

# **Baking Science...**

# **Flour to Table**

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## **Quick Breads, Yeast Breads & Cookies**

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# Sanitation & Food Safety Science at Home or Bakery

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- Wear a hair restraint
  - Limit jewelry to a watch and plain ring
  - Do not wear acrylic nails or nail polish
  - Wear a clean apron every time
  - Wash hands at hand washing sink w/ soap
  - Cover open cuts or bandages with gloves
  - No smoking in kitchen area
  - Fresh dish cloths/towels twice a day
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# Sanitation & Safety - *cont.*

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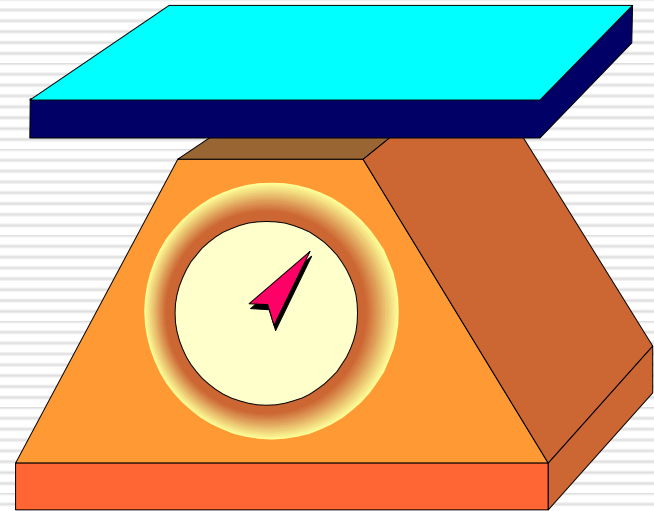
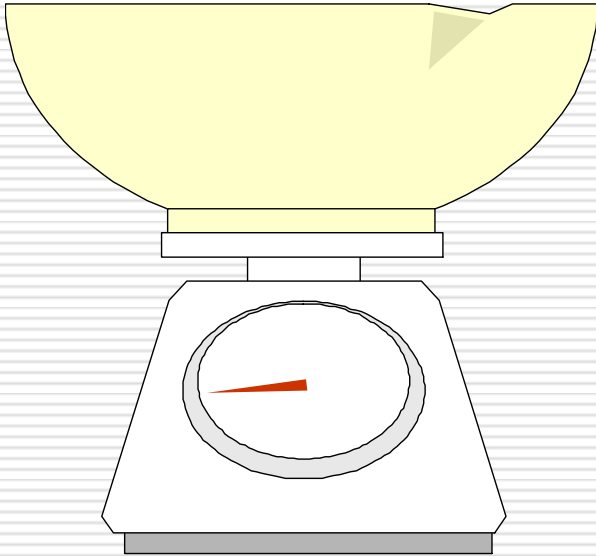
- Do not eat, drink or chew gum in kitchen area.
- Follow all rules for food safety in the kitchen and service area.
- Use cleaning chemicals according to directions.  
Store separately.
- Clean all equipment used.
- Use [www.FightBAC.org](http://www.FightBAC.org) guidelines



# Weigh vs. Measure

## Baking Ingredients

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Are bakers scientists or artists?

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# Accuracy=Success Every Time

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- Home baking: Americans use graduated dry measuring cups, liquid measuring cup, and measuring spoons for small amounts
  - If using cups, important to spoon and level dry ingredients; measure liquids in liquid cup on flat surface at eye level
  - Professional bakers (and European home bakers) always weigh ingredients, dry or liquid, for accuracy every time
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# Types of Quick Breads

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- Pour Batter - pancakes, waffles
  - Drop Batter - muffins, drop biscuits, loaf style quick breads
  - Soft Dough - rolled & cut biscuits, scones
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# Quick Breads Basic Ingredients

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- Flour
- Liquid
- Leavening Agent

- Fat
  - Sugar
  - Eggs
  - Spices or Flavorings
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# FLOUR

