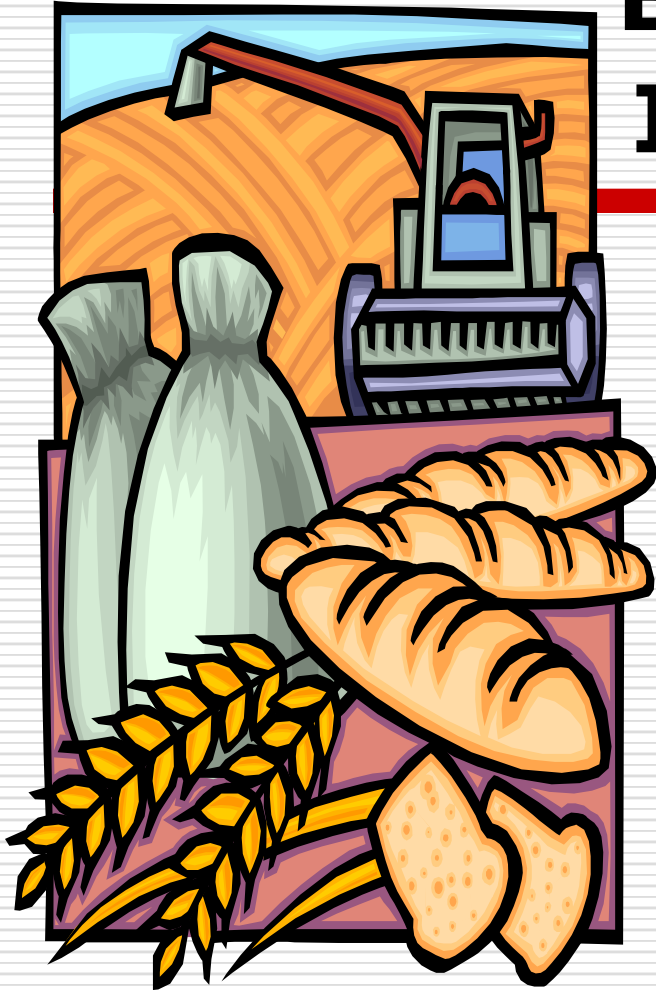


Baking Science Ingredient Functions



Farm to Oven

Sharon Davis,
Family & Consumer Sciences Education
Baking STEAM
HomeBaking.org



Gracias Vielen Dank Merci Thanks Grazie

The Home Baking Association MEMBERS

ADM

American Sugar Refining (ASR)

Anchor Hocking Bakeware

Ardent Mills

Chelsea Milling Company

Colorado Wheat

Grain Craft

Hammons Black Walnuts

Hopkinsville Milling Company

Kansas State U. Bakery Science

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North American Millers' Association

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Northern Crops Institute

Oklahoma Wheat

Panhandle Milling

Renwood Mills

Shawnee Milling Company

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Stafford County Flour Mills Co.

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Texas Wheat Board

Thermoworks

The Sugar Association

The Uhlman Company

Washington Wheat Foundation



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Bigger Bolder Baking

Partners:

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Child and Adult Care Food Program (CACFP)

Family, Career and Community Leaders of America (FCCLA)

National Extension Association of Family & Consumer Sciences (NEAFCS)

The Family Dinner Project

Wheat Foods Council

Whole Grains Council

Basic Ingredient Categories



- Flours
- Liquids
- Leavening Agent

- Fats
- Sweeteners
- Eggs
- Spices or Flavorings
- Chocolate



INGREDIENT CHART

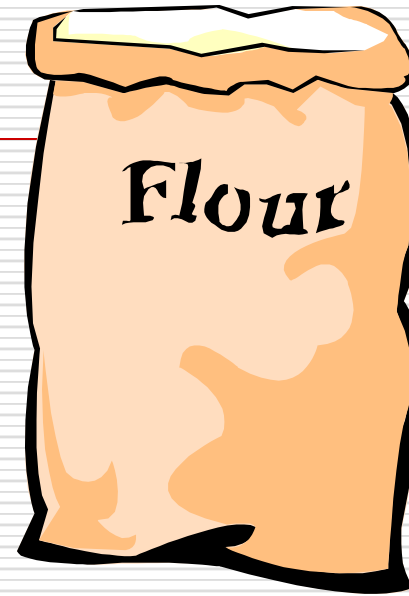


After reviewing this power point, assign students to Name and chart the functions for ingredients they're using in the next baking recipe.

| Ingredient | Functions | Examples |
|-----------------------|---|--|
| Flour | | Hard wheat – Soft wheat – |
| | Contributes tenderness, moistness and enhances flavor | |
| Sugar | | 1. 2. 3. 4. |
| Eggs | | |
| Liquids | | Water, milk, cream, buttermilk, sour cream, juice, etc |
| | Strengthens gluten and enhances flavors | |
| Flavorings and Spices | | |
| Chocolate | | Unsweetened chocolate Semi-sweet chocolate White chocolate Cocoa powder |
| Leavening Agents | | |

FLOUR

Provides gluten
and starch...



the framework of bread.

Grain flour sources of gluten: Primary: Wheat
Lesser amounts: rye, triticale, barley



Flour is NOT Just Flour

What types of flour are you familiar with?



Functions of Flour

- ❑ Forms structure of product
- ❑ Determines color, texture, and eating properties of baked food
- ❑ Viscoelastic properties, retains gas (bubbles)
- ❑ Absorbs water in dough or batter



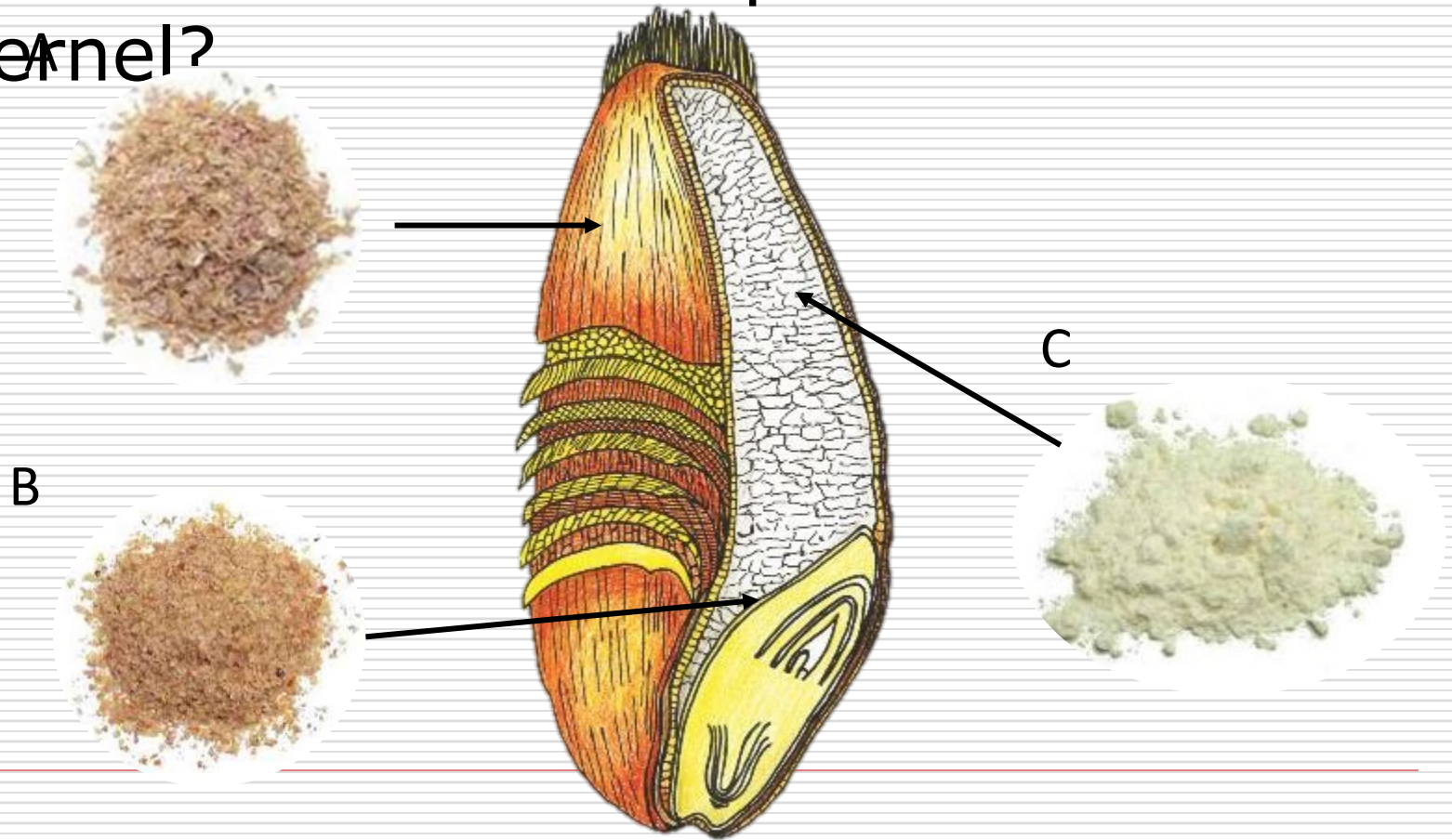
Start with Wheat

- ❑ Why should a baker care about wheat?
 - Flour comes from wheat
 - All wheat is not created equal
 - Therefore all flour is not created equal



