Making Great Cider

"It is not the cidermaker who makes the cider; the cider makes itself from the apples." - Claude Jolicoeur.

The Basics

* Cidermaking is much more like winemaking (or meadmaking) than brewing.
* Great cider requires great apples, just like great wine requires great grapes.
* Great cider requires time. It takes cider months or years to become drinkable, just like it takes wine years to mature.
* The skill of the cidermaker lies in choosing the right apples and controlling the process.

Part 1 - Making Cider

Choosing The Best Apples: The best cider apples are very different from commercial apples! They will be small, often scabby and wormy, and will come from old, under-fertilized, "standard" (i.e., full-sized) apple trees. They are best picked and pressed when they are ripe or slightly overripe. For some varieties of apples and pears, it is necessary to "sweat" the apples for a few days to a few weeks before pressing them, to allow them to ripen and soften, and to allow some water to escape from the apples.

Good cider apples also have higher sugar levels than supermarket varieties. Cider apples will have 15-20 Brix, compared to 12-14 Brix for typical apples. They will also have relatively low nitrogen, and have unique flavors and aromas which carry over into the finished cider. Just like wine doesn't taste like Concord grapes, cider shouldn't taste like apple juice!

Depending on the apple varieties, good cider might have floral or citrusy notes, fruity notes reminiscent of fruits other than apples (e.g., pineapple, strawberry). Ciders made from apples high in tannins can have earthy, smoky, roasted or bitter notes and seemingly fuller body. Still other varieties can have salty, steely or mineral-like notes.

By contrast, large commercial apples contain more water, meaning lower sugar content and reduced flavor. Likewise, the strong floral and fruity estery aromas which are desirable in dessert apples can contribute off flavors and smells to finished cider.

Finally, apple varieties which are easiest to grow and yield the most juice don't necessarily produce the best cider. Big commercial cider and apple juice producers like apple varieties which grow quickly and easily and yield a lot of juice, but they might not have the best flavor. Likewise, commercial growers of dessert or cooking apples grow early-ripening, high-yielding apples which store well and are attractive to the eye. These varieties seldom make great cider.

The Four Types of Cider Apples: In cidermaking, apples are typically divided into four classes: *Sweet, Sharp, Bittersharp* and *Bittersweet*, based on their levels of sugar, acids and tannins.

Bittersharp apples have tannin levels greater than .2% and acid levels greater than .45%, making them sour and somewhat bitter or astringent. These varieties of apples are very rare and are only used for blending for cider. A cider made only with extremely bittersharp apples would be almost undrinkable due to its sourness and drying, mouth-puckering character. Crabapples are commonly used as "bitter-sharp" apples by home cidermakers.

Bittersweet apples have tannin levels greater than 0.2% and acid levels of less than 0.45%, giving them a sweet and somewhat astringent or bitter taste.

Sharp apples have tannin levels of less than 0.2% and acid levels greater than 0.45%. Some varieties of sharp apples can produce excellent "single varietal" cider, but usually must be blended with other varieties of apples to avoid producing cider which is too acidic. Apples described as "cooking apples" are likely to be sharper than sweet apples, but not as sharp as some sharp apple varieties intended for blending for cider.

Sweet apples have tannin levels of less than 0.2% and acid levels less than 0.45%. They are sweet and can sometimes seem bland. They must be blended with other apple varieties to produce good cider. Early maturing apples (i.e., varieties available in August and early September) are often sweet. Varieties described as being good to eat fresh ("out of hand") are usually sweet apples, but some are *Sharp*.

What Varieties Are Best?: Late-maturing apple varieties (i.e., those which mature from late September to the end of October) are best for cider. Early maturing varieties tend to be low in sugar, acids and tannins.

Commonly Available Apples Varieties: In Upstate NY, the following varieties are commonly available and are recommended for cidermaking:

Sweet: Delicious, Empire, Golden Russet, Honey-Gold, Liberty, Macintosh, Northern Spy, Spartan.

Sharp: Paula Red, Roxbury Russet.

Bittersharp: None commonly available, substitute crabapples.

Bittersweet: Cortland, Ida Red.

Occasionally Available Apple Varieties: Other apple varieties which grow in Upstate New York a listed below. Those recommended for cidermaking are starred:

Bittersharp: Fox Whelp*, Kingston Black*, Porter's Perfection*, Stoke Red*, Tremlett's Bitter*, Yarlington Mill*. Also various varieties of crabapples might be suitable for blending.

Bittersweet: Ashton Bitter*, Binet Rouge*, Brown Snout*, Bulmer's Norman*, Chisel Jersey*, Dabinette*, Ellis Bitter*, Frequin Rouge*, Medialle D'Or*, Stembridge Jersey*, Somerset Redstreak.

Sharp: Bramley's Seedling*.

Sweet: Akane, Ashmead's Kernel*, Calville Blanc*, Cox Orange Pippin*, Empire*, Fuji, Goldrush, Idared, Jonagold, Liberty*, Macoun, Mutsu, Reinette Zabergau*, Saint Edmund's Russet*, Spigold.

Note: English or French apple varieties grown in the U.S. can differ from their European ancestors, since the U.S. climate is hotter and drier in summer, sunnier in the autumn and colder in the winter.

Apple Juice vs. Cider

Outside of the U.S. and Canada, the word "cider" means fermented apple juice. For the sake of convenience and historical accuracy, I use that terminology in this handout.

In the U.S. and Canada, the term "hard cider" is used to describe fermented apple juice, while "sweet cider" or just "cider" is used to describe unfiltered "farmhouse" apple juice. This confusion originated when late 19th century Temperance advocates managed to convince people that unfermented apple juice was "cider" while fermented cider was poison. Quite the trick, considering that before about 1840 cider was the drink of choice for most Americans and was considered to be a temperate alternative to distilled spirits!

"English style" or "French style" cider made from U.S. grown English or French apple varieties can vary from authentic European ciders.

Another Way of Looking at Things: When blending, you want a mix of high sugar apples and low acid apples so you can create a blend of apples with O.G. 1.050 to 1.080, and T.A. % (as Tartaric) of 0.6-0.8% acidity.

High Sugar Apples: These have SG > 1.060, with medium to very high acidity. These provide the alcohol and base flavor to the cider. High sugar varieties include some cider apples (e.g., Porter Perfection), most russets (e.g., Golden, Roxbury, Belle de Boskoop, Ashmead's Kernel), many well-grown late-maturing apples (e.g., King of Pippins, Sandow, Ribston, Honeygold) and some mild crabs (e.g., Bilodeau).

Low Acid Apples: These have T.A. % (as Tartaric) of less than 0.5%, with varying amounts of sugar. They are essential for blending with high sugar apples which usually contain too much acidity. They are also often rich in tannins. Low acid apples include sweet and bittersweet cider apples (e.g., Bulmer's Norman, Tremlett's Bitter, Yarlington Mill), most wild seedlings, and most pears.

Medium Sugar Apples: These have low to medium sugar (SG 1.045 - 1.055) with medium to high acidity. They can substitute when there aren't enough high sugar apples. Examples include many sharp and bittersharp cider apples (e.g., Brown's Apple, Breakwell Seedling, Stoke Red), many late and mid-season eating apples (e.g. Frostbite, Honeycrisp, Lobo, Wealthy, Haralson, Alexander, Winter Banana, Freedom).

Special Apples: These are apple varieties which add special character to a cider (e.g., aromas, flavors, colors) even if they aren't otherwise desirable for cidermaking. They are typically blended with more suitable apples. Examples: Dolgo or Kerr (acidity too high but wonderful aroma), SG 1060, TA>2%) very special, various red flesh apples are usually low in sugar and high in acid, but can impart a nice pink color.

Useless Apples: These apples are useless for making cider. Eat them, cook them or use them to make sweet cider or vinegar, instead. They have very low sugar (SG < 1.045), high or very high acid (TA > 0.8%), high nitrogen levels, and low tannin levels. Examples include most early season apples (e.g., Yellow Transparent, William's Pride, Redfree, Duchesse, Melba) and most mass production eating apples (e.g., McIntosh).

Blending Your Juice

Apple Blends: A few apple varieties, such as Kingston Black or Northern Spy, make great single varietal cider. In most situations, however, you will need to blend apple juice from different varieties (or press different varieties of apples together) to get the best taste. Typically, you want a base of sweet apples for fermentability, but also some apples which are higher in tannins and acids to balance the sweetness. As a very rough rule of thumb, you want a mix of approximately 50-60% "sweet" apples, with about 25-30% "sharp" and about 10-25% bitter or bittersweet apples is a good start.

Even if you must buy your apple juice, you can still get a sense of what the final cider will be like if you know the varieties of apples which went into the juice blend and if the juice seems "balanced" with a fair degree of tartness and bitterness.

Essential Elements of Apple Juice: To make great cider, your juice must have four things: high sugar, low nitrogen, and balanced acidity and tannins.

Sugar: Sugar content directly relates to final gravity. Small, late season apples tend to be highest in sugar. High sugar tends to occur when nitrogen in the apples is low. Apple juice typically has O.G. 1.040-1.050 and will ferment to about F.G. 1.010-1.005, producing a cider of 5-6% ABV, but a good blend of apple juice for cider will have a minimum SG of 1.050 (12.5 Brix, 6.2% potential ABV). If your SG is lower than this, try to find better apples rather than adding sugar, since low-sugar apple juice is likely to have other problems (e.g., high nitrogen, excessive acidity).

If that isn't possible, since low-alcohol ciders tend to be less stable and more vulnerable to infection by microbes, you must add sugar to bring the base apple juice up to a S.G. of at least 1.045. 2.25 ounces of sugar (or 3 ounces of honey) will raise the S.G. of 1 gallon of juice by 5 points (e.g., from S.G. 1.045 to 1.050).

Any fermentable sugar will work, but sucrose (table sugar) is the cheapest and easiest to work with. When added to apple juice, the acids in the juice immediately convert it into invert sugar (a mixture of fructose and glucose) which is ideal for fermentation.

