# Technical Question T1. “Off Flavors”

**Describe and discuss the following beer characteristics. What causes them and how are they avoided and controlled? Are they ever appropriate and if so, in what beer styles? (three will be given)**

|  |  |
| --- | --- |
| **30%** | **Describe each characteristic.** |
| **40%** | **Identify the causes and controls for each characteristic.** |
| **30%** | **Identify appropriate/ inappropriate styles.** |

**The choices will be drawn from: a) cloudiness, b) buttery, c) low head retention, d) astringency, e) phenolic, f) light body, g) fruitiness, h) sourness, i) cooked corn, j) bitterness, k) cardboard, l) sherry-like, m) acetaldehyde, n) alcoholic.**

# Sample Answer from a Test: Scored an 84

**I include(below) a sample answer from a BJCP judge who got a master/national type score. His answers were 80ish characters per off flavor. This is significantly less than the madness on the BJCP website. I also note where he got dinged on this section. Basically need to specifically name styles for appropriate and inappropriate.**

I tried to type his answer with similar spacing and spelling to illustrate it.

Graders comments: Excellent, thorough job describing the characteristics and how they are caused and controlled. And included more than just yeast as a source of fruitiness. “Appropriate styles” section is well done but could use some specific styles where fruitiness is not appropriate and note that cardboard is never desirable oxidation characteristic. (score was near master with a ding for identifying the styles. He identified appropriate styles but never inappropriate styles by name)

**Acetaldehyde** – Chemically green apple flavor and aroma.

Naturally produced by yeast during fermentation but similar to diacetyl. Healthy yeast will take it back up after fermentation begins to show. Some yeast strains(lager) are more prone to generating acetaldehyde than others. Controlled by making sure beer stays on yeast till it is cleaned up. Some more flocculent yeasts may need to be stirred back in to suspension.

Not required by any style. Ok in American light lagers but even then in low amounts. Generally considered a flaw.

**Cardboard** – A papery or cardboard flavor or aroma.

Caused through oxidation of alcohols and fatty acides in beer. Controlled by limiting exposure to oxygen on cold side.(cooling -> fermenting -> packaging) but also lower alcohol beers are less prone to oxidation even w/ low oxygen exposure, beer will oxydize over time so also better to consume fresh.

Only appropriate for high alcohol, long aged beers such as old ale and barleywines.

**Fruitiness** – perceived as a wide array of fruit flavors and aromas from berry to stone fruit to dark fruit. Pear, apple, strawberry, banana, apricot, plum, cherry, among others.

Caused by multiple factors but most commonly yeast, hops and fruit additions.

W/ yeast, different strains are prone to generating different types of esters at different tempers. Typically higher temp means more esters. English strains are more apple/pear or berry. German hefe strains are more banana. Belgian strains more stone fruit as well as apple/pear and berry.

Many newer American, New Zealand and Australian hops are very fruity w/ citrus, tropical fruit, stone fruit. All being common.

Lastly, some styles of beer call for actual fruit additions in the boil or fermenter or post fermentation. The later is added in the process, more fruit character is retained.

Not appropriate for lagers except some malts(much for example) can impart a cherry pie type flavor. Most American ales call for clean ferment w/ low esters.

More noticeable esters are called for w/ Belgian, German wheat beers and fruit beers.

**Producing my own answers from here:**

[**http://www.bjcp.org/course/Class5Lesson1Troubleshooting.php**](http://www.bjcp.org/course/Class5Lesson1Troubleshooting.php)

