

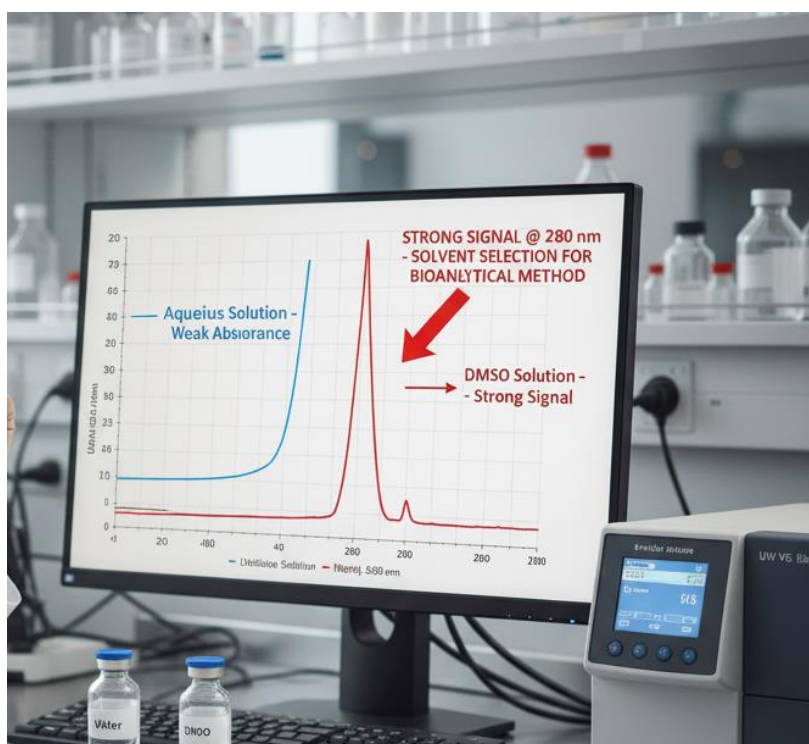
CASE STUDY BASED PUZZLE

BP701T: INSTRUMENTAL METHODS OF ANALYSIS

TOPIC: UV VISIBLE SPECTROPHOTOMETER

Puzzle 1: Solvent Selection for Poorly Soluble Drug

A new antifungal drug candidate with low aqueous solubility shows weak absorbance in water but strong signals in DMSO at 280 nm. The team must select a solvent for bioanalytical method validation without altering the drug's electronic structure.



1. Discuss solvent effects on absorption spectra and recommend a solvent with minimal hypsochromic shift.
2. Justify using Beer's-Lambert law for concentration determination in the chosen solvent.

