

# THE WHEAT YOU EAT

RECOMMENDED GRADE LEVELS	AVERAGE TIME TO COMPLETE <i>Time does not include optional items listed in the lesson plan.</i>	THANK YOU TO THE FOLLOWING EDUCATORS FOR DEVELOPING SPECIFIC COMPONENTS OF THIS LESSON PLAN.
9-12	<b>Anticipatory Set &amp; Facilitation:</b> 90 minutes  <b>Conclusion/Assessment Options:</b> 90 Minutes	<ul style="list-style-type: none"> <li>▪ Joanna Krogstad; F.C.S. Educator; Bozeman High School</li> <li>▪ Montana Agriculture in the Classroom Program</li> </ul>
NATIONAL STANDARDS		LESSON PLAN OBJECTIVES
National Family and Consumer Sciences Standards: 14.2.4 Analyze sources of food and nutrition information, including food labels, related to health and wellness. 14.3.1 Apply various dietary guidelines in planning to meet nutrition and wellness needs.  Common Core Standards: <ul style="list-style-type: none"> <li>▪ WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.</li> </ul>		Upon completion of this lesson, participants will be able to: <ul style="list-style-type: none"> <li>▪ Identify the five varieties of wheat grown in Montana and their family characteristics</li> <li>▪ Identify the agricultural careers as related to all aspects of wheat production</li> <li>▪ Determine the relative differences in gluten content between different types of wheat flour</li> </ul>
<b>TEACHER NOTES...</b> Northern Plains Student Ag Mag, Wheat can be viewed on line at <a href="http://www.flipsnack.com/5D687897C6F/fzps499h.html">http://www.flipsnack.com/5D687897C6F/fzps499h.html</a> or ordered in bulk from Lorri Brenneman, Montana Department of Agriculture, Phone: (406)437-1906, E-mail: <a href="mailto:LBrenneman@mt.gov">LBrenneman@mt.gov</a>		

MATERIALS		
MATERIALS PROVIDED WITHIN THIS LESSON PLAN	RESOURCES AVAILABLE IN A SEPARATE DOWNLOAD AT ...	MATERIALS THAT MAY NEED TO BE ACQUIRED SEPARATELY
<ul style="list-style-type: none"> <li>▪ True &amp; False Questions, pg. 6-7</li> <li>▪ True &amp; False Signs, pg. 8</li> <li>▪ Connections, Points, and Questions Worksheet, pg. 9</li> <li>▪ Spoons Activity Directions, pg. 10</li> <li>▪ Spoons Answer Key, pg. 11</li> <li>▪ Spoons Activity Cards, pg. 12-15</li> <li>▪ Goodness Gracious! Great Balls of Gluten Experiment!, pg. 16-17</li> </ul>	<ul style="list-style-type: none"> <li>▪ The Journey: Wheat into Flour-Part 1; <a href="https://youtu.be/PYP6AnNQjNo">https://youtu.be/PYP6AnNQjNo</a></li> <li>▪ Bob's Red Mill: <a href="http://www.bobsredmill.com">http://www.bobsredmill.com</a></li> <li>▪ Great Globes of Gluten! Which Wheat Flour Has The Most? <a href="http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p040.shtml">http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p040.shtml</a></li> </ul>	<ul style="list-style-type: none"> <li>▪ Chairs</li> <li>▪ Cardstock</li> <li>▪ Tape</li> <li>▪ Spoons (1 less than the number of students)</li> <li>▪ Hard Red Winter Wheat Flour (1 cup per lab group)</li> <li>▪ Hard Red Winter Wheat Flour (1 cup per lab group)</li> <li>▪ Hard Red Spring Wheat Flour (1 cup per lab group)</li> <li>▪ Hard White Wheat Flour (1 cup per lab group)</li> <li>▪ Durum (semolina) (1 cup per lab group)</li> <li>▪ Bowls</li> <li>▪ Measuring cups</li> </ul>

## CONTENT

### EDUCATOR MATERIALS

### PARTICIPANT READING

*Content materials are provided to help educators gain a better understanding of background information for this lesson.*

- Montana Wheat & Barley Committee  
<http://wbc.agr.mt.gov/wbc/Consumer/>
- [Agricultural Experiment Station \(MSU\)](#)
- [Montana Grain Growers Association](#)
- [Montana Wheat & Barley Committee](#)
- [US Wheat Association](#)
- [Wheat Foods Council](#)
- [Plant Sciences and Plant Pathology](#)

- Northern Plains Student Ag Mag, Wheat
- Discovery How Stuff Works: Wheat; Not for just nutrition, wheat is used in many things that you would never expect. <https://youtu.be/F4VoVLLlyuS0>

### ANTICIPATORY SET

**The Journey: Wheat into Flour-Part I (option 1) ;** <https://youtu.be/PYP6AnNQjNo>

**Approximate time: 6:47**

1. Although this video is not specific to Montana it is very thorough in its overview of the wheat crop industry.
2. While students are watching the video ask them to keep a list of the occupations that are be associated with the production and harvesting of wheat.
3. Discuss the wide variety of occupations discovered by the students at the conclusion of the video.