**(included at the bottom of this document)**

1. Clouidiness –
   1. Described: Often described as hazy. With cloudiness the beer is not clear or not perfectly clear. It is quite common especially in all grain beers, beers with a substantial dry hop, wheat beers.
   2. Cuases/Control: Suspended proteins and starches in the beer which cause the haze. Chill haze is common when the beer isn’t chilled rapidly enough to promote a healthy cold break. Cure it with a better wort chiller. Starch caused cloudiness can be because you brewed all grain and didn’t get a complete conversion leaving starches suspended. Mash longer next time and test for conversion with iodine. Yeast caused can be because of low flocculating yeasts such as those in german weizen strains. Cure would be to use a different yeast if you want more clear beer. A cure for just about every cause is fining. Isinglass, gelatin, polyclar, bentonite for example. Gelatin is extremely effective post boil.
   3. Appropriate styles would be German Weizen and very fresh double IPAs especially the recently popular North East IPAs. Highly inappropriate styles are European and German lagers especially Pilsners. Basically any American lager it’s inappropriate.
2. Buttery –
   1. Described: Caused by Diacetyl. This compound is responsible for an artificial butter, butterscotch or toffee- like aroma and taste. At low levels, it may also produce a slickness on the palate.
   2. Causes Control: Always caused by issues with fermentation and yeasts because it is a fermentation by product. If not enough yeast or unhealthy yeast then it may not reabsorb the diacetyl. Making sure you pitch appropriate levels of healthy yeast will reduce chances of diacetyl. Slightly increasing the temperature at the end of fermentation can help reduction.
   3. Appropriate/Inappropriate Styles: Low diacetyl is acceptable in most English beers such as Brown Porter, English Barleywine. It’s never acceptable and highly offensive in a lager such as German pilsner.
3. Low Head Retention -
   1. Described: Generally, low head retention is when a beers head collapses to less than half its original height when poured, in less than a minute. If the head were good it would be uniform, tight and level at the post minute point.
   2. Causes Control: Being flat is a common cause of low head retention. Brewers should ensure carbonation is appropriate to form and retain head retention. A thin body can also be a cause of low head retention. Enhancing the body through addition of dextrins and other proteins can help control this. For example mashing at 158F to promote full bodied beers or using a dextrin malt.(carapils)
   3. Appropriate/Inappropriate Styles: Low head retention is generally accepted in English Barleywines and Baltic porters. High alcohol and low CO2 are contributing factors here. Beers where low head retention are highly inappropriate include German Pilsners, German Weizen. Head is a major part of German brewer craftsmanship.
4. Astringency -
   1. Described: A puckering quality like sucking on a tea bag. Dry, kind of powdery.
   2. Causes Control:Steeping grains too long is a common cause. Caution in mashing schedule length(less than 2 hours) should prevent. Exceeding 170F with a pH outside of the 5.2-5.6 range when mashing dark roasted grains may extract extract harsh tannins. Being careful not to exceed 170F.
   3. Appropriate/Inappropriate Styles: Astringency is generally highly unacceptable in all beers especially unforgivable in clean lagers, german lagers(pilsners), witbiers. It seems that extremely low levels are forgiven in roasted beers like a dry stout or highly hopped pale ales.
5. Phenolic -
   1. Described: Bad phenolic is described as band-aid, medicine or mouth wash. Good phenolics occur only in specific beer styles calling for clove or vanilla such as Bavarian wheat beers.
   2. Causes Control: Bad phenolics are generally caused by bacteria or wild yeast which are usually due to infection through weak sanitation practices. Improving sanitation and using a sanitizer like star san can help.
   3. Appropriate/Inappropriate Styles: Bad phenolics are generally never acceptable. In any German lager or American ale they’re highly offensive. However small amounts are usually forgiven in barrel aged dark beers like stouts. Clove/Vanilla are desirable characteristics of German Weizens.
6. Light Body
   1. Described: Light body is described as a beer feeling “thin” or “watery” in the mouth and back of the throat, when drinking. This is opposed to the fullness that may be expected in some beer styles such as doppelbocks
   2. Causes Control: Low medium length protein levels and lack of dextrins can be causes to light body beers. An excessively long protein rest can cause this. Cure would be to not have a protein rest or to mash at a temperature that promotes medium-length protein or dextrins. 155-158F. Using a dextrin malt like carapils can help as well.
   3. Appropriate/Inappropriate Styles: American light lager is appropriate for a light body. Inappropriate would be American Barleywine, English Barleywine.
7. Fruitiness -
   1. Described: The wide variety of fruit flavors and aroma that are perceived while drinking. Common perceptions are pear, cherry, dark fruits, passion fruits, stone fruits.