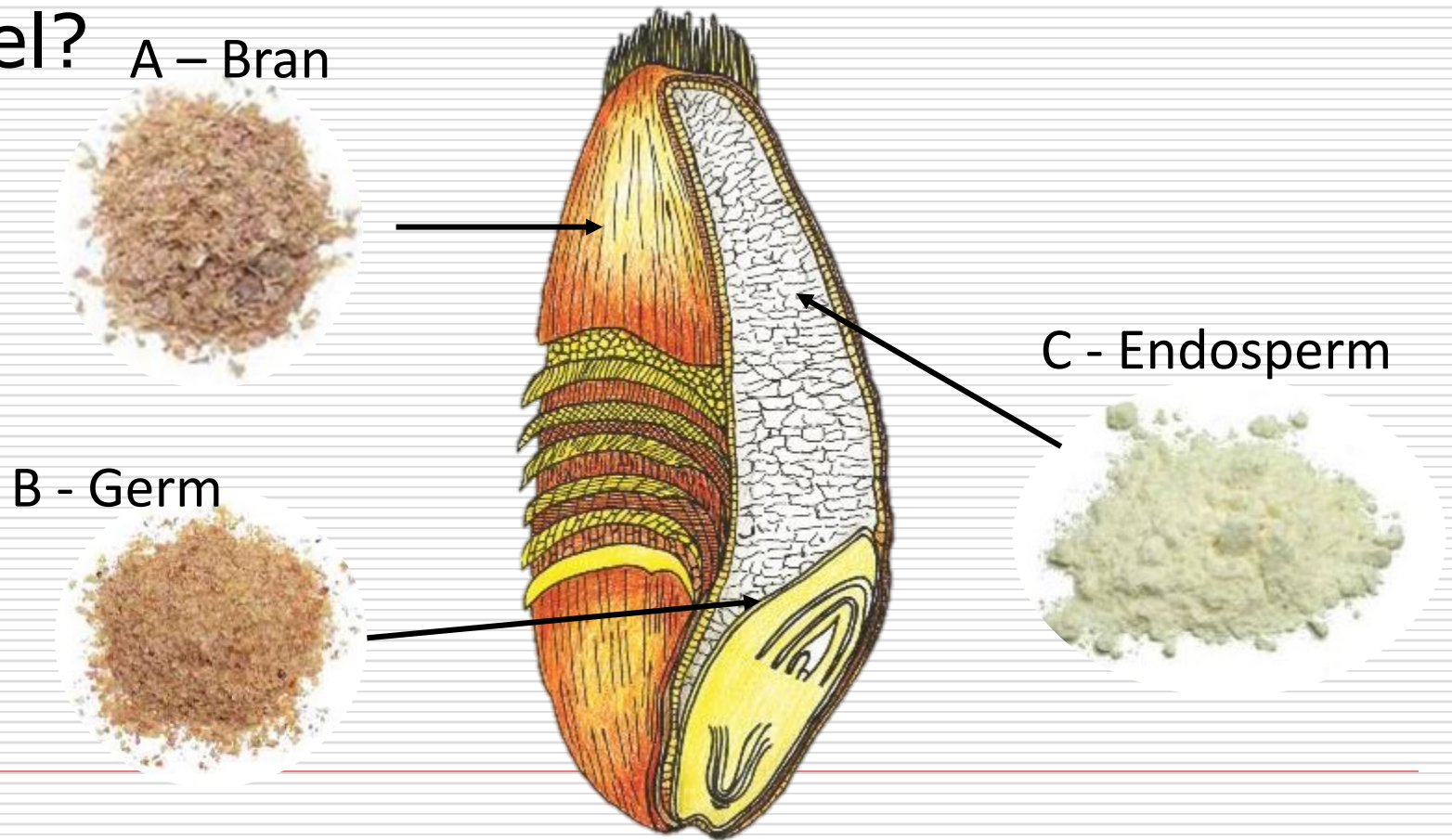
Kernel of Wheat

What are the 3 main parts of the wheat kernel?



Kernel of Wheat

What are the 3 main parts of the wheat kernel?



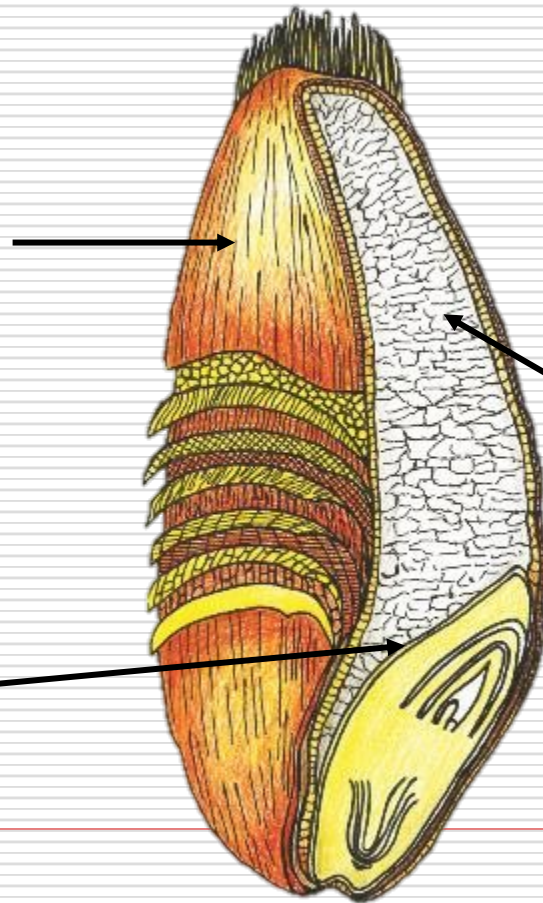
Kernel of Wheat

Which part is the primary source of white, refined, enriched wheat flour?

A – Bran



B - Germ



C - Endosperm



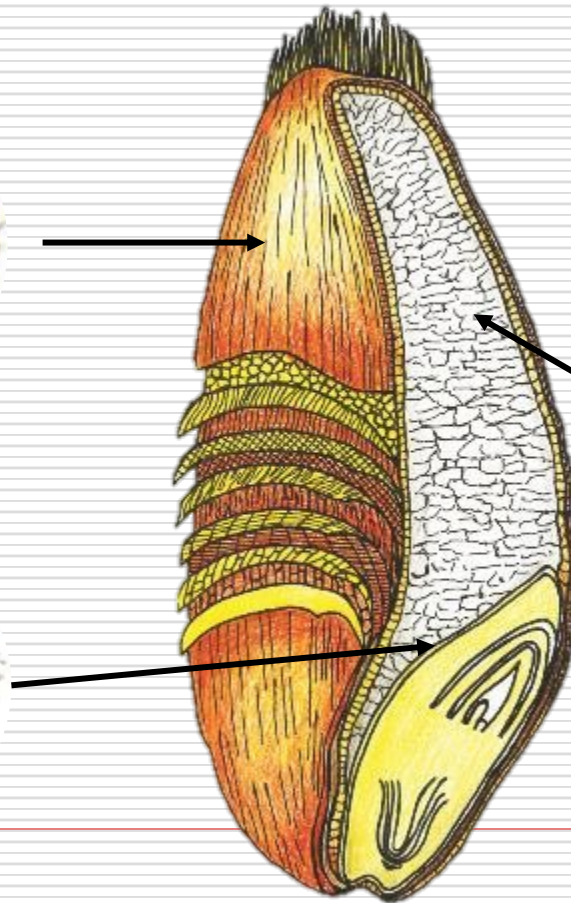
Kernel of Wheat

Which part is the primary source of white, refined, wheat flour?

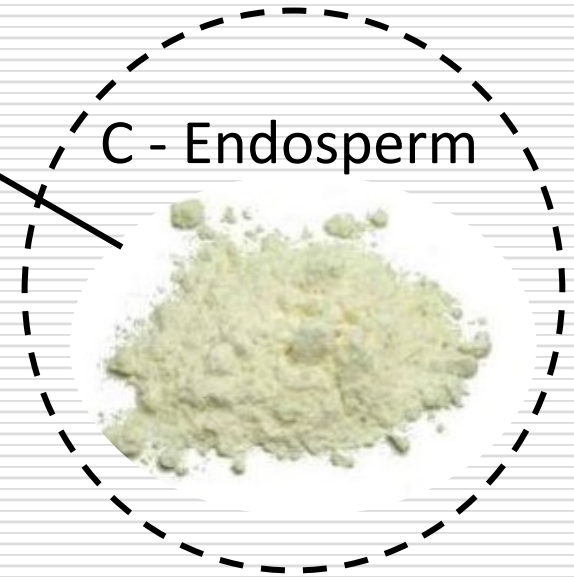
A – Bran



B - Germ



C - Endosperm



Wheat Classifications

US wheats are grouped into classes by:

- Kernel hardness
 - Hard vs. soft
- Seed color
 - Red vs. white
- Time of planting and harvesting
 - Winter vs. spring



U.S. Wheat Classes

HARD RED WINTER



Medium to high protein, medium hard endosperm, red bran, medium gluten content, mellow gluten. Used in pan breads, Asian noodles, hard rolls, flatbreads and general-purpose flour.

SOFT RED WINTER



Low protein content, soft endosperm, red bran, weak gluten. Used in pastries, cakes, cookies, crackers, pretzels and flat breads. Can also be used for blending.