It is possible to increase the potential alcohol by adding any other sugar, such as fruit sugar (fructose) or corn sugar (dextrose AKA glucose). Fruit or maple syrup, brown sugar, molasses or honey can also be used to increase sugar content, but these impart their own flavors, turning ordinary cider into a specialty cider.

Generally, specialty sugars added to apple juice lose much of the character during fermentation. If possible, add these sugars once fermentation has slowed or stopped.

Sugar Ranges for Apples and Apple Juice Blends

Sugar Content	S.G.	Brix	Potential Alc. %	Comment
Too low	1.040>	10 >	5>	No good for cider
Low	1.050	12.5	6.2	Minimum for cider
Medium	1.055	13.5	7	
High	1.060	15	7.8	good
Exceptional	1.070<	17+	9+	

Acidity: Acids determine how "sharp" the cider will be and is expressed in terms of pH and total acidity. A sufficiently low pH (pH 3.0-3.8) is necessary to inhibit bacterial action.

Ciders with low total acidity (below 0.3%) ciders taste insipid, while those with too high an acid level (above 0.7-0.8%) can taste unpleasantly sour. The acidity of your juice blend should be between 0.45-0.9% Total Acidity (T.A.) expressed as tartaric acid. Too much acid gives a tart cider. Too little acid leaves the cider vulnerable to infection during fermentation and can lead to oxidation and other "off" flavors. For safety sake, your apple juice must have a pH of 3.8 or lower.

Crisp, sparkling "champagne-like" ciders can be at the top of the range (i.e., 0.8% TA), while still English-style ciders are at the lower end of the limit (i.e., ~0.55%).

Sharp apples might have up to double the desired level of acidity for a balanced cider, and some varieties of sharp apples might be too acidic to used in cider, except as a small part of an apple blend.

Ideally, you won't need to adjust the sourness of your apple juice, since the blend of apples will already contain enough acid. If necessary, however, you can make your apple juice sourer, or give it a more complex sourness, by adding some combination of malic acid, citric acid or lactic acid. Malic acid is the major acid naturally present in

apples, so it should predominate in any acid blend. As a rule of thumb, 20 grams of malic acid per 5 gallons will increase acidity by 0.1%.

Extremely sour ciders often mellow with age, due to Malolactic Fermentation (MLF), where malic acid is converted into lactic acid by lactobacillus bacteria. This process makes the cider taste smoother and can give it a "nutty" or "bacon" flavor. MLF is desirable in some styles of cider (notably English Cider).

Acid Ranges for Apples and Apple Juice Blends

Acidity	% TA Tartaric	% T.A. Malic	pH	Comment
Low	0.1-0.4	0.1-0.35	3.8+	Insipid. Sweets or bittersweet apples
Medium	0.5-0.7	0.45-0.6	3.5-3.4	Balanced, ideal
High	0.8-1.0	0.7-0.9	3.3-3.1	Most eating apples
Very High	1.0+	0.9+	3.0-	Sharp. Most cooking apples

Tannins: The type and amount of tannins present in the juice influence the finished cider. Tannins act as a natural preservative and anti-oxidant, balances sweetness, aids perception of body and helps to clarify the cider. Excessive tannins are detectable as bitterness and astringency (drying or puckering aftertaste) in the juice. "Hard" tannins give bitter notes, while "soft" tannins cause astringency.

Typically, dessert apples or apples for commercial apple juice or mass-produced "industrial cider" will have about 1/5 the required tannin levels. On the other end, extremely bittersharp apples might have 12 times as much tannin, or about double what is required for a semi-sweet cider.

Sparkling "champagne" style common cider should have low levels of tannins. English or French ciders will usually have higher levels of tannins due to the presence of special cider apples (i.e., bittersharp varieties).

There is no quick and easy way to test for tannin levels, other than by tasting the juice. Tannins also oxidize when the apples are milled, giving the juice a darker orange or amber color.

If possible, avoid adding tannins to your juice. Instead, produce a balanced juice blend with sufficient tannins to begin with. If that isn't possible, consider adding tannins to the finished cider when you have a better sense of how the finished cider will taste. If this isn't possible (e.g., when making cider using dessert apples) carefully add grape tannins to a juice sample at a rate of 0.1%, then scale up the measurements to the full batch when you've achieved sufficient tannin levels.

If you're in a hurry and are making cider from dessert apples which you know are deficient in tannin, approximately 1 level teaspoon per 5 gallons of juice is generally enough and might be too much.

It is also possible to increase tannin levels by adding the juice of high tannin fruits, such as crabapples, elderberries, cranberries or blueberries.

It is possible to reduce the tannin level by allowing the crushed apple pulp to macerate for 8-24 hours before it is pressed. This technique darkens the color of the juice (tannins are responsible for apples turning brown) and is used to "soften" the flavor of French cider. If the pulp is allowed to sit for too long, however, tannin levels can be reduced too far, resulting in an unbalanced or "flabby" cider.

Nitrogen: Apple juice contains 5-10 times less nitrogen (in the form of proteins and amino acids) than grape juice or beer wort. Likewise, apple juice is extremely low in the nitrogen based vitamin thiamin (vitamin B1), which is necessary for yeast to convert pyruvate into ethanol. Apples from older trees and of "vintage" varieties have lower nitrogen content. Apples from fertilized orchards have higher nitrogen content.

This has a huge effect on fermentation speed since vitamins and amino acids are critical for yeast growth. The less nitrogen there is in your apple juice, the slower the yeast will ferment. This means that fewer aromatic compounds are driven off during fermentation and the yeast will naturally stop fermenting when S.G. reaches approximately 0.015-1.025, resulting in higher residual sweetness. Also, since nitrogen in apple juice takes the form of proteins (which are composed of nitrogen-rich amino acids), and pectin is a haze-forming protein, apple juice which is lower in nitrogen is likely to be clearer and easier to fine or filter to bright or brilliant clarity.

The drawback is that apple juice which is low in proteins and vitamins takes a long time (4-5 months) to ferment to completion and poor yeast health means that the fermenting juice is more vulnerable to infection and incomplete ("stuck" fermentation). For this reason, many cidermakers add nitrogen in the form of yeast nutrient. Historically, farmhouse cider makers put a piece of meat into their cider barrels, since the meat provided both amino acids and vitamins to the yeast. There are also lurid tales of "stuck" cider restarting fermentation after a rat drowned in the barrel, providing the same nutrients.

Aromatic Compounds: The esters and other aromatic compounds which give cider its characteristic aroma and flavor depend on the varieties of apples pressed to make the juice. Not surprisingly, cider apples have the best aromatic profile for ciders. Dessert apples can have excessively high levels of esters which seem out of place in a finished cider. Aromatic compounds are volatile and are easily lost during vigorous fermentation. The best cider is made using a slow fermentation.

If this is not possible, it is possible to restore fruity and floral esters by back-sweetening the cider with unfermented juice. Some ciderers freeze a gallon of apple juice from the same batch as they used to ferment the cider and add it to the finished cider for exactly this reason. Avoid using artificial flavorings, since they inevitably smell and taste artificial.

Putting it all Together: For English-style cider, the "perfect" apple juice blend has exactly 0.2% tannin and exactly 0.40% acidity. Apple juice pressed from varieties such as Kingston Black come close to this ideal, but typically you will need to blend.

For North American common cider, the ideal juice blend will have S.G. 1.060 (Brix 15 or 8% potential alcohol), moderate (or balanced acidity) with T.A. as Tartaric Acid of about 0.6-0.8%, and tannin content based on the type of cider desired: higher from dry cider, lower for sweet ciders.

In all cases, you want low nitrogen content to encourage slow fermentation.

Claude Jolicoeur has a small Excel spreadsheet which will automatically calculate sugar and acidity levels in an apple blend at: http://cjoliprsf.awardspace.biz/wizard.htm.

Sulfur Dioxide and Yeast

Wild Yeast: Unpasteurized apple juice naturally contains wild yeasts, which naturally live on apple skins and are carried into the juice when it ferments. (The "dust" you see on an unpolished apple fresh off the tree is largely wild yeast.) While it is often possible to make good cider using just the naturally occurring yeast, most wild yeasts are of the S. *Kloeckera* or S. *Candida* strains, meaning they can produce off

flavors and might not ferment well in high-alcohol environments (anything above 1-2% ABV). For this reason, you might wish to add sulfur dioxide (AKA Campden tablets or SO_2) and add cultured yeast.

Unless you add sulfur dioxide, wild yeast will usually start fermentation within a day. They often quickly die after a few days, as the alcohol level rises; leaving a high level of residual sugar in the partially-fermented cider and leaving it open to infection by other organisms.

Sulfur Dioxide: Sulfur dioxide is commonly used prevent spoilage organisms from ruining wine or cider. Unlike processes such as pasteurization, it doesn't kill yeast and bacteria, but it does inhibit their growth, allowing cultured yeast to get a head start when fermentation begins.

Sulfites added at the beginning of fermentation bind to other chemicals (typically acetaldehyde) and drop out of solution by the time fermentation is finished, so their impact on the finished cider is reduced, but sulfites added at the end of fermentation are much more noticeable. Excessive levels can impart unpleasant dry and sulfury notes to the cider, and can cause headaches or even asthma attacks in people who are sensitive to sulfites. For these reasons, sulfite levels should be kept as low as possible - some ciderers prefer a SO_2 concentration of 50-75 ppm. In any case, total sulfur dioxide levels should never exceed 200 ppm.

Add sulfur dioxide 12-24 hours before adding your yeast in order to give it time to act against wild yeast and bacteria and give free sulfur dioxide a chance to outgas from the juice. The cultured yeast will be inhibited as well if it is added too soon after the SO_2.

If making cider with wild yeast, use half the amounts indicated on the table or less, in order to inhibit spoilage bacteria while keeping the wild yeast alive.

High-acid cider (3.0 pH or below) doesn't need sulfites, since the acidity is sufficient to kill any unwanted microbes. When adding cultured yeast, the amount of sulfur dioxide needed depends on the pH of the apple juice:

Recommended Sulfur Dioxide Levels for Apple Juice

Juice pH	SO2 (ppm)	Campden Tablets *
> 3.8	Reduce pH to 3.8 with malic acid	
3.8-3.5	150	3
3.5-3.3	100	2
3.3-3.0	50	1
3.0 <	None	None

* Per gallon or ml of 5% SO_2 stock solution per liter. One Campden tablet typically imparts 50 ppm sulfur dioxide to 1 gallon of juice.