   2. Causes Control: Caused by many different things. Fruit additions to beer, hops. For example stone fruit from modern American and New Zealand hops. Age and oxygen can create fruity flavors of dark fruits. English yeasts tend to produce fruity esters. Controlled by being very aware of yeast, hops, oxygen and procedures to reduce or enhance fruitiness.
   3. Appropriate/Inappropriate Styles: Fruitiness is acceptable as hop fruitiness in American Pale Ales. English Ales allow for slight fruity esters from fermentation. German Weizens allow banana because of yeast. Inappropriate styles would be German Pilsners, Helles and Marzen.
8. Sourness -
   1. Described: Generally perceived as a taste on the side of the tongue, towards the back of the mouth. Esters thrown by bacteria are perceived in aroma as well.
   2. Causes Control: Generally caused by bacteria that produce lactic and acetic acids. Bacteria are either introduced purposely or accidentally due to a sanitation problem. Can be removed by improved sanitation.
   3. Appropriate/Inappropriate Styles: Beers where sour is appropriate include Lambic, Berlinerwise, Gueze and Mixed Fermentation Beers. Inappropriate beers would be Scottish Ales, American Pale Ale, German Pilsner
9. Cooked Corn –
   1. Described: A component of flavor and aroma. Detected as the impression of cooked corn, vegetables or cooked cabbage.
   2. Causes Control: Caused by a high level of the component DMS in beer. DMS is a normal component in wort that is typically boiled off. However if the boil kettle is closed(by a lid) then the DMS doesn’t escape and ends up staying in the beer. Control it by always boiling the wort with no cover so the DMS can escape especially when using Pilsner malt which is prone to high levels of the DMS precursor, DMM.
   3. Appropriate/Inappropriate Styles: DMS is never desirable in any beer style. It’s very offensive in say, Milk Stout or American Pale ale. It is acceptable in small levels in American Light Lagers or Munich Helles where the beer is delicate and the ingredients are prone to DMS.
10. Bitterness -
    1. Described: A component of flavor in beer it’s experienced at the back of the tongue and the roof of the mouth.
    2. Causes Control: Typically caused by boiling hops resulting in the Alpha acids becoming iso-alpha acids which are bitter. Can be reduced by using less hops or hops with a lower alpha acid and total oil content. Can be increased by boiling more hops or hops with higher AA. Filtration can also reduce bitterness.
    3. Appropriate/Inappropriate Styles: Bitterness is appropriate in almost all beers to a degree. High bitterness in IPA’s and Double IPAs or English IPAs. Moderate bitterness in German Pilsners. Very low bitterness in witbiers. Also classic European sours will have low IBUS
11. Cardboard -
    1. Described: Detected in the flavor, carboard is a papery like or stale taste in beer.
    2. Causes Control: Cardboard is caused by a combination of oxygen exposure post fermentation and age in beer. It is the effect of oygen on alcohols in beer. Poor handling of beer in packaging can cause this. Control it by being careful not to splash beer around. Taking effort to avoid oxygen exposure.
    3. Appropriate/Inappropriate Styles: Cardboard is never appropriate in any beer especially American pale ales or German pilsners. Oxygen and age are ok in aged barleywines but it should not present as paper or cardboard. This off flavor is most common in commercial beers shipped over seas.(age and poor handling)
12. Sherry-like -
    1. Described: This is the aroma and taste of dry sherry and is often accompanied by hazelnut or almond notes. This flavor is one of the few positive flavors attributed to oxidation and adds complexity to barleywines, old ales and Scotch ales
    2. Causes Control: Oxygenated compounds in the melanoidin family are the primary reason for sherry-like flavors.
    3. Appropriate/Inappropriate Styles: Defects in almost all lower gravity beers. American lagers, American Pale Ales are inappropriate for sherry-like. Acceptable in high gravity barleywines. Especially English barleywines and old ales.
13. Acetaldehyde -
    1. Described: A flavor and/or aroma in a beer that is produced by yeast. It’s described as green apple like in both flavor and aroma.
    2. Causes Control: A bi-product of fermentation. Usually associated with an incomplete fermentation. The control is to allow the beer to stay on the yeast until it cleans it up. Perhaps even rousing the beer to keep the yeast suspended longer for clean-up.
    3. Appropriate/Inappropriate Styles: It is acceptable in American lagers, especially American light lagers. Although the preference is to reduce it. It is inappropriate in every other style. Especially German Pilsner or German Helles
14. Alcoholic -
    1. Described: The warming and sometimes prickly sensation of alcohol in beer. It is detected in the mouthfeel.
    2. Causes Control: Alcoholic in beer is caused by very high original gravity and finishing low enough that the alcohol is very noticeable in the beer. Fusel and prickly alcohols can be caused by fermenting at too high of a temperature. Control alcohol by lowering original gravity, fermenting at appropriate temperatures to avoid higher alcohols.
    3. Appropriate/Inappropriate Styles: High alcohol is appropriate in Baltic porter where big alcohol is expected. Barleywines are appropriate also. Inappropriate styles would be German pilsner where too high of an alcohol has no where to hide in the delicate balance of this beer. Germen Weizens are inappropriate. Witbier is inappropriate for high alcohol.

