Properties and Applications of Flour and Sugar

Unit: Culinary Science

Problem Area: Food Science

Lesson: Properties and Applications of Flour and Sugar

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Describe the various types of flour and sugar.**
2. **Explain the various applications of flour and sugar.**

Resources.

The following resources may be useful in teaching this lesson:

Daleiden, George. "Sugar's Uses in Cooking and Baking," *suite101.com*. Accessed Oct. 31, 2010. <http://bakingdesserts.suite101.com/article.cfm/sugars_uses_in_cooking_and_baking>.

"The Flour Page: What Is Flour?" *cookeryonline.com*. Accessed Oct. 31, 2010. <http://www.cookeryonline.com/Bread/flour.html>.

Gisslen, Wayne. *Professional Baking*, 5th ed. Wiley, 2008.

Labensky, Sarah R., Priscilla A. Martel, and Eddy Van Damme. *On Baking: A Textbook of Baking and Pastry Fundamentals,* 2nd ed. Prentice Hall, 2009.

McGreal, Michael J. *Culinary Arts Principles and Applications*. American Technical, 2008.



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Equipment, Tools, Supplies and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visuals from accompanying masters
- ✓ Copies of sample test, lab sheet, and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials
- ✓ *Supplies below are suggested for use in the Interest Approach:
  - granulated sugar
  - white corn syrup
  - molasses
  - "pink packet" saccharine based sugar substitute
  - honey
  - bowls in which to place sweeteners
  - labels for bowls with numbers or letters
  - tasting spoons
  - paper
  - writing utensils

Key Terms. The following terms are presented in this lesson (shown in bold italics):

- adhere
- all-purpose flour
- baking
- body
- bread flour
- breading
- brown sugar
- cake flour
- caramelize
- coating
- confectioners' sugar
- creaming
- dredge
- flour
- gluten
- granulated sugar
- hygroscopic
- lactose
- meringue
- pastries
- roux

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- structure
- sucrose
- sugar
- sugar substitutes
- superfine sugar
- table sugar
- turbinado sugar
- whole wheat flour
- yeast

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Assemble white corn syrup, table sugar, honey, molasses, and a sugar substitute, preferably the pink packet variety of saccharine-based sweetener. Ideally, these would all appear in bowls or containers, unlabeled, and out of their packages (with only numbers or letters to identify the bowls). Let students observe the products. Then ask if they can identify them. (Do not mention that all are sweeteners.) Listen to what they have to say. Next, tell them they each need paper and a writing utensil. Have students taste the products and identify them (on their paper).*

> *Collect their answers. Then, as a class, discuss their answers and the correct answers. Students may think this was simply a "demo" to ID these products. However, once identified, ask the students to explain the differences. What is the purpose of each sweetener? Can some be used in ways that others cannot?*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Describe the various types of flour and sugar.

Anticipated Problem: What types of flour and sugar are available?

I. Types of flour and sugar

A. ***Flour*** (farine) is a powdery cooking ingredient made from grains that are usually finely ground. It is made up of starch, protein (gluten), and small amounts of fat, sugar, and minerals. The most common type of flour for cooking and baking tasks is wheat. Flour is used in all baked goods. Wheat grains are composed of the bran

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(rough outer shell), the endosperm (starchy inner part), and the germ (located at the bottom of the kernel). When most flour is milled, all of the germ and most of the bran is removed. The germ contains the highest-grade of protein and all the fat. Hard wheat has a higher protein content than soft wheat. Also, flour with a high gluten content is better suited to yeast leavening because it has the elasticity to withstand the expansion of the gas bubbles. Flour with a lower gluten content is better suited to leavening with chemicals (e.g., baking soda or baking powder) that produce smaller and finer bubbles than yeast.

