The precision measuring tools in this kit allow the home vintner to measure their additives and ingredients with much more control over the amounts. This will provide repeatability and fine tuning of winemaking goals. The products included in this kit can be used throughout the winemaking process to make measuring, testing, blending and trialing new ingredients easier and more convenient.

KIT CONTENTS:

- Blade Scale: Precise weight measurement of additives
- Hydrometers: Precise measurement of Specific Gravity
  Includes narrow-range hydrometers: SG 0.980-1.020, SG 1.000-1.070, SG 1.060-1.130
- Hydrometer Test Jar
- pH Meter: pH Testing
- 100mL Graduated Cylinder: Precise volume measurements
- 2 Each 50mL and 250 mL Beakers: For weighing and mixing additives
- Wine Thief: Taking samples of your wine
- Buffer Solution pH 4.01 and 7.01
- Storage Solution for pH meter
BLENDING INSTRUCTIONS:

BLENDING WINES

Blending is more an art than a formula, and is deeply based in personal preference. Blending post fermentation will allow you to create the exact final product you want and can be done with any wine you have available.

Blending trials will allow you to choose from the best possible combinations of the blending components. These trials are best done with finished wine that is ready to bottle. This is a method for both red and white wines. You’ll need a 100 mL graduated cylinder, several wine glasses, a notebook, and a few friends.

Taste the blending components, record the appearance/ aroma/flavor/mouth-feel/finish descriptions (no table talk, you want independent descriptors from each participant). Discuss your thoughts after tasting each wine and record the common descriptions. Make three blends to start with, using the graduated cylinder. The wine that will make up the bulk of the final wine is the base wine (wine A) the others will be components. For example by taste you think you would like a blend as follows: wine A 60%, wine B 25%, wine C 15%. (Make sure the percentages add up to 100%). Measure 60 mL (60% of 100 mL) of wine A and pour into a glass, pour 25 mL of wine B into the glass, and 15 mL of wine C into the glass. Mix well and set aside. Make 2 other blends, one with proportionately less base wine and one with proportionately more base wine. Repeat the tasting steps, and discuss the results. Adjust your blends to taste and pick the best one.

Blend your wine in a larger container than you will be storing it in to allow room for mixing. Blend your component wines carefully to avoid oxidation. Rack your blend into an appropriately sized aging vessel with as little head space as possible. Bring your SO2 levels up to your final bottling goals and allow the wine to stabilize for 2-3 weeks before bottling. Due to the varying chemistries of the blending components, what could seem like perfectly stable wines apart, can throw a protein haze or the pH could shift enough to precipitate more Bitartrate crystals once combined. Letting the wine sit for a few weeks will give you a chance to fine or filter the wine again before bottling. This is not very common, but can happen and ruin the appearance of your finished wine. This is a better safe than sorry technique, but it is highly recommended.
SO₂ ADDITION INSTRUCTIONS:

USING SULFUR DIOXIDE TO PROTECT YOUR WINE

The use of Sulfur and Sulfur Dioxide (SO₂, Sulfite) in winemaking has been around for centuries. SO₂ has many uses in the wine making process that ensure that the wine turns out the best it can. SO₂ is an anti-oxidant, anti-microbial, and a preservative that can be added to juice, must, or wine at any point for its benefits. When used at harvest in juice or must it will prevent the wild yeast and bacteria on the skins of the grapes and fruit from starting the fermentation process before the winemaker can add their own selected yeast culture. Once all forms of fermentation are complete, sulfite should be added in small amounts every time a wine is racked, transferred, or filtered to protect it from oxidation and contamination from spoilage organisms. A small amount of SO₂ should be added at bottling to help preserve wine during long term aging.

CALCULATING A SO₂ ADDITION:

As an example, your wine has a pH of 3.5, after referencing the chart below you see a safe goal is 40 ppm free SO₂. After you test your wine you have a free SO₂ level of 15 ppm so 40 – 15 = 25 ppm. Sulfur Dioxide is added to wine in the form of Potassium Metabisulfite (KMS), the average KMS contains 57% SO₂.

