Baking Science: Bread

Introduction: Have students look up the word "staple" as it refers to food. Few cultures are without a staple bread, often shaped in a loaf. This loaf may not look anything like our sliced breads. It has only been in recent years, and in countries struggling with obesity, that bread has become viewed as anything less than the basis of hospitality and meals. As we learn more about nutrition, we soon learn that it is not bread that is the cause of obesity. Bread remains part of the foundation for health and wellness.

He who shares my bread and salt is not my enemy.
Arabic Bedouin proverb

Loaves come in a variety of names, shapes and sizes. (Show samples or pictures on-line)
(French) Baguette, batarde, baton, ficelle
(Swedish) Limpa
(German) Pumpernickel, kommisch and kugelhopf
(Italian) Ciabatta, pugliese, grissini, focaccia
(Jewish) Challah
(Russian) Kulich
(Portuguese) Pao duce
(Czechoslovakian) Houska
(English) Sally Lunn
(American) Pan bread (milk, raisin, multigrain, whole wheat)

The **Kansas Festival of Breads** baking contest is a wonderful way to test your skills and locate winning home and professional bread recipes. **Visit** www.kswheat.com

More breads @ www.homebaking.org

***See all types of Breads at The Cook's Thesaurus**
http://www.foodsubs.com/Bread.html

Loaves may be:
- sweet, savory or without any sugar at all
- baked in a loaf pan, on a baking stone, in a cast iron skillet or on a sheet pan
- shaped round, oblong, thin or thick, or braided
- tender, crusty, chewy

Students will:
- Examine traditional breads and place them geographically with their country or region.
- Determine the function of the basic ingredients in bread.
- Discuss Bakers Percent as it is used by bakers to determine the amount of each ingredient used in a bread formula.
- Discuss the impact of water, dough, baked and storage temperatures for quality results.
- Measure the result of varying a standard procedure (scalding milk) to save time.
- Accurately determine the net weight of a loaf of bread produced in a lab setting.
- Develop a multigrain bread and label it for both market appeal and accuracy after successfully altering two ingredients in a basic bread recipe.

Equipment and ingredients needed:
- 8 ½-inch standard loaf pans
- Instant read thermometer
- Electronic or other food scales
- Mixers with dough attachments
- Ovens, oven mitts
- Wire cooling racks
  1. WHEAT FLOURS: Bread flour, whole wheat flour (high protein; white or red, winter or spring wheat)
  2. NON-WHEAT FLOUR, MEAL or ROLLED GRAINS: oat or cornmeal; rolled barley, oats, rye or wheat; soy, rye, barley, amaranth, triticale or oat flour

3. FATS: Butter, vegetable oil, shortening
4. EGGS: large
5. MILK, dairy or soy, and/or dry milk
6. SUGARS: granulated, brown sugar, honey, molasses
7. DRIED FRUITS: cherries, raisins, currants, apples, apricots, peaches
8. NUTS: walnuts, pecans, sunflower kernels, almonds
9. YEAST: fast rising or instant; active dry
10. SALT: table, iodized or non-iodized; Kosher coarse salt
11. WATER: (Find out how hard it is)

<u>Ingredient Functions</u>: Help students learn what each ingredient contributes to great bread.
-Power Point: *Baking Science: From Flour to Table* available @ www.kswheat.com
-DVD: *Bakers Dozen* lessons, www.homebaking.org

Common ingredients in breads and their functions include:
Flour: The major ingredient used in yeast-raised breads, it will be milled from hard or soft wheat. Flour must have adequate protein (gluten) strength to:

- Form elastic dough
- Withstand mixing, stretching, shaping
- Support the weight of the other ingredients

