LabtronX

Water Analysis Equipment

Maintenance and Calibration

About LabtronX

- We keep your laboratory and monitoring equipment accurate and reliable
- Accuracy Assurance Program - Regularly scheduled calibration and maintenance on all your lab equipment and flow meters
- We make it easy and guarantee your satisfaction

About Eric Link

- Have worked at LabtronX for over 30 years
- Became the CEO about 10 years ago
- Bought the company from my father about 5 years ago
- Married with 6 kids
- Love sailing, the Preds, playing guitar, directing and writing plays, and my job.

What we will cover

Everything pH

What pH is

How do we measure pH

pH Calibration and Maintenance

Calibration and Maintenance Program

Information Overload Ahead

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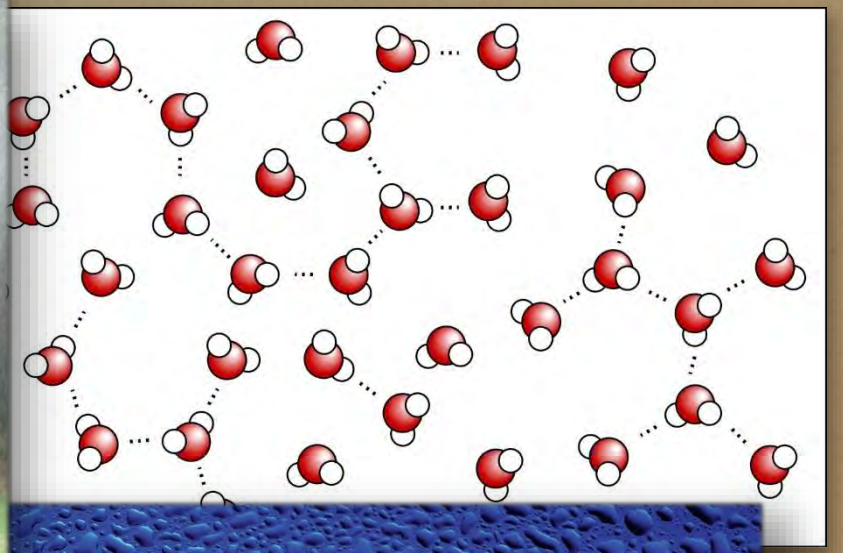
What pH is

Sorta

What is...



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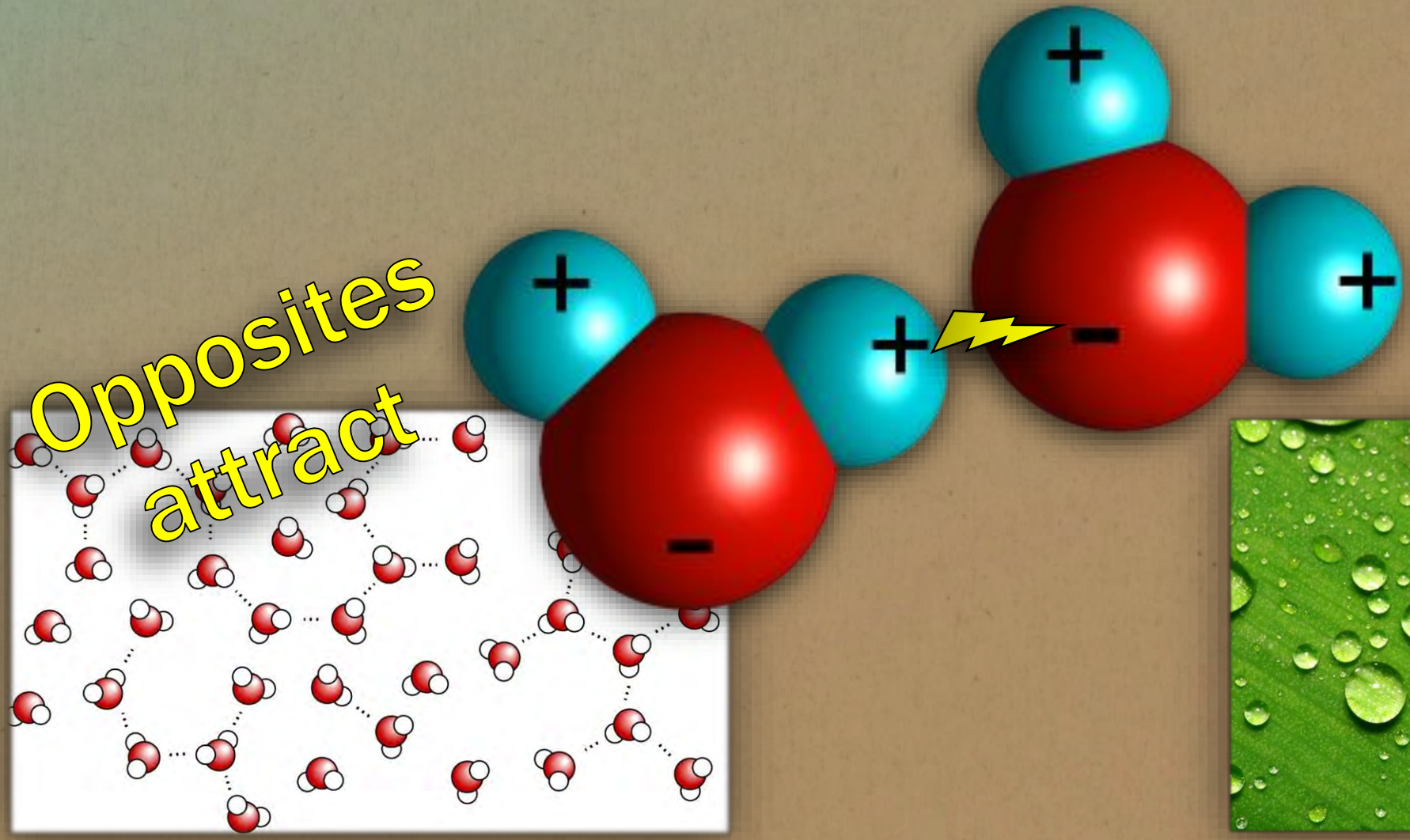
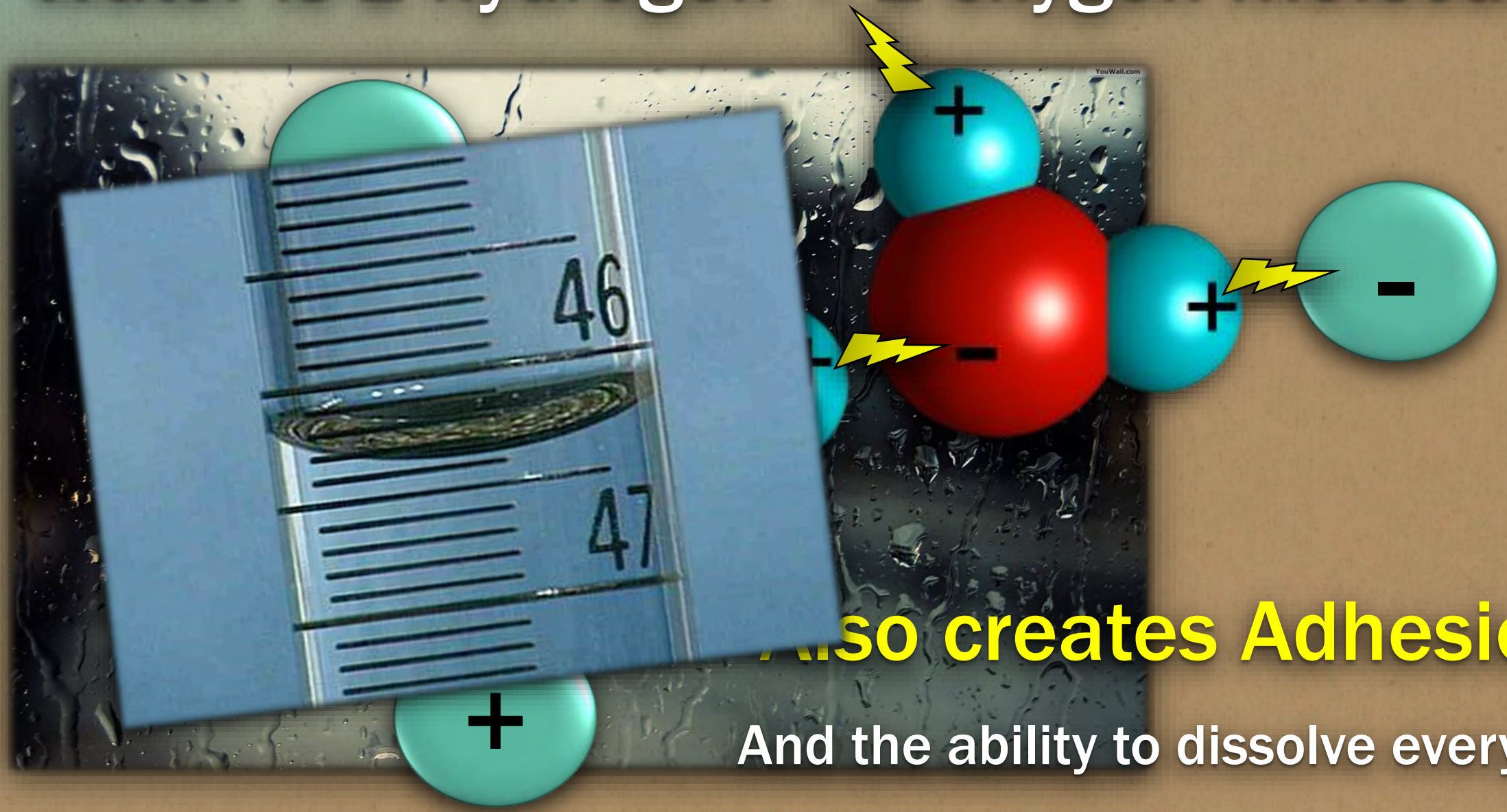
Water is 2 hydrogen + 1 oxygen molecules.



