

Glossary of Winemaking Terms

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- **Acetaldehyde:** a chemical compound in wine formed by the oxidation of ethanol, during aging and exposure to air, and unless there is sufficient free-SO₂, vinegar, is the final by-product. Normally, when adequate SO₂ levels are maintained, it binds with acetaldehyde, making it imperceptible.
- **Absolute filters:** see Nominal filters
- **Acetic acid** (vinegar): a volatile acid (one you can smell) that can develop in wine. It is typically created by Acetobacter bacteria that thrive in an oxygen-rich environment.
- **Acetobacter bacteria:** a group of bacteria that are part of the complex natural microbial flora of grapes and wine. They are ubiquitous in the environment, and well adapted to sugar- and ethanol-rich environments, like grape juice and wine. They ‘oxidize’ ethanol to acetaldehyde, and ultimately acetic acid (vinegar).
- **Acid:** a solution with pH less than 7, an elevated concentration of H⁺ ions, a substance that donates hydrogen ions (protons) to another substance in solution, is identified by its sour taste, and reacts with bases to form salts
- **Acidity:** the sharp, crisp, or tart taste that balances the sweetness in a wine. It comes from natural acids in the grapes. All the elements of a wine: acidity, tannins, alcohol, sweetness, and body must be in relative balance or harmonious. Wines with too low acidity taste flat and those with too much acid taste sharp or tart.
- **Acidification:** typically, the addition of Tartaric acid to grape juice, must, or wine to increase acidity of by raising TA and lowering pH.
- **Aerobic fermentation:** occurs when white grapes (primarily) are fermented in closed tank and the air with it is displaced using CO₂, Nitrogen gas or Argon or inert gas
- **Aeration:** the process of actively of introducing air during to fermenting juice/must to soften tannins and heighten fruitiness.
- **Aging:** with respect to wine, the process of maturing wine in tanks or barrels before bottling to improve appearance, stability, aromas/flavors, balance, body, and complexity. Aging also occurs in the bottle.

- **Airlock:** a simple device inserted in the bung hole of a barrel or aperture of a fermentation tank used during fermentation and Malolactic conversion to allow CO₂ to escape, while preventing the entry of air.
- **Aerobic:** conditions that promote some exposure to O₂, during fermentation, racking(s), use of an oak barrel with porous wood, or even the use of natural and many synthetic corks that are slightly pervious.
- **Albumen:** egg white or a powdered-form of egg whites use to remove excess astringency in a red wine.
- **Alkaline:** pertaining to basic solution having a pH greater than 7. A substance (base) that can donate a hydroxide ion (OH⁻), or accepts a proton (H⁺) ion, and it also reacts with an acid in solution to form a salt, neutralizing both. This is an important concept when deacidification of juice, must, or wine is needed.
- **Alcohol by volume (ABV):** a standard measure of how much alcohol (ethanol) is contained in wine, expressed as a percentage of total volume.
- **Alcohol by weight (ABW):** is a measure of the proportion or percent of alcohol in wine when measured as weight rather than volume. For example, 10 percent alcohol by weight equals 10 fl. oz. of alcohol per 100 fl. oz. of wine. This measure is always lower than Alcohol by Volume. To calculate the approximate Alcohol by Weight, divide Alcohol by Volume by 1.25. Similarly, to calculate the approximate Alcohol by Volume, multiply Alcohol by Weight by 1.25. Abbreviated as ABW or alc./wt.
- **Alcohol conversion factor:** a simple way to approximate the potential alcohol content of a wine is to multiply the °Brix at harvest by 0.59, the current alcohol conversion factor. This gives you the likely percentage alcohol by volume. The actual content will vary a bit, depending on grape variety, yeast uses, and fermentation temperature.
- **Ambient yeast:** those that have not been introduced to the must by inoculation with a cultured strain. Those that occur naturally (wild or indigenous) on the grapes and vineyard, and those that have taken up residence in a winery. Although there are many genera and species of yeast throughout the world and countless clones or isolates, most modern wine fermentations involve *S. cerevisiae* is necessary to avoid stuck fermentation and wines with unpleasant aromatic notes (see **Pied de cuve**). *Saccharomyces cerevisiae* is found at relatively low levels in vineyards throughout the world on freshly harvested grapes, but patterns of

distribution are variable and there is a high level of biodiversity (isolates) within different sub populations from vineyard to vineyard, unless a winery reintroduced winery waste, such as lees or pomace and into the vineyard. Some of the factors for diversity involved include, climate altitude, plant communities nearby, grape variety, farming practices. Other species of *Saccharomyces* can also be found on grapes as higher frequencies.

- **Anerobic:** conditions that restrict exposure to air, for example, fermentation and aging in tanks, use of dry ice or argon to blanket fruit before crushing or afterward, liberal use of SO₂ throughout the winemaking process, moving wine under gas pressure or gravity, the use of Ascorbic acid to remove dissolved O₂ in wine before bottling, and bottling under anerobic conditions.
- **Antioxidant:** chemicals, such as SO₂ Ascorbic acid, and tannins can be used to prevent or minimize oxidation of grape juice, must, and wine.
- **Anthocyanins:** pigments found in grape skins that give red wine its color.
- **Appellation:** a legally defined geographical area used to identify the region where the grapes for a wine were grown.
- **Argon:** a colorless, odorless, and tasteless inert gaseous element found in the air. It is chemically inactive and, thus, useful in winemaking to fill the void in barrels and tanks to displace the air. It is heavier than air and, therefore can be used to blanket juice, must, or wine stored temporarily in a tank or container.
- **Astringency:** the mouth-drying, puckery sensation caused by tannins in wine. It is caused by interaction of tannins with proteins in the saliva, binding them so that your mouth is no longer lubricated leading to a dry or rough mouthfeel. The level of astringency is influenced by the type and quantity of tannins present, the pH of the wine, and the temperature when served.
- **Autolysis:** the breakdown of dead yeast cells in wine, particularly sparkling wines and aging wines sur-lie and extended maceration, adds richness and complexity.
- **AVA (American Viticultural Area):** the appellation of origin used on wine labels. Each grape-growing region is delimited by specific geographic or climatic features that affect the grapes and distinguish them from the surrounding regions. For example, the Sonoma Coast, versus Russian River Valley AVA
- **Balance:** the harmony among a wine's components, such as acidity, tannins, alcohol, sweetness, and body.

- **Barrel aging:** the process of aging wine in oak barrels, exposing it to small amount of air, and that that impart tannins and aromas like vanilla, caramel, cloves and other sweet spices, coconut, smoke, toast, etc.
- **Barrel fermented:** wines fermented in oak barrels rather than in stainless-steel plastic, concrete or terracotta tanks, or other containers.
- **Bâtonnage:** the French term for stirring lees (yeast sediment) during wine aging to enhance texture and flavor. Most yeast die shortly after fermentation and release polysaccharides and mannoproteins into the wine as they breakdown (autolysis). These compounds add body and enhance mouthfeel.
- **Bentonite:** a type of clay used as a fining agent to clarify white wine by removing unstable proteins and other particulates.
- **Bordeaux blends:** those containing more than one of the following 6 traditional varieties—Cabernet Sauvignon, Merlot, Malbec, Cab Franc, Petite Verdot, and Carménère.
- **Blending:** combining different lots of wine to create a desired final product, often used to achieve consistency or complexity, or to enhance or diminish some element of a wine.
- **Body:** the feel or sensation of weight or viscosity of a wine on the palate. The factors that influence body include alcohol, sugar, tannins, glycerol, and compounds like polysaccharides and mannoproteins. It is a tactile thing, for example: full, thin, watery, oily, or unctuous. For example, or skim milk, whole milk, or and cream.
- **Bound SO₂:** the portion of the SO₂ added to grape juice, must, or wine that quickly binds with various grape components, e.g., tannins, anthocyanins, and other poly phenols, sugars, and other grape components, and acetaldehyde, thus, is referred to as '**bound**' SO₂. Sulfites, once bound, are no longer available to protect the wine. Total SO₂ is level of free and bound.
- **Bottle shock:** a temporary condition that occurs shortly after bottling. Affected wines smell and tasted dull, muted, closed-in, or just disjointed. Thankfully, the condition is temporary. Wines that are shipped (shaken, tumbled) are also likely to suffer this condition). After several weeks the condition usually disappears.
- **Botrytis cinerea:** a fungus that grows on the skin of grapes as they ripen, causing them to dehydrate, concentrating the sugars, and enhancing flavors (see **noble rot**).

