write balanced equations for the:
- a. Dissociation of calcium hydroxide,  $\text{Ca}(\text{OH})_2$
- b. Ionization of nitric acid,  $\text{HNO}_3$
6. Write the equation for the ionization of nitric acid,  $\text{HNO}_3$ , showing the formation of the hydronium ion.

7. Identify the hydrogen-ion donor & acceptor (present on the reactant side of each equation) in each of the following reactions:

	<b>H<sup>+</sup> donor (the acid)</b>	<b>H<sup>+</sup> acceptor (the base)</b>
a. $\text{HNO}_3(l) + \text{H}_2\text{O}(l) \rightarrow \text{H}_3\text{O}^+(aq) + \text{NO}_3^-(aq)$		
b. $\text{C}_2\text{H}_5\text{NH}_2(l) + \text{H}_2\text{O}(l) \rightarrow \text{C}_2\text{H}_5\text{NH}_3^+(aq) + \text{OH}^-(aq)$		
c. $\text{CH}_3\text{CO}_2\text{H}(l) + \text{H}_2\text{O}(l) \rightarrow \text{CH}_3\text{CO}_2^-(aq) + \text{H}_3\text{O}^+(aq)$		

8. For each acid listed in question 7, identify its conjugate base.

<b>Acid (Reactant side of equation)</b>	<b>Conjugate Base</b>
a.	
b.	
c.	

9. Write the formulas for the conjugate base of each of the following acids.

a. $\text{H}_2\text{SO}_3$	b. $\text{HCO}_3^-$	c. $\text{NH}_4^+$

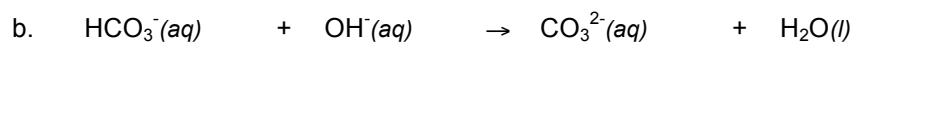
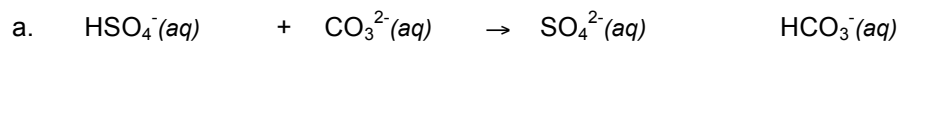
10. Write the formulas for the conjugate acid of each of the following bases.

a. $\text{H}_2\text{O}$	b. $\text{CO}_3^{2-}$	c. $\text{PH}_3$

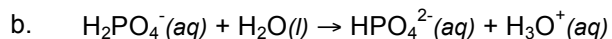
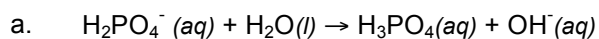
11. Which of the following would you expect to act as Brønsted-Lowry bases:

- a)  $\text{Br}^-$     b)  $\text{Li}^+$     c)  $\text{H}_3\text{PO}_4$     d)  $\text{NH}_4^+$     e)  $\text{H}_2\text{O}$     f)  $\text{NH}_2^-$

12. For each of the following reactions, identify the Brønsted-Lowry acid and Brønsted-Lowry base on the reactant side of the equation, and the conjugate acid and conjugate base on the product side.



13. Consider the following two reactions. In which reaction does  $\text{H}_2\text{PO}_4^-$  act as a base? In which does it act as an acid?



**Is  $\text{H}_2\text{PO}_4^-$  an acid or base?**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_