# T3 Body and Mouthfeel

First go Read Palmers Answer. It’s easier than all this below:

<http://howtobrew.com/book/section-4/experiment/increasing-the-body>

# T3 Body and Mouthfeel: My Answer from Studying

**I am targeting around 400 words for the answer. I have an answer from another judge’s test who got master marks for the Gypsum/Fining/Krausening question. His answer was at 400 words.**

Body is how rich or “filling” the beer feels in your mouth. If it physically feels heavier there is more body and if it physticall feels lighter, it’s thought of as less body. Other commons parts of describing the body are how much viscosity, how much flavor, how much gravity, how thick is the beer. Body is a part of mouthfeel.

Mouthfeel is the physical and chemical interaction of the beer with the mouth. It is the tactile experience when the beer touches your mouth. Primary elements considered in mouthfeel are alcohol, astringency, body, carbonation and creaminess. However, there are many more elements in food sciences that may become part of a beers mouthfeel discussion if those sensations are detected. The sum of the quality of a beers mouthfeel will be how well these touch qualities balance together in relation to the style of the beer in question.

Body is primarily caused by the make up of the wort. Dextrins and medium-length proteins that are not fermentable by yeasts. Dextrins are tasteless carbohydrates that only add weight to a beer. Sources of dextrins include dextrin malts which are already high in dextrins from how they’re made. Dark caramel and roasted malts also contain more dextrins that base malts or lighter malts. Dextrins are also produced by Alpha amylase(145F-158F) enzymes during the mash where as fermenatables are created by the Beta Amylase(131-149) enzyme. This is why raising or lowering mash temperature effects body.

Appropriate Mouthfeel is a balancing of the major components of “beer mouthfeel” without any harsh or style inappropriate sensations from other aspects of mouthfeel. The primary “causes” of mouthfeel would be alcohol, astringency, body, carbonation, creaminess. Any other sensations may be considered to style. For instance, resinous may be ok for American pale ale but it would be terrible in German Pilsner. Mouthfeel is controlled by carefully considering the effects of different aspects of a beer and they’re usually tied directly to the ingredients and brewing process. For instance, adding a pound of cane sugar to a normal German Pilsner recipe might carry it far out of style for gravity. Leading to higher alcohol and therefore a biting in the tactile experience of the beer. Not lautering the wort correctly could may lead to grain husks being boiled leading to astringency which is almost never ok. Low CO2 in American pale ale may make the beer seem to have a heavier body while causing hop aromatics to fall flat. Mashing at too high a temperature in a beer you want having a lighter body will result in a higher body. So mash at a lower temperature to control that.

# T3 Body and Mouthfeel Information from online Study Guide:

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

**Cover the following topics:**

|  |  |
| --- | --- |
| **50%** | **Describe each characteristic.** |
| **50%** | **Identify the causes and controls for both.** |

**Question T3. “Body and Mouthfeel” Sample Answer.**

**1) Body**

 **Describe:** A sub-characteristic of Mouthfeel (see below).

**2) Mouthfeel**

 **Describe:** The tactile character of beer, how it “feels” in your mouth. Determined by Alcohol, Astringency, Body, Creaminess, Carbonation, and other physical sensations.