- **Brettanomyces (Brett):** one of the many types of wild yeast that contribute an earthy, barnyard, horsey, or medicinal or Band aid-like aroma to wine, and when noticeable, is considered a fault.
- **Brix (°B) / Balling:** a measure of the dissolved solids, mostly **sugars**, in grape juice, must, or wine, indicating potential alcohol in the wine. °Brix is also a measure of the specific gravity of a solution, relative to that of water. The value is expressed as degrees Brix (°B) which is the number of grams of sucrose present per 100 grams of juice, must, or wine. Both °B and specific gravity can be determined using a hydrometer. (see **Specific gravity**). A °Brix reading of -1.5 to -2 indicates that a wine is essentially dry and contains little to no fermentable sugar.
- **Bung:** the solid plug or stopper, usually made of silicon that is inserted in a bunghole of a barrel, or the top of a carboy to prevent the entry of air.
- **Bunghole:** the hole in oak staves of a barrel that provides access the wine or the barrel's interior.
- **Cap:** the dense layer of crushed grapes, skins, seeds, stems and other solids that quickly rises to the top of the fermenting must, carried by CO₂ gas bubbles during fermentation. To ensure good extraction of tannins, pigments, and varietal aromas, it must remain in contact with the juice below, for much of the time. For that to happen, it must be broken up, remixed and resubmerged by physical means ('punching down') into the juice below at the very least once a day.
- **Carbon dioxide (CO₂):** one of the byproducts of fermentation. It gives sparkling wines their characteristic fizz and bubbles. When making still wines, CO₂ is allowed to escape during fermentation. The evolution of CO₂ during fermentation displaces air, thus, preventing oxidation. Additionally, CO₂ helps to maintain freshness by preventing the growth of bacteria and other harmful microorganisms. In the form of dry-ice, it is often used to cool grapes quickly after picking to help prevent spontaneous fermentation by wild yeasts, and prevent the fermentation from ramping up quickly after inoculation. It can also be used to displace oxygen when topping up, or when opening barrels, tanks, or carboys. One issue, though, is that it dissolves into the wine, making it a slightly fizzy. This, however, dissipates unless the CO₂ is introduced shortly before bottling. Other gasses, such as Nitrogen or Argon, are commonly used for this purpose by professional winemakers.

- **Carbonic maceration:** a unique technique involving fermenting whole grape clusters in a carbon dioxide-rich environment. Tanks, rather than open-topped fermenters, are used, and the air within them is displaced by Carbon Dioxide (CO₂). The resulting wines are intensely fruity, and low in tannins. It is commonly associated with the production of Beaujolais in France. The initial anerobic fermentation is not caused by yeast or any other microbes, but an intracellular fermentation mediated enzymatic. Whole clusters are placed in a sealed container, which are then filled with carbon dioxide. Natural fermentation begins quickly near the bottom of the tank as some clusters nearer the bottom are crushed by the weight of those above them, releasing their juice. The CO₂ creates an aerobic environment that inhibits yeast and bacteria within the intact berries/clusters. So, in this oxygen-free environment, the berries begin to ‘ferment’ from the inside. The CO₂ breaks down the sugars and malic acid, resulting in the production of some alcohol along with a range of other compounds that affect the wine’s final flavor. Once the alcohol reaches about 2%, the berries burst, releasing their juice naturally, and the remaining sugars are allowed to ferment natural. Resulting wines are light in color, low in acidity and tannins, and characterized by ample fruity aromatics.
- **Carboy:** typically, 5-gal glass or food-grade plastic (PET) containers used for fermentation, to hold juice/wine while for settling, or storage. Primarily used by home winemakers.
- **Casein:** a fining-agent derived from milk protein to reduce the level of phenolic compounds associated with bitterness and oxidative browning. It can also be used to minimize oak character from an over-oaked wine.
- **Chitosan:** natural compounds derived from the chitin, the principal structural component of fungus and plant cell walls, and the exoskeletons of crustacean and insects, used increasingly by winemaking as a fining agent to replace gelatins (animal proteins). It can be formulated to control or eliminate bacterial growth, remove oxidized color, and clarify wine. It has a positive charge to help promote flocculation of colloids.
- **Citric acid:** an acid that occurs in small amounts in grapes and wine. The use of Citric acid to acidify juice or must before fermentation is not recommended, as it can be converted to acetic acid. It can be added to some white and blush wines because it imparts a citrusy character that may be desirable. It is poor choice for red wine as it heightens astringency. It is most useful for doing a final rinse of barrels cleaned or treated with Sodium percarbonate

(Proxycarb) a basic cleaning agent, to neutralized it, and to inhibit microbial activity in cleaned/treated barrels.

- **Clarification (stabilization):** the process of removing insoluble materials (dead yeast, bacteria tartrates, pectins, phenolic compounds, unstable proteins, and other extraneous material including bits of grape skins and pulp, suspended in a wine. Unless removed, such material would adversely affect appearance, taste and aroma, and stability. A wine with too much suspended matter will appear cloudy and dull. Wine, at the time of bottling should be clear and brilliant, so that sediment does not form in the bottle. Methods to clarify wine include: fining, filtration, centrifugation, refrigeration, racking, and barrel aging. In white wines, 'clarifying' enzymes help to break down pectins and other structural components within the skins, pulp, and other structural material, to reduce the level of suspended solids in the juice. Gravity plays an important role, but fining agents may be needed to remove a persistent haze or cloudiness. Filtration is also effective.
- **Closed-fermentations:** when a fermentation is done within a closed (sealed, but vented) tanks, rather than one where exposure to air cannot be controlled.
- **Cold-soaking or cold maceration:** a common practice of chilling red grape must to $<50^{\circ}\text{F}$, for several or more days prior to starting fermentation. This is thought to enhance the extraction of color and fruit flavors from the skins without extracting bitter tannins. The process of chilling the grape-must allows for a longer, cooler maceration of the skins in an aqueous solution before fermentation, rather than one with an increasing level of alcohol, a strong solvent.
- **Cold stabilization:** the process of exposing wine to near- freezing temperatures for several weeks to cause the excess Tartaric acid in solution to precipitate out as crystals of Potassium Bitartrate crystals from forming in the bottle. This reduces acidity and prevents the crystals from forming later in the bottle upon chilling.
- **Copper sulfate:** a common fining agent used to treat reduced wines. It binds with Sulfides like H_2S and mercaptans, and can dramatically clear up a quickly a stinky wine and improve aromatics. If it occurs early in the fermentation, add a commercial yeast nutrient, like Fermaid O. It is best to treat reduced wines as soon as reduced odors are detected or just after fermentation. Use Reduless (Lallemand) to mitigate the odor, and remove any lingering

Copper residue which could reduce wine quality and shorten the wine's lifespan. It can be added anytime during fermentation or MLC

- **Cork taint:** a decidedly musty or moldy odor in wine caused by TCA, a chemical compound occasionally found in wine corks. The odor from tainted cork infuses into the wine, making it undrinkable. The compound develops when the corks are contaminated by fungal spores or remnants of the fungi, and are then treated with Chlorox or other chlorine disinfectants. Cork is the outer bark of the cork oak, where fungi are plentiful. Wood pallets and wine-case boxes can be affected in the same manner. Both wood and paper products commonly contain mold spores or hyphae (the vegetative body of fungi). Wine in bottles with clean corks can be contaminated when stored on wood pallets or in case boxes that have been exposed to Clorox or chlorinated compounds. Root systems of cork oaks growing in areas where fungicides and insecticides were widely used in the past, can take up the chemicals that can cause the taint. Thus, cork made from their bark are contaminated.
- **Counter-fining agents:** a fining-agent used to facilitate the removal of another agent in wine after it has done its work. They can help compact the lees after treatment with Bentonite, expedite settling, reduce the risk of leaving a protein- or plant-based agent, including Isinglass behind, or prevent over-fining. Bentonite has a plus (+) charge, and can be used to remove protein-based agents having a negative (-) charge. Silicon Dioxide has a negative (-) charge and, thus, is useful for hastening the settling, and compacting of Bentonite-protein particulates.
- **Crushing:** the mechanical process of rupturing grape skins to release the juice, typically the first step in winemaking.
- **DAP (Diammonium Phosphate):** an inorganic Nitrogen-based substance. When added to wine, it provides an immediate source of Ammonium ions (NH_3^+), which stimulates rapid cell growth and hot fermentations. The issue is that Nitrogen supplied as ammonia (DAP) is taken up very quickly, and often cannot sustain the yeast for long. Consequently, the fermentation may falter or stop altogether before all the sugar is metabolized. The use of balanced organic yeast-derived nutrients formulated with amino acids produces healthier fermentations, better aromatics (e.g. terpenes and esters), and lower levels of undesirable compounds (e.g. ethyl acetate and hydrogen sulfide). In general, DAP should only be used when YAN is severely deficient in juice or must. If used, combine it with complex organic nutrients, such as

Fermaid O (Scott) or Nutriferm Energy (Enartis). Both Fermaid K (Scott) and Nutriferm Advance (Enartis) contain DAP, and are recommended for use when YAN is very low, but after 1/3 of the sugar is depleted. When YAN is less than 150 you can increase it to that level 12 to 24 hours after inoculation. Rate: 25 g/hL of DAP will increase YAN by 50 mg N, or use an increased rate of a DAP-free nutrient formulation after sugar has dropped 2 to 3 °Brix.