Yeast: Yeast strain depends on the style of cider you're trying to make, and what character you want the final cider to have. Typically, any strain of wine yeast will work, but specialized cider yeasts are also available. Common wine yeasts used for cider are Lalvin EC-1118 and K1V-1116, Riesling, Montrachet and Champagne yeast strains. Ale and even lager yeasts can also work, especially when making lower-alcohol ciders. I've successfully made cider using English ale yeast (Munton's Windsor and Nottingham, Wyeast Thames Valley and British Ale II) and recultured Trappist (Chimay) yeasts.

Pasteur Champagne yeast works well and can ferment high-gravity ciders, but can "strip out" some flavor. Wine yeasts designed for light, fruity wines (e.g., Chardonnay, Epergne, Montrachet) preserve more apple character and are good for French or strong ciders, while English Ale yeasts are ideal for producing English and American farmhouse ciders.

Factors to consider when choosing a yeast for your cider are: cold tolerance (some strains will continue to work down to ~41 °F, 5° C), alcohol tolerance (some strains don't ferment well above about 8% ABV - important if making an applewine, New England cider or iced cider), attenuation, flocculation and aroma/flavor profile.

For simplicity's sake, beginners should start with robust, neutral-flavored yeast which allows the character of the apples to show through. K1V-1116 is a safe choice.

It is generally safe to pitch dry yeasts directly into your apple juice. If you wish, however, you can make a "starter" by pitching your yeast into a quart or half gallon (for a 5 gallon batch) of sterile juice or sugar water solution 12-24 hours before adding it to your apple juice.

Other Additions

Acids: Apple juice contains many organic acids, mostly malic and tartaric acids. As a rule of thumb, if you're working with good-quality apples and have chosen your juice blend well, you don't need to add acid.

But, if you are certain that your apple juice has insufficient acid levels, you can carefully add malic acid crystals at the rate of 1 gram per liter (0.1%) until acid levels are sufficient. Even so, it's better to wait until the cider has at least partially fermented and then taste it to determine if it needs acid for balance.

Other acids which can be present in cider are tartaric, citric and lactic acids. These are all available at homebrewing stores, but there is no reason to add them to your apple juice. Instead, they should be added sparingly, if at all, to the finished cider to balance acidity.

Oxygen: If you wish, you can aerate your apple juice when you pitch the yeast, just as you would for beer.

Pectin Enzyme: Pectins are a class of branched carbohydrate chains naturally found in the cell walls of many fruits. They are responsible for making fruit juice hazy, but also contribute body and perception of smoothness.

Pectinase, or pectin enzyme, breaks pectins down into sugars and simpler carbohydrates. If added to apple pulp during pressing it helps to increase juice yields. If added to apple juice, it slightly increases the fermentability of the juice and helps to clarify the finished cider.

While pectin is usually water soluble, it is precipitated by alcohol, so it can be a problem in the finished cider. Juice blends made from dessert apples, tart apples (including crabapples) or apples which have been in storage for a long time can have high levels of pectin. In such cases, the pectin haze might not clear on its own. Likewise, apple juice which has had lemon juice (citric acid) added to it, or which has been heated (e.g., heat pasteurized) is likely to have a persistent pectin haze. Pectin removal is also vital if you filter your cider, since the large, gummy pectin molecules can quickly clog filters.

In such cases, you might need to add pectinase, which breaks down pectins over a period of about a week.

Testing for Pectin: Pectin is precipitated by alcohol, so a quick and simple test for the presence of pectin is to add one part of your apple juice to one part 70% alcohol (iso-propanol and vodka both work).

If pectin is present, it will gel, causing the sample to become cloudy and begin to precipitate. This gives you a sense of how much pectin is in your juice.

Adding Pectin Enzyme: Pectinase is available in both dry and liquid forms for winemaking. Add it to the juice according to the manufacturer's directions.

Sugar: Avoid adding sugar to your apple juice unless you're making New England Cider, apple wine or some other form of fortified cider. If you're using the right sort of apples they should have sufficient sugar levels already.

If you must add sugar to your apple juice, add neutral flavored sugar or syrup such as white sugar (sucrose) or glucose (dextrose) rather than more expensive and delicately-flavored sugars such as honey or maple syrup.

Instead, add strongly flavored specialty sugars later once fermentation has slowed, "feeding" the fermentation, or use them to back-sweeten the finished cider. This preserves more of the specialty sugar character.

Tannin: Grape tannin is available at homebrewing stores as a winemaking supply. Like acids, tannin shouldn't be added to your apple juice. Instead, it should be carefully added after the cider has finished fermenting in order to balance sweetness. Alternately, instead of adding grape tannin, you can add a bag of oak chips or oak cubes to the finished cider. This potentially gives you more control over the degree of tannin since you can remove the oak chips when you've determined that the cider is dry enough.

Yeast Nutrient: If you want a quicker, stronger fermentation for your cider, but possibly at the risk of reduced quality, add yeast nutrient. Yeast nutrients might be necessary when fermenting a high-gravity cider, or one with a high honey or simple sugar content. Commercial producers add ammonium phosphate or ammonium sulfate and thiamin, in doses of up to 0.2 milligrams per liter of thiamine and up to 300 milligrams per liter of ammonium salts. Homebrewers can add winemaker's yeast nutrient according to the manufacturer's directions. These nutrient blends are usually some combination of urea, thiamine (vitamin B1) and ammonium sulfate.

A traditional cidermakers technique was to put a piece of meat into the fermenting cider, so that it slowly released amino acids and vitamins into the cider. A more salubrious modern equivalent might be to "feed" the fermentation by adding a tiny amount of yeast nutrient to the fermenting cider at intervals.

Fermenting and Maturation

Fermentation: Wild yeast will begin fermentation within a day in unsulfited apple juice. Yeast cultures will usually begin fermentation within 48 hours.

If the juice is sulfited but no yeast is added, surviving wild yeasts will multiply to sufficient levels to begin (noticeable) fermentation within two weeks.

Ideally, cider is fermented at temperatures of 40-60° F, but cider fermented using ale yeast will work happily at 55-65° F. For best flavor, cider needs to ferment slowly. One source suggests topping up the cider fermenter, leaving much less head space than one would for a batch of beer, and using a blow-off fermentation for the first couple of weeks to remove suspended particles of pectin and other materials. Leaving too much headspace can contribute to acetobacter infection.

Depending on temperature and yeast health, the cider should be fully fermented in anywhere from a few weeks to 4-5 months. After 4-5 months, or once the S.G. has dropped to 1.010 or so, taste the cider. If it is excessively sharp, allow it to stand on its lees for another month to encourage MLF. Otherwise, rack it to secondary, using fresh cider to top up the new container. (Some of the original apple juice can be frozen and held in cold storage for this purpose).

Stuck Fermentation: Especially with a weak fermentation, cider might stop fermenting above the desired final gravity (1.025 for sweet ciders, 1.015 for semi-sweet, 1.010 or less for dry ciders). In such cases, you might be able to restart fermentation by adding yeast nutrient, aerating the apple juice (e.g., 20 minutes vigorous stirring) or slightly increasing fermentation temperature (but most cider yeasts work best at around 60 °F, 15 °F).

Extremely acidic ciders might also be slow to ferment. In such cases, you might want to delay the first racking by a month in order to encourage malolactic fermentation. Fully fermented cider shouldn't be left on its lees for more than a few weeks, however.

Racking: When racking, avoid aerating the cider and try to leave behind as much trub as possible. Run the transferred cider into the bottom of the new vessel without splashing or allowing it to cascade down the walls. Once you've racked your cider, minimize headspace and contact with the outside air. If possible, blanket the cider with a layer of carbon dioxide. This will help to keep out spoilage organisms and will also prevent oxidation.

Some cidermakers add 50 ppm of sulfur dioxide at every racking to combat oxidation and risk of spoilage, but this is generally unnecessary and might add excessive sulfites to the finished cider. Added sulfites are also likely to inhibit malolactic fermentation.

When cider is racked, otherwise clear cider might throw a haze or precipitation as yeast falls out of solution. Maturing cider should not sit for more than a few months on the lees, however, lest it pick up autolyzed yeast notes.

Maturation: Once fermentation has ceased, cider should be put in a closed fermenter to continue maturing. Depending on the style, the temperature and your level of patience, cider can age for weeks or years. Most cider is ready to drink within 3 months after fermentation starts, but aging for another 3-9 typically improves flavor. Cider doesn't age well, however, and even well-maintained cider begins to decline if stored for more than a few years at room temperature. Up to 50 ppm sulfur dioxide can help combat oxidation and aid storage stability, as long as total SO_2 additions to the fermenting or fermented cider don't exceed 200 ppm.

Malolactic Fermentation: When fermentation is slow, over a period of months, Lactobacillus or Leuconostoc bacteria in the fermenting juice convert malic acid into lactic acid and carbon dioxide; a process called malolactic fermentation (MLF). Traditionally, it occurs the summer after the cider is laid down, as temperatures in the ciderhouse warm.

MLF gives the cider a crisper, less lingering sourness and a more rounded, smoother flavor due to reduced levels of malic acid (which has a fruit-like sourness) and increased levels of lactic acid. In bittersweet ciders it can produce characteristic "spicy" notes (often detectable in Norman ciders) or "bacon" or "smoky" notes (typical of English ciders).

MLF is common, even desirable, in English and French ciders, but it can make ciders which were already low in acid seem insipid. Reduced acidity can also leave the cider vulnerable to infection by other organisms, especially if pH goes above 3.8.

MLF can be detected if the cider begins to produce gas but doesn't become turbid or hazy due to the presence of suspended yeast cells. "sheen" in an otherwise clear cider is also a sign of lactobacillus bacteria at work, although this is considered to be a fault in cider entered in competition.

MLF is enhanced if the cider is allowed to sit on a small amount of autolyzed yeast, since the decaying yeast provides nutrient to the lactobacillus bacteria. It is difficult to deliberately induce, although there

are lactobacillus cultures available which can be added to cider to start it.