To calculate an addition of 25 ppm free SO₂:

\[ ppm = \text{mg/L} \text{ so } 25 \text{ ppm} = 25 \text{ milligrams per liter } \text{SO}_2 \]

(Potassium Metabisulfite (KMS) contains 57% SO₂)

\[ \text{(Goal mg per L } / 0.57) \times \text{(Volume of wine in liters)} \text{ = KMS in mg} \]

\[ 25 / 0.57 = 43.85 \text{ mg/L of KMS} \]

A 23L (6 gallon) batch would need:

\[ 50.87 \times 23 = 1,008 \text{ mg (1g) of KMS added to it.} \]

(There are 3.78 liters in a gallon, if you know your gallons just convert to liters and run your numbers.)

An Alternative to the math — If your wine measures a safe 3.2 to 3.6 pH, below is an easy alternative to the formula above.

A simple and convenient method for making SO₂ additions is to mix 66 grams of Potassium Metabisulfite with 1 liter of distilled water; this creates a 6.6% SO₂ stock solution. Adding 1mL of stock solution per gallon of wine will add 10 PPM of SO₂ to the wine. Simply multiply the needed SO₂ addition by the number of gallons in the batch, for example 25 PPM would be 2.5mL per gallon so; 2.5 X 6 =15mL of stock solution.

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### Wine pH

<table>
<thead>
<tr>
<th>Wine pH</th>
<th>Recommended Free Sulfur Dioxide in PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>13</td>
</tr>
<tr>
<td>3.1</td>
<td>16</td>
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<tr>
<td>3.2</td>
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<tr>
<td>3.9</td>
<td>99</td>
</tr>
<tr>
<td>4.0</td>
<td>125</td>
</tr>
</tbody>
</table>
BENCH TRIAL INSTRUCTIONS:

HOW TO CONDUCT A BENCH TRIAL

Bench trials are used to determine the exact amounts of additives, fining agents, and ingredients to add to your wine to achieve your goals. Trialing different levels of products in small portions of your wine allow you to strike the perfect balance or find the right product without having to dedicate the whole batch to trial and error.

There are many situations that call for running a bench trial; testing for the best sweetness level, tannin addition rates, oak products, fining agents, Increasing or decreasing acid and pH, and enzyme addition rates.

There are just a few simple steps that all bench trials require:

1. Decide on the volume of your sample.
2. Research the dosage range of the product you are testing.
3. Scale the dosage range down to your sample size.
4. Mix a Model solution.
5. Create your trial samples.
6. Evaluate the samples.

Step 1: Decide on the volume of your sample.

For convenience sake most bench trials can be performed in 100mL sample sizes, this allows for easy conversion from volume to percentages. For longer term trials your sample size will be determined by the storage containers you have available, sample sizes can range from 50mL-750mL. Larger sample sizes are easier to work with when dealing with products with very small dosages like tannins or enzymes.

If you have a lot of wine to work with use a sample size that represent the total volume well, around 10% works well. The larger the volume used as a sample the less impact small measuring errors will have. A 1mL error in a 10mL sample is 10%, where in a 100mL sample it’s only a 1% error.

Step 4: Mix a Model solution.

A model solution is a way to increase a small dose of additive to a workable volume. Most home vintners do not have a way to precisely measure 0.01 grams or 0.1 mL. The answer to this issue is the model solution. This solution will create a method to add the product to your trial samples in manageable measurements.

Look at how the recommended dosage rates increase, do the increasing levels go in 50% steps, 100% steps? A 50% increase would look like; first dose level is 1 g/L the second is 1.5 g/L, A 100% increase would look like first dose level is 1 g/L the second is 2 g/L. The goal with most model solutions is to create a solution that will have the equivalent of a full step increase in each dose of 1mL, 10mL, or 100mL depending on the sample sizes you are using.

To create a model solution that contains 0.01g of an additive in 1mL of solution add 1 gram of the product to 100mL of the base wine. \((1 \text{ g}/100 \text{ mL})\times(1 \text{ mL})=0.01\text{ grams}\) use this formula to make any model solution that will fit your trials.
Step 2: Research the dosage range of the product you are testing.

Due to the vast difference between the different products that are used in winemaking, dosage rates vary widely. All wine additive products have recommended dosages from the manufacturer and can be found on the package or on their website. The bench trial is where you will find the best dose for your wine based on personal taste and how the product works in a specific wine.

Dosage rates can be found in many units; grams/liter (g/L), pounds/gallon (lb/Gal), milliliters/liter (mL/L), pounds/1000 gallons (lb/1000 gal). Simply convert them to a scale you are comfortable with.

Step 3: Scale the dosage range down to your sample size.

Here are a few handy conversions to help you scale the dosage rates to your sample sizes.