- **Deacidification:** the process of lowering the acidity of grape juice, must, or wine to reduce TA and raise pH. You cannot raise or lower one without affecting the other.
- **Defect (wine):** an unpleasant appearance, smell, flavor, or sensation, associated when something has gone amiss during the winemaking process or during storage/maturation (see **Wine Faults**). Defects significantly diminish a sensory appeal and may make a wine unpalatable.
- **Délestage:** French term for racking (draining) the juice/wine under the cap, and then returning it to the tank. It is also known as 'rack and return.' The wine is drained into a secondary vessel as the cap settles to the bottom. As the wine is drained from the tank, a sieve is used to capture the seeds and removes them from the wine. The wine is then returned (pumped gently) to the fermenting tank or container. This is often done daily in lieu of punch-downs. The object is to minimize harsh seed tannins, and extract phenolic compounds more gently, while aerating the wine to produce a softer, less astringent wine, exhibiting more fruit. It also cools the fermentation, extending the fermentation, and allows off-aromas to dissipate. Rather than going to such lengths, some winemakers will rack their wine from one container to another, once or twice during fermentation to remove the seeds and aerate the wine.
- **Destemming:** the mechanical separation of grapes from their stems.
- **Diacetyl:** an organic compound that certain strains of Malolactic bacteria produce, imparting a buttery smell/taste. Something you may not want.
- **Disulfides:** volatile sulfur compounds that can be formed in wine after fermentation when sulfides and/or Mercaptans are oxidized. They do not respond to copper without first converting them back to Mercaptans with Ascorbic acid to break the disulfide bond
- **Élevage:** a term used by French winemakers to describe the process of maturing and refining their wines from the time of harvest to bottling. Also: the art and science of maximizing the grapes' potential through: fermentations using wild or ambient yeast, long, slow macerations,

extended maceration, controlled exposure to air, racking frequency, barrel-aging, fining, filtering, and blending. Roughly translates to "raising" in English.

- **Enology:** the science of wine and winemaking.
- **Enological tannins:** commercial preparations of tannins made from oak wood, exotic woods, grape skins, and other natural sources, can be added at different stages of winemaking to meet a range of objectives (see **Tannins**).
- **Enzymes:** with respect to winemaking, naturally occurring or commercially prepared substances (proteins) that break down the skins and pulp to increase the extraction of tannins and aroma/flavor precursors, or expedite clarification (the settling of solids). Depending on the type used, they can increase yield, reduce turbidity, improve filterability, enhance color and aromas, or hasten the release of mannoproteins from dead yeast (**autolysis**). Various enzymes have different functions, some are best for juice clarification, while others are better at extracting aromas, flavors, and/or improving color. Winemakers may use one or more enzymes to meet their objectives.
- **Enzymatic browning:** the browning of white grape juice due to oxidation caused by an oxidative enzyme – polyphenol oxidase. The addition of Sulfites effectively renders it harmless.
- **Ethyl Acetate:** a serious defect in wine with the distinct smell of finger-nail polish or its remover. This chemical is produced by Acetic acid and Lactic Acid bacteria when finished wine becomes oxidized by exposure to excess oxygen. It commonly forms in neglected wine, particularly when SO₂ levels are allowed to drop below the targeted free SO₂ level, when barrels are not topped-up or storage tanks are not filled to near capacity. Sometimes it is caused by an air leak in a barrel or contained, a poorly-seated bung, or even a damaged (eroded) bung-hole.
- **Extraction:** the process of extracting pigments, aroma/flavor precursors, and, of course, tannin from grape skins during fermentation, cold-soaking, and extended maceration.
- **Extended maceration:** the practice of leaving finished red wine in contact with their skins and seeds for several weeks or longer to 'soften' the tannins, decrease bitterness, create tertiary aromas/flavors, and add complexity.
- **Fermentation:** the natural process by which yeast cells convert sugar for metabolic energy, while producing alcohol and carbon dioxide as waste or by-products, transforming grape juice

into wine. This reaction occurs largely in an anerobic environment because the evolving CO₂ displaces air, and the small amount of dissolved O₂ in the juice or must is quickly depleted by the yeast. For successful and relatively trouble-free fermentations, it is vital to suppress the undesirable microorganisms, and minimize oxidation. Nutrient availability is a crucial factor to sustain a healthy yeast population. Fermentation temperature, greatly influences fermentation. Problems arise when the fermentation is allowed to rise above the yeast tolerance range, or the temperature is too cold. Ensuring a sufficient level of Oxygen to meet the metabolic needs of the yeast is also important during fermentation in the outcome.

- **Field blend:** a wine made from multiple grape varieties that are harvested, fermented, and vinified together.
- **Film yeast or bacteria:** these microbes grow on the surface of wine, forming a white, waxy film over the wine's surface. They thrive in an oxygen-rich environment, such as leaky barrels, or when barrels and tanks are not filled to near-capacity, or large voids are allowed to develop in barrels due to infrequent topping. These organisms produce acetaldehyde that can ultimately form vinegar and ethyl acetate (volatile acidity) and or that can spoil the wine. Maintaining sufficient levels of SO₂ inhibit their development.
- **Fining:** the addition of various substances to remove undesirable elements in juice, must, or wine or enhance sensory appeal. Objectives include: clarification, removal of bacteria, a resistant haze, an undesirable odor, oxidative browning, or some other undesirable characters. Fining can also improve palatability by reducing astringency or bitterness, or enhancing mouthfeel by increasing viscosity. Other benefits include stabilization of color and colloids (substances that cause haziness).
- **Fining agents:** selective substances that allow winemakers to improve clarity, stability, and sensory appeal. They work by binding with something in the juice, must, or wine that is objectionable, due to their opposite electrical charges, or through *absorption*, or *adsorption* (adhesion of molecules to a surface) to form larger particles (floculates) that are no longer soluble, and heavier than water, so they settle out. These agents are used to enhance a wine's stability and sensory appeal, and they can be added during or after fermentation, during aging or just prior to bottling, depending on the objective.
- **Filtration:** the removal of suspended particulates and microorganisms from wine by pumping it through a filter pad or cartridge to trap them, ultimately improving clarity and stability.

- **Finish:** The final impression of the textural sensation and flavors lingering in the mouth after swallowing a sip of wine, particularly in terms of length and persistence, e.g., dry vs. or sweet, tart vs. flabby, thin vs. unctuous, smooth vs. harsh (astringent), rich vs. austere, bitter, other descriptors fruity, spicy, floral, herbal, earthy
- **Free-run juice:** the juice that flows freely from grapes without pressing, often considered the highest quality for winemaking.
- **Free SO₂:** the relative amount of dissolved SO₂ gas, HSO₃⁻ (Bisulfite), and SO₃²⁻ (Sulfite) in wine that is free (unbound) to protect the wine from microorganisms and oxidation.
- **Fruit flies:** tiny golden-brown flies that plague wineries during winemaking, carry yeast cells, as well as bacterial spoilage organisms. There is some research indicating that they carry *Saccharomyces cerevisiae* yeast, and may play a role in spontaneous fermentation, unless fruit flies are carefully managed. They are strongly attracted to smell of alcohol and other fermentative odors. Fermenting wine should be tightly covered during fermentation, and steps to keep them away when pressing grapes or processing wine, should be taken.
- **Gelatins:** a group or protein-based fining agents derived for animal bones or fish swim bladders, and now there are vegetal proteins alternatives. They effectively remove bitterness, and astringent tannins, or improve clarity.
- **Gas-transfer tool:** a specially designed tool, typically called a ‘bulldog,’ used to transfer (rack) a wine, from one barrel to another, or back to the original container, using pressurized gas. This minimizes exposure to air during racking so the sediment (‘lees’) can be flush out.
- **Gum Arabic:** a gum or resin-like substance (carbohydrate) obtained from the bark of several Acacia species. Because it improves colloidal stability, it is commonly used as a food additive, in pharmaceuticals, and wines for the same reason. Benefits include improved mouth-feel, reduced bitterness and astringency, pigment stability in red wines, and it adds a sense of sweetness, and roundness.
- **Hard press wine:** the juice or wine that flows when moderately high to maximum pressure is applied to grapes/must during pressing. It is considered of lesser quality because it can be more astringent.
- **Haze (protein haze):** cloudiness in wine that resist settling, usually caused by excess protein that binds with tannins, creating a haziness. Bentonite or Sparkaloid can be used to mitigate proteins/tannins particles.

