BJCP STUDY GROUP - SESSION 1

> FIRST - Print the Style Guidelines and create a 3-ring study guide binder. Leave room to add more information, and it is a good idea to get a binder with pockets for adding additional information, color guides, notes, etc.

> READ / STUDY - The appropriate / matching section of the new BJCP Study Guide that corresponds to the technical topics / off flavors / flavors / etc. listed below.

- Water
- Malting

- Light Body
- Dimethyl-sulfide (DMS, cooked corn)
- Vegetal (cooked, canned, or rotten vegetables)
- Lightstruck (skunked)
- Sweet vs Malty (i.e. Sugary Sweetness vs Malty Sweetness)
- Oxidized (paper, cardboard)
- Phenolic (medicinal, band-aid)

> READ / STUDY - Style Guidelines - Introduction (all) and the Styles listed below.

1. Light Lager
    - 1A. Lite American Lager
    - 1B. Standard American Lager
    - 1C. Premium American Lager
    - 1D. Munich Helles
    - 1E. Dortmunder Export
2. Pilsner
    - 2A. German Pilsner (Pils)
    - 2B. Bohemian Pilsener
    - 2C. Classic American Pilsner

SESSION 1

> Introduction

- Welcome everyone !!! Thanks for coming. Let's do a quick roll call and introduce the group members to each other.

- IMPORTANT: We have a lot of material to cover, so we need to stay on schedule. Please keep side chats to a minimum or avoid them completely, and when making points, asking questions, etc., please be aware of our time restrictions. There will be some time to chat informally after the meeting, and we can always have an offline chat as well. After class, we can also re-sample any remaining beer, but please do so in moderation!

> Preparing for the BJCP Exam

Review the following handouts:
--- The BJCP Exam Structure
--- The BJCP Entrance Exam
--- The BJCP Entrance Exam Registration Process
--- The BJCP Study Guide - Section on the BJCP Entrance Exam
--- The BJCP Study Guide - Section on BJCP Ranks and Points

The BJCP Exam - Some General Notes:

- People often complain and wonder why it is a timed exam, and why do we have to actually remember all the parameters, etc. The answer is obvious to anyone that has judged in a few competitions, because timing is always an issue at a competition. Lunch is scheduled at a certain time, Best of Show judging is scheduled at a certain time, the awards dinner is scheduled at a certain time, etc. It is important for the judges (especially the higher level judges) to help keep the competition on schedule. If things get delayed, people may have to leave, you may lose key BoS judges, people get frustrated, etc.

- 10 minutes is usually allotted per beer to be judged, and that may seem like a long time, but it isn't once you get into good judging practices and are really trying to provide good comments and feedback. To stay on a 10-minute pace, you may not have time to re-read the entire style guidelines for the styles being judged, especially if your flight has multiple and/or diverse styles in it. Thus, you need to have the bulk of this knowledge in your head and readily available.

- Also, think about mini-BoS (Best of Show) and BoS situations where there is absolutely no time to refer to the guidelines. A BoS round may have 20+ different beer styles to be sorted through quickly, with no reference materials. Having a timed exam and requiring judges to memorize a large amount of information is very important.

- Above is a photo of me judging a BoS round at the Indiana Brewers Cup competition. 24 Gold Medal winners… Which one is Best Overall ?!?

- Old Legacy Exam Questions - Included Because This Information Still Needs to Be Known:

--- Old Question 1: Part 1 covers the BJCP Organization and its rankings (see below) and Part 2 cover the Judging and Competition Procedures document (see below).

--- Old Style-Related Questions (Q2-3): The allocation of the 10 points available for each answer is explicit in the exam question. The questions are now of the form shown below. RON'S NOTE: Providing "parameters" in some cases could show that you have a deeper understanding of the style (optional, but good to do).

> For each of the three sub-styles *style-1*, *style-2*, and *style-3*, provide a statement describing the sub-styles as well as the differences and similarities between them by addressing each of the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles, name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Describe the similarities and differences between the three sub-styles.

--- Old Style-Related Questions (Q1-2): The allocation of the 10 points available for each answer is explicit in the exam question. The questions are now of the form shown below. RON'S NOTE: Providing "parameters" in some cases could show that you have a deeper understanding of the style (optional, but good to do).

> Identify three top-fermenting beer styles where the minimum original gravity is 1.070 or higher. For each style provide a statement describing the style as well as the differences and similarities between the styles by addressing the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.

1 point	Describe the similarities and differences between the three sub-styles.

POSSIBLE STYLES TO USE FOR THIS QUESTION (my opinion only):

- Strong Scotch Ale
- Imperial Stout
- Imperial IPA
- Belgian Tripel or Golden Strong
- Belgian Dark Strong
- English or American Barleywine

> Identify three distinctly different German bottom-fermented beer styles. Beer styles that are variations of each other based on color, strength or other similarly subtle differences do not count as distinctly different for the purposes of this question. For each style provide a statement describing the style as well as the differences and similarities between the styles by addressing the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Describe the similarities and differences between the three sub-styles.

POSSIBLE STYLES TO USE FOR THIS QUESTION (my opinion only):

- Munich Helles
- Dortmunder Export
- German Pilsner
- Oktoberfest / Marzen
- Munich Dunkel
- Schwarzbier
- Maibock / Helles Bock, Traditional Bock, Doppelbock, or Eisbock

> Identify three distinctly different beer styles that contain wheat as 25% or more of the grist. Beer styles that are variations of each other based on color, strength or other subtle differences do not count as distinctly different for the purposes of this question. For each style provide a statement describing the style, as well as the differences and similarities between the styles by addressing the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Describe the similarities and differences between the three sub-styles.

POSSIBLE STYLES TO USE FOR THIS QUESTION (my opinion only):

- Blonde Ale (25% is Maximum amount of wheat, so not a great example)
- American Wheat
- Weizen or Dunkelweizen
- Weizenbock (I would not include if using Weizen or Dunkelweizen)
- Witbier
- Berliner Weisse
- Lambic or Gueuze or Fruit Lambic

> Identify three distinctly different Belgian beer styles. For each style provide a statement describing the style as well as the differences and similarities between the styles by addressing the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Describe the similarities and differences between the three sub-styles.

POSSIBLE STYLES TO USE FOR THIS QUESTION (my opinion only):

- Witbier
- Belgian Pale or Blond
- Saison
- Biere de Garde
- Belgian Specialty Ale
- Belgian Dubbel or Dark Strong
- Belgian Tripel or Golden Strong
- Flanders Red or Brown (Oud Bruin)
- Lambic or Gueuze or Fruit Lambic

> Identify three top-fermenting beer styles where the maximum original gravity does not exceed 1.040. Beer styles that are variations of each other based on color, strength or other subtle differences do not count as distinctly different for the purposes of this question. For each style provide a statement describing the style as well as the differences and similarities between the styles by addressing the following topics:

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Describe the similarities and differences between the three sub-styles.

POSSIBLE STYLES TO USE FOR THIS QUESTION (my opinion only):

- Standard Ordinary Bitter
- Scottish Light 60 or Scottish Heavy 70

- English Brown Mild
- Berliner Weisse

--- Old Famous Cities Question (Q1): Identify, describe, and give at least one classic commercial example as listed in the BJCP Style Guidelines of a major beer style commonly associated with the following three classic brewing centers:

Location One	Location Two	Location Three

The three locations will be provided from the following list:

Bamberg	Berlin	Burton-on-Trent	Dublin
Düsseldorf	Edinburgh	Einbeck	Köln (Cologne)
Newcastle	San Francisco	Senne Valley	Vienna

After identifying the style, then use the usual system for describing the styles, with the exception of the similarities and differences section (this is replaced with identifying the style)...

6 points	Describe the aroma, appearance, flavor, and mouthfeel of each sub-style as in the BJCP Style Guidelines.
2 points	Identify at least one aspect of the ingredients (malts, hops, water chemistry) or background information (history, fermentation techniques and conditions, or serving methods) that distinguishes each sub-style.
1 point	For each of the sub-styles name at least one classic commercial example as listed in the BJCP Style Guidelines.
1 point	Identify the styles - DO THIS FIRST / AT TOP.

NOTE: We will cover this information below.

--- Old Classic Example Scoresheet Question (Q1): Complete the attached scoresheet marked with "*Classic Example Scoresheet*" as if you were judging a *classic commercial* example of the _____ style. You do ***not*** need to complete the *Overall Impression* section but otherwise the scoresheet should be completed as it would during a normal competition. You should describe a single exemplary sample of the style as if you are judging it during a competition. *Note: The style will vary for each exam, and could be just about any style other than the fruit, spice, herb and specialty categories that don't really have classic examples.*

--- Old Troubleshooting Question (Q1): 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)

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

Graded as follows…
[Phenolic][Describe/Discuss][Causes][Avoid/Control][Appropriate][Style]
[Acetaldehyde][Describe/Discuss][Causes][Avoid/Control][Appropriate][Style]
[Sourness][Describe/Discuss][Causes][Avoid/Control][Appropriate][Style]

--- Old Recipe Question (Q1): Provide a complete ALL-GRAIN recipe for a <STYLE*>, listing ingredients and their quantities, procedure, and carbonation. Give volume, as well as original and final gravities. Explain how the recipe fits the style's characteristics for aroma, flavor, appearance, mouthfeel, and other significant aspects of the style.
*Styles may include:

Belgian Tripel	Oktoberfest	Classic American Pilsner
Doppelbock	American IPA	Bohemian Pilsner
Robust Porter	Weizen	German Pilsner
Dry Stout	English Pale Ale	

Graded as follows…

1 point	Target statistics (starting specific gravity, final specific gravity, and bitterness in IBUs or HBUs) and color (as SRM or a textual description of the color).
2 points	Batch size, ingredients (grist, hops, water, and yeast) and their quantities.
3.5 points	Mashing, boil, fermentation, packaging, and other relevant brewing procedures.
3.5 points	Explain how the recipe fits the style's characteristics for aroma, appearance, flavor, mouthfeel, and other significant aspects of the style; and describe how the ingredients and processes used impact this style.

Also / Alternative Graded as follows…
[Volume]
[Water – chemistry/strike volume/sparge volume]
[Grist – appropriate choices/appropriate volumes]
[Mash – appropriate choice/decoction traditional]
[Boil]
[Hops – appropriatevariety/AAU/weight/times]
[Chill]
[Yeast – appropriate variety]
[Ferment – primary/secondary/duration/temperatures/diacetyl]
[OG]
[FG]
[Carb Technique]
[Aroma]
[Appearance]
[Flavor]
[Mouthfeel]

--- Old Additional Possible Questions (Q1):
Note: Read these questions “carefully” and answer them completely !!!

Troubleshooting:

T2. Explain how the brewer gets the following characteristics in his/her beer:
a) good head retention
b) clarity in a beer
c) a proper diacetyl level for style

T3. What are body and mouthfeel? Explain how the brewer controls body and mouthfeel in his/her beer.

Ingredients:

T4. Discuss hops, describing their characteristics, how these characteristics are extracted, and the beer styles with which the different varieties are normally associated.
T5. Explain the malting process, identifying and describing the different types of malts by their color and the flavor they impart to the beer. Give the styles with which they are associated.

T6. Describe the role of yeast in beer production and the positive and negative effects on the finished product of oxygen introduction during the various stages of fermentation.

T7. Describe the stages of yeast development and give five considerations in selecting the appropriate yeast strain for a given beer style.

T8. Discuss the importance of water characteristics in the brewing process and how water has played a role in the development of world beer styles.

The Brewing Process:

T9. Discuss the following brewing techniques. How do they affect the beer?
a) kräusening b) adding gypsum c) fining

T10. What is meant by the terms *hot break* and *cold break*? What is happening and why are they important in brewing and the quality of the finished beer?

T11. Describe and explain the role of *diastatic* and *proteolytic* enzymes in the brewing process and how they affect the characteristics of the finished beer.

T12. What are five primary purposes for boiling wort? How does a brewer achieve these objectives?

T13. Explain what happens during the mashing process. Describe three different mashing techniques and the advantages and disadvantages of each.

> Technical Topic 1

- Water, including minerals, pH, hardness, adjustment, and the effect on the development of world beer styles.

Water in the Brewing Process

Compiled by Brian Steuerwald and Ron Smith

Water is the most abundant ingredient in beer, making up 85% to 94% of the finished product.

Despite this, water is often one of the most overlooked ingredients in beer. In addition to its contribution to the final product, it is involved in all aspects of brewing including mashing, lautering, sparging, boiling, and fermentation. Furthermore, water is the medium used in most sanitation processes.

Water consists of H_2O and several other dissolved solids (mineral and salts), referred to as ions. Collectively, these ions are referred to as total dissolved solids (TDS). The ions most often considered in brewing are Calcium (Ca), Magnesium (Mg), Bicarbonate (HCO_3), Sulfate (SO_4), Chloride (Cl), and Sodium (Na). These ions in various levels and combinations can affect the entire brewing process and the taste of the finished product.