Wheat and Flour Type	Flour Uses	Protein	Doug Strength	Water Absorption
Hard Spring High Gluten Strong Patent Spring Patent	Whole wheat Bagels Hearth breads Thin pizza Pizza crust Hearth bread *Sweet dough Breads Rolls	**12-14%** 13.4-14.4% 12.8-13.2% 12.4-12.8%	High	High 60-65%
Hard Winter Winter patent All-purpose	Pan breads Artisan & flat breads Thick crust Pizza Quick breads Cookies *Sweet dough	**10-12%** 11-12% 10-11% 8.5-10%	Med	Medium 50-60%
Soft Winter Pastry Cake	Cookies Brownies *Sweet dough Sheet cakes High Ratio cakes; angel	**7-9%** 8-9% 7-8%	Low	Low

*Sweet dough may be a combination; ex: 70% bread flour, 30%

Flour from other grains: All flours are different.
Oats, corn, soy, barley, rye, rice, amaranth, triticale, kamut, and buckwheat are most commonly used in multigrain breads and rolls to add character, flavor, texture, nutritional variety and color. These grains contribute little or no gluten, so *vital wheat gluten* may be used to help produce a lighter texture bread.

Basics for using a non-wheat flour or ingredient in yeast breads:
(Also view Flour segment, Bakers Dozen DVD, www.homebaking.org)
Refer to the Baking Terms and Techniques.

- Substitute non-wheat flours at levels 5 to 25% of total wheat flour weight.
  (EX: 5 lbs. whole wheat, bread or all-purpose flour is called for
  Substitute 25% of the wheat flour = 3 lb 12 oz wheat flour
  1 lb 4 oz. non-wheat flour or meal
  A different mixing method may also be needed, such as a *sponge dough* method.
- When bran, flaked or rolled grains are used, additional water is usually needed and presoaking or cooking the flakes or rolled grain is recommended.
- Pre-soak or cook whole or coarsely cracked kernels of grain before adding to the recipe (bulgar, cracked wheat, groats).

Ground dry peas or lentils; isolated soy or wheat protein powder:
Pre-cooked green or yellow pea powder (flour), precooked lentil powder (flour), and isolated soy or wheat proteins are highly nutritious and economical. Substitute at levels of 5-10% of total flour weight. Additional water may be needed to (moisten) hydrate properly. Vital wheat gluten may be needed to boost the dough's elasticity.

Vital wheat gluten:
Dried gluten; derived from high protein flour; it is 80% protein. Used in high-fiber, whole grain, multigrain or blended with low protein flours to increase dough strength to support heavy ingredients (nuts, fruit, whole grains, fiber) to improve gas (CO_2) retention; reduce potential collapsed loaves. Use at levels of 1 to 4% of flour weight and add 1 ½ times the gluten's weight in additional water.

Water:
Water is the second major ingredient in bread, comprising 20-35% of the dough weight. Water hydrates (moistens) ingredients (sugar, salt) so they will blend, become active (leavening), and gluten can develop. Water temperature is the main control of dough temperature. Water should be medium-hard (50-100 parts per million grains of hardness) to provide mineral salts which strengthen gluten. Soft water produces sticky dough. Hard water (100ppm andup) slows fermentation.

Ingredients
"A recipe is only as good as the ingredients used. Quality depends on: the proportions of ingredients, how they are measured, their temperature, how they are mixed, how they are baked and in what type of pan and at what oven temperature for how long.
Use the ingredients your recipe specifies."

"Ingredients can generally be divided into two types:
* *Toughеners or strengtheners* (flour, egg whites, milk)
* *Tenderizers or weakeners* (fat, sugar, egg yolks, and acid such as lemon juice or cream of tartar)
There needs to be a balance between the two types."

Sarah Phillips
Baking 9-1-1
www.baking911.com

Yeast:

Yeast is a living organism that enables dough to rise. Use an instant read thermometer to measure water and liquid temperatures. Three main forms of yeast are used in bread baking: fresh (compressed or cream), active dry and instant (fast-rising).

Compressed or cream yeast are mostly used in commercial bakeries using large quantities of yeast every day. Use as the recipe or formula directs—it contains more water than dry, so the recipe may require less in ratio to flour. Crumble into dry ingredients or soften in 80 to 90°F. water.