- **Head-space:** the unfilled space above a wine in a container (see **ullage**). After fermentation, holding containers should be filled to near capacity. Leave a small amount of space to allow for expansion if the temperature increases.
- **Hectoliter (hL):** a useful measure for winemaking, meaning 100 liters because dosage rates for many wine additives are listed as **g/hL**. One **hL** is equal to about 26.4 gallons.
- **Hydrometer:** an instrument for measuring the percent sugar ($^{\circ}\text{Brix}$) or specific gravity of a liquid, and determining potential alcohol.
- **Inert gas:** a gas that does not react with wine or other chemical substances. Argon, Nitrogen (N_2) and Carbon Dioxide (CO_2), are considered inert in wine. CO_2 though will dissolve in wine making it spritzy or carbonated.
- **Iodoform:** a disinfecting agent containing Iodine commonly used by brewers and winemakers to sanitize equipment and bottles. Its major advantage over other sanitizers is that when used as recommended it does not require rinsing. However, it can leave unattractive orange-brown stains on plastic parts and equipment if left in contact with them.
- **Ionization:** a chemical reaction in which electrically neutral atoms or molecules *dissociate*, and become electrically charged ions by gaining or losing electrons. This often involves the loss of H^+ ions in solution. Wine acids, like Tartaric acid (H_2Ta), ionize in solution, releasing one or both of its 2 H^+ ions, and a negatively charge ion (HTa^-) an ‘anion’ or a conjugate base or (TA^{2-}). In this manner, they can react with other ions with the opposite charge. For example, Potassium ions (K^+), in grape juice will react with Bitartrate (HTa^-) ions released when Tartaric acid dissociates in solution, forming Potassium Bitartrate, the crystalline salt found on the walls of fermenters and barrels. Acids, bases, and salts in solutions like wine, exist as charged ions with either a positive or negative charge. Depending on the pH of the solution, the second H^+ ions, resulting in the Tartrate (TA^{2-}) ions.
- **Isinglass:** a gelatin (collagen) obtained from the dried swim-bladders of fish, used to improve clarity, and add brilliance to white and rose wines. Also favored for Pinot noir for its gentle fining effect, and for softening tannins and improving aromas.
- **Juice panel:** typically, a bank of tests performed on a sample of juice, by a commercial wine lab to accurately determine Brix° , TA, pH, YAN, and level of Malic acid. This information is critical for adjusting the juice and knowing whether YAN is deficient of the available deficient or dosage rates for adding supplemental nutrients.

- **Lactic acid:** the acid produced during malolactic fermentation, contributing a creamy texture, and reducing overall acidity.
- **Lactic acid bacteria:** a group of bacteria, some of which convert Malolactic acid to Lactic acid in wine. Such bacteria are usually inoculated into wines, mostly reds, after fermentation. Other members of this group are not so beneficial, as they can render a wine undrinkable by producing a mousey, cheesy, or a sauerkraut or pickle-like aroma/taste.
- **Lag phase:** with respect to yeast, the period shortly after inoculation when there is no perceptible activity. This is the time the yeast cells acclimate to their environment and become functional. Their numbers remain largely unchanged. Once fully acclimated, usually by day 2, they enter a period of exponential growth (replication) which requires an abundant supply of YAN nutrients. From the outset of inoculation, they have a high demand for vitamins, minerals, and sterols, but only a moderate demand for Nitrogen. Unless YAN is very deficient, the addition of YAN nutrients like Fermaid O, are most efficient when added after a 2 to 3 drop in °Brix, as this is when the yeast population is reaching peak numbers. The growth rate of yeast increases with temperature to a point, and is also quicker when their environment is well-aerated. Growth rate continuing until about 1/3 sugar depletion (day 3 to 4), depending on temperature, and then remains largely unchanged.
- **Lees:** the dead yeast cells and other sediment that settle to the bottom of the holding vessel after fermentation. Although the lees layer is typically removed within a few days of fermentation, it can be retained for an extended periods to add complexity and body, but it does have to be stirred regularly, and ultimately removed (see **Lees-stirring** and **Sur-lie** below). The lees that form soon after red grapes are pressed following fermentation, is typically removed before Malolactic conversion. It is, however, retained when doing **extended macerations**.
- **Late harvest wines:** those made from very over-ripe grapes harvested later in the season, and when fermented, some of the sugar remains unfermented because the yeast stop fermenting once alcohol levels exceed their tolerance.
- **Lees-stirring** (Batonage—the French term): the practice of stirring the lees during aging to enhance mouthfeel, aromas/flavor, and complexity in the wine. The dead yeast in the lees release polysaccharides and mannoproteins into the wine as their cell walls disintegrate (lyse) with time.

- **Leesy:** a tasting term for the rich aromas and yeasty smells that result from wine aged on its lees, for example Champagne and high-quality Sparkling wine.
- **Liter (L):** a metric unit of measure, having a volume of 10 centimeter (cm) by 10 cm by 10cm. It is a basic unit of measure much like the gallon. This makes it easier to make additions by simplifying the math. There are about 3.79 L in a gallon of wine. 100 L is about the same as 26.4 gal. Dosage rate for most winemaking products are given in g/hL. One hL contains 100 L. Liters are commonly used for items (such as fluids, but can be used for flowable solids, and measured by the size or capacity of their container. One L of water has a mass nearly one kilogram (1000 grams). Thus, one milliliter (mL) or 1000th of a Liter of water has a mass of about 1 g. 1000 L of water has a mass of about 1000 kg (a metric 'tonne', and with a weight of about 2200 pounds.
- **Lysozyme:** an enzyme that can prevents ML conversion, or stops it before it finishes (partial MLC) for stylistic reasons.
- **Malolactic conversion:** a natural process following fermentation, involving the use of specialized Lactic Acid Bacteria that metabolizes Malic acid – a very tart acid, to **Lactic Acid**, one that is significantly less tart. Consequently, the wine seems rounder, more balanced, less astringent, and more complex. Although MLC may begin spontaneously, most red wines are inoculated with cultures selected for their specific attributes.
- **Maceration:** the soaking and gradual extraction of color, aromas, flavor, and tannins primarily in the grape skin, bits of stems in the must, for either a relatively short or more protracted period. The longer the juice/must remain in contact with the skins, the greater the extraction of phenolic compounds, tannins, pigments (anthocyanins), and aromatic compounds. Maceration begins immediate after crushing, continues with cold-soaking (optional), and ends with pressing following fermentation or 'extended maceration' (optional) (see below).
- **Mannoproteins:** a group of complex proteins bond to polysaccharides (primarily mannose) in the cell walls of yeasts. Mannoproteins are released during yeast fermentation and then later during yeast **autolysis** – the breakdown of the cell wall after the yeast die. Benefits of their use include tartrate stability, enhanced mouthfeel, and reduction of bitterness and astringency.
- **Micro-oxygenation:** a widely used technique involving the addition of controlled amounts of oxygen into wines to positively influence color, aroma, and texture. The purpose is to

simulate the slow oxidation of wine in tanks that would naturally occurs during barrel aging over a protracted period, and thus lower production costs. The technique is often used in combination with added tannins and oak alternatives, to improve stability and the organoleptic qualities of the wine. It is thought to reduce astringency, improve mouthfeel, and stabilize color (see **Aeration**).

- **Membrane filter:** typically, a filter cartridge, like those that are used for reverse osmosis for the removal of bacteria and contaminants from water. The filter is constructed using a membrane rather than paper or some other material, and made with pores (perforations) of a uniform size that prevents larger molecules or microorganisms from passing through. They are often used to remove yeast and/or bacteria, and for that purpose, should prevent microbes or particles equal to or greater than 0.45 microns from passing through. Such filters are pricey and will quickly plug, unless the wine has been clarified by fining and cleanly racked. Such filters can be back-flushed and used several times.
- **Mercaptans:** also known as thiols, a large group of volatile sulfur compounds that emit unpleasant odors, for example, skunk, rubber, sulfur, onion, garlic, cabbage, etc. Mercaptans form when H_2S is not removed quickly. Mercaptans are quickly converted (oxidized) to Disulfides (see **Disulfides**). Mercaptans and Disulfides are very smelly, even at very low concentrations, so they can make a wine rather off-putting. These compounds are produced primarily by the fermenting yeast when Nitrogen availability is deficient. To compensate, the yeast metabolize the Sulfur-containing amino acid: cysteine or methionine as a nitrogen source. Mercaptans can be easily removed by using Copper Sulfate, Disulfides can not.
- **Mousiness:** an off-flavor/aroma reminiscent of caged mice or rancidity that renders the wine undrinkable. The ‘taint’ is generally perceived further back in the throat after the wine has been swallowed, and it usually takes a few seconds to detect. It tends to linger and leave a foul taste in the mouth for some time. The odor/taste is produced by certain species of *Lactobacillus* bacteria
- **Must (grape):** freshly crushed grapes, including skins, seeds, and some stems, waiting to be fermented into wine. The term refers to this mixture from the time the grapes are crushed until the mixture is pressed.
- **Natural wine:** generally defined as those made from organically farmed grapes and without the addition or removal (fining or filtering) of most anything during the winemaking process,

other than the lees. Most producers avoid the use of Sulfites, or use the bare minimum. Producers may resort to the use of natural fining agents. So, in general, little or no SO₂, and acid or sugar adjustments are to avoided as much as possible. Limited fining or coarse filtering is tolerated. Furthermore, such wines are fermented using only the native or ambient yeast cells on the grapes.