Water that is low in TDS is considered “soft” and low in total hardness. Home water softener water is not soft water. The process does not reduce the amount of TDS. Water softeners remove Ca and Mg (which are highly desired in the brewing process), and replaces it with Na, which isn’t really desired for brewing. The use of water softener “softened” water is all-grain brewing is generally discouraged. If it is used, Ca and Mg typically need to be replaced. Using “softened” water in extract brewing is less of an issue. However, adding Ca and Mg or a yeast nutrient may be useful to aid fermentation during extract brewing.

Hardness is mostly measured by the amount of Calcium (Ca) and Magnesium (Mg) in the water. This is important and good for brewing. Most hard water is also high in Total Alkalinity. For brewers, Total Alkalinity is often measured as the amount of Bicarbonate (HCO_3) in the water. A high level of Total Alkalinity can be detrimental to the brewing process and the finished product, so this is a very important consideration in brewing.

Another measure of alkalinity in water is pH (power of Hydrogen). Water (H_2O) contains alkaline OH^- ions and acidic H^+ ions. The pH is the proportional relationship between the amount of alkaline OH^- ions and acidic H^+ ions. The pH is measured on a scale of 0 to 14. A pH measure of 7 is considered neutral and what is found in distilled water. A pH above 7 is considered alkaline, and a pH below 7 is considered acidic. A slightly acidic environment (i.e., a pH between 5.0 and 5.5) is preferred to maximize mashing and sparging operations during the brewing process. Thus, water with a high pH often needs to be treated to lower pH to a more brewing “friendly” level.

Below is a description of the various ions in water identified as important in the brewing process or taste of the finished product.

Calcium (Ca)

- Often considered the most important of all ions.
- In the mash, it stimulates enzyme activity, helps gelatinize starch, and improves lautering.
- During the boil it facilitates hot break.
- During fermentation, it serves as a yeast nutrient and promotes flocculation.
- In the finished product, it reduces chill haze and promotes a longer shelf life.
- Too much Ca will reduce hop utilization (if it lowers pH too much) and can create a minerally taste in the finished beer.
- Want 50 - 100 ppm in brewing water.

Magnesium (Mg)

- In small quantities, it works the same as Ca in the mash and during fermentation, but to a lesser extent.
- At high levels produces astringency.

- At very high levels creates a laxative.
- Want 10 - 30 ppm, but could go as high as 50 - 60 ppm for beers with high hop bitterness.

Bicarbonate (HCO_3)

- Neutralizes the acids from dark malts.
- Smoothes the astringency and bitterness associated with dark malts.
- At high levels or in worts without dark malts, it increases the pH of the brewing water. In the mash, this hinders wort acidification (reduction of pH to desired range), which has several negative effects:
  - Increases tannin extraction
  - Slows starch gelatinization
  - Reduces starch conversion to sugars
  - Slows sparging and lautering
  - Darkens the wort color
- High levels also interfere with cold break (protein) coagulation.
- Increases mouthfeel and perceived sweetness of dark beers.
- High levels may contribute to be instability, chill haze and infection in the finished product.
- High levels can also create a harsh bitterness in the finished beer.
- Want levels of less than 50 ppm for lighter beers, and as high as 200 ppm for dark beers.

Sodium (Na)

- Creates a salty or sour flavor which could be appropriate at low levels or harsh and overpowering at high levels.
- Generally want as little as possible, but 70 - 150 ppm is OK.

Sulfate (SO_4)

- Promotes acidification (lowering of pH to desired range).
- Accentuates hop bitterness (in a drying, sharper manner), which is desirable in some styles but not in others.
- Generally want less than 500 ppm, but levels as high as 760 ppm work well for Pale Ales and beers trying to accentuate their hop bitterness.

Chloride (Cl)

- At low levels, accentuates hop bitterness (in a mellower, softer manner).
- Can also contribute to perceived sweetness.
- At high levels, creates a harsh, salty taste.
- Want less than 200 ppm.

Other ions and minerals

Sulfur (S)

- Imparts a rotten egg aroma.
- Use filtration to remove if levels are detectable and offensive.
- Want as little as possible.

Iron (Fe)

- In trace amounts, assists with fermentation.
- Above trace amounts, can impart a metallic, blood-like, or inky taste.
- Want as little as possible (less than 0.05 ppm).

Chlorine (HOCl) and Chloramines (NH_2Cl)

- Chemical disinfectants placed in municipal water supplies to reduce bacteria.

- Contribute to medicinal, disinfectant aroma and taste.
- Want as low as levels as possible.
- Chlorine can be removed by boiling water for 15 or more or allowing to set at temperatures of 78 degrees or more for 12 or more hours.
- Chloramines must be removed by either charcoal filtration (not all charcoal filtration systems however) or the use of campden tablets (potassium metabisulfite) (one tablet is okay for 5 gallons but is sufficient for 20 gallons) (These processes also work for the removal of chlorine too.)

Sometimes brewing water needs to be treated to facilitate the brewing process or make a certain style that tastes of a certain character. Brewing water can be treated in three primary ways: De-mineralization, Salt addition, Acid addition.

De-mineralization is the process of lowering ions and minerals in brewing water. There are several ways to accomplish this: precipitation, membrane-filtration, distillation, and dilution.

Precipitation De-mineralization occurs by boiling water to reduce some of the hardness. When boiling hard water, Calcium Carbonate (CaCO3) (chalk) is formed and falls to the bottom of the boiling kettle when the water is cooled. The water can then be carefully siphoned or poured off this solid. (Note this process also occurs when boiling wort.) The process is very time consuming, and other methods of reducing hardness are generally more effective (e.g., adding an acid). One may consider doing this if water is very high in bicarbonate (HCO_3) so that excessive amounts of acid do not need to be added to the brewing water to adjust the pH.

Membrane-Filtration De-mineralization is commonly known as Reverse Osmosis (RO). In this process, the water is passed through a special filter that removes most dissolved solids and hardness. This process is so effective that ions need to be added back to the treated water (particularly Ca and Mg) or the brewing process and finished product will be negatively affected. Excellent method if one wants to “build” a water to make a certain beer style. RO systems can be costly to install and maintain, but lower cost systems are becoming more readily available to homebrewers. As an alternative to purchasing a system, bottled R/O water is readily available to brewers.

Distillation is the process where water is first boiled into a gas, thereby removing dissolved solids. The gas is then cooled to form “pure” H_2O. As with RO, this process is so effective that ions need to be added back to the treated water or the brewing process and finished product will be negatively affected. Another, excellent method if one wants to “build” a water to make a certain beer style. Distillation systems can be costly to install, but bottled distilled water is readily available to brewers.

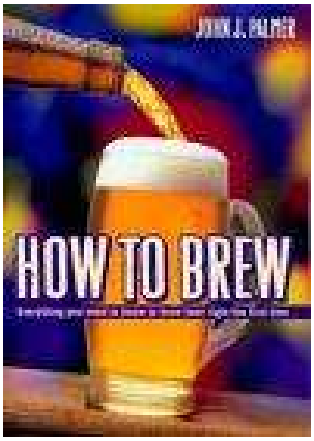
Dilution is the process of combining untreated water with RO or distilled water to adjust TDS to desired levels. In general, the dilution of TDS works on a 1:1 basis (e.g. one gallon of Ca free water added to a gallon of untreated water will results in two gallons of water with a Ca amount half of that in the initial untreated water). To do this, need to purchase or make RO or distilled water.

Salt addition is a common way to adjust brewing water. Different salts add certain minerals. See above for more effects on brewing process and finished product:

- Calcium Sulfate (gypsum) adds Ca and SO_4, lowers pH, can add “crispness” to hop bitterness
- Magnesium Sulfate (Epsom Salt) adds Mg and SO_4, lowers pH, can add “crispness” to hop bitterness
- Calcium Chloride adds Ca and Cl, lowers pH, can add perceived sweetness
- Sodium Chloride (table salt) adds Na and Cl, lowers pH, accents beer flavors in low amounts
- Calcium Carbonate (chalk) = adds Ca and CO_3, raises pH
- Sodium Bicarbonate (baking soda) adds Na and HCO_3, raises pH

Acid addition is commonly used to lower the pH of alkaline (pH above 7) brewing water, and to increase the removal of Bicarbonates (and hardness) during precipitation de-mineralization. Different types of acids can be used as follows:

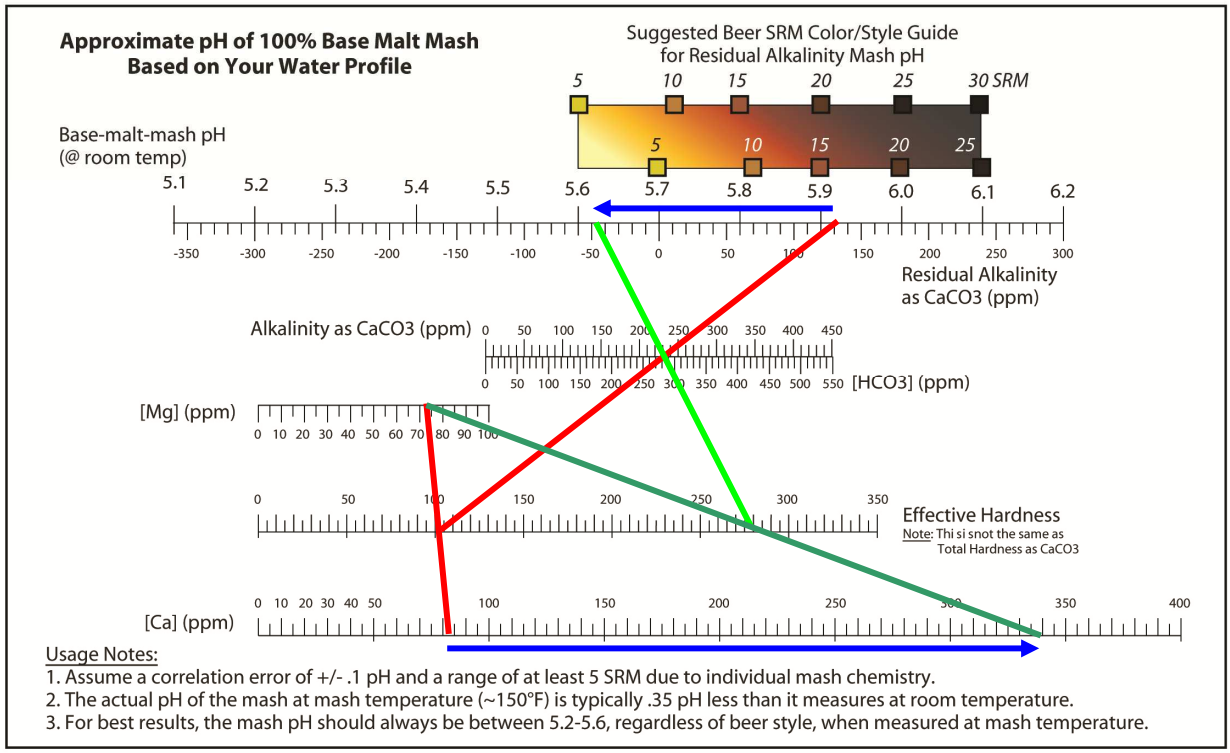
- Lactic and Phosphoric Acids do the job while adding little to taste, so they are good for lagers and light beers. Note: phosphoric acid adds phosphates that serve as a yeast nutrient and lactic acid can be unstable at high temperatures
- Sulfuric Acid adds SO4, so this is good for Pale Ales
- Hydrochloric Acid adds Cl and that can affect beer character (see above)



John Palmer's Nomograph (found in his book, How to Brew, as well as on his website, www.HowToBrew.com) offers a new approach for adjusting mash pH that many people are using today (see the next page for an example of a completed nomograph and an explanation of it).

Our highly alkaline Indianapolis water will produce a mash pH that is too high without any dark malts to help acidify it. The pH of the mash "with all base malts" can be estimated using Palmer's nomograph (see below). The science and calculations behind this can be found in his book or at… www.howtobrew.com/section3/chapter15-3.html .

Our base malt pH is probably over 5.9 (at room temp on the graph - about 5.6 at mash temp). For these lighter beers, this value needs to be closer to 5.6 (at room temp on the graph - about 5.25 at mash temp). To correct this, using the graph, you can determine how much Ca needs to be added. In this case… 338 (new value) - 82 (original value) = 256 ppm of Ca added per gallon of water. The source of this calcium can be either calcium chloride or calcium sulfate (calcium chloride can add to the perceived sweetness of the finished beer, while calcium sulfate will add to the perceived bitterness / crispness of the finished beer).



So, adding the right amount of Ca would get you the proper mash pH… BUT overall this is still very hard water (measured by the Total Dissolved Solids or TDS, which is primarily a combination of the Ca and Mg). Fairly soft water is desired / preferred for these beers (and this is soft in terms of TDS, not water softener water, which is not soft at all - the Ca and Mg is just exchanged for Na). To reduce the TDS, try diluting your water with distilled or Reverse Osmosis (RO) water, perhaps 50%-50%. This should leave enough Ca and Mg needed for good brewing water, while reducing the TDS and softening the water. After cutting all your numbers in half with a 50%-50% dilution, rework the nomograph and make the necessary adjustments to get the correct mash pH.