Active dry yeast should be re-hydrated in a portion of the formula's water prior to mixing—4 parts water (100 to 110°F. water) to 1 part yeast—for 15 minutes.

Instant dry yeast may be mixed directly with dry ingredients or added directly to the mixing dough. Liquids should be 120 to 125°F. (never over 130° F.) when added and the dough should be 70 to 95°F. if yeast is added directly.

Slow fermentation: Cool dough to 50°F., refrigerate or freeze it to hold dough overnight or longer. Use only cooler temperatures for the liquids if doing this "cool rise" method, so the dough is not overly warm (only 75°F.) when put under refrigeration. Punch once if needed. Keep sealed in large, greased plastic food bags or containers.

Sugars:

Sugars are used for sweetening and fermentation in breads. Non-sweet breads may have 0 to 9% sugars. *Added sugars are not essential* in yeast breads, but add color, flavor and keeping qualities. Sugars may be from beet or cane sugar (sucrose), fruits (fructose), milk (lactose), honey, molasses, sorghum or corn syrup.

Sweet yeast bread dough (15 to 25% of total flour weight is sweetener) may need more yeast than a non-sweet dough. In yeast bread dough, honey, molasses and sorghum provide higher sweetening power than sugar, hold moisture, add flavor, color and improve keeping qualities. They may be substituted for 50 to 100% of the sugar. Honey is 1½ times sweeter than granulated or brown sugar and is 20% water.

Non-nutritive sweeteners should ***not*** be substituted unless in a special formulation. They do not provide food for the yeast and may produce off-flavors.

Fats:

Fats and shortenings tenderize crusts, lubricate gluten strands, increase loaf volume, improve crumb character and keeping qualities (Bread will not stale as quickly when it contains some fat). Fats make up 0 to 10% of dough weight in non-sweet breads

- Fats include butter, margarine, vegetable and lard or oil.
- Oils result in a more open, dark and porous loaf
- Shortening and oil are 100% fat (no water incorporated)
- Butter and margarine are 80% fat/20% water
- Unsalted butter is considered premium for flavor in breads; salted butter contains 1-3% salt, and may influence the flavor and fermentation of a sweet dough.
- Olive oil: Authentic for texture and flavor in Mediterranean flatbreads and pizza crust, and some Artisan crusty breads. May also be brushed onto bread dough before or after baking for additional flavor.

Milk:
Milk improves flavor and keeping qualities; increases crust browning. Milk solids (non-fat dry milk) make up 0-2% of dough weight. Types include:

- Evaporated milk
- Dried milk: Baker's use *high heat* dry skim or whole milk solids (NFDM or DMS in formulas) Home bakers may not have high heat dry milk so scalding reconstituted milk may be recommended.
- Other substitutes may include dried blends of whey and caseinates; Buttermilk/milk; soy flour or soy milk
- Yogurt; fluid buttermilk; sour cream or cottage cheese.

Scalding = 150°F. or nearly boiling. Pasteurized, homogenized fluid milk will produce a better volume loaf if scalded to stop enzymatic action that affects gluten development and decreases loaf volume. Scald, skim, and cool.

Salt:
Salt is required. It enhances flavor, crust color, and tightens gluten for bread stability, prevents excessive yeast action, and inhibits acid producing bacteria. Salt represents 0.5-1% of dough weight and1.75-2.25% of flour weight.If a rich yeast dough is prepared, use an *unsalted* butter to control level of salt—salted butter is 1-3% salt.

Eggs:
Egg yolks aid gluten development, crust browning and improves the texture and keeping qualities of bread and rolls. Substituting egg whites is not recommended in yeast dough due to toughening attributes. Types include:

- Fresh, whole eggs or yolks: Use at 0 – 14% of dough weight
- Frozen whole eggs or yolks: Use weight equivalent called for in recipe
- Dry egg mix: Requires addition of water, but always mix egg mix with dry ingredients.