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- Provides structure in batter and baked product
  - Gluten is the protein in flour. It develops long strands when mixed with liquid. These strands form a structure that traps air as the bread rises.
  - Quick breads use lower gluten flour and are mixed very little so the product has a tender structure.
  - Quick breads may use up to ½ whole wheat flour with good results
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# FAT

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- Types: Butter, margarine, shortening, oil
  - Coats the flour making the batter “short” or tender; traps air for leavening  
(Note: oil will not shorten)
  - Provides flavor
  - Increases keeping quality
  - Keeps the product from sticking
  - Some fat may be replaced with applesauce, soft fruit puree, yogurt—start with about  $\frac{1}{4}$
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# LEAVENING AGENT

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- An ingredient that adds or produces gas in a dough or batter.
  - The gas makes the product rise and/or have a light texture.
  - Leavening agents in baking are:
    - Baking Powder
    - Baking Soda
    - Cream of Tartar
    - Eggs
    - Air
    - Steam
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# LIQUIDS

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Liquid dissolves the ingredients and forms a mixture. Liquids may be:

- Water
- Milk
- Buttermilk
- Juice
- Mashed Fruit

**Note:** Butter and margarine are 20% liquid  
Shortening and oil have no liquid

***Avoid using spreads—they will add too much liquid—Spreads maybe 45% or more water***

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# SUGARS

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- Sugar gives a sweet flavor, helps tenderize the product and gives it color and texture.
- May be granulated, powdered, brown, honey, molasses, syrup, **or** new blend of sugar and non-nutritive crystals

More at [www.sugar.org](http://www.sugar.org) and [www.honey.org](http://www.honey.org)

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# SPICES & FLAVORINGS

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Measure spices and flavorings carefully to get the right taste or flavor.

- Sweet spices: Cinnamon, nutmeg, cardamom, anise, ginger
  - Savory: Herbs, basil, oregano, pepper
  - Salt
  - Vanilla, maple, lemon, almond flavoring
  - Citrus peel, zest or juice
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# Changes During Baking

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- Gases form and expand
  - Gases are trapped in air cells
  - Starches become firm
  - Proteins coagulate
  - Some water evaporates
  - Fat melts
  - Crust forms and the product browns
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# Yeast Breads and Rolls

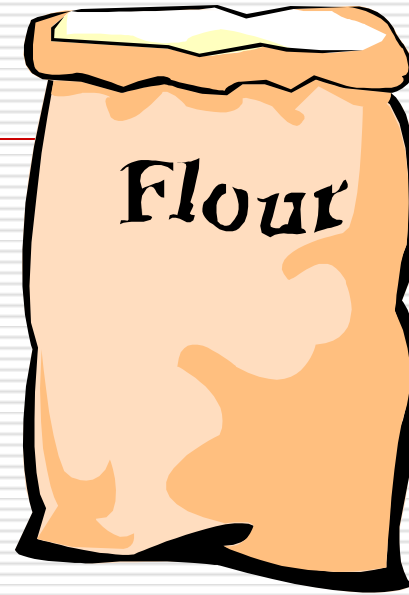
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# FLOUR

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Provides gluten  
and starch...



the framework of bread.

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# Protein Content of Flours

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Cake Flour                      7 to 8.5% protein

All-Purpose Flour              9 to 11% protein

Bread Flour                    11.3 to 13% protein

<b>Wheat and Flour Type</b>	<b>Flour Uses</b>	<b>Protein</b>	<b>Dough Strength</b>	<b>Water Absorption</b>	<b>Mix Time</b>	<b>Gluten Forming</b>
<b>Hard Spring</b> High Gluten	Bagels, Hearth brds Thin pizza	<b>12-14%</b> 13.4-14.4%	High	High 60-65%	Long Mix Time 12-14 minutes	
	Strong Patent Pizza crust Hearth bread	12.8-13.2%			High gluten forming	
	Spring Patent Breads Rolls	12.4-12.8%				
<b>Hard Winter</b> Winter patent	Pan breads Artisan bread Sweet dough Thick crust Pizza	<b>10-12%</b> 11-12%	Med	Medium 50-60%	Medium Mix Time 8-12 minutes Medium gluten forming	
	All purpose Quick breads Cookies	10-11%				
<b>Soft Winter</b> Pastry Cake	Cookies Brownies Sheet cakes High Ratio cakes; angel	<b>7-9%</b> 8-9% 7-8%	Low	Low	Short mix time Low gluten forming	

