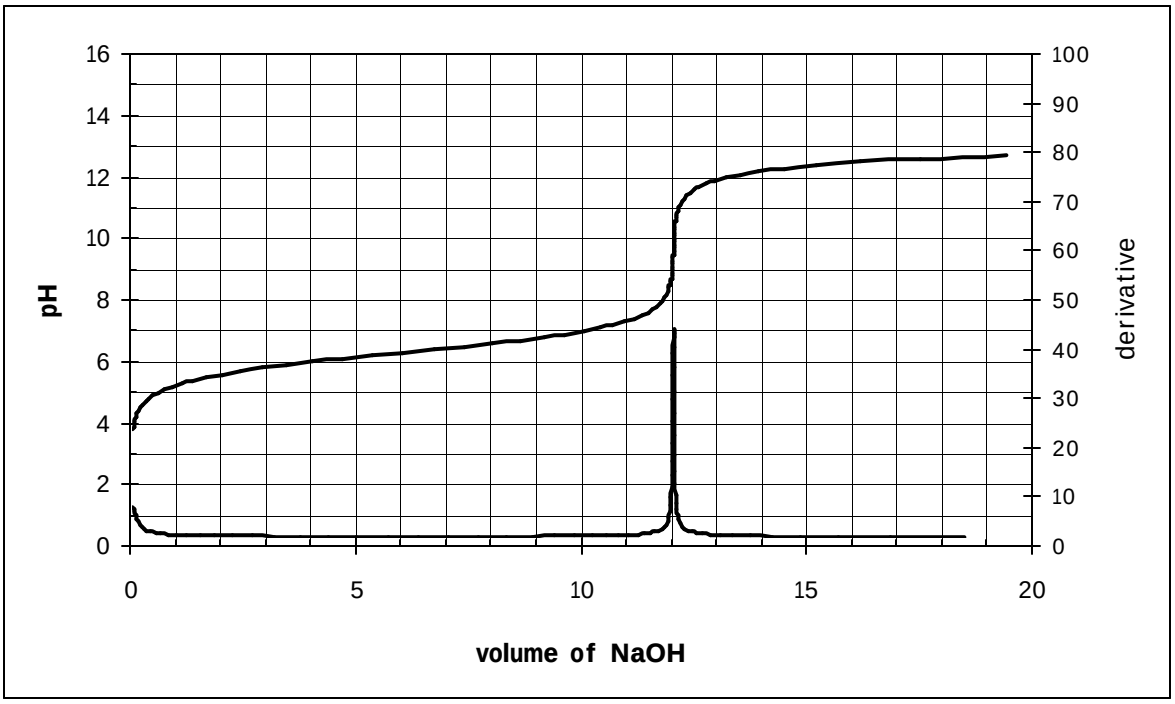
Spring 2002 Name_____
Sinex

CHM 103 EXAM II

Show all calculations with units and proper number of significant figures! Write in clear and complete sentences. Turn in the take-home component with this exam. **GOOD LUCK!!!**

1. Consider the titration of a weak acid, HX, as given below. A weak acid sample of 232.5 mg was dissolved to make 25.00 mL solution. This was titrated with 0.1107 M NaOH. (35)

$$HX + NaOH \rightarrow NaX + H_2O$$



Locate the coordinates of the equivalence point. Describe how you determined this.

What is the acid dissociation constant, K_a, of the weak acid? Illustrate how you determined this on the graph above.