Substituting dry eggs for liquid eggs: ¼ weight of fresh or frozen egg weight=dry egg weight (¾ fluid weight is added water needed)
Egg wash or egg glaze: See Glossary of terms; demonstrated on *Bakers Dozen* DVD

Fruits, seeds, nuts, cheeses, vegetables, herbs all add interest and nutritional value to breads. These added ingredients

- Slow fermentation so follow the formula to know how much the dough can "carry." The dough may not double in size.
- Should be kneaded into the dough **after** the first fermentation (rising), **after** punching, rather than while developing the dough.
- Dried fruits should be moistened (conditioned) before adding. (See below or view on *Bakers Dozen* DVD).

Fruits:
Fruites add flavor, color, texture, moisture and nutritive value.

- **Dried:** Weight before moistening—use at levels of 25 to 55% of flour weight. Chop larger dried fruits for fuller flavor in the dough.
  Condition dried fruits if very dry: Cover dried fruit with 80°F. water, drain immediately and cover with plastic wrap. Let absorb moisture for 3-4 hours. Toss raisins or chopped dried fruits with flour to prevent sticking together. Add in final stage of mixing or kneading.
- **Canned:** Drain fruit; reserve liquid (not syrup) for use in recipe. Chop larger fruit pieces and fold into dough at Makeup stage.
- **Fresh:** Used as fillings or toppings; peeled and chopped before adding to batters and dough. Grated peel or zest (lemon, orange, lime) adds flavor to bread dough and batter.

Nutmeats:
Nuts add texture, fiber, density, flavor, nutrients and eye appeal. Add in bread dough at levels of 10 to 15% of flour weight (bakers percent).

- Store nuts well sealed in cool, dry place or in the refrigerator or freezer.
- Always check for off flavors or rancidity before adding. Use unsalted roasted peanuts.
- Walnuts and pecans may be chopped and added to dough or halves are used decoratively on tops of breads.
- Be sure to place decorative nut halves on dough when dough has proofed, just prior to baking.
- Hard nuts (almonds/hazelnuts) are best lightly pre-toasted.
- Pistachios are hydroscopic (absorb water) and should be added to thin consistency batters. Chopped, they may be folded into batters and dough or used in fillings.

Seeds:
Sunflower kernels, sesame seeds, flax seeds and poppy seeds add distinctive flavor, nutrition, texture and appeal to breads.

- Pre-toast raw sunflower kernels prior to adding to dough.
- Pre-soak seeds in water and drain well prior to adding.
- Seeds may be added to dough or used as a surface topping after egg-washing the dough, just prior to baking.

Potatoes, squash:
Cooked, unseasoned mashed potatoes, squash or sweet potatoes may be added at 10% of the flour weight. Deduct 70 to 80 percent of the weight of the potatoes added from the water weight. (These vegetables are 70-80% water).

Dried potato flakes, granules, flour:
Use at 5 to 10% of the flour weight, adding them to the flour before adding liquids. Add water equal to weight of dehydrated potato.

Olives, grated vegetables:
Chopped olives and grated carrots or zucchini may be added to batters and dough for flavor and texture. Add at 2-10% of flour weight.

Cheeses:
Add distinctive flavor and color to breads, enhance the crust color and texture.

- Add directly to dough at levels of 10-15% of flour weight and reduce water by 3-5%.
- Roll out dough and sprinkle with cheese; roll up jelly-roll style
- Sprinkle on formed breads, rolls and breadsticks just prior to baking

Onions, garlic, scallions:
Add intense flavor and appealing texture.

- Add minced or chopped into dough or batter while mixing (less than 10% of flour weight)
- Coarsely chop or thinly slice for fillings or toppings
- Caramelize onions and add to tops of flatbreads before baking
- Re-hydrate dried onions before adding to dough or batter

Fresh and dried herbs:
Adds savor to bread dough. Add herbs to the dough or sprinkle on surface. If using dried herbs, use about ¼ the amount of fresh herbs. Amounts vary—for dill bread, ¼ cup dill weed to 4 cups (1 lb) flour is possible or as little as 2 ¼ tsp. for some herbs. Avoid ground herbs—use dried leaves or pieces. **Learn more**: www.spiceadvice.com

Ingredient Lab: Milk—to scald or not to scald?

