

**ALAYEN IRAQI UNIVERSITY**  
**Health and Medical Technologies**  
**Anesthesia Department**



# **Acid- Base Balance**

## **General Chemistry**

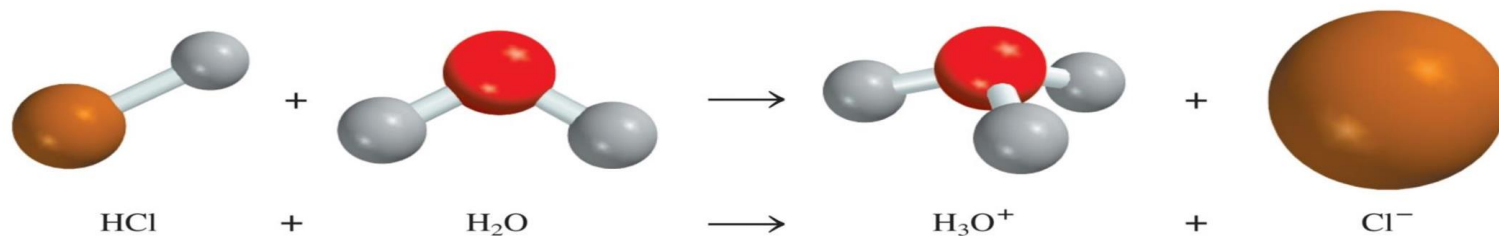
### **Lec 6**

## Acids and Bases: Arrhenius Definition

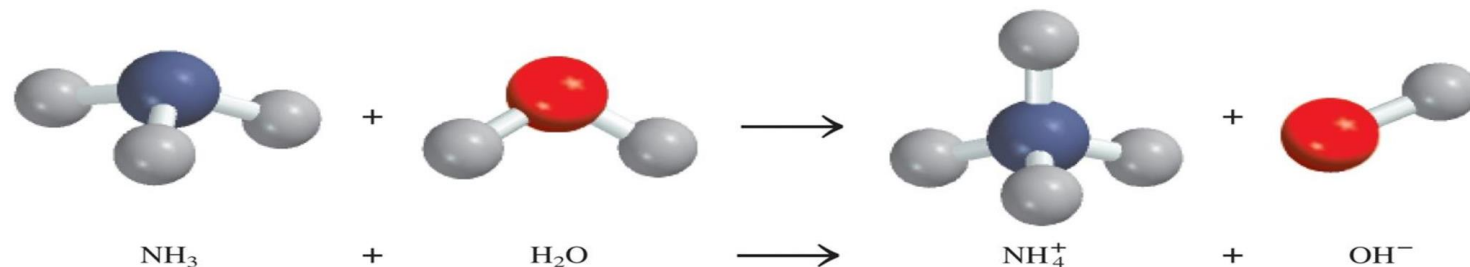
- An **acid** is a substance that take apart in water to yield  $\text{H}_3\text{O}^+$ .
- A **base** is a substance that take apart in water to yield  $\text{OH}^-$ .
- This explains why all neutralization reactions between strong acids and bases and have similar heats of reaction:



**Arrhenius acid** is a substance that produces  $\text{H}^+$  ( $\text{H}_3\text{O}^+$ ) in water.



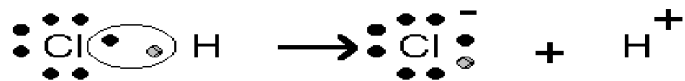
**Arrhenius base** is a substance that produces  $\text{OH}^-$  in water.



**Brønsted and Lowry proposed a more general definition...**

# Brønsted Acids

**Brønsted Acids**- able to donate protons in the form of hydrogen ions – protons –  $H^+$ .



**Typically :**

- have a sour taste (vinegar-acetic acid, lemons-citric acid)
- change the color of litmus from blue to red.
- react with carbonates to produce  $CO_2$ .



- react with metals to produce hydrogen gas.



- aqueous acidic solutions conduct electricity



# Brønsted Bases

**Bronsted Base-** able to accept protons in the form of hydrogen ions or  $H^+$ .



**Typically :**

- have a bitter taste (antacids- $Mg(OH_2)$ ).
- change the color of litmus from red to blue.
- feel slippery (turns your cells and fat into soap!).