In brewing's early days, water chemistry was not understood (nor was yeast), but over hundreds of years brewers learned how they could make their best beer with the water they had to work with. This is how many of the classic brewing styles came to be associated with certain regions of the world. Today, brewers simply adjust their water for the style of beer they want to make.

Water ion "make-up" contributes to some of the world's classic beer styles. Below are some of the main places where the water dictated the beer that was (is) made.

Location	Ca (ppm)	Mg (ppm)	Na (ppm)	SO_4 (ppm)	HCO_3 (ppm)	Cl (ppm)
Pilsen	7 – 10	2 – 4	2 – 3	4 – 5	3 – 15	3 – 5
The very low hardness and alkalinity creates a soft profile beer (i.e. Pilsners). Step mashing is necessary due to the lack of Ca and Mg that are required for a good mash. The lack of SO4 allows for a soft, well-rounded hop bitterness that matches the overall softness of this style.						
Dortmund	225 – 250	25 – 40	60 – 70	120 – 280	180 – 550	60 – 100
The high hardness and alkalinity make for a more minerally and harder profile beer than in Pilsen (i.e. Dortmunder Export). The high SO4 content makes the hop bitterness more sharp and dry.						
Vienna	163 – 200	60 – 68	8	125 – 216	118 – 243	12 – 39
This water is similar to Dortmund's, but it can lack the level of calcium needed to balance the carbonates, so some darker malt is required, creating the Vienna and Oktoberfest styles. This water also lacks some sodium and chloride when compared to Dortmund, so the beer is less minerally and more well-rounded.						
Munich	75 – 109	18 – 21	2	10 – 79	148 – 171	2 – 36
Although moderate in most minerals, alkalinity from carbonates is high. The smooth flavors of the Dunkels, Bocks and Oktoberfests of the region show the success of using dark malts to balance the carbonates and acidify the mash. The relatively low sulfate content provides for a mellow hop bitterness that enhances malt flavor.						
London	52 – 90	5 – 32	15 – 86	24 – 32	82 – 125	10 – 34
The higher carbonate level dictates the use of more dark malts, but the chloride and high sodium content also smooth the flavors out, resulting in the well-known Porters and copper-colored Pale Ales from this area.						
Edinburgh	100 – 140	18 – 60	20 – 80	96 – 140	140 – 225	20 – 65
This water is similar to London's but with a bit more bicarbonate and sulfate, making a beer that can embrace a heavier malt body while using less hops to achieve balance (thus, the malty Scottish Ales).						
Burton-on-Trent	268 – 352	24 – 62	25 – 55	450 – 820	197 – 320	16 – 40
Compared to London, the calcium and sulfate are very high, but the hardness and alkalinity are "balanced" to nearly the degree of Pilsen. The high level of sulfate and low level of sodium produce an assertive, clean hop bitterness. Compared to London, Burton ales are paler, but much more bitter, although the bitterness is balanced by the higher alcohol and body of these English Ales.						
Dublin	118 – 120	4 – 5	12	53 – 55	125 – 319	19 – 20
Dublin has a very high bicarbonate water that is perfect for the dark, malty Stouts produced in Ireland. Low levels of sodium, chloride and sulfate create an unobtrusive hop bitterness to properly balance with the malt.						
Indianapolis Average	55 – 110	51 – 94	23 – 42	63 – 150	170 – 364	30 – 67

FAMOUS CITIES / WATERS:

Dusseldorf is famous for Alt Bier, a bitter, yet malty ale (the alt/old brewing method before lagers). Zum Uerige Alt.

Berlin is famous for Berliner Weiss, a small sour (lactic) wheat beer often served with sugary syrups. Berliner Kindl Weiss.

Einbeck is famous for "Traditional" Bock Bier, a melanoidin-rich, malty, decoction-mashed German lager. Einbecker Ur-Bock Dunkel.

Cologne (or Koln) is famous for Kolsch, a soft, light, highly hopped, slightly fruity (usually pear) Light Hybrid Beer (uses an ale yeast, but at lower ale temps, and often lagered for a month or so). Reissdorf Kolsch.

Edinburgh is famous for Scottish Ales and Strong Scotch Ales, dominantly malty (clean malt character) ales of various strengths (hops were too expensive to import, so they used little). Belhaven Scottish Ales and Wee Heavy.

Bamberg is famous for Smoked or "Rauch Bier", a Marzen style beer brewed with smoked malts. Schlenkerla Rauchbier Marzen.

Burton-on-Trent is famous for English Pale Ales, bitter (EKG hops) ales, often with a caramelly malt character, of various strengths. High sulfate SO4 water accentuates the hop bitterness. Fullers London Pride (Best Bitter) and Fullers ESB.

Newcastle is famous for Northern English Brown Ales, well-balanced (hop-malt) brown ales with a nutty, toasty malt character. Newcastle Brown Ale.

The Senne Valley is famous for Lambics, sour / acidic, complex wheat-based ales fermented with a variety of Belgian microbiota that may be unblended or a blend of young and old (Gueuze). Cantillon Lambic or Gueuze.

Dublin is famous for Dry Stout, a relatively small, roasty (roasted barley / coffee-like character), bitter session beer. High carbonate water neutralizes the acids from dark malts to smooth them out. Guinness Draught Stout.

San Francisco is famous for Steam Beer / California Common Beer, a purely American style that is similar to an American Pale or Amber, but showcases the woody, earthy, minty Northern Brewer hop (rather than a citrusy hop). As an Amber Hybrid, it is fermented with a lager yeast, but at low ale yeast temps. Anchor Steam.

Vienna is famous for Vienna Lager, a soft, elegantly malty lager with some slight toastiness from the nearly all Vienna malt used (no caramel malts). Negra Modelo or Gosser Dark.

WATER REVIEW: - Review

- Hard water is mostly water high in Ca (calcium) and Mg (magnesium)
    - Both are important to fermentation
    - These are solids (TDS)

- Alkalinity is the amount of Bicarbonate (HCO_3) in Water
    - Alkaline = Above 7 on the 0-14 pH scale

- Water Treatment (3 types):
    - Demineralization - Reduces Ca and Mg
    - Salt Addition - Increases Ca, Mg, Sulfates (SO_4), etc. depending on the salts used
    - Acid Addition - To lower pH of alkaline water
        - Lactic Acid adds nothing - good for lagers
        - Sulfuric Acid adds SO_4 - good for pale ales

- Ca helps in the mash - reduces mash pH / helps acidify the mash
    - If low Ca, need to do a step mash (need the acid rest to help acidify the mash)
    - If too much Ca, it negatively affects hop utilization by lowering the pH too much

- HCO_3 neutralizes acids from dark malts and reacts with Ca to reduce hardness
    - Smoothes out dark beers
    - Increases mouthfeel
    - Increases perceived sweetness
    - BUT, also - Increases pH / makes alkaline water, which hinders wort acidification in the mash, and…
        - Increases tannins
        - Reduces starch conversion to sugars (lower yield)
        - Other negative effects

- SO_4 increases wort acidification and accentuates hop bitterness (such as in pale ales)

- Chloride (Cl) enhances sweetness at low levels, but hinders yeast flocculation at high levels

<u>FAMOUS WATERS</u>

- Pilsen - Bohemian Pilsner
    - Soft water lacking Ca and Mg
    - Lack of Ca, which helps the mash, means a step mash is needed (need acid rest)
    - Lack of SO_4 makes for a rounder, softer hop bitterness

- Dortmund - Dortmunder Export
    - High hardness (Ca and Mg) and alkalinity (HCO_3) makes more minerally and provides for a harder profile
    - High SO_4 accentuates hop bitterness

- Vienna - Vienna
    - High alkaline / HCO_3 water, but lacks Ca (so not hard water), so Ca can't balance the HCO_3, thus darker malts are required to do this, but still a soft, round profile

- Munich - Munich Helles / Munich Dunkel
    - High alkalinity, so acids in dark malts are neutralized and mash is acidified
    - High HCO_3 increase perception of sweetness
    - Low SO_4 keeps bitterness soft

- London - Porter
    - High alkalinity, so dark malts used to acidify the mash
    - High Cl and Sodium (Na) smoothes out flavors

- Edinburgh - Scottish Ales
    - High alkalinity, so dark malts used to acidify the mash
    - High SO4 requires less hops for balance

- Burton-on-Trent - English Pales
    - Lower alkalinity, so don't need darker malts
    - Higher SO4 accentuates hop bitterness
    - Higher alcohol balances the bitterness ?

- Dublin - Stout
    - High alkalinity, so dark malts used to acidify the mash
    - Low SO4 provides for a clean hop bitterness

Also, review the section on Water in the BJCP Study Guide.

> Technical Topic 2

- Malt, including the malting process, types, adjuncts, kilning and the styles with which different malts are associated.

MALTING

Compiled by Brian Steuerwald and Ron Smith

Barley is the most common source of fermentable sugars in beer. The barley kernel is the seed of a plant in the grass family. There are two basic types of barley used in brewing, 2 row and 6 row.

The barley kernel is made-up of organic matter consisting of lipids, proteins, and carbohydrates. Although the barley kernel contains the components to create fermentable sugars, in this raw form it does not have much, if any, fermentable sugar.

So somehow we must help the barely kernel along to get it in a form where these fermentable sugars can be created and extracted.

Malting is the first step in this process.

During the malting process, enzymes, proteins, and lipids are created (or made available) and starches (i.e., complex carbohydrates) are made available to be later converted to fermentable sugars (simple carbohydrates) (principally maltose) during mashing.

Steps and Reactions in Malting

1. The malting process begins by steeping raw barely grain in 55 – 65 degree water for 2 – 3 days.

2. Next, the wet grain is placed in a damp area for 6 – 10 days at 50 – 70 degrees. Under these conditions, the grain begins to germinate and grow.

3. As a brewer, we are concerned with certain chemical and mechanical reactions occurring in the kernel during this germination process. More specifically, enzymes in the aleurone layer are released that create other enzymes that breakdown the endosperms protein/carbohydrate matrix into smaller carbohydrates, amino acids, and lipids.

4. The endosperm is composed of large and small starch granules (complex carbohydrates) that are packed like bags of jellybeans in a box (kernel husk). The cell walls (bags) within the matrix holding the starch granules (jellybeans) are primarily composed of beta-glucans (a type of cellulose), some pentosans (gummy polysaccharide) and some protein.

5. The degree to which the enzymes tear open the bags and start unpacking the starch granules for use by the growing plant (or brewer) is referred to as “modification.”

6. One visual indicator that a maltster uses to judge the degree of modification is the length of the acrospire which grows underneath the husk. The length of the acrospire in a fully modified malt will typically be 75-100% of the seed length. (Note: Undermodified malt has a more complete set of enzymes and more complex proteins that must be broke down later during mashing to avoid problems in the finished product (e.g., chill haze).

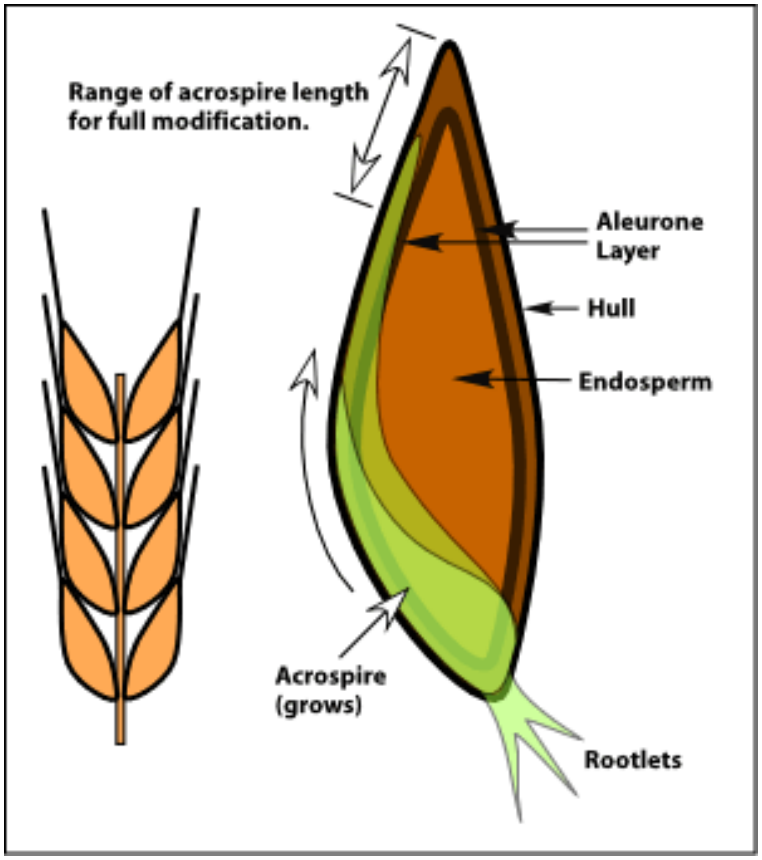


Figure: A simplified diagram of a barley kernel during malting, showing a progressive picture of how the acrospire (the plant shoot) grows along one side of the kernel. As it grows, pre-existing enzymes are released and new enzymes are created in the aleurone layer which "modify" the endosperm (the protein/carbohydrate matrix starch reserve) for the acrospire's use.