Option: You may wish to demonstrate this lab, or offer it to advanced students.

Teacher: Discuss the function of milk in bread (above). This lab tests the conflicting information between home and professional baking re: whether to scald milk or not. Home bakers are often instructed to simply "warm" the milk. Professional bakers use a "high heat" (pre-scalded) drymilk or will scald liquid milk and cool it, skimming off the proteins that form.

Question: Review the information in the Text Box with the students. What measurable difference could there be if fluid ***or*** reconstituted dry milk is not scalded and the resulting "skin" skimmed from the surface before adding the milk to yeast bread dough?

Hypothesis: State what you think you will observe between breads using scalded or unscalded milk.

Controls: *Be sure to use instant read thermometers in all labs.*

- Temperature of water and milk (115-120˚F) prior to adding to dough
- Use the same bread flour in all test batches—11-12 % protein
- Have ingredients at room temperature or about 70˚F.
- Mixing times—same length and speed for each lab test
- Dough temperature after mixing: 80-85˚F.

Scalding and skimming fluid milk OR the use of "high heat" nonfat dry milk solids is recommended by professional bakers.
" Scalding breaks down a constituent in milk that can weaken gluten, the protein in dough that gives bread its structure. That milk protein is removed when the skin that forms on the scalded
milk is skimmed off and discarded."

Oregon State U. Food Resource Web site.
Kitchen Notes, p30.
Cook's Illustrated. March 2004

Variable: Conduct as many comparison labs as students and lab space allow.

Consider using a demonstration method for this lab, with students assisting with each variable.

Prepare the Milk Bread recipe below. Have lab teams vary this factor:

Lab #1: Nonfat dry milk powder mixed with 120˚F. water, not scalded (1/3 c dry milk+ water=8 fl. oz)

Lab #2: Evaporated milk mixed per directions with 120˚F. water, but not scalded

Lab #3: Heat 1% milk to scalding (190˚F.), cool and skim off "skin"; add scalded milk to dough mixture when milk cools to 120˚F.

Lab #4: Heat 1% milk to 120ˆF., add with water to dough

Lab #5: Heat 1% milk to scalding (190˚F or steaming); do not skim off "skin," just add when cooled to 120˚F.

Lab #6: Obtain *high heat dry milk solids* (type used by bakers) from school kitchen or local baker OR at www.kingarthurflour.com. Add dry milk with flour, or as directed; then add 120˚F. water.

Lab Report *Optional:* Take digital photos to show variations of exterior and interior.

1. Measure and record the temperature of the dough after mixing.
2. Weigh the dough.
3. Record the dough weight after mixing is complete. (For later use)
4. Prior to baking: Record height of loaf in the pan from table top to highest point. After baking: Record height of loaf in pan and sitting flat on counter (as measured prior to baking)
6. Record weight of baked loaf.
7. Compare and discuss the differences between loaves from each variable.

Milk Bread **(Two day lab)**

Makes one, 20 oz. loaf

Ingredients	Measure	Weight	Bakers%
Bread flour, stirred	4 cups	1 lb.	100.00%
Salt	2 teaspoons	0.3 oz	1.75
Sugar	2 tablespoons	1.0 oz.	6.0
Butter	1 tablespoon	0.5 oz	3.0
Dry milk solids*	1/3 cup	0.8 oz	5.0
Fast acting dry yeast	2 ¼ teaspoons	0.25 oz.	1.5
Water, 120 °F*.	1 ¼ cup water	10 oz.	60.0


Nutrition Facts

Note: If lab uses fluid milk, use 8 oz. fluid milk and 2 oz. (1/4 c) water

*__Two day lab__: Liquids should be (cooled to) 80°F.