HARD WHITE



Medium to high protein content, hard endosperm, white bran. Used in Asian noodles, whole wheat or high extraction flour applications, pan breads and flat breads.

HARD RED SPRING



Highest protein content, hard endosperm, red bran, strong gluten, high water absorption. Used in pan breads, hearth breads, rolls, croissants, bagels, hamburger buns, pizza crust and for blending.

SOFT WHITE

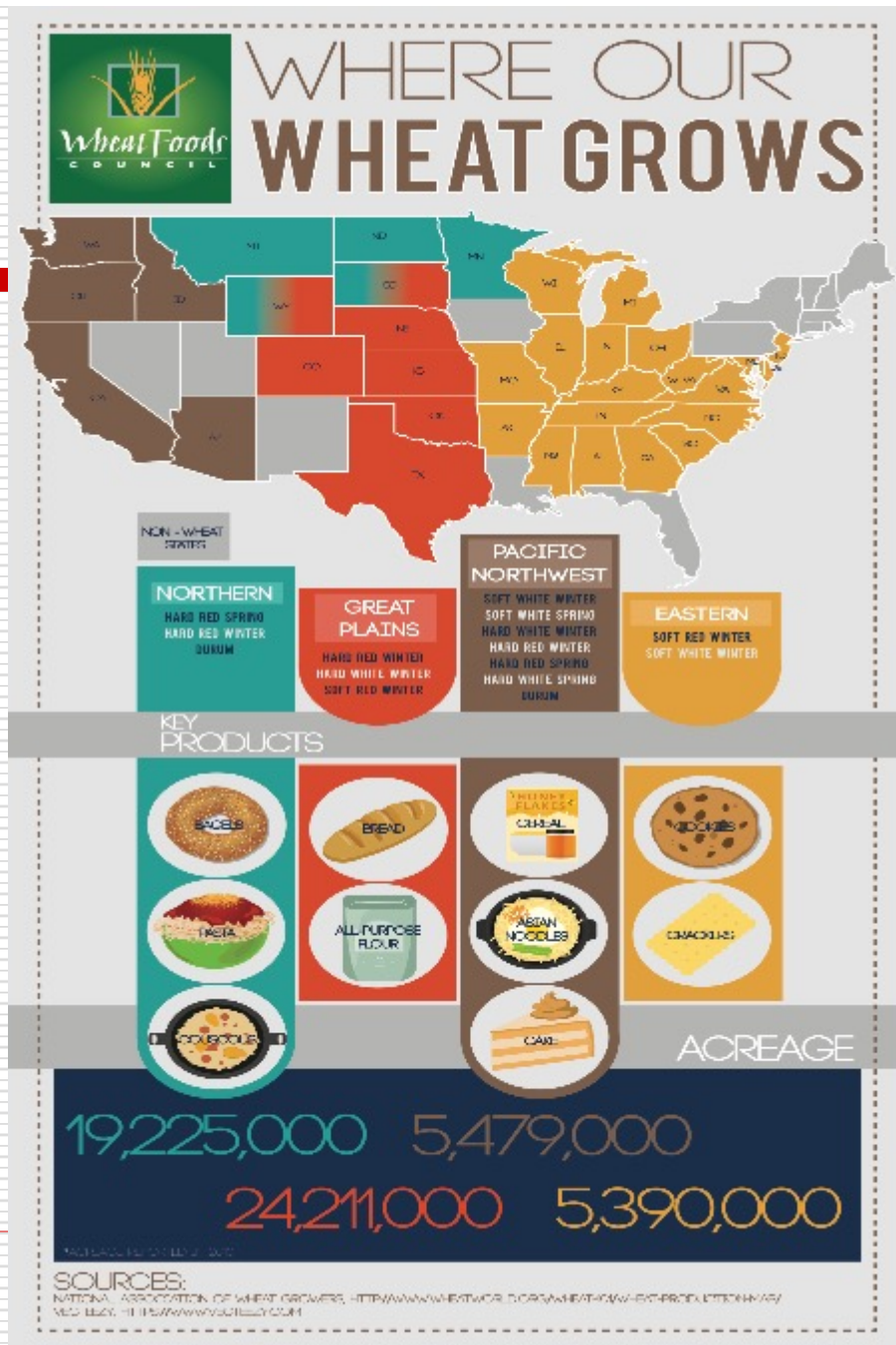


Low protein, low moisture wheat, soft endosperm, white bran, weak gluten. Used in pastries, cakes, biscuits, crackers, flat breads, Asian-style noodles and snack foods.

DURUM



Hardest of all wheats, high protein content, yellow endosperm, white bran. Used to make pasta, couscous and some Mediterranean breads.



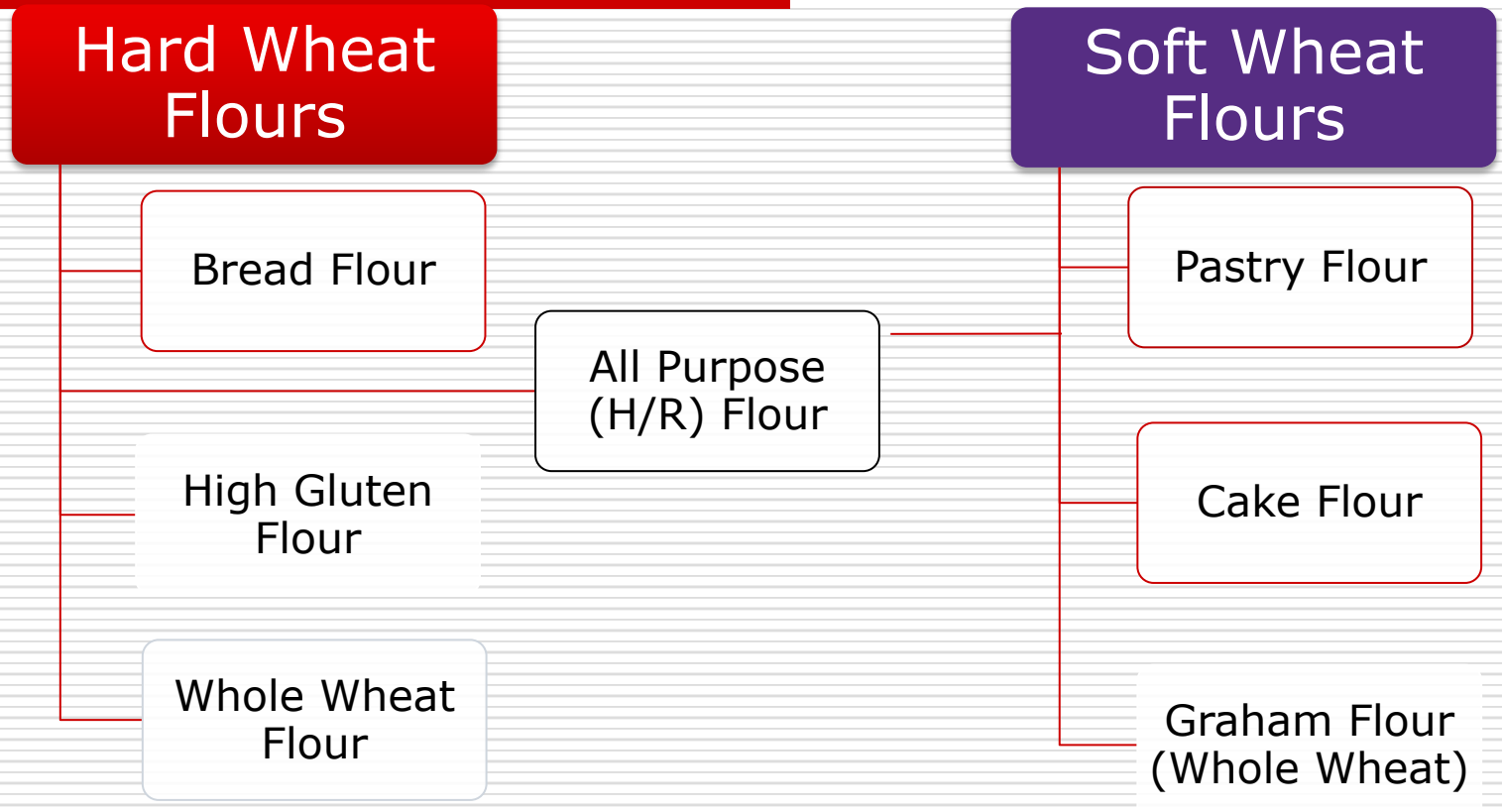
Infographics about wheat,
WheatFoods.org

National Assoc of Wheat
Growers,
wheatworld.org/wheat-101/

North American Millers'
Association, namamillers.org

View The Journey of Wheat,
Field to Flour
<https://youtu.be/9ctwYVNzIU>
[U](#)

Types of Flour



FLOUR...is NOT Just Flour

Provides structure (or not) in batter and baked products

Baking Science Activity/Demo,
HomeBaking.org/distance-learning/

- Gluten forms based on **protein** in flour (*glutenin and gliadin*)
- Gluten develops when flour is mixed with liquid
- Forms structure (web), traps CO₂ = "dough rises"
- Quick breads may use lower gluten flour and are mixed very little for tender structure.
- May use up to ½ whole wheat flour of same % protein with good results
- "Heritage," ancient grains, legume or seed flours may or may not contain gluten

Learn more, Northern Crops Institute, www.northern-crops.com



Protein Content of Flours

Cake Flour 7% to 8.5%

Pastry Flour 8% to 9.5%

All-purpose flour 9% to 11%

Bread Flour 11.3 to 13%

- Protein level is an indicator of gluten strength in wheat flours.
- Lower protein percentages are likely to be used for cakes, cookies, crackers, biscuits, pastries for a tender product.