MLF can be inhibited by using sulfur dioxide at racking.

Advanced Techniques

Adjusting Acids and Tannins: When the cider is fermented and has had some time to mature, you can adjust acidity and tannin levels by adding tannins.

Adding Tannins and Acids: Add tannins or acids (citric, lactic, malic or tartaric) in 0.1% increments to test batches. Taste carefully and keep careful notes before you do anything to the whole batch. Also see Blending, below.

Reducing Acids: It is difficult to remove acids from cider, but it can be done by adding potassium carbonate (calcium carbonate gives cider a chalky flavor). Add potassium carbonate in 0.1% increments to test batches. Taste carefully and keep careful notes before you do anything to the whole batch.

Reducing Tannins: It is possible to remove some tannins (and associated chill haze) by fining with gelatin or similar fining agent. Crash-chilling the cider for several days after adding finings will also help precipitate tannins.

Blending: Blending ciders after fermentation is complete is a great way to achieve perfect flavor balance. But, like any other aspect of brewing, it's an art. Guidelines for blending:

* Only blend if required. Don't mess with your cider if you don't have to.

* Blend well before final racking for kegging or bottling. Changes in acidity, nutrients and yeast levels occur when batches are blended. This might cause fermentation to restart, make otherwise clear ciders to throw a haze or sediment, or otherwise alter the character of the blend.

* Blending can only tweak the character of the mixed ciders. You can't blend to correct serious faults.

* Test blends using small samples of the ciders to be blended before mixing the entire batch.

* If blending to sweeten (or back-sweetening with sugar or juice) blend to the desired level of sweetness (S.G. 1.025 for sweet, 1.015 for semi-sweet) first, then blend to get the right levels of tannins and acids.

* If you must add acids or tannins to the blend, add them to your test mixtures in 0.1% steps.

* Keep careful notes of volumes used in test blends before blending entire batches!

Carbonation: For purposes of the BJCP, cider can be still (i.e., flat), petillant (i.e., lightly carbonated) or sparkling (i.e., carbonated).

Many brewers (and judges) are unsure exactly what petillant means, however, so "petillant" cider can be anywhere from barely carbonated (with carbonation just detectable as a tingling on the tongue) to slightly carbonated (to about the level of a cask-conditioned ale). In competition, it's safer to describe your cider as still (if it is truly uncarbonated) or carbonated.

To Carbonate or Not to Carbonate?: Carbonating your cider helps lift aromas out of solution, improving aroma, and also makes the cider seem fuller-bodied and drier in the mouth.

The danger of carbonation is that it can be hard to control the exact carbonation level (especially if bottle-conditioning) and carbonation can negatively affect perceptions. A huge gushing head is a fault, not just because of the mess, but also because the carbon dioxide can scrub too many delicate aromas out of the cider, giving a huge initial "bloom" of aroma which doesn't carry through into the flavor. Likewise, carbonation can make a cider seem too tart and astringent.

Force Carbonation: If you have a kegging system, it is easy to get the exact level of carbonation you desire in your cider. Otherwise, it's a bit tricky. As a rough rule of thumb, still cider has less than 1.2 volumes of dissolved carbon dioxide, petillant cider has 1.2-1.8 volumes and sparkling cider has 1.9-3.0 volumes.

Bottle-Conditioning: Bottle-conditioning cider is harder, since cider takes a long time to come into condition and the yeast is likely to be in very bad health when it's time to bottle.

The simplest, but riskiest, strategy is to track the drop in S.G. as the cider ferments to terminal gravity and then bottle it when S.G. reaches about 1.010, allowing it to finish fermenting in the bottle. Alternately, you can add a bit of new yeast, some fresh juice and some yeast nutrient to your cider once it reaches terminal gravity.

In either case, there is the risk that yeast in the bottle will contribute off-flavors and that bottle-conditioned cider will no clear properly. The latter is a serious fault if you plan to enter your cider in competition. Even for styles where haze is allowed, judges often take off points for appearance if they assume that all cider should have brilliant clarity.

Degorgement: French cidermakers (and obsessive home cidermakers) solve the problem of hazy, yeasty bottled cider by using the *method champegnoise*, just like champagne makers. The cider is primed with sugar and then allowed to partially ferment and clarify in a corked bottle. Then the bottle is inverted to allow the lees to fall into the neck. Once the lees have settled, the neck is immersed in bath of salt and ice. This ice bath freezes the lees in the neck of the bottle making them stick to the cork, so when the cork is drawn, the frozen lees come with it, thus clarifying the cider. The bottle is then recorked and fitted with a wire cage, allowing carbonation to continue without blowing the top off the bottle.

If you bottle-condition your cider, be sure that the bottle (and the cap) is up to the task! Highly-carbonated champagne-style ciders (i.e., any cider with more than more than 2.5 volumes of carbon dioxide) should be bottled in a champagne-style bottle with a thicker walls and a punted base. Corks or caps should be held in place with wire cages.

Fining: Finings can be used to remove haze from cider. This is very important for cider entered into competition, especially for styles where bright or brilliant clarity is an option. In addition to pectinase (described above), traditional cider finings include egg whites (albumin), blood, gelatin, milk (casein), isinglass and Irish moss. Modern finings include bentonite (kaolin clay), casein, carrageenan (the active ingredient in Irish moss), alginate, diatomaceous earth, PVPP (Polyclar®), kieselsol (colloidal silica), copper sulfate, dried albumen, hydrated yeast, and activated carbon.

Most of these fining compounds work via the electrostatic principle – attracting molecules with an opposite charge to form larger clumps of material which drop out of solution more quickly. Activated carbon, PVPP, fining yeast and copper sulfate work on the adsorbent principle, chemically adhering to the surface of the undesirable compounds to form larger particles. Fining yeast can remove excessive copper, while copper sulfate can remove unwanted sulfur compounds. In both cases, however, the finings must be removed using a different type of fining. Some types of finings can remove tannins and melanoidin compounds, which may be undesirable. Gelatin, casein and PVPP can be used to remove quercetin (an astringent compound associated with oak-aging). A book on wine-making will give much more information.

Keeving: Keeving is a French technique used to reduce nitrogen levels in the fermenting apple juice. It only works for apple varieties which are high in tannins and low in yeast nutrient, and requires careful temperature control. During keeving the apples are pulped *(cuvage* or *maceration)* and allowed to sit for up to 24 hours before the pulp is pressed. Then, salt and wood ashes or calcium chloride and a special enzyme are added to the juice.

The juice is then placed in sanitized barrels and is allowed to slowly ferment at temperatures of about 5 °C for up to a week. During this period of very slow fermentation, the pectin in the juice converts to pectic acid, which forms a brown scum (the "*chapeau brun*") on top of the fermenting cider while the yeasts, bacteria and other substances precipitate to the bottom of the barrel ("*defecation*"). The cider is then racked into a new container so that the scum on the top and bottom is left behind.

Keeving can reduce protein levels by up to 50%, resulting in nutrient-poor juice which ferments slowly and ultimately stops fermenting at 2-4% ABV. This produces a clearer, more flavorful cider. Smooth, mellow French *cidre bouche* depends on keeving for its unique character.

Sweetening: It is easy to let a cider ferment to completion, with a final gravity of 1.010 or less. Sweet and semi-sweet ciders are more popular, but trickier to produce. There are two ways to get higher levels of residual sugar in cider: stop fermentation prematurely and/or back-sweeten the cider once the yeast has been killed or gone dormant due to lack of nutrients. The latter technique allows you to produce "fruitier" ciders since you can back-sweeten with unfermented apple juice. It also works well for specialty ciders made with delicately-flavored sugars like maple sugar or honey, since those flavors and aromas don't need to survive fermentation.

Commercial cider producers allow the cider to ferment to terminal gravity, then centrifuge and/or filter the cider (see Filtering) to remove the yeast and then back-sweeten it. French cider producers maintain a high level of residual sweetness by Keeving (see above) so that the yeast doesn't have sufficient nutrient to complete fermentation. Other methods are listed below.

Artificial or non-fermentable sweeteners: Unfermentable sugars such as lactose or artificial sweeteners such as saccharine can be added to cider to sweeten it, but their use is problematic. Lactose can be fermented by lactobacillus bacteria which might be present in the cider, and artificial sweeteners often contribute bitter and "artificial" flavors. Saccharine doesn't work well in cider. Sucralose (AKA Splenda™) allegedly works well.

Fining: Fining to remove yeast works in a similar manner to Racking (see below), except that you use a fining agent to precipitate the yeast. Add fining agent according to the manufacturer's instructions, but be aware that fining agents can take much longer than advertised to clear, and that some fining agents are designed to operation in conjunction with filtration. Crash-cooling the cider for several days, or cold-conditioning it, can also help to precipitate yeast. Fining can be combined with Filtering or Racking.

Filtering: Yeast can be removed from cider by running it through a 10 micron filter. Just be sure that the cider has very low pectin levels and is otherwise fairly clear before you filter or else your filters can clog. Sheet filters are also difficult, messy and slow to use, especially if you don't have a pump to help the process along.

Pasteurizing: Blend sweetener with the fully-fermented cider, then pasteurize the bottles at approximately 154 °F (68 °C) for 20 minutes. The drawback of this method is that it makes bottle conditioning impossible and can also impart unpleasant "cooked" characteristics to the finished cider.

Racking: This method is a deliberate attempt to induce stuck fermentation by repeatedly racking the fermenting cider off the lees. By reduce the amount of yeast nutrient available, you slow or stop fermentation.

When fermentation is almost complete (e.g., S.G. 1.030 or less) and S.G. is dropping at the rate of less than 1 degree S.G. per day, rack the cider into a new vessel, leaving most of the yeast behind. For sweet cider, rack again when the cider is at about 1.020-1.025. For semi-sweet cider rack again when S.G. is at about 1.015. Then, monitor the cider for several weeks to determine that fermentation doesn't restart. Once you're sure that fermentation has stopped, you can back-sweeten, making sure that you don't do anything to restart fermentation, such as adding oxygen or yeast nutrient. If you can, rack the cider on a clear, sunny day (when the barometric pressure is high) since higher atmospheric pressure helps to keep suspended yeast to a minimum.