Directions:


Gluten Stretch Test

1. Weigh/measure all dry ingredients into large mixing bowl and mix to blend well. Add liquids and mix on low speed for 2 minutes to blend. **(Note**: Flour humidity varies: Adjust water if dough is too dry by adding 1 tablespoon at a time until dough is soft but not shiny or wet. Have students turn off mixer and touch dough to see how dry or soft it is.)
2. Mix with dough hook(s) on medium speed—or knead, until dough is smooth, elastic and cleans the bowl (about 7-10 minutes). Take dough temperature. Goal: Mixed dough temperature: 82-85°F. (Have students do the gluten stretch test pictured—dough should not fall apart.)
3. Ferment dough, covered for 10 to 15 minutes. **Or,** Refrigerated, two-day method. After mixing, place in greased or sprayed large plastic food bags, squeeze out air, seal and refrigerate. Punch dough down after one hour. Make-up loaf on Day 2—Take refrigerated dough out to warm 1 hour prior to shaping, step #6
4. After punching, round up dough into a smooth ball, cover with bowl, and allow to rest 5-10 minutes.
5. Grease one, 8 ½-inch loaf pan. Flatten dough into a 9 X 10-inch rectangle; roll up into loaf, pinching seams and ends. Place seam-side-down in pan; cover with plastic wrap that has been sprayed with vegetable cooking spray.
6. Proof covered loaf about 30-40 minutes in warm (100°F.) place until dough rises above the edge of the pan at least an inch. Preheat oven to 375 to 400°F. (Baking readiness test: Touch side of loaf lightly. If an indentation remains, and loaf is above the edge of the pan, it is ready to bake.)
7. Bake loaf 25 to 30 minutes—use instant probe thermometer, inserted in end of loaf to determine interior temperature—it should be 200-210°F.
8. Remove pan from oven and cool on wire rack 5 minutes; remove bread from pan and cool on a wire rack before wrapping. (Loaf may be wrapped when it has an interior temperature of 100°F.)
9. Store at room temperature or freeze—do not refrigerate.

Lab Option: Hamburger Buns (Buns rise faster than a loaf and may be baked sooner.)

The above dough makes nine hamburger buns.

1. Divide dough into 3 oz. portions and shape into smooth balls, pinch bottom of balls and place on greased or parchment lined baking sheets 1.5 to 2 inches apart. Flatten slightly.
2. Cover and allow to double in a warm (100-105°F.) place. Bake at 400°F.,12-15 minutes.
4. Slice when cooled (100°F. interior)
5. What does each baked bun weigh? (ounces and grams) How do the buns compare to commercial buns? (visually, texture, nutrition) How does the cost compare?

Baking Lab: Designer Bread

Teacher: Bring a variety of loaf breads—wheat, white, raisin, hearth, multigrain, whole wheat. Include some "artisan" bread if possible. (See www.bbga.org)
Discuss how some breads have a "standard of identity" (white, whole wheat, raisin). They must contain a certain amount of specific ingredients to be labeled "milk" or "whole wheat" or "raisin" bread.

> **See the Sites**: Some breads are required by law to have a certain weight or quantity of aningredient to be labeled "Milk Bread" or "Raisin Bread," for example. This is called a "standard of identity." What breads and rolls have a "standard of identity? These are listed at National Food Service Management Institute: www. nfsmi.org
> What is an example of the standards of identity for Raisin Bread? Milk Bread?

Teacher: Review the importance of **temperatures** in bread baking (see below).
Require students to **take and write down these temperatures as they work**.
Write the temperatures by the ingredients on the recipe as they measure or weigh.
They will use a probe, instant read thermometer.

- Flour
- Water/milk (calculate the water temperature they need to achieve an 80°F dough)
- Dough temperature after mixing/kneading
- Room temperature when dough is fermenting and proofing
- Oven temperature
- Interior loaf temperature when removed from oven
- Loaf temperature when wrapped for storage
- Storage temperature (See "staling" in Terms and Techniques)

Milk Bread Lab #2: Design a bread by varying ***one ingredient*** in the Milk Bread recipe. Have students use the Matter of Taste form with at least 10 other students to see how well the bread is liked by a consumer group.