Opposites attract

Creates Cohesion

Water is 2 hydrogen + 1 oxygen molecules.



Also creates Adhesion

And the ability to dissolve everything!

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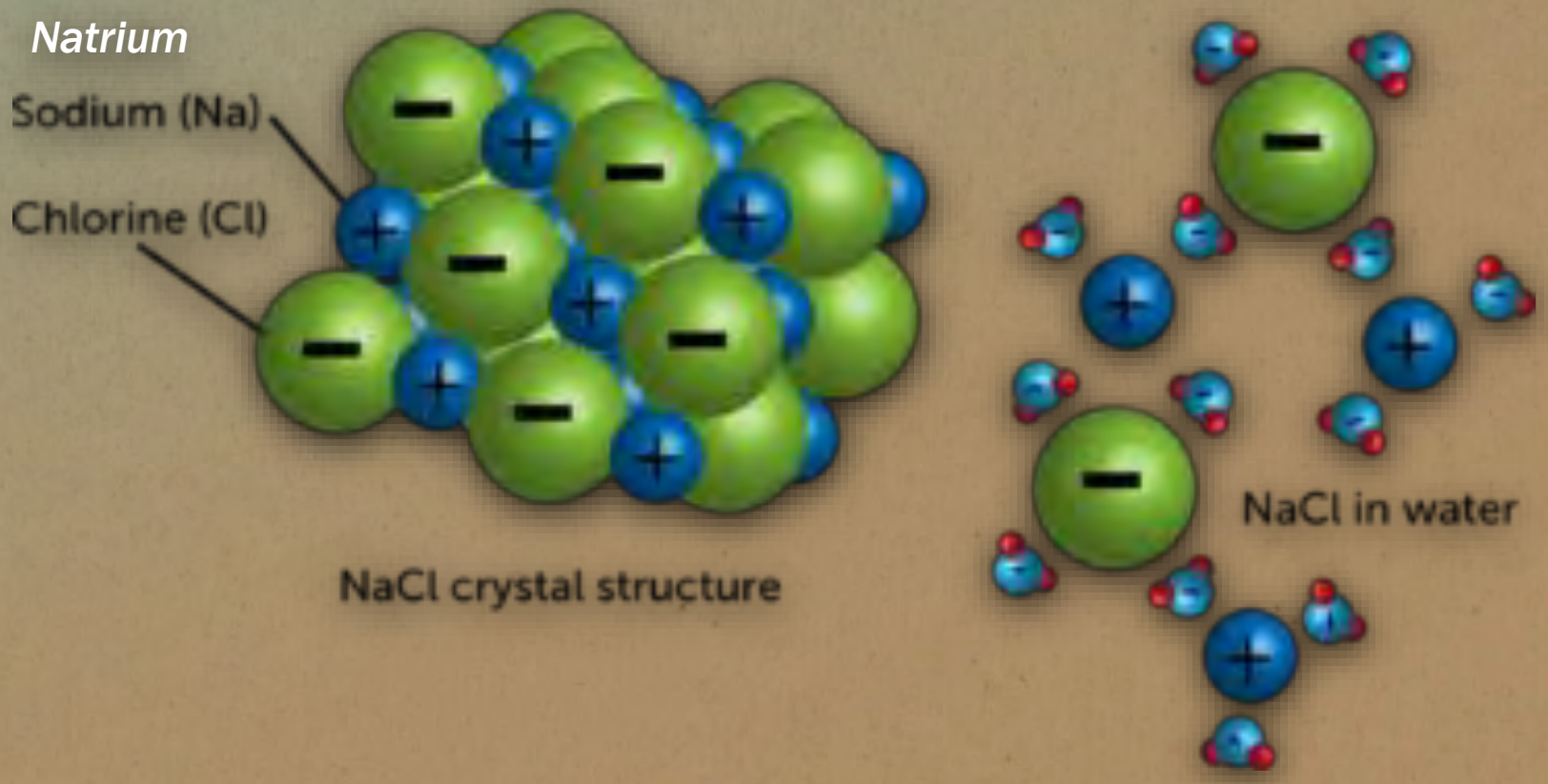
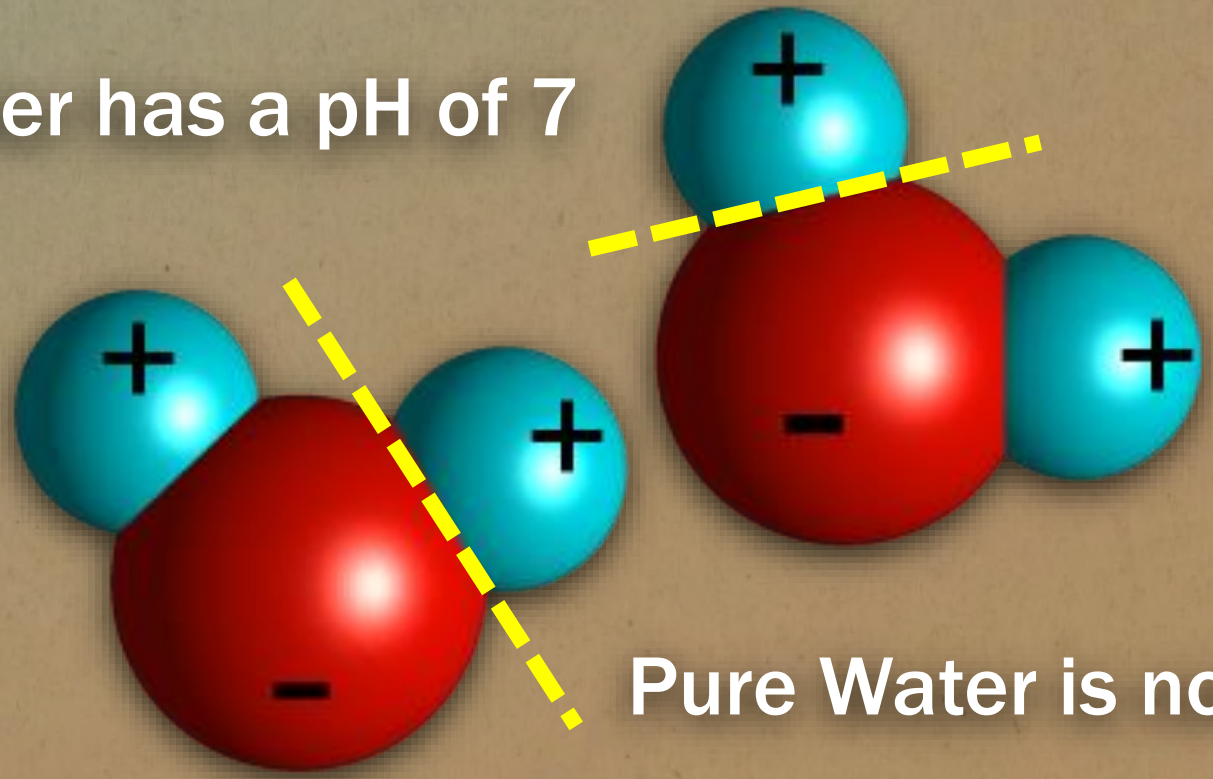
How Salt Dissolves in Water