# Lewis Acids and Bases

A **Lewis acid** is a substance that accepts a pair of electrons to form a covalent bond ( ex;  $\text{CCl}_4$ )

A **Lewis base** is a substance that donates a pair of electrons to form a covalent bond ( ex;  $\text{NH}_3$ )

a Lewis acid-base reaction is represented by the transfer of a pair of electrons from a base to an acid

## Summary

**Acids are H<sup>+</sup> donors.**

**Bases are H<sup>+</sup> acceptors, or give up OH<sup>-</sup> in solution.**

**Acids and bases can be:**

**Strong** – take apart completely in solution

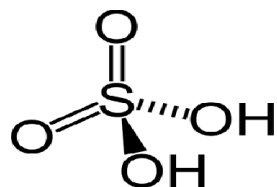
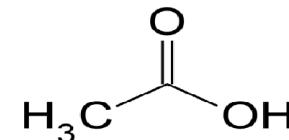
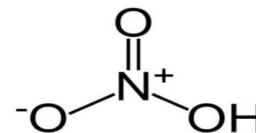
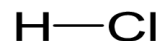
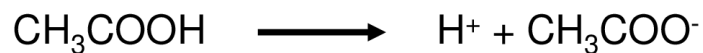
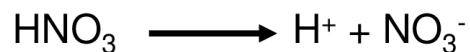
HCl, NaOH

**Weak** – take apart only partially in solution

Lactic acid, carbonic acid

## Mono- and Polyprotic Acids

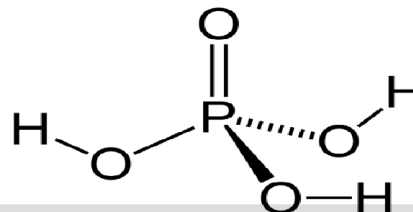
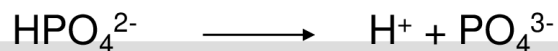
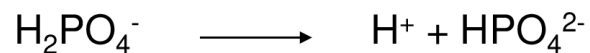
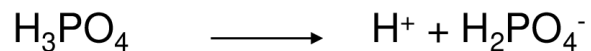
### *Monoprotic* acids



### *Diprotic* acids



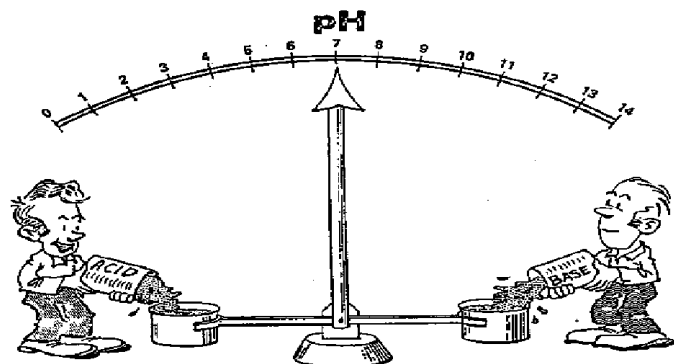
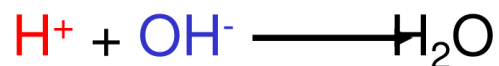
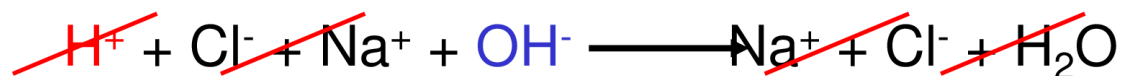
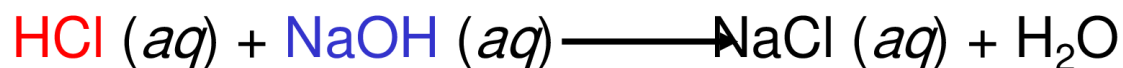
### *Triprotic* acids



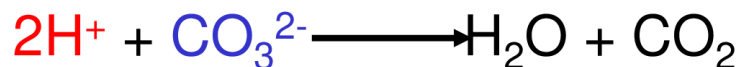
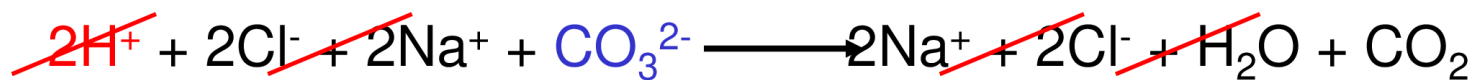
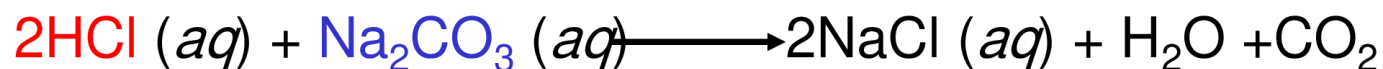