Puzzle 2: Detector Sensitivity in Low-Concentration Assay

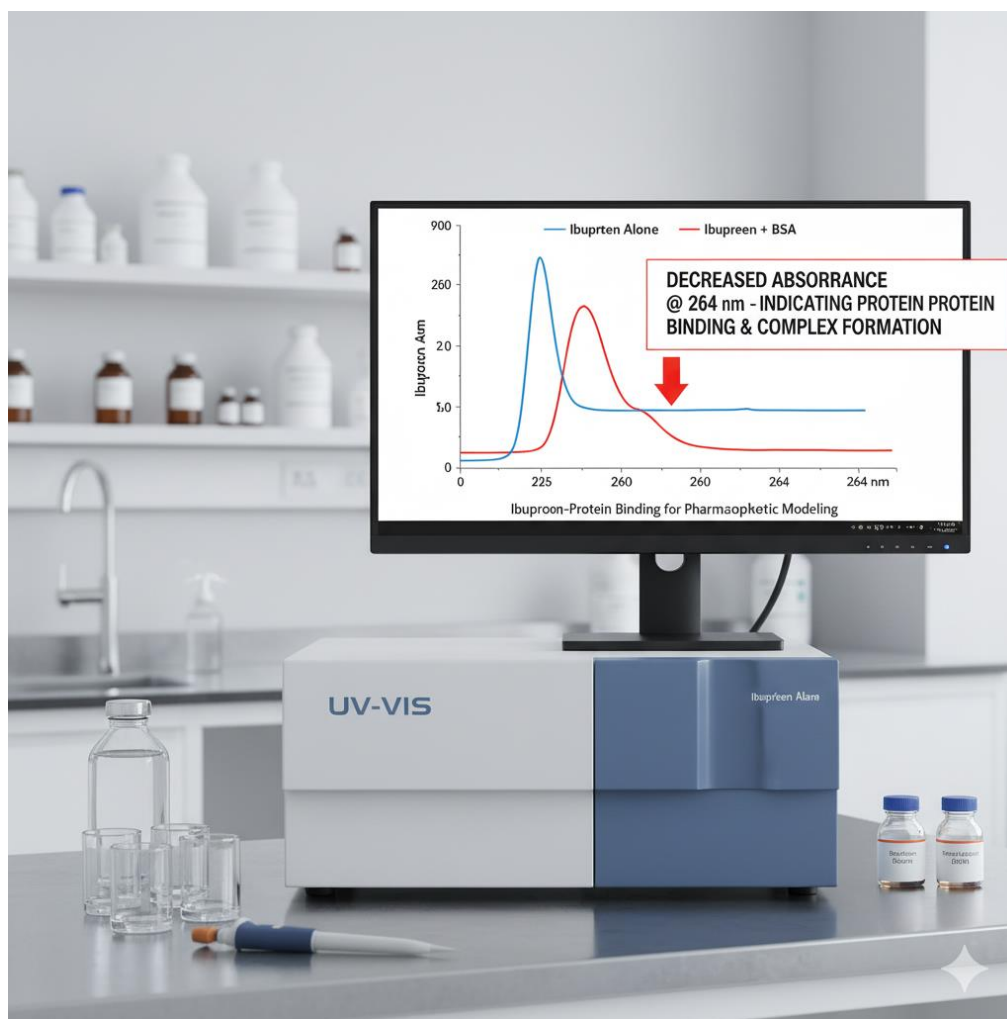
In a clinical lab assaying trace vitamin B12 in plasma, a silicon photodiode detector yields low signal-to-noise ratio below $0.1 \mu\text{g/mL}$ at 361 nm, delaying patient reports.



1. Compare the suitability of silicon photodiode vs. photomultiplier tube for this UV region and explain.
2. Suggest wavelength selector adjustments to improve sensitivity.

Puzzle 3: Hypochromic Effect in Protein Binding

Studying ibuprofen-protein binding for pharmacokinetic modeling, the analyst observes a decrease in absorbance at 264 nm upon adding bovine serum albumin, indicating complex formation.



1. Explain the hypochromic shift in terms of electronic transitions and chromophore interactions.
2. Use Beer's-Lambert law to quantify the binding constant from absorbance changes.

