# Winemaking and pH

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**Outline:**

**pH**

What it is (and what it isn't).
Role of pH in winemaking.
pH meters and pH electrodes.
Calibrating pH meters and measuring pH of wine.

# pH: Its Role in Winemaking

- Needed to **manage sulfite** levels in wines. ***
- Predict **microbial stability** (< 3.65).
- Determine wine's potential for **MLF** (> 3.3).
- Guides choice of **wine style**.
- Predicts a wine's **potential for aging**.
- **Titration end-point** for red wines.
- Guides **cold stabilization** decisions for red wines.
- Viticulture: Some winegrowers determine **when to pick** their grapes based upon pH.

# pH: What is it?

- **pH** is an index that represents the concentration of "available" hydrogen ions ($H^+$) in an water based solution (e.g., wine).
- **$[H^+]$** = concentration of hydrogen ions (mol/L)

- **$pH = \log_{10}(1 / [H^+])$** = $-\log_{10}([H^+])$

  pH is inversely related to $H^+$ concentration
  ph is a logarithmic scale (1 unit = 10-fold change)

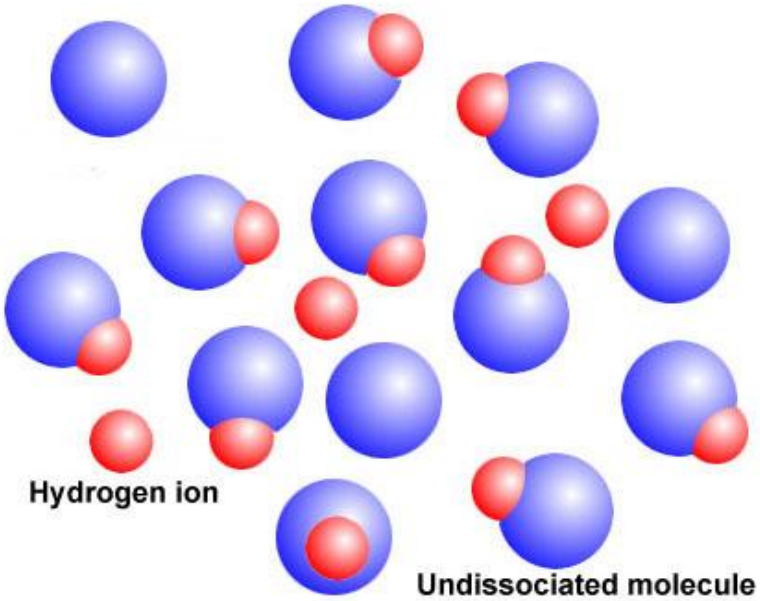
# pH: What is it?

- **pH** of "pure" water is 7
  $pH_{water} = \log(1/[H^+]) = \log(1/0.0000001)$
  $= \log(10{,}000{,}000) = 7$
- If [H+] is greater than water's, then its pH < 7. Such solutions are **acidic** (e.g., wine).
- If [H+] is less than water's, then its pH > 7. Such solutions are **basic** (i.e., alkaline).
- Wine pH typically falls between 3-4.

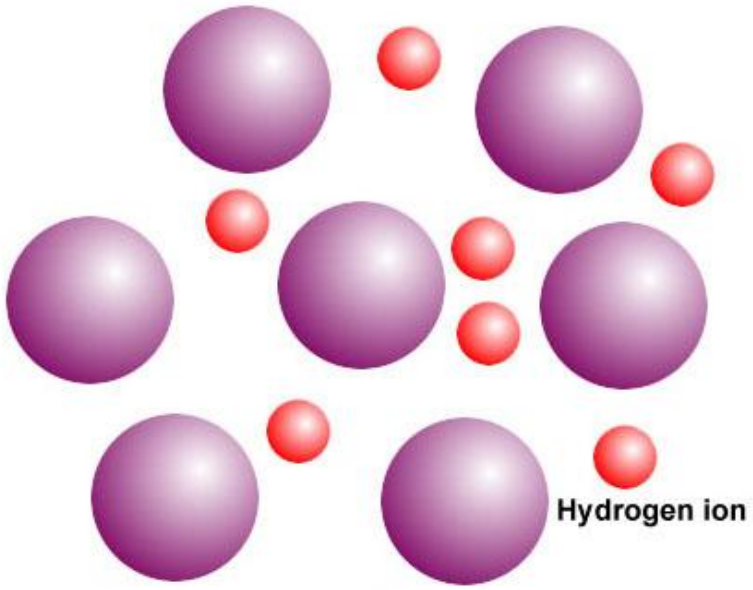
# pH: What it's Not!

- **pH** is not a measure of the **AMOUNT** of acid in a solution such as wine.
- Winemakers usually describe the AMOUNT of acid in solution in terms of Titratable Acidity expressed in grams/liter (Discussed below).
- **pH** is better conceptualized as a measure of the **STRENGTH** of an acid (The more easily an acid "donates" its $H^+$ ions in solution, the greater its relative reactivity).

# Concentration of $H^+$ = Acid Strength




Weak acids dissociate only slightly in aqueous solution. The majority of molecules remain undissociated.