Source: A Bakers Dozen Labs, Wheat Flour & Cornmeal, Lab 3, HomeBaking.org



Infographic Source:
KansasWheat.com

More about Gluten
WheatFoods.org

View *The Truth About
Wheat* at
okwheat.gov



Baking Science Experiment: Flour Absorption and Gluten Development

Question to test:

What difference(s) will you observe when substituting different flours one-for-one with all-purpose flour in a mixture?

Control: Mix each type of flour/water mixture for the same amount of time and at the same speed.

Student name(s): _____ Lab: _____ Date: _____

Our lab compared all-purpose flour with _____ flour _____ flour _____ flour

Hypothesis: _____

Lab Supplies:

- ☐ Choose 4 or more flours

Use 1/2 cup (2 oz. or 55 grams) of each flour

- ☐ All-purpose flour (bleached, unbleached)
- ☐ Cake or pastry flour
- ☐ Bread flour
- ☐ Whole wheat flour (hard red or white OR pastry/soft wheat)
- ☐ Corn starch
- ☐ Cornmeal, yellow or white
- ☐ Rye, barley, oat, sorghum, rice or other non-wheat flour
- ☐ Ultragrain® flour ultragrain.com
- ☐ Water (3 oz./85 ml)
- ☐ Measuring cups or scales
- ☐ Four or more bowls and electric mixers (use standard beaters, not dough hook).

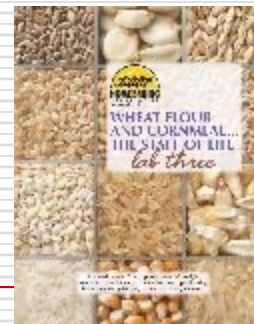
Basic Experiment: What to do.

1. Scoop each type of flour out of its bag and into a separate bowl; label.
2. Stir each flour or cornmeal with a large spoon to "fluff" or unpack the particles.
3. Spoon flour into a 1/2 cup dry measuring cup, heaping it up, then level it off (do not pack, shake or push down on the flour in the cup); **OR**, use an ingredient scale and weigh 2 oz. or 55 grams of each flour.
4. Put each type of flour in a medium mixing bowl. Label with flour name. Use a liquid measuring cup or beaker, placed on a flat surface. Add 3 oz. (85 g/100ml) cold water.
5. Mix each flour and water mixture on LOW speed 1 minute; record observations. Continue mixing on MEDIUM speed 2 minutes. Record observations. **Be consistent in mixing speed and time.**

1, 2, 3 Report:

1. List the flour type(s) your lab compared.
2. Describe the differences found in the mixtures after 1 minute mixing and 3 minutes total mixing.
 - Use descriptions such as: how fluid or stiff; development of batter structure (gluten strands developing, lumpy, no strands), how much water was absorbed (stiff, fluid, medium stiff) batter/dough strength (hard to mix, not hard to mix)
3. Use the **Flour Chart** and the **Need to Know Flour Basics**, (p. 8) to help you hypothesize what differences you'll observe.

| | One Minute Mixing | Three Minutes Mixing |
|--|-------------------|----------------------|
| Bowl 1: All-purpose flour (Control) | | |
| Bowl 2: _____ flour | | |
| Bowl 3: _____ flour | | |
| Bowl 4: _____ flour | | |



Based on gluten structure developing as you mix, which flour is

1. Bread flour
2. All-purpose flour
3. Cake flour
4. Pastry flour
5. Whole red wheat
6. Whole white wheat



Download Lab 3 and video,
HomeBaking.org

Baking with Non-wheat Flours

Offers

1. Variety, additional whole grains, flavors
2. Wheat-allergic* (<0.5% pop)
3. NCGS or Celiac options * *Non-Celiac Gluten-Sensitivity (NCGS <1-6%) or Celiac disease (<1% pop)*

Option 1: Make no change, standard recipe

Use $\frac{1}{4}$ (25%) or less non-wheat flour(s) or cornmeal + $\frac{3}{4}$ wheat flour

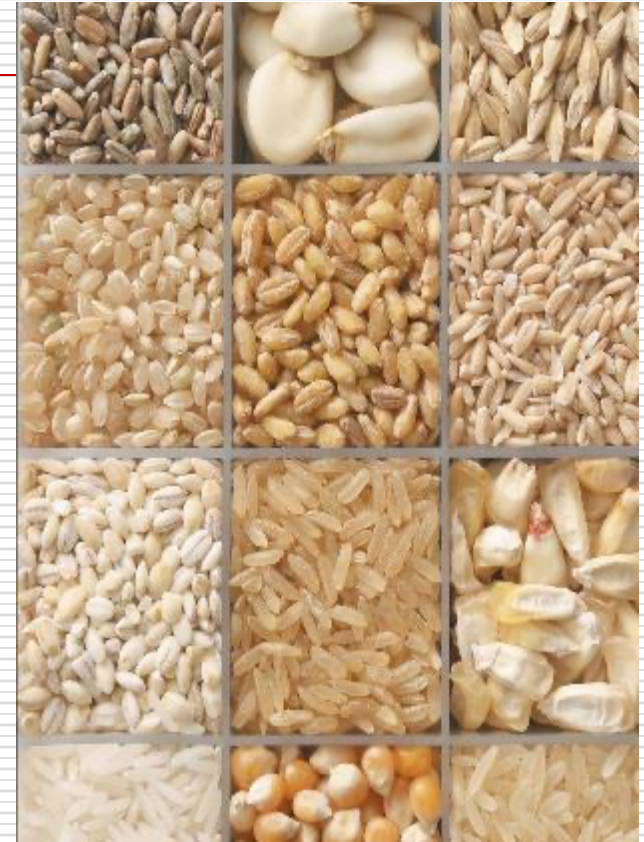
Rye and barley flours offer some gluten

Option 2: Wheat allergy--1:1 sub for 1 c. wheat flour

1 c. or blend non-wheat flours amaranth, barley, corn, millet, rye, sorghum,

OR $\frac{7}{8}$ c. brown or white rice flour, teff flour

Option 3: Gluten Free, Next slide



*A Baker's Dozen Lab Manual
Labs 1 and 4. HomeBaking.org*



Gluten-free Flour Blend

Makes 3 cups.

Brown rice flour (or part sorghum) 2 cups

Potato starch 2/3 cup

Tapioca starch (aka flour)* 1/3 cup

Xanthan gum 1 tsp.

Use wire whisk to blend well.

*May substitute corn starch for tapioca

Source: landolakes.com

Other blends: KingarthurfLOUR.com

More @ HomeBaking.org/glossary

Wheat, barley and rye are NOT GF.

Use 25% (1/4) more baking powder per 1 c.
wheat- or gluten-free flours

Use ¼ c. almond flour in cookie recipes

Cream guar/xanthan gums w/butter

Xanthan gum *per cup GF flour*:

Cookies-1/4 tsp.

Cakes, ½ tsp.

Quick breads, ¾ tsp.;

Yeast breads, 1 to 1 ½ tsp.

Pizza dough, 2 tsp.

Guar gum, in similar amounts, is best for
severe corn or soy allergies.

Sources: PanhandleMilling.com

NEW! SimplySorghum.com

Whole Wheat Flour Substitution

NOT **whole wheat flour** if

...enriched, bleached, all-purpose, cake, pastry, self-rising

NOT **whole-grain** if ...de-germinated, bran, germ or pearled

Any recipe:

→Fluff flour, spoon, level OR weigh

→Substitute enriched wheat flour with
1 T, up to ½ (50%) whole wheat flour


Download Guide at HomeBaking.org

+++++

“Whole grain” =

8 g whole grain (or more) per serving

Include *total* whole meal and flour weights



Whole Grain Baking 101
Sharon Davis
Family & Consumer Sciences Education



Grain Anatomy
Bran, Endosperm, Germ

Whole grain (WG) flour or meal may be milled from many different kinds of grains and must contain all the grain's parts: bran, endosperm and germ. The grain may also be sprouted first, then milled. After milling, the product may be fine, coarse, rolled, cracked, flaked, stone ground or graham.

Whole grain-rich: 80% (1/2) or more of the grain ingredients are whole grain. "Rule of Three" (on food labels): The first ingredient (or second after water) must be whole grain; the next two grain ingredients (if any) may be whole grains, enriched, bran, or germ. In recipes, half (or more) of grain ingredients should be whole.

EXTRA! Today's grains may be called ancient (thousands of years old...corn, sorghum or ancient wheat (such as emmer, einkorn, spelt, hardtongue or heritage) pre-1800/70s, and modern (grown since 1870s). Any of these may be whole grain, or not.

The ingredient label tells if an ingredient is whole grain or enriched, bran or germ (partial grain) or de-branned or de-germinated.

Whole grain may or may not be organically grown. Some grains are GMO and some are not--wheat flour is always "non-GMO," corn may not be.

