### Technical Question T14. “All Grain Recipe”

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

|  |  |
| --- | --- |
| **10%** | **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).** |
| **20%** | **Batch size, ingredients (grist, hops, water, and yeast) and their quantities.** |
| **35%** | **Mashing, boil, fermentation, packaging, and other relevant brewing procedures.** |
| **35%** | **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.** |

**How to Design Your Recipes for the Exam**

 \* Keep target statistics within the midpoint of the style descriptions.

 \* **Assume 5 gallon batches** (or whatever size you’re most comfortable with) and calculate all quantities based on that target.

 \* **Keep recipes simple.** You’re not trying to win a medal.

 \* **Use, or at least mention, proper ingredients for the style** (e.g., “Bohemian Pilsner was traditionally made using undermodified continental Pilsner malt”).

 \* **Use, or at least mention, traditional techniques for brewing the style** (e.g., “Bohemian Pilsner was traditionally made using a triple decoction mash.”)

 **\* Understand, and mention, why each ingredient is used in a particular beer.** (e.g., “Burton-style water, with its high sulfate levels, increases alpha acid extraction rates from hops, increasing hop bitterness.”)

 \* **Understand, and mention, what each ingredient contributes to the finished beer** (e.g., “Pilsner malt produces a light-colored beer with bready, cracker-like aromas and flavors and possibly hints of DMS or hydrogen sulfide.”)

 \* **Describe each ingredient** - grain, hops, water, yeast, adjuncts.

 - At least describe quantities and basic ingredient type (e.g., “7.5 lbs. pale malt”).

 - Better yet, give as much detail as possible about the ingredient as possible (e.g., “7.5 lbs. of 5 °Lovibond Thomas Fawcett™ Maris Otter English pale malt” or “7.25 gallons of mash water, adjusted to have at least 350 mg/l Ca++ and 150 mg/l SO4-, heated to a strike temperature of 175 °F.”)

 - Mention specific brands of ingredients if appropriate. E.g., Wyeast 1056 American Ale Yeast, Lyle’s Golden Syrup.

 \* Understand, mention and describe each step of the brewing process, why each step is done and how it should be controlled.

- The steps in the brewing process are: Milling, Mashing, Sparging/lautering, Boiling, Cooling, Fermenting, Conditioning/lagering, Packaging.

 - At minimum, describe the process. E.g., “After wort boil ends, crash cool wort.”

 - Better yet, describe exact techniques and purposes for each step. E.g., “After wort boil ends, crash cool wort using a counterflow chiller or heat exchanger to precipitate cold break, which keeps unwanted proteins and fatty acids from getting into your wort. Crash cooling also limits exposure to airborne pathogens before yeast is pitched.”

**Calculating Original Gravity**

 To find the potential original gravity for a beer recipe, you must know the diastatic power of the grains in your mash, the extract efficiency of your brewing setup and the weight of grains in your grist.

 As a rule of thumb, however, pure sugars yield 46 “gravity points” per pound, pale malt yields about 33 gravity points per pound and amber and toasted malts yield about 20 points per pound. Roasted or brown malts and non-malted grains don’t yield any gravity points on their own. Expressed as a formula:

OG = ((G x P)/V) x E

Where:

 OG = Original gravity.

 G = grains (in pounds)

 P = gravity points for the grain type.

 V = final wort volume.

 E = Extract efficiency.

 **Grain Blends:** If you use more than one type of malt in the grist, you must calculate the OG of each type of malt separately and sum the total.

 The Basic Recipe Discussion assumes 10 pounds of grain which yield 330 gravity points, 5 gallons of wort, and 75% extract efficiency. So: ((10 x 33)/5) x 0.75 = 1.050.

 \* **Mention formulas if appropriate** (e.g., W x A x U x 7489 / V x C = hop utilization formula)

 \* **Mention common potential brewing or technique faults.** (e.g., “High levels of esters are wrong for this style, avoid by fermenting at cool end of the yeast’s temperature range.”)

 \* **Mention potential overlap with other styles** (e.g., “Similar to a German pilsner, but darker in color, sweeter, not as hoppy, and with a hint of DMS in the aroma.”)

**Basic Recipe Design**

 This section discusses the basics of recipe design for the test. It is based on Al Boyce’s BJCP for Dummies exam prep guide, which was a very common preparation guide for the “legacy” BJCP exam. For this reason, most graders are very familiar with “Boyce method” recipes and are somewhat prejudiced against it. If used properly, this recipe design section will give you a score in the 70-85% range, but no higher. **Use it only if you don’t have the time or resources to design your own recipes.**

 If you do have time, work with your favorite basic brewing text and supplemental books such as ***Brewing Classic Styles*** and ***Designing Great Beers****.* It’s also helpful to play with various brewing software programs, since you can instantly see how changing ingredient types and quantities will change your recipe.