### True or False (option 2)

**Approximate time:** varies minutes depending on the number of questions asked

Materials to prepare:

- True and false questions
  - 1 chair per person plus 2 extra
1. Activity set up:
    - a. Find the same number of chairs as participants plus two extra chairs. Make two rows with these chairs.
      - i. Place the chairs back to back.
    - b. Place one chair at both ends of the chairs facing outward.
      - i. Label one chair "True" and the other "False." The True or False Signs are provided.
    - c. Refer to the diagram illustration.
      - i. Each arrow represents a chair. The direction the arrow is pointing indicates the direction to face the chair.
      - ii. The example is for 6 participants (2 teams of 3). However, any number of participants may participate by adding more chairs.



2. Play the activity:

- a. Divide participants into two teams.
- b. Have team one sit on one side of the chairs and team two sit on the other side.
- c. Start at one end of the chairs. Participants will compete against the person sitting behind them on the opposing team.
  - i. If there is an odd number of participants, the competitor may change every time by moving to the next person available for each team. Or, one participant may facilitate the activity.

- d. Read a true or false question.
  - e. The competing participants decide if the answer is true or false, and walk to the appropriate chair.
  - f. The participant who sits in the correct chair first wins one point for his/her team.
    - i. Keep score on the board or on a piece of paper.
  - g. After the score is recorded, participants return to their original chairs.
  - h. Play moves to the next two participants.
    - i. If both participants answer wrong, no points are awarded and the play moves to the next two participants.
3. The team with the highest score wins.

#### RECOMMENDED FACILITATION

**Approximate time:** 45 minutes

1. Each student will receive a **Northern Plains Student Ag Mag, Wheat** and the **Connections, Points, and Questions worksheet**.
2. Students will complete the first two columns of the chart (“Connections” and “Most Important Points”) as they read the assignment.
3. In the “Connections” column, have students make entries from their reading that match something they already know. The entries might expand on their prior knowledge or be a new connection they have made with something they already knew.
4. As students encounter ideas in the reading that they think are important to remember or that summarize a main point, have them enter those in the “Most Important Points” column.
5. After students have completed the reading, have them frame questions about what they still don’t understand or what they would like to know more about and enter those in column 3.

Tips/Variations:

**\*Rather than using the worksheet, use small stick-on notes throughout the reading to mark connections, most important points, and questions. Have students put an exclamation point (!) on some notes to indicate a connection, a star (\*) for most important points, and a question mark (?) for questions they have. Students should put the appropriate stick-on note directly on the text page.**

\*Use student questions to guide further classroom instruction, discussion, or study. Have the students select the questions for further study.

#### CONCLUSION

##### **Spoons Activity Instructions**

**Approximate time:** 45 minutes

*\*Note to educator:* If participants are not confident with material being covered, provide them with the *Spoons Activity Answer Key* to be used as a reference for the first few games. When printing, page 15 may be printed on the back of each card to quickly identify the activity.

##### **Supplies Needed:**

- 1 set of *Spoons* activity cards per group of 5-6 participants
- 1 *Spoons Activity Answer Key* per group of 5-6 participants
- 1 spoon per participant

##### **Object of the activity:**

The object of the activity is for participants to match a **Wheat Variety card** with the **Culinary Use/Nutrient Value card**, and the **Production/Export card** for that particular wheat variety. For instance, if the **Wheat Variety card** reads, “Durum”, the correct **Culinary Use/Nutrient Value card** would read “The hardest of all U.S. wheat. Used to make semolina flour for pasta production.” and the correct **Production/Export card** would read, “Consistently the class with the lowest export volume...”

The second object of the activity is to ensure you are not the player who ends up without a spoon. When a player finds a matched set, (Wheat Variety, Culinary Use/Nutrient Value, and the Production/Export card) they grab a spoon from the center of the table.

