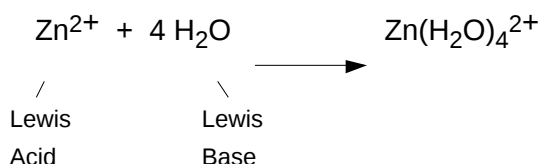


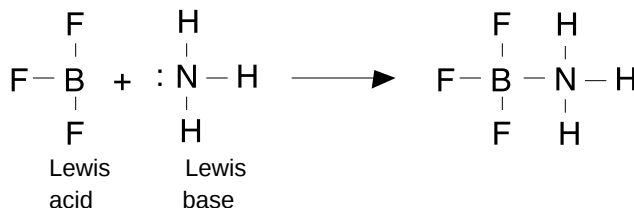
There are three definitions for acids and bases. They are historically and practically based. The newest, the Lewis definition, is the most general, but it is a little more abstract. So the oldest, the Arrhenius definition, the most limiting but easiest to understand, is still kicking around. The intermediate one, Brønsted-Lowry, is both easy and fairly general so it's a popular in-between. The long and short of it is that you could use the Lewis definition all of the time, but it is not quite friendly enough so the other two are still hanging on—it's like buying new sneakers.

- Arrhenius Concept:** Acids dissociate to produce H^+
Bases dissociate to produce OH^-
Works for the basics HCl , H_2SO_4 , NaOH but doesn't work for NH_3 , etc.
- Brønsted-Lowry Concept:** An acid is a substance that can donate a proton (H^+) and a base is a substance that can accept a proton. (This is the conjugate acid-base pair idea)
Works for NH_3 but doesn't work for metal hydroxides or other things that react with H_2O to form H^+
- Lewis Concept:** Acids are electron pair acceptors
Bases are electron pair donors
Works for everybody

(These can be kind of weird, like:



Or



Water Dissociation: You've got to be very good at the mechanics of converting between pH , pOH , $[\text{H}^+]$, and $[\text{OH}^-]$.

(Know how to go from one to another)

Know Water Equilibrium

$$K_w = [\text{H}^+][\text{OH}^-] = 10^{-14}$$

To "p" something in chemistry means to take the negative logarithm base 10.

So,

$$\text{pH} = -\log[\text{H}^+]$$

$$\text{pOH} = -\log[\text{OH}^-]$$

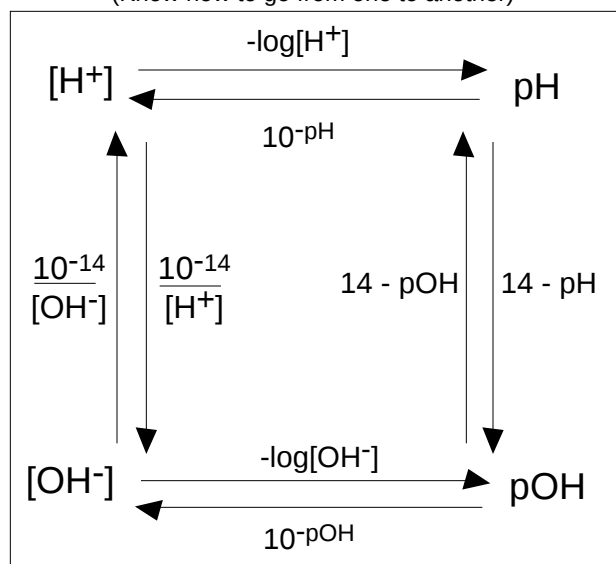
$$\text{pbrain} = -\log[\text{brain}]$$

Using log rules and the K_w expression you can see where: $\text{pH} + \text{pOH} = 14$

Exponentiation is the inverse operation of taking a log, so:

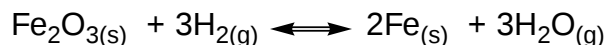
$$[\text{H}^+] = 10^{-\text{pH}}$$

$$[\text{OH}^-] = 10^{-\text{pOH}}$$



Student Packet: 6.1: The Basics: AssessMe questions

- 1) If $\text{H}_2\text{O}_{(g)}$ is removed, the following equilibrium will



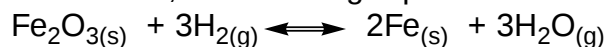
$\Delta H = 15 \text{ kJ}$

A) Shift left
C) No change

B) Shift right
D) Not possible to predict

E) I'm clueless

- 2) If the temperature is increased, the following equilibrium will



$\Delta H = 15 \text{ kJ}$

A) Shift left
C) No change

B) Shift right
D) Not possible to predict

E) I'm clueless

- 3) The acid HX has an equilibrium constant of 1×10^{-4} . A solution is 0.1 M in HX and 1 M in the salt NaX. What is a close approximation of the hydrogen ion concentration?