# LIQUIDS

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- Combines with protein in flour to form gluten
  - Milk improves food value and delays staling.  
Milk should be scalded and skimmed to stop enzymatic action—improves volume of yeast products
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# LIQUIDS

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- High heat dry milk developed for bread baking is available. Talk to a local baker or visit: [www.kingarthurflour.com](http://www.kingarthurflour.com)
  - A minimum of 2 oz. water per  $\frac{1}{4}$  oz. yeast is needed.
  - Starch in flour is also very absorbent.
  - Water should neither be hard nor soft for best results.
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# YEAST

A leavening agent; Increases volume

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Types:

- Active Dry Yeast
- Instant Dry Yeast
- Home bakers: fast or quick rise
- Fresh or Compressed Yeast
- Cream or liquid yeast (commercial bakeries)

Yeast dies at or near 140 degrees F.

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# SALT

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- Adds flavor
  - Controls yeast action and strengthens gluten
  - Too little makes texture dense and heavy; flavor will be flat or yeasty
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# SUGAR

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- Food for yeast
- Adds flavor
- Helps brown crust
- Too much delays yeast action and softens gluten. Ex: Sweet roll dough may need more yeast due to high amounts of sugar slowing fermentation.
- Honey, molasses, sorghum, may be substituted for 50-100% of sugar.

Note: Honey is 20% water and 1 ½ X sweeter than sugar.

More at: *Sugar a User's Guide* [www.sugar.org](http://www.sugar.org) and

*Baking with Honey* [www.honey.com](http://www.honey.com)

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# FAT

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- Adds flavor
- Tenderizes
- Delays staling
- Large amounts interfere with formation of gluten

More at: [www.landolakes.com](http://www.landolakes.com)

<http://webexhibits.org/butter>

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# EGGS

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- Add color and flavor
- Improve food value
- Form fine crumb and tender crust
- When beaten; adds volume, leavening
- May need to be at room temperature—68-72° F.

More at: American Egg Board [www.aeb.org](http://www.aeb.org)

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# Other Additional Ingredients

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- Potatoes
- Dried fruits
- Cheeses
- Fresh fruits
- Rolled oats
- Vegetables
- Nuts\*
- Seeds\*
- Onions, garlic and scallions
- Liquid seasonings
- Herbs and spices

**Amounts to use:** No more than 10-15% of total flour weight; adjust liquids if using mashed potatoes or fresh fruits containing high % of water.

\*Toasting the nuts and seeds will provide more flavor.

More in: Breads the Significant Edge. Sharon Davis. 1990.  
[www.wheatfoods.org](http://www.wheatfoods.org) or [www.kswheat.com](http://www.kswheat.com)

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# SCALING

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A baking term that means measuring by weighing ingredients.

Portioning out dough into equally-sized pieces by weight.



# MIXING

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- Home: by hand, mixer, food processor, bread machine
  - Professionals: Straight Dough Method
  - No-time Dough Method
  - Sponge Method
  - Vertical Cutter Mixer (VCM)
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# Mixing Time

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- Lean Dough: 8 to 12 minutes
- Use Dough Stretch Test after 8 minutes

Gluten Stretch Test [www.redstaryeast.com](http://www.redstaryeast.com)

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# FERMENTATION

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- The production of carbon dioxide and alcohol triggered by the action of yeast on available sugars in the dough.
  - After dough comes off the mixer, it is fermented before punching and resting.
  - Temperature should be 80-85 degrees F.
  - High humidity speeds fermentation.
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# Controlling DOUGH TEMPERATURE

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To obtain correct water temperature, subtract flour temperature from 145°F. This will yield a dough temperature of 82-88°F.