**1) Vital Statistics**

 Use the following information to set up the vital statistics for your recipe:

 **O.G.:** Original Gravity is 1.050 for “table strength” beers, 1.075 for strong beers - American IPA, Belgian Tripel and Doppelbock. **Memorize “1.075” and “1.050.”**

 **F.G.:** Finishing Gravity is 1.010 for beers with medium to medium-light body, 1.016 for sweeter beers with medium-full to full body - Bohemian Pilsner, Oktoberfest, Robust Porter and Doppelbock. **Memorize “1.010” and “1.016.”**

 **IBU:** Bitterness (International Bitterness Units) is 40 for beers with medium to medium-high hop bitterness, 25 for beers with medium-low hop bitterness and 10 for beer with very low hop bitterness (i.e., Weizen). **Memorize “40-25-10.”**

 **SRM:** Color (Standard Reference Measurement) is 6 for dark gold beers, 25 for dark brown beers. The outliers are 5 (Gold) for German Pilsner and 7 (Amber) for Oktoberfest. Memorize “6-25” “7 Oktoberfest,” “5 German Pilsner” (**Mnemonic: At 6:25, you ordered 7 Oktoberfests and 5 German Pilsners**).

**Vital Statistics Table**

 This table lists numbers to use for each of the beers mentioned in the question. Outliers are in bold italic type.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| STYLE**Calculating Final Gravity** Final gravity is based on fermentability of the wort, but primarily yeast attenuation. Since most yeast strains attenuate to about 75%, a rough formula for F.G. is:((OG -1) - ((OG - 1) x A) +1) = FG The recipe discussion assumes 1.050, so ((1.050 – 1) - ((1.050 - 1) x .75) +1) = 1.0125, which is rounded down to 1.010. Beers with less attenuable worts and/or lower attenuating yeast strains use 1.016 instead. | OG | FG | IBU | SRM |
| American IPA | 1.075 | 1.010 | 40 | 6 |
| Belgian Tripel | 1.075 | 1.010 | 25 | 6 |
| Bohemian Pilsner | 1.050 | 1.016 | 40 | 6 |
| Classic American Pilsner (CAP) | 1.050 | 1.010 | 40 | 6 |
| Doppelbock | 1.075 | 1.016 | 25 | 6 |
| Dry Stout | 1.050 | 1.010 | 40 | 25 |
| English Pale Ale (EPA) | 1.050 | 1.010 | 40 | 6 |
| German Pilsner | 1.050 | 1.010 | 40 | 5 |
| Oktoberfest | 1.050 | 1.016 | 25 | 7 |
| Robust Porter | 1.050 | 1.016 | 40 | 25 |
| Weizen | 1.050 | 1.010 | 10 | 6 |

2) Batch Size

 **Choose 5 gallons.** Mention that actual batch size might be a bit bigger (5.5 gallons) to allow for equipment losses.

 Note: The rest of the Basic Recipe Design section assumes 5 gallon batches.

3) Grain Bill (AKA Grist)

 Use the following information to describe the grist for your recipe. Note that if you have time and know what you’re doing, you can specify specific products (e.g., 15 °L Weyermann CaraMunich malt, Munton’s Maris Otter English Pale Malt).

 **Extract Efficiency:** **Mention 75% for grains, 100% for adjunct sugars.** It’s easy to remember and allows you to use 10 or 15 lbs. of grain to design a 5 gallon recipe. Note: Actual extract efficiency can vary.

 **Malt Amounts:** **Use 10 lbs.** for all beers except for IPA, Tripel and Doppelbock, which use **15 pounds.** Multiply by the percentages given below to get the exact grain bill:

 **Malt Types:** **Use malts from the appropriate country for the style (e.g., German Pilsner malt).** Remember that some form of pale malt (“base malt”) forms the largest portion of the grist for virtually all beer styles. You should list your base malt first.

 **Malts Percentages:** Use the following malt percentages for the various styles:

 **American IPA:** 80% American 2-row pale ale malt, 15% 20 °L crystal malt, 5% 60 °L crystal malt. Alternately, just 100% American 2-row pale. **Memorize: 80-15-5.**

 **Belgian Tripel:** 80% Pilsner malt, 20% light candi sugar. **Memorize: 80-20.**

 **Bohemian Pilsner:** 100% Moravian Pilsner malt.

 **CAP:** 75% American 6-row lager malt, 25% flaked maize. **Memorize: 75-25.**

 **Doppelbock:** 100% Munich Malt.

 **Dry Stout:** 65% English pale ale malt, 25% flaked barley (unmalted), 10% 500 °L black roasted barley (unmalted). Alternately: 3% °L 400 chocolate malt, 3% 500 °L patent malt, and 3% 400 °L unmalted roasted barley. **Memorize: 65-25-10.**

 **English Pale Ale:** 90% English pale malt, 10% 60 °L crystal malt or 10% Lyle’s Golden Syrup™. **Memorize: 90-10%.**

 **German Pilsner:** 100% Pilsner malt.

 **Oktoberfest:** 100% Munich malt. Alternately: 50% Munich malt, 45% pilsner malt, 5% 15 °L crystal malt. **Memorize: 50-45-5.**

 **Robust Porter:** 80% English pale ale malt, 10% 40 °L Crystal, 5% 350 °L chocolate malt, 5% 525 °L black patent malt. **Memorize: 80-10-5-5.**

 **Weizen:** 70% German wheat malt, 30% pilsner malt. **Memorize: 70-30.**

4) Hop Additions

 Use the following information to describe the hops used for your recipe.