Even so, there is a risk that fermentation might continue in the keg or bottle. Ciders of this sort often become petillant, sparkling, or even explosive if stored for any length of time.

Racking and back-sweetening is best for ciders which will require no further blending, which can be force-carbonated, and which will be consumed within a few weeks of packaging.

Waiting: If a cider has finished fermentation, has been racked off the lees at least once, and has been conditioning for several months, it might be possible to back-sweeten the cider without fermentation restarting. This carries the same risks and drawbacks as Racking.

Yeast Inhibitors: Used in conjunction with some other method of stopping fermentation, such as Filtration, Fining, Racking or Waiting, you can also reduce the chances that the yeast will re-start fermentation by adding naturally-occurring yeast inhibitors such as potassium sorbate or benzoate, at levels up to 200 ppm.

Both potassium sorbate and benzoate are available from winemaking supply shops. Potassium sorbate is most effective if you add about 50 ppm of sulfur dioxide (Campden tablet) at the same time. Total levels of sulfite and sorbates should not exceed 200 ppm, however.

Sorbate should not be added to cider which has undergone malolactic fermentation, or which is likely to do so, since lactic acid bacteria reacting with sorbate can produce geranium-like off-flavors.

Other Cider-Like Beverages

Perry and cider-strength "wines" made from other fruits, such as plums or peaches, basically follow the rules for cider. You must balance sugar, acidity, tannins and nitrogen levels to produce an optimal juice blend, and then ferment slowly using commercial yeast.

Perry: Perry is very similar to cider, except that it is virtually impossible to find cider-quality pears which press well. Typical dessert pears like Bartlett or Bosc pear produce a very fine, wet pulp which doesn't press well. They also might not have the proper levels of sugar, acid and tannins.

Other Fruit Ciders: Homebrewers have made good ciders from peaches, plums and cherries, among other fruits. As with perry made from dessert pears, there are problems with the pulp not pressing well, as well as insufficient levels of sugar, acids and tannins. Additionally, many tree fruits have pits which might need to be removed before the fruit can be pulped. Expect a lot of work and a lot of mess!

Part 2 - Cider History and Styles

Cider has been around in one form or another since Neolithic times, and virtually every European culture has produced some form of cider. During the Middle Ages and Renaissance, cider was highly prized in England, France and Spain. American colonists brought apples and cider-making techniques to North America. Throughout the 17th and 18th centuries, American colonists relied on hard cider as a safe beverage, especially when early attempts to grow hops and barley in North America proved unsuccessful.

Cider's downfall in popularity came in the 19th and 20th centuries. As both Great Britain and the United States become more urbanized, cider became increasingly more expensive, both due to increased demand and due to the cost of transporting cider from the countryside

to the city. Since cider doesn't keep very well, especially when exposed to the rigors of travel over primitive roads, its quality suffered. Even worse, unscrupulous merchants adulterated cider or stored it in metallic containers, ruining its flavor and in some cases poisoning those who drank it. ("Devonshire colic" or "apple palsy" were 19th century terms used to describe the symptoms of poisoning from drinking cider which had been contaminated by exposure to lead.) By contrast, beer, which was produced in the city, could be relied upon to be fresh and wholesome. As a result, cider's reputation suffered badly – it was soon considered to be a drink fit only for the most desperate of the urban poor or for backcountry yokels who didn't know any better. In the U.K., although cider's reputation has improved somewhat, it still has the something of same stigma that malt liquor has in the U.S. – a cheap, inferior beverage consumed by those too young, too poor or too far gone to care.

In the U.S., two other factors contributed to cider's demise. The first factor was that German lager brewers produced light, crisp beers which filled the same market niche that cider once occupied. The second factor was the Temperance Movement of the late 19th century which culminated in Prohibition early in the 20th century. New England and the Upper Midwest were the main cider-producing regions of the country, but they were also had strong Temperance Movements. Furthermore, hard cider became associated with apple brandy, rather than being seen as a healthful, "temperance beverage" as it once had been. As a final blow, an unseasonably cold winter in 1917 killed millions of apple trees, devastating the U.S. cider industry on the eve of Prohibition. After Prohibition ended, the hard cider industry was nearly dead. Only with the rise of the craft-brewing movement in the U.S. and the Campaign for Real Ale (CAMRA) in the U.K. has craft cider-making been revived.

In France and Spain, however, cider has never gone out of style. In Asturias, Galicia and the Basque Country of Spain, "*sidera*" was the traditional drink of choice. In France, cider from Brittany and Normandy has always enjoyed a strong following, along with the sublime apple and pear brandies of the region. Likewise, In Germany, especially in Hesse and the Saar valley, Apfelwein has always been a treasured local beverage.

BJCP Cider Guidelines

Cider is fermented apple juice. Perry is fermented pear juice. There are two categories for cider/perry: Standard (Category 27) and Specialty (Category 28).

The Standard category covers ciders and perries made primarily or entirely from the juice of apples or pears (but not both at once). The only adjunct permitted in the Standard category, and only in some sub-categories, is a limited addition of sugar to achieve a suitable starting gravity. Note that honey is not a "sugar" for this purpose; a cider made with added honey must be entered either as a Specialty cider or as a Cyser under the appropriate mead sub-category. Other sugar sources that also add significant flavors (brown sugar, molasses) would also create a Specialty cider (such as New England style).

Aroma and Flavor

Ciders and perries do not necessarily present overtly fruity aromas or flavors — in the same sense that a wine does not taste overtly of grapes. Drier styles of cider in particular develop more complex but less fruity characters. In fact, a simple "apple soda" or "wine cooler" character is not desirable in a cider or perry.

Some styles of cider exhibit distinctly NON-fruity tastes or aromas, such as the "smoky bacon" undertones of a dry English cider.

The sweetness (residual sugar, or RS) of a cider or perry may vary from absolutely dry (no RS) to as much as a sweet dessert wine (10% or more RS). In sweeter ciders, other components of taste — particularly acidity — must balance the sweetness. The level of sweetness must be specified in order to arrange flights of tastings and entries within flights. Tasting always proceeds from drier to sweeter. There are three categories of sweetness:

Dry: below 0.9% residual sugar. This corresponds to a final specific gravity of under 1.002.

Medium: in the range between dry and sweet (0.9% to 4% residual sugar, final gravity 1.002 to 1.012). Sometimes characterized as either 'off-dry' or 'semi-sweet.'

Sweet: above 4% residual sugar, roughly equivalent to a final gravity of over 1.012.

If a cider is close to one of these boundaries, it should be identified by the sweetness category which best describes the overall impression it gives.

Acidity is an essential element of cider and perry: it must be sufficient to give a clean, refreshing impression without being puckering. Acidity (from malic and in some cases lactic acids) must not be confused with acetification (from acetic acid — vinegar): the acrid aroma and tingling taste of acetification is a fault.

Ciders and perries vary considerably in tannin. This affects both bitterness and astringency (see "Mouthfeel" below). If made from culinary or table fruit, tannins are typically low; nevertheless some tannin is desirable to balance the character. The character contributed by tannin should be mainly astringency rather than bitterness. An overt or forward bitterness is a fault (and is often due to processing techniques rather than fruit).

Appearance

Clarity may vary from good to brilliant. The lack of sparkling clarity is not a fault, but visible particles are undesirable. In some styles a "rustic" lack of brilliance is common. Perries are notoriously difficult to clear; as a result a slight haze is not a fault. However, a "sheen" in either cider or perry generally indicates the early stage of lactic contamination and is a distinct fault.

Carbonation may vary from entirely still to a champagne level. No or little carbonation is termed still. A moderate carbonation level is termed petillant. Highly carbonated is termed sparkling. At the higher levels of carbonation, the "mousse" (head) may be retained for a short time. However, gushing, foaming, and difficult-to-manage heads are faults.

Mouthfeel

In general, cider and perry have a mouthfeel and fullness akin to a substantial white wine. The body is less than that of beers. Full-sparkling ciders will be champagne-like.

Ingredients

The apple and pear varieties are intended to illustrate commonly used examples, not dictate requirements when making the style. In general, adjuncts are prohibited except where specifically allowed in particular styles, and then the entrant must state them. Common processing aids, and enzymes, are generally allowed as long as they are not detectable in the finished cider. Yeast used for cider/perry may be either "natural" (the yeast which occurs on the fruit itself and/or is retained in the milling and pressing equipment) or cultured yeast. Malo-lactic fermentation is allowed, either naturally occurring or with an added ML culture. Enzymes may be used for clarification of the juice prior to fermentation. Malic acid may be added to a low-acid juice to bring acidity up to a level considered safe for avoiding bacterial contamination and off-flavors (typically pH 3.8 or below). Entrant MUST state if malic acid was added. Sulfites may be added as needed for

microbiological control. If used, the maximum accepted safe level for sulfites (200 mg/l) should be strictly observed; moreover, any excess sulfite that is detectable in the finished cider (a "burning match" character) is a serious fault.

Sorbate may be added at bottling to stabilize the cider. However, any residual aroma/flavor from misuse or excessive use of sorbate (e.g., a "geranium" note) is a distinct fault.

Carbonation may be either natural (by maintaining CO2 pressure through processing or by bottle-conditioning) or added (by CO2 injection).

27A. Common Cider

A common cider is made from culinary/table apples, with wild or crab apples often used for acidity/tannin balance.

Aroma/Flavor: Sweet or low-alcohol ciders may have apple aroma and flavor. Dry ciders will be more wine-like with some esters. Sugar and acidity should combine to give a refreshing character, neither cloying nor too austere. Medium to high acidity.

Appearance: Clear to brilliant, pale to medium gold in color.

Mouthfeel: Medium body. Some tannin should be present for slight to moderate astringency, but little bitterness.

Overall Impression: Variable, but should be a medium, refreshing drink. Sweet ciders must not be cloying. Dry ciders must not be too austere. An ideal cider serves well as a “session” drink, and suitably accompanies a wide variety of food.