Learn more: WholeFood.org, wholegrainscouncil.org, Organic and GMO defined: FoodLabels.org. See "How Free is Milled?" and visit "Food Food Safety" videos, aamailers.org (Click Education and News Room)



Flour is NOT just Flour. Bakers rely on a grain's protein and gluten qualities for volume and structure. Gluten is made of two nutritious proteins found in some grains—glutenin and gliadin. When gluten containing flour mixes with water, a stretchy structure develops that holds leavening gas (CO₂). The structure expands and when baked, becomes firm. Gluten-free structure comes from Xanthan or guar gums, and sometimes eggs. Additional leavening is often added.

| Grains w/ Gluten | Gluten-Free (GF) |
|------------------------------|--|
| Bulgur wheat | Amaranth flour |
| Rye, flour, groats, sprouted | Brown rice flour |
| Spelt, berries, flour | Corn, whole grain flour, meal, grits |
| Triticale, berries, flour | Oat-flaked, quick, flour, instant, steel-cut |
| Wheat, white or red* | Sorghum flour |

*Whole wheat flour is milled from hard red or soft (white) wheat. It may be sold as whole berries, cracked, flaked or rolled, groats or sprouted grain flour. (Flour 101, Wheat101.org)

Baking Whole Grain Tips

- **Bake with a well-tested (standardized) recipe.** Most good recipes may be baked as a whole-grain product.
- **Start with half whole grain.** Identify the amount of enriched all-purpose or bread flour in the recipe. Divide the amount in half. Substitute a whole wheat flour for half the flour. (B: For 2 c. all-purpose or bread flour substitute 1 c. whole wheat flour and 1 c. all-purpose or bread flour.)
- **Measure or scale flour accurately.** 1 cup flour = 4.25 oz (120g) "fluff, spoon, level" or use a scale. View Flour to Measure Flour, aamailers.org, wholegrainscouncil.org.
- **For a lighter appearance and flavor use white whole wheat flour (and perhaps less).** Standard whole wheat flour is produced from red wheat and has a darker bran color.
- **For yeast breads, use hard whole wheat flour (red or white) cornmeal, sub one for one whole grain cornmeal.**
- **Want multi-grain?** Create your own blend to sub for 1/3 (33% and no more) of the enriched or whole wheat flour.
- **More liquid needed?** Not if veggies, fruits or buttermilk are included. If batter/dough seems dry, add 1-2 T. liquid.
- **Bake together, eat better.** When children help, they're much more likely to try and adopt whole grain foods.
- **Find lessons, recipes and more at HomeBaking.org**

Baking Lab: English Muffin Batter Bread

10 oz FLOUR (vary flour type to compare how flour functions)

- 1¼ teaspoons yeast
- 1 Tablespoon sugar
- 1 teaspoon salt
- ¼ teaspoon baking soda
- 1 cup whole milk -- (8 ounces)
- ¼ cup water -- (2 ounces)
- 1 Tablespoon vegetable oil

Shortening to grease the pan

- 1 Tablespoon Semolina flour or cornmeal -- to coat the bread pan

1. Heat the milk in the microwave approximately 20 seconds or until 70-80 degrees. **CHECK WITH A THERMOMETER!! (BEST TO SCALD AND COOL IF TIME)**
2. Prepare the pan with shortening and sprinkling with about 1 tablespoon of semolina flour.
3. In the large mixing bowl whisk the flour, yeast, sugar, salt, and baking soda. **TAKE OUT THE WHISK AND DO NOT USE AGAIN!**
4. Add the oil and water with the milk.
5. Stir the liquids into the dry ingredients with a wooden spoon.
6. Beat the **batter** for 5 more minutes with a wooden spoon. **TAKE TURNS IF ONE PERSON GETS TIRED OF STIRRING.**
7. Spoon the batter into the prepared pan.

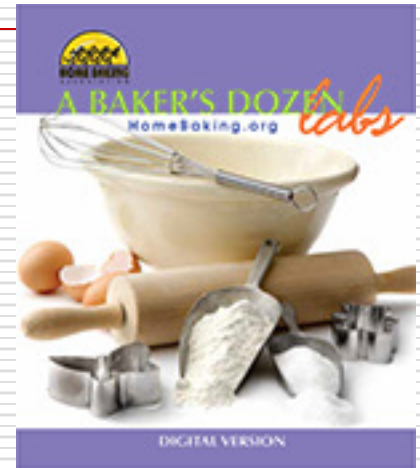
Label the side with masking tape with kitchen number, hour, and type of flour used. Put in the refrigerator overnight.

Day 2 Preheat the oven to 400 degrees. Bake for 20 TO 25 minutes.

****YOU MUST USE AN INSTANT READ THERMOMETER AND TAKE THE INTERNAL TEMPERATURE. INSERT THE THERMOMETER NEAR THE END AND THE TEMPERATURE SHOULD BE 185 TO 190 DEGREES.**

Cool the loaf of bread for 5 to 10 minutes and slice and compare textures.

A Baker's Dozen Labs 3, Baking Science: Flour is Not Just Flour.



English Muffin Batter Breads

(Use to support Flour is Not Just Flour)



Flour Food Safety Ready Resources

www.HomeBaking.org/baking-food-safety/

DID YOU KNOW FLOUR IS A RAW INGREDIENT? IT'S TRUE.

WHEAT COMES FROM THE FARM, IS MINIMALLY PROCESSED, THEN PACKAGED FOR USE

SO YOU SHOULD NEVER EAT RAW FLOUR

HEALTH & SAFETY TIPS: DON'T EAT RAW DOUGH OR BATTER

WASH HANDS, BAKING TOOLS AND SURFACES WITH SOAP AND HOT WATER

AND ONLY EAT FOOD THAT CONTAINS FLOUR WHEN IT IS FULLY COOKED

Endorsed By:



Flour Food Safety

Presented by
Brian Smith, Grain Craft
Manager of Regulatory Compliance & Documents

Sharon Davis,
Family & Consumer Sciences Education, HomeBaking.org

Heat is an ingredient!

AND SAFETY: REACHING THE RIGHT TEMPERATURES TO KILL BAKING MICROBES

Use a food thermometer to measure the internal temperature of products.

Use a digital thermometer (1) and a pop-over thermometer (2) to check internal temperatures.

| Product | Temperature |
|-----------------|--------------|
| Chesecakes | 160°F (71°C) |
| Custard pies | 160°F (71°C) |
| Flour tortillas | 160°F (71°C) |
| Yeast breads | 190°F (88°C) |
| Most cakes | 200°F (93°C) |

Take it from the experts...

Look for a thermometer in the kitchen. It's a good idea to have a thermometer in the kitchen. It's a good idea to have a thermometer in the kitchen. It's a good idea to have a thermometer in the kitchen.

Computer Lab

Baking Food Safety Lesson

For Home, Classroom, Community or Out-of-School Programs

Leader Objectives: Guide participants to

- Define recipe's raw ingredients
- Identify risks of raw ingredients/batter
- Use best baking food safety practices (cover)
- View Quality Safety Temperatures
- Insert food safety steps in the Mug Muffin recipe
- Identify on temperature chart the target internal mug muffin doneness temperature
- Cost, handle and eat or package baked goods away from raw flour, eggs, batter or dough

Step 1. View Did You Know Flour safety video.

Step 2. Read the Blueberry Mug Muffin recipe.

Step 3. Prepare Mug Muffin recipe.

Step 4. Prepare Mug Muffin recipe.

Step 5. Prepare Mug Muffin recipe.

6 Simple Baking Food Safety Steps

Find a complete Baking Food Safety Checklist on the back.

- 1 STORE** raw flour, baking mixes, dough and eggs separately from ready-to-eat foods.
- 2 BEFORE BAKING**, tie back long hair, clean counters, assemble ingredients and equipment, wash hands, and apron up.
- 3 KEEP SEPARATE** the measuring, mixing and handling of unbaked batter or dough from cooking, serving and packaging of baked products.
- 4 TEST** baked products with wooden toothpick or cake tester and food thermometer at center to ensure products are completely baked.
- 5 CLEAN** tools, work surfaces and equipment with hot, soapy water or in dishwasher.
- 6 WASH HANDS** before you taste, serve or package baked goods.

Baked Goods Internal Doneness Temperatures

Maximize quality and confirm products are fully baked by reaching these at-center temperatures:

| Temperature | Products |
|-------------|---|
| 150°F | Chesecakes (Remove from oven at 150°F to avoid overcooking; temperature should rise to 160°F as it cools) |
| 160°F | Quiche, Meringue pies, Bread pudding, Baked custard, Calzoni, Molten chesecakes |
| 165°F | Stuffing & casseroles, Leftovers, Chocolate cream pie, Meat, cheese or poultry filled breads (Especially for pies, include thermometer) |
| 170°-175°F | Custard pies, Fruit pies, Flan, Crème brûlée |
| 190°-210°F | Yeast breads (190°F), Cherry tarts (210°F) |
| 200°-209°F | Most cakes (Pound cakes 200°F), Cupcakes, Quick breads, Scones, Biscuits, Pies |

DING! When oven timer indicates product is done, take an internal temperature at the center of the product.

After baking: Cool product on wire rack. Wash hands before handling products. Refrigerate egg-rich, cream- or meat-filled baked goods within two hours of baking. Yeast breads are best stored at room temperature or frozen if not eaten in one day.