- 453.6 grams = 1 pound
- 28.34 grams = 1 ounce
- 16 ounces = 1 pound
- 3.785 liters = 1 gallon
- 1000 milliliters = 1 liter
- 1 part per million = 1 milligram per liter
- 1 gram in 1 liter = 0.1%
- 10 grams in 1 liter = 10%

If the dosage rate for a tannin is 1 lb/1000 gallons that is equal to 0.12 grams per liter.

1000 (gallons) x 3.785 = 3,785 liters
1 (pound) x 454 (grams) = 454 grams
454 grams / 3,785 liters = 0.12 grams per liter.

Step 5: Create your trial samples.

Use your model solution to dose your samples to the proper levels. Remember that most model solutions are made with the wine you are testing so take that into consideration when mixing your sample volumes.

As an example let’s look at a basic sugar trial:

The goal is to have 4 levels of sweetness to find the best tasting sugar level and one unsweetened control. **Always maintain a control sample in the same conditions as your trial samples.**

To make a model solution that is 10% sugar, mix 10 grams of sugar with 100mL of the wine being trialed. Now for every 10mL of this solution you add to any solution of 100mL you will get a 1% sugar increase.

- 90mL base wine plus 10mL model solution = 1% residual sugar in the sample
- 85mL base wine plus 15mL model solution = 1.5% residual sugar in the sample
- 80mL base wine plus 20mL model solution = 2% residual sugar in the sample
- 75mL base wine plus 25mL model solution = 2.5% residual sugar in the sample

Allow the samples to age for the appropriate time frame for the product you are testing. Age the samples in containers that are completely filled with the sample volume with no head space. With sugar trials and other flavoring products no aging is required. When trialing tannins, oak, and enzymes wait at least 2 weeks, and if time permits age for the entire recommended time from the manufacturer. You can also trial contact time (the time that the wine is exposed to an additive will determine how much character it will impart) by creating several samples with the same dose of product and sampling them at increasing times.

Step 6: Evaluate the samples.

This is the best step, drinking wine. Taste the samples side by side and choose the best one. This is best done with at least one other person whose palate you trust, and always take good notes. If you feel the ideal dose falls in between two of your trials, simply blend them into the proper proportions and taste them again.

Once you have decided on the best dosage rate, scale up the dose and add it to your total wine volume and age for the recommended period of time.
ACID ADJUSTMENT INSTRUCTIONS:

HOW TO ADJUST ACID AND pH IN WINE

Being able to control the acid levels in your wine is a major key to creating balanced, drinkable wines. Maintaining the proper pH in wine throughout the winemaking process is vital for color stability, spoilage prevention, and SO₂ effectiveness. Having a firm grasp on the techniques that can bring your acidity and pH into balance will give you the ability to fix many of the issues and off flavors that arise from acid or pH imbalances. More than half of wine faults can be attributed to acid levels or pH issues, understanding how to work with these aspects of your wine will help you create more enjoyable wines on a more consistent basis.

First it would be helpful to know what the difference is, between Acidity and pH.

**Titratable Acid** (TA, Titratatable Acidity, and Total Acidity) is the measure of the amount of actual organic acid compounds that are in the juice, must, or wine. TA is expressed in Tartaric Acid equivalent units. Total Acidity is generally expressed in one of two ways, in Grams per Liter such as 7.5 g/L, or as a percentage of the solution and is shown as 0.75%.

TA affects the flavor of the wine or juice, the acid character of wine is determined by the Total Acidity and how it is balanced by the winemaker. TA itself can be adjusted up or down depending on the winemaker’s needs, through Biological methods, chemical measures and physical processes.

**There are many methods to test the TA of juice, must, and wine.** It should be tested before and after Primary Fermentation, after Malo-Lactic fermentation, and before and after acid reduction and addition. (Refer to [http://www.midwestsupplies.com/winemaking-equipment/measuring-testing.html](http://www.midwestsupplies.com/winemaking-equipment/measuring-testing.html) for testing supplies to determine Total Acidity.)

**pH**, on the other hand, is the measurement of H⁺ ions that are released from the acid compounds mentioned above when they are in solution. The pH is affected by many other components found in wine, so it does not directly correlate to the amount of acid(s) found in a specific juice or wine. The pH affects the; color, yeast health, microbial stability, and availability of free SO₂ in your wine.