 **Alpha Acid (AA):** **A quick “cheat” is to** a**lways use 5%,** **regardless of hop type.** It is better, however, to memorize a few simple hops which are appropriate to all the beer styles and make them 4% or 5% AA for flavor and aroma hops and 8 or 10% for bittering hops.

 **Hop Additions:** **Only use bittering, flavor and aroma additions** for the exam. **Mention other techniques where appropriate** (e.g., first wort for Bohemian Pils, dry hopping when for English Pale Ale or American IPA).

 Boil Time: Use 60 minutes for bittering hops, 15 minutes for flavor hops and 0 minutes (“at knockout”) for aroma hops.

 Utilization Rates: Mention 25% or 28% for bittering, 5% or 8% for flavor, 0% for aroma.

 Hop Amounts: Choose 2 ounces of bittering hops for 40 IBU, 1 ounce for 25 IBU or ½ ounce for 10 IBU. If a beer is supposed to have hop aroma or flavor, use ½ to 1 ounce of flavor and/or aroma hops. Effectively, they’re “free” in terms of utilization.

 **Hop Types:** Choose hop varieties appropriate for the beer’s country of origin or style. Where multiple types are possible, mention multiple varieties.

 **Belgium:** Styrian Goldings or Strisselspalt.

 **England:** East Kent Goldings, Fuggles.

 **Czech Republic:** Mention “Czech-grown noble hops” or just say Saaz.

 **Germany:** Mention “German-grown noble hops” or name one: Hallertauer Mittelfrüh, Spalt or Tettnang.

**Points per Gallon**

Realistically, malts, sugars and grains vary in their extract efficiency.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Malt | FGDB% | Max PPG | Typ. PPG (75%) | PPG Steep |
| 2-row lager | 80 | 37 | 28 | 0 |
| 2-row pale ale | 81 | 38 | 29 | 0 |
| 6-row pale | 76 | 35 | 26 | 0 |
| Barley, roast | 55 | 25 | 19 | 21 |
| Biscuit | 75 | 35 | 26 | 0 |
| Brown | 70 | 32 | 24 | 8\* |
| CaraPils | 70 | 32 | 24 | 4\* |
| Chocolate | 60 | 28 | 21 | 15 |
| Crystal 10-15 °L | 75 | 35 | 26 | 14\* |
| Crystal 120 °L | 72 | 33 | 25 | 16 |
| Crystal 15-40 °L | 74 | 34 | 25.5 | 18 |
| Crystal 60-75 °L | 74 | 34 | 25.5 | 18 |
| Flaked barley | 70 | 32 | 24 | 0 |
| Flaked Rice | 82 | 38 | 38.5 | 0 |
| Flaked wheat | 77 | 36 | 27 | 0 |
| Flaked, Oats | 70 | 32 | 24 | 0 |
| Munich | 75 | 35 | 26 | 0 |
| Patent | 55 | 25 | 19 | 21 |
| Rostmalz | 70 | 32 | 24 | 21 |
| Rye malt | 63 | 29 | 22 | 0 |
| Special B | 68 | 31 | 23 | 16 |
| Sugar, cane | 100 | 46 | 46 | 46 |
| Sugar, corn | 92 | 42 | 42 | 42 |
| Sugar, dextrin | 100 | 40 | 40 | 40 |
| Victory | 75 | 35 | 26 | 0 |
| Wheat malt | 79 | 37 | 28 | 0 |

\* Low extraction rates due to unconverted starches.

Data taken from **How to Brew**, p. 193.

 **USA:** Choose one of the “C Hops:” Cascade, Centennial, Chinook or Columbus. If you want to get fancy, mention one of the modern, “dual use,” proprietary types, such as Amarillo, Citra or Warrior.

**Suggested Hop Additions**

 This table lists suggested hop amounts and types for each beer listed in the question. Note that “East Kent Goldings is listed as “EKG,” Hallertauer Mittelfrüh is listed as “HM” and Styrian Goldings is listed as “SG.”