- **Neutral barrels:** those that have been used for several or more years. Once neutral, the ability of the barrel to impart oak flavors is minimal. Fortunately, relatively inexpensive oak-alternatives, and tannins derived for oak wood, can be used can to infuse the wine with the essence of toasted oak that characterize new barrel. Nonetheless, neutral barrels are ideal for wine storage because their porous wood allows small quantities of air to penetrate to the wine, critical for aging and flavor/aroma integration, and you do not have to worry about extracting too much oak. When properly maintained, neutral barrels can be used indefinitely.
- **Nitrogen (N₂):** a colorless, odorless, and tasteless gas. It is also the most plentiful element in the atmosphere, and a major constituent of all living organisms. It is essential for the synthesis of amino acids, proteins, DNA, RNA, and the energy transfer molecule–ATP in all living cells. Yeast struggle during fermentation and cease to function when grapes are Nitrogen-deficient. Thus, fermentation success depends on the Nitrogen availability in the juice or must being fermented.
- **Noble rot (*Botrytis cinerea*):** the fungus that invades grape skins during moist (foggy) weather, and when the temperatures are beginning to warm. The fungus causes the grape to dehydrate, concentrating their sugars. When widespread, affected grapes can be fermented to produce lovely, sweet, and intensely fruity wines. In most cases, it is not considered beneficial.
- **Nominal filter cartridges:** those that remove most of the particles equal to or greater than their ‘micron’ rating; they are relatively inexpensive. **Absolute filters**, by comparison, use a membrane that removes all particles equal to and larger than the stated ‘micron’ rating. A micron is a unit a unit of length equal to one millionth of a meter. Although, reliable, these

absolute membrane filters are expensive. They are available in a cartridge form that fits in the standard filter housings used by many home-winemakers

- **Oak alternatives:** oak chips, cubes, sticks, or other ‘inserts,’ etc., used to add the aromas, flavors, and tannins of oak. They can be used in stainless steel and plastic tanks, carboys, beer kegs, and neutral barrels.
- **Off-dry:** A wine with just a hint of sweetness; one where the sweetness is just perceptible.
- **One third sugar depletion:** the point during fermentation when the about one third ($\frac{1}{3}$) of the sugar has been depleted – about 16°Brix. This is when the second addition of yeast nutrients becomes nutrients are particularly critical for sustaining the fermentation. In general, the first addition should occur shortly after yeast inoculation or a drop of 2 to 3 Brix°, depending on the nutrient product used.
- **Open-top fermenters:** open fermentation tanks or vessels used for ‘oxidative’ wine fermentation, primarily for red wines. They provide easy access to the “cap” of berries, skins, and seeds that rise to the surface during fermentation, so that it can be resubmerged by pushing it or **punched it down**) back into contact with the juice. Reds, of course, can be made in large closed tanks, but the cap must be moistened periodically by gently pumping or sprinkling it with wine from below (**pump-overs**).
- **Oxidative fermentation:** the exposure, primarily of red must, to air during fermentation in open-top fermenters. It also occurs in some whites, most notably, Chardonnay fermented in barrels. Winemakers can introduce varying amounts of air or Oxygen at various stages of winemaking, for example during fermentation, or later during aging in tanks (**micro-oxygenation**), by aging wine in barrels, stirring the lees, racking, or doing more frequent racking. Minimal use of antioxidants like sulfur dioxide, an (antioxidant) is another way to promote intentional oxidation. The risk of oxidative winemaking, however, is that the wines will become oxidized, however inert gases and SO₂, as well as temperature control can be used as needed to minimize excessive oxidation. Commercial winemakers can measure the redox potential (reduction-oxidation potential) of a wine, allowing them greater control. The objective of oxidative winemaking is more about developing secondary aromas/flavors in the wine, as well as for complexity, improved structure, and texture, for example, a big barrel-fermented Chardonnay), rather than preserving the primary fruit aromas of a lighter, crisp, and fruity Pinot gris.

- **Oxidative and reductive styles:** opposite winemaking strategies that depend on the relative presence or absence of oxygen during winemaking. Oxidative (aerobic) winemaking involves intentionally exposing the juice, must, or wine to air, or introducing air or controlled amounts of Oxygen at different stages of winemaking. In contrast, reductive winemaking is done under more anaerobic (low Oxygen) conditions. The objective is to avoid the influence of oxygen throughout vinification as much as possible.
- **Oxidation:** with respect to chemistry – the gain of Oxygen, the loss of Hydrogen, or loss of electrons during chemical reactions involving molecules, atoms, or ions. With respect to wine, oxidation is what happens when juice, must or wine is exposed to air. It is a complex process that can affect either positively or negatively the flavors, aromas, and color of wine. simply oxidation. It occurs when juice, must, or wine are exposed to air or Oxygen, at any stage of winemaking, or later in the barrel and, of course, the bottle. It converts ethanol to acetaldehyde, stabilizes color and creates complex aromas/flavors, to a point. Controlled oxidation is key to winemaking, as it can soften tannic reds, and increase complexity by allowing secondary or tertiary aromas to develop. Fortunately, Bisulfite ions in SO₂ bind with it, making it imperceptible. In small amounts, oxidation adds complexity. When excessive, though, it adversely affects color (browning), and leads to unpleasant aromas and taste – a serious fault.
- **Oxidized:** wines exposed to excessive air or Oxygen at any stage of winemaking often become ‘oxidized.’ Affected wine lose their vibrancy, fruitiness, and become flat or a dulling of the aroma may be evident. Aromas are best described as ‘cardboard,’ ‘straw’ and ‘hay-like’ aromas vinegary, Sherry-like, ‘Madeirised,’ or have a nutty, bruised-apple, or caramel-like nose, stales, or in extreme cases ‘wet dog.’ Of course, oxidized wines are often undermined by a vinegar (volatile acidity). The bacteria that produce vinegar under high levels O₂ also produce Ethyl Acetate (finger nail polish remover). Color, also is an indicator. Whites become more yellow to amber, and reds lose their youthful bluish hue, and take on a more brick-red, reddish-brown color. White wines, having much less tannins than reds, are more susceptible to oxidization. Oxidation typically develops when free-SO₂ levels are too low to inhibit the chemical process that is occurring. The process involves a series of chemical reactions that convert ethanol (alcohol) to acetaldehyde, in the presence of air, for example, a leaky bung, or barrel, or low-fill levels in containers, or just neglect. When there is sufficient SO₂ in a wine,

it binds with acetaldehyde, formed during oxidation, making it imperceptible. When free-SO₂ is low or deficient, acetaldehyde remains unbound and is converted to vinegar (acetic acid) which is offensive in wine.

- **Pectins:** are gel-like substances in grapes responsible for maintaining cellar structure and cohesiveness. During winemaking it gradually breaks down, but it is a slow process. This is where commercial enzymes can be useful.
- **Pectic enzymes:** speed up the process by softening the fruit tissues (skins and pulp) before pressing. Benefits include increased wine yields and more rapid settling of solids.
- **pH:** is a measure of the strength of an acid or a basic solution, using a specialized meter to determine the concentration in g/L of H⁺ ions currently in a solution, such as grape juice, or wine. It is expressed using a logarithmic scale from 0 (the greatest) to 14 (the lowest). Acidity decreases 10-fold for each whole number on the scale of 0 to 14. For example, a pH of 3 is 10 times more acidic than a pH of 4, and a 100-times greater than a pH of 5. A sparkling wine with a pH under 3.0 is significantly more acidic than a red wine with a pH close to 3.8. A pH of 7—close to that of water, is considered neutral, neither acidic nor basic.
- **Phenolic compounds:** a large, diverse group of chemical compounds found in grapes. They are important constituents in red wines that contribute to the sensory properties: taste, color, and mouthfeel (body, texture, and structure, as well as its bitterness and astringency (see **Tannins**). They also act as antioxidants that slow aging. Furthermore, they bind to one another and other components in wine. Tannins and anthocyanins (pigments) and flavonoids are examples of phenolic compounds, and they polymerize, forming (polymers of large molecules) composed of smaller subunits that are bonded together in a specific way, e.g., chains, sheets, or complex three-dimensional networks.
- **Physiological ripeness:** traditionally, sugar content was the primary measure of ripeness, however commercial winemakers are more concerned about ‘polyphenolic’ ripeness to determine when to harvest. The primary source of polyphenols or tannins is in the skins, but are also found in the seeds and stems. They are responsible for a wine's color, flavor, and mouthfeel. As grapes mature, particularly in warmer regions or AVAs, sugar levels frequently rise faster than polyphenol concentrations. The downside is that by leaving grapes on the vine longer to achieve polyphenolic ripeness, alcohol levels increase due to higher sugar contents. Achieving a balance between the sugar content (potential alcohol), acidity (TA and pH), and

polyphenol content is critical to making high quality wine. Obviously, the desired ripeness will depend on the type of wine being made, for example, sparkling, fortified, late harvest, still, or rosé. Indicators of ripeness include uniform color, skin elasticity (puckering) in reds, and mostly brown seeds and stems, optimal °Brix (°B), TA and pH within an acceptable range, 'ripe' (soft, smooth) skin tannins, and of course, desired varietal aromas/flavors. Relying solely on Brix is a mistake, as all factors must be considered, along with what the winemaker is looking for.