7. When the maltster determines the desired level of modification has been reach, the germination process is halted.

8. If germination continues after full modification has occurred, all of the starches that the brewer hopes to use will eventually be used by the plant.

9. To halt germination, the maltster gradually heats up the kernels to 90 degrees where it is held for approximately 24 hours to permit enzyme action and then the temperature is gradually raised to 120 – 140 degrees and held for 12 – 48 hours to dry the malt.

10. After drying, any roots or acrospire is removed by tumbling the malted grain.

11. Among other materials (e.g. proteins, lipids), the resulting malted grain contains enzymes and accessible starches that can later be converted to fermentable sugars.

12. The amount of enzymes present in the malt that convert starches to fermentable sugar is referred to as diastatic power.

13. The diastatic power of a particular malt will vary as a result of several factors. For example, although two row barley is the generally preferred variety, having a bit higher yield per pound, lower protein levels, and claiming a more refined, less grainy flavor than six row, six row has a little higher diastatic power than two row. Six row also has more husk, making it less likely to get a stuck mash. Moreover, six row has higher protein which can lead to higher body. Historically, this drove brewers to thin the wort with unmalted grains like corn and rice. Brewers were able to take advantage of six row barley's higher diastatic power to achieve full conversion of the mash in spite of the non-enzymatic starch sources (adjuncts).

14. Other factors influencing diastatic power are the amount of moisture, heat, and time during the malting process. Generally, heat (particularly when combined with moisture) tends to destroy these enzymes.

The process in #9 will result in malt that can serve as the base for many beer styles. It is often referred to as a “lager” or “pilsner” malt. This type of malt contains a high degree of diastatic power. It has more than enough enzymes to convert its own starches and amounts in excess that can convert starches of others grains/malt added to the mash.

Other types of malt can be created by manipulating three factors: moisture, temperature, and time.

Some of these light malts are kilned or roasted at higher temperatures to lend different tastes (e.g. Biscuit, Vienna, Munich, Brown). The roasting destroys some if not all of their diastatic power.

Besides the lighter-colored base and toasted malts, there is another group of malts that **don't** need to be mashed and these are often referred to as "specialty malts". They are used for flavoring and have no diastatic power whatsoever. Some of these malts have undergone special heating processes in which the starches are converted to sugars by heat and moisture right inside the hull. As a result, these malts contain more complex sugars, some of which do not ferment, leaving a pleasant caramel-like sweetness.

These pre-converted malts (called caramel or crystal malts) are available in different roasts or colors (denoted by the color unit Lovibond), each having a different degree of fermentability and characteristic sweetness (e.g. Crystal 40, Crystal 60).

Also within the specialty malt group are the roasted malts. These malts have had their sugars charred by roasting at high temperatures, giving them a deep red/brown or black color (e.g. Black Patent malt).

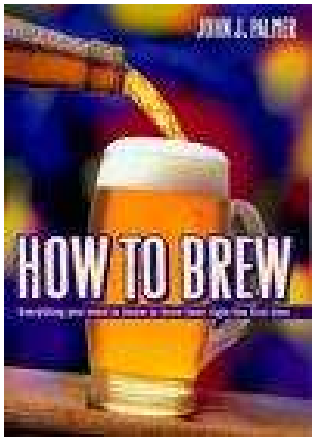
The Lovibond color scale ranges from 1 to 600. See the figure above. To put this in perspective, most American mega-brewed light lager beers are less than 5 Lovibond. Guinness Extra Stout on the other hand, is comfortably in the 100s.

Specialty malts do not need to be mashed, and can simply be steeped in hot water to release their character. These grains are very useful to the extract brewer, making it easy to increase the complexity of the wort without much effort.

Lastly, there are fermentables not derived from malted barley which are called "adjuncts". Adjuncts include refined sugars, corn, rice, unmalted rye and wheat, and unmalted barley. These are not to be scorned, some adjuncts like wheat and unmalted roasted barley are essential to certain beer styles. Whole brewing traditions like Belgian Lambic, Witbier, and Irish Stout depend on the use of adjuncts.

ANOTHER PERSEPCTIVE ON MALTING:

- The following text was taken primarily from John Palmer's book titled How to Brew. This information is on his website at www.howtobrew.com. John does an excellent job of explaining the most important aspects of a subject, in a clear and concise manner. A lttle additional content was added from other sources and John's information was put into bullet form for easier studying. Key points have also been highlighted, and there is a Simplified Summary at the end of this section. John's book is excellent, and should be a part of any brewers's library.



What is Malted Grain ?

- Barley Malt Defined

--- Barley is the most common source of fermentable sugars in beer.
--- The barley kernel is the seed of a plant in the grass family.
--- Malted barley is the source of the sugars (principally maltose) which are fermented into beer.
--- The malting process allows the grain to partially germinate, making the seed's resources available to the brewer.
--- During germination, enzymes in the aleurone layer are released, and new enzymes are created, that break down the endosperm's protein/carbohydrate matrix into smaller carbohydrates, amino acids and lipids, and open up the seed's starch reserves.
--- The endosperm is composed of large and small starch granules that are packed like bags of jellybeans in a box. The cell walls (bags) within the matrix holding the starch granules (jellybeans) are primarily composed of beta-glucans (a type of cellulose), some pentosans (gummy polysaccharide) and some protein. The box in this metaphor is the outer husk.
--- The degree to which the enzymes tear open the bags and start unpacking the starch granules (i.e. breakdown the endosperm) for use by the growing plant (or brewers in our case) is referred to as the "modification."
--- One visual indicator that a maltster uses to judge the degree of modification is the length of the acrospire which grows underneath the husk. The length of the acrospire in a fully modified malt will typically be 75-100% of the seed length.
--- If germination continued, a plant would grow, and all of the starches that the brewer hoped to use would be used by the plant. So, the maltster gauges the germination carefully and stops the process by drying when he judges he has the proper balance between resources converted by the acrospire and resources consumed by the acrospire.
--- Note: Undermodified malt usually have a more complete set of enzymes, but they also have more proteins that require additional enzymatic breakdown to avoid protein-polyphenol induced haze (chill haze). It has become difficult to find truly undermodified malt that requires extensive protein rests as part of the mashing schedule.
--- The purpose of malting is to create these enzymes, break down the matrix surrounding the starch granules, prepare the starches for conversion, and then stop this action until the brewer is ready to utilize the grain.
--- Malting is done by steeping the barley in 50-65 degree F water for two to three days, then allowed to germinate for six to ten days between 50-70 degrees F. The acrospire grows to about 50% by the sixth day. After germination, the malt is gradually raised in temp to 90 degrees F, where it is held for 24 hours to permit enzyme action, then gradually raised to 120 degrees F and held for another 12 hours to dry the malt. The malt must be dry before kilning to prevent the destruction of the enzymes.
--- After modification, the grain is dried and the acrospire and rootlets are knocked off by tumbling.
--- The kiln drying of the new malt denatures (destroys) a lot of the different enzymes, but several types remain, including the ones necessary for starch conversion. The amount of enzymatic starch conversion potential that a malt has is referred to as its "**diastatic power**".
--- From a brewer's point of view, there are basically two kinds of malted grain, those that need to be mashed and those that don't.
--- Mashing is the hot water soaking process that provides the right conditions for the enzymes to convert the grain starches into fermentable sugars.

--- The basic light colored malts such as pale ale malt, pilsener malt and malted wheat need to be mashed to convert the starches into fermentable sugars. These malts make up the bulk of the wort's fermentable sugars.

--- Some of these light malts are kilned or roasted at higher temperatures to lend different tastes e.g. Biscuit, Vienna, Munich, Brown. The roasting destroys some of their diastatic power.

--- The diastatic power of a particular malt will vary with the type of barley it is made from.

--- There are two basic varieties of barley, two row and six row - referring to the arrangement of the kernels around the shaft.

--- Two row barley is the generally preferred variety, having a bit higher yield per pound, lower protein levels, and claiming a more refined flavor than six row. However, six row has a little higher diastatic power than two row. Two row has bigger kernels, and thus a higher yield than six row, which has more husk and protein, thus two row beers taste less grainy.

--- Historically, the higher protein level of six row barley (which can produce a very heavy bodied beer) drove brewers to thin the wort with unmalted grains like corn and rice. Brewers were able to take advantage of six row barley's higher diastatic power to achieve full conversion of the mash in spite of the non-enzymatic starch sources (adjuncts).

--- Besides the lighter-colored base and toasted malts, there is another group of malts that **don't** need to be mashed and these are often referred to as "specialty malts". They are used for flavoring and have no diastatic power whatsoever. Some of these malts have undergone special heating processes in which the starches are converted to sugars by heat and moisture right inside the hull. As a result, these malts contain more complex sugars, some of which do not ferment, leaving a pleasant caramel-like sweetness.

--- These pre-converted malts (called caramel or crystal malts) are available in different roasts or colors (denoted by the color unit Lovibond), each having a different degree of fermentability and characteristic sweetness (e.g. Crystal 40, Crystal 60).

--- Also within the specialty malt group are the roasted malts. These malts have had their sugars charred by roasting at high temperatures, giving them a deep red/brown or black color (e.g. Black Patent malt).

--- The Lovibond color scale ranges from 1 to 600. See the figure above. To put this in perspective, most American mega-brewed light lager beers are less than 5 Lovibond. Guinness Extra Stout on the other hand, is comfortably in the 100s.

--- Specialty malts do not need to be mashed, and can simply be steeped in hot water to release their character. These grains are very useful to the extract brewer, making it easy to increase the complexity of the wort without much effort.

--- Lastly, there are fermentables not derived from malted barley which are called "adjuncts". Adjuncts include refined sugars, corn, rice, un-malted rye and wheat, and unmalted barley. These are not to be scorned, some adjuncts like wheat and unmalted roasted barley are essential to certain beer styles. Whole brewing traditions like Belgian Lambic, American Light Lagers, and Irish Stout depend on the use of adjuncts.

Malt Types and Usages (Color / Lovibond values listed are typical values)
Base Malts (need to be mashed)
--- **Lager Malt** 2 L Lager malt can be used to produce ales as well as lagers. The name comes from the fact that pale lagers are the most common style of beer and this is the malt type most commonly used to produce them. Because it tends to be the most available malt, it is used for nearly every other style also. Logically, if you intend to brew a pale lager, you would be best served by using lager malt. After germination, lager malt is carefully heated in a kiln to 90F for the first day, withered at 120-140F for 12-20 hours and then cured at 175-185F for 4-48 hours depending on the maltster. This produces a malt with fine mild flavor and excellent enzyme potential. It is used as the basis of most of the world's beers in conjunction with specialty malts for added flavors.
--- **Pale Ale Malt** 3 L This malt type is kilned at higher temperatures than lager malt, giving a slightly toastier malt flavor well suited to Pale Ales.
--- **Wheat Malt** 3 L Wheat has been used for brewing beer nearly as long as barley and has equal diastatic power. Malted wheat is used for 5-70% of the mash depending on the style. Wheat has no outer husk and therefore has fewer tannins than barley. It is generally smaller than barley and contributes more protein to the beer, aiding in head retention. But it is much stickier than barley due to the higher protein content and may cause lautering problems if not given a "Protein Rest" during the mash.
--- **Rye Malt** 3 L Malted rye is not common but is gaining in popularity. It can be used as 5-10% of the grain bill for a rye "spicy" note. It is even stickier in the mash than wheat and should be handled accordingly.

Kilned Malts (need to be mashed)
These malts are commonly produced by increasing the curing temperatures used for base malt production, but can also be produced by toasting finished base malts for a period of time in an oven.
--- **Biscuit Malt** 25 L This fully toasted, lightly roasted malt is used to give the beer a bread and biscuits flavor. It is typically used as 10% of the total grain bill. Gives a deep amber color to the beer.
--- **Victory Malt** 25 L This roasted malt is similar in flavor to Biscuit but gives a more nutty taste to the beer. Victory adds orange highlights to the beer color.
--- **Munich Malt** 10 L This malt has an amber color and gives a very malty flavor. This malt has enough diastatic power to convert itself but is usually used in conjunction with a base malt for mashing. This malt is used for Oktoberfest-type beers and many others, including pale ales.
--- **Vienna Malt** 4 L This malt is lighter and sweeter than Munich malt and is a principal ingredient of Bock beers. Retains enough enzymatic power to convert itself but is often used with a base malt in the mash.
--- **Dextrin Malt** 3 L Also known as American Carapils, this malt is used sparingly and contributes little color but enhances the mouthfeel and perceived body of the beer. A common amount for a five gallon batch is 1/2 lb. Dextrin malt has no diastatic power. It must be mashed; if steeped it will contribute a lot of unconverted starch and cause starch haze.

