

LESSON
120

CLASSWORK

How Favorable Equilibrium Constant K

Name _____

Date _____ Period _____

Purpose

To examine what the equilibrium constant, K , measures.

Part I: Acid Dissociation

You have been given solutions cards used in the Toxins unit to answer these questions.

- Sort the 5 solution cards from lowest pH to highest pH. [Recall that pH decreases as the concentration of H^+ increases.]
- When an acid is placed in water, the acid breaks apart to H^+ and an anion, A^- . This is called *dissociation*. Which acid dissociation processes represented on the cards do you think are reversible? Explain your thinking.
- In the table, for each of the solutions on the 5 cards, write the chemical equation that shows the acid-dissociation reaction. Use a single arrow if the reaction is not reversible. Use a double arrow if the reaction is reversible.

#	Solution	Solution molarity	Chemical equation
1	Hydrochloric acid	0.010 M	$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$
2	Hydrochloric acid	0.005 M	
3	Hydrochloric acid	0.001 M	
4	Formic acid	0.010 M	
5	Acetic acid	0.010 M	

Part 2: Equilibrium Constant

For acids, the *equilibrium constant*, K , is a number that indicates the extent to which the acid dissociates to form the product ions. The table on the next page provides data for several acids. Recall that the brackets, [], around the letters indicate the concentration at equilibrium. Review the table and look for patterns.

#	Solution	Formula	Solution molarity	[HA]	[H ⁺]	[A ⁻]	K	pH
1	Hydrochloric acid	HCl	1.0 M	~0 M	1.0 M	1.0 M	1,300,000	0
2	Hydrochloric acid	HCl	0.50 M	~0 M	0.50 M	0.50 M	1,300,000	0.30
3	Hydrochloric acid	HCl	0.10 M	~0 M	0.10 M	0.10 M	1,300,000	1.0
4	Formic acid	HCOOH	1.0 M	0.99 M	0.013 M	0.013 M	0.00018	1.9
5	Acetic acid	CH ₃ COOH	1.0 M	1.0 M	0.0042 M	0.0042 M	0.000018	2.4

- Make a list of at least 5 patterns that you observe in the table above.
- How does the equilibrium constant, K , relate to the amount of ion products in an acid solution?
- The 0.1 M HCl solution is less concentrated compared with 1.0 M CH₃COOH solution. Why is the concentration of H⁺ larger in the 0.1 M HCl solution?
- Making Sense** The H⁺ concentration of a weak acid solution depends on both the solution molarity and the equilibrium constant, K . Explain why.