Puzzle 4: Titration Endpoint Detection

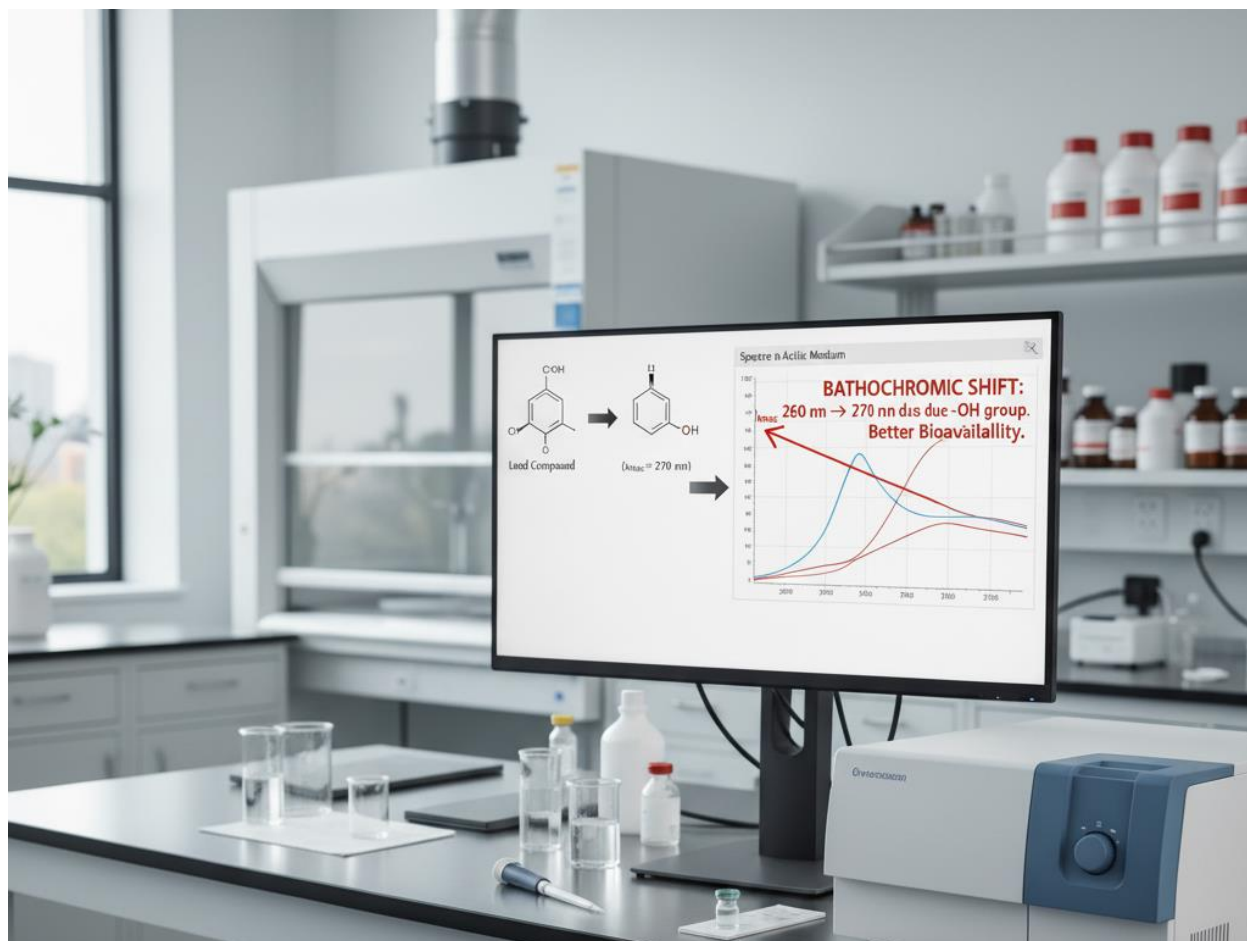
In a QC titration of iodine with sodium thiosulfate for antiseptic formulation, the endpoint at 520 nm is unclear due to turbidity from starch indicator.



1. Describe how UV-Vis monitors the spectrophotometric titration and identifies the endpoint.
2. Account for any deviations from Beer's-Lambert law in colored solutions.

Puzzle 5: Auxochrome Impact on Bathochromic Shift

Modifying a lead compound for better bioavailability, the R&D team adds a hydroxyl group (-OH) to a benzene chromophore, shifting λ_{max} from 260 nm to 270 nm in acidic medium.



1. Classify the auxochrome effect and the resulting spectral shift type.
2. Predict the shift in basic medium and its impact on formulation stability testing.

Puzzle 6: Sample Cell Contamination Issue

Repeated UV-Vis scans of a caffeine standard at 273 nm show inconsistent absorbances (0.45 to 0.65) across runs, traced to quartz cuvettes not rinsed properly after previous acidic samples.



1. Explain how sample cell material and contamination affect UV measurements.
2. Outline cleaning and verification steps aligned with instrument qualification.