Caramel Malts (may be steeped or mashed)
Caramel Malts have undergone a special heat "stewing" process after the malting which crystallizes the sugars. These sugars are caramelized into longer chains that are not converted into simple sugars by the enzymes during the mash. This results in a more malty, caramel sweet, fuller tasting beer. These malts are used for almost all ale and higher gravity lager styles. Various crystal malts are often added in half pound amounts to a total of 5-25% of the grain bill for a 5 gallon batch.
--- **Caramel 10** 10 L This malt adds a light honey-like sweetness and some body to the finished beer.
--- **Caramel 40** 40 L The additional color and light caramel sweetness of this malt is perfect for pale ales and amber lagers.
--- **Caramel 60** 60 L This is the most commonly used caramel malt, also known as medium crystal. It is well suited for pale ales, English style bitters, porters and stouts. It adds a full caramel taste and body to the beer.
--- **Caramel 80** 80 L This malt is used for making reddish colored beers and gives a lightly bittersweet caramel flavor.

--- **Caramel 120** 120 L This malt adds a lot of color and bittersweet caramel flavor. Useful in small amounts to add complexity or in greater amounts for old ales, barleywines and doppelbocks.
--- **Special B** 220 L This unique Belgian malt has a roasted nutty-sweet flavor. Used in moderation (1/4-1/2 lb.), it is very good in brown ales, porter, and doppelbocks. Larger amounts, more than a half pound in a 5 gallon batch, will lend a plum-like flavor (which may be desired in a barleywine in small amounts).

Roasted Malts (may be steeped or mashed)
These highly roasted malts contribute a coffee or burnt toast flavor to porters and stouts. Obviously these malts should be used in moderation. Some brewers recommend that they be added towards the end of the mash, claiming that this reduces the "acrid bite" that these malts can contribute. This practice does seem to produce a smoother beer for people brewing with "soft" or low bicarbonate water.
--- **Chocolate Malt** 400L Used in small amounts for brown ale and extensively in porters and stouts, this malt has a bittersweet chocolate flavor, pleasant roast character and contributes a deep ruby black color.
--- **Black Patent Malt** 580L This is the blackest of the black. It must be used sparingly, generally less than a half pound per 5 gallons. It contributes a roasted charcoal flavor that can actually be quite unpleasant if used in excess. It is useful for contributing color and/or setting a "limit" on the sweetness of other beer styles using a lot of caramel malt; one or two ounces is useful for this purpose.
--- **Roast Barley** 550L This is not actually a malt, but highly roasted plain barley. It has a dry, distinct coffee taste and is the signature flavor of Stouts. It has less of a charcoal "bite" to it than does Black Patent.

Other Grains and Adjuncts
--- **Oatmeal** 1 L Oats are wonderful in a porter or stout. Oatmeal lends a smooth, silky mouthfeel and a creaminess to a stout that must be tasted to be understood. Oats are available whole, steel-cut (i.e. grits), rolled, and flaked. Rolled and flaked oats have had their starches gelatinized (made soluble) by heat and pressure, and are most readily available as "Instant Oatmeal" in the grocery store. Whole oats and "Old Fashioned Rolled Oats" have not had the degree of gelatinization that Instant have had and must be cooked before adding to the mash. "Quick" oatmeal has had a degree of gelatinization but does benefit from being cooked before adding to the mash. Cook according to the directions on the box (but add more water) to ensure that the starches will be fully utilized. Use 0.5-1.5 lb. per 5 gal batch. Oats need to be mashed with barley malt (and its enzymes) for conversion.
--- **Flaked Corn (Maize)** Flaked corn is a common adjunct in British bitters and milds and used to be used extensively in American light lager (although today corn grits are more common). Properly used, corn will lighten the color and body of the beer without overpowering the flavor. Use 0.5-2 lb. per 5 gal batch. Corn must be mashed with base malt.
--- **Flaked Barley** Flaked unmalted barley is often used in Stouts to provide protein for head retention and body. It can also be used in other strong ale styles. Use 0.5-1 lb. per 5 gal batch. Flaked barley must be mashed with base malt.
--- **Flaked Wheat** Unmalted wheat is a common ingredient in wheat beers, including: American Wheat, Bavarian Weisse, and is essential to Belgian Lambic and Wit. It adds starch haze and high levels of protein. Flaked wheat adds more wheat flavor "sharpness" than malted wheat. Use 0.5-2 lb. per 5 gal batch. Must be mashed with base malt.
--- **Flaked Rice** Rice is the other principal adjunct used in American and Japanese light lagers. Rice has very little flavor and makes for a drier tasting beer than corn. Use 0.5-2 lb. per 5 gal batch. It must be mashed with base malt.
--- **Oat and Rice Hulls** Not an adjunct per se, the hulls of oats and rice are not fermentable, but they can be useful in the mash. The hulls provide bulk and help prevent the mash from settling and becoming stuck during the sparge. This can be very helpful when making wheat or rye beers with a low percentage of barley malt and barley husks. Use 2 - 4 quarts of oat or rice hulls for 6 - 10 lbs. of wheat if doing an all-wheat beer. Rinse thoroughly before using.

MALTING VIDEOS:
Part 1 = http://www.youtube.com/watch?v=8qbtRUrPU6A&feature=related
Part 2 = http://www.youtube.com/watch?v=zCnhfIq7bVA&feature=related
Part 3 = http://www.youtube.com/watch?v=RXV4k47HkZs&feature=related
Part 4 = http://www.youtube.com/watch?v=r_3X730CkCU&NR=1
Part 5 = http://www.youtube.com/watch?v=hDwb1agfxes&feature=related
Part 6 = http://www.youtube.com/watch?v=bS6tkU7B1Uw&feature=related
Weyermann Videos =
http://www.weyermann.de/usa/film.asp?umenue=yes&idmenue=272&sprache=10

MALT & GRAIN REVIEW: - Review

- Malting is the process of steeping grains over 2-3 days
    - Allows grain to partially germinate, which creates enzymes and opens up starch reserves

- Most malt today is fully modified, so it doesn't require complex step mashing schedules
    - Undermodified malt has excess proteins that require a protein rest during mashing or proteins will create chill haze and possibly off flavors
    - Downside to fully modified malt is that some of the kernels starches are consumed, which reduces the yield
- After malting, the grain is kilned to dry it (base malts are done at this stage)
    - Darker malts are also roasted after kilning to darken and give a charred / cooked flavor
        - Ex's: Black Patent and Chocolate malts

- Base Malts:
    - Common ones include:
        - Lager (mild flavor)
        - Pale (Pale ales and other styles)
        - Munich (amber color, Oktoberfests)
        - Vienna (lighter and sweeter than Munich malt, good for Bocks)
        - Victory (nutty and orange color)
        - Biscuit (bready, biscuity)
        - Dextrin (American carapils, increases body, used sparingly)
        - Rye (spicey)
        - Wheat (no outer husks, no tannins, various wheats - Wheat beers and other styles)
            - Note: Wheat and rye need a protein rest in the mash (lots of proteins to reduce)
    - Munich, Vienna, and Dextrin would typically be used with another primary base malt

- Crystal / Caramel Malts:
    - Do not require mashing, since they are essentially mashed in the kernel during the kilning process by increasing the kilning temp beyond what is needed just to dry it
    - Create a sweet caramelly flavor
    - Special B creates a plumy, dark fruit flavor

- Dark Roasted Malts:
    - Chocolate Malt - Bittersweet cocoa, chocolate flavor
    - Black Patent - Charred flavor, use only a little in Stouts and some Porters

- Roasted Barley:
    - Not "malted", is just roasted plain barley (the coffee taste of Stouts)

- Cereal Adjuncts (usually require step mashing for the protein rest):
    - Flaked Barley (unmalted) - Promotes head retention in Stouts and big beers
    - Flaked Wheat (unmalted) - Adds more wheat character to wheat-based beers
    - Corn
    - Rice

Also, review the section on Malting in the BJCP Study Guide.

> Off Flavors / Problems / Other Flavors

- Light Body
- Dimethyl-sulfide (DMS, cooked corn)
- Vegetal (cooked, canned, or rotten vegetables)
- Lightstruck (skunked)
- Sweet vs Malty (i.e. Sugary Sweetness vs Malty Sweetness)
- Oxidized (paper, cardboard)
- Phenolic (medicinal, band-aid)

- Light Body

- Light body is not always an off-characteristic, but it is a common problem identified when judging beers. The body of a beer is characterized as the fullness of the flavor and mouthfeel, and the descriptors range from watery, characterless, thin, light, etc. to satiating, full, heavy, thick, etc. 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. 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-accentuated styles.

One common suggestion for increasing body is to increase the mash temperature, but this has to assume that it is an all-grain beer. Increasing the mash temp produces more non-fermentable sugars, which will remain in the beer and create a fuller palate sensation. Remember **"Hot Body"** (a Ronism)!

- Dimethyl-sulfide (DMS, cooked corn)

- DMS is Dimethyl-sulfide and has the taste and aroma of cooked vegetables, notably corn, celery, cabbage, etc. It is typically produced in the boil (heat-induced conversion of S-methylmethionine), but most of it evaporates during an open, rolling boil. Thus, a closed boil (with the lid on), a lazy boil, or slow cooling of the wort can lead to DMS staying in the beer at levels higher than usual and higher than desired. Post boil, nearly all beer still contains some DMS, but it is typically scrubbed out of the beer during a vigorous fermentation, which is why lager beers (that don't have that vigorous fermentation period) may retain more DMS in the finished product than ales. DMS can also be produced with certain grains, especially Pils Malt. A high percentage of this malt alone can produce a low DMS character, and depending on the style, this level of DMS may or may not be considered a problem. Wild yeast can also produce high levels of DMS, but this isn't typically the cause of this flavor. DMS is appropriates in most lagers, but should not be present in any ales.

HowToBrew: Like diacetyl in ales, DMS is common in many light lagers and is considered to be part of the character. DMS is produced in the wort during the boil by the reduction of another compound, S-methyl-methionine (SMM), which is itself produced during malting. When a malt is roasted or toasted, the SMM is reduced beforehand and does not manifest as DMS in the wort, which explains why it is more prevalent in pale lagers. In other styles, DMS is a common off-flavor, and can be caused by poor brewing practices or bacterial infections. DMS is continuously produced in the wort while it is hot and is usually removed by vaporization during the boil. If the wort is cooled slowly these compounds will not be removed from the wort and will dissolve back in. Thus it is important to not completely cover the brewpot during the boil or allow condensate to drip back into the pot from the lid. The wort should also be cooled quickly after the boil, either by immersing in an ice bath or using a wort chiller. When caused by bacterial infection, DMS has a more rancid character, more liked cooked cabbage than corn. It is usually the result of poor sanitation. Repitching the yeast from an infected batch of beer will perpetuate the problem.

- Vegetal (cooked, canned, or rotten vegetables)

HowToBrew: Like diacetyl in ales, DMS is common in many light lagers and is considered to be part of the character. DMS is produced in the wort during the boil by the reduction of another compound, S-methyl-methionine (SMM), which is itself produced during malting. When a malt is roasted or toasted, the SMM is reduced beforehand and does not manifest as DMS in the wort, which explains why it is more prevalent in pale lagers. In other styles, DMS is a common off-flavor, and can be caused by poor brewing practices or bacterial infections. DMS is continuously produced in the wort while it is hot and is usually removed by vaporization during the boil. If the wort is cooled slowly these compounds will not be removed from the wort and will dissolve back in. Thus it is important to not completely cover the brewpot during the boil or allow condensate to drip back into the pot from the lid. The wort should also be cooled quickly after the boil, either by immersing in an ice bath or using a wort chiller. When caused by bacterial infection, DMS has a more rancid character, more liked cooked cabbage than corn. It is usually the result of poor sanitation. Repitching the yeast from an infected batch of beer will perpetuate the problem.

NOTE: Hop flavor in beer is often mistaken as vegetal - Know the difference !!!

- Lightstruck (skunked)

- Lightstruck or skunky is the aroma and taste due to the presence of the same mercaptans that are found in the scent glands of skunks. These compounds are formed when ultraviolet light cleaves an isohumulone molecule, and the resulting radical combines with a sulfur compound. Basically when sunlight or fluorescent light meets the remnants of hops in beer, this is the result. Brown bottles protect the beer to some degree, but not completely. This is not desirable in any beer, but is quite common, especially in European exports (i.e. Heineken). This reaction can happen quickly, as in seconds on a bright sunny summer day. Miller uses a clear bottle, but they use a UV resistant strain of hops.

HowToBrew: Skunky or cat-musk aromas in beer are caused by photochemical reactions of the isomerized hop compounds. The wavelengths of light that cause the skunky smell are the blue wavelengths and the ultraviolet. Brown glass bottles effectively screen out these wavelengths, but green bottles do not. Skunkiness will result in beers if the beer is left in direct sunlight or stored under fluorescent lights as in supermarkets. In beers which use pre-isomerized hop extract and very little flavoring hop additions, the beer will be fairly immune to damage from ultraviolet light.