|  |  |  |
| --- | --- | --- |
| Element | Describe/Cause | Control |
| Alcohol | Solventy, hot, burning, numbing, warming.**Cause:** Alcohol attacking pain receptor nerves. Closely related to alcohol flavor. Ethanol produces “smoother” heat than fusel oils, which are “harsh” or hot. All alcohols are produced by yeast as fermentation products. Fusels are caused by high temperature fermentation or unhealthy or stressed yeast. | \* Reduce O.G.\* Ferment at cooler temperature (reduces fusels).\* Properly aerate wort.\* Pitch sufficient yeast for style (at least 1-1.5 quarts of starter for most styles, more for strong ales and lagers).\* Age beer to allow higher alcohols to degrade. |
| Astringency | Puckering, numbing or harsh bitterness. Phenolics (esp. polyphenols = tannins) acting on nerves.**Causes:** From husks due to excessively fine grain crush, sparge water > 5.8 pH, sparge water >170 °F, or husks in boiling wort. From barrel-aging in oak. From fruit pits, stems or husks in fruit beers, esp. if boiled/pasteurized above ~>170 °F. Hot break & trub carried into fermenter. Cold break carried into finished beer. Highly alkaline water. Bacterial infection. Yeast autolysis. | \* Don’t overmill grain. \* Don’t oversparge/rinse grains (below SG 1.008). \* Don’t expose grains to temp. above ~>170 °F \* Avoid high alkaline/sulfate water. \* Rolling boil for at least 1 h. to promote hot break. \* Longer aging time for barrel-aged beer. \* Remove pits/stems/husks from fruit before adding to beer & don’t expose to temp. above ~>170 °F. |
| Body | Subjective measure of palate fullness or viscosity - how “rich” or “filling” the beer feels in your mouth. Primarily determined by the concentration of dextrins & med.-length proteins in finished beer. Gums and highly caramelized sugars also play a role. Non-flocculent yeast or suspended starch particles contribute to sensation of body.**Causes:** Wort gravity. Yeast/starch haze. Mash temperature: low mash temp. (140 - 150 °F) promotes Beta-Amylase activity, prod. thinner, more fermentable wort. Excessively long Protein rest (122 - 133 °F for 1+ hr.) breaks down body-forming proteins. Bacterial/Wild yeast infection can metabolize dextrins, reducing body. | **To increase:** Increase grain bill. Increase dextrin and protein levels in mash. Toasted & caramel/crystal malts have higher levels of non-fermentable sugars. Higher protein malts (e.g., wheat, rye, oat) or unmalted protein-rich grains (e.g., flaked rye or oats). Don’t filter or fine beer. Don’t cold condition for long periods of time. Choose non-flocculent yeast strain. Mash at higher temp. (162 - 167 °F). Skip protein rest. Skip beta-glucan rest. Don’t filter, or use a larger filter. Practice good sanitation. |
| Carbonation | “Prickly,” “stinging” or “tingling”**Cause:** CO2 activating trigeminal nerve. Can affect perception of flavor and body due to “drying” and “lightening” effects on flavor and body. Can aid in perception of aroma due to volatile compounds in beer being “scrubbed out” of solution by escaping CO2. | To increase: Control CO2 levels during packaging. Don’t agitate beer excessively (removes CO2). |
| Creaminess | “Creaminess” or “oiliness” opposite of “Crispness” Physical texture and mouth-coating characteristic. Related to body. | To increase: add high-protein or “oily” grains to beer (e.g., oats). Don’t filter or fine. Choose non-flocculent yeast strain. Proper protein/beta-glucan rest (at ~110-120 °F for 20 minutes) to get proteins/gums into beer. |

**Mouthfeel**

 **Describe:** Mouthfeel is the tactile character of food or drink -how it “feels” in your mouth and how it stimulates the sensory nerves of your mouth and tongue other than the tastebuds. Mouthfeel of beer is determined by levels of Astringency, Body (Viscosity), Carbonation, Creaminess (Mouth Texture), Warmth (Alcohol) and Other Palate Sensations (e.g., temperature and chemical warming or cooling sensations).

**Astringency**

 Detected in: Mouthfeel.

 *Described As:*Astringent, drying, harsh, numbing, puckering. Always a fault.

 *Typical Origins:* Grains, wood aging, fruits or spices.

 *Discussion:* Caused by Phenols (esp. polyphenols = tannins) acting on nerves and physically drying tissues. Polyphenols are naturally found in grain husks and other tough plant material. Imparted to beer from grain husks, but also excessive hop levels, fruit/spice/herb/veg. additions, Barrel-aging Hot break & trub carried into fermenter. Cold break carried into finished beer. Highly alkaline water. Bacterial infection. Yeast autolysis.

 *To Avoid:* \* Don’t overmill grain. Don’t oversparge/rinse grains. Keep sparge water at or below 5.8 pH. Don’t collect runoff below 0.008 S.G. Don’t expose grains to temperatures above 168 °F. \* Rolling boil of at least 1 hour to promote hot break. Proper hot & cold break separation. \* Age wood-aged beer for longer period of time. \* Remove pits, stems and husks from fruit before adding to beer. Don’t expose fruit, herbs or spices to temperatures above 168 °F. \* Avoid alkaline (i.e., high carbonate) or high sulfate (above ~200 ppm) water. \* Observe proper sanitation to avoid bacterial infection. \* Don’t leave beer on yeast cake for more than 1 month to avoid autolysis.

 *When is Astringency Appropriate?:*High levels of astringency are never appropriate. Very low levels of astringency are acceptable in wood-aged beers, beers made with a high proportion of dark malt or roasted grains, and beers made with fruits or spices which are high in tannins (e.g., cranberries, cinnamon).