|  |  |  |  |
| --- | --- | --- | --- |
| Style | Bitter | Flavor | Aroma |
| American IPA | 2 oz. Centennial | 1 oz. Chinook | 1 oz. Cascade |
| Belgian Tripel | 1 oz. SG | 1 oz. SG | None |
| Bohemian Pilsner | 2 oz. Saaz | 1 oz. Saaz | 1 oz. Saaz |
| CAP**Calculating Hop Amounts** A simplified formula for figuring the weight of hops needed is: Weight= IBU x V/ (A x U x 7490)Where: Weight = weight of hops in ounces. IBU = target IBU level for your beer. V = wort volume in gallons A = Alpha Acid percentage of the hops. U = Utilization efficiency. 7490 = This is a conversion factor from metric to English units.The calculation for IBU (Rager method) is IBU = ((W x A x U x 7462) / (V \* (1+GA))If wort gravity > 1.050 GA = (Boil Gravity - 1.050) **Utilization Efficiency:** Utilization efficiency depends on a number of factors, mostly boil time, but also wort pH, mineral levels in the wort and sugar concentration. Utilization of bittering hops ranges from 25-33%, 2-10% for flavor hops and 0-2% for aroma hops. **Hop Blends:** If you add a blend of hops, you must determine the average level of alpha acids. If you add different types of hops at different times during the boil, you must determine their total contribution to alpha acid levels separately and sum the total. The sample recipe section assumes IBU targets of 40, 25 or 10, 5 gallons of wort, 5% alpha acid level, a utilization of 25% for bittering hops and utilization levels of 0% for flavor and bittering hops. Calculations are then rounded to the nearest whole ounce. For example, for a beer with 40 IBU: 40 x 5 / (.05 x .25 x 7490) = 2.13 oz (rounded to 2 oz.) | 2 oz. Cluster | 1 oz. U.S. grown HM | 1 oz. U.S.-grown Tettnang |
| Doppelbock | 1 oz. Spalter | 0.5 oz. Tettnang | None |
| Dry Stout | 2 oz. EKG | None | None |
| EPA | 2 oz. EKG | 1 oz. Fuggles | 1 oz. Fuggles |
| German Pilsner | 2 oz. HM | 1 oz. Tettnang | 1 oz. Spalt |
| Oktoberfest | 1 oz. HM | 1 oz. HM | None |
| Robust Porter | 2 oz. EKG | 1 oz. Fuggles | None |
| Weizen | 0.5 oz. HM | None | None |

**5) Water**

 Water Treatment: Water should be dechlorinated using filtration and adjusted to match the historical city (or a historic city) for the style. **M**ention levels of particular mineral ions if they are particularly high, low or important to the style (e.g., very low ion water for Plzen, high sulfate water for Burton-on-Trent).

 Total Volume: **9 gallons of total water for all styles except IPA, Tripel or Doppelbock**, where water is increased by 50% to 13.5 gallons.

 Strike Water: 3.5 gallons of strike water (increased by 50% to 5.25 gallons for IPA, Tripel or Doppelbock) at 163 °F for a mash temperature of 150 °F.

 Sparge Water: 5.5 gallons of sparge water (increased by 50% to 8.25 gallons for IPA, Tripel or Doppelbock) at 168 °F.

 Water pH: All water should be adjusted to pH 5.2 using phosphoric or lactic acid. **Use 3 tsp for most beers, increased by 50% to 4.5 tsp for IPA, Tripel or Doppelbock.** Mention that more acid (or buffer) might be needed when brewing with highly alkaline water (e.g., Burton, Dublin, London).

**Water Treatment Type**

|  |  |  |
| --- | --- | --- |
| Style | City | Mineral Ion Ranges |
| American IPA | San Francisco | Medium low CO3, Low Ca, Cl, SO4, Mg, Na. |
| Belgian Tripel | Brussels | Medium Ca & CO3, medium-low SO4, low Cl, Mg, Na |
| Bohemian Pilsner | Plzen | Very low overall ion levels. Use distilled or reverse osmosis water, cut 50/50 or 75/25 with medium hardness dechlorinated tap water. |
| CAP | St. Louis | Medium CO3, med-low Cl, SO4, low Ca, Mg, Na. |
| Doppelbock | Munich | High CO3, medium-low Ca, low Cl, Mg, Na, SO4. |
| Dry Stout | Dublin | High Ca, CO3, medium-low SO4, low Cl, Mg, Na. |
| EPA | Burton-on-Trent | Very high Ca, CO3 & SO4, medium-low Cl, Mg, Na. |
| German Pilsner | Munich | High CO3, medium-low Ca, low Cl, Mg, Na, SO4. |
| Oktoberfest | Munich | High CO3, medium-low Ca, low Cl, Mg, Na, SO4. |
| Robust Porter | London | High CO3, medium Ca, Cl, Na, SO4, low Mg. |
| Weizen | Munich | High CO3, medium-low Ca, low Cl, Mg, Na, SO4. |

**6) Yeast**

 **Yeast Type:** **Choose ale or lager. Mention country of origin** (e.g., German lager yeast, English ale yeast). If possible, or appropriate to the style, **mention specific yeast strain or brand** (e.g., Wyeast 3068 Weihenstephan Weizen yeast).

 Starter Culture: Create 1.5 quarts of starter for ales, 4 quarts for strong ales, 3 quarts of starter for lagers and 7 quarts for strong lagers. Cell counts for ales should be about 175 million/liter for ales, 275 million/liter for strong ales, 300 million/liter for lagers and 500 million/liter for strong lager. If you want to be clever, and have the time to explain yourself, suggest underpitching yeast for weizen.

 Aeration: Write “Use food-grade oxygen and a sintered airstone for 1 minute to deliver 10 ppm dissolved oxygen to the cooled wort.”