- Sweet vs Malty (i.e. Sugary Sweetness vs Malty Sweetness)

Sweetness is a taste perceived primarily at the tip of the tongue and is due to the presence of sugars. High levels of residual sugars can result from a flocculant or low-attenuating yeast health linked to low FAN levels or low levels of dissolved oxygen prior to pitching. High gravity worts, high dextrin content and the addition of lactose also play a role in determining sweetness of the finished beer. The

appropriate level is style-dependent, with high levels in most strong beers, and lower levels in most small beers, American light lagers and lambics.

That is the basic explanation of what sweetness is, but it doesn't explain the confusion that surrounds the use of the terms "malty" and "sweet". After this topic was discussed in a previous study group, I still didn't feel that it had been properly addressed. Some of those in the group were looking at me like I had two heads and perhaps did not understand my confusion, so I'll try to explain it more here, as well as offer a legitimate answer to my question. I sought out the thoughts of Grand Master Judge Gordon Strong on this topic, and after some discussion, I think it can be summed up as stated below.

The following explanation may be a little surprising to some. I honestly don't think that most people (experienced judges included) really understand this topic, because you will hear the terms "malty" and "sweet" used interchangeably by many, and/or these terms will be used to describe different types of a perceived sweetness in the flavor of a beer (i.e. "its sweet, but not malty", or vice versa, "its malty, but not sweet"). As you can see below, these types of descriptions are inaccurate.

- When evaluating a beer, "sweetness" (i.e. residual sugars) may be detected as:
  - an aroma,
  - an initial flavor, and
  - an aftertaste / finishing flavor.

- The general term "sweet" should be saved for describing the aftertaste / finish. This term is in contrast to "dry", just like in wine descriptions. A beer may finish sweet or dry. A beer that finishes sweet may be described overall as a sweet beer.

- In the aroma and initial flavor of a beer, the sweetness is primarily going to be either malty or sugary, but it is typically malty unless some adjuncts, lactose, candi sugar, fruit, spices, etc. have been used in the beer. When describing this sweetness, avoid the term "sweet" alone, and describe the type of sweetness (i.e. generally a "malty sweetness", but it could also be a fruit sweetness or sugary sweetness, etc.).

- Further describing the malty sweetness in either aroma or initial flavor can, and should, be broken down into its more descriptive subcategories of bready, biscuity, caramel, toffee, chocolate, dark fruit (i.e. raisins, plums, etc.), molasses, etc. These variations are due to the types and amounts of malts used in the beer.

- Thus, if using the type of sweetness (i.e. malty) to describe the aroma and initial flavor, and the terms "sweet" or "dry" to describe the finish of a beer, a beer with some moderate to dominant initial sweetness may be described as:
  - malty and sweet - OR - malty and dry.

On some rare occasions where the initial sweetness is not from malt, the description may be:
  - sugary and sweet - OR - sugary and dry.

- Note: A malty beer with a dry finish is more drinkable than a malty beer with a sweet finish. Malty beers with sweet finishes seem heavier and are typically considered "sipping beers."

- Oxidized (paper, cardboard)

- Oxidation is perceived as both the aroma and taste of wet paper or cardboard. Technically it is the compound aldehyde, 2-transnonenal. It is caused from the oxidation of higher alcohols. Oxygen can be an asset to beer and assists with fermentation if added after the wort has cooled and prior to fermentation. However, if oxygen enters the wort prior to cooling (hot side aeration due to splashing or agitating the hot wort), or after fermentation (cold side aeration due to splashing or agitating the beer when kegging or bottling), it has an adverse affect on the finished product. Nearly all beer has some oxygen in it and over time it will slowly oxidize the beer. Abusing the beer through heating and cooling

cycles will speed up this oxidation process. It is a common off-flavor in older commercial beers. Oxidation is almost always undesirable, but some high gravity beers like Barleywines, Old Ales, and Scotch Ales can actually benefit from a little oxidation of the melanoidins, which produces a dry sherry-like aroma and taste.

HowToBrew: Oxidation is probably the most common problem with beer including commercial beers. If the wort is exposed to oxygen at temperatures above 80°F, the beer will sooner or later develop wet cardboard or sherry-like flavors, depending on which compounds were oxidized. See the discussion of oxygen and the wort in Chapter 6 - Yeast.

- Phenolic (medicinal, band-aid)

- This is the aroma and taste of Band Aids™, medicine chest, disinfectant, etc. 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 alkaline water. Chlorinated water or sanitizer residue are also possible sources of chlorophenols. Phenolic flavors are generally never desirable, with the exception of the clove-like, vanilla-like, or slightly smoky flavors and aromas in Bavarian wheat beers and the spicy, peppery flavors in some Belgian beers.

HowToBrew: These flavors are often described as mediciney, Band-Aid™ like, or can be spicy like cloves. The cause are various phenols which are initially produced by the yeast. Chlorophenols result from the reaction of chlorine-based sanitizers (bleach) with phenol compounds and have very low taste thresholds. Rinsing with boiled water after sanitizing is the best way to prevent these flavors.

> The Judging Process and How to Judge Beer 101

- This covers what you need to know for the other part of Question 1 on the exam, as well as a brief discussion of the judging process. Walk through a blind beer together (Light Lager) and discuss each section of the score sheet.

AHA/BJCP Sanctioned Competition Program

Judge Procedures Manual - Updated: September 2008

Introduction

The American Homebrewers Association (AHA) and the Beer Judge Certification Program (BJCP) have been involved in sanctioning and running thousands of homebrew competitions. The information in this manual is based on many years of experience with homebrew competitions.

The intent of this manual is to clarify the roles of judges and stewards in order to accomplish three primary goals for homebrew competitions:

- To give the entrants valuable feedback on the quality of their brew as perceived by the judges in order to enhance the quality of homebrewing.
- To provide training for aspiring beer judges.
- To maintain valid standards of judging.

Judge and Steward Definitions

Judge Director

The judge director manages all judging operations for the competition. The judge director recruits judges, assigns judges to categories, and handles all other judging issues. In many cases, the competition organizer is also the judge director, but for large competitions, it is best to split the two jobs. Once underway, the judge director may be able to judge if he has no knowledge of entries and entrants.

Head Judge

Each flight of judges should have one judge designated as the head judge for that group of judges. The head judge's responsibilities include reviewing all scores and paperwork for accuracy. The head judge should review the style guidelines for the categories being judged and go over the scoring guidelines with the other judges. The head judge should take the lead in discussions to form a consensus on scores. Once judging is completed, the head judge should make sure scoresheets, cover sheets, and flight sheets are turned in to the judge director or competition organizer.

Judge

A judge is any participating person whose scores count in evaluating entries. BJCP judges are participants in the Beer Judge Certification Program who have taken the BJCP exam. It is recommended that novice judges be paired with BJCP judges.

Novice Judge

A novice judge is someone relatively inexperienced at judging beer in competition, but who has been approved to evaluate entries by the competition organizer. Novice judges are not members of the BJCP. Participating in a homebrew competition with experienced judges is an excellent educational opportunity for aspiring judges.

Steward

A steward serves to help the judges. Whenever possible, a steward should be assigned to each flight of judges. Most flights have between two and four judges; three is optimal. Stewards ensure that the judges have all of the judging materials they need including judging forms, pencils, cups, bottle openers, water, and bread or crackers. During the judging, they double check all of the competition forms to be sure they have been properly filled out and that the math has been done correctly.

Judging is an intensive process, and the stewards play a key role in making sure all goes smoothly. Serving as a steward is an excellent means of learning about beer evaluation and is usually the first step in becoming a beer judge.

Guidelines for Conduct

Judges, stewards and other volunteers must maintain uniform standards.

Participant Conduct, Responsibilities, and Expectations

Judges, stewards and staff should all realize that when they volunteer to help in a competition that they are making a commitment to the Organizer, who then relies on them to help make the competition a success. BJCP Members and all other volunteers should make every effort to fulfill their commitments. If for some reason a volunteer cannot attend as planned, it is the volunteer's responsibility to notify the Organizer as soon as possible. Volunteers that neglect their duties (particularly if they fail to notify an Organizer in advance that they cannot attend) should not be surprised if they are not invited back to participate in future competitions.

Competition judges and volunteers should behave in a civil and forthright manner. Follow these guidelines to make competition judging fair and fun for everyone involved:

- Be prompt to all sessions.
- Do not become intoxicated during any portion of a judging session or event while serving as a judge.
- Do not use tobacco, perfume, cologne or aftershave in the judging room.
- Speak in a hushed conversational tone to avoid distracting others.

Judges

- Do not judge in a category you have entered.

- Review the style guidelines for the category you are judging before you begin.
- Discuss the general characteristics of an entry, but do not attempt to influence opinions of other judges. Be patient, tactful, and respectful of others. The head judge may approve continued discussions if appropriate.
- Seek guidance from the judge director if you notice another judge practicing any questionable behavior.
- Strive to maintain anonymity of entries.

Novice Judges

Novice judges may evaluate entries only as authorized by the judge director. Follow all other guidelines for judges.

Stewards

- Assist organizers and judges as needed.
- Make sure all required materials are present at the assigned judging table.
- Ensure that everything required for judging, including openers, cups, pencils, scoresheets, ice, dump buckets, water, and crackers/bread is at the assigned table prior to the scheduled start for the judging.
- Bring beer for the given flight to the judging table. Double check to be sure all of the entries assigned to the given flight are in your box. Arrange the bottles in sequential order, as specified by the judges.
- Remember that some beers will contain sediment—treat them gently.
- Maintain proper serving temperatures during judging. 50° F is a good temperature for ales. Lagers may be served colder. Use ice as needed to maintain proper serving temperature.
- Replenish bread, water, cups, forms, etc. as needed.
- Empty dump buckets as needed or at the request of the judges.
- Check scoresheets, cover sheets, and flight sheets to be sure they have been fully and accurately filled out. Staple the cover sheets to the scoresheets.
- Do not empty opened bottles or discard bottle caps until instructed to by the judges. Some entries may need additional evaluation at the end of the flight.
- The judges may permit stewards to sample the entries along with them, however, stewards must refrain from attempting to influence the judging.

Preparing For Judging

Before you can evaluate a brew, prepare yourself. Try to be well rested, mentally fresh and eager for the evaluation session. Be aware that some medications may impair your ability to perceive certain stimuli. If you are taking medication that could negatively influence your ability to judge, please inform the judge director that you are unable to judge.

Avoid eating very spicy or greasy foods; applying cologne, perfume or aftershave; and using lipstick or lip balms several hours before you begin a judging session. All of these substances can markedly alter your perception of beer characteristics.

Brush your teeth, gums, and tongue before judging. Try to avoid strong flavored toothpastes, which can alter your perception of beer flavors (you can substitute water and baking soda for toothpaste). Do not use mouthwash or antiseptic rinse before judging.

Be sure not to underrate the less aggressive beer styles while evaluating them. Commercial products used for calibration beers are intended help judges narrow their scoring to within an acceptable range prior to commencing with the judging. Calibration beers are not intended to serve as a standard against which entries should be judged, instead entries should be judged based on the standard set by the style guidelines.

Mechanics of Judging

Judge Director

- Allow 2 ½ hours for each session. Experienced judges can evaluate 12 entries in two hours—approximately 10 minutes per entry.
- Try to limit flights to 12 or fewer entries. Judging more than 12 entries per flight can lead to palate fatigue.
- Arrange flights so judges evaluate more delicately flavored and lighter-bodied beers first and the most assertively flavored and full-bodied beers last.

- Select the most qualified judge in each flight to be the head judge. This person is in charge of assigning the consensus score to each entry.
- Prior to the start of judging, the Judge Director should lead an "judges' instructions" session, covering the rules and judging procedures for the competition.