1. ***Whole wheat flour*** is flour that contains the bran, endosperm, and germ; it is milled from the entire wheat kernel. A drawback to whole wheat flour is its short shelf life. Stone-ground flour deteriorates quicker than other types due to the high oil content in the germ.
2. Cracked wheat flour is a mixture of wheat kernels and white flour. As a result, some chopped bits remain in it. Because kernels for cracked wheat are cut rather than ground, cracked wheat flour retains most of its starch. Therefore, it needs to be mixed with all-purpose or other wheat flour when used for baking. Cracked wheat imparts a nutty flavor to baked goods.
3. ***Bread flour*** is flour that feels a bit gritty (as compared to all-purpose flour) and has a high gluten content, which makes it desirable for bread making. It is sometimes called high-gluten flour. Gluten allows great elasticity in dough. It is able to expand and hold gases that are given off by the yeast. Gluten is actually formed when flour and water are mixed and the dough is kneaded.
4. Semolina flour is a high protein Durum wheat that is granular in texture. It is used primarily for pasta production. The use of all-purpose flour in place of semolina is a common error when people make homemade pasta.
5. ***All-purpose flour*** is a mixture of hard (high protein) and soft (low protein) wheat flours. When a standardized recipe or formula calls for bread flour or cake flour, a person can use the product with a high degree of certainty that the product will be standard. The same is not true of all-purpose flour because the milling process has many more variables. High-protein flour produces a more elastic structure. For example:
    a. The protein content of all-purpose flour varieties ranges from 8 grams to 13 grams of protein per cup.
    b. Southern U.S. all-purpose flour has a protein count of 8 to 9 grams per cup and is closer to cake flour. When a recipe calls for a chemical leavening agent (e.g., baking powder or baking soda), the most consistent results will occur with flour milled in the southern United States or with a national brand.
    c. All-purpose flour from New England and Canada has a protein count of about 13 grams per cup and is closer to bread flour. Yeast bread recipes have more consistent results with flour milled in the northern United States and Canada.
    d. Nationwide brands of all-purpose flour hover at about 12 grams per cup.

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6. ***Cake flour*** is wheat flour that has the lowest amount of gluten. It is made from lower protein wheat and is finer ground than all-purpose varieties. Cake flour produces a finer textured cake than all-purpose flour.
7. Pastry flour is soft and contains low-protein flours similar to cake flour. It is primarily used for quick breads and pastries.
8. Instant flour has a granular appearance (rather than a powdery appearance) and is generally used in gravies and sauces because it dissolves quicker than all-purpose flour and tends not to lump.
9. Non-wheat flour contains no gluten and, when used in bread making, is usually combined with wheat flour. Using any of the following flours alone to make a loaf of bread would result in a heavy, dense, crumbly product.
    a. Rye
    b. Buckwheat
    c. Corn
    d. Potato
    e. Rice
    f. Nut (e.g., almond and walnut)
10. Measuring flour by weight is more accurate than measuring it by volume. According to the reference book *Food for 50*, the following are approximate measures and weights for flour:
    a. About 4 C. all-purpose flour weighs 1 pound
    b. About 3½ C. (scant) unsifted bread flour weighs 1 pound
    c. About 4 C. sifted bread flour weighs 1 pound
    d. About 4¾ C. sifted cake or pastry flour weighs 1 pound
    e. About 3¾ C. whole wheat flour weighs 1 pound

B. ***Sugar*** (sucre) is a sweetener that comes in multiple forms (e.g., liquid, solid, and sugar substitutes) usually from the juice of sugar cane and sugar beets. Each type of sugar has a unique taste and degree of sweetness. Raw sugar is turned into crystals through a process called *refining*. Liquid and dry sugars react very differently in baking and, as such, are not interchangeable with regard to volume and weight. In addition, baking always requires more liquid than dry sugar to sweeten a product. Sugar types are:
    1. Dry sugars
        a. ***Granulated sugar*** or ***table sugar*** (***sucrose***), the most common type of sugar, is ground to a fine consistency. In contrast, medium coarse sugar is used to make syrups and candies. Coarse (sanding) sugar is sprinkled on cookies, doughnuts, and other pastries. The letter X signifies a sugar's fineness (grind). More Xs equate to a finer grind. Granulated table sugar is usually 5X.
        b. ***Turbinado sugar*** is a light brown, coarse-ground granulated-type sugar that is only partially refined (in a turbine); it has some impurities that table sugar does not. It has some molasses content and thus a heavier flavor than table sugar.