 **Fermentation Temperature:** **Choose 55 °F for lagers, 65 °F for ales and 70 °F for Belgian Tripel.** If you want to be clever, and have the time to explain yourself, suggest fermenting weizen at 62 °F and gradually letting the temperature rise to 70 °F.

**Yeast Information Table**

 Suggested brands are based on Wyeast, no insult intended to other yeast producers! Outliers are in bold italic text.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Style | Brand | Cell count (mill/l) | Starter | Temp. |
| American IPA | American Ale | 275 | 4 qt. | 65 °F |
| Belgian Tripel | Abbey Ale | 275 | 4 qt. | 70 °F |
| Bohemian Pilsner | Budjevoice Lager | 300 | 3 qt. | 55 °F |
| CAP | American Lager | 300 | 3 qt. | 55 °F |
| Doppelbock | Munich Lager | 500 | 7 qt. | 55 °F |
| Dry Stout | Irish Ale | 175 | 1.5 qt. | 65 °F |
| EPA | London Ale | 175 | 1.5 qt. | 65 °F |
| German Pilsner | Munich Lager | 300 | 3 qt. | 55 °F |
| Oktoberfest | Munich Lager | 300 | 3 qt. | 55 °F |
| Robust Porter | London Ale III | 175 | 1.5 qt. | 65 °F |
| Weizen | Weihenstephan weizen | 175 | 1.5 qt. | 65 °F |

**7) Mashing**

 Mash Type: Choose the proper mash type for the style you wish to brew.

 **If you can’t remember the details for the appropriate mash type, choose Single Infusion, but mention and describe the appropriate traditional (or modern commercial) method of producing the beer and give justification for your choice.** For example: “X is the classic mash technique for this style, but due to the highly modified malts available today, this recipe uses a single infusion mash.”

 Rests: Unless you specified a Single Infusion Mash, mention types of rests and rest temperatures associated with the traditional forms of mashing.

 **Acid Rest:** 95-120 °F for 60-120 minutes.

 **Protein/Beta-Glucanase Rest:** 122 °F for 20 minutes.

 **Saccharification Rest - Beta Amylase:** 130-150 °F for 30-90 minutes. Mash at this temperature for thinner-bodied, drier beers, e.g., EPA, Pilsners, American IPA.

 **Saccharification Rest - Alpha Amylase:** 149-158 °F for 30-90 minutes. Mash at this temperature for fuller-bodied beers, e.g., Doppelbock, Oktoberfest.

 **Mash Out:** 168 °F for 15 minutes.

 **Strike Water Temperature & Volume:** Discussed under Water.

 **Mash Water Acid and Mineral Adjustments:** Discussed under water (should be 3.5 or 5.25 gallons). Mash pH should be 5.2. Regardless of style, mash water should have 50 mg/l of calcium for optimal mash efficiency.

**Calculating Water Volume**

 To find the volume of water needed for mashing and sparging you must know the mass of grain to be mashed and the target volume of the wort to be collected.

 **Mash Water Formula:** The formula for mash water volume is:

Mass weight (lbs.) x 1.25 quarts = Wort volume (gallons).

 **Total Water Volume Formula:** The formula to find the total volume of water needed for mashing, sparging and wort boiling is:

(Batch Volume + Trub Volume)/ (1 - ((Wort Shrinkage Percent/100)/ 1 - (Boil Time x (Boil-off Percentage/100)) + Equipment Loss Volume + Grain Volume) x Absorption Rate) = Total Water Volume.

The sample recipe section assumes a 5 gallon batch, with .5 gallons of trub, 4% wort shrinkage, 1 hour boil time, 10% boil-off, 1 gallon of equipment loss volume, 10 lbs. of grain and an absorption rate of = .13.

 **Sparge Water Volume Formula:** The formula to find the amount of sparge water needed is:

Total Water needed – Mash Water = Sparge Water Volume

 **Special Ingredients:** Tripel uses Candi Sugar, which is added to the boil, not the mash. CAP made using a cereal mash would use ground corn or rice, rather than flaked corn.

 **Recirculation (AKA Vorlauf):** You should recirculate the mash runoff back through the mash bed in order to clarify the runoff for 30 minutes. Avoid splashing or spraying the runoff to avoid hot side aeration.

 **Sparging (Lautering):** You mentioned sparge water volume back in the water section (5.5 or 8.25 gallons). Sparge water temperature should be **168 °F** and should last **for 45 minutes**. To avoid extracting tannins from your grist, **stop collecting runoff if the mash pH goes above 5.8 or the specific gravity of the runoff goes below 1.008.**

**Mash Type Table**

|  |  |  |
| --- | --- | --- |
| Style | Mash Type | Rests |
| American IPA | Step | Beta Amylase > Alpha Amylase > Mash Out. |
| Belgian Tripel | Step | Saccharification > Mash Out |
| Bohemian Pilsner | Triple Decoction | Acid Rest > Saccharification > Mash Out. |
| CAP | Cereal Mash | Protein > Saccharification > Mash Out |
| Doppelbock | Double Decoction | Protein > Saccharification > Mash Out. |
| Dry Stout | Single Infusion | Saccharification |
| EPA | Step | Saccharification > Mash Out |
| German Pilsner | Double Decoction | Protein > Saccharification > Mash Out. |
| Oktoberfest | Double Decoction | Protein > Saccharification > Mash Out. |
| Robust Porter | Single Infusion | Saccharification |
| Weizen | Triple Decoction | Protein/Beta-Glucanase > Saccharification > Mash Out |