Judges

- Head judge should read aloud from the BJCP Beer Style Guidelines all aspects of the styles being judged. Judges should discuss and reach consensus on the guidelines before commencing judging. Judge only according to the style guidelines, regardless of any personal knowledge or opinions of the styles being judged.
- Protect entries from light and agitation. Help ensure proper serving temperatures are maintained.
- Confirm that the numbers on the caps and labels match.
- Write legibly. Be sure to write your name and judging info at the top of each scoresheet.
- Use clear, concise, and meaningful language when filling out the scoresheet. Your comments should help the entrant improve upon his/her brewing.
- Inspect bottles prior to opening for fill level, evidence of infection (ring around the neck), or bottle conditioning. Make note of anything unusual. Bottle inspection does not affect scoring.
- Wait until all judges are ready before opening the first entry. Completely judge the entry before moving on to the next. Try to reserve some of the entry in the bottle in case the entry needs to be reevaluated when determining the top entries in the flight.
- Pour in a manner that gives each entry its optimum appearance, keeping in mind some entries may be under or over-carbonated.
- Sniff beer immediately after pouring to ensure proper evaluation of volatile aromatics. If you need to re-evaluate aroma after your initial evaluation, swirl the entry in the cup to release volatiles.
- Evaluate the appearance immediately after evaluating aroma. Make note of head, head retention, color, and clarity.
- Taste the entry after your initial evaluation of aroma and appearance. Attempt to isolate as many flavor components as you are able, making note of each of them and their appropriateness to style.
- After noting your initial impressions of aroma, appearance, and flavor, reevaluate the entry and note any changes or additions to your initial comments, then fill out the overall impression section of the scoresheet.
- Once all of the judges at the table have finished filling out their scoresheets, they should discuss the entry and their scoring. Keep in mind that some people are more sensitive to certain flavor and aroma compounds (e.g. diacetyl) than others. Scores should be within seven points, and preferably within five or fewer points. Adjust scoring as necessary, and note the final assigned score on the cover sheet and flight sheet. Final assigned scores are not necessarily an average of the individual scores.
- Use French-style bread or unsalted crackers and water between entries to cleanse the palate.
- Remove any offensive smelling entries (e.g. strongly skunked) from the judging table to avoid influencing judging of the remaining entries.
- Judge comments should be fair and constructive. Snide or rude comments on scoresheets are absolutely unacceptable. Keep in mind that a "bad" entry could be an unfortunate contamination or inconsistency limited to a single bottle. Your comments should be extensive and aimed at helping the entrant to improve upon his/her brewing.
- Judge each entry as presented. If an entry seems to be entered in the wrong category, consult with the judge director or competition organizer to make sure it was properly sorted and entered in the database before continuing. Do not judge any entry according to a style other than the style you have been assigned. Scores and comments must reflect appropriateness to the style entered.
- Judge each entry to the best of your ability with the information provided. Entry labels and pull sheets often lack information (e.g. specialty ingredients, or base style) that would complement judging because the entrant did not include the proper information or the entry form was illegible. Judge the entry as best you can.
- Judges may not disqualify any entry. Questionable entries should be referred to the judge director or competition organizer for a final decision.

Scoresheet Comments

As a judge, the product of your work is the scoresheet that is returned to the entrant. Entrants trust you to provide legible, accurate, and thorough evaluations of their entries. They have paid entry fees and possibly shipping costs to submit their entries. Keep in mind that your comments will not only affect the entrants' impressions of you, but also of the competition and the competition organizers. Fill out scoresheets as you would have other judges fill out scoresheets for your own homebrew.

Judges' comments must include:

- Evaluations of the sensory aspects of the entry and how those aspects relate to the Style Guidelines.
- Comments that are constructive and reflect knowledge of the brewing, fermenting, bottling, and handling processes.
- Information on how to improve the entry as warranted.
- Constructive feedback and encouragement for the entrant in all cases.

Judges' comments must **NOT** include:

- Assumptions about the brewing process or ingredients without qualifying statements such as "If you used…" or "Did you…?"
- Derogatory, rude, and/or snide comments.

Supplies for Competition Judging

- Judge registration forms
- Scoresheets, cover sheets, and flight sheets. Make between two and three copies of the scoresheet per entry received, the exact number depends on how many judges are assigned to judge each flight. You will need one cover sheet per entry. Make one copy of the flight sheet per flight, keeping in mind that some categories may require more than one flight. Make extra copies of all competition forms.
- BJCP Style Guidelines. Make one-to-two copies per table. You may choose to only print the portion of the guidelines for the styles assigned to each table. Keep in mind that some categories (Fruit Beer, Spice/Herb/Vegetable Beer, Smoke-Flavored and Wood-Aged Beer, Specialty Beer) will require the entire guidelines for judging.
- Pencils
- Staplers and Staples
- Clear hard plastic cups or "beer-clean" glassware. Plan on at least four cups per entry. Judging cups are often used for water, so you may want to have water glasses on hand.
- Bottle openers (one per flight) and at least one cork screw.
- Pitchers for water (one per table).
- French-style bread or unsalted crackers. You will need a bread knife if using bread and plates or baskets to hold the bread or crackers.
- Dump buckets for excess beer and "gushers."
- Ice for chilling entries as necessary.
- Table signs denoting categories being judged at each table.
- Plastic trash bags (sturdy enough to hold wet trash and ice without leaking).
- Tables – generally one per category being judged in the largest judging session.
- Paper towels, rags, or sponges for cleaning

QUESTION POOL (with answers):

1	T	A competition organizer may serve as the judge director and may also serve as a judge, provided this person has no knowledge of entries and entrants.
2	T	A judge director may serve as a judge, provided this person has no knowledge of entries and entrants.
3	T	A competition organizer may serve as the judge director, provided this person has no knowledge of the association between entries and entrants.
4	F	A judge director may not serve as a judge, even if this person has no knowledge of entries and entrants.
5	F	A competition organizer may not serve as a judge, even if this person has no knowledge of entries and entrants.

6	T	A judge director may serve as the competition organizer and may also serve as a judge, provided this person has no knowledge of entries and entrants.
7	T	If an individual has knowledge of entries and entrants they may not serve as a judge.
8	F	A competition organizer may serve as a judge, provided this person does not divulge information about entries and entrants to other judges.
9	T	The "head" judge at a table should try to tutor apprentice or lower-rank judges if time permits.
10	F	The steward at the table has sole responsibility for completing the Cover Sheets for beers in each flight.
11	T	The "head" judge at the table has sole responsibility for completing the Cover Sheets for beers in each flight.
12	T	The "head" judge at a table should fill out Cover Sheets for beers in his or her flight as directed by the competition management.
13	F	The "head" judge at a table has no responsibility for filling out Cover Sheets for beers in his or her flight as directed by the competition management.
14	T	The "head" judge at the table has sole responsibility for completing the Cover Sheets for beers in each flight but with the agreement of the steward may delegate the completion of the Cover Sheets to the steward.
15	T	The "head" judge, with the agreement of the steward, may delegate filling in of the Cover Sheets for beers in his or her flight to the steward.
16	F	There is no need for the "head" judge to complete the Flight Summary Sheet - the competition organizer can obtain all that information from the cover sheets.
17	T	If possible, there should be at least one BJCP-ranked judge in every flight.
18	T	When novice judges evaluate entries in a competition, each novice should be paired with a BJCP judge.
19	T	Novice judges may only evaluate entries if authorized by the judge director, and novices should be paired with BJCP judges when possible.
20	T	To reduce stray odors and flavors present, beverages and foods other than water, bread or crackers should not be brought to the judging table.
21	F	It is acceptable to bring food items other than bread, crackers, and water to the judging table.

22	F	You must filter out strong scents from fellow judges or the environment from your mind rather than discussing the problem with the competition organizer.
23	T	Strong scents from the environment or other judges or stewards should be brought to the attention of the competition organizer.
24	F	Because entries cannot have any identifying marks, it is OK for a judge to judge beers in a category he or she has entered.
25	T	If a judge is assigned to judge a category that he/she has entered, that judge should ask the competition organizer to reassign him/her to another category.
26	F	If assigned to judge a category that he or she has entered a judge should just judge the category without notifying the judge director or competition organizer.

27	F	Judges should not review the sub-style being judged from the BJCP Style Guidelines while at the judging table prior to judging that style.
28	T	Judges may invite stewards to taste the beers in a flight, if there's enough sample to share.
29	T	It is acceptable to change the order in which you judge the beers on your flight sheet from how it was printed.
30	F	Beers must be evaluated in the sequence specified on the flight sheet.
31	F	If you have eaten spicy or greasy food within a few hours prior to judging, you should use mouthwash or antiseptic rinse before judging.
32	T	You should avoid eating spicy or greasy food within a few hours prior to judging.
33	T	Spicy and/or hot foods should be avoided prior to a judging event because they can reduce a judge's sensitivity to the aromas and flavors of beer.
34	T	Perfumed shampoos and colognes should be avoided prior to a judging event because they can reduce a judge's sensitivity to the aromas of beer.
35	F	It is a good idea to take a decongestant prior to a judging event to increase your sensitivity to the aromas of beer.
36	F	Calibrations beers are selected to be the standard against which entries should be judged.
37	T	It is the responsibility of the "head" judge, in consultation with the other judges in a flight, to assign a consensus score to each entry.
38	F	It is not necessary for scores produced by the judges on a panel to be within seven points or each other.
39	T	After discussing the initial scores, judges should adjust their final scores to be within seven points.
40	T	Judges must adjust their scores to be within seven points (or less if directed by the competition director) of each other as part of developing a consensus score for the beer.
41	T	The consensus score assigned to the beer is not necessarily an average score.
42	T	It is important to be quick as well as to write your scoresheets thoroughly and completely.
43	T	On average, experienced judges should be able to completely evaluate a beer, including arriving at a consensus, in 10 minutes.

44	F	When there is a discrepancy in the scores for a given beer, the lower-ranked judges should yield to the opinion of the highest ranked BJCP judge at the table.
45	T	It is acceptable to remove offensive smelling entries from the judging table after they have been evaluated.
46	F	A judge must disqualify an entry if it has raised lettering or the cap has identifying marks.
47	F	A judge may disqualify an entry if it has an improper bottle or cap.
48	T	Only the judge director or competition organizer can disqualify an entry.
49	T	The results of the bottle inspection does not affect the scoring.
50	T	Snide or rude comments are unacceptable on scoresheets.

51	T	Pour each entry in a manner that gives it its optimum appearance, keeping in mind that some entries may be over- or under-carbonated.
52	F	When you suspect an entry has been placed in the wrong flight based on the style being judged, you should request that it be judged in a different flight instead.
53	T	When you suspect an entry has been placed in the wrong flight based on the style being judged, you should consult with the judge director or competition organizer.
54	T	Sniff the entry immediately after pouring to ensure proper evaluation of volatile aromatics.
55	F	There is no need to sniff the aroma immediately after pouring the entry into the glass.
56	T	Complete judging of one entry before moving on to the next entry.
57	F	It is not necessary to offer any feedback for improvement if you score a beer above 40.
58	T	It is common practice to refrain from sharing your thoughts while judging a beer until the other judges have completed their scoresheet.
59	F	If you are very familiar with a beer style, it is preferable to disregard the BJCP Style Guidelines and rely on your personal expertise instead.
60	F	If rushed, it's OK to write only comments and an overall score on a scoresheet, leaving the scores for the subsections blank.
61	F	If rushed, it's OK to write only 1-2 comments on a scoresheet as long as the numeric score is filled out.
62	F	If a beer is a "gusher" or has an unpleasant aroma upon opening, a judge may assign a courtesy score of 13 without tasting and commenting on the characteristics of the beer.
63	T	All beers should be tasted and scored, even if they are "gushers" or have an unpleasant aroma upon opening.
64	F	It is appropriate to penalize the entrant if the beer is not served at the proper temperature.
65	T	If the beers are not served at the proper temperature work with the competition staff to resolve the problem.
66	F	In each section of a scoresheet, you should only comment upon the most prominent features of each entry, not subtle characteristics.
67	F	Judges' comments must not include phrases like "if you used .."

68	F	Judges' comments must not include phrases like "did you .."
69	T	Judges' comments must include a complete evaluation of the sensory aspects of the entry and how those aspects relate to the style guidelines.
70	T	Judges' comments should be constructive and reflect knowledge of the brewing, fermentation, bottling, and handling process.
71	T	Judges' comments need to provide information on how to improve the entry as warranted.
72	T	Scores should not be assigned to the aroma section immediately because the entry's aroma profile may change over time.

73	F	Each section must be scored with a number prior to writing any comments, to best capture your first impressions.
74	F	To assure objectivity, you should never write your full name or put contact information on the scoresheet.
75	T	You should write your full name and judging rank on each scoresheet.
76	T	You should always fill out the "Style Scales" on the scoresheet, as a good check against your scores.
77	F	You should use the "Overall Impression" section of the scoresheet to refer to how the entry compares to other entries in the flight.
78	T	You should use the "Overall Impression" section of the scoresheet to comment on how much you enjoyed the entry or provide suggestions for how to improve the beer.
79	T	A score in the "Outstanding" range is reserved for beers that not only lack flaws but also have the hard-to-define "extraordinary" character that great beers have.
80	F	The courteous lower limit for scores assigned to "Problematic" beers is 6 points-one point for each section of the scoresheet.
81	T	The courteous lower limit for scores assigned to "Problematic" beers is 13 points.
82	F	If judges require more "samples" than one bottle to judge a flight, the "head" judge should ask the steward to request a second bottle from the cellar master.
83	F	It is preferable to use ink on scoresheets so that your scores and comments cannot be altered by contest personnel.
84	T	It is preferable to use mechanical pencils, rather than wooden pencils, on scoresheets so that wood odors do not interfere with beer aromas.
85	T	It is acceptable to request a second bottle to give the entry a fair chance at an accurate judging if a beer is a "gusher" or tastes infected.
86	T	Entrants may contact the judge, the competition director, or their BJCP Regional Representative if they are dissatisfied with any aspect of their scoresheets.
87	T	When your flight has finished, you should avoid having conversations that might distract other judges who have not yet finished their flights.
88	F	When your flight has finished, it is OK to visit other flights still in progress to see how beers you have entered are faring.
89	T	Because it may have been entered by a person in the room, it is polite to refrain from publicly deriding a "problem" beer that you have scored during a competition.
90	T	Judges from outside the table should not be consulted on a beer unless the judges at the table cannot reach a consensus score, and then only if they all agree to the consultation.