Comments: Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (dry, medium, sweet).

Varieties: Common (Winesap, Macintosh, Golden Delicious, Braeburn, Jonathan), multi-use (Northern Spy, Russets, Baldwin), crabapples, any suitable wildings.

Vital Statistics: OG: 1.045 – 1.065, FG: 1.000 – 1.020, ABV: 5 – 8%.

Commercial Examples: Bellwether Spyglass.

27B. English Cider

This includes the English “West Country” plus ciders inspired by that style. These ciders are made with bittersweet and bitter-sharp apple varieties cultivated specifically for cider making.

Aroma/Flavor: No overt apple character, but various flavors and esters that suggest apples. May have “smoky (bacon)” character from a combination of apple varieties and MLF. Some “Farmyard nose” may be present but must not dominate; mousiness is a serious fault. The common slight farmyard nose of an English West Country cider is the result of lactic acid bacteria, not a Brettanomyces contamination.

Appearance: Slightly cloudy to brilliant. Medium to deep gold color.

Mouthfeel: Full. Moderate to high tannin apparent as astringency and some bitterness. Carbonation still to moderate, never high or gushing.

Overall Impression: Generally dry, full-bodied, austere.

Comments: Entrants MUST specify carbonation level (still or petillant). Entrants MUST specify sweetness (dry to medium). Entrants MAY specify variety of apple for a single varietal cider; if specified, varietal character will be expected.

Varieties: Kingston Black, Stoke Red, Dabinett, Foxwhelp, Yarlington Mill, various Jerseys, etc.

Vital Statistics: OG: 1.050 – 1.075, FG: 0.995 – 1.010, ABV: 6 – 9%.

Commercial Examples: Farnum Hill Extra-Dry (NH), Wandering Aengus Wickson Single Varietal Cider (unofficial), Belwether Heritage.

27C. French Cider

This includes Normandy styles plus ciders inspired by those styles, including ciders made by various techniques to achieve the French flavor profile. These ciders are made with bittersweet and bitter-sharp apple varieties cultivated specifically for cider making.

Traditional French procedures use small amounts of salt and calcium compounds (calcium chloride, calcium carbonate) to aid the process of pectin coagulation. These compounds may be used, pre-fermentation, but in limited quantity. It is a fault if judges can detect a salty or chalky taste.

Aroma/Flavor: Fruity character/aroma. This may come from slow or arrested fermentation (in the French technique of défécation) or approximated by back sweetening with juice. Tends to a rich fullness.

Appearance: Clear to brilliant, medium to deep gold color.

Mouthfeel: Medium to full, mouth filling. Moderate tannin apparent mainly as astringency. Carbonation moderate to champagne-like, but at higher levels it must not gush or foam.

Overall Impression: Medium to sweet, full-bodied, rich.

Comments: Entrants MUST specify carbonation level (petillant or full). Entrants MUST specify sweetness (medium, sweet). Entrants MAY specify variety of apple for a single varietal cider; if specified, varietal character will be expected.

Varieties: Nehou, Muscadet de Dieppe, Reine des Pommes, Michelin, etc.

Vital Statistics: OG: 1.050 – 1.065, FG: 1.010 – 1.020, ABV: 3 – 6%.

Commercial Examples: Etienne Dupont Cidre Normand 2007.

27D. Common Perry

Common perry is made from culinary/table fruit.

Aroma/Flavor: There is a pear character, but not obviously fruity. It tends toward that of a young white wine. No bitterness.

Appearance: Slightly cloudy to clear. Generally quite pale.

Mouthfeel: Relatively full, low to moderate tannin apparent as astringency.

Overall Impression: Mild. Medium to medium-sweet. Still to lightly sparkling. Only very slight acetification is acceptable. Mousiness, ropy/oily characters are serious faults.

Comments: Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (medium or sweet).

Varieties: Bartlett, Kiefer, Comice, etc.

Vital Statistics: OG: 1.050 – 1.060, FG: 1.000 – 1.020, ABV: 5 – 7%.

Commercial Examples: Spire Organic Pear (unofficial).

27E. Traditional Perry

Traditional perry is made from pears grown specifically for that purpose rather than for eating or cooking. Many “perry pears” are nearly inedible.

Aroma/Flavor: There is a pear character, but not obviously fruity. It tends toward that of a young white wine. Some slight bitterness.

Appearance: Slightly cloudy to clear. Generally quite pale.

Mouthfeel: Relatively full, moderate to high tannin apparent as astringency.

Overall Impression: Tannic. Medium to medium-sweet. Still to lightly sparkling. Only very slight acetification is acceptable. Mousiness, ropy/oily characters are serious faults.

Comments: Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (medium or sweet). Variety of pear(s) used must be stated.

Varieties: Butt, Gin, Huffcap, Blakeney Red, etc.

Vital Statistics: OG: 1.050 – 1.070, FG: 1.000 – 1.020, ABV: 5 – 9%.

Commercial Examples: Oliver's Blakeney Red Perry (UK), Oliver's Herefordshire Dry Perry (UK).

28A. New England Cider

This is a cider made with characteristic New England apples for relatively high acidity, with adjuncts to raise alcohol levels.

Aroma/Flavor: A dry flavorful cider with robust apple character, strong alcohol, and derivative flavors from sugar adjuncts.

Appearance: Clear to brilliant, pale to medium yellow.

Mouthfeel: Substantial, alcoholic. Moderate tannin.

Overall Impression: Substantial body and character.

Comments: Adjuncts may include white and brown sugars, molasses, small amounts of honey, and raisins. Adjuncts are intended to raise OG well above that which would be achieved by apples alone. This style is sometimes barrel-aged, in which case there will be oak character as with a barrel-aged wine. If the barrel was formerly used to age spirits, some flavor notes from the spirit (e.g., whisky or rum) may also be present, but must be subtle. Entrants MUST specify if the cider was barrel-fermented or aged. Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (dry, medium, or sweet).

Varieties: Northern Spy, Roxbury Russet, Golden Russet.

Vital Statistics: OG: 1.060 – 1.100, FG: 0.995 – 1.010, ABV: 7 – 13%.

Commercial Examples: Crispin Irish Stout Yeast and Molasses (unofficial), Spire Brown Sugar and Molasses (unofficial, and a bit low in alcohol for the style).

28B. Fruit Cider

This is a cider with other fruits or fruit-juices added - for example, berry. Note that a "cider" made from a combination of apple and pear juice would be entered in this category since it is neither cider nor perry.

Aroma/Flavor: The cider character must be present and must fit with the other fruits. It is a fault if the adjuncts completely dominate; a judge might ask, "Would this be different if neutral spirits replaced the cider?" A fruit cider should not be like an alco-pop. Oxidation is a fault.

Appearance: Clear to brilliant. Color appropriate to added fruit, but should not show oxidation characteristics. (For example, berries should give red-to-purple color, not orange.)

Mouthfeel: Substantial. May be significantly tannic depending on fruit added.

Overall Impression: Like a dry wine with complex flavors. The apple character must marry with the added fruit so that neither dominates the other.

Comments: Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (dry or medium). Entrants MUST specify what fruit(s) and/or fruit juice(s) were added.

Vital Statistics: OG: 1.045 – 1.070, FG: 0.995 – 1.010, ABV: 5 – 9%.

Commercial Examples: Belwether Cherry Street, Belwether Black Magic (unofficial) Lolo Romy (unofficial and a bit strong at 12%).

28C. Applewine

The term for this category is traditional but possibly misleading: it is simply a cider with substantial added sugar to achieve higher alcohol than a common cider.

Aroma/Flavor: Comparable to a Common Cider. Cider character must be distinctive. Very dry to slightly medium.

Appearance: Clear to brilliant, pale to medium-gold. Cloudiness or hazes are inappropriate. Dark colors are not expected unless strongly tannic varieties of fruit were used.

Mouthfeel: Lighter than other ciders, because higher alcohol is derived from addition of sugar rather than juice. Carbonation may range from still to champagne-like.

Overall Impression: Like a dry white wine, balanced, and with low astringency and bitterness.

Comments: Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (dry or medium).

Vital Statistics: OG: 1.070 – 1.100, FG: 0.995 – 1.010, ABV: 9 – 12%.

Commercial Examples: None, although the Lolo Romy sort of counts.

28D. Other Specialty Cider/Perry

This is an open-ended category for cider or perry with other adjuncts such that it does not fit any of the categories above. This includes the use of spices and/or other sweeteners. A cider with added honey may be entered here if the cider character remains dominant. Otherwise it should be entered as mead in the cyser sub-category.

Aroma/Flavor: The cider character must always be present, and must fit with adjuncts.

Appearance: Clear to brilliant. Color should be that of a common cider unless adjuncts are expected to contribute color.

Mouthfeel: Average body, may show tannic (astringent) or heavy body as determined by adjuncts.

Comments: Entrants MUST specify all major ingredients and adjuncts. Entrants MUST specify carbonation level (still, petillant, or sparkling). Entrants MUST specify sweetness (dry or medium).

Vital Statistics: OG: 1.045 – 1.100, FG: 0.995 – 1.020, ABV: 5 – 12%.

Commercial Examples: Wandering Aengus Dry Oaked Cider, Crispin Trappist Yeast and Maple Syrup (unofficial), Isastegi (Spanish Asturian cider - unofficial).

Other Cider Varieties

In addition to the cider and perry varieties listed in the BJCP Guidelines, several other varieties of cider exist. If you brew these, they should probably be entered in Category 28D in competition.

Apfelwein: A German cider associated with Hesse and the Saar Valley. It is a tart, sour beverage of 5.5-7% ABV. It is also called *Apfelmost*, *Viez* or *Saurer Most*.

Applejack: Applejack is distilled American apple brandy, traditionally associated with New Jersey (which was renowned for its apples in the 18th and 19th centuries). Modern applejack is made in much the same fashion as Calvados, except that it isn't aged as long and the apple brandy might be diluted with grain neutral spirits as well as water at packaging. Modern applejack is rougher and has less apple aroma and flavor than Calvados.