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c. ***Superfine sugar*** (bar sugar, berry sugar) is a finer grind than granulated sugar, but it is also a coarse crystal. It dissolves easily and is used in meringues, beverages, and cocktails.

d. ***Confectioners' sugar*** (powdered sugar) is soft, very white, and powdery sugar that is used to ice, frost, and coat cookies, cakes, and pastries. To prevent lumping, a small amount of cornstarch is added to confectioners' sugar during processing. Confectioners' sugar comes in several grinds, including:

   (1) Ultrafine (or icing sugar) is 10X and is used for uncooked icings and frostings.

   (2) Very fine is 6X and is used for coating sweet rolls and other baked goods.

   (3) Medium coarse is 4X and is used for coating doughnuts, cookies, and pastries.

e. ***Brown sugar*** is light to dark brown sugar that is somewhat moist, with larger crystals than granulated sugar and confectioners' sugar. It has a molasses flavor and is less refined than white sugar. Brown sugar is used in baking and candy making. In addition, it can be used as a caramel flavor enhancer.

2. Liquid sugars (syrups)

   a. Honey is a sweet viscid (sticky) substance created by honeybees from the nectar of flowers. It is the only naturally occurring liquid sugar. The type of flower accounts for honey varieties. For instance, clover honey is light and delicate, and buckwheat honey is dark and strong. Honey is a bit acidic, so baking formulas usually add a neutralizing agent, such as baking soda.

   b. Corn syrup is a thick, sweet product made from pressed corn juice and is most often used for candy making and baking. It ranges in color from clear to dark, with markedly different tastes and sweetness levels. Dark corn syrup is much sweeter and more flavorful. Corn syrup is composed of approximately equal amounts of fructose and glucose.

   c. Molasses is a dark and heavy-flavored sweetener with a strong flavor that overshadows its sweetness. It is a byproduct of sugar production. Molasses is the leftover juice from the refining process. The darker the molasses, the stronger the flavor. Because molasses is a bit acidic, recipes usually call for a neutralizing agent (e.g., baking soda).

3. ***Sugar substitutes*** are items that come from natural sources (e.g., Truvia™ from the Stevia plant) and artificial processes (e.g., saccharine, aspartame, and sucralose), with the purpose of sweetening. However, sugar substitutes have no relationship to sugar, other than sweetness. All sugar substitutes are lower in calories than sugar and may be less sweet or hundreds of times sweeter than table sugar. Few forms add bulk or volume to a recipe as sugar does. Some can lose their sweetness under heat. In general, they do not pro-

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vide the functions in cooking or baking that are common in sugar (e.g., tenderizes and aids in creaming).

a. Saccharin is 300 times sweeter than sucrose (granulated sugar), becomes bitter when heated (should not be used for cooking), and has a slightly metallic aftertaste. For example, Sweet 'n Low® is a saccharin sugar substitute.
b. Aspartame is 200 times sweeter than granulated sugar and is primarily used in commercial food production for candy, breakfast cereal, and soft drinks. For instance, NutraSweet® and Equal® are aspartame sugar substitutes.
c. Sucralose is made from granulated sugar, but it is 400 to 800 times sweeter. It is fairly stable under heat and may be used for baking. For example, Splenda® is a sucralose sugar substitute.

4. Measuring dry sugar by weight is more accurate than measuring it by volume. According to the reference book *Food for 50*, the following are approximate measures and weights for dry sugar:
   a. 1 cup of granulated sugar (5X) weighs about 7 ounces.
   b. 1 cup of confectioners' sugar (10X) weighs about 4 ounces.
   c. 1 cup of packed brown sugar weighs about 7½ ounces.
5. Liquid sugar may be measured by volume or by weight, but weight measurements are more accurate. For example, 1 cup of molasses, honey, or corn syrup will weigh about 12 ounces. To measure liquid sugar by volume:
   a. It is necessary to lightly spray the interior of the measuring cup with a spray shortening or to film the inside of the cup with vegetable oil.
   b. Then the sugar can be poured into the measuring cup to the desired measurement.
   c. When pouring liquid sugar into the mixture, it will release easily from the sides of the cup and will make cleanup easier.
   d. The spray-shortening tip can be used for weight measurement vessels as well.