Water is 1 Hydrogen + 1 Hydroxyl molecule.

Pure water has a pH of 7



Pure Water is non-conductive

Water dissolves everything!

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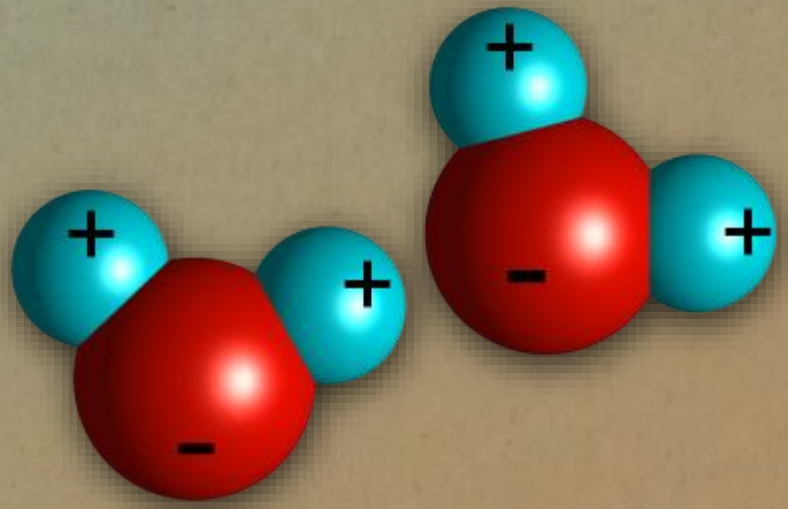
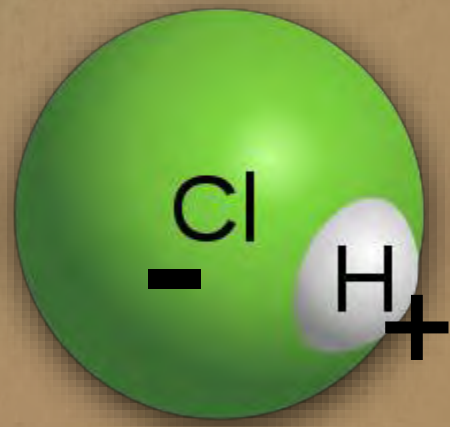
Even dogs dissolve in water!

What Happens?



Water

+



Hydrochloric Acid

Extra Hydrogen

1 H:1 OH = pH7

15 H:15000 OH = pH10

The ratio of H:OH determines the pH of the solution.

10 H:1 OH = pH6

1 H:10 OH = pH8

For every 10 times the number of one over the other equals one pH unit.

100 H:1000 OH = pH8

70000 H:70 OH = pH4

What is pH?

- pH is an attempt to measure the ratio of Hydrogen vs. Hydroxyl ions or the negative log of the activity of the hydrogen ion in an aqueous solution.
- For each 10 times more H to OH gives you 1pH unit of acid (below 7)
- For each 10 times more OH to H gives you 1pH unit of base (above 7)

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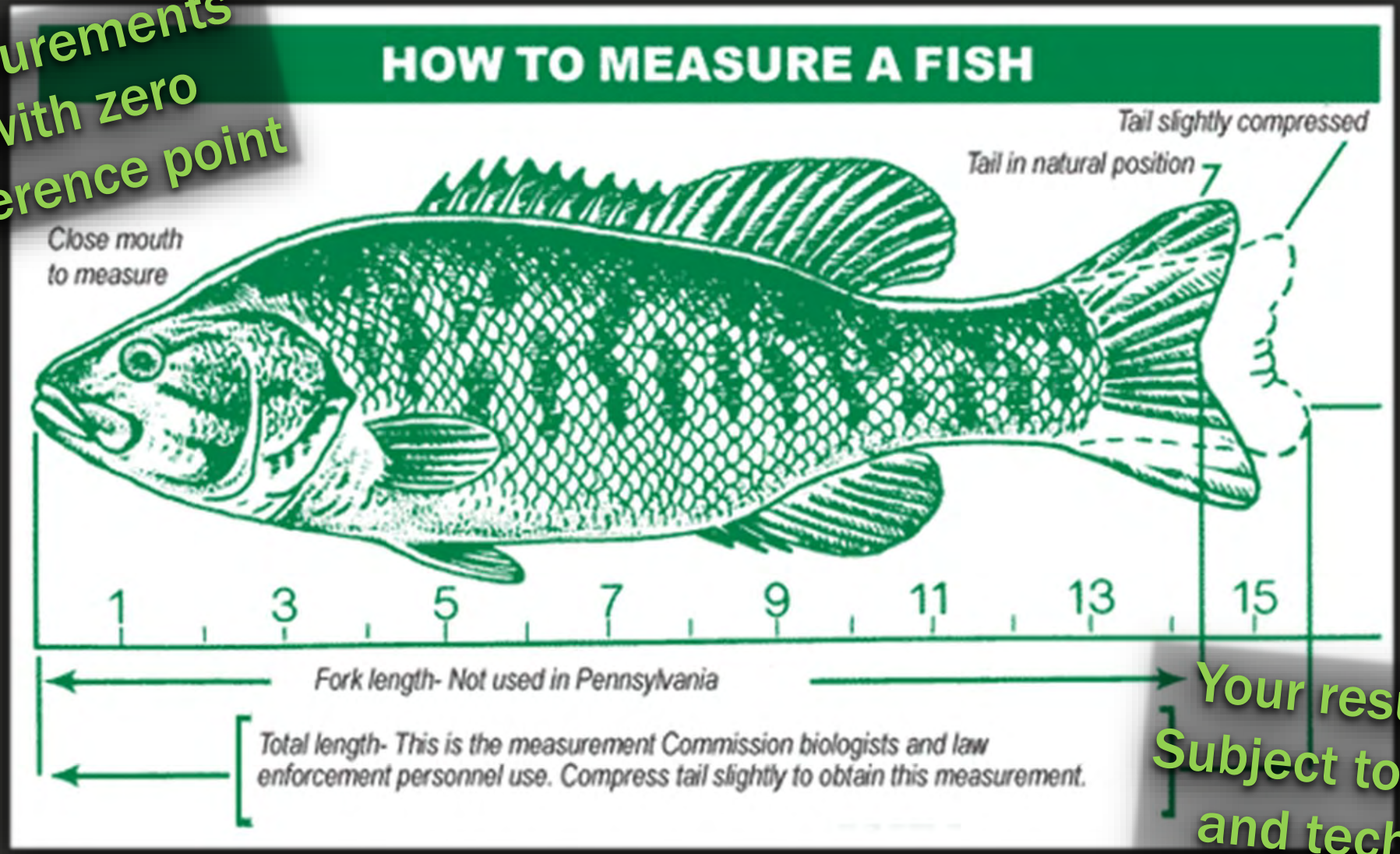
How do we measure pH