# Taken From BJCP Website:

Seems like it will help but are probably long given that the BJCP 84 exam posted above is about 100-120 words per answer on average. Writing this much information will eat up the clock on me.

With this question, as with all others, it is important to answer all aspects of the question so let's break it down.

1. **Describe/discuss**
2. **what causes them**
3. **how are they avoided and controlled**
4. **are they ever appropiate**
5. **if so, in what beer styles**

These points are all contained in the [Off Flavor Flash Cards](http://www.bjcp.org/docs/OffFlavorFlash.pdf). It is highly recommended that you print these and frequently review them.

In addition to these flash cards, here are some other discussions, mostly from the study guide (did I say that that is a great resource!!!)

#### a) cloudiness

* Describe/discuss
  + in Appearance - Cloudy, hazy
* what causes them
  + Chill haze: - Insufficent conversion time
  + Permanent Haze: - excessive or high temperature sparge
  + Bacterial/ wild yeast contamination
  + Poor, wrong, weak or mutated yeast strains
  + Wheat malt
* how are they avoided/controlled
  + Longer mash
  + Use protein rest
  + Use clearing/fining agents
  + Use filtration
  + Reduce sparge temps
  + Practice good sanitation
  + Use well-flocculating yeast
* are they ever appropiate
  + Yes
* if so, in what beer styles
  + Wheat Beers, Lambics, American Wheat

#### b) buttery

**Diacetyl:** This compound is responsible for an artificial butter, butterscotch or toffee- like aroma and taste. At low levels, it may also produce a slickness on the palate. A significant number of tasters cannot perceive diacetyl at any concentration, so every judge should be aware of his or her limitations. Diacetyl is a fermentation by-product which is normally absorbed by the yeast and reduced to more innocuous diols. High levels can result from prematurely separating the beer from the yeast or by exposure to oxygen during the fermentation. Low FAN levels or mutation may also inhibit the ability of yeast to reduce diacetyl. Note that high fermentation temperatures promote both the formation and elimination of diacetyl, but the latter is more effective. For that reason, lager breweries often employ a diacetyl rest, which involves holding the beer in the 50-55 F range for a few days after racking to the conditioning tank. Diacetyl is also produced by some strains of lactic acid bacteria, notably Pediococcus damnosus. Low levels of diacetyl are permissible in nearly all ales, particularly those brewed in Scotland, and even some lagers, including Czech pilsners and Vienna-style beers.

**Diacetyl** is produced at the beginning stages of fermentation and then later reduced. Maintaining or even increasing the temperature at the end of fermentation can help in its reduction, as will not prematurely removing the beer from the yeast. Oxygen reintroduction can cause its formation through oxidation of diacetyl precursors present in the beer. Ensuring the presence of adequate amounts of amino acids will also help prevent its formation. Extract brewers can often have problems due to the lack of amino acids in the extract. Lastly, diacetyl can be produced by some strains of bacteria. Again, proper sanitation and control during yeast propagation will help minimize its presence