- **Pied de Cuve:** French for 'foot of tank.' It is much like using a sourdough starter to bake with. The procedure involves picking 5 to 10 pounds of ripe grapes a few days to a week before harvest; crushing them, and placing them in a small fermenter, usually left in the vineyard without any SO₂ to inhibit wild yeast to give them a head-start. The object is to isolate a dominant culture of yeast of suitable strains and build up an adequate starting population, instead of waiting for the wild yeast to sort things out and ramp up their numbers. This 'culture' which should be active and then can be used as an inoculum when the rest of the grapes are harvested, avoiding a long build-up because there are relatively few yeast cells on the grapes, but a lot of genetic diversity. So, there is competition until a handful predominate. Once that has been done, fermentation can get underway. Typically, there is a succession of strains and a lot of competition until only the most dominant and adaptable strain finishes the job. This helps to avoid bacterial spoilage and development of reduced odors. (see **Ambient yeast, Natural wine**)
- **Polysaccharides:** long-chain (polymeric) carbohydrates composed of many different sugar molecules, predominantly sucrose, fructose, glucose, etc. Their use in wine can add mouthfeel (weight) and softness, stabilize color, and minimizes astringency and bitterness.

- **Pomace:** the solid waste left after the juice or wine is pressed off the skins and seeds and stems.
- **Potassium Caseinate:** (see **Casein**)
- **Potassium Metabisulfite:** an inorganic compound with the chemical formula $K_2S_2O_5$. It is a powerful antimicrobial and antioxidant. When dissolved in water it forms mostly Bisulfite ions (HSO_3^-), a small amount of dissolved SO_2 gas, and an even smaller amount of Sulfide ions (SO_3^{2-}), depending on the pH level.
- **Potassium Bicarbonate** ($KHCO_3$): is a basis salt compound commonly used to deacidify wine. It neutralizes some Tartaric acid by forming Potassium Bitartrate. That precipitates out of solution, so TA decreases. The reaction also neutralizes the two hydrogen ions available on the Tartaric acid molecule, increasing pH. Water and CO_2 are the byproducts. An addition of 0.9 g/L results in a 1 g/L reduction in TA (titratable acidity) in most cases.
- **Potassium Bitartrate:** salt (crystals) formed in wine, through the reaction between Bitartrate ions from Tartaric acid, and Potassium ion (K^+) found in the grape skins.
- **ppm:** parts per million, or milligrams per liter (mg/L) ex. 1mgL = 1 ppm.
- **Press:** a mechanical device that applies pressure to grape must (whites and reds used to make rosés) after crushing, or intact clusters to release their juice, or to press the wine from the fermented red must.
- **Press wine:** the juice or wine that flows when light to moderate pressure is applied to the grapes or must during pressing.
- **Pump:** to transfer wine from one vessel to another using an electric pump.
- **Pump-over:** pumping the fermenting juice from below the cap, to wet the grapes and skins, rather than punching down. This is typically done in large tanks or to minimize maceration of grapes.
- **PVPP:** a clarifying agent consisting of a synthetic polymer used diminish bitterness, herbaceousness, and oxidized color in wine. It binds with and remove small monomeric phenolic species, such as catechins (very bitter), occurring grape must, particularly wines.
- **Racking:** the process of transferring wine from one container to another, allowing the sediment to be flushed away. At least two racking are needed to clarify most wines.
- **Redox potential:** refers to a wine's dynamic balance between being reduced or oxidized. It can be measured to provide useful information for the winemakers to intervene and prevent

a wine from becoming either reduced or oxidized. When present in moderate levels, O₂ prevents wine from becoming **reduced**, but when present at high levels, it leads to **oxidation**.

- **Reduced:** used to describe fermenting juice/must, or wine in storage that has developed an overt stinky, rotten egg-like odor, or notes of cooked-cabbage, onions, garlic, burnt rubber, skunky, and other unpleasant smells. Wines are said to be ‘reduced’ when they develop odors of volatile sulfur compounds (**Sulfides**). Wines can become reduced when there is a residue of elemental sulfur on the grapes, and when Nitrogen availability in the juice/must is deficient. The sooner reduced wines are treated, the better. Sulfides such as Hydrogen Sulfide and Mercaptans are easily remedied using CuSO₄ (see **Copper Sulfate**). Disulfides, however, are more difficult to mitigate. Hydrogen sulfides is quickly converted to Mercaptans (also very smelly) which are soon converted to Disulfides, which are harder to remove.
- **Reduction:**
 - chemically speaking – the loss of oxygen, or the gain of Hydrogen or simply, electrons during a chemical reaction.
 - With respect to winemaking, it occurs when there is insufficient Oxygen present during fermentation, or later during aging in tanks after it has been depleted. When present, oxygen counteracts reduced compounds. However, when a wine contains a higher amount Sulfides and there is not enough available oxygen to mitigate all of them, the odors persist.
 - Reduction occurs when grapes are fermented or held in an environment largely free of oxygen, or the juice or must is nutrient deficient.
 - Reduction is the opposite of oxidation. Oxidation occurs when exposure to Oxygen after fermentation is excessive. Reduction is neither good nor bad, but has the potential to create problems when exposure to air or Oxygen is too little or too great.
 - Some people refer to reduction as the production of volatile (stinky) sulfur compounds (Sulfides), but more correctly, it is the practice of winemaking in a reductive (i.e. oxygen-free) environment, as opposed to one that uses oxygen as part of the process. Problems arise only when the reaction goes too far or not mitigated soon enough.
 - Many fine wines are made in a ‘reductive’ style – wine made in a relatively Oxygen-free environment. The object is to retain fresh, fruity (primary) aromas, and thus, avoid the development of secondary aromas.

- **Reductive** (conditions): wines low in oxygen are said to have a low ‘**redox**’ **potential** – a measure of how oxidative or reductive the wine is. If levels get too low, there is a danger that some components will become **reduced**.
- **Reductive winemaking**: involves fermenting and maturing wines in closed-top tanks to exclude Oxygen to the extent possible, the use of dry-ice during crush to protect the grapes and pre-fermented juice from air. Inert gases can be used to displace the air that enters tanks, barrels, and carboys, every time they are opened to taste, smell the wine, stir it, or to make an addition. SO₂ is another tool to scavenge O₂. The objective is to preserve freshness and primary fruitiness, and minimize color in whites, for example, New Zealand Sauvignon Blancs. In reds, it involves minimizing exposure to air by doing fewer rackings and top-ups. The risk of reductive winemaking is that the wine becomes reduced.
- **Refractometer**: a hand-held device used to measure grape sugar while in the vineyard, and to monitor ripeness throughout the season. When light passes through a solution, like grape juice, it enters a prism that bends (refracts) the light that passes through a sample—a drop or two of juice. The angle of refraction shown on a scale seen through the eyepiece, indicates the approximate °Brix,
- **Remontage**: French term for pumping wine from underneath the cap of grape skins. and then back over the cap to keep it moist and encourage maceration.
- **Residual sugar** (RS): the grape sugar left in wine after fermentation that contributes to some degree of sweetness.
- **Rhone blends**: grape varieties traditionally grown in the Rhone Valley wine region of France. Red varieties include: Grenache, Mourvèdre, Syrah, Cunoise, Cinsault, Carignan, Petite Sirah, and others. White varieties include: Roussanne, Marsanne, Grenache blanc, Picpoul, Viognier, and a few others
- **Saignée**: this method, developed in France, involves draining off a portion of pinkish juice immediately after crushing red grapes, and then fermenting the juice separately from the rest. The pressed skins and seeds are then fermented along with the red must. The object of removing some of the juice is to increase the skin-to-juice ratio of the remaining portion for greater extraction of polyphenols, while being able to make Rosé, a marketable byproduct.
- **SaniClean**: like **Star San**, but has been formulated to produce minimal foaming—ideal for sanitizing pumps, filters, and as a final acid rinse (see **Star San** below).