**Body (Viscosity)** - **Remember: Focus mostly on this section!**

 *Detected in:* Mouthfeel.

*Described As:*Ranges from very thin (bland, characterless, diluted, empty, flavorless, watery) to very full (chewy, cloying, filling, satiating, unctuous).

 *Typical Origins:* Grain.

 *Discussion:* A subjective measure of palate fullness or viscosity - how “rich” or “filling” the beer feels in your mouth. Body is primarily determined by the concentration of dextrins, oligosaccharides & medium-length proteins in finished beer. Gums and highly caramelized sugars also play a role. Non-flocculent yeast or suspended starch particles contribute to sensation of body.

 *To Increase:* Increase wort gravity. Use malts adjuncts with more dextrins (e.g., toasted, caramel/crystal malts) Use higher protein malts (e.g., wheat, rye, oats) or unmalted protein-rich grains (e.g., flaked rye or oats). Skip protein/beta-glucan rests. Don’t filter or fine beer. Don’t cold condition for long periods of time. Choose non-flocculent yeast strain. Mash at higher temp. (162 - 167 °F). Practice good sanitation.

 *To Reduce:* Reduce wort gravity. Use fully fermentable sugar adjuncts. low mash temp. (140 - 150 °F) promotes Beta-Amylase activity, prod. thinner, more fermentable wort. Protein rest (122 - 133 °F) - esp. a long protein rest. Beta-glucan rest (110 °F) - esp. a long rest breaks. Bacterial/Wild yeast infection can metabolize dextrins. Filtration through a 1 micron or smaller filter will remove dextrins and proteins.

 *When is Body Appropriate?:*Body is an inherent part of any liquid, so all beers have body. High alcohol, malt-focused beers can have very full body (e.g., doppelbock, Russian imperial stout, barleywines), while light American-style lagers, especially low-calorie or low-carbohydrate “lite” lagers, will have thin body. Some varieties of sour beers, where microflora have consumed most of the available starches, will also have thin body (e.g., Berlinerweisse, lambics).

**Carbonation**

 *Detected in:* Mouthfeel.

*Described As:*Drying, effervescent, lively, lightening, prickly, stinging or tingling. Low carbonation can be described as being flat or lifeless. High carbonation can be described as gassy. Small bubbles are generally due to bottle conditioning, larger bubbles might be due to force carbonation. Carbonation affects perception of Creaminess and is also the driving force behind head formation.

 *Typical Origins:* Yeast.

 *Describe:* Carbon dioxide is produced by yeast during fermentation, accounting for about 50% of metabolic products. Carbon dioxide is forced into solution under pressure, traditionally occurring when beer was bottled or packaged in sealed casks. Since the 1900s, brewers have also for force-carbonated bottled or kegged beer. Kegged beer is also forced from the tank using carbon dioxide.

 Homebrewers typically get carbon dioxide into their beer by bottle-conditioning, by adding priming sugar or fresh or partially fermented wort to their raw beer just before packaging, at the rate of ½ to ¾ cup of priming sugar (or equivalent, like dry malt extract) per 5 gallons. (Also see Question T9: Kräusening). Some commercial breweries bottle condition their beers as well, notably some producers of German wheat beer beers and Belgian strong ales.

 Carbon dioxide is detected as a prickliness or effervescence because it activates the trigeminal nerve (the nerve responsible for sensation in the face, which has branches which terminate in the mouth and tongue).

 In addition to its effects on mouthfeel, high levels of carbon dioxide can indirectly affect other sensory aspects:

 *Aroma:* Escaping carbon dioxide and bursting bubbles formed by carbon dioxide help carry volatile aroma compounds out of solution, thus increasing beer aroma.

 *Appearance:* Carbon dioxide bubbles are visible in the glass unless the beer is flat. Escaping carbon dioxide is the main force behind head formation, so it directly affects head formation and retention.

 *Flavor and Mouthfeel:* High carbonation levels can affect perception of flavor and body due to “drying” and “lightening” effects on flavor and body. Conversely, low carbon dioxide levels can make flavors seem sweeter and more intense, and make body seem fuller.

 *To Increase:* If bottle conditioning, increase priming sugar during packaging. If necessary, add yeast or yeast nutrient at packaging to quickly obtain proper CO2 levels. Cap firmly to keep gas from escaping. If force carbonating choose proper CO2 level for style. Don’t agitate beer excessively (removes CO2).