Teaching Strategy: *Use VM–A to review the weights of various flours and sugars.*

Objective 2: Explain the various applications of flour and sugar.

Anticipated Problem: How are flour and sugar used in the culinary arts?

II. Applications of flour and sugar

A. Flour

1. Properties of flour
   a. Structure is the chief function of flour in baking and cooking processes. Wheat flour is the type most commonly used in baking. Several types exist, each with its own properties based, in part, on the gluten content. ***Gluten***

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is the protein in wheat flour and is directly linked to the physical structure of the final product. Less gluten results in a softer structure. Higher gluten contents in a product result in a firmer and chewier structure. Gluten only forms when two proteins (glutenin and gliadin) come in contact with water. Kneading activates these proteins. The more protein the flour contains, the more water it can absorb. When a dough or pastry is baked, the gluten coagulates—becomes firm—and forms the structure of the baked item.

b. Flavor is a major function of flour in cooking and baking. Whether using cracked wheat, whole wheat, rye, buckwheat, or soy flour, the flour imparts its essence to a baked product.

c. Color is a function of flour in baking and cooking. Browning (turning from white to brown) is a desirable trait for most baked and many cooked foods. Flour browns in or under heat, whether it is the outside of a bread or cake baked in the oven, a brown roux for shrimp gumbo soup, or a batter-dipped food in a fryer. The browning of flour occurs when the proteins and sugars in flour react to heat. Most flour consists primarily of starch, which is really sugar in a compressed form.

d. As a thickening agent, flour is used in roux, pastry cream, soup, and sauce. Cream soup and sauce use roux for thickening purposes. ***Roux*** (pronounced roo) is a mixture of equal weights of flour and butter (or some other fat) that is cooked until some of the starch is removed from the mixture and it becomes a paste. When this paste is added to liquid, it readily absorbs the liquid, effectively thickening the product. Adding raw flour to a liquid can cause lumps to form in the product and is not exceptionally effective in thickening liquids, though it can work as the liquid heats.

e. Binding one or more ingredients together is a function of flour in baking and cooking. Flour (in its raw state) is sometimes added to a savory stuffing that is a bit too runny or to a raw fruit pie filling that contains sugar. In both cases, the addition of flour binds (and thickens) the product as it cooks or bakes.

2. Applications of flour

a. ***Baking*** is a generic term that refers to all bakery-related products, such as cinnamon bread, French bread, cakes, muffins, cookies, and brownies. Baking is the single largest application of the ingredient flour. No baked good can be prepared without flour.

(1) Flour provides body and structure to baked goods. In baking, ***body*** is bulk—the mass of the product—and ***structure*** is the texture of the body (e.g., tender and crumbly or firm and chewy). Different types of flour create different structures.

(2) Flour is often used as part of pan preparations to prevent cake batters and other baked goods from sticking to the pans. The preparations require the pans to be greased with butter or vegetable spray and then lightly coated with flour, with the excess tapped out of the pans.

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The grease/flour combination works far better than using either item alone.

b. ***Coating*** is the process of covering food through a batter or dredging process prior to pan-frying or deep-frying (e.g., chicken fried steak and battered fish and onion rings). Battered and dredged foods that are fried come out golden brown and crunchy when they are cooked properly. For example, deep-fry batters have a similar consistency to those for pancakes, doughnuts, hush puppies, and crepes. Flour provides a portion of the coating mixture as well as the thickening, body, and structure.

c. ***Breading*** is the process of coating (a dry application) food with a starchy product (e.g., flour, cornstarch, or breadcrumbs). Flour is used as breading on some food, such as Maryland fried chicken. Breaded food creates a golden brown and often crunchy coating on cooked products, but the effect is lighter than for batter-dipped food. To bread products, it is necessary to:

(1) It is necessary to ***dredge*** (coat or sprinkle food with a breading product) the food in seasoned flour to effectively dry the surface and to give the food a "texture" that will hold the liquid "glue" for the breading. Dredging of the food in flour makes the liquid glue agent (e.g., milk or egg mixtures) ***adhere*** (stick) to the food.

