

Buffers, titration curves and indicators

AP Chemistry · Lab answers

The sample data were taken at 25 °C with a calibrated meter. Your results will vary slightly with the probe and the exact concentrations. Use the same graph for all the answers and show every substitution.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 8

Question 1 Equivalence volume

The pH rises most steeply between 24.9 and 25.1 cm³ (7.14 to 10.30), so equivalence is at **25.0 cm³**.

Question 2 Concentration of acid

$n(\text{NaOH}) = 0.0250 \times 0.100 = 2.50 \times 10^{-3} \text{ mol} = n(\text{acid})$. $c = 2.50 \times 10^{-3} / 0.0250 = \mathbf{0.100 \text{ mol/dm}^3}$.

Question 3 Finding pKa

Half of 25.0 cm³ is 12.5 cm³, where the pH is 4.74. At this point $[\text{HA}] = [\text{A}^-]$, so **pKa = 4.74**.

Question 4 Ka value

$K_a = 10^{-4.74} = \mathbf{1.82 \times 10^{-5}}$. This differs from 1.8×10^{-5} by 1 %, within experimental error.

Question 5 Indicator choice

Phenolphthalein changes colour between pH 8.3 and 10.0, inside the steep part (7 to 10.3) and around the equivalence pH. **Phenolphthalein**.

Question 6 Buffer region

In this region the flask contains both CH_3COOH and CH_3COO^- , a buffer. Added OH^- converts HA to A^- and the ratio changes slowly, so the **pH changes by only about 1.2 units** (from 4.14 to 5.34).

Question 7 Uncertainty

Absolute uncertainty = $2 \times 0.05 = 0.10 \text{ cm}^3$. Percentage = $0.10 / 25.0 \times 100 = \mathbf{0.4 \%}$.