Teacher: Offer guidance to avoid failure or have students look at the percentages recommended for non-wheat flours or seeds, nuts, fruits.
Write on the recipe exactly what substitution you made.
Substitute 1 tablespoon honey for 1 tablespoon sugar (1:1 substitution)
Substitute 2 cups (8 oz.) whole wheat flour for the same amount of bread flour
Substitute ¾ cup quick oatmeal for ¾ cup bread flour
Substitute ½ cup defatted soy flour for ½ cup bread flour
Substitute ¼ cup yellow cornmeal + ¼ cup rye flour for ½ cup bread flour
Substitute ¼ cup potato flakes or potato flour for ¼ cup bread flour
Substitute 1 tablespoon olive oil or vegetable oil for 1 tablespoon butter
Do not include any dry milk—make bread with only water.
Add one large egg while mixing. Add only 2 tablespoons additional bread flour.
Increase sugar *and* butter each to 3 tablespoons.

Lab Report: Name your bread. Write or type a copy of the bread recipe you made. Evaluate the bread with other students (consumers) using the form below.

Sample Project Evaluation Form

Product Name: _____

Consumer Test Group: _____ Date: _____

Please rank the product in each category.
5 = Excellent 4 = Good 3 = Acceptable 2 = Fair 1 = Poor

_____ Color _____ Aroma _____ Taste

_____ Moistness _____ Softness _____ Texture

I would eat this bread (check one):
___ Never ___ Less than once per week ___ Often (several times per week)

I would (check all that apply):
_____ Like to have this bread served in teh school cafeteria.
_____ Buy it at the grocery store to use at home.
_____ Not care to eat this bread again. Why?

Other comments:

Evaluate Your Results:
Use the chart "What Happened to the Yeast Breads?" on the next page to help evaluate your bread. On the back of the recipe make notes of anything you might need to do to improve your product.

Teacher note: For *culinary or vocational* students, this lab would be ideal to teach about ***baker's percent*** used in baking formulas or recipes—see definition in Terms & Techniques.

Activity:
1) Weigh out the flour (100% of the weight) in the Milk Bread Lab.
2) Calculate the *percentage* weight for the other ingredients (based on flour weight) and weigh each ingredient.
3) Mix bread as directed

Community Service Learning. Take the new skills students have gained and make plans to share with the community.

- **"Book and Bake"** with some younger children. Choose a favorite bread story at the library and read it. Then follow-up by making the bread with a sibling or when you babysit. Have your class host an elementary class or preschool class. Plan to share why bread is nutritious!
- Participate in **Bake and Take Day**, last Saturday of March. Learn more at www.bakeandtakeday.org
- Plan a bake sale to tie in with **Share Our Strength** and the **Great American Bake Sale** at www.strength.org
- Raise funds for a local need. See **"High Yield Bake Sales**" at www.homebaking.org and plan a bake sale featuring your own Artisan Breads. Create Food Labels that Sell (See activity below).

Food Labels that Sell.

- Develop the information you would include on a food label for your bread.
- Sketch a logo and show the colors you would use on the label.
- Include the following information

1. Identify your consumer group: kids, moms, seniors, teens…
2. Product name:
3. Bakery name and location:
4. Dates: Packaged, purchase by, best if eaten by
5. Ingredient list: List all ingredients, most to least.
6. Storage or handling recommendations for best result
7. Net Weight: Calculate the difference in weight of the dough and the baked loaf. What percentage of the dough weight was lost during baking? What was lost in baking? Record the accurate net weight on the food label for your loaf.
8. Servings per loaf: How many 1 oz (28 g) servings will the bread provide?
9. Nutrition Facts Label: Analyze the formula and determine number of servings you will recommend. Print out a Nutrition Facts label to place on the label.
10. Health Claim: Does your product qualify for a "low fat," whole grain," or other health claim? If yes, write the health claim. (Learn more at: www.cfsan.fda.gov/label.html)
11. Price: (Must cover ingredient cost, $10.00 per hour labor for production and provide some profit). What do you think is the *price point* at which your consumer will notbuy your product?