Baker's Bottom Line for Food Safety: Raw flour, baking mixes, batter and dough are not ready-to-eat. Flour, as well as eggs, must be thoroughly cooked or baked to prevent illness from bacteria in the flour. Wash hands.

Baking Food Safety Checklist

Before You Begin:

- Wash hands in warm water and soap
- Wash tools and equipment with hot, soapy water or in dishwasher
- Wash hands in warm water and soap
- Wash hands in warm water and soap

Measures, Mix & Portion:

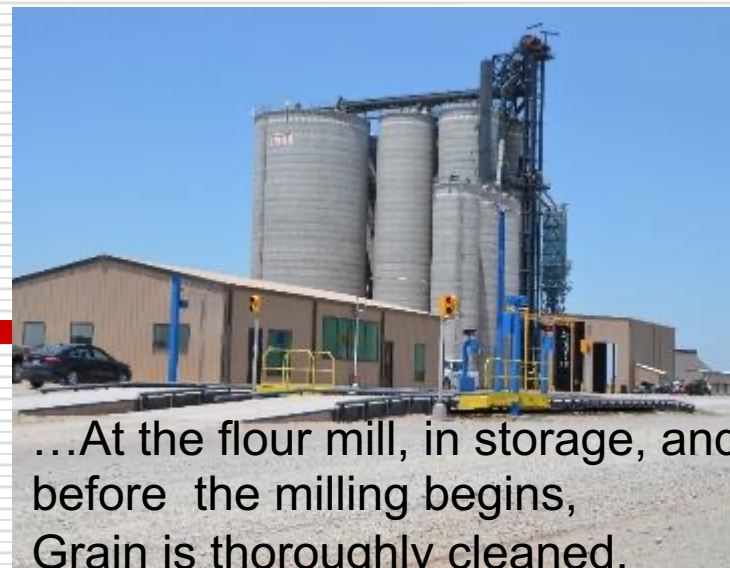
- Use measuring cups and spoons to measure ingredients
- Use measuring cups and spoons to measure ingredients
- Use measuring cups and spoons to measure ingredients
- Use measuring cups and spoons to measure ingredients

Bake, Test Temperature & Cool:

- Preheat oven to the temperature specified in the recipe
- Use a food thermometer to check the internal temperature of the product
- Use a food thermometer to check the internal temperature of the product
- Use a food thermometer to check the internal temperature of the product



Wheat is cleaned...in field by how the combine cuts and winnows it.



...At the flour mill, in storage, and before the milling begins, Grain is thoroughly cleaned.



...At the elevator prior to storage

Flour...Cleaned,
NOT
cooked or
baked.

FDA's 2018
*Food Safety
Modernization
Act* = food safety
checks and balances for
mills.

- See How Flour is Milled, KidsZone Namamillers.org



Flour is NOT a ready-to-eat food.



**DON'T EAT BATTER THAT
CONTAINS RAW EGGS OR
RAW FLOUR!**

Raw eggs
and raw flour may contain
harmful bacteria that could
make you or your family sick.

Wheat flour has a very strong food safety track record, however...

- Flour is made from raw grain that is grown and harvested in nature and exposed to the elements.
- E. coli and other naturally occurring pathogens present in nature and in fields, crops.
- Traditional milling does not include a process to eliminate the presence of pathogens such as e coli and salmonella.



Teach Consumer Sciences...

Critical thinking skills re on-line information.



Cooking Light Magazine, Sara Tane—July 29, 2016

□ <http://www.cookinglight.com/eating-smart/smart-choices/safe-to-eat-cookie-dough>

How you can safely eat raw dough...millions of hits...

"Frequent flour recalls are starting to make everyone's favorite part of cookie making (licking the bowl clean) seem life-threatening.

However if you take the time to toast your flour before Using it in your recipe you not only kill any lingering Bacteria, like E.coli, also adds delicious nutty flavor from toasting process."

Provided pictorial step-by-step how-to, plus finished cookies to prove it didn't change baking properties...

BUT...

Bottom line: This doesn't assure food safe raw dough.

2 cups flour
Cookie sheet
350° F.
5 minutes



Key Messages

Raw Dough's a Raw Deal and Could Make You Sick

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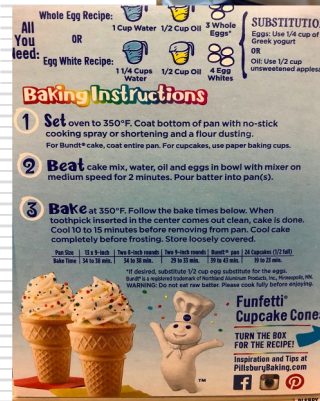
✉ Email

FDA



5 Important Things to Know About Flour

1. Flours most commonly used in home baking and cooking are made directly from raw grains.
2. Processing raw grains into flour does not kill harmful bacteria.
3. Many foods made with flour also contain raw eggs, which may contain harmful bacteria.
4. Cooking is the only way to be sure that foods made with flour and raw eggs are safe.
5. **Never eat or taste raw flour, dough, or batter.**



“Do not eat raw batter”



saferecipeguide.org



SAY NO TO RAW DOUGH



www.fightbac.org/kids

Baker's Bottom Line for Food Safety: Raw flour, baking mixes, batter and dough are not ready-to-eat. Flour, as well as eggs, must be thoroughly cooked or baked before eating to prevent illness from bacteria in the flour. Wash hands, utensils, and surfaces after mixing and handling batter or dough.



HomeBaking.org

STEPS OF FLOUR & BAKING FOOD SAFETY

CACFP and FCS Educators needed– On-line Partners

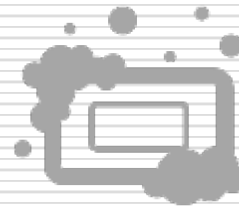
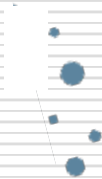
5



Flour is a minimally processed ingredient that carries pathogens from the field



Wash hands before and after



Work with a clean workstation & utensils



Do not eat raw dough or batter



Cook or bake everything to safe temperature



Takes time, but wash hands and surfaces before AND after measuring, mixing, kneading, shaping with raw flour.

Use a digital thermometer to verify your **doneness temperatures...**



Heat Is A Baking Ingredient

homebaking.org/baking-food-safety

And carefully measuring how much you add is the key to baking success for students and their families.

Use a digital thermometer to measure your **ingredient and process temperatures...**



Cutting in Butter
35 to 40°F



Creaming Butter
68 to 70°F



Dry Blend Yeast
(Water Temp)
120 to 130°F



Blooming Yeast
(Water Temp)
105 to 115°F



Cheesecake
145 to 150°F



**Quiche/Custard/
Cream Pie**
160 to 165°F



Brioche
180 to 190°F



Bagels
185 to 195°F



Sourdough
190 to 210°F



Yeast Breads
190 to 210°F



Rich Cake
200 to 205°F



Muffins
205 to 210°F



Light Cake
205 to 210°F

<https://www.homebaking.org/wp-content/uploads/2022/04/HBA-Student-Flyer-with-recipe.pdf>

<https://www.homebaking.org/baking-food-safety/>

Ask: What needs to change in the lab?



Flour food safety teaching strategies: Research proved...

Strategy:

Have students write in the baking food safety steps in their next recipe or Formula used in lab...

Safe Recipe Style Guide

<https://www.saferecipeguide.org/>

Example:

[Hot Chocolate Cookies](https://www.homebaking.org/baking-food-safety/)

<https://www.homebaking.org/baking-food-safety/>

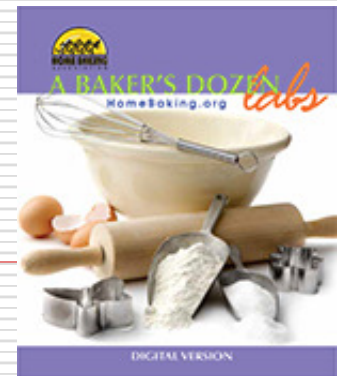
A: Baked muffins should not be cooling near raw flour or eggs.

FAT

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



More at: landolakes.com and crisco.com
<http://webexhibits.org/butter>



Fats

Butter, solid shortening, margarine, oils (liquid at room temperature)

- ❑ Animal Source
 - Pork (lard)
 - Beef (tallow)
 - Milk (butter)
- ❑ Vegetable Source
 - Soybean (most common in US)
 - Cottonseed
 - Sunflower
 - Canola
 - Palm



FATS



- Types: Butter, margarine, shortening, lard, oils (olive, coconut, grapeseed...) and “plant butter”
- Butter, margarine = 80% fat
Shortening, oil, lard= 100% fat
Read label re fat content in plant butter or reduced fat spreads
- *Cutting in coats flour, makes batter “short” or tender*
- *Creaming traps air for leavening
(Note: oil will not shorten, cream)
- Increases keeping quality
- Keeps the product from sticking

***Temperature matters:**
Keep fat COLD for scones, biscuits, pastries
Melting points:
Lard, 85°F
Butter, 90°F
Shortening, 112°F

Reducing fat in baking is tricky—it may add liquid, sugars

- Applesauce for oil, fat – begin with only ¼ substitution
- Use specific recipes for reduced fat sticks- they vary in liquid content