In low pH wines (<pH 3.5) the color will be much closer to what you would expect from a particular grape, white wines will be light straw to gold and reds will be purple to bright red. As the pH approaches 4 the color will darken and become brownish, and the wine will become more accessible to spoilage organisms. Very low or very high pH in your must or juice can cause your yeast to perform poorly and create off flavors in the wine, or fail to complete fermentation. Oxidation will happen faster in high pH wines because SO₂ quickly becomes bound up in an unusable state. There are many chemical methods to raise and lower pH, depending on the winemaker’s goals.

**pH is tested with an electronic pH meter.** It should be tested before and after Primary Fermentation, after Malo-Lactic fermentation, and before and after acid reduction and addition.

MAKING AN ADJUSTMENT TO pH OR ACID LEVELS

When adjusting one aspect or the other, both acidity and pH will be affected, it is important to maintain a balance between the two values. As you adjust pH down the acid level will go up, and conversely as you remove acid the pH will go up. When working with classic grape varieties or most other fruit you will probably need to add acid to bring the pH down and the TA up. When making wine with cold climate or French hybrid grapes and other high acid fruit, you will need to bring the acid down while keeping the pH in an acceptable range.

There may come a time that your wine is a little lifeless or flabby due to a low acid content, acid in wine is a major structural component and can greatly affect the quality of the wine. There may also be a time when your pH may get too high due to harvest chemistry or after Malo-Lactic Fermentation is complete.

In grapes, the primary acid is Tartaric acid, with lower amounts of Malic and Citric acids. In most non-citrus fruits and berries the primary acid is Malic acid with a small portion of Citric acid and in citrus fruit Citric acid is the primary acid. Keep this in mind as you will want to use the proper acid or blend of acids to correct your wine.

The adjustment addition should be added before fermentation starts or after it completes(use the SG 0.980-1.020 range hydrometer and test jar to determine if the fermentation has completed, the wine’s specific gravity will be 0.998 or less), if you change the environment of the juice or must during fermentation you run the risk of shocking the yeast. This can stall or even completely stop the fermentation; this includes Malo-lactic Fermentation.
Start by testing your juice, must, or wine for pH and acid levels (Total Acidity), and then compare that to your wine making goals. The following are guidelines to get you into the right ballpark, once in the neighborhood it will be up to your personal tastes to fine tune the acid character.

<table>
<thead>
<tr>
<th>Wine Style</th>
<th>Total Acidity (TA)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry White Wine</td>
<td>0.65–0.75 %</td>
<td>3.1–3.5</td>
</tr>
<tr>
<td>Sweet White Wine</td>
<td>0.70–0.85 %</td>
<td>3.0–3.3</td>
</tr>
<tr>
<td>Dry Red Wine</td>
<td>0.60–0.70 %</td>
<td>3.4–3.8</td>
</tr>
<tr>
<td>Sweet Red Wine</td>
<td>0.65–0.80 %</td>
<td>3.2–3.6</td>
</tr>
<tr>
<td>Sherry or Port Grape Wines</td>
<td>0.50–0.75 %</td>
<td>3.2–3.8</td>
</tr>
<tr>
<td>Non-grape White Wines</td>
<td>0.55–0.65 %</td>
<td>3.2–3.5</td>
</tr>
<tr>
<td>Non-grape Red Wines</td>
<td>0.50–0.60 %</td>
<td>3.2–3.5</td>
</tr>
</tbody>
</table>

To balance high acid in wine there are two main techniques used; either removing acid or adding sugar once the wine is stabilized.

Removing acid from wine is done by three main methods; biological, chemical, or physical and is usually achieved with a combination of methods.

**Biological Acid Reduction:** In red wine, and a few styles of white wine, acid is reduced following alcoholic fermentation by inoculating the wine with a lactic acid bacteria strain. This secondary fermentation is referred to as Malo-Lactic Fermentation; acid is reduced when the culture consumes malic acid and converts it into lactic acid and CO₂. Not only does this process reduce the amount of acid in the wine but also softens the acid character by replacing sharper malic acid with more mellow lactic acid. There are many strains of ML bacteria to choose from and many have secondary sensory impacts, take care to match the right culture to your wine making goals. There are also a few yeast strains with malic acid reduction abilities, these are usually suited for white wine making when MLF is undesirable.