 *To Reduce:* Reduce priming sugar, kräusening or CO2 pressure. Allow beer to stand or off-gas before consuming.

 *When is Carbonation Appropriate?:*Most beers have some degree of carbonation (see table below). Unblended lambics and other Belgian sour beers have very little to no carbonation. Cask-conditioned English, Irish and Scottish beers, notably bitters and English pale ales, are cask-conditioned, resulting in low carbonation, but they are not truly flat. German wheat beers and bottle-conditioned Belgian strong ales can have very high levels of carbonation, as can gueuze and fruit lambics.

High CO2 = 3-4 vol = German Wheat Beers, Berlinerweiss, Gueuze, Fruit Lambic, Belgian Strong Ales

Med. High CO2 = 2.5-3.0 = Lagers, Cream Ale, California Common, Kolsch, Altbier, American Ales, Belgian Strong ales

Med CO2 = 2-2.5 vol = Eisbock, Bohemian Pils, Doppelbock, American Wheat/Rye, Foreign/Extra Stout, Altbier, American ales, Rauchbier, Schwarzbier, Witbier, Sweet Stout, Belgian Pale Ale, Flanders Brown, Flanders Red, Robust Porter, IPA

Med-Low CO2 = <2 vol. Robust porter, English ales, strong American or English ales, Stouts, IPA, Scottish Ale, Strong Scottish Ale.

Low CO2 = 0.75-1.5 = Any cask style ale (e.g., English bitter, Scottish ales)

V. Low = <0.75 = Straight Lambic

**Creaminess (AKA Mouth Texture, Stickiness, Oiliness)**

 *Detected in:* Mouthfeel.

 *Described As:* Creamy, oily, mouth-coating, rich, slippery, smooth. In some ways, “creaminess” it is the opposite of “crisp” mouth texture.

 *Typical Origins:* Grain.

 *Discussion:* Creaminess is the degree to which the liquid clings to, and coats, the mouth. It is closely related to body and carbonation levels. To some extent creaminess is affected by presence of the same ingredients which aid head retention and formation - short chain proteins and carbohydrates (e.g., dextrins, oligosaccharides, beta-glucans). Perception of creaminess can also be affected by sub-threshold levels of diacetyl, which are detected only as slickness or richness in mouthfeel and by use of grains or other materials which are naturally oily (e.g., oats).

 *To Increase:* \* Protein rest to break down proteins. Beta-glucan rest to break down gums. Higher temperature mash which promotes formation of dextrins. \* Use grains which are naturally gummy and/or oily (e.g., oats). \* Smaller bubble size in carbonation (i.e., bottle-conditioning vs. forced carbonation). Nitrogen dispense promotes smaller bubbles which increases creaminess. \* Sub-threshold levels of diacetyl.

 *To Decrease:* \* Extremely long protein or beta-glucan rest which degrades those compounds to an excessive degree. Lower temperature mash which promotes the formation of simple sugars. \* Reduced diacetyl levels. \* Larger bubble size (i.e., forced carbonation).

 *When is Creaminess Appropriate?:* Creamy texture might be encountered in any full-bodied beer, especially one which includes oats or oat malt as part of the grist (e.g., oatmeal stout).

**Warmth (Alcohol)**

 *Detected in:* Mouthfeel.

*Described As:*Burning, hot, harsh, numbing, prickly, solventy, smooth or warming. Can be felt in the nose, throat and chest as well as the mouth.

 *Typical Origins:* Yeast.

 *Discussion:* Alcohol warm is caused by Ethanol or Fusel Alcohols attacking pain receptor nerves in the mouth. Ethanol causes “smooth” warming sensations. Higher alcohols produce hot, harsh, solventy feelings.

 *To Increase:* Increase wort gravity. Mash at lower temperature (143-149 °F). Add fermentable sugars. Ferment at higher temperatures.

 *To Reduce:* Reduce wort gravity. Mash at higher temperature range (149-158 °F). Ferment at cooler temperature (to reduce higher alcohols) Age beer to allow higher alcohols to degrade.

 *When is Alcohol Warmth Appropriate?:*Any beer of 6% ABV or higher might have detectable alcohol warmth. Harsh or burning alcohol warmth is never appropriate, but smooth warming from ethanol is expected, even welcome, in strong beers.

