

Indicator pKa by UV Spectroscopy

Experiment 5 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To estimate the pKa of an assigned indicator using absorbance at known pH.

Principle

The acid and base indicator forms have different spectra. At a suitable wavelength, absorbance can estimate their ratio if total concentration and path length are constant.

Requirements

- Assigned indicator, buffers, pH meter, UV-visible instrument, matched cells and appropriate blanks.

Procedure

1. Obtain end-form readings

Record the assigned acid-form and base-form absorbances at the same wavelength and total concentration.

2. Measure intermediate pH

Read actual pH and absorbance for the assigned buffer conditions.

3. Calculate the ratio

Use the two-form absorbance relation only if Beer-Lambert behaviour and the endpoint forms are suitable.

4. Calculate pKa

Apply the acid/base equation and compare estimates from more than one intermediate point.

5. Record limits

Avoid an estimate from absorbance indistinguishable from either end-form value.

Pharmaceutical Analysis

Observations and Record

Reading	Value
Acid-form absorbance A _{HA}	_____
Base-form absorbance A _A	_____
Intermediate pH / absorbance A	_____
Calculated ratio / pKa	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- $[A^-]/[HA] = (A - A_{HA})/(A_A - A)$, for matched total concentration and path.
- $pK_a = pH - \log_{10}([A^-]/[HA])$.
- Example: $A_{HA} = 0.10$, $A_A = 0.90$, $A = 0.50$ and $pH = 7.0$ give a ratio of 1 and $pK_a = 7.0$.

Result

Record the completed observations, calculations and conclusion with units. State any limitation of the observation.

Precautions

- Use measured pH and valid endpoint-form spectra.
- Do not use the relation if precipitation or additional absorbing species invalidate the two-form model.

Viva Questions and Answers**1. What happens when acid and base forms are equal?**

pH equals pKa in the ideal stated acid/base model.

2. Why avoid the extreme end-form points?

Small absorbance errors can produce large ratio errors near an endpoint.

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