**8) Wort Boiling, Cooling and Transfer**

 **Boil Time:** **A 60 minute, full, rolling boil in an open kettle to facilitate hot break.,** except for beers where extensive hop extraction or color development is desired (American IPA, Doppelbock, Oktoberfest), in which case specify a 90 minute boil. For styles which use Pils malt or corn, mention that this process drives off DMS.

 Hop Additions: Bittering hops added at the beginning of the boil. Flavor hops added at 30 minutes before the end of the boil. Aroma hops added at the end of the boil.

 Finings: For all but weizen, 1 tbsp of Irish moss (or similar kettle finings) added 5-15 minutes before the end of boil in order to help precipitate the hot break.

 **For weizen:** “No finings added due to desired cloudiness in finished beer.”

 Chilling: Crash cool the wort using a counterflow wort chiller or heat exchanger in order to precipitate the cold break. Wort should be cooled to approximately 5 °F below desired fermentation temperature.

 Wort Transfer: Wort should be whirlpooled, filtered or siphoned to avoid transferring trub (hot and cold break, hop residue) to the fermentor. Some cold break is acceptable in the wort since it is necessary for optimum yeast health.

**Fermentation**

 Yeast Strain, Volume, Temperature, etc: See Yeast, above.

 Primary Fermentation Time: Ales: 3-5 days. Strong Ales: 7-14 days. Lagers: 2-4 weeks. Strong Lagers: 3-6 weeks.

 **Secondary Fermentation Time:** **Ales:** None (for cask-conditioned English ales), otherwise 1-3 weeks. Strong Ales: 2-4 weeks. Lagers: Diacetyl Rest at 65 °F for 2-3 days. Conditioning for 2-4 weeks (6-8+ weeks for strong lagers).

**8) Packaging**

 Bottle Conditioning: A quick and simple “boilerplate” answer to this part of the question is to just write, “Add ¾ cup of corn sugar at bottling or force carbonate to achieve 2.5 volumes of CO2.”

 A better approach is to adjust bottle conditioning methods to the exact style, as listed below.

**Color Calculations (Mosher, Daniels Formulae)**

 A rough and ready method of calculating beer color is as follows:

 MCU = sum of (°Lovibond rating x pounds)/gallons

 Once you’ve gotten MCU, you then need to correct the formula:

 MCU < 10.5 SRM, the MCU rating is reasonably accurate.

 MCU => 10.5- =>37 use Ray Daniels’ formula to get actual SRM 10.5 to 15.8

 MCU >37 MCU, use Randy Mosher’s formula to get SRM 15.8 and higher.

 **Ray Daniels’ formula:** SRM = (MCU x 0.2) + 8.4 (Use this for Doppelbock on exam).

 **Randy Mosher’s formula:** SRM = (MCU x 0.3) + 4.7(Use this for Stout and Robust Porter on the exam)

 **Example: Tripel,** 15 lbs 1.8 L Pilsner malt, (15 x 1.8) / 5 = 5.4 MCU = 5.4 MCU = 5.4 SRM.

 **Example: Doppelbock (**8 lbs 10 L Munich malt, 8 lb 4 L Vienna Malt, Color = (8 x 10) + (8 x 4) / 5 = 22.4 MCU, 22 > 10.5 and < 37. Use Daniels 22.4 x .2 + 8.4 = 12.88 SRM.

 **Example: Dry Stout** 8 lbs 2 L 2 row malt, 1 lb 400 L Roasted Barley, 1 lb 1 L Flaked Barley SRM = ((8x2)+(1x400) + (1x1))/5 x = 83.4 MCU. Use Mosher 83.4 x.3 + 4.7 = 29.72 SRM.

 **Example: Robust Porter** 8 lb English pale 2 row malt 2L 1 lb crystal malt 60L 0.75 lb chocolate malt 350L 0.25 lb black patent malt 400L SRM = ((8x2) + (1x60)+(.75x350) +(.25x400))/5 = 87.7 MCU, Use Mosher 87.7x.3 + 4.7 = 31.01 SRM

|  |  |  |
| --- | --- | --- |
| Style | Vol. CO2 | Carbonation method |
| American IPA | 2.5 | 115 g (4 oz.) corn sugar |
| Bohemian Pilsner | 2.5 | 115 g (4 oz.) corn sugar\* |
| CAP | 2.5 | 115 g (4 oz.) corn sugar |
| Doppelbock | 2.5 | 115 g (4 oz.) corn sugar\* |
| German Pilsner | 2.5 | 115 g (4 oz.) corn sugar\* |
| Oktoberfest | 2.5 | 115 g (4 oz.) corn sugar\* |
| Belgian Tripel | 3.0 | 150 g (5.5 oz.) corn sugar |
| Weizen | 3.0 | 150 g (5.5 oz.) corn sugar\* |
| Dry Stout | 2.0 | 75 g (2.6 oz.) corn sugar |
| EPA | 2.0 | 75 g (2.6 oz.) corn sugar |
| Robust Porter | 2.0 | 75 g (2.6 oz.) corn sugar |

\* Use of speise (wort at high kräusen from another, similar batch of beer) is traditional.

