

Ph measurment

Template:Zkontrolováno thumb|Indikátorový papírek pro orientační stanovení pH thumb|pH metr

The value of pH is one of the very important characteristics for the course of chemical and especially biochemical processes. According to the accuracy with which we need to know the pH value, we choose the method of measurement. Solutions of acid-base indicators or indicator paper are used for approximate determinations, pH meter are used for pH measurements with greater accuracy.

pH estimation using acid-base indicators

Some organic compounds change their color depending on the pH of the environment. These are weak acids or bases in which the colour of the undissociated molecules differs from that of the ions. We refer to them as acid-base indicators. The area of the color gradient varies from one indicators to another, the center of the color gradient always corresponds to a pH equal to pK_A Indicator. We use them in solution or as papers impregnated with an indicator solution.

The indicator solution is usually added to a small sample of the investigated solution in the amount of 1-2 drops. After shaking, assess the colour of the solution by comparison with the colour gradient table or, in the case of mixed indicators, by comparison with the colour scale.

Examples of acid-base indicators

Acid-base indicator	Color gradient	pH of the color gradient
Methyl orange	red – yellow	3,0–4,4
Bromthymol blue	yellow – blue	3,0–4,4
Phenolphthalein	colorless – red-violet	8,2–10,0

Potentiometric pH Measurement

Potentiometric pH measurement is based on the measurement of the equilibrium electromotive voltage of a galvanic cell consisting of two electrodes immersed in the measured solution. One electrode is a reference electrode with a known constant electrode potential (most commonly a calomel or argent chloride electrode). The second electrode is an indicator (specific), whose potential is a function of the activity of hydrogen ions and (H^+), so it depends on pH.

The half-cell is glass electrode. It has the shape of a flask blown at the end of a glass tube and is made of special glass. It is filled with a solution of known and constant pH value that is affected by an internal comparison electrode, e.g. argente chloride. When the electrode is immersed in the measured solution, a glass is formed between the outer and inner sides of the membrane potential difference, the magnitude of which is proportional to the pH difference between the measured and internal solution. Since the solution inside the electrode is always the same, the resulting potential depends only on the pH value of the measured solution:

$$E_{ind} \approx \frac{RT}{nF} \ln a_{H^+} = \frac{2,3 \cdot 8,314 \text{ J} \cdot 298\text{K}}{1 \cdot 96487 \text{ C}} \log a_{H^+} = -0,059 \text{ pH (V, } 25^\circ\text{C)}$$

From a relationship derived from Nernst equation implies that if the activity (concentration) of H^+ in the measured solution changes tenfold (which corresponds to a change in pH by a unit), a change in the electromotive voltage of the entire galvanic cell by 59 mV is detected at a temperature of 25 °C.

Conventional pH-meters are electronic voltmeters with high internal resistance that measure with an accuracy of hundredths of pH units; More sensitive devices can achieve an accuracy ten times greater, they are used to measure blood pH in clinical-biochemical laboratories.

Combined glass electrodes are often used, which also have an external comparison electrode built into their shell; Both electrodes, glass and comparator, are thus in a single body.

Since the electromotive voltage of the cell (proportional to the hydrogen exponent – pH) depends on temperature, perfection of electrode response and meter reliability, the pH meter is calibrated with at least two solutions of known pH value (buffers) prior to measurement.

Links

Související články

- pH
- pH of strong acids and bases
- pH of weak acids and bases
- pH-metry
- pH buffers
- urine pH
- pH of salts

External links

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