**Chemical Acid Reduction:** If you are making a dry white wine, or using cold climate hybrid grapes, and MLF is not suited to the style (styles the are fruity and/or sweet), you will need to reduce the acid chemically. There are many chemicals to reduce acid in wine, and twice as many opinions as to which should be used. In the end it will be up to your personal taste and experience to choose the right combination to achieve your winemaking goals.

**Potassium Carbonate (KCO₃):** Use at a rate of 1 g/L to reduce TA by 1 g/L (0.1%). The wine can be chilled or cellar temperature, but unlike CaCO₃, KCO₃ reacts very quickly and does not leave sediment due to the fact that it neutralizes Tartaric acid to remove it. If you need to reduce your wine’s acid levels more than 3 g/L consider using a combination of methods to reach that goal. Adding more than 3 g/L of KCO₃ can have significant flavor impacts. Only reduces Tartaric acid. Bench trials should be done to determine the proper amount to add to your wine, if an excessive addition is made the wine can suffer from a lack of acid in the flavor or the pH can raise to unsafe levels.

**Potassium Bicarbonate (KHCO₃):** Use at a rate of 0.9 g/L to reduce TA by 1 g/L (0.1%) up to a maximum of 3 g/L. KHCO₃ works by both neutralizing Tartaric acid and precipitating it out. This method takes 2-3 weeks to complete the desired reduction but is gentler in regards to flavor profiles. Only reduces Tartaric acid.

**Potassium Bitartrate (KHTa) aka Cream of Tartar:** This is a natural product of wine making and can show up in varying degrees in different wines. Using it in conjunction with cold stabilization can reduce the TA of your wine and ensure the Potassium Bitartrate will not precipitate in your wine bottles. Adding KHTa to wine when it is below 40°F will cause the access Tartaric acid to form larger Bitartrate crystals and fall out of the wine. This is commonly known as seeding, adding more of a chemical that is already present to draw more of it out than went in. Only reduces Tartaric acid.

**Calcium Carbonate (CaCO₃) aka Chalk:** Use at a rate of 0.7-1.5 g/L to reduce TA by 1 g/L (0.1%). This method should be used at least 3 months before bottling to prevent a chalk haze or crystalline deposit from forming in bottle. Adding chalk 2-3 weeks before filtering will reduce the chance of hazes or chalky flavors. This is commonly used in juice pre-fermentation to avoid the issues above.
Acid Adjustment (continued)

AcideX Super K: This is a proprietary Tartaric acid reduction powder that contains Potassium Bicarbonate (99%) and Potassium Bitartrate(1%). This product works by both neutralizing acid and seeding to precipitate acid reaction products. Use at a rate of 1.2 g/L to reduce TA by 1g/L (0.1%) up to 3 g/L TA reduction. The manufacturer recommends the wine should have a TA of 10 g/L (1%) or greater and a pH of 3.0 or lower when employing this product. To complete this method of acid reduction, the wine must be cold stabilized.

Physical acid reduction: This is achieved with a process called Cold Stabilization. With this method the wine is held at 28º-38ºF for 2-3 weeks. This causes Tartaric acid to form large crystals and fall out of solution; this is most commonly done in white wines so it will not happen in the finished bottles when it is refrigerated. Cold stabilizing is becoming a common practice for acid reduction with high acid, cold climate grape wines, both red and white. This method can be used with no chemical aids, but the total TA reduction will depend on the chemical makeup of each specific wine. Test the TA before and once a week during the process to track the progress. For more predictable results, use this method with Potassium Bitartrate seeding.

Balancing low acid wine it is as simple as adding the right acid in the right amount.

To increase acid: 1 gram of Tartaric Acid per liter of wine will increase your TA by 1 g/L or 0.1%, it will also bring your pH down by 0.1. When using Malic or Citric acid to adjust fruit wines keep in mind that malic acid will increase your TA by 1.12 and citric acid will add 1.17 to your TA values. Different wines have different pH buffering capacities so if you need to make a large pH reduction it may take more than 1 g/L of tartaric acid, for instance going from 3.6 pH to 3.3 pH may require 4 g/L since pH changes on a curve not a line. Make a standard addition of 1 g/L and wait a few hours and retest your wine and make any corrections according to your results.

The goal is to create balanced, drinkable wines that showcase the character of the grapes or fruit you use. Finding the right balance between the flavor, acid, and sweetness in a wine is an act of both art and science. With experience and experimentation you can master acid and pH balance in your wines, taking your craft to a higher level of quality and enjoyment.