SUGARS

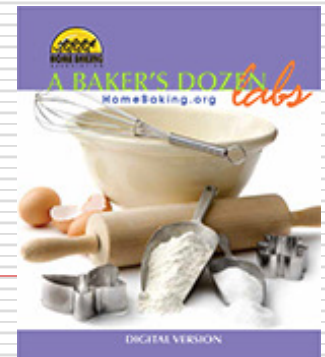


- Provide a sweet flavor,
- helps tenderize the product
- carmelizes, providing color and texture
- May be



granulated, powdered, brown, raw **or** sugar+stevia
fluid—agave nectar, honey, molasses, corn syrup, maple syrup

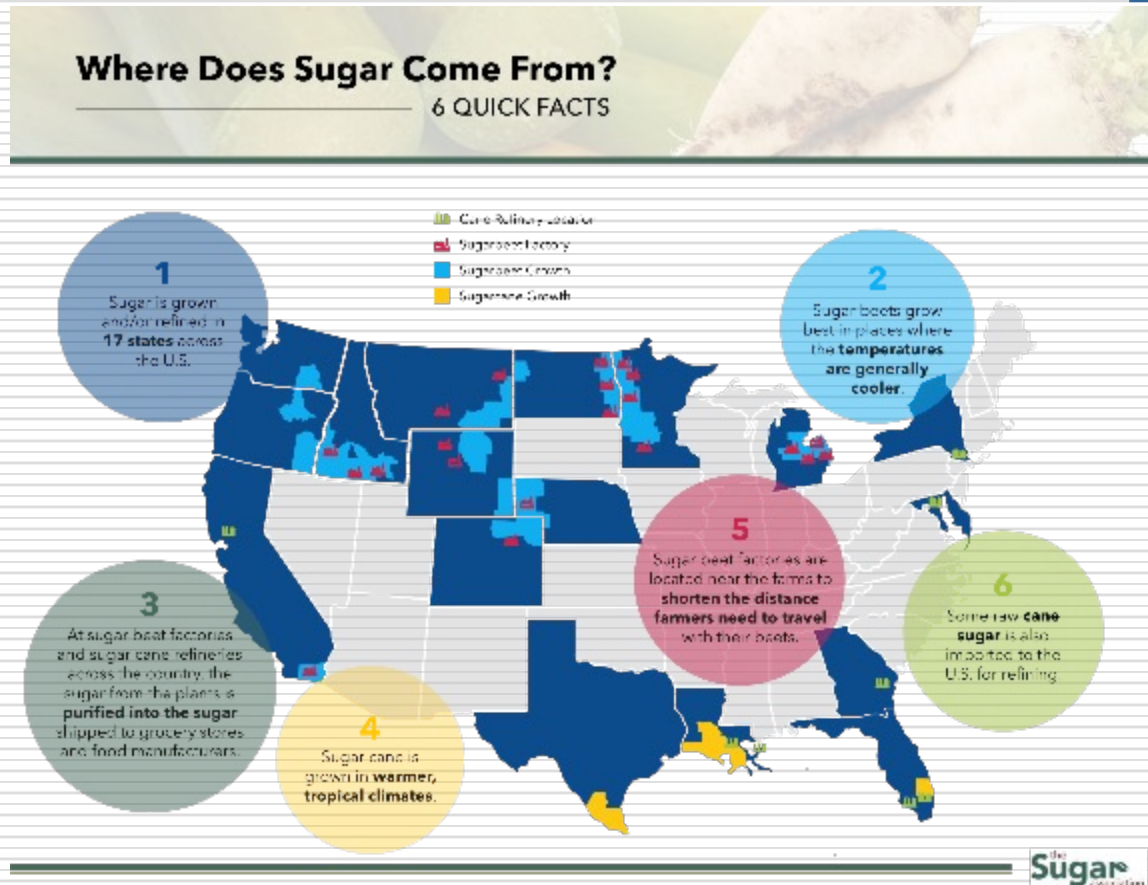
- More sugar.org, honey.org,
- chsugar.com dominosugar.com



Is Sugar Natural??

Get Facts vs Myths
How Well Do You Know Sugar
How Sugar is Made
Types of Sugar
Functions of Sugar

www.Sugar.org



<https://www.sugar.org/resources/steam-stem/>

SUGAR



- 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 slows fermentation—greater than $\frac{1}{2}$ c. sugar/4 c. flour
- Agave nectar, honey, molasses, sorghum may be substituted for 50-100% of sugar--adjust liquids
- Stevia/sugar blends usually sub for $\frac{1}{2}$ the sugar










Note: Honey is 20% water and 1 $\frac{1}{2}$ X sweeter than sugar.

Videos and More at www.sugar.org

Test kitchens: chsugar.com, dominosugar.com, karosyrup.com

Sugar's Functional Role in Foods Beyond Sweetness-

<https://www.sugar.org/diet/role-in-food/>

| | | FLAVOR ENHANCER/ BALANCER, AROMA | BULK | TEXTURE/ MOUTHFEEL | SHELF-LIFE/ MICROBIAL STABILITY | FERMENTATION | FREEZING POINT DEPRESSION | COLOR | MOISTURE RETENTION |
|---|---|--|------|-----------------------|---------------------------------------|--------------|---------------------------------|-------|-----------------------|
| Dairy Products |  | ● | ● | ● | | ● | | | |
| Whole-Grain, Fiber-Rich Breads & Cereals |  | ● | ● | ● | ● | ● | | ● | ● |
| Breads |  | ● | ● | ● | ● | ● | | ● | ● |
| Bakery Products |  | ● | ● | ● | ● | | | ● | ● |
| Salad Dressings, Rubs and Sauces |  | ● | ● | ● | ● | | | | |
| Preserves & Pickling |  | ● | ● | ● | ● | | | | |
| Jams & Jellies |  | ● | ● | ● | ● | | | ● | |
| Canned Fruits & Vegetables |  | ● | ● | ● | ● | | | ● | |
| Prepared Foods |  | ● | ● | ● | ● | | | ● | ● |
| Beverages |  | ● | ● | ● | ● | | | | |
| Frozen Beverages |  | ● | ● | ● | | | ● | | |
| Fermented Beverages |  | ● | ● | ● | | ● | | | |
| Ice Cream |  | ● | ● | ● | | | ● | | |
| Confectionery |  | ● | ● | ● | ● | | | ● | ● |



Generations of Expertise

Since 1901, Domino® Sugar has been the trusted partner for generations of bakers. Our commitment to quality and expert craftsmanship is our enduring promise to you. We use the highest standard to maintain the naturally sweet flavor found in the sugarcane plant. We don't take sugar lightly, and we know you don't either. People who choose the best, choose Domino®.



TRUSTWORTHY BAKING TIPS

Whether you're teaching new bakers or simply want to brush up on the basics, we have tips, videos and handy charts to help anyone become an expert in the kitchen.

LEARN THE BASICS



FROSTING TECHNIQUES

Mastering frosting techniques takes time and patience. But with a little practice and a few helpful tips from our baking experts, your students will be crafting perfectly frosted treats in no time.

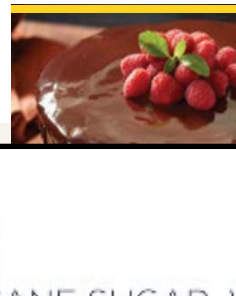
GET FROSTING



WHEN TO USE

From d... moistn... to use... Here a... and da... goods...

MAS



FROM CANE SUGAR, WE CRAFT LIFE'S SWEETEST MOMENTS

Crafting sugar and happiness has been our mission since 1906, and our experts have dedicated themselves to quality, earning the respect and trust of the baking community for more than a century. Over the years, we've grown, but we're still in California, still committed to quality and still bringing sweetness to every home. We know that when you mix family, friends and food made with C&H® Sugar, you create magical moments and memories you'll never forget. In other words—The Recipe for Happiness Starts with C&H®.



C&H® Sugar Baking Tips

Looking to pass on some sweet knowledge to new bakers? We'll link that great... to help you teach the baking basics, we've compiled tips and charts to give you a hand in the classroom (or kitchen).

LEARN THE BASICS



The Ultimate Guide to Frosting

From mixing ingredients to creating a crumb coat, there's a lot to know about frosting baked goods. But with our handy tips and videos, your students will quickly become experts.

START FROSTING



The Benefits of Brown Sugar

There's a secret to adding deeper flavor and moisture to recipes, and that secret is brown sugar. Here are our helpful tips for baking with C&H® Golden Brown and C&H® Dark Brown Sugar.

LEARN BROWN SUGAR



The Fine Points of Cake Decorating

Nothing is more impressive than a beautifully decorated cake. Teach your students to pressure their... with our tutorial that covers everything from piping buttercream frosting to advanced plating techniques and more.

GET FANCIER

EGGS



THE POWER OF EGGS



Image Source: apjonesart.com

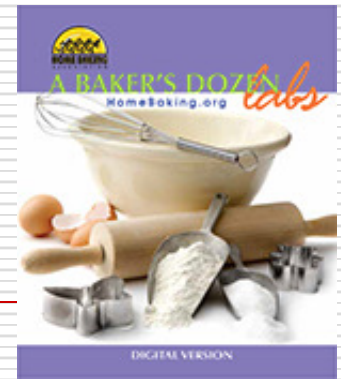
*Debbie A. Stendahl
Whitchell Memorial Schools
Whitchell, WI*

Educator Lesson,
HomeBaking.org

- 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— $68-72^{\circ}$ F.
- In quick breads or cookies: 1 T. flaxmeal + 3 T. water = 1 large egg OR $\frac{1}{4}$ c. soft tofu

More at: American Egg Board www.aeb.org

Flax meal is found in the grocer's flour or cereal aisle.