Millivolts and Electrodes

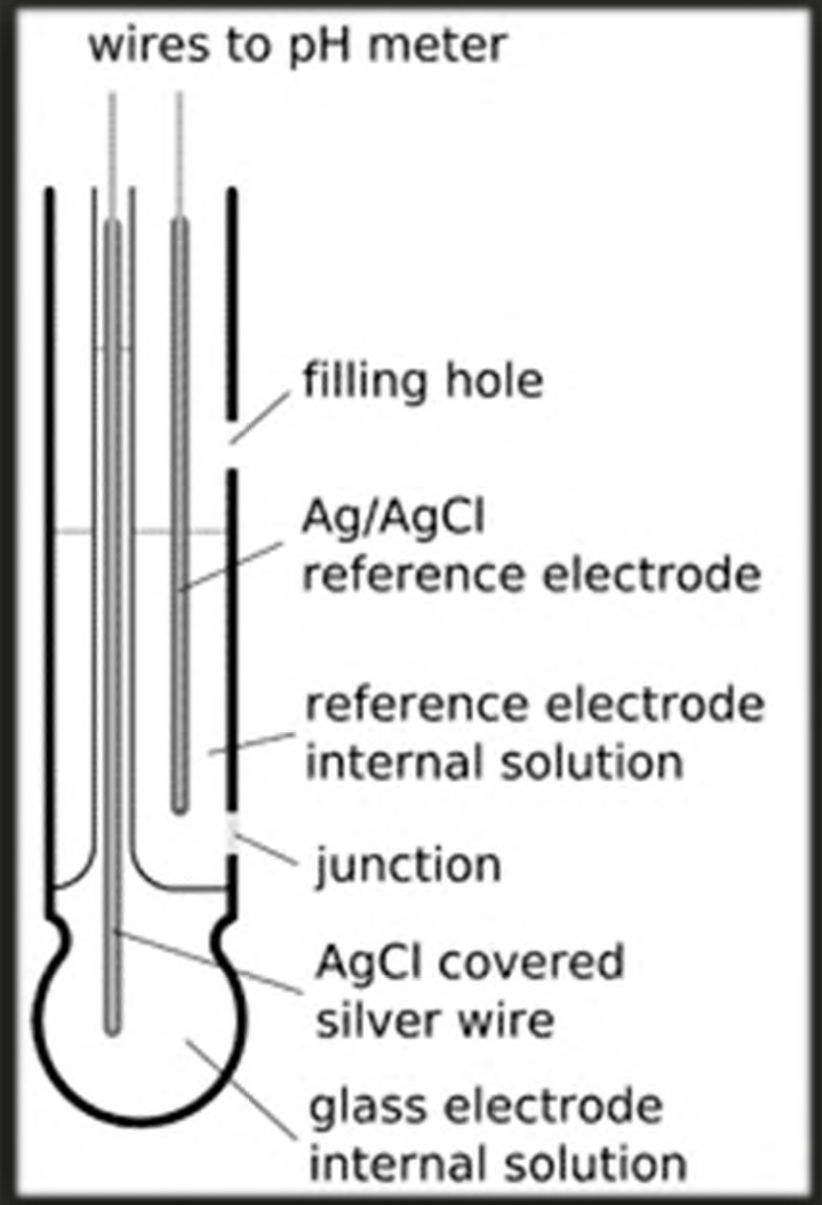
All measurements start with zero or a reference point



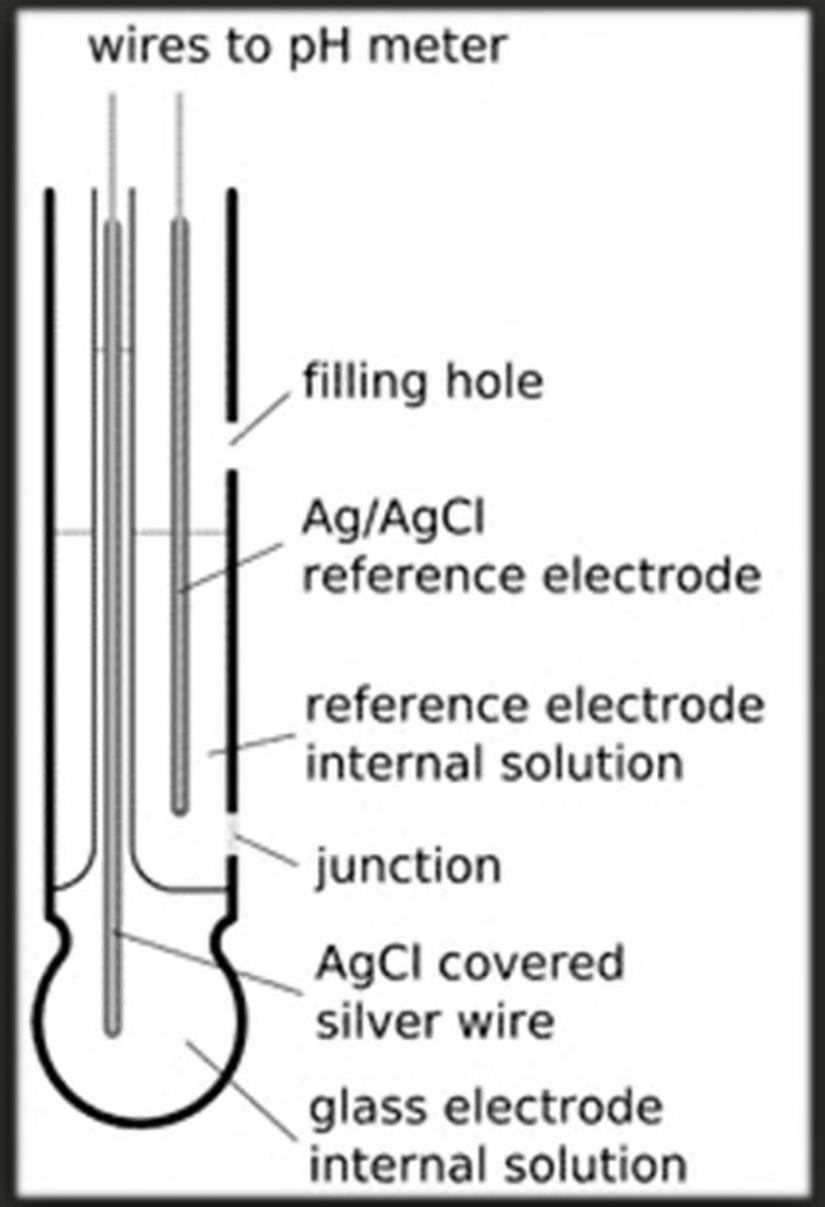
Your results are Subject to method and technique

A typical pH Electrode

A negative lead (reference)
behind a salt junction
and
a positive lead (pH)
behind a glass membrane
to read a voltage.