Which indicator would work for this titration?

color change ranges: 6-8 8-10 10-12

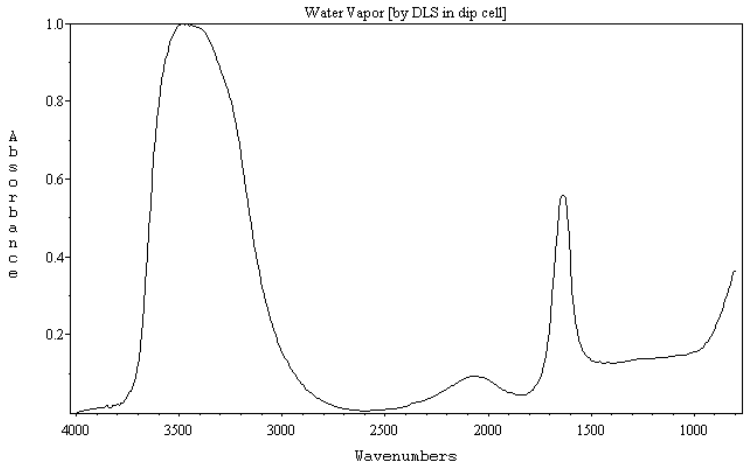
What substance(s) is (are) present at the following volumes of titrant?

Volume of titrant, mL	substance or substances
0	
4	
8	
12	
16	

Calculate the molar mass of the acid.

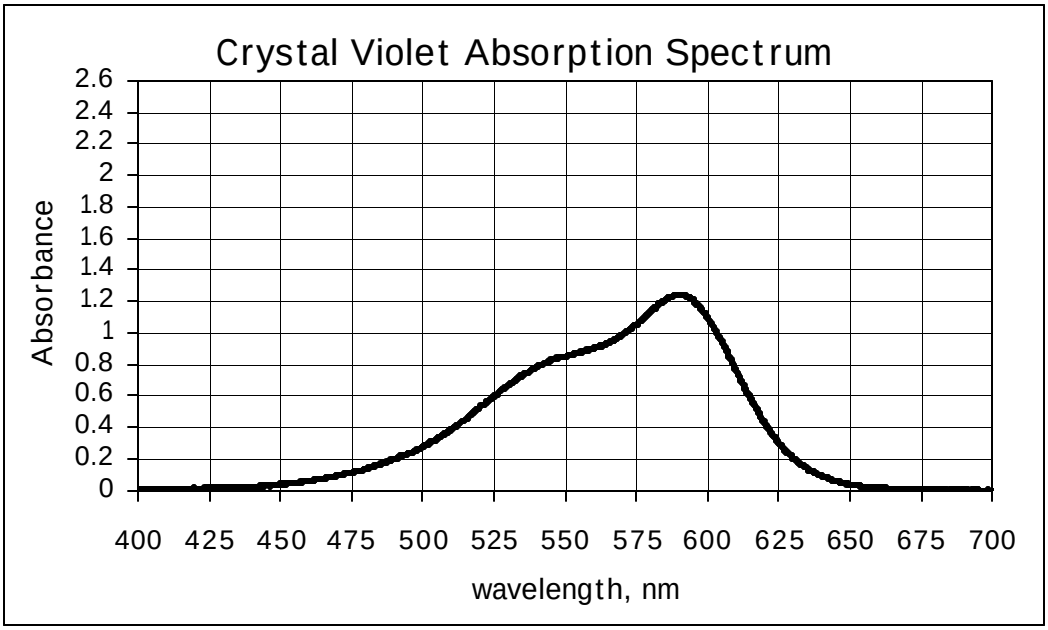
2. Illustrate the three possible modes of vibration in water. Which of the three vibrations would have the lowest wavenumber on the IR spectrum? (10)

Which peak on the IR spectrum of water is due to the combination of the stretching vibrations?
(See the chart on the last page of this exam.)



3. The absorption spectrum of crystal violet is shown below for a certain concentration. (15)

What is the value of λ_{max} and locate it on the graph. λ_{max} = _____



Using a dashed line (----), carefully sketch the graph if the pathlength, b, was doubled.

If the concentration of the crystal violet above on the graph were halved, what would the absorbance at 525 nm be equal to?

4. A pH meter is calibrated by measuring the voltage, E, for a known pH of a buffer. Then the equation below is used to form a linear calibration curve.

$$E = E' - 0.0591pH$$

If a single calibration using a pH 5.00 buffer gave a voltage such that E = 0.912v, what pH would a voltage of E = 0.671v give. (10)