2B. Bohemian Pilsener Some diacetyl is acceptable, but need not be present   
8A. Standard/Ordinary Bitter Generally no diacetyl, although very low levels are allowed.   
8B. Special/Best/Premium Bitter Generally no diacetyl, although very low levels are allowed.   
8C. Extra Special/Strong Bitter (English Pale Ale) Generally no diacetyl, although very low levels are allowed.   
9A. Scottish Export 60/- low diacetyl aroma, ... (optional).   
9B. Scottish Export 70/- low diacetyl aroma, ... (optional).   
9C. Scottish Export 80/- low diacetyl aroma, ... (optional). and is sometimes accompanied by a low diacetyl flavor component   
9E. Strong Scotch Ale . Caramelization often is mistaken for diacetyl, which should be low to none.   
10C. American Brown Ale Moderately low to no diacetyl.   
11A. Mild---- Very low to no diacetyl   
11B. Southern English Brown Low to no diacetyl   
11C. Northern English Brown Ale aroma Very low to no diacetyl -- low diacetyl (especially butterscotch) is optional but acceptable.   
12A. Brown Porter Diacetyl should be moderately low to none   
12B. Robust Porter Diacetyl should be low to none   
13B. Sweet Stout Diacetyl low to none   
13C. Oatmeal Stout . Diacetyl medium-low to none   
13D. Foreign Extra Stout Diacetyl low to none   
14A. English IPA Very low levels of diacetyl are acceptable   
  
17B. Flanders Red Ale Diacetyl is perceived only in very minor quantities, if at all, as a complementary aroma/flavor.   
17C. Flanders Brown Ale/Oud Bruin Diacetyl is perceived only in very minor quantities, if at all, as a complementary aroma/flavor.   
  
19A. Old Ale Diacetyl low to none   
19B. English Barleywine . Low to no diacetyl.   
  
25A. Cyser (Apple Melomel) light diacetyl character from malolactic fermentation (optional)   
25B. Pyment (Grape Melomel) light diacetyl character from malolactic fermentation (optional)

#### c) low head retention

Good head retention is measured in terms of the time required for the head to collapse to half of its initial height. This should be at least a minute in well-brewed and conditioned beers. The beading should also be uniform and tight, leaving lace on the glass as the beer is consumed. ***Good head retention****is promoted by several factors, including isohumulones, high original gravity, alcohol content, dextrins and the levels of high- and medium- molecular weigh proteins.* Adequate carbonation is also important. Most of these variables are style-dependent, but the brewer can increase the protein content by adjusting the length and temperature of the protein rest and using adjuncts such as flaked wheat and barley. Fatty acids carried over from the trub and unclean glassware are both detrimental to head stability, since they decrease the surface tension of the foam, causing the bubbles to collapse.   
American and Continental malts are generally less modified. Continental malt is modified only to 50-75%, which retains more of the endosperm for fermentability and creates greater nitrogen complexity, but at the price of reduced enzyme activity. American six-row is also modified to between 50-75%, but the higher protein and nitrogen content of six-row gives greater enzyme strength. Both Continental and American malts require a protein rest (at ~122 F) to degrade the albuminous proteins into fractions that can be both used to promote yeast growth and give good head retention.

The most widely used malted grain besides barley is wheat, which is a key ingredient in German and American wheat beers and used in small quantities in others to improve head retention. It has sufficient diastatic power to breakdown its own proteins and starches, but since it does not have a husk, it is usually mashed with barley malt in order for an adequate filter bed to be formed during the lautering stage. The protein and beta-glucan content of wheat is high compared to barley, so a more extensive mash schedule with an extended protein rest may be needed when large quantities are used.

Cellulose, polyphenols and tannins are present in the husk and can lead to harsh flavors in the finished beer if they are leached out by hot or alkaline sparge water. Fatty acids and lipids support respiration of the embryo during malting, but oxidative off flavors and low head retention may result if excessive levels are carried into the wort. Hemicellulose and soluble gums are predominantly polysaccharide in nature and for about 10% of the corn weight. The gums are soluble, but the hemicellulose must be reduced by the appropriate enzymes into fractions that permit good head retention, otherwise they may cause clarity problems in the finished beer.

#### d) astringency

This flavor is a mouthpuckering sensation that is comparable to chewing on grape skins or grape seeds. It is often produced by the extraction of tannins from grain husks due to overcrushing oversparging, or sparging with alkaline or boiling water. Astringency may also be produced by polyphenols that result from spoilage by acetobacter or wild yeast. Another possible source is oxidation, in which case the responsible compounds are polyphenols and aldehydes. Finally, spices such as coriander, orange peel and cinnamon also contribute astringent flavors, but these tend to mellow with age. Note that overattenuation and low dextrin levels can increase the perception of astringency.