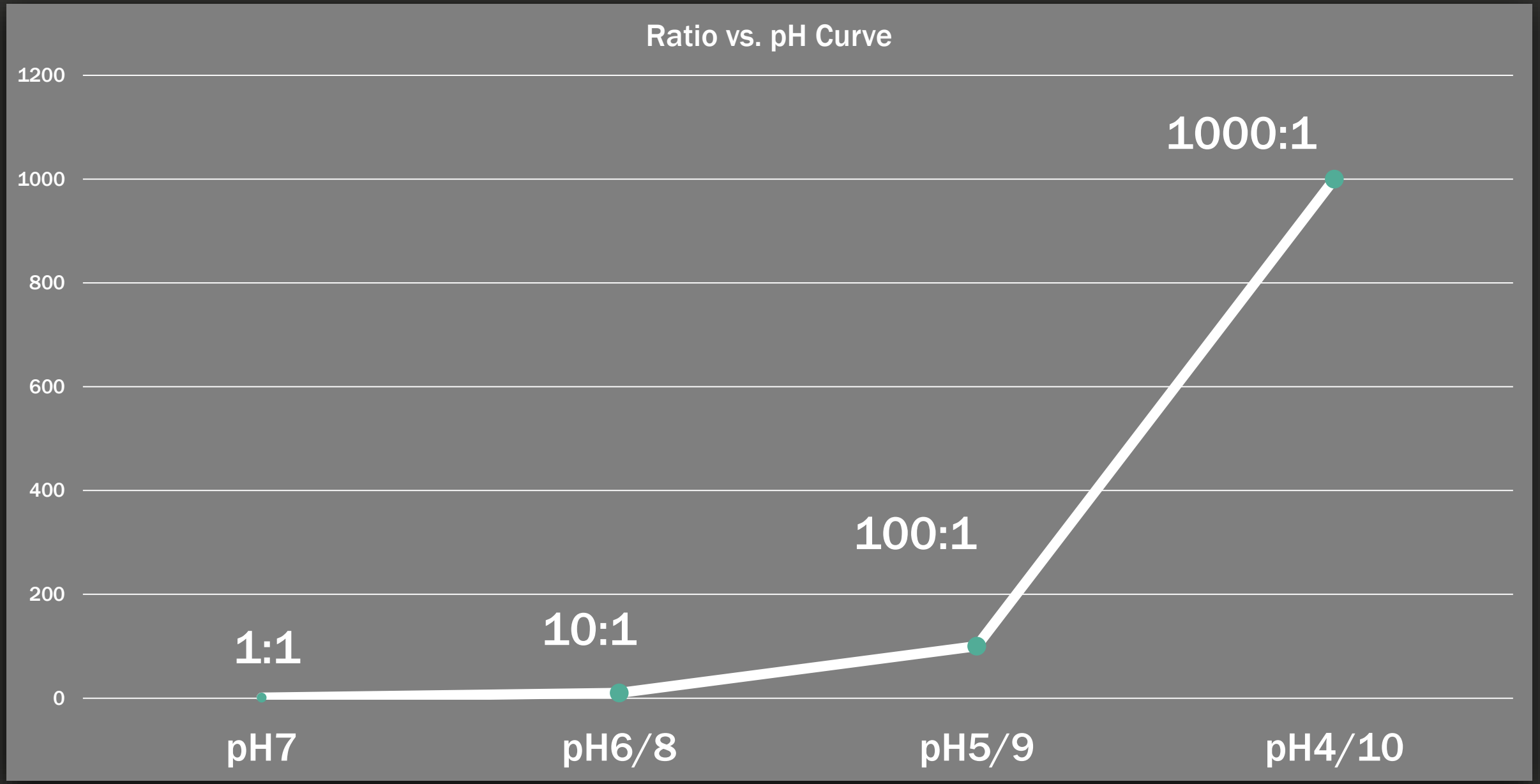


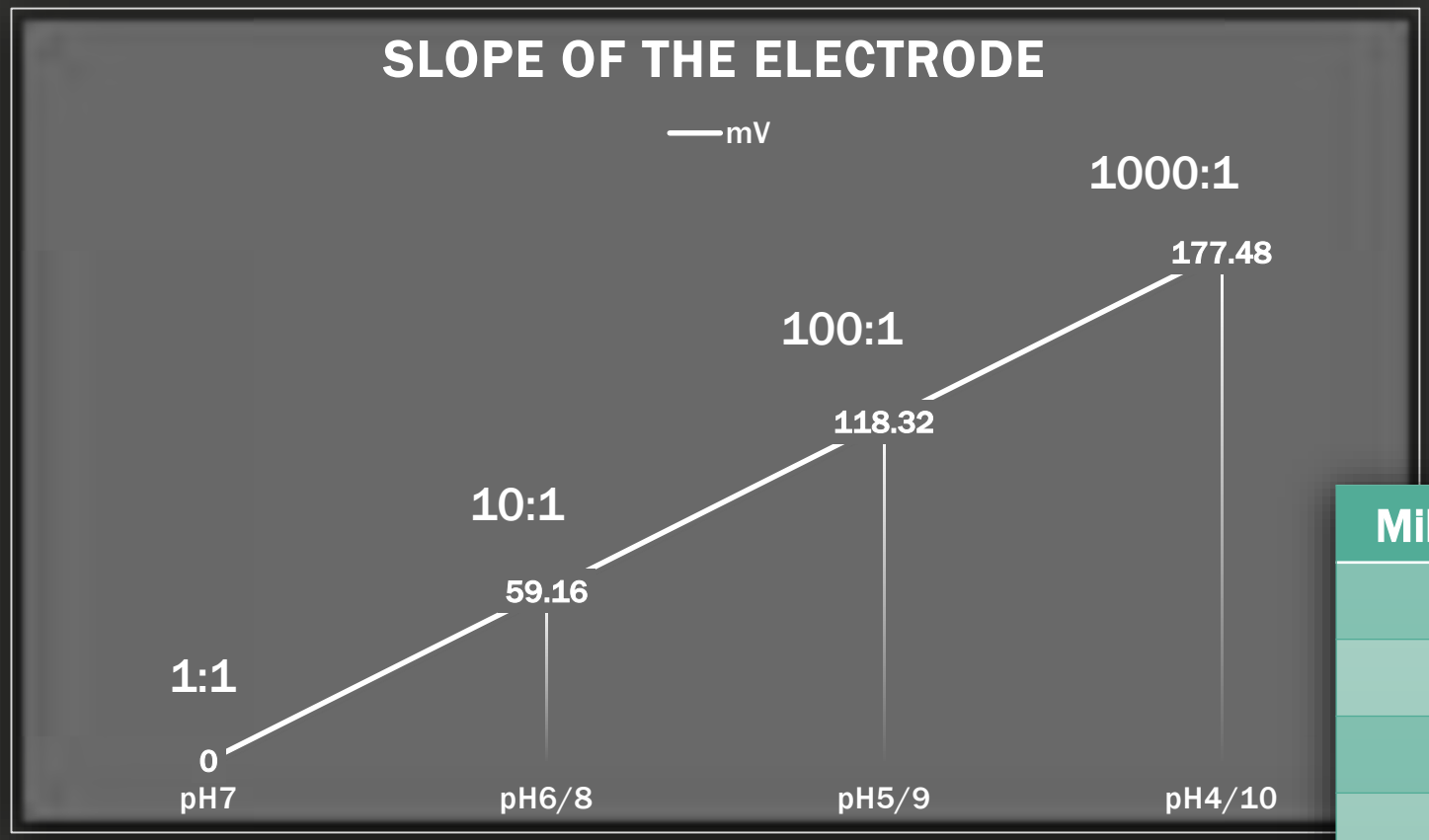
The pH meter reads
positive millivolts
when solution is below pH 7 (extra H)
and
Negative mV
when it is above pH 7 (extra OH)