Formula:

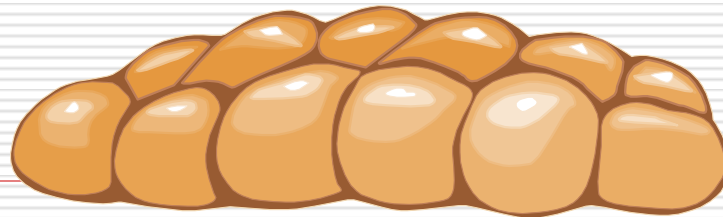
$$145 \text{ } ^\circ\text{F} - \text{flour temp } ^\circ\text{F} = \text{water temperature } ^\circ\text{F}$$

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# MAKE-UP METHODS

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- Loaves
- Braids
- Pan or cluster rolls
- Split or twin rolls
- Cloverleaf rolls
- Single knot rolls
- Double knot rolls
- Kaiser knot rolls
- Parker house rolls
- Hamburger buns
- Hot dog buns
- Butter gem or butterflake rolls

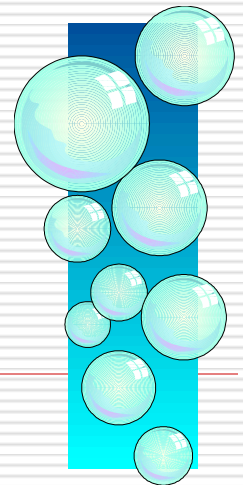




# PROOFING

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- A leavening process during which gas is produced within the bread dough after shaping and panning but prior to baking.
- The final rising of the formed product prior to baking.
- Best temperature: 90-100°F
- Relative humidity: 80-85%



# BAKING

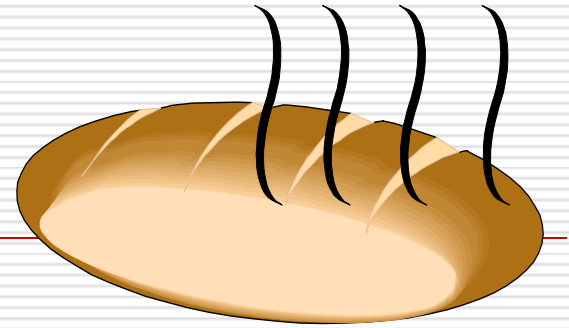
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- Yeast dies at 140°F.
  - Starches begin to gelatinize between 140°F and 160°F.
  - Bake to an interior temperature of 200°F to 210°F.
  - Under-baked products will taste starchy.
  - Well-baked products will taste sweet.
  - Crust should be evenly browned on all sides
  - Addition of steam during part of baking results in a hard or crisp crust
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# COOLING

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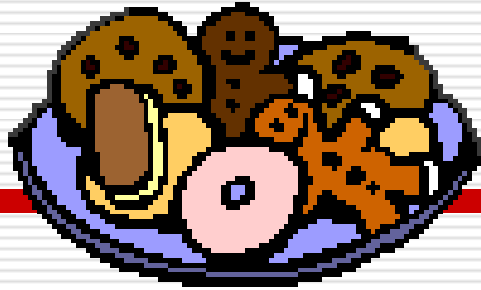


- Cool in a draft-free area
  - To prevent soggy bottoms, cool on racks
  - Cool to an internal temperature of 90°F -100°F; then wrap
  - Products will dry out if cooled below 90°F -100°F.
  - Never refrigerate baked yeast breads; store at room temperature or freeze
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# Characteristics of Cookies

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# Crispness

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## *Cause of Trait:*

- Stiff dough with low moisture.
  - High fat and sugar in the recipe.
  - Baking long enough for moisture to evaporate.
  - Small size or thin shape.
  - Storage to prevent cookies from absorbing moisture.
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# Softness

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## *Cause of Trait:*

- A lot of moisture in mix.
- Lower fat and sugar.
- Honey, molasses, or corn syrup in recipe.
- Under baking
- Large size and thick shape.
- Storage to keep cookies moist.