**Playing the activity:**

1. Provide groups of 5-6 participants with the following:
  - a. 1 less spoon than the number of participants in each group. For example if you have a group of 6 participants, 5 spoons will be needed.
  - b. 1 set of *Spoons* activity cards
  - c. 1 *Spoons Activity Answer Key*
2. Each group should designate a participant as the “spoonmaster.” This participant is in charge of checking the answers as needed.
2. The spoons should be arranged in the center of the table, an equal distance from all players. There should be one less spoon available than players.
4. The dealer deals three cards to each player and keeps the remaining cards in a stack.
5. The dealer quickly takes a card from the deck and can either keep the card and pass one card from her hand to the player on his/her left OR the dealer may simply pass the card selected to the player to the left.
6. Players continue quickly passing the one card from the dealer or a different card from their hand to the player on his or her left, attempting to make a set in their hand.
7. A set is when a participant matches a **Wheat Variety card**, with the **Culinary Use/Nutrient Value card**, and the **Production/Export card** for that particular theorist.
8. Once a player has what they think is a correct set, they take a spoon from the middle of the table.
9. Once a spoon has been taken, remaining players should quickly grab the remaining spoons.
10. The spoonmaster must then verify that the set of the player first taking a spoon was correct. If it was, the player who did not get a spoon is out of that round. If it was not a correct match, the player who took the first spoon is out.
11. For the next round, the player who was eliminated automatically becomes the spoonmaster, and one spoon is taken off of the table.
12. Play continues until there are only two players remaining and one spoon. The winner is the participant who gets that spoon with a correct set.

**ASSESSMENT**

**Great Globbs of Gluten! Which Wheat Flour Has The Most?** <http://www.exploratorium.edu/cooking/bread/activity-gluten.html>

**Approximate time:** 90 minutes

These flours may be ordered from Bob’s Red Mill: <http://www.bobsredmill.com> or found at a local food co-op.

**Ingredients:**

- Hard Red Winter Wheat Flour (1 cup per lab group)
- Hard Red Winter Wheat Flour (1 cup per lab group)
- Hard Red Spring Wheat Flour (1 cup per lab group)
- Hard White Wheat Flour (1 cup per lab group)
- Durum (semolina) (1 cup per lab group)
- Water (1/2 to ¾ cup for each flour you will be using)
- Bowls (one for each type of flour you will be using)
- Measuring cups (one each for liquid and dry for each lab group)

**Directions:**

1. Create lab groups.
2. Hand out one Goodness Gracious! Great Balls of Gluten Experiment! to each lab group.
3. Read lab out loud with students as they follow along.
4. Allow students to complete lab.
5. Follow up with group class discussion.

## True and False Questions for Wheat

The following true or false questions are based upon content in Montana Wheat and Barley, Consumer Education, All About Wheat Fast Facts, <http://wbc.agr.mt.gov/wbc/Consumer/>.

Question	Answer	Explanation if answer is false
Montana exports about 20% of total wheat production overseas, with the remaining 80% that stays in the United States.	False	Montana exports about <b>80%</b> of total wheat production overseas, with the remaining <b>20%</b> that stays in the United States. <b>Every man, woman, and child in the Montana would have to eat 8 loaves of bread every day for a year to consume the rest.</b>
The hull is the seed from which the plant grows.	False	The <b>kernel</b> is the seed from which the plant grows.
A modern combine can harvest 1,000 bushels (60 pounds = one bushel of wheat) per hour.	True	
Wheat is grown in 12 states in the U.S.	False	Wheat is grown in <b>42</b> states in the U.S.
More foods are made with corn the world over than with any other cereal grain.	False	More foods are made with <b>wheat</b> the world over than with any other cereal grain.
A family of four could live ten years off the bread produced by one acre of wheat.	True	
Assuming a sandwich was eaten for breakfast, lunch, and dinner, it would take 168 days to eat the amount of bread produced from one bushel of wheat.	True	
Wheat is a member of the legume family that produces a dry, one-seeded fruit commonly called a kernel.	False	Wheat is a member of the <b>grass family</b> that produces a dry, one-seeded fruit commonly called a kernel.
More than 17,000 years ago, humans gathered the seeds of plants and ate them. After rubbing off the husks, early people simply chewed the kernels raw, parched or simmered.	True	
Wheat originated in the United States.	False	Wheat originated in the <b>“cradle of civilization” in the Tigris and Euphrates river valley, near what is now Iraq.</b>
The Roman goddess, Ceres, who was deemed protector of the grain, gave grains their common name today – “cereal.”	True	
Wheat was first planted in the United States in 1903.	False	Wheat was first planted in the United States in <b>1777 as a hobby crop.</b>