pH is backwards

or
the negative log
of Hydrogen activity





Millivolts / pH unit	% Slope
59.16mV	100%
58.57mV	99%
57.98mV	98%
57.39mV	97%
56.79mV	96%
56.20mV	95%
55.61mV	94%

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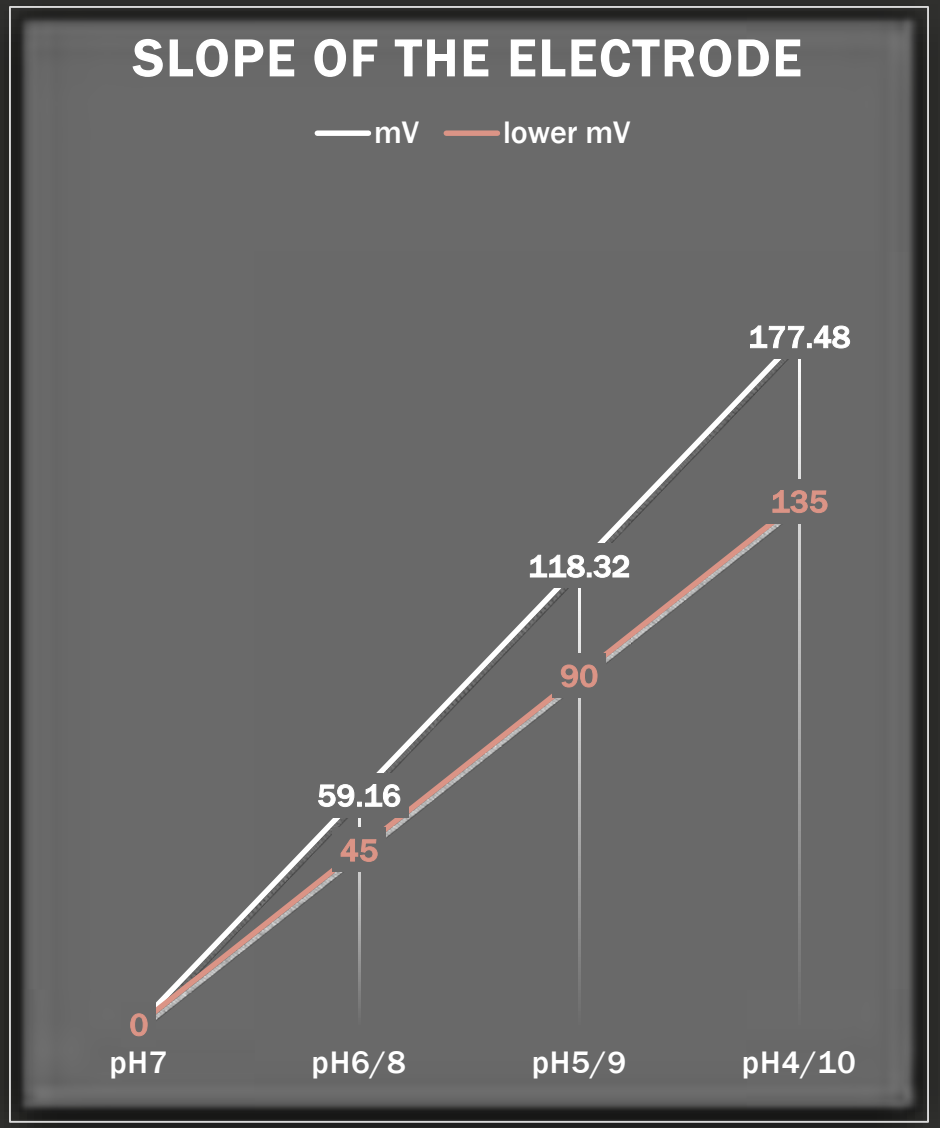
Effects of Temperature

Temperature does not change the pH,
only the pH reading (or slope)

ATC Probes (Automatic Temperature Compensation)
compensate for the theoretical change
in the mV output of the pH electrode
as it is effected by temperature

The further away from 7
the more temperature compensation

Triode electrodes have pH elements
with less surface



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pH Calibration and Maintenance

What we can check

Calibration

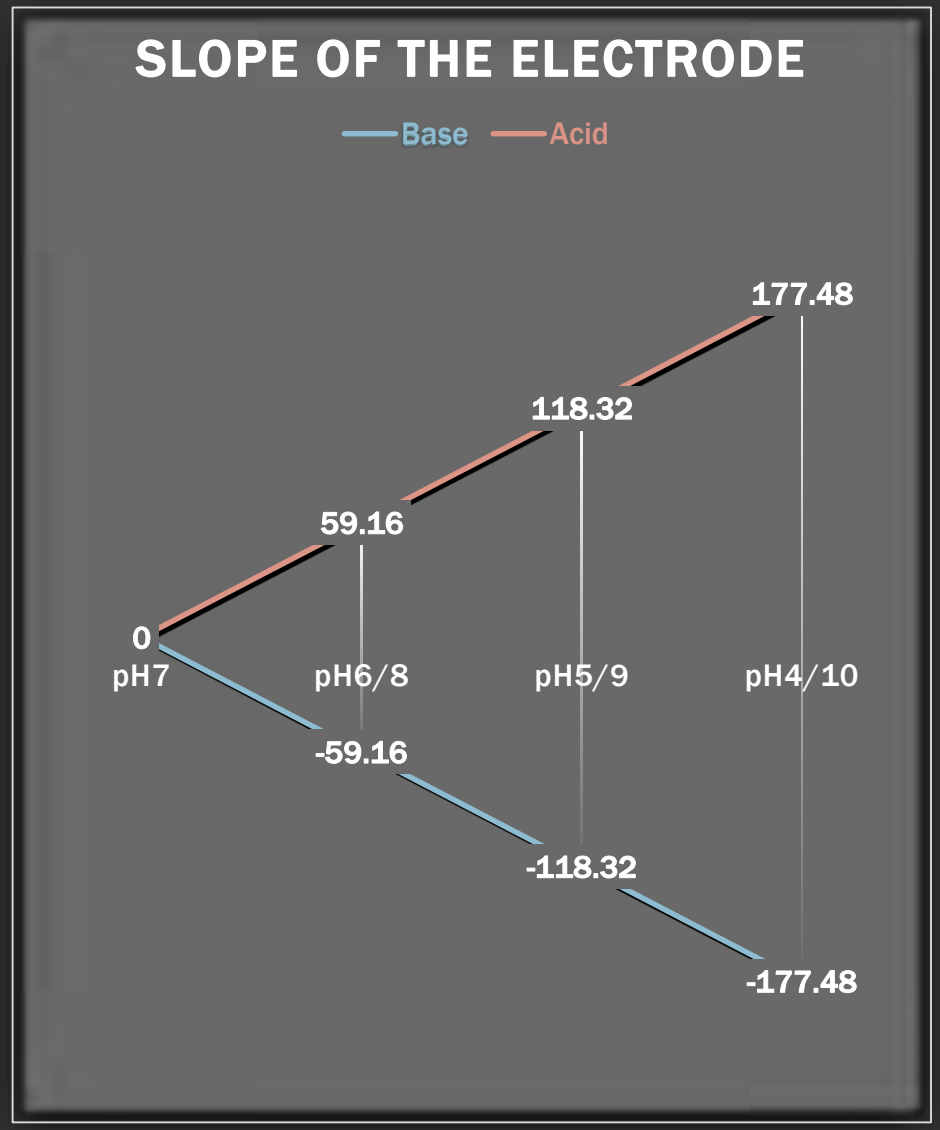
pH meters have two curves to be calibrated, one positive and one negative.

