Try to complete the AP FRQ worth 10 points in 24 minutes.
You can find the video explanations answers for the FRQ on the Chem-Tube page at ChemAdvantage.net .

Sorbic acid, $HC_6H_7O_2$ (molar mass 112.3 g/mol) is commonly used as a sour flavoring and also as an antimicrobial agent for foods. The concentration of $HC_6H_7O_2(aq)$ of solution must be determined. A student titrates 45.00 mL of the solution with 0.250 M NaOH(aq) using both an indicator and a pH meter.
The value of K_a for sorbic acid is 1.7×10^{-5}.

(a) Write the molecular and net-ionic equations for the reaction between $HC_6H_7O_2(aq)$ and NaOH(aq).
(1 point)

(b) The images below show the buret before the titration begins (below left) and at the end point (below right). What should the student record as the volume of NaOH(aq) is required to reach the end point.
(1 point)

(c) Assuming that the end point is equal to the equivalence point, calculate $[HC_6H_7O_2]$ in the original solution.
(2 points)

(d) The pH of the equivalence point of the titration is measured to be 8.83. Which of the following indicators would be the best choice for determining the end point of the titration? Justify your answer.
(1 point)

Indicator	K_a
Phenolphthalein	5.0×10^{-10}
Bromothymol blue	1.0×10^{-7}
Methyl red	1.0×10^{-5}
Thymol blue	1.0×10^{-2}
Methyl violet	1.6×10^{-1}
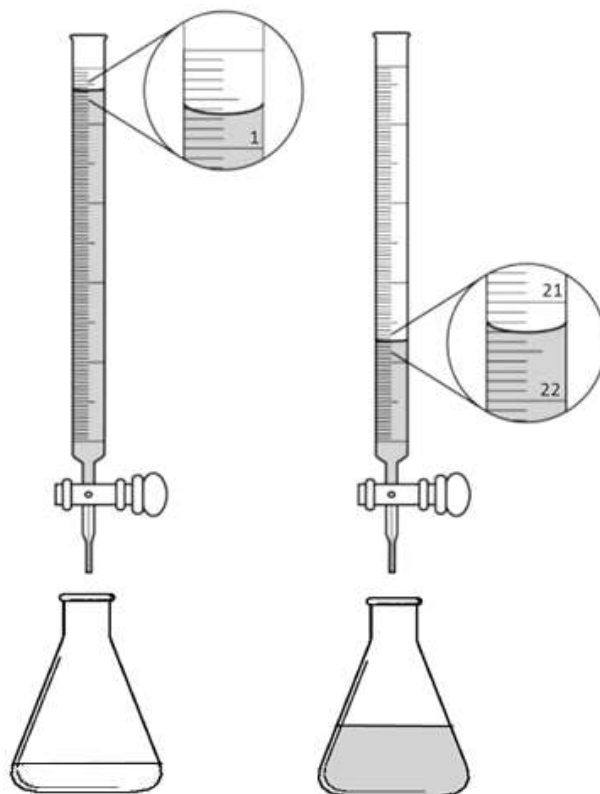
(e) Calculate the pH at the half-equivalence point.
(1 point)

(f) The initial pH and the equivalence point are plotted on the graph below. Accurately sketch the titration curve on the graph below. Mark the position of the half-equivalence point on the curve with an X.
(3 points)

(g) The pH of a soft drink is 3.37 after the addition of $HC_6H_7O_2(aq)$ and Na $C_6H_7O_2(aq)$. Which species $HC_6H_7O_2$ or $C_6H_7O_2^-$, has a higher concentration in the soft drink? Justify your answer.
(1 point)

Volume of 0.250 M NaOH Added (mL)