



## INSTRUCTIONS FOR TOTAL TITRATABLE ACIDITY ASSEMBLY 170-3493

Wines are solutions of weak acids like tartaric, malic, lactic, and acetic acids. Fresh grapes should have around 0.7 to 1.0 grams of acid for every 100 ml of juice (g/100 ml, roughly equal to percent). A finished wine will be balanced if it is slightly less acidic (reds about 0.55-0.75, whites 0.6-0.8, higher if sweet).

The principle behind acid testing is to neutralize the acid with an alkaline solution of known strength. Acid molecules in solution form hydrogen ( $H^+$ ) ions, responsible for acidic behavior. An alkaline solution (also called a "base") releases hydroxide ( $OH^-$ ) ions, which react with the  $H^+$  ions to form  $H_2O$  (neutral).

In this test a sodium hydroxide solution ( $NaOH$ ) is added to a sample of the wine or juice until all the acid has been neutralized and the sample is no longer acidic. When just a little extra  $NaOH$  has been added the solution becomes alkaline and the phenolphthalein indicator turns very pale pink. Or, a pH meter may be used to determine the endpoint instead; titrate to pH 8.2.

We call the value that can be calculated from this test "total titratable acidity." The word "titratable" is used because there are compounds in a wine (tannins, for example) with the chemical structure of an acid but are too weak to react with a solution of  $NaOH$ , so they do not contribute to the acidity as measured by this test.

This Assembly measures only total titratable acidity, not pH. The pH, a measure of the "free acid," or activity of the acid, must be tested to 0.01 (0.1 is NOT sufficient) with a pH meter (NEVER pH strips). It is not possible to assess the acid balance of a wine without BOTH pH and acidity values, since both play an important part. The pH is responsible for much of a wine's acidic character, color stability, tendency to oxidize or spoil,  $SO_2$  interaction, and aging potential.

We recommend that ALL winemakers test pH as well as total acidity. Home winemakers may be able to find a friend who uses a good pH meter at work to test for them; a winery needs a pH meter of its own.

### *COMPONENTS*

- 1. 16 oz Sodium hydroxide,  $NaOH$  0.100N** (170-2891). This normality, also written as "N/10," NOT the same as 10%  $NaOH$ , which is about 2.5N. A 0.067N  $NaOH$  solution can also be used. If you make your own  $NaOH$  solution from pellets or dilute a stronger solution, standardize it with 0.1N HCL before use, since it reacts with  $CO_2$  in the water and the normality will be a little lower than expected. This strength of  $NaOH$  is not dangerously caustic, but should not be swallowed.

2. **2 oz Hydrochloric acid, HCL 0.100N** (175-2135): NaOH is standardized with this solution, which lasts up to a year if kept tightly closed. This strength is about as acidic as lemonade, so it is not dangerous even if swallowed.

3. **1 oz Phenolphthalein, in dispenser** (170-4277): Phenolphthalein indicator comes in a squeeze bottle for easy dispensing. It lasts forever, and crystals that form do not affect it. Since it is a powerful laxative be sure not to taste it!

4. **2 Beakers, 600 ml** (471-3285). **If a pH meter is used for the endpoint, substitute 3 glass beakers, 400 ml** (471-3278). Flasks provide an easy view of the titration and enough room for swirling. The 500 ml size allows 200 ml of water to be added before titration.

5. **1 Volumetric Pipet, 5 ml** (471-3943): Measures the test sample, and HCL when standardizing. Do not include the small drop of liquid left in the tip after the rest has drained out (don't blow it out).

6. **1 oz each Dilute Acid** (170-1582) **and Base** (170-1596): Distilled water is not exactly neutral, so the boiling water used is neutralized with dilute acid or base before the sample is added. These very dilute solutions (approx. 0.03N) are not harmful and are OK until moldy.

#### *TITRATION PROCEDURE*

1. **Preparation:** Clean off a work surface and spread paper to catch spills. Use a well-lit place and put a white background (paper towel or index card is OK) under the titration flask. Boil some distilled or deionized water (200 ml per test). The water must be actively boiling, but should boil only a few minutes before beginning the test.

2. **Fill a 10 or 25 ml buret with 0.100 or 0.067 N NaOH.**

3. **Pour about 200 ml of actively boiling distilled/deionized water** (not tap water or drinking water) **into a 600 ml Beaker** (or 400 ml glass beaker). The water is just for dilution and does not enter into the calculations, so the measurement need not be accurate.

4. **Add a squirt of phenolphthalein indicator.** The amount is not critical, but should be at least 5-10 drops. An excess does not interfere, just wastes phenolphthalein.

5. **Neutralize the water by adding dilute base**, drop by drop, until the water is very pale pink. The correct color is the first point that the water is too pink for you to drink it by mistake. If the water turns pink when you add the phenolphthalein, or if you overshoot the pale pink stage, add dilute acid until the water is pale pink. If the water turns bright pink when you add the phenolphthalein, use a different brand of distilled or deionized water for best accuracy.

6. **Pipet 5 ml of the sample to be tested into the neutralized water**, using a 5 ml pipet (not a cylinder or beaker). The pink color will disappear, leaving only the sample color.