Tip: Always condition (moisten 5 minutes and drain) dry fruit before adding

Good Source: *A Baker's Cookie Guide* [www.preparedpantry.com](http://www.preparedpantry.com)

# Chewiness

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## *Cause of Trait:*

- High sugar and liquid content, but low fat content
- Higher proportion of eggs
- A lot of mixing to develop gluten and use a stronger flour

Great source: The All-American Cookie Book.  
Nancy Baggett, [www.kitchenlane.com](http://www.kitchenlane.com)

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# Spread is increased by:

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- High amount of sugar
  - Coarse granulated sugar
  - High amount of baking soda
  - Creaming of fat and sugar until light
  - Low oven temperature
  - Batter that is high in liquid
  - Heavily greased baking pan
  - Scooping dough onto warm baking pan
  - Substituting spreads for butter, margarine
  - Substituting butter or margarine when shortening was previously used
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# Spread is decreased by:

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- Use of superfine sugar or confectioners' sugar
- Blending fat and sugar just to paste
- High oven temperature
- Strong flour or heavy mixing
- Properly cooling baking pan before scooping cookie dough onto pan
- Use of parchment liners

More great tips: Baking 9-1-1. Sarah Phillips  
[www.baking911.com](http://www.baking911.com)

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# Culinary Technique for Making Cookies

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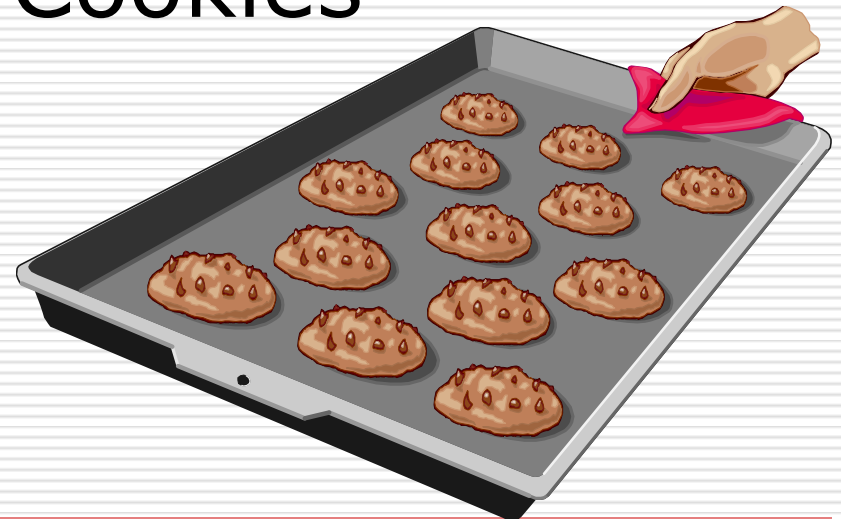
- Conventional Method  
(sometimes called  
Creaming Method)



# Makeup Methods for Cookies

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- Dropped Cookies
- Sheet or Bar Cookies





# Dropped Cookies

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- No. 20 Scoop – Very large, about 1 ½ oz.
  - No. 30 Scoop - Large cookie, about 1 oz.
  - No. 40 Scoop - Medium cookie, about ¾ oz.
  - No. 50 or 60 Scoop - Small cookie
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# Sheet Cookies

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- Bake in sheet pans and then cut in squares
  - Follow the recipe for scaling the correct amount of dough in the pan
  - Bake according to recommended temperature and time
  - Cutting sheet cookies while they are too warm causes crumbling
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# Prepare Pans for Baking

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- Line sheet pans with parchment paper to eliminate greasing pans and to speed clean-up.
  - A greased sheet pan increases the spread of a dropped cookie. A greased and floured pan decreases the spread.
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# Baking

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- Follow the recipe for baking temperature and time.
- Remember that cookies continue to bake when left on a sheet pan that has been removed from the oven.
- Follow the recipe about when to remove the cookies from the baking pan.