LIQUIDS

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

- Water
- Milk
- Buttermilk
- Juice
- Mashed Fruit
- Grated/shredded veggies



Notes:

Butter and margarine are 20% liquid (80% fat)

Shortening and oil have no liquid (100% fat)

Spreads (tub or stick) will add more liquid—they may be almost half liquid so will alter your results if used 1 for 1 with butter, margarine, shortening or oil.

Gluten develops when liquid is mixed with flour. The protein in the flour forms gluten. Lower protein flour, more fat, less handling, less liquids are important for tender pastry, scones, biscuits.

LIQUIDS

- 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



Lab 9 and
Baking Science
Experiments re
Scalding, Liquids

Fruits, Veggies Add Liquid, Sugar in Baking

Most fruits, veggies are 80-92% water

1 cup shredded apple, carrot, mandarin oranges, zucchini; cooked pumpkin, sweet potato, squash; beets; mashed or pureed bananas, strawberries...

~ $\frac{3}{4}$ to $\frac{7}{8}$ cup water

1 cup water = 1 cup shredded carrots + $\frac{1}{4}$ cup water

Whole grain baking

2 c. whole grain flour, add $\frac{1}{4}$ c - $\frac{1}{2}$ c any above

If the fruit/veggie is acidic:

↓ 1 Tablespoon baking powder to
 $1\frac{1}{2}$ - 2 tsps baking powder + $\frac{1}{2}$ tsp baking soda



A Bakers Dozen Smart Snack Recipes, Carrot Cupcakes

www.HomeBaking.org



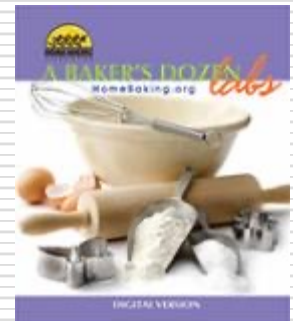
Child Nutrition & Wellness, Kansas State Department of Education
in collaboration with the non-profit Home Baking Association

New Summer 2016

LEAVENING AGENTS



- 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



Much more: A Bakers Dozen Labs, Lab 4 *Creating Lift*, www.HomeBaking.org

WHAT'S THE DIFFERENCE BETWEEN BAKING POWDER and BAKING SODA?

Both are leavening agents which cause baked goods to rise,
BUT THEY ARE NOT CREATED EQUAL.



BAKING POWDER

Contains both an acid and an alkaline component (usually baking soda) which react to release carbon dioxide.

VS.



BAKING SODA

Must be combined with an acid ingredient such as buttermilk or molasses to react and release carbon dioxide.

Carbon dioxide bubbles in batter cause baked goods to rise.



Carbon dioxide bubbles in batter cause baked goods to rise.

CAN CONTAIN TWO KINDS OF ACID:

SLOW-ACTING ACID
will not react until heated



FAST-ACTING ACID
reacts in a wet mixture



ACID

DOES NOT CONTAIN ANY ACID

TWO TYPES OF BAKING POWDER:



SINGLE ACTING

Includes only slow OR fast reacting acid



DOUBLE ACTING

Contains both slow and fast reacting
Rises with addition of liquid AND again with heat



Don't have all day?
QUICK BREAD TO THE RESCUE!



Both baking powder and baking soda provide faster leavening than yeast fermentation. That's why breads and muffins made with either are called "quick breads."

MORE ABOUT SODA

Can leave a bitter taste if not combined with acid

Reacts with liquid, not heat.

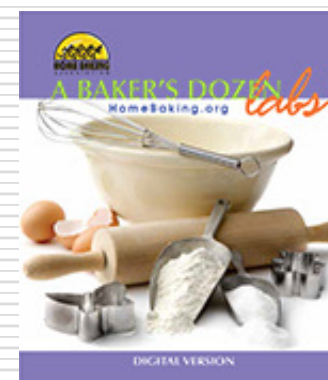
Because it reacts with liquid upon contact, baking soda should always be combined with other dry ingredients first.

For best results, batter should be placed in the oven immediately.

*This bit of kitchen genius
brought to you by*

CLABBER GIRL®

www.clabbergirl.com



More leavening science
At HomeBaking.org



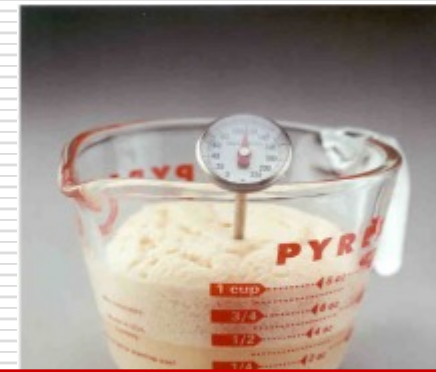
YEAST

A leavening agent; Increases volume



Types: NOT Brewer's or Nutritional yeasts

- Active Dry Yeast (ADY); fast/instant/breadmachine
- Professional bakers:
Fresh Cake or Compressed Yeast
- Specialty yeasts: home and pros
Platinum®, redstaryeast.com
- Home bakers: Active dry, fast-rising, cake (in dairy case)
- Cream or liquid yeast (commercial bakeries)



Yeast activity test
Gluten window test
Redstaryeast.com

Baker notes: TEMPERATURES and TIME MATTER.

Yeast dies at, or near, 140° F. Yeast and yeasted dough may be frozen or refrigerated-bring yeast and dough to room temp before baking.

Long-fermentation dough requires less yeast.

HeatisanIngredient.com



Cutting in Butter
35 to 40°F



Creaming Butter
68 to 70°F



Dry Yeast Flour Blend
65 to 70°F
Water
120 to 130°F



Blooming Yeast
(Water Temp)
105 to 115°F



Proofing Dough
(Air Temp)
75 to 90°F

www.HomeBaking.org
Baking Food Safety

BAKING TEMPERATURES

Ingredient and Process Temperatures

| | | |
|--|-------------|-------------|
| Cutting in Butter | 35 - 40°F | (2 - 4°C) |
| Creaming Butter | 65 - 75°F | (20 - 21°C) |
| Blooming Instant Yeast (Water Temp) | 85 - 100°F | (29 - 38°C) |
| Blooming Dry Active Yeast (Water Temp) | 105 - 115°F | (41 - 46°C) |
| Yeast Flour Blend (Water Temp) | 120 - 130°F | (49 - 54°C) |
| Dough Proofing (Proof Box Temp) | 80 - 90°F | (27 - 32°C) |
| Dough Proofing (Proof Box Humidity) | 80 - 90% | |

Check Your Altitude

Decreased air pressure at elevations above 3,000 ft. can increase the evaporation of liquids and the expansion of gasses. Increase oven baking temperature by 10 - 25°F (5 - 14°C). See thermoworks.com/high-altitude/.

Doneness Temperatures*

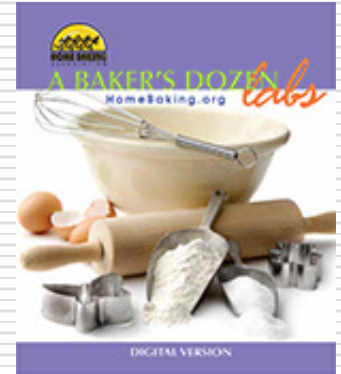
SALT



- Adds flavor; salt essential to health
- BUT, need to balance Na (sodium)
K (potassium), Mg (magnesium)

(Another reason *why fruits, veggies, whole grains matter*)

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



Kosher vs. table

1 tsp table salt = 1 1/4 tsp kosher

Salt in Baking



- ❑ “Potassium chloride only” substitutes not recommended

Daily sodium and potassium targets:

- ❑ Sodium—1500mg (over 51 years) to 2300 mg
- ❑ Potassium—4700 mg from food

“Home baked” often less Na than commercial.



Child Nutrition & Wellness, Kansas State Department of Education
in collaboration with the non-profit Home Baking Association

New Summer 2016

Ages 2- 5 in U.S. average 2310 mg; 8-12 = 3260mg; 13-19 = 3480 mg

- ❑ Smart Snack baking: 200mg or less per serving

Center for Disease Control. 3/2013. http://www.cdc.gov/salt/pdfs/children_sodium.pdf

SPICES & FLAVORINGS

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

$\frac{1}{4}$ tsp. dried herb = 1 tsp. fresh

- Sweet spices: Cinnamon, nutmeg, cardamom, anise, ginger
- Savory: Herbs, basil, oregano, pepper
- Salt
- Vanilla, maple, lemon, almond flavoring
- Citrus peel, zest or juice
- Fresh grated is zzz-best.





Chocolate

Add body, bulk and unique color and flavor to products

- ☐ Unsweetened (100% cacao)
- ☐ Bittersweet (60%+ cacao)
- ☐ Dark (cacao varies, 70-99%)
- ☐ Semi-sweet (35% or more)
- ☐ White (no cacao, cocoa butter)
- ☐ Cocoa powders—"Dutch" process

(neutralizes acids—use baking powder, or add buttermilk)

Natural baking cocoa (naturally acidic, use baking soda)



*Chewy Double Chocolate
Smart Snack Cookie*
A Baker's Dozen Recipes
HomeBaking.org





Bake with us!



Chocolate Whole Wheat Waffles