**Other Palate Sensations**

 Researchers into mouthfeel disagree over which flavor characteristics actually constitute mouthfeel. This section covers a wide variety of factors. For the exam, you don’t need to go into detail about any of them, just mention that they exist and possibly a type of beer particularly associated with them (e.g., resinous and IPA).

 ***Aroma/Flavor Sensations:*** Some sensations which primarily affect aroma and flavor can also affect mouthfeel, especially at high levels. See Alkaline, Alpha Acids, Chlorophenol, Fat Oil or Hydrocarbon, Leathery, Metallic, Mineral, Oxidation, Phenols, Smoky, Solventy/solventy esters, Sour, Spicy, Sweet, Umami, Vicinal Diketones (VDK) and Yeasty.

**Pain/Numbness**

 Detected in: Mouthfeel.

 *Described As:* Burning, cooling, painful, numbing.

 Typical Origins: Yeast.

 *Discussion:* Certain chemicals can physically affect the mouth by fooling, numbing or burning nerve endings. Most of these are phenolic compounds (see Chlorophenols, Phenols and Spicy), but there are exceptions. Burning or numbing compounds found in beer can include capsicum which causes chemical burning and chlorophenols which can cause numbing (although they are seldom encountered in high enough levels to do so in beer). Wintergreen - methyl salicylate - can give the illusion of cooling.

 *To Control or Avoid:* See Chlorophenols, Phenols and Spicy.

 *When is Pain or Numbness Appropriate?:* Unpleasant levels of pain or numbness are never appropriate. Low levels of pain or numbness associated with capsicum or wintergreen might be found in spice beers.

**Powdery**

 Detected in: Mouthfeel.

 *Described As:* Chalky, dusty cushion, dusty cushion, grainy, gritty, irritating, minerally, particulate, particulate matter, scratchy, silicate-like, siliceous.

 *Typical Origins:* Process/technical faults, contamination.

 *Discussion:* Powdery mouthfeel is caused by suspended solid materials in the beer. This fault is rarely encountered, since solid materials tend to precipitate quickly. It is occasionally encountered in cheaply made German hefeweizens where trub is added at bottling to add yeast character and turbidity. High levels of minerals in beer can also impart a powdery, minerally mouthfeel (see Alkaline or Mineral).

 *To Control: \** Reduce mineral additions to water. \* Properly filter beer. Make sure that material added to the conditioning tank (e.g., hop pellet particles, spices) doesn’t get into the packaged beer.

 When is Powdery Mouthfeel Appropriate?: Never.

**Resinous**

 Detected in: Mouthfeel.

 *Described As:* Mouth-coating or lingering hop bitterness.

 Typical Origins: Hops.

 *Discussion:* High levels of hop resins dissolved in beer can cling to the teeth and mouth as alcohol and water in the beer evaporates. Resinous mouthfeel is associated with extremely high levels of hop bitterness and is accentuated by high levels of sulfates in water.

 *To Control:* Adjust hopping rates as appropriate for the style. Control mineral additions as appropriate for the style.

 *When is Resinous Mouthfeel Appropriate?:* Harsh resinous aftertaste is never welcome. Pleasant lingering bitterness is expected in highly hopped beers, like American IPA and barleywines.

**Temperature (Warming)**

 Detected in: Mouthfeel.

 ***Described As:*** Cellar temperature, cold, cool, hot, freezing, refrigerator temperature, room temperature, tepid, warm.

 ***Typical Origins:*** Serving temperature.

 Typical Concentrations in Beer: n/a.

 Perception Threshold: ?.

 Beer Flavor Wheel Number: n/a.

 ***Discussion:*** In addition to being a basic mouthfeel sensation, the temperature at which beer is served affects psychological sensations of how “refreshing” or “drinkable” a beer is.

 Serving temperature also affects other sensory perceptions. Cooler temperatures increase the volume of carbon dioxide which can be dissolved in beer, reduces the rate at which volatile aroma compounds escape from solution (thus reducing overall aroma) and suppresses perception of malt and yeast-derived flavors. Indirectly, this can affect perception of body, making the beer seem thinner-bodied, crisper and cleaner than it might otherwise be.

 Conversely warmer serving temperatures (above ~55 °F) increase perception of malt and yeast-derived flavors, which in turn affects perception of body, possibly making the beer seem fuller-bodied, creamier and less crisp. Lower carbon dioxide absorption also makes beer served too warm go flat faster.

 ***To Control:*** \* Serve beer at the proper serving temperature for the style, typically 40-45 °F for lagers, 55 °F for ales.