(2) Breading (e.g., breadcrumbs, cereal flakes, chips, and cracker crumbs) is then adhered to the food by dipping it in the dry breading medium.

d. Thickening for pastry cream, soup, and sauce is a large part of the role flour plays in cooking. As previously mentioned, cream soup and sauce preparations rely on the role flour plays in roux to thicken each food item to the correct consistency.

e. Pasta, dumplings, and other noodles also rely on flour (usually wheat but also rice and potato) as the main ingredient.

B. Sugar

1. Properties of sugar

a. The primary function of sugar in baking and cooking is to sweeten food products. It provides and activates the sensory perception of sweetness in the mouth. (The other sensory tastes are sour, salt, and bitter.)

(1) ***Lactose*** is the sugar found naturally in milk and milk products. It is not very sweet to the taste, but it is a sugar and reacts like sugar. It can feel sticky to the touch; it can brown when heated; and, to a lesser degree, it can sweeten. Where milk or milk products are used, these properties follow.

(2) Sugar can be used in small amounts to diminish or soften harsh sensory tastes. The sweetness of sugar offsets and/or complements sour (acidic) or bitter flavors. For instance, cranberries, rhubarb, and tomato sauce are all commonly adjusted (neutralized) with sugar, even if the desired flavor is not sweet.

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b. Sugar is a tenderizer and it softens (weakens and interferes with) the gluten formation of bread, cake, and more. The more sugar present in a batter or dough, the more tender the crumb of the product. While high sugar content items (e.g., cookies) can be crispy, that has more to do with the other ingredients and the baking time. Other factors do impede gluten development (e.g., the amount of shortening and the type of flour), but sugar is a factor to consider. Sugar also works as a tenderizer in marinades and coatings.

c. Sugar impacts the color of a food product. It can ***caramelize*** (brown) in the presence of heat and enhance the flavor of food. Sugar in any natural form caramelizes when it becomes hot enough. Sugar caramelizes when heated on its own (as in candy making), when it is part of another product (e.g., cookies), and when it is part of a food containing natural sugar (e.g., fruit). For example, an onion has so much natural sugar that the longer it is heated, the browner it becomes and the more enhanced the flavor becomes.

d. Sugar aids in the leavening of baked goods.

   (1) Sugar aids in the creaming process for baked goods by increasing the plasticity (ability to be mixed, worked, or spread) of the fat. ***Creaming*** is a technique by which room temperature (60°F) fat is beaten together with sugar to create a light and fluffy mixture. The additional air cells that are trapped as a result of creaming help batter and dough rise (leaven).

   (2) Sugar is a food source for yeast and, as such, aids in the leavening process. ***Yeast*** is a one-cell living organism and requires food (sugar) to live and grow. Liquid sweetener is more readily available as a food source for yeast. Even if no added sugar is present, yeast can break down the starch in flour and convert it to sugar as a food source. This would slow down the growth process. Yeast leavening occurs over a long period of time, and sufficient sugar must be available to allow the yeast to react during the sponge stage, again during the first rising, and finally in the oven. Yeast is also essential in the fermentation of sugar and starch to make alcohol.

   (3) Sugar added slowly to whipping eggs or egg whites (meringues) assists in the formation and holding of air cells in the mixture. (Air is another form of leavening.)

e. Sugar keeps food fresher longer. Sugar has a natural ***hygroscopic*** (absorbing or attracting moisture from the air) property. This is a particularly important and useful property, especially in baked goods. Pastries that are high in sugar attract and retain moisture, keeping them fresh longer (even more so when the sugar is a liquid type). Conversely, bakery items that are meant to be crisp (e.g., cookies) can get soggy or stale quickly in humid environments for the same reason. Candies made primarily of sugar (unlike chocolate) that are exposed to humidity will become sticky and eventually gooey because of the absorption of moisture from the air.

