

# Effects of Temperature on pH measurement

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## Effects of Temperature on pH measurement

- **The temperature change the pH of the measured solution**
- *The dissociation of molecules is highly temperature dependent. Any change in temperature of the measured solution results in a change in the hydrogen ion concentration of that solution and therefore in its pH value.*

# The temperature change the pH of the measured solution

- The pH/Temperature dependency is known only for the pH buffer solution
- For all acids and bases is not known.

- Examp<sup>l</sup>s:

Sample/Temp.:	0°C	20°C	25°C	30°C	40°C	50°C
■ Water	7.47		7.00			6.63
■ 0.01 N HCl	2.04		2.04			2.04
■ TRIS-Buffer	8.40	7.84	7.65	7.56		7.02
■ 0.001 N NaOH		11.17		10.83		

## The temperature change the pH of the measured solution

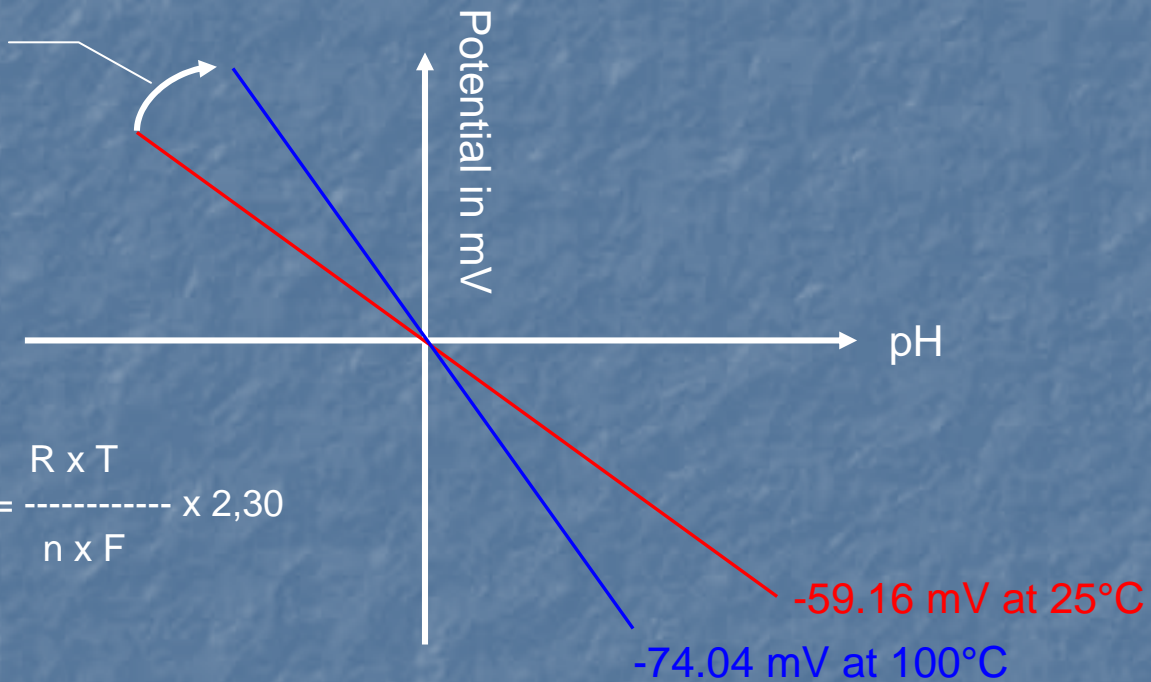
- It is therefore of utmost importance to state the related temperature when giving a pH value of a solution, otherwise the pH measurement is meaningless
- **Example : pH 3,27 at 22 °C**

## Effects of Temperature on pH measurement

- The temperature change the pH of the measured solution
- The slope of pH electrode is temperature dependent