Traditional applejack is an American specialty made by freeze-distilling New England or Common Cider. Cider was left in an unheated building over the winter. The cycle of warming and cooling over the course of a winter day, allowing the alcohol to liquefy and run out of the water ice. By removing the water ice, the ciderer could gradually increase the strength of the remaining liquor. Applejack was traditionally 30-40% ABV, but it had a ferocious reputation because it was capable of causing appalling hangovers or even death in those who drank too much of it. This is because freeze-distilling concentrates fusel alcohols, aldehydes and other toxic compounds which are normally driven off during heat distilling.

Applewine: Applewine is any cider with enough sucrose added to it to raise its ABV to wine strength (9-11% ABV). Applewines should still have a predominantly apple flavor, however, despite their higher alcohol content. Strong ciders flavored with honey or other sugars have their own categories.

Breton Cidre Doux: About 3% ABV, golden, very sweet due to keeving.

Calvados: An apple brandy associated with Normandy, made from French Cider. It is doubly distilled to 140-150 proof (70-75% ABV) and then aged for 2-20+ years. Just before bottling, it is cut with distilled water to 30-40% ABV.

Cider: In Europe, this term refers to any alcoholic beverage made from apple juice, which is fermented to beer strength (4-6% ABV). In the U.S. the term is synonymous with unfermented apple juice – see *Sweet Cider*.

Common Cider is any North American cider made largely from dessert apples, possibly with added sugar, acid or tannins. This is typical of most craft-brewed ciders in the U.S., as well as most homebrewed ciders. Assume that a cider is a "common cider" until proven otherwise.

Cyser: A beverage made from a mixture of apple juice and honey, fermented to wine or beer strength. If the honey flavor predominates and the resulting beverage is of wine strength (9-11% ABV), a cyser is considered to be a form of fruit mead under the BJCP Guidelines. If it is of beer strength (4-6% ABV) and the fruit character predominates, it is treated as a Specialty Cider under the BJCP guidelines.

The Spanish equivalent of Bulmer's is El Gaitero, which produces a sweet, carbonated cider for the Spanish and Latin-American markets.

Draft (Industrial) Cider or Perry: This is a manufactured cider-like beverage rather than a "real cider." Sadly, it represents the majority of "cider" produced worldwide. It is produced from a base blend of sweet apple concentrate (typically dessert and/or cooking apples) purchased in bulk on the world commodities market. Better quality products use better apples from local orchards and blend in juice or concentrate obtained from cider-quality apples.

The concentrate is diluted with deoxygenated filtered water and chaptalized (sugar added) with 35-65% glucose syrup to obtain an initial S.G. of 1.070 or higher. It is then treated with yeast nutrients and fermented at ale temperatures until dry. The applewine strength cider (up to 12% ABV) is then filtered to pasteurize it and give it brilliant clarity and diluted with deoxygenated filtered water to reduce strength to 4-7% ABV. Finally, it is back-sweetened with sugar or apple juice and acidified using malic acid. In some cases, it also has added flavorings (real or artificial), and is colored with caramel color. Finally, it is force carbonated before being bottled.

Strong UK "white" ciders are very light in color, with minimal apple flavor and aroma, and have 6.5-7% ABV. Brands marketed in North America have more fruit aroma and sweetness (but not necessarily more flavor) and are colored to a golden to amber tint.

Commercial Examples: US: Hardcore Hard Cider., Hornsby's, Jacks, Magners, Original Sin, Woodchuck.
UK and Ireland: Addlestones, Aspall, Brothers, Bulmers, Diamond White, Dry Blackthorn, Frosty Jacks, Gaymer's, Jacques, K Cider, Kingstone Press, Kopparberg, Magners, Merrydown, Natch , Red C, Samuel Smith's, Saxon, Scrumpy Jack, St. Helier, Stella Cidre, Stow ford Press, Strongbox, Thatcher's Gold, Woodpecker.

English Cider is a cider made using varieties of apples which originated in the U.K. It can be sharper and bitterer than common cider. Devon cider is sweeter, since it uses Keeving to inhibit fermentation. British "farmhouse" cider will sometimes have a bit of a "smoky bacon" or nutty flavor or aroma due to MLF. "West Country" cider, associated with Wessex and Cornwall, is traditionally bitterer, sourer, and more alcoholic than other varieties.

English Scrumpy: Similar to English Cider, but it is unfiltered and can be hazy to cloudy in appearance.

English West Country Farmhouse Cider: Similar to English Cider, but often stronger. Fermented to dryness, sometimes with an extreme mouth-puckering character due to tannins and sour apples.

Farmhouse Cider: This is a term which can be applied to British, French or North American cider which has "funky" notes from wild yeast or secondary fermentation, much like a lambic. "Smoky bacon" or nutty notes might be present due to MLF.

French Cider: Also called *Cidre Doux,* this is Norman or Breton cider from the *Pays d'Auge* made from apple varieties native to those regions. Maceration of the apple pulp and défécation are used to produce a sweet, complex, well-balanced cider of 2-4% ABV. This cider also forms the basis of Calvados, the local apple brandy.

Fruit Cider: Any type of cider which contains fruit juice other than apples. This includes Peach Cider (a 19th century Georgia specialty, which was distilled into a fiery peach brandy), "Pider" – a mixture of cider and perry, as well as ciders which incorporate other fruit juices. Cherries, cranberries, blueberries and raspberries all work well in cider.

Graff Cider: Cider with added malt and hops. Typically 80% cider (often made from concentrate or commercial apple juice) and 20% amber ale. This appears to be a recent homebrewer's invention. Due to the presence of malt and hops, the cider ferments completely within a couple of weeks and is drinkable within a month.

Ice Cider (Cidre de Glace): Strong Quebecois cider made from freeze-concentrated apple juice. 7-13% ABV, very complex and sweet.

International Varietal Ciders: Ciders which features distinctive apples varieties from a particular country or region (e.g., Germany, Spain (Astoria), Wales).

New England Cider: A type of *Specialty Cider*, made from Common North American cider with added brown sugar, molasses or maple sugar to bring it up to 6-9% ABV. It was traditionally made by New England farmers to allow their cider to keep better and to give it more of a kick. It was sometimes distilled into Applejack. New England Cider often, but not always, will have a bit of caramel flavor due to these darker sugars.

Perry: A cider made from pears. French perry is made from French pear varieties, English perry is made from English pear varieties, and common perry is made from dessert pears. The production of Perry is identical to the production of ciders in most respects, and most of the terms which apply to ciders and cider making also apply to perry and its production. French perry is sometimes fermented into a pear brandy sold under the name Poire Williams, among others.

Pommeau: Cider fortified with apple brandy. Also see Royal Cider.

Royal Cider: A cider to which a bit of apple brandy has been added to increase the alcohol content. Also see Pommeau.

Scrumpy: A general term for British or Common Cider made using inferior juice or methods, resulting in a sour (often acetic), rough cider. Historically, it was an inexpensive, low-alcohol beverage made from rotted fruit ("drops" which had spent time on the ground), vegetable juice, sugar, and whatever other ingredients the maker happened to have on hand In some cases, it is synonymous with "farmhouse" ciders. In other cases, it is synonymous with highly alcohol, tart, bitter "West Country" ciders.

Spanish Cider or *sidera* is very dry, tart and slightly effervescent, with noticeable tannin levels. It is the traditional drink of choice in Northwestern Spain. Traditionally, it is served from the bottle into thin

glasses, and once consumed, the drinker throws the lees of the cider onto the tavern floor.

Specialty Cider: Any cider to which sugars, spices, herbs or juices from other fruits has been added. *Cyser* is a type of Specialty Cider, as is *New England Cider* and *Fruit Cider*. BJCP Category 28 covers Specialty Cider and Perry.

Vin den Pomp/Pomade: Northern Italian cider fermented on red grape pomade.

Sweet Cider: In Europe, sweet cider can means any "hard" cider which still has a lot of residual sweetness, such as a French or Devon cider. In North America, it refers to unfermented apple juice, especially fresh-pressed, unfiltered apple juice, which is opaque and brown due to oxidation and suspended pectins.

Part 3 - Cider Faults

This is a summary of the faults common to cider and their prevention and cure.

Acetic: Acetic sourness is a vinegar sourness and aroma. It occurs due to acetobacter infection. While acceptable in very small amounts for farmhouse ciders, it is a serious fault and is a sign that the apple juice or fermenting cider was badly oxidized under unsanitary conditions. Acetobacter infection produces a wispy gray film on the surface of the cider, which eventually grows to a clear scum called "mother of vinegar." Acetobacter bacteria can survive sulfating. Infection can be avoided by practicing good sanitation, avoiding aeration of the apple juice and fermenting cider and by minimizing headspace within fermentation containers.

Acidic: Sour flavor/aroma from low pH. Typically from one of several acids: malic, acetic, lactic, or citric. Malic acid gives a crisp "apply" or "fruity" acid flavor and aroma. Citric acid gives a more citrus fruit sourness and aroma. Both Citric and Malic acid are due to acids naturally present in the fruit, lend complexity and are desirable unless they make the cider too sour to be enjoyable. Lactic acid gives a crisp "yogurt" sourness and is a sign of MLF. It is desirable in limited quantities in some types of cider.

Alcoholic: A "warming" or "hot" aroma and mouthfeel from ethanol & higher alcohols. A moderate alcohol warming due to high ethanol concentrations is acceptable or even desirable in strong ciders such as applewine or New England cider. "Hot" or "solventy" alcoholic notes indicate the presence of higher alcohols, which mean that the cider was fermented at too high a temperature, that the yeast was improperly nourished, or that there was a wild yeast infection.

Aldehydes: Solvent or rotten fruit odor and flavor caused by *Cider Sickness* – a Zymomonas bacteria infection which mostly affects low acid, sweet ciders. It is sometimes noted as the odor of rotten lemons, banana skins or raspberries (the French term for cider sickness is *Framboise*). It can be prevented by lowering the pH of the apple juice to 3.7 or lower.

Astringent: A drying sensation in the mouth similar to chewing on a teabag. This is due to tannins in the fruit and is expected, in moderation, in some styles, especially for young ciders. It can be reduced by fining with certain materials or by aging. Tannin levels which are excessive or out of balance are a fault.