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f. Sugar adds caloric value to foods. Sugar substitutes would be the exception to this function of sugar.

2. Sugar applications
   a. Baking is a generic term that refers to all bakery-related products (e.g., cinnamon bread, French bread, and cake). Baking is one of the primary applications of the ingredient sugar. ***Pastries*** are baked goods that are high in sugar and that are often glazed or iced.
   b. Candy making is a prime example of the application of sugar in the culinary arts. Due to its unusual properties, when sugar is heated to different temperatures, it takes on different textures as it cools (e.g., from soft and chewy to hard and brittle).
   c. Glazes, icings, and frostings—cooked and uncooked—use sugar as the key ingredient. Sugar adds sweetness and provides the physical bulk and base of the product. For example, doughnut icing is virtually all sugar. Frosting and buttercream, which are typically made from fat and sugar, rely on sugar to make them lighter and fluffier through the process of creaming (the whipping or beating of fat and dry sugar together). The natural crystalline shape of sugar smashes into the fat and other sugar granules, making pockets that trap air cells. The result is a fluffy product.
   d. Mousse, soufflé, chiffon, angelfood, and sponge cakes are the benefactors of air leavening from folding meringue into their batters. Sugar added slowly to whipping eggs or egg whites (meringue) assists in the formation and holding of air cells in the mixture (leavening). ***Meringue*** is a classic example of egg whites and sugar whipped into a fluffy mixture that can be eaten as is, baked crisp, or added to other ingredients to lighten a product.
   e. Sorbet, semifreddo, gelato, and ice cream rely on sugar in high concentrations to lower the freezing point. For instance, while most liquids freeze solid, products high in sugar (e.g., ice cream) require a much lower temperature (well below 0°F) to freeze rock hard. Short of a temperature well below 0°F, the products may be technically frozen, but “softly” frozen (pliable) is a more accurate description.
   f. Syrup, jam, jelly, and other toppings rely on sugar to break down vegetable and fruit cell structures to release moisture. It is not the hygroscopic nature of sugar but the crystalline structure of sugar that breaks down fruit and vegetable cell structure, resulting in the release of moisture from the produce and a softened, even mushy texture. (This same phenomenon occurs with salt.) For example, when sugar is sprinkled on berries or sliced apples in a bowl, a sweet liquid forms at the bottom of the bowl, and the structure of the fruit becomes limp. If planned, this application can be an advantage. Sugar can be applied to berries 30 minutes before using them as a topping for ice cream or in a shortcake presentation. It can also be a disadvantage as when an unsuspecting cook cuts various fruits in the morning and adds sugar for service as a fresh fruit cocktail that evening. Unfortunately, the fruit will be limp and mushy by service time, and the bowl will be filled with draining liquid.

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g. Sugar is a natural preservative. It can be added to eggs, fruits (by way of sauce, preserve, jam, etc.), dairy products, and other prepared products to extend shelf life. The added sweetness would have to be taken into consideration when making the final product.

Teaching Strategy: *Use VM–B. Assign LS–A to have students practice identifying the properties of flour and sugar.*

- **Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used.

- **Application.** Use the included visual masters and lab sheet to apply the information presented in the lesson.

- **Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

- **Answers to Sample Test:**

Part One: Short Answer

(Answers may vary slightly, but these are the primary responses.)

1. Sugar is often added to sour (acidic) or bitter foods to "soften" the taste.
2. Flour is sprinkled on greased pans to coat the pans. It is necessary to shake off the excess.
3. The granular structure of dry sugar coupled with the motion of beating and whipping into fat forces the development of air pockets in fat that create a light fluffy creamed mixture. The chemical structure of liquid sweeteners is unable to duplicate this affect.