**9) Explaining How the Recipe Fits the Style**

 \* Mention the most important attributes first. (e.g., hop character for the American IPA).

 \* **Aroma:** Comment on malt, hop and yeast aroma (e.g., esters, phenols, diacetyl, DMS, sulfury notes, acetaldehyde), as well as other aromatics.

**Calculating Strike Temperature**

 **Strike Temperature Formula:** When using an infusion mash, you must know the “strike temperature” for your water to achieve a particular target temperature before you add it to the mash. The formula is:

(0.2 ÷ R) X (T2 – T1) + T2 = Tw

Where:

Tw = actual temperature of infusion water

 R = Ratio of water to grain in quarts per pound.

 T1 = Initial mash (or dry grain) temperature.

 T2 = Target mash temperature.

The sample recipe discussion assumes 1.25 quarts/lb. of mash, a mash temperature of 70 °F, a target temperature of 150 °F. So (0.2 ÷ 1.25) x (150 – 70) + 150 °F = 162.8 °F (rounded to 163 °F)

 \* **Appearance:** Comment on color, clarity and effervescence (e.g., sparkling, still), as well as head size, retention, color and texture. If appropriate, mention viscosity or alcohol “legs.”

 \* **Flavor:** Comment on malt flavor, sweetness or dryness, hop bitterness, hop flavor, yeast character (e.g., esters, phenols, diacetyl, DMS, sulfury notes, acetaldehyde), balance (sweetness vs. hop bitterness) and finish/aftertaste.

 \* **Mouthfeel:** Comment on body, carbonation level, alcohol character (e.g., warming, prickly, burning), texture (e.g., creaminess), astringency, and other palate sensations.

 - **If a beer doesn’t have a particular characteristic, say so!** (e.g., “Alcohol warmth is inappropriate for this style”).

**10) Describe How ingredients & Process Affect Style**

 \* If you’re running out of time, a quick cop-out is to just write, “The malt, hops, and yeast used in this recipe work together to produce the aroma, appearance, flavor and mouthfeel representative of an X style beer.” But, if you use this boilerplate text expect the graders to recognize it for the B.S. it is, and grade accordingly.

 \* A better way to answer is to briefly describe what each ingredient adds to the final beer, hitting the most import aspects first. For example for a German Pils, a good answer might be, “IBU levels, and Noble German hops (Tettnang and Spalt), used for flavor and aroma, give the beer firm bitterness, and the moderate to high elegant floral, spicy notes expected for this style.”

 \* If you’ve got extra time at the end of the test come back to this part and elaborate, if you know it.

### Question T14 Sample Recipe Sheet

 This is a sample recipe sheet for question T14. You should practice using it to design sample recipes. Before the exam begins, if the exam organizer allows you to do so, write out as much of the form as you can remember and then fill in the blanks once you know what style you’re being tested on.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Style: | Category: | Subcategory: |  |  |
| **Batch Size:** 5 Gallons |  |  |  |  |
| Vital Statistics |  |  |  |  |
| OG: | IBU: | FG: | SRM: |  |
| **Grist** (@ 75% efficiency) | **Amount** |  |  |  |
| Base Malt: | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other fermentables: | \_\_\_\_\_\_Lbs. |  |  |  |
| **Hops** (all @ 5% AA) | **Amount** | **Utilization** | **Boil** |  |
| Bittering: | \_\_\_\_\_\_Oz. | 25% | 60 min. |  |
| Flavor: | \_\_\_\_\_\_Oz. | 5% | 30 min. |  |
| Aroma: | \_\_\_\_\_\_Oz. | 0% | at flame-out |  |
| Mash hopping? Y/N |  |  |  |  |
| Dry hopping? Y/N |  |  |  |  |
| **Water** | **Volume** |  |  |  |
| Total Volume: | \_\_\_\_\_\_\_gal. |  |  |  |
| Mash Volume | \_\_\_\_\_\_\_gal. |  |  |  |
| Sparge volume: | \_\_\_\_\_\_\_gal. |  |  |  |
| Acid: | \_\_\_\_\_\_\_tsp. |  |  |  |
| Water adjusted to: (City name) |  |  |  |  |
| Important ion adds: Cl, CO3, Ca, Mg, Na, SO4 |  |
| **Yeast** |  |  |  |  |
| Variety: | Starter volume: | 1.5, 3, 4 or 7 qt. |  |  |
| Aeration: 2 min. w/ food-grade O2 & sintered airstone to get 10 ppm dissolved O2 |
| Fermentation Temp. \_\_\_\_\_\_\_\_\_\_ºF |  |  |  |  |
| **Mash** |  |  |  |  |
| Mash Type: Infusion. |  |  |  |  |
| Traditional Mash Type: Step, Decoction, Cereal. |  |  |  |  |
| Strike Water Temp. | \_\_\_\_\_\_\_\_\_\_ºF |  |  |  |
| Traditional Rests | Mash temp. | Time | Purpose |
| 1. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| 2. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| 3. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| Mash Out Y/N | 168 °F | 15 min. |  |
| Recirculate/Vorlauf:  | 168 °F | 30 min. |  |
| Sparge/Lauter: | 168 ºF | 45-90 min. |  |
| **Boil:** Boil 90 min. Full rolling boil to facilitate hot break, add hops according to schedule above. |
| Finings: 1 tsp Irish moss added 15 minutes before flame-out to precipitate hot break. |
| **Chill**: 1. Use counterflow chiller to crash cool wort to facilitate cold break. 2. Cool to 5 °F below fermentation temp. before pitching yeast. 3. Siphon, whirlpool or filter to separate wort from most of the cold break. |
| **Fermentation:** | **Temp.** | **Time** |  |  |
| Primary:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| Diacetyl Rest:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| Secondary:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| **Packaging:** Bottle condition with ¾ cup corn sugar for priming |  |  |  |  |
| **Aroma:** |
| **Appearance:**  |
| **Flavor:** |
| **Mouthfeel:**  |
| **Impact of ingredients & procedures on style?** |