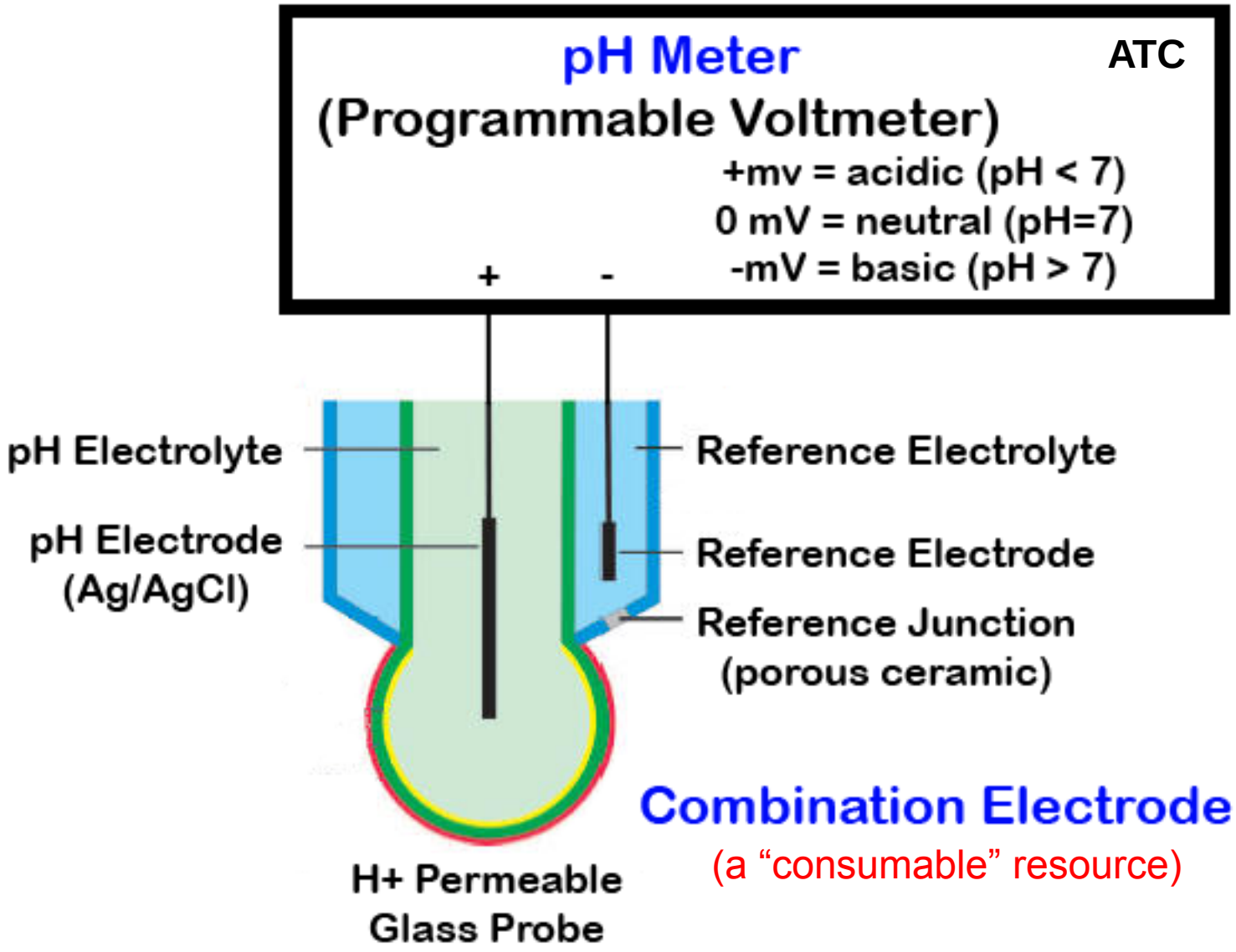

Strong acids are assumed to dissociate completely when in aqueous solution.

**Low [H+] = High pH**

**High [H+] = Low pH**

Source: http://www.chem.ubc.ca/courseware/pH

# Measuring pH



# Laboratory Quality pH Meter/Probe

(Yet, portable enough for field use)


High Quality “used” meters are readily available on eBay.

Caveat Emptor:
Most pH electrodes available on eBay are “expired”. It’s OK to look for a meter on eBay but buy a FRESH/NEW probe from a reliable retailer.

# pH Meter Calibration Video

**Youtube Video showing Calibration of Hanna portable pH Meter**
http://www.youtube.com/watch?v=0Y3-7idlcVw

# pH Electrode Maintenance

## Conditioning a New Probe/Electrode

- Rinse off dried crystals with water
  (Don’t rub with cloth or paper towel)
- Soak electrode in distilled water for 1 hour ***
- Soak in Buffer 4 for 5 min
- Soak in Buffer 7 for 5 min
- Calibrate

# pH Electrode Maintenance

## Short- and Long-Term Storage

- Never let glass “bulb” dry-out
- Store electrode in Storage Solution recommended by manufacturer or in Buffer 4
- For maximum lifespan: Replace storage solution every 6-8 weeks
- Never store electrode in water for more than an hour (especially distilled water). This will leach ions from internal electrolyte solution.

# pH Electrode Maintenance

## Sluggish or Drifting Performance

- Soak in 0.1 M HCl solution for 1 hour (Removes protein build-up from glass bulb)
- Soak in hot (50°C) Buffer 4 for 1 hour (Clear blockage from reference junction)
- Allow electrode to cool down and Recalibrate. If performance doesn't improve, it's probably time to secure a new pH electrode.