Calibrate with a pH7 and at least one other buffer to bracket your readings (4 or 10)

Check expiration and open dates of buffers

Once opened, 10 Buffer often fails first

Calibrate once a day... maybe once a shift



Electrode Health

96% Slope is a warning

94% Slope is when the electrode should be changed in the water and wastewater field.

Look for less than 15mV offset at pH7

Look for quick response at stable temperatures

Millivolts / pH unit	% Slope
59.16mV	100%
58.57mV	99%
57.98mV	98%
57.39mV	97%
56.79mV	96%
56.20mV	95%
55.61mV	94%

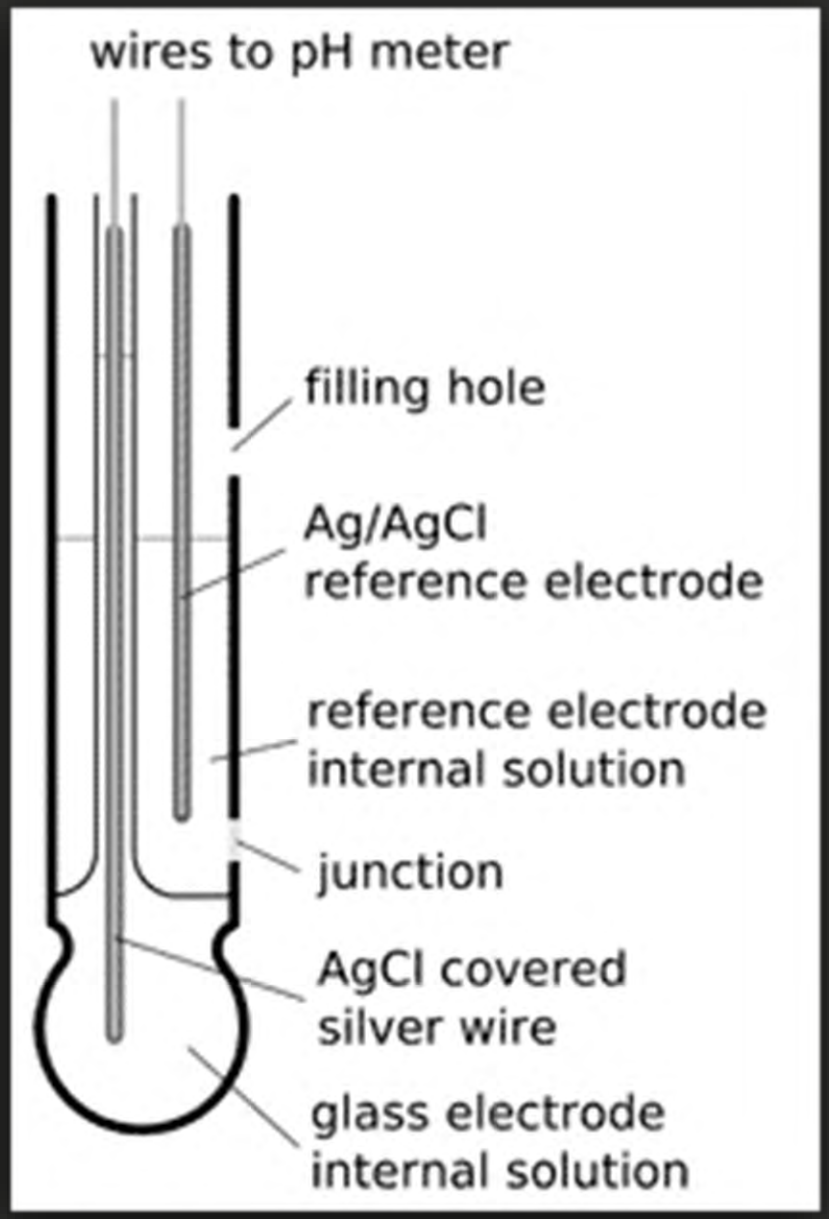
Refillable electrode vs. gel-filled

Liquid wicks better at reference junction than a gel

Filling hole allows better flow at reference junction

Warranty is typically twice as long on refillable electrode

Gels are known to respond slower and can have pH reading errors earlier



Storage and cleaning electrode

Store electrode wet to keep both junctions active

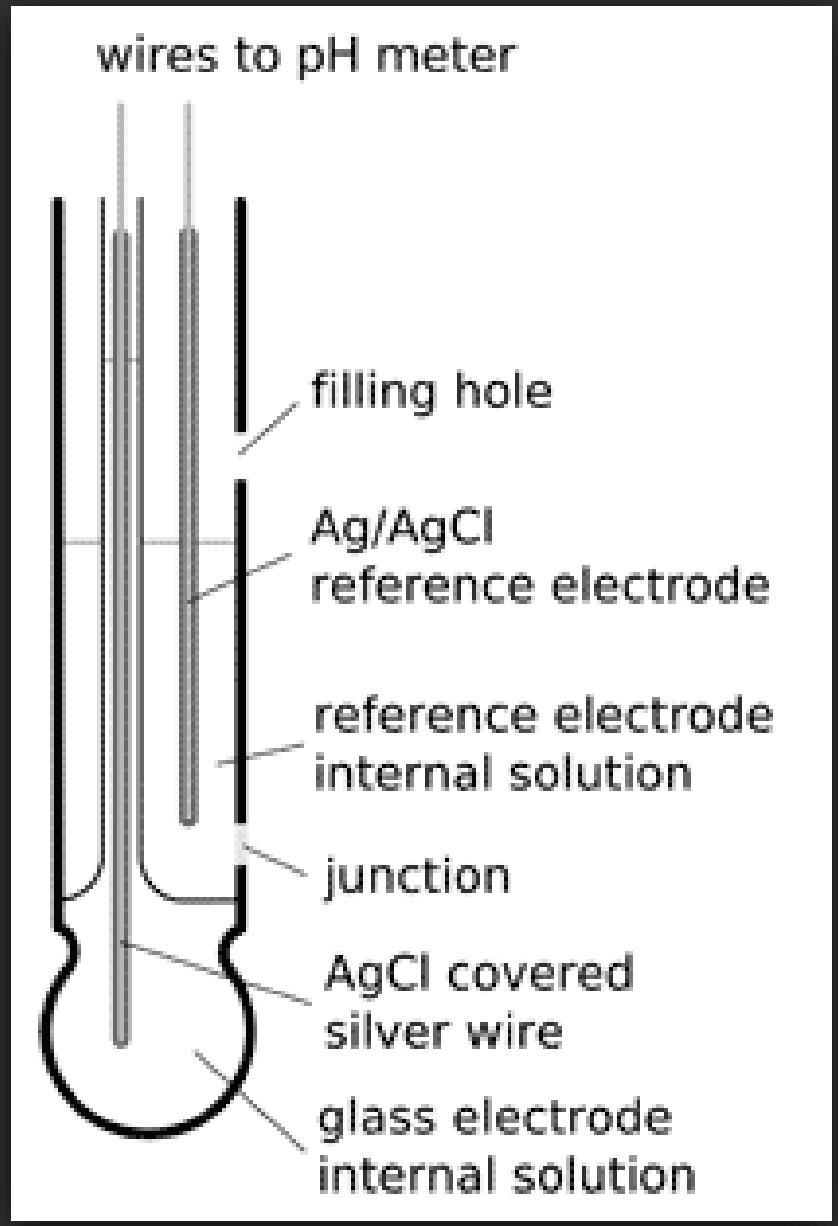
Do not use distilled water for storage

Using pH buffers can cause errors

pH electrode storage solution

(Shameless plug - LabtronX makes this right!)

Quick clean with toilet bowl cleaner



Checking the Meter

BNCs are the most universal input connectors

Meters can be checked with a mV generator to confirm accuracy and response

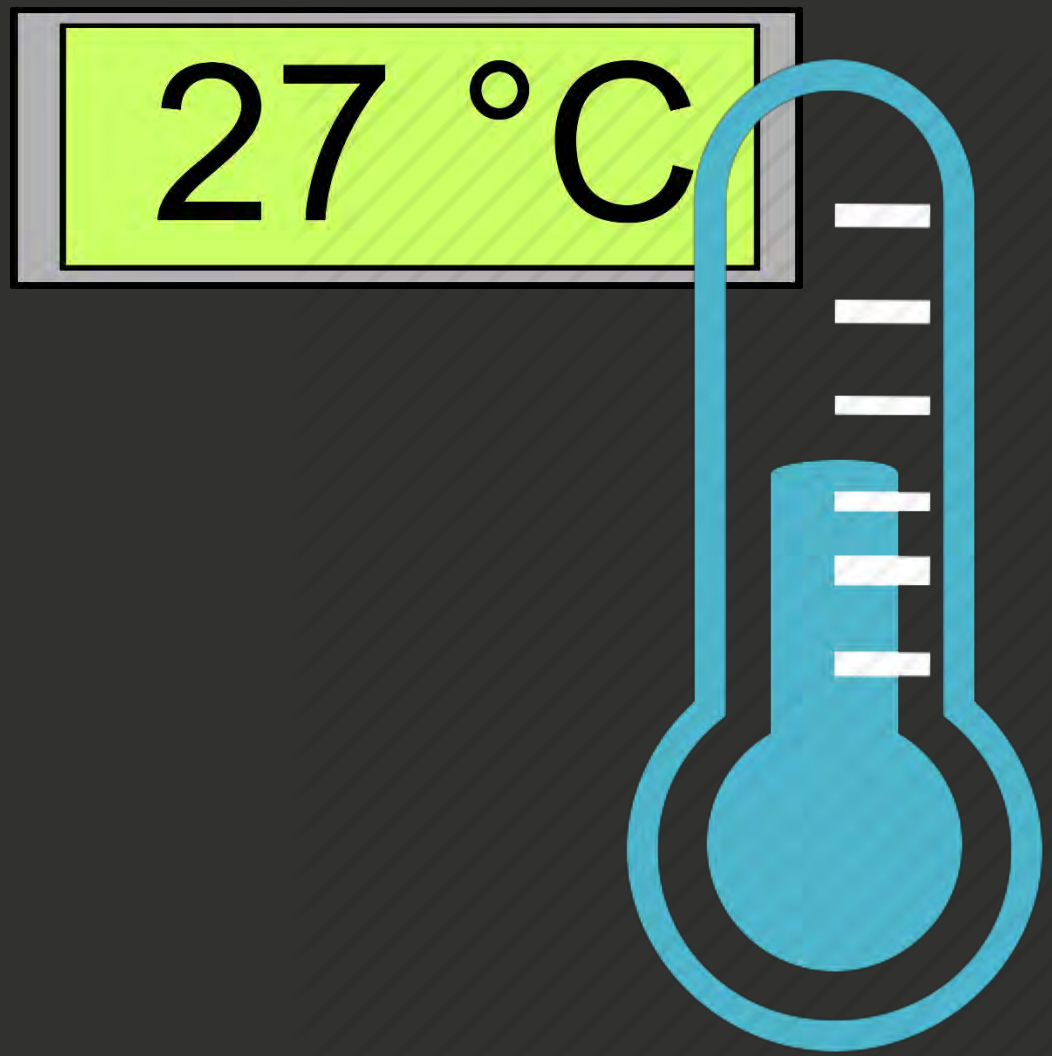
Shorting the input connector will give you 0mV (7pH)

Checking the Temperature

Digital equipment is precise
but may not be accurate

Incorrect temperature
is more likely to give you a bad slope
than a bad reading

Using a separate ATC probe
gives you more versatility



Too much information?

Want some more?
Ask a question.