#### e) phenolic

This is an aroma and taste often compared to Band-aids (tm), medicine chest or disinfectant. Chlorophenols are particularly offensive members of this family with bleach-like flavors in addition to the ones listed above. High levels of phenols are generally produced by bacteria or wild yeast, both of which indicate a sanitation problem. Phenols may also be extracted from grain husks by overcrushing, oversparging or sparging with hot or alkaline water. Chlorinated water or sanitizer residue are possible sources of chlorophenols. Phenolic flavors are generally never desirable, the exception being the clovelike, vanilla-like or slightly smoky flavors and aromas in Bavarian wheat beers and some Belgian ales.

#### f) light body

The body of a beer is characterized as the fullness of the flavor and mouthfeel, and descriptors range from watery or characterless to satiating or thick. Body is technically separate from mouthfeel, which encompasses physical sensations such as astringency, alcoholic warmth and carbonation, but the combination determines how the beer stimulates the palate. The body is determined by the levels of dextrins and medium-length proteins. Lack of dextrins is caused by low saccharification temperatures, excessive use of adjuncts or by highly attenuative yeast strains. A low protein level may be caused by excessively long protein rests, excessive fining or the addition of large amounts of fermentable sugars. Light body is appropriate in American light lagers and lambics, but not in malt-accented styles such as barleywines and doppelbocks.

#### g) fruitiness

This is an aroma and taste that recalls bananas, strawberries, pears, apples, plums, papaya and/or other fruits. The responsible compounds are esters, which are formed from the combination of an alcohol and an organic acid. High ester levels are a product of the yeast strain, fermentation temperature, high gravity worts and the metabolism of fatty acids in the trub. These flavors are desirable in most ales, particularly Belgian and British styles, and the signature banana notes in Bavarian wheat beers are primary due to the ester isoamyl acetate. Note that esters often have solvent notes at very high concentrations.

1A. Lite American LagerLow levels of yeast character (green apples, DMS, or fruitiness)   
1B. Standard American Lager Low levels of yeast character (green apples, DMS, or fruitiness)   
1C. Premium American Lager Low levels of yeast character (green apples, DMS, or fruitiness)

#### h) sourness

This is usually perceived as a taste on the sides of the tongue, towards the rear of the mouth. The two most common acids responsible for this flavor are lactic and acetic, which both have related esters that may be perceived in the aroma. Lactic acid is produced by Gram positive bacteria such as Lactobacillus and Pediococcus, which are present in dust and saliva. Acetic acid may be produced by several contaminants, including Acetobacter, Zymomonas, and yeast in the Kloeckera and Brettanomyces families. High levels of sour and acidic flavors generally indicate a sanitation problem, but they are an important part of the profile of the lambic, oud bruin and Berliner weiss styles, and to a lesser extent, Belgian white beers.

#### i) cooked corn

DMS, or dimethyl-sulfide produces the aroma and taste of cooked vegetables, notably corn, celery, cabbage or parsnips. In extreme cases, it may even be reminiscent of shellfish or water in which shrimp has been boiled. DMS is normally produced by the heat-induced conversion of S-methyl-methionine, but most of this evaporates during an open, rolling boil. A closed boil or slow cooling of the wort may therefore lead to abnormally high levels. Some DMS is also scrubbed out during a vigorous fermentation, which is why lagers and cold-conditioned ales may have slightly higher levels than warm-fermented ales. Wild yeast or Zymomonas bacteria may produce high enough levels of DMS to make the beer undrinkable. Low levels of DMS are appropriate in most lagers, particularly American light lagers and pre-prohibition pilsners, but are not desirable in any ale style.   
1D. Munich Helles a low background note of DMS

#### j) bitterness

* Describe/discuss
  + will be tasted on the back of the tongue and the roof of the mouth
* what causes them
  + High AAU hops - Lengthy hops times - fermentation temperature
* how are they avoided/controlled
  + Use hops with lower alpha acids
  + Reduce hop boil times
  + Higher temperature and quick fermentation decrease bitterness
  + filtration reduces bitterness
* are they ever appropiate
  + Yes
* if so, in what beer styles
  + IPA�s Pales ales English Bitters

#### k) cardboard

These are perceived in both the aroma and flavor and are primarily due to the aldehyde, 2-transnonenal. This compound has an extremely low flavor threshold and is produced by the oxidation of higher alcohols. The threat of oxidation may be reduced by minimizing splashing of the hot wort or of the fermented beer while racking or bottling. This flavor is never appropriate and is rare in homebrew due to the reducing power of yeast, but it is a common flaw in many old or abused commercial beers.