OTHER CONSIDERATIONS REGARDING THE BJCP, JUDGING & STYLES:

- The BJCP is all about establishing guidelines for creating consistent competitions and a certification program for recognizing judges and judge levels. It is appropriate to be concerned with BJCP style guidelines in tech sessions like this one and primarily at BJCP sanctioned competitions. The BJCP

style guidelines don't always matter (i.e. I love this beer, but it doesn't really fit a style - great, but don't enter it in a BJCP competition and expect to win - if you are a pro brewer, then put it in the GABF or the WBC - if a homebrewer, just enjoy it).

- Commercial beers don't always fit nicely into a BJCP style guideline (just as many homebrews don't either, but in general homebrewers tend to brew towards guidelines more than pro brewers - just a general observation). Domestic swill beers will often be called Pilsners. Commercial "Ice" beers are not really "Eis" beers. Lagers are sometimes called Ales. Have you ever had a commercial Porter that was really a roast laden Stout, or a lighter Brown Mild ? Have you ever had a Weizen in a brewpub and it was actually an American Wheat (i.e. no clove phenolic and banana at all) ? It would be great if everyone could get on the same page, but that will likely never happen, so just focus on styles when it matters (i.e. when among fellow judge geeks or at a competition). Otherwise, it is enough to drive you crazy. Besides, styles aren't for everyone. The Belgians hate the whole concept for instance. But to judge beer and hold competitions, there have to be standards and guidelines or it is just a beauty contest.

- In general, one commercial beer does not define a style. Be aware that there is a range of beers and style parameters that describe a style. If a beer is in the range and is well made, give it the benefit of the doubt, even if it doesn't taste just like that commercial beer you have in mind.

- It is important to note that not everyone can taste and smell the subtleties necessary to be a good beer judge. If you smoke cigars, eat hot peppers like candy, drink lots of scalding hot black coffee and / or whisky on a regular basis, it may take a major flavor to even move your tasting meter. If you have chronic sinus problems, you may not be able to smell anything and if you can't smell, you can't taste. I think as long as people with these issues are aware of these things, I think anyone can learn to pick up certain flavors and aromas, but it takes a lot of listening to others in a group setting like this. If the majority of the group is picking something up and you aren't, you may need to find it, regardless of how subtle it is to you, and then program your brain to identify it again in the future.

- Being a judge is not just about deciding what beers should win a competition. More importantly, the BJCP is focused on having judges that can provide constructive feedback on how to improve the beer, how to correct faults, and to encourage the brewer to learn and continue brewing. A good judge always tries to be positive and helpful.

- Many people come into BJCP study groups thinking they know a fair amount about beer, because they have "tasted" a lot of beer. Tasting and judging are two completely different things. Tasting, as we will be doing, can be very constructive IF it is in the context of the BJCP style guidelines, but even then, it is no substitution for judging. This will become clearer as the course develops.

- With the above being said, some people that haven't taken the exam can still be extremely knowledgeable beer people, so never discount the knowledge of certain people that are not BJCP ranked judges.

VARIOUS CONSIDERATIONS REGARDING TASTE AND SMELL:

- SCIENTISTS now believe that human beings acquired the sense of taste as a way to avoid being poisoned. Edible plants generally taste sweet, harmful ones bitter.

- Taste buds offer a limited means of detection, however, compared with the human olfactory system, which can perceive thousands of different chemical aromas. Indeed, "flavor" is primarily the smell of gases being released by the chemicals you've just put in your mouth. The aroma of a food can be responsible for as much as 90 percent of its taste.

- The act of drinking, sucking, or chewing a substance releases its volatile gases. They flow out of your mouth and up your nostrils, or up the passageway in the back of your mouth, to a thin layer of nerve cells called the olfactory epithelium, located at the base of your nose, right between your eyes. Your brain combines the complex smell signals from your olfactory epithelium with the simple taste signals from your tongue, assigns a flavor to what's in your mouth, and decides if it's something you want to eat.

- Today's sophisticated spectrometers, gas chromatographs, and headspace-vapor analyzers provide a detailed map of a food's flavor components, detecting chemical aromas present in amounts as low as one part per billion. The human nose, however, is even more sensitive. A nose can detect aromas present in quantities of a few parts per trillion -- an amount equivalent to about 0.000000000003 percent. Complex aromas, such as those of coffee and roasted meat, are composed of volatile gases from nearly a thousand different chemicals. The smell of a strawberry arises from the interaction of about 350 chemicals that are present in minute amounts. The quality that people seek most of all in a food -- flavor -- is usually present in a quantity too infinitesimal to be measured in traditional culinary terms such as ounces or teaspoons. The chemical that provides the dominant flavor of bell pepper can be tasted in amounts as low as 0.02 parts per billion; one drop is sufficient to add flavor to five average-size swimming pools.

- A typical artificial strawberry flavor, like the kind found in a Burger King strawberry milk shake, contains the following ingredients: amyl acetate, amyl butyrate, amyl valerate, anethol, anisyl formate, benzyl acetate, benzyl isobutyrate, butyric acid, cinnamyl isobutyrate, cinnamyl valerate, cognac essential oil, diacetyl, dipropyl ketone, ethyl acetate, ethyl amyl ketone, ethyl butyrate, ethyl cinnamate, ethyl heptanoate, ethyl heptylate, ethyl lactate, ethyl methylphenylglycidate, ethyl nitrate, ethyl propionate, ethyl valerate, heliotropin, hydroxyphenyl-2-butanone (10 percent solution in alcohol), a-ionone, isobutyl anthranilate, isobutyl butyrate, lemon essential oil, maltol, 4-methylacetophenone, methyl anthranilate, methyl benzoate, methyl cinnamate, methyl heptine carbonate, methyl naphthyl ketone, methyl salicylate, mint essential oil, neroli essential oil, nerolin, neryl isobutyrate, orris butter, phenethyl alcohol, rose, rum ether, g-undecalactone, vanillin, and solvent.

- Although flavors usually arise from a mixture of many different volatile chemicals, often a single compound supplies the dominant aroma. Smelled alone, that chemical provides an unmistakable sense of the food. Ethyl-2-methyl butyrate, for example, smells just like an apple. Many of today's highly processed foods offer a blank palette: whatever chemicals are added to them will give them specific tastes. Adding methyl-2-pyridyl ketone makes something taste like popcorn. Adding ethyl-3-hydroxy butanoate makes it taste like marshmallow. The possibilities are now almost limitless. Without affecting appearance or nutritional value, processed foods could be made with aroma chemicals such as hexanal (the smell of freshly cut grass) or 3-methyl butanoic acid (the smell of body odor).

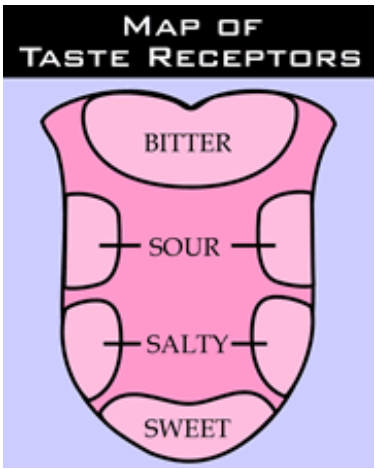
- A well-made flavor compound will have a "top note" that is often followed by a "dry-down" and a "leveling-off," with different chemicals responsible for each stage. The taste of a food can be radically altered by minute changes in the flavoring combination.

- In order to give a processed food a taste that consumers will find appealing, a flavorist must always consider the food's "mouthfeel" -- the unique combination of textures and chemical interactions that affect how the flavor is perceived. Mouthfeel can be adjusted through the use of various fats, gums, starches, emulsifiers, and stabilizers. The aroma chemicals in a food can be precisely analyzed, but the elements that make up mouthfeel are much harder to measure. How does one quantify a pretzel's hardness, a french fry's crispness?

- MISC: Distinctions between artificial and natural flavors can be arbitrary and somewhat absurd, based more on how the flavor has been made than on what it actually contains. Amyl acetate, for example, provides the dominant note of banana flavor. When it is distilled from bananas with a solvent, amyl acetate is a natural flavor. When it is produced by mixing vinegar with amyl alcohol and adding sulfuric acid as a catalyst, amyl acetate is an artificial flavor. Either way it smells and tastes the same.

- MISC: One of the most widely used color additives -- whose presence is often hidden by the phrase "color added" -- violates a number of religious dietary restrictions, may cause allergic reactions in susceptible people, and comes from an unusual source. Cochineal extract (also known as carmine or carminic acid) is made from the desiccated bodies of female Dactylopius coccus Costa, a small insect harvested mainly in Peru and the Canary Islands. The bug feeds on red cactus berries, and color from the berries accumulates in the females and their unhatched larvae. The insects are collected, dried, and ground into a pigment. It takes about 70,000 of them to produce a pound of carmine, which is used to make processed foods look pink, red, or purple. Dannon strawberry yogurt gets its color from carmine, and so do many frozen fruit bars, candies, and fruit fillings, and Ocean Spray pink-grapefruit juice drink.

WHAT WE TASTE IN BEER:



- We can only actually “taste”… Sweet - Salty - Sour - Bitter.
    - “Taste” is experienced in the mouth.
    - “Flavor” is a “composite experience” that includes the smell, Sight, mouthfeel, etc.
    - Thus, the millions of other “flavors” come from our sense of smell. (recall that a cold may cause you to lose your sense of taste)

- Discuss tongue map (not perfectly accurate, but still works).
    - Discuss other / new flavors being considered (fat, carb. Umami, etc.)

- Major Components we Taste in Beer:

    - Water = Hard, soft, minerally, high sulfates, etc.
        - 85% of beer, so a major flavor component.

    - Malt = Grains = Barley (mostly), Wheat, Rye, Corn, Rice
        - Sweet, bready, toasty, grainy characters.

    - Hops = American and European varieties
        - Provide bitterness to balance the malt.
        - Provide a flavor as well (spicy, floral, herbal, etc.).

    - Yeast = Many, many varieties.
        - Fruity esters, spicy or clove phenols, etc.

    - Specialty Ingredients when used.

HOW TO TASTE BEER FOR EVALUATION AND JUDGING PURPOSES:

- Enjoy the **Aroma** - Swirl (if possible) and take a Deep Sniff.

- Enjoy the **Appearance** - Color, Head, Clarity, etc.

- Enjoy the **Flavor** - Malt, Hops, Balance, etc.
  - Close mouth and roll all around the tongue.
  - Keep mouth closed when you swallow and exhale through your nose.

- Enjoy the **Mouthfeel** - Body, Finish, Alcohol Warmth, etc.
  - Sweet or Dry Finish = Often the level of bitterness.

- IMPORTANT: Personal preference has nothing to do with proper beer judging !!!

>Beer Styles 1

1. Light Lager

   1A. Lite American Lager
   - Miller Lite - Note DMS.

   1B. Standard American Lager
   - Miller High Life

   1C. Premium American Lager
   - Miller Genuine Draft

   1D. Munich Helles
   - Weihenstephaner Original Lager

   1E. Dortmunder Export
   - Bells Lager of the Lakes

2. Pilsner

   2A. German Pilsner (Pils)
   - Bitburger (in cans)

   2B. Bohemian Pilsener
   - Pilsner Urquell
   - Sample a Skunked Example as well.

2C. Classic American Pilsner
- Bohemia - NOT A CLASSIC
EXAMPLE !!!

> HOMEWORK - Old Sample Exam Questions (complete on your own) - Review

x. Describe the purpose of the Beer Judge Certification Program and give the requirements for the different judging levels (fill out the chart).

x) Answer questions (15 from the pool of 90) on the Judging Process and Procedures.

S3. Describe and differentiate between a German Pilsner, Dortmunder Export, and Munich Helles. Give commercial examples of each style.

S10. Describe and differentiate the German Pilsner, Bohemian Pilsner, and Classic American Pilsner beer styles. Give commercial examples of each style.

S22 (new). Describe and differentiate the Lite American Lager, Standard American Lager, Premium American Lager, and Dark American Lager beer styles. Give commercial examples of each style.

T12. Describe how water and mineral content influence each of the following styles of beer:
a) Dry Stout b) English Pale Ale c) Czech Pilsner

T13. Where in the brewing process are water characteristics important and why?

S5. Describe and differentiate all distinctly different German bottom fermented beer styles. Note that color differences don't count as different beer styles. Give commercial examples of each.

S8. Identify, describe and differentiate the lager members of the Bock family. Give commercial examples of each style.

T11. What are the technical names for ale and lager yeast? How do they differ in the brewing process and in the flavor imparted to the beer?

T8. Explain the malting process. Identify the different types of malt and give reasons why they are made and their uses.

T14. Explain how the following grains are produced, and what effect each has on beer:
a) Black Patent b) Chocolate malt c) Dextrin malt
e) Roasted barley f) Munich malt.

END OF SESSION 1