# The slope of pH electrode is temperature dependent

Temperature dependency of the Nernst equation



NERNST equation: 
$$E = \frac{R \times T}{n \times F} \times 2,30$$

E = Potential difference

R = Gas constant

F = Faraday constant

T = Absolute temperature

n = charge number of the measured ion = 1

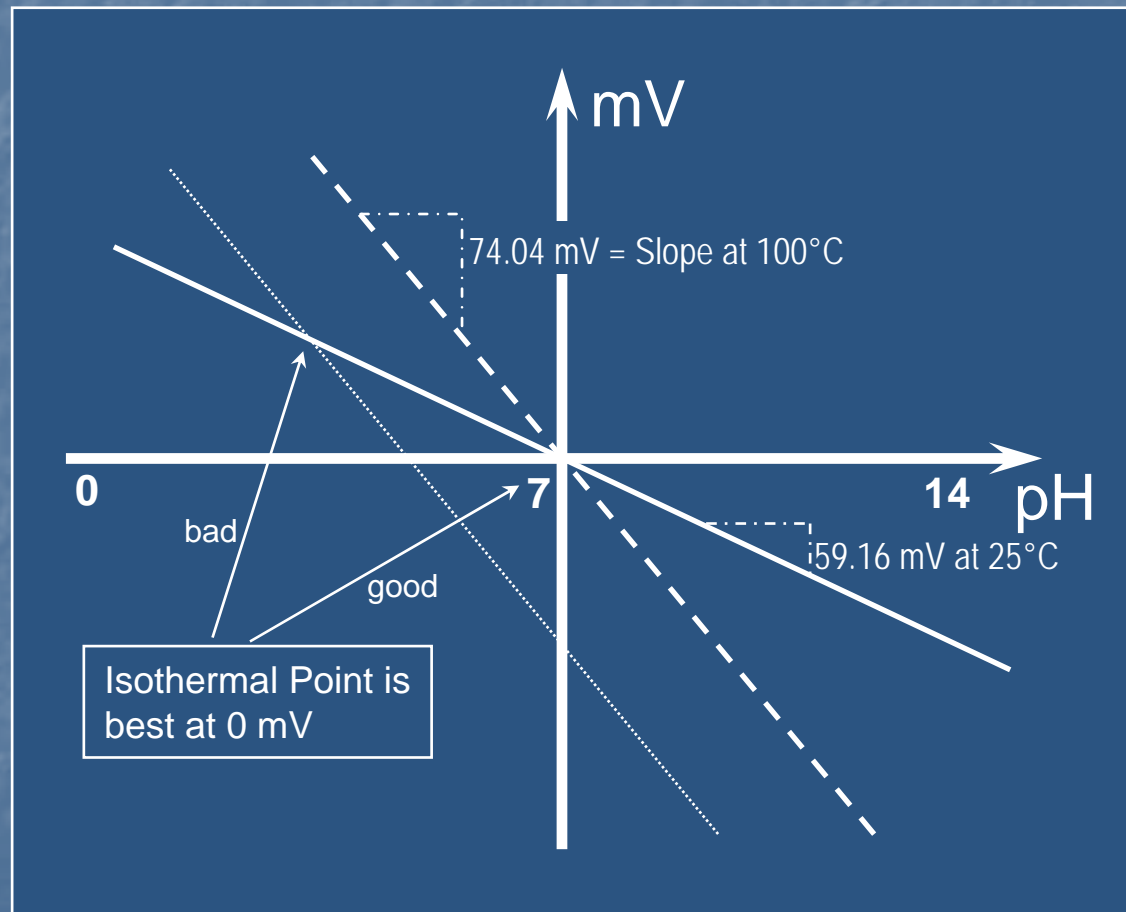
The slope of pH electrode is temperature dependent

This temperature influence is considered by instrument manufactures when they incorporate conventional manual or automatic temperature compensation in their pH measuring products.

# Effects of Temperature on pH measurement

- The temperature change the pH of the measured solution
- The slope of pH electrode is temperature dependent
- The temperature change the position of the isotherm intersection point

# The temperature change the position of the isotherm intersection point



The temperature change the position of the isotherm intersection point

- The position change of the isotherm intersection point is compensate if the pH buffer solution and the sample are at the same temperature.

Examp<sup>l</sup>s:

Sample/Temp.: 0°C      20°C      25°C      30°C      40°C      50°C

Water	7.47		7.00		6.63
0.01 N HCl	2.04		2.04		2.04
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## Error from temperature effect on slope and isotherm intersection point in pH electrode

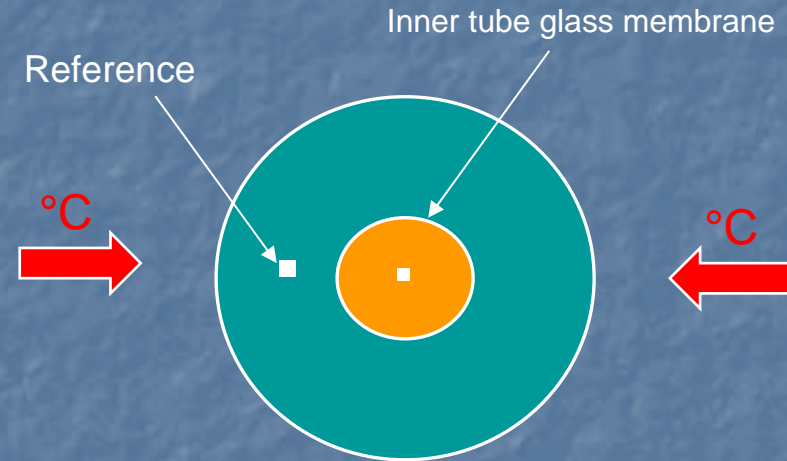
- Example :
- 0.001 mol/l HCl = pH 3,00
- Temperature of calibration : 25° C
- Temperature of measure : 60° C
- If we don't made automatic or manual temperature compensation at 60°C on the pHmeter the error is: **0,47 pH**
  
- The error from different temperature of calibration and measure is : **0,047 pH**

## Effects of Temperature on pH measurement

- The temperature change the pH of the measured solution
- The slope of pH electrode is temperature dependent
- The temperature change the position of the isotherm intersection point
- The temperature change the response time of pH electrode

# The temperature change the response of pH electrode

- Electrodes are made in glass body.  
The glass is bad conductor of heat  
Electrodes are asymmetrical made.  
This condition generate a delay in temperature stabilisation on the individual electrode parts and delay in response and stable reading of final pH value.



## The temperature change the response of pH electrode

- Important:

When the electrode jumps from different temperature, please wait before to read a final value.

Example : from 20°C to 60°C the electrode need minimum 5-10min for stabilisation.

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- The slope of pH electrode is temperature dependent
- The temperature change the position of the isotherm intersection point
- The temperature change the response time pH electrode

# Conclusion

- Theory is necessary !
- Experience is essential
- Good luck with your pH measurement
- And greetings from Italy.....

Thank you.