- **Sanitation** (winery): the first step in winemaking begins with cleaning – a pre-rinse to remove juice or wine residues, debris (leaves, stems, dirt, visible particle, followed by cleaning (scrubbing, using cleaning agents or pressure washing to remove stubborn films and residues on wine making equipment, and anything the juice, must, or wine will contact. Although, there are others, **Sodium percarbonate** is an effective cleaning agent useful for home winemakers. Once clean, winemaking surfaces must be disinfected (sanitized). Because there is no practical means to kill all microbe, the best you can do is to reduce their number to safe levels. Using various sanitizing agents, like **Saniclean** or **Star San** or **Iodophore**. All rinsing must be done with ‘clean,’ non-chlorinated water. Clean and sanitize everything before and after use, and keep the winery as clean as practical.
- **Settling**: the clarification process that begins by allowing suspended material in juice or wine to drop out and settle on the bottom of the container.
- **Siphon**: the passive transfer juice or wine from one container to another through a hose using the force of gravity. The trick is to make sure that the receiving container is lower than the container being drained. Start Siphons by drawing the liquid into a hose by sucking on the opposite end, and while elevating the hose until it is mostly filled. While holding your finger over the end to keep the wine from flowing back into the holding tank, lower the hose to the receiving tank. Place the hose just above the bung hole and remove your finger from the end of the hose, and the siphon will start.
- **Skin-contact**: another term for **maceration**. For white wines, the skins are allowed to remain in contact with the juice following crushing for several or more hours (up to 24) before pressing. The benefit is increased wine aroma, flavor, and mouthfeel (body), due to a high concentration of phenolic compounds in the skins. Ideally, the must should be protected by inert gas (Argon or dry-ice) and the temperature held at close to 50°F. In general, white wines are made with limited skin contact to avoid extracting tannins. Red wines receive far more skin contact beginning after crush, during cold-soaking (optional), fermentation, and extended maceration, also optional. Thus, long skin contact gives reds their characteristic intense color, aromas and flavors, high tannin levels, and rich mouth-feel.
- **Sluggish**: pertaining to a wine fermentation. When yeast cells begin to struggle because nutrient are unavailable, growth-limiting toxins are beginning to build up, or the fermentation

temperature is too high. Consequently, the fermentation is in jeopardy of ‘sticking’ (stopping), leaving the wine sweet and prone to oxidation unless you act quickly to restart it.

- **Sodium percarbonate** (Sodium Carbonate or Peroxyhydrate): a non-chlorine bleaching agent sold as Proxycarb or PeroxyClean. It is made by combining Sodium carbonate and hydrogen peroxide. When added to water it releases hydrogen peroxide, resulting in a foaming action. More importantly, it dissolves the hard to remove tartrate deposits inside of barrels and storage tanks, and it neutralizes acetic acid (vinegar) in problem barrels.
- **Specific Gravity (SG):** refers to the *relative* density (weight) of a liquid solution, such wine, compared to that of pure water (lacking dissolved materials). It is measured using a Hydrometer. The SG of water is 1, so it is the ratio of the SG of water and that of the solution. The higher the hydrometer rises in the holding-cylinder, the higher the SG, as well as the °B. It gradually sinks as the fermentable sugar is consumed. During fermentation, yeast convert fermentable sugars to CO₂ and alcohol. Consequently. Winemakers can monitor the decline in SG over time, and determine when the fermentation is done. The density of juice, must, or wine is largely dependent on its level of sugars. The higher the sugar, the higher the SP. The starting SG for most wines will be somewhere around 1.10 to as high as 1.11 for juice with a °B of 26. A final reading of somewhere between 0.996 and 0.990, indicates that the fermentation is done.
- **Stabilization:** the remove or mitigate of defects (odors, chemical substances, suspended material, bacteria, etc., that can adversely affect a wine’s sensory appeal once bottled. avoiding the occurrence of some usual wine precipitations after bottling.
- **Strain:** in the context used here: a genetic variant, a subtype, or culture within a biological species of microorganisms such as yeast or Malolactic bacteria. They are selected for their desirable traits, and then cultures for use in winemaking.
- **Star San:** a common ‘sanitizer for winery use. It is made to foam, so it is ideal for most general sanitizing duties (ex: tanks and equipment, etc.), as the foaming action lifts away loose debris and bacteria. It is an acid-based sanitizer, and when used at the recommended concentration is safe, efficient, quick, odorless, tasteless, agent for sanitizing tools and equipment used in winemaking. There is no need to for rinsing. Just allow the sanitized item to dry (see **SaniClean** (see **Star San**) above). There are no fumes and intermittent skin contact is not an issue.

- **Sugars:** grape leaves produce sucrose (a disaccharide), but it is enzymatically converted in the grapes to glucose and fructose (monosaccharides) that yeast can easily metabolize for energy. The by-products are alcohol and CO₂. There are some other sugars but they are of little importance.
- **Sulfides:** volatile sulfur compounds that contribute to stinky, skunky, or rotten egg-like aromas in wine.
- **Sulfites (SO₂):** with respect to winemaking, sulfites are produced when Potassium Metabisulfite is added to water, juice, must, or wine, it dissociates into **SO₂** gas, and two ions: HSO₃⁻ (**Bisulfite**) SO₃²⁻ (**Sulfite**). Typically, at normal wine pHs (3 to 3.8), there are significantly more Bisulfite ions, and far fewer Sulfite ions. Sulfites are critical to protect the juice, must, or wine after fermentation. The level of each of these 3 components is pH-dependent. SO₂ gas concentration is highest at very low pH values, and lowest at high pH. Bisulfite predominate at moderate pH values, and Sulfite is more plentiful when pH is greater than pH 3.7. SO₂ inhibits spoilage bacteria, Bisulfite acts as an oxidant by binding with acetaldehyde, the precursor to VA, and Sulfite scavenges Oxygen.
- **Sulfiting:** the addition of Potassium Metabisulfite to grape juice, must or wine to maintain stability (prevent oxidation and inhibit microorganisms). After adding sulfites, stir the wine to uniformly incorporate it, except when using effervescent tabs or packets.
- **Sur lie:** French term meaning ‘on the lees,’ indicating that the wine has, or is being aged on its sediment, allowing the extraction of polysaccharides and mannoproteins from the dead yeast as they breakdown (**autolysis**), adding complexity to the wine.
- **Stabilization:** the removal of suspended material in a wine before bottling, involving the use of racking, fining-agents, filtration, refrigeration (cold stabilization), barrel aging, topping, use of inert gas to purge air when after a barrel, tank, or container has been opened, and maintenance of a free SO₂ level that will protect against oxidation and spoilage microbes.
- **Stick/Stuck (fermentation):** one that ceases prematurely when yeast cells begin to struggle, or sticks (stops fermenting and loses viability). Consequently, they are unable to metabolize the remaining sugars to alcohol. The cause is often attributable to nutrient deficiencies, hot fermentations, and/or the buildup of toxic byproducts that inhibit further fermentation. The partially fermented wine is perceptively sweet, prone to oxidation and microbial spoilage. With intervention, restarting the fermentation is possible. Unless you are OK with the level of

sweetness, you will need to restart the fermentation, otherwise, sulfite the wine and fine (Bactiless or Stab Micro to remove inactive yeast, and other spoilage organisms. You could also sterile filter it.

- **Tannins:** naturally occurring substances, known as polyphenols, that occur in nearly all plants. Phenols make up a large and diverse group of chemicals, consisting of a 6-Carbon ring attached to one or more hydroxyl groups. Depending on conditions, they readily bind with other phenols to form chains or three-dimensional molecules. In grapes, they are found in the skin, seeds, pulp, and stems. Their usefulness and versatility are often overlooked by home winemaker. Tannins have a broad range of applications in winemaking: building structure, preventing oxidation, improving mouthfeel by adding volume and roundness, enhancing aroma, stabilizing color pigments, and generally improving palatability, or acting in a sacrificial manner to preserve grape tannins. Commercial tannins are made from oak, exotic woods, or other sources, and there are many to choose from. Winemakers commonly use more than one type, and may make multiple addition to meet their objectives, such as adding body or augment the aromas of oak. Dosage rates are typically low, and a little goes a long way
- **Tartrates:** crystalline salt deposits of Tartaric acid that precipitate out of solution (crystallize), over time, particularly when exposed to near freezing temperatures. They can be found in the lees or adhering to the inner surfaces of barrels, tanks, or other holding-container, particularly during cold stabilization. Tartrates are resistant to removal; however, they dissolve readily in hot water, and more slowly when a mild solution of Proxycarb is used to clean the container, but it may take soaking overnight.
- **Temperature control:** the ability to control temperature during the winemaking process (particularly fermentation), has a major influence on the speed and success of fermentation, as well as the aroma, taste, and complexity of the wine. Chemical reactions, like oxidation are also temperature-dependent. The ideal temperature range will depend on type of wine being made – white or red, stage of winemaking, ex. fermentation vs. cold-stabilization, and objectives. Cooling methods range from rudimentary to more sophisticated: e.g., evaporative cooling, frozen, water-filled jugs, dry-ice, cold water-baths, or more sophisticated, like refrigeration. Heating can be done using electric blankets, aquarium heaters, space-heaters etc.