Go the Distance.

Consider entering the secondary student division of the National Baking Contest sponsored by Retail Bakers of America and Skill USA.
Learn more at www.rbanet.com or www.skillusa.org

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Temperatures for Yeast Bread Production

34° F. Yeast will not grow below this temperature

60°F. Do not serve bread at a temperature below 60°F.

78°- 82°F. Recommended temperature of dough after mixing when made with active dry yeast

82°- 88°F. Recommended temperature of dough after mixing when made with instant yeast

80°- 85°F. Desired temperature for fermentation (before “make-up” or shaping)

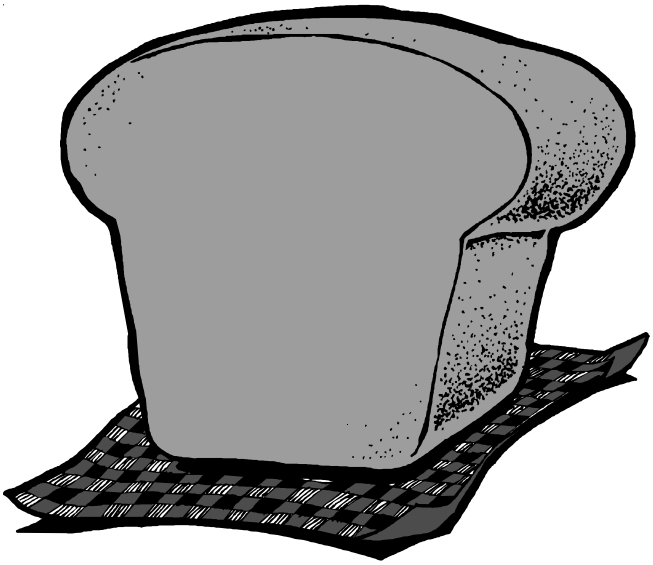
90°- 100°F. Desired temperature for proofing (final rising after “make-up”)

90°- 100°F. Internal temperature of bread when ready to wrap; lower temperatures result in drying out of bread

105- 115°F. Temperature for re-hydrating active dry yeast

140°F. Temperature at which yeast is destroyed or dies while baking

200°- 210°F. Internal temperature of bread when baked to correct degree of doneness



Credit: Kansas Child Nutrition and Wellness

Controlling Dough Temperature

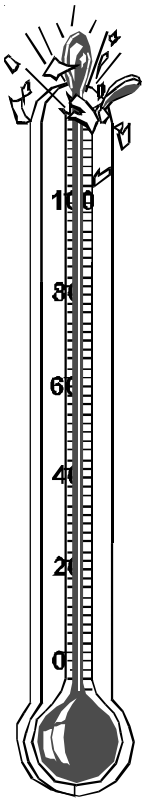
Yeast bread dough will ferment (rise) more evenly and produce a better quality product if they are in the correct temperature range after mixing.

The temperature of the dough depends on the amount and temperature of each ingredient going into the dough, and the number of degrees of heat generated during the mixing of the ingredients in the mixer (called machine allowance or friction factor).
Control dough temperature by pre-determining the correct water temperature. Ice can be used to cool water if necessary.

Be certain to follow recommended instructions if yeast is to be dissolved before adding to other ingredients. Use a small amount of warm (follow manufacturer's directions) water to dissolve yeast. Use the formula for the remainder of the water.

To achieve a dough temperature in the range of 82° F., take the temperature of the flour (using a probe or stem thermometer) and subtract from 145. The resulting number is the temperature of water to use.

Example: 145 (friction from mixing/kneading)
- 65 (flour temperature)
80° F. (water temperature)



Credit: Kansas Child Nutrition and Wellness