Bitter: A taste that is sharp, acrid, and unpleasant. As opposed to astringency, bitterness can come from contaminants (e.g., cleaning compounds), crushed seeds, excess levels of adjuncts such as hops or spices, or exposure to wood (especially oak barrels or oak-chips).

Film yeasts: These can grow under anaerobic conditions to produce "flower," a greasy or powdery film on the cider surface. A cider afflicted by film will smell like solvent (from acetates produced by the yeasts) and will taste moldy or musty. It can be stopped, if caught early by adding 100 ppm of sulfur dioxide. It can be prevented by proper sanitization.

Fruity/Estery: The aroma and flavor of fresh fruits that may be appropriate in some styles and not others. May be from the presence of fruit or esters resulting from fermentation. High levels of fruitiness might be due to fruit strains, yeast strains, high fermentation temperature or poor yeast nutrition. Low levels of fruitiness might be due to fruit strains, yeast strain, quick or vigorous fermentation or low fermentation temperature. A flowery "geranium" note indicates the presence of too much Sorbate.

Metallic: Tinny, coiny, copper, iron, or blood-like flavor. Any level of metallic flavor is a fault caused by metals leaching into the juice or fermenting cider. The only metal safe to use around cider is stainless steel. Copper, iron, mild steel and tin solder are all common sources of metallic taints in cider. Lead or other heavy metals (found in some solders) will not only cause off-flavors but is also a potential health hazard.

Cracked or chipped enamel vessels are one source of contamination, as is contact with metal pipes, transfer vessels or stirring utensils. It can also be caused by long-term contact with metal-based pottery glazes (found in some old storage vessels).

Metal contamination sometimes results in a condition called "*black breakage*" or "*green breakage*" where the cider turns dark or green when the bottle is opened and exposed the air. The former is caused by exposure to steel or iron, while copper causes the latter.

Mousy: A "barnyard" or "unclean bathroom" aroma and flavor, which smells like the bottom of a rodent's den. It is caused by infection by lactic acid bacteria. It occurs slowly in stored ciders which have undergone MLF and can't be prevented, although sulfur dioxide seems to inhibit it.

Musty: Stale, musty, or moldy aromas/flavors. These can be caused by a variety of causes, ranging from leaving oxygen-permeable (plastic) fermentation vessels in contact with musty-scented surfaces (like basement floors, or moldy water trapped under the bucket), wild yeast infection, bacterial infection caused by a variety of causes.

Oily/Ropy: A sheen in visual appearance, as an unpleasant viscous character proceeding to "ropiness." present as a slimy texture, like light oil or egg white, when the cider is poured. Flavor is not affected. This is typically found in low-acid ciders and is caused by lactic acid bacteria which produce a gel-like substance. The condition can be prevented by sulfiting apple juice before fermentation. To treat it once fermentation has started, pour the cider into another container and stir it vigorously to break up the clumps, then add 100 ppm of SO_2.

Oxidized: The aroma/flavor of damp cardboard or sherry. This is due to storage at high temperatures and/or exposure to air during fermentation and after packaging. It is a fault in all ciders.

Phenolic: Spicy (clove, pepper), smoky, plastic, plastic adhesive strip, and/or medicinal (chlorophenolic). In ciders, these flavors are caused by excessive additions of spices or herbs, improperly rinsing chlorine-based sanitizers from equipment, use of non-food-grade plastic storage or fermentation containers or bacterial infection. Once present, it can't be cured, although the means of prevention are self evident.

Sulfur: The aroma of rotten eggs or burning matches. This is occasionally due to severe bacterial contamination, but more likely due to excessive levels of sulfites. Sulfite levels should never exceed 200 ppm from all sources.

Sweet: Basic taste associated with sugar. Some sweetness is desirable in anything but a dry cider, but excessive sweetness can be a fault, especially if it is cloying or is inappropriate for the style. Sweetness indicates a high level of residual sugar, due to stopped or incomplete fermentation or the deliberate addition of non-fermentable sugars or artificial sweeteners.

Thin: Lacking body, "mouthfeel," "fullness" or "stuffing." Depending on the style of cider this may or may not be a fault. It is caused by very low levels of residual sugar and/or pectin in the cider. To some extent it can be remedied by adding non-fermentable sugars such as dextrin, but usually it is a result of improper juice and/or yeast selection.

Vegetal: Cooked, canned, or rotten vegetable aroma and flavor (cabbage, onion, celery, asparagus, etc.). In cider this is due to Zymomonas bacteria infection. It might also arise as a byproduct of wild yeast infection or excessive sulfite levels.

Woody: A taste or aroma caused by extensive exposure to wood, especially oak. This is a fault in anything other than a wood-aged specialty cider, and even then it shouldn't be excessive. Certain finings can remove tannins and other materials associated with wood-aging, but the best cure is prevention.

Yeasty: A bready, sulfury or yeast-like aroma or flavor. This can be due to poor yeast strain selection or wild yeast infection, but is most likely caused by letting the cider sit on its lees for more than a few weeks.

Inspirational Reading

Books

Lea, Andrew, ***Craft Cider Making, 2nd edition, Voyageur Press.***

Proulx, Annie & Nichols, Lew, ***Cider: Making, Using & Enjoying Sweet & Hard Cider, 3rd Edition***, Storey Press, North Adams, MA.

Watson, Ben, ***Cider Hard & Sweet,*** Countryman Press, Woodstock, VT.

Web Sites

Cider Mailing Lists

Cider Digest (http://talisman.com/cider/index.html#Digest)
Cider Workshop (http://www.ciderworkshop.com/)

Cider Styles and History

Canadian Regulations for Ice Cider (http://www.appleicewine.com/cidredeglace_en.html)
Cider (http://en.wikipedia.org/wiki/Cider)
Cymdeithas Perai a Seidr Cymru - The Welsh Cider and Perry Association (http://www.welshcider.co.uk/)
Hard Honey Cider (http://www.bjcp.org/mead/cider.pdf)
Historical Information on Perry (http://hbd.org/brewery/library/PerryLA.html)
Ice Cider (http://en.wikipedia.org/wiki/Ice_cider)
Sidra de Asturias (http://www.sidradeasturias.es/) - Spanish cider page (in Spanish).

Events

Cider & Perry Academy (http://www.cider-academy.co.uk/usa_scheduled_classes.shtml)
Franklin County Cider Days (http://www.ciderday.org/)
Mitchell F&D (http://www.mitchell-food-drink.co.uk/)

General Information

Eve's Cidery (http://www.evescidery.com/) - An Ithaca, NY cidery.
Great Lakes International Cider and Perry Association (http://www.greatlakescider.com/)
Hard Cider International (http://www.hardciderinternational.com/)
How to Make Cider (http://www.howtomakecider.com/)
Of Apples and Cider (http://cjoliprsf.awardspace.biz/#pomona) - Claude Jolicoeur's web page, heavily mined for this handout.
Old Scrump's Cider House (http://www.somersetmade.co.uk/oldscrump/index.php)
Old Time Cider Blog (http://www.oldtimecider.com/)
Orange Pippin (http://www.orangepippin.com/apples) - Online catalog of 7,000+ apple varieties.
Perry (http://en.wikipedia.org/wiki/Perry)
The Real Cider and Perry Page (http://homepage.ntlworld.com/scrumpy/cider/homepage.htm)
The Wittenham Hill Cider Portal (http://www.cider.org.uk/frameset.htm) - Andrew Lea's cidermaking page. Includes the first edition of his book. Highly recommended!
UK Cider (http://www.ukcider.co.uk/wiki/index.php/Main_Page)
Vintage Virginia Apples (http://www.vintagevirginiaapples.com/cidermaking.htm)

Cideries in the U.S. and U.K.

Appletreow Winery (http://aeppeltreow.com/about_us.htm)
Beak & Skiff – Growing Since 1911 (http://www.beakandskiff.com/)
BellWeather Hard Cider (http://www.cidery.com/)
Dunkerton's Cider Co. (http://www.dunkertons.co.uk/)
Farnum Hill Ciders (http://www.farnumhillciders.com/)

Merrindale Estate Cidery (http://www.merridalecider.com/about)
White Oak Cider Home Page (http://www.crockettdesign.com/whiteoakcider/)

Technical Articles

Apple Blending for Cider (http://cjoliprsf.awardspace.biz/Documents/AppleBlendingCider.pdf)
Cider Apple Chemistry (http://www.ashridgetrees.co.uk/cider-apple-chemistry)
Cider Blending Wizard (http://cjoliprsf.awardspace.biz/wizard.htm)
Cider Press (http://hbd.org/brewery/library/CPressJS94.html)
Comment Faire du Bon Cidre (http://www.cider.org.uk/comment_faire_du_bon_cidre.pdf) - A French government pamphlet on how to make French-style cider.
Keeving and Natural Conditioning of Cider (http://www.cider.org.uk/keeving.pdf) - Scientific details of how keeving works.
Keeving, What's That? (http://www.cider.org.uk/keeving.html)
Maceration and Defecation in Cider-Making (http://www.cider.org.uk/beech_larsrept1950.pdf)
My Experience With Hard Cider (http://hbd.org/brewery/library/cider0695.html)
Original Gravity to Brix Conversion Table (http://www.skotrat.com/go/default/brewing-info/ogbrix-conversion/)
Why Cider Apple Tannin and Acid are Important (http://www.ashridgetrees.co.uk/tannin-and-acid-in-cider)

Troubleshooting

BJCP Cider Scoresheet (http://www.bjcp.org/docs/SCP_CiderScoreSheet.pdf)
Cider and Perry Workshop (http://www.bjcp.org/cep/nhc08_cider.pdf) - Gary Awdey's presentation on cider faults.

Yeasts

Lalvin Yeasts (http://www.lalvinyeast.com/strains.asp)
White Labs Wine, Mead and Cider Yeasts (http://www.whitelabs.com/beer/craft_strains_wine.html)
Wyeast Cider Yeast (http://www.wyeastlab.com/rw_yeaststrain_detail.cfm?ID=62)
Yeast Selection for the Production of Hard Cider in Canada (http://hbd.org/brewery/library/CidYeast091595.html)