- **Terroir:** the combination of soil, climate, and other environmental factors that influence characteristics of a wine.
- **Titrateable acidity (TA):** the acid content of grape juice, must, or wine that gives wine its characteristic tartness. It is also a measure of the **total** concentration of both dissociated (free) H^+ ions, and those that are still bound to the acid molecule, as determined by *titration*, a chemical reaction (see **Titration**). TA is expressed as g/L of Tartaric acid, or as a percent concentration. More simply, it is a measure of all acids in juice, must, or wine, and important for determining its balance (palatability) and aging potential.
- **Titration:** the chemical test procedure that measures **TA**. It involves gradually adding NaOH (Sodium hydroxide), a strong base, to neutralize all of H^+ ions, to a specified pH end-point. TA is expressed as g/L of Tartaric acid, or as a percent concentration.
- **Topping:** periodically filling the void (head-space) in a barrel to replace wine lost to evaporates during aging, minimized excess exposure to air, depletion of sulfites and prevents the development of film yeast/bacteria. It also means filling all containers holding wine to near-capacity
- **Total SO_2 :** includes both free- (unbound) and bound- SO_2 . The remaining '**free**' portion is available to perform its important work. SO_2 testing measures free- SO_2 .
- **Turbidity:** with respect to wine, the cloudiness or presence of a slight haze.
- **Ullage:** the head-space between the wine and the cork that allows for expansion, as temperature changes. The term is also used for wine in barrels to describe a drop in the wine level due to evaporation. The issue is potential oxidation, growth of film yeast or bacteria, and increased loss of free- SO_2 due to a greater surface area and empty void.
- **Variable capacity fermenter:** wine fermenters used for both oxidative (open-top) and non-oxidative wine (reductive) closed-top or tank fermentation. Such fermenters are fitted with a removable lid that can be moved up or down to accommodate variable sized batches of wine or must. The lid is sealed by inflating a bicycle-like innertube fitted to the edges of tank lid.
- **Vinification:** the process of converting grapes into wine, encompassing all stages from fermentation to aging.
- **Volatile acidity (VA):** an indicator that a wine has oxidized. It is evidenced by the perception of vinegar (Acetic acid) and sometimes (Ethyl Acetate) – the odor of finger-nail polish or its solvent. The defect typically develops when SO_2 is poorly managed, exposure to air is

excessive, storage tanks are not filled to capacity, and barrels are not topped up often enough. It can also develop during cold-soaking and extended maceration. Such conditions allow vinegar-forming bacteria (*Acetobacter*) to develop).

- **YAN** (Yeast Assimilable Nitrogen): a measure of Nitrogen availability in juice or must. It is conceivably the most important factor are measured and reported when a juice sample is submitted to a wine lab for analysis. Test results are reported as mg (one 1,000th of a gram) of Nitrogen per liter, and that works out to **ppm**. It determines how much supplemental yeast nutrient will be needed to meet the nutritional needs of the yeast culture to be used. The nutritional needs of yeast, which vary from low to high, must be consider when determining how many grams of a yeast nutrient product like Fermaid O will be needed to ensure a successful fermentation. A low YAN means that unless you supplement the juice or must, the fermentation is likely to falter.
- **Yeast:** single-celled fungi responsible for fermenting (making) wine. During fermentation, they convert sugar for their metabolic energy, and produce alcohol and CO₂ as by-products. The most common yeast associated with winemaking is *Saccharomyces cerevisiae*, due in large measure to its tolerance to relatively high levels of alcohol and SO₂, and adaptability to normal wine 2.8 to about 4. *S. bayanus* is also in common use, and even more resistant to alcohol. *S. cerevisiae* is rarely the only yeast species involved in a fermentation. Grapes brought in from harvest are usually teeming with a variety of indigenous and ambient yeast in other different genera (**see wild yeasts**) or other species of *Saccharomyces* species.
- **Yeast hydration:** allows freeze dried yeast to soak in warm water often containing nutrients until the shrunken yeast cells can expand, allowing them to become functional. Hydration can be skipped in the case of a few specially formulated yeast cultures.
- **Yeast nutrients:** yeast cells are dependent on the Nitrogen (amino acids and often other Nitrogen-based compounds, vitamins, fatty acids (sterols), and trace minerals, etc., in the juice or must to support their growth, replication, and health. It is quite common for some of these nutrients to be deficient. Rather than rolling the dice, test for Nitrogen availability and when warranted, add supplemental nutrients to the fermenting juice/must shortly before or after fermentation begins. Commercial preparations have been developed to ensure yeast health and a problem-free fermentation. Failure to address this important consideration, can

be a most unpleasant learning experience—a stuck fermentation. Adding the right amount of nutrients at the right time, ensures that the yeast complete the fermentation without issue.

- **Yield:** the quantity of grapes or wine produced per unit of vineyard area, often measured in tons per acre or hectoliters per hectare. Also, the number of gallons of juice or wine, obtained from the weight of a particular lot of grapes, say 500, 1000 pounds or a ton after pressing.
- **Water-back:** the common practice of adding water to a batch of grapes to lower the sugar content. The object is to prevent the potential alcohol level from exceeding 15°Brix, otherwise the wine is likely to taste ‘hot.’
- **Wild yeasts:** those present on the skins of grapes (see **Ambient yeast**). Grapes are usually teeming with a variety of ‘wild yeast’ in the following genera: *Candida*, *Hansenula*, *Kloeckera*, *Metschnikowia*, *Pichia*, *Torulaspora*, and others. These wild yeasts have a very low tolerance to both alcohol and sulfur dioxide. They can start a fermentation, but are soon incapacitated, as the alcohol level increases. They are usually replaced by other more alcohol-tolerant yeast, and then ultimately a strain or strains of *Saccharomyces cerevisiae*, the most versatile and commonly used yeast, finishes the job (see **Pied de Cuve**). This species, though, is seldom found in the vineyard or on freshly harvested wine grapes unless the winery frequently reintroduced winery waste (such as lees or pomace) into the vineyard. In most cases it is brought in by fruit flies or inadvertently introduced during winemaking (see **ambient yeast**).
- **Wine faults:** unpleasant tastes, smells, or sensations in the mouth or nose (like hotness due to excessive alcohol, mouth-puckering astringency, fizziness where it is undesirable, or the sharp, pungency of excess SO₂ in a wine. These faults may result from a miscalculation, a simple mistake, or more commonly from an undesirable chemical reactions or microbial spoilage during fermentation, or later during aging and maturation, or in the bottle and may be the result of poor winemaking practices, a stuck fermentation, an incomplete ML, too much or too little SO₂, oxidation, reduction (funky smelling lees) use of contaminated corks, inadequate sanitation, dirty barrels, poor storage conditions, and neglect. Examples include, oxidation or reduced odors.
- **Wine panel:** typically, a bank of tests performed on a sample of wine by a commercial wine lab to accurately determine free- and total-SO₂, VA, pH, TA, residual sugar (Glucose and Fructose) percent alcohol, level of remaining Malic Acid, Specific Gravity/Density. This is the only way to know if the wine is stable and what if any adjustments should be made.

- **Whole-cluster fermentation:** involves fermenting whole-clusters (the amount can vary from 10 to 40%, or even higher, along with the must rather than destemming them all. Stems impart their own unique aromas/ flavors, as well as tannins that improve body. How well this works depends on the **Physiological ripeness** of the stems. This is most often done to intensify Pinots. Some winemakers, though, ferment uncrushed clusters for stylistic reasons. This practice is referred to as carbonic maceration (see **Carbonic Maceration**). It is thought to enhance fruitiness, minimize tannic structure, keep temperatures lower, and inexplicably lower the resulting alcohol. The downside is stemminess, or green vegetal notes, so the grapes need to be physiological ripe.
- **Whole-cluster pressing:** the pressing of white grape clusters without first destemming and crushing them. The object is to produce more delicate and less astringent whites by reducing the contact time with the stems and skins. The advantage is less color and tannins and less Potassium from the grape skins, so acidity will be higher. The juice is also relatively clear unless high pressure is applied, or the grapes are repacked to increase yield. The downside is that the yield is significantly less because the gelatinous pulp remains mostly intact.