Part Two: True/False

1. T
2. T
3. F
4. F
5. F
6. T
7. F
8. F
9. F
10. T

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Part Three: Completion

1. sugar substitute (or artificial sweeteners)
2. roux
3. honey
4. high-gluten flour
5. hygroscopic
6. batter
7. liquid, dry
8. gluten
9. lower
10. weight, volume (or cups)

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Sample Test

Name _____

Properties and Applications of Flour and Sugar

Part One: Short Answer

Instructions: **Answer the following.**

1. Why might sugar be added to tomato sauce if a sweet sauce is not the desired outcome?

2. How is flour used to help keep batters from sticking to pans in baking?

3. Why is dry sugar used for *creaming* rather than liquid forms?

Part Two: True/False

Instructions: **Write *T* for true or *F* for false.**

_____1. Flour with low gluten generally makes tender baked goods.

_____2. Sugar is a food for yeast.

_____3. Sugar substitutes are not as sweet as granulated table sugar.

_____4. The primary property of flour is as a thickener.



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_____5. Breading for fried food that is made from rice or potato flour does not brown.

_____6. Sugar interferes with gluten development, resulting in more tender pastries.

_____7. Rice flour is the preferred flour from which to make noodles and dumplings.

_____8. The number of Xs on a container of sugar reveals the level of expense.

_____9. Cake flour has more gluten than all-purpose flour.

____10. Molasses is less refined than granulated sugar.

Part Three: Completion

Instructions: **Provide the word or words to complete the following statements.**

1. Products designed to sweeten foods with few or no calories are called _____.
2. The thickening agent made by cooking equal weights of flour and fat is called _____.
3. The only natural liquid sweetener is _____.
4. Bread flour is also called _____.
5. The _____ nature or ability of sugar is the reason candy gets sticky and gooey on humid days.
6. A flour-based alternative to breading is _____ though it fries up heavier and denser than breading.
7. It always requires more _____ sugar than _____ sugar to sweeten a product.
8. The protein in wheat flour is _____ and it is directly linked to the physical structure of the final product.
9. Sorbet, semi-freddo, gelato and ice creams rely on sugar in high concentrations to _____ their freezing point.
10. Measuring flours and sugars by _____ is more accurate than measuring them by _____.

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MEASURING FLOURS AND SUGARS

Flours are most accurately measured by weight:

- about 4 C. all-purpose flour weighs 1 pound
- about 3½ C. (scant) unsifted bread flour weighs 1 pound
- about 4 C. sifted bread flour weighs 1 pound
- about 4¾ C. sifted cake or pastry flour weighs 1 pound
- about 3¾ C. whole wheat flour weighs 1 pound

Dry sugars are most accurately measured by weight:

- 1 cup granulated sugar (5X) weighs about 7 ounces
- 1 cup confectioners' sugar (10X) weights about 4 ounces
- 1 cup packed brown sugar weighs about 7½ ounces
- 1 cup molasses, honey, corn syrup weighs about 12 ounces



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Liquid sugars may be measured by volume or weight, but weight is more accurate:

1. To measure liquid sugar by volume, lightly spray the interior of the measuring cup with a spray shortening or film the inside of the cup with vegetable oil.
2. Then pour the sugar into the measuring cup (scooping it adds sugar to the outside of the cup and makes more cleanup) to the desired measurement.
3. When you pour the liquid sugar into the mixture it will release easily from the sides of the cup and makes cleanup easier.
4. The spray-shortening tip can be used for weight measurement vessels as well.

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APPLICATION OF FLOUR—BAKING

- Fresh bread making is an art form. Look at all the different flours, shapes and styles of breads.



- The crumb on this slice of chocolate mousse cake has a finer and softer crumb than the breads. Why?



- This apple pie's crust has a structure built by the gluten in the flour and the filling is thickened with flour.



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LS–A

Name _____

Identify Properties and Uses of Flours and Sugars

Purpose

The purpose of this activity is to practice identifying properties and uses of flours and sugars.

Objectives

1. Identify properties of flours and sugars.
2. Identify uses of flours and sugars in culinary arts tasks.

Materials

- lab sheet
- writing utensil
- cookbooks and reference books

Procedure

1. Work independently or in pairs to complete this lab sheet. There are two sections: a word scramble and a short answer section. All answers relate to the properties and uses of flours and sugars in culinary arts tasks.
2. You may use cookbooks, reference books, and the Internet to research your answers.
3. Use the clues to unscramble the flour and sugar terms from this lesson. Write your answers in the space provided.