**Question T14 Sample Recipe Sheet**

 This is a sample recipe sheet for question T14. You should practice using it to design sample recipes. Before the exam begins, write out as much of the form as you can remember and then fill in the blanks once you know what style you’re being tested on.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Style: | Category: | Subcategory: |  |  |
| Batch Size: 5 Gallons |  |  |  |  |
| Vital Statistics |  |  |  |  |
| OG: | IBU: | FG: | SRM: |  |
| **Grist** (@ 75% efficiency) | Amount |  |  |  |
| Base Malt: | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other Malt: \_\_\_\_\_\_\_\_\_ °L | \_\_\_\_\_\_Lbs. |  |  |  |
| Other fermentables: | \_\_\_\_\_\_Lbs. |  |  |  |
| **Hops** (all @ 5% AA) | Amount | Utilization | Boil |  |
| Bittering: | \_\_\_\_\_\_Oz. | 25% | 60 min. |  |
| Flavor: | \_\_\_\_\_\_Oz. | 5% | 30 min. |  |
| Aroma: | \_\_\_\_\_\_Oz. | 0% | at flame-out |  |
| Mash hopping? Y/N |  |  |  |  |
| Dry hopping? Y/N |  |  |  |  |
| Water | Volume |  |  |  |
| Total Volume: | \_\_\_\_\_\_\_gal. |  |  |  |
| Mash Volume | \_\_\_\_\_\_\_gal. |  |  |  |
| Sparge volume: | \_\_\_\_\_\_\_gal. |  |  |  |
| Acid: | \_\_\_\_\_\_\_tsp. |  |  |  |
| Water adjusted to: (City name) |  |  |  |  |
| Important ion adds: Cl, CO3, Ca, Mg, Na, SO4 |  |
| Yeast |  |  |  |  |
| Variety: | Starter volume: | 1.5, 3, 4 or 7 qt. |  |  |
| Aeration: 2 min. w/ food-grade O2 & sintered airstone to get 10 ppm dissolved O2 |
| Fermentation Temp. \_\_\_\_\_\_\_\_\_\_ºF |  |  |  |  |
| Mash |  |  |  |  |
| Mash Type: Infusion. |  |  |  |  |
| Traditional Mash Type: Step, Decoction, Cereal. |  |  |  |  |
| Strike Water Temp. | \_\_\_\_\_\_\_\_\_\_ºF |  |  |  |
| Traditional Rests | Mash temp. | Time | Purpose |
| 1. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| 2. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| 3. | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_\_\_ min. |  |
| Mash Out Y/N | 168 °F | 15 min. |  |
| Recirculate/Vorlauf:  | 168 °F | 30 min. |  |
| Sparge/Lauter: | 168 ºF | 45-90 min. |  |
| **Boil:** Boil 90 min. Full rolling boil to facilitate hot break, add hops according to schedule above. |
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| **Chill**: 1. Use counterflow chiller to crash cool wort to facilitate cold break. 2. Cool to 5 °F below fermentation temp. before pitching yeast. 3. Siphon, whirlpool or filter to separate wort from most of the cold break. |
| Fermentation: | Temp. | Time |  |  |
| Primary:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| Diacetyl Rest:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| Secondary:  | \_\_\_\_\_\_\_\_\_\_ºF | \_\_\_days/weeks. |  |  |
| **Packaging:** Bottle condition with ¾ cup corn sugar for priming |  |  |  |  |
| Aroma: |
| Appearance:  |
| Flavor: |
| Mouthfeel:  |
| Impact of ingredients & procedures on style? |