A) 10^{-3} M

B) $2 \times 10^{-3} \text{ M}$

C) 10^{-5} M

D) 10^{-8} M

E) I'm clueless

- 4) What is the pH of a solution that has a hydroxide concentration of .01 M?

A) 2
C) 12

B) -2
D) -12

E) I'm clueless

- 5) How many moles of pure NaOH must be used to prepare 10.0 L of a solution that has a pH of 13.00?

A) 1.0 mol

B) 0.10 mol

C) 0.011 mol

D) 0.0010 mol

E) I'm clueless

- 6) What is the pH of a 0.20 M solution of the hypothetical strong acid HZ?

A) 0.7

B) 2

C) -2

D) 12

E) I'm clueless

Student Packet: 6.1: The Basics: ShowMe questions

1) Match the following species with their definitions:

- | | |
|------------------------|-------------------------------|
| a. Arrhenius acid | 1. Electron pair acceptor |
| b. Arrhenius base | 2. Proton donor |
| c. Brønsted-Lowry acid | 3. Producer of hydroxide ions |
| d. Brønsted-Lowry base | 4. Electron pair donor |
| e. Lewis acid | 5. Producer of hydronium ions |
| f. Lewis base | 6. Proton acceptor |

2) Given the following numbers, determine the missing values.

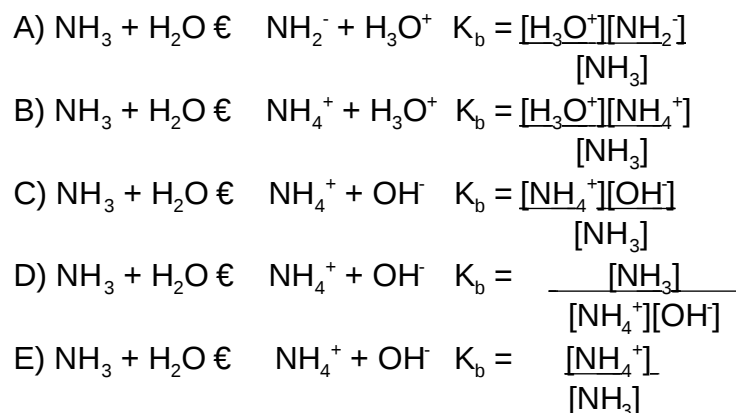
[H ⁺]	[OH ⁻]	pH	pOH
	1 x 10 ⁻⁹		
		2	
			5
1 x 10 ⁻⁹			

3) A micropipette is used to measure 2×10^{-3} ml of .01 M HCl. The HCl is mixed with 2 L of water. What is the pH of the solution?

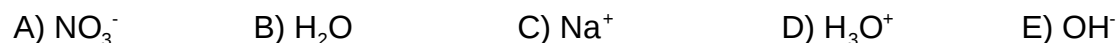
4) Find the H⁺ concentration, OH⁻ concentration, pH and pOH of a 1.0 M H₂SO₄ solution.

Student Packet: 6.1: The Basics: TestMe questions

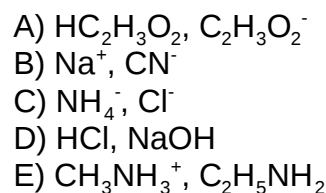
- 1) Which of the following correctly illustrates the reaction of ammonia with water and the corresponding equilibrium constant expression?



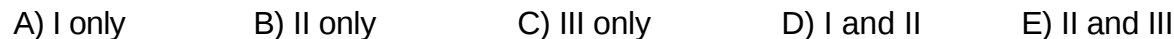
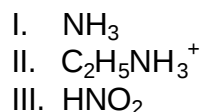
- 2) Which species is most likely to function as both an acid and a base?



- 3) Which of the following is a conjugate acid-base pair?



- 4) According to the Brønsted-Lowry definition of acids and bases, which of the following should behave as acids?



- 5) Solution A has a pH of 5.6. Solution B has a pH of 4.4. What is the ratio of $[\text{OH}^-]_A/[\text{OH}^-]_B$?