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Word Scramble		
Scrambled word	**Answer**	**Clue**
a. zeeendti		Sugar has this affect on baked goods
b. gcinmrea		Dry sugar and fat are needed for this
c. tayse		Needs sugar to grow
d. rbetta		Tastes great fried on onion rings
e. ttscuerrs		Flour provides this to baked goods
f. ezliemcaar		What happens to heated sugar
g. derbin		Flour causes things to stick together
h. twneees		The primary use of sugar
i. cshycigoroop		Sugar attracts moisture
j. wongnirb		Happens when flour is heated

4. Write a complete sentence or two to answer each of the following items. Place your answer in the space provided.

   a. Define the word *structure* as it relates to texture in this lesson.

   b. How does *gluten* affect the structure of baked goods?

   c. What is *dredging*?

   d. What property or properties does sugar have that sugar substitutes do not?

   e. What does sugar do that makes a cake's crumb more tender than that of pizza dough?

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f. The crystalline structure of sugar has an effect on fresh fruits (and vegetables). What is that affect, and how could you use it to your advantage?

g. For what reason or reasons is *roux* prepared? Briefly describe how it is prepared.

h. Breading and batter usually include flour. What is the difference between the two?

i. The flour most people think of comes from wheat. List three other sources of flour. How do these non-wheat flours differ from wheat flour?

5. Participate in a discussion of the flour and sugar properties.
6. Turn in your completed lab sheet to your instructor.

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Identify Properties and Uses of Flours and Sugars

3. Word Scramble

   a. tenderize
   b. creaming
   c. yeast
   d. batter
   e. structure
   f. caramelize
   g. binder
   h. sweetener
   i. hygroscopic
   j. browning

4. Short Answer

   a. Structure, as it relates to texture, refers to the degree of tenderness or firmness and the degree to which the product has a soft crumb or a crisp or sturdy crumb.
   b. Gluten is the protein in wheat flour. The more it is developed, the tougher or firmer the final product becomes. The less developed gluten is, the softer and more crumbly the product.
   c. Dredging is the dipping of a product in flour or a crumb to coat it lightly, shaking off the excess.
   d. Sugar has several properties that sugar substitutes lack. It adds bulk or volume, caramelizes, adds calories, tenderizes wheat dough, breaks down fruit and vegetable cells allowing their juices to flow, aids in creaming, attracts moisture and keeps foods from drying out (hygroscopic), traps air, fluffs and stabilizes whipped eggs, lowers the freezing point of sorbets and ice creams, and feeds yeast.
   e. To make cake crumb tender, sugar is added to the batter to inhibit gluten development. A batter with a higher sugar content results in a product with a tender crumb. Pizza dough only has a few teaspoons of sugar to feed the yeast so the gluten development is strong.
   f. The crystalline structure of sugar has an interesting effect on fresh fruits and vegetables. Sugar breaks down the cell structure in produce, making it render its juices and leaving the product looking a bit wilted. To make this property an advantage, one could use sugar to soften fruits prior to baking, providing natural fruit

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liquids to turn into a sauce. In addition, cooking times could be shortened for fruit by softening the fruits ahead of time.

g. Roux is prepared to thicken cooking liquids for a sauce or a soup. Roux is prepared from equal weights of fat (butter) and flour, cooked for at least several minutes (as long as needed to turn it the correct shade of brown).

h. Breading and batter are different. Breading is a dry coating applied to food, held on by dredging foods in flour and dipping in eggs or milk prior to dipping in the breading mixture. The resulting product, despite how it is cooked, will be brown, somewhat crisp, and not very heavy. Batter is a mixed and light moist coating made primarily of eggs and flour. Products are dipped into this soft dough and are almost always pan- or deep-fried. The result is brown and crisp, but considerably heavier than breaded items.

i. Other non-wheat flour sources are rice, potato, buckwheat, almond, and corn. Non-wheat flour differs from wheat flour in the following ways: None have gluten, so all create soft dough or batter and a crumbly texture. They all have different tastes.

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