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Calibration of a pH Meter

Practical 14 - Bench practical

Aim

To calibrate and verify a pH measuring system using traceable buffers bracketing the intended measurements.

Principle

A pH electrode develops a potential related to hydrogen-ion activity. A meter calibration estimates the electrode response from buffers with assigned values at the measurement temperature.

Calibration buffers establish the relationship, while an independent check evaluates performance. The electrode, junction, temperature measurement and preparation matrix all influence the reported pH.

Materials and Requirements

- pH meter with identified electrode and temperature probe
- Traceable buffers of suitable values
- Fresh clean buffer aliquots and rinse water
- Compatible electrode storage and cleaning materials

Procedure

1. Inspect electrode condition, filling requirements where applicable and storage history. Record equipment and buffer identities and expiry information.
2. Allow buffers and electrode to reach the chosen measurement condition and use their temperature-assigned pH values.
3. Rinse and gently blot as specified. Calibrate with buffers bracketing the intended pH range, avoiding contamination of stock containers.
4. Record slope, offset and acceptance assessment according to the instrument and laboratory procedure.
5. Measure a fresh independent check buffer and record the difference from its assigned value.
6. Measure the test preparation using the specified stirring, equilibration and temperature conditions. Retain the stable reading criteria.
7. Rinse and store the electrode as specified and document any performance issue before further measurements.

Observations and Record

Enter actual measurements or the supplied teaching data. Record the method, material identity, conditions and units.

Buffer / preparation	Assigned pH	Measured pH	Temperature / comment
Calibration buffer 1	Record	Record	Record
Calibration buffer 2	Record	Record	Record
Independent check	Record	Record	Record
Test preparation	Not assigned	Record	Record

Calculations

- Check error = measured check pH - assigned check pH

• The ideal Nernst slope magnitude is about 59.16 mV per pH unit at 25 degrees C; operational acceptance is instrument- and procedure-specific.

Worked Example

Illustrative independent check: assigned pH 7.00 and measured pH 7.03 at the buffer-specified temperature.

The observed error is +0.03 pH unit. Compare this with the predefined criterion and include the electrode slope and offset in the decision.

Passing the check in aqueous buffer does not by itself establish suitability for a difficult nonaqueous matrix.

Result and Interpretation

• State the calibration points, check result, electrode response and intended measurement range.
• Record the actual test pH with temperature and preparation conditions.
• Investigate unstable response or failed checks rather than reporting an arbitrary stable-looking value.

Precautions

• Use fresh buffer aliquots and prevent cross-contamination.
• Follow the electrode-specific storage instructions.
• Do not rub a fragile glass membrane aggressively.
• Temperature compensation does not remove all chemical temperature effects on the preparation.

Viva Questions and Answers

Why bracket the test range?

It reduces reliance on extrapolating the calibration.

Why use a separate check?

It tests the calibrated system independently of the fitting points.

What can a blocked junction cause?

Slow, drifting or biased measurements.

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