#### l) sherry-like

This is the aroma and taste of dry sherry and is often accompanied by hazelnut or almond notes. The responsible compounds are oxidized members of the melanoidin family. This flavor is one of the few positive flavors attributed to oxidation and adds complexity to barleywines, old ales and Scotch ales. Sherry-like flavors are considered a defect in most other styles, particularly low-gravity ales.

#### m) acetaldehyde

This compound has the taste and aroma of fresh-cut green apples, and has also been compared to grass, green leaves and latex paint. It is normally reduced to ethanol by yeast during the secondary fermentation, but oxidation of the finished beer may reverse this process, converting ethanol to acetaldehyde. Elevated levels are generally present in green beer or if the beer is prematurely removed from the yeast. It can also be a product of bacterial spoilage by Zymomonas or Acetobacter. Background levels of acetaldehyde can be tasted in Budweiser due to the use of beechwood chips to drop the yeast before it can be reduced to ethanol.

1A. Lite American Lager Low levels of yeast character (green apples, DMS, or fruitiness)   
1B. Standard American Lager Low levels of yeast character (green apples, DMS, or fruitiness)   
1C. Premium American Lager Low levels of yeast character (green apples, DMS, or fruitiness)

#### n) alcoholic

This flavor may be detected as a spicy, vinous character in the aroma and taste and is often accompanied by a warm or prickly mouthfeel. The simplest and most prevalent alcohol in beer is ethanol, which is produced by the fermentation of glucose and other reducing sugars. Higher, or fusel, alcohols are usually present at sub-threshold concentrations, but elevated levels are associated with underpitching, low levels of dissolved oxygen prior to pitching or low levels of free available nitrogen (FAN). These deficiencies force the yeast to metabolize fatty acids in the trub as a source of oxygen and carbon, producing a greater fraction of long chain alcohols. High gravity worts and high fermentation temperatures also tend to increase the concentration of these higher alcohols through increased yeast activity. Alcoholic characteristics are desired in strong ales and lagers as long as they are not coupled with the solvent notes associated with elevated ester or fusel alcohol levels.

We are now going to spike some beers.

#### Sourness

Both Lactic and Acetic sourness typically indicate sanitation problems but both are appropiate in some beer styles.

Please spike two of your Cat 1 beers as follows:   
Sour/Acidic, using USP lactic acid 0.4 ml (1/3. tsp of solution of 1/8 tsp. lactic acid plus 3/8 tsp. distilled water) in 12 oz of beer   
  
Sour/Acidic, using White wine vinegar (acetic acid) 3/4 tsp. in 12 oz of beer

Remember to observe when you are sampling beer. Was it a "gusher"? What are the causes if a gusher? Sanitation is one cause so it MAY be sour/acidic, but it may also not be sour. You can smell that acidic bite, can you taste a corresponding flavor?   
If you don't taste it, make your sample a bit stronger until you do. This excercise is about being able to detect, at various levels, and identify what various off-flavors/aromas are. On sourness, the nose can often detect an acidic "bite/tinge" in the aroma.

We are tasting two different sournesses here. They are different! Can you tell the difference?

Off flavors, because they can be subtle, are among the most difficult for the beginner to detect/identify. This improves with experience. This excercise is where that experience starts. **Do vary the strength** of the adulterant you train yourself in the art of tasting. As you gain experience you will see your thresholds drop. This is the norm.

This is usually perceived as a taste on the sides of the tongue, towards the rear of the mouth. The two most common acids responsible for this flavor are lactic and acetic, which both have related esters that may be perceived in the aroma. Lactic acid is produced by Gram positive bacteria such as Lactobacillus and Pediococcus, which are present in dust and saliva. Acetic acid may be produced by several contaminants, including Acetobacter, Zymomonas, and yeast in the Kloeckera and Brettanomyces families. High levels of sour and acidic flavors generally indicate a sanitation problem, but they are an important part of the profile of the lambic, oud bruin and Berliner weiss styles, and to a lesser extent, Belgian white beers.