# Acid-Base Neutralization

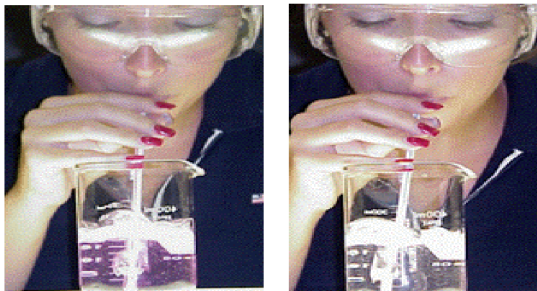
acid + base  $\longrightarrow$  salt + water



# Acid-Base Neutralization



## Magic Breath



Phenolphthalein in limewater, a base

Carbon dioxide in breath acts as an acid to neutralize base

Dr. ahmed jaber ibrahim

C. Ophardt, c. 2003

# pH Review

**pH** : is the negative log of the hydrogen ion concentration

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

$\text{H}^+$  is really a proton

**Range is from 0 - 14**

If  $[\text{H}^+]$  is high, the solution is acidic;  $\text{pH} < 7$

If  $[\text{H}^+]$  is low, the solution is basic or alkaline ;  $\text{pH} > 7$

# pH Value

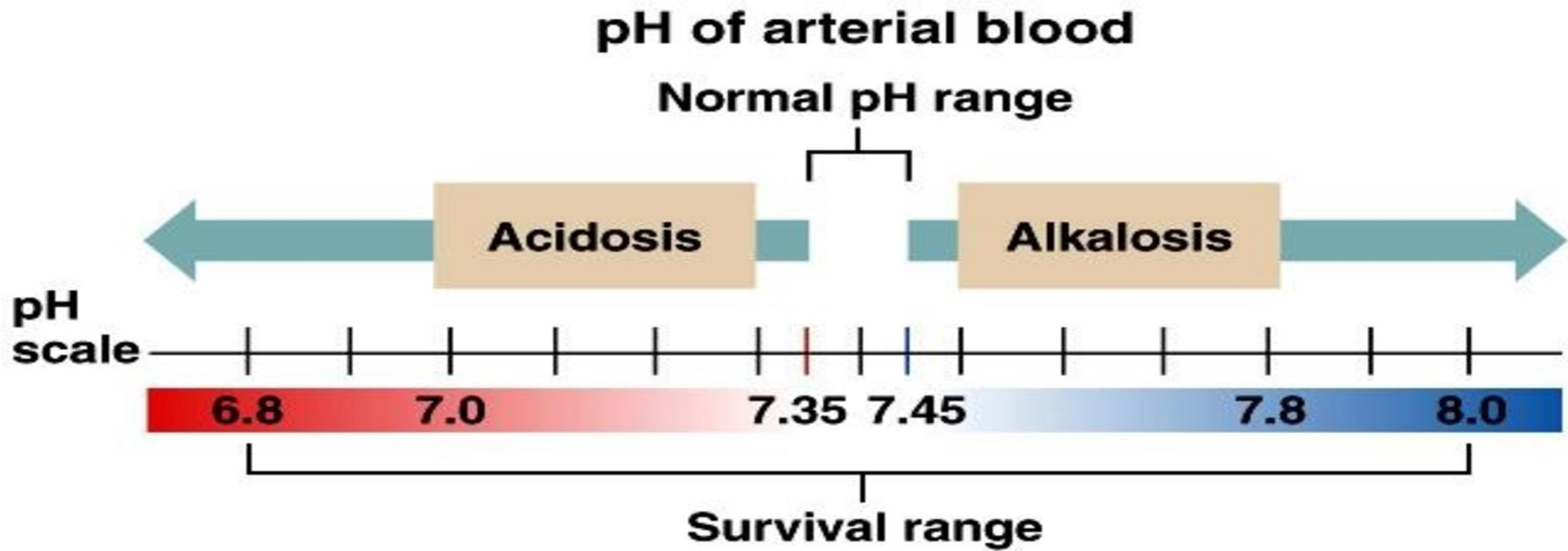
is neutral 7

is acidic  $7 >$

is basic  $7 <$

**High  $H^+$  ion concentration = low pH ➤**

**Low  $H^+$  ion concentration = high pH ➤**



# Small changes in pH can produce major disturbances

- Most enzymes function only with narrow pH ranges
- Acid-base balance can also affect electrolytes (Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>)
- Can also affect hormones

# The body produces more acids than bases

- Acids take in with foods
- Acids produced by metabolism of lipids and proteins
- Cellular metabolism produces  $\text{CO}_2$ .
- $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$

# THANK YOU!

!! ANY QUESTIONS  
PLEASE ASK