# Baking - *cont.*

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- A dropped cookie is done when the edges brown and the bottom turns golden brown.
  - If the bottom of the cookies burn, place the sheet pan of cookies in another sheet pan for baking.
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# Cooling

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- Cool cookies slowly, away from drafts, to avoid cracking.
  - Most cookies need to be cooled on wire or sheet pan racks.
  - For cookies baked without parchment paper, to avoid sticking remove them from the pan while still warm.
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# Storing

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- Cool cookies completely.
  - Store each type of cookie separately in an airtight container.
  - Most cookies can be stored up to 1 week.
  - Most cookies freeze well.
  - Some drop cookie dough can be frozen, then thawed and dropped.
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# Ways to Slow Staling

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- 1 Protect baked products from air.
    - Cool baked products to 90°F.
    - Wrap cooled baked products in plastic film.
    - Do not refrigerate yeast breads or low-fat muffin products—this promotes staling.
    - Frost cakes.
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# Ways to Slow Staling-*cont.*

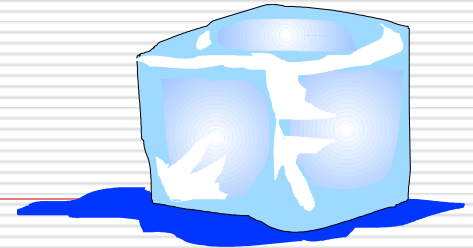
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- 2 Add ingredients in the recipe that help retain moisture.
    - Fats and sugars help keep a product moist.
    - Some recipes replace some of the fat with pureed fruit which helps keep the product moist.
    - Serve low-fat products immediately after baking.
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# Ways to Slow Staling-*cont.*

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- ③ Freeze baked products if they will not be used immediately.
- Tightly wrap.
  - Label with preparation date.
  - Serve immediately after thawing.
  - Quick breads can be reheated after freezing for a fresher taste.



# Ways to Slow Staling-*cont.*

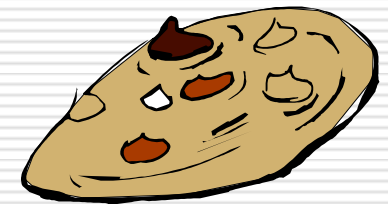
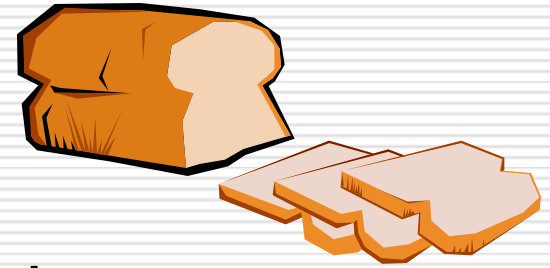
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- ④ Thaw baked products in the wrapping at 95°-100°F.
    - Do not remove any ice crystals because the moisture came from the product and is needed for a quality product.
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# Estimated Frozen Storage Life of Some Baked Products

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- Muffins: 2 weeks
- Biscuits: 1-2 months
- Yeast breads: 1 month
- Cakes: 2 months
- Cookies: 12 months



*Source: Spears, M. (2000). Foodservice Organizations: a managerial and systems approach.*

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# Sites to Cite

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- [www.aibonline.org](http://www.aibonline.org)
  - [www.baking911.com](http://www.baking911.com)
  - [www.foodnetwork.com](http://www.foodnetwork.com)
  - [www.kswheat.com](http://www.kswheat.com)
  - [www.homebaking.org](http://www.homebaking.org)
  - [www.oznet.ksu.edu/sp\\_grsi/](http://www.oznet.ksu.edu/sp_grsi/)
  - [www.thepreparedpantry.com](http://www.thepreparedpantry.com)
  - [www.wheatfoods.org](http://www.wheatfoods.org)
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