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Calibration and Maintenance Programs

Risk Management

What is your maintenance policy?

If its not broke don't fix it.

If it breaks we'll get a new one.

MacGyver has nothing on us!

Patch it up and move on.

We're getting a new plant next year.

We have trained personnel
who perform and document
regular maintenance and calibration

How do you know?

How do you know your numbers are right?

Accuracy

How do you know that they are always right
Or that your equipment will be working when you need it?

Reliability

Regular Calibration and Maintenance

Reasons Equipment Becomes Inaccurate

Consumable Components
Lightbulbs, Membranes, Glassware

Environmental Changes
Temperature, Pressure, Humidity

Miscalibration
Bad Standards, Procedures, or Technique

Unstable Systems
Power Fluctuations, Discoloration, Changes in Sample

Lack of Maintenance or Care
Physical Wear, Dirt, Insects

Equipment Failure
See Next Slide

Reasons Equipment Becomes Unreliable

Over-stressed Components
Overuse or Over Limits

Physical Attacks
Environmental or Misuse

Error or Mistakes
Lack of Knowledge or Information

Poor Design, Assembly, or Installation
Incorrect Equipment, Components, or Engineering

Lack of Maintenance or Care
Inconsistent, Reactive, or Limited

Unimagined Incidents
Accidents, Acts of God, or Sabotage

Setting Your Maintenance Policy

Why do it? Identifying Risks

What results do you expect? Setting Overall Goal

What do you do? Proactive Actions

How often do you do it? Cycles of Uncertainty

Who does what? Roles and Responsibilities

How can you answer these questions?

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