Wheat is the primary grain used in U.S. grain products — approximately three-quarters of all U.S. grain products are made from wheat flour.	True	
North Dakota is the only place that has commercial production of five of the six major classes of wheat grown in the U.S.	False	<b>Montana</b> is the only place that has commercial production of five of the six major classes of wheat grown in the U.S.
In the United States, one acre of wheat yields an average of around 4 bushels of wheat.	False	In the United States, one acre of wheat yields an average of around <b>40 bushels</b> of wheat.
About 2% of the wheat grown in the United States is used domestically.	False	About <b>50%</b> of the wheat grown in the United States is used domestically.
The first bagel rolled into the world in 1683 when a baker from Vienna Austria was thankful to the King of Poland for saving Austria from Turkish invaders. The baker reshaped the local bread so that it resembled the King’s stirrup. The new bread was called “beugel,” derived from the German word stirrup, “bugel.”	True	
If you eat pasta three times a week, it would take 70 weeks to eat all the pasta made from one bushel of durum.	True	
There are more than 20 pasta shapes produced worldwide.	False	There are more than <b>600</b> pasta shapes produced worldwide.
The early crackers, or “biscuits” as the English called them, were handmade, hard-baked products made from flour and a little moisture.	True	
Per capita consumption of pasta in the United States was 22 pounds in 1996 and in 2005 was at 19.52 pounds.	True	
Semolina is coarsely ground barley with a texture somewhat like sugar. It is the best product for pasta.	False	Semolina is coarsely ground <b>durum</b> with a texture somewhat like sugar. It is the best product for pasta.
One bushel of wheat contains approximately one fifty individual kernels.	False	One bushel of wheat contains approximately <b>one million individual kernels</b> .
One bushel of wheat weighs approximately 60 pounds.	True	
One bushel of wheat yields approximately 42 pounds of white flour OR 60 pounds of whole-wheat flour.	True	

## True and False Signs

**TRUE**

**FALSE**



# Spoons Activity Instruction

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The second object of the activity is to ensure you are not the player who ends up without a spoon. When a player finds a matched set, (Wheat Variety, Culinary Use/Nutrient Value, and the Production/Export card) they grab a spoon from the center of the table.

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# Wheat

## Spoons Answer Key

Wheat Variety	Culinary Use/Nutrient Value (Red)	Production/Export (Green)
<b>Hard Red Winter Wheat</b>	Wide range of protein content, good milling and baking characteristics. Used to produce bread, rolls and, to a lesser extent, sweet goods and all-purpose flour. Used to make delicious flat breads and is good for all purpose use	The dominant class in U.S. exports and the largest class produced each year. Major foreign buyers include Russia, China, Japan, Morocco and Poland.
<b>Hard Red Spring Wheat</b>	Contains the highest percentage of protein, making it an excellent bread wheat with superior milling and baking characteristics. Great for baking yeast breads.	Majority of crop is grown in Montana, North Dakota, South Dakota and Minnesota. Exported largely to Central America, Japan, Taiwan, the Philippines and Russia.
<b>Soft Red Winter Wheat</b>	High yielding, but relatively low protein. Used for flat breads, cakes, pastries, and crackers.	The only one of the six major wheat varieties not grown in Montana. Grown primarily east of the Mississippi River. Largest customers are China, Egypt and Morocco.
<b>Durum</b>	The hardest of all U.S. wheat. Used to make semolina flour for pasta production.	Consistently the class with the lowest export volume, accounting for less than 5 percent of all U.S. wheat exports. Grown in the same northern states as Hard Red Spring, although 70 to 80% of the U.S. annual production comes from North Dakota. The largest importer is Algeria.
<b>Hard White Wheat</b>	Closely related to red wheats (except for color genes which keep this whole wheat flour whiter), this wheat has a milder, sweeter flavor, equal fiber and similar milling and baking properties. Used mainly in yeast breads, hard rolls, bulgur, tortillas and oriental noodles.	The newest class of wheat to be grown in the United States. Used primarily in domestic markets, although it is exported in limited quantities.
<b>Soft White Wheat</b>	Low protein, but high yielding. Produces flour for baking cakes, crackers, cookies, pastries, quick breads, muffins and snack foods.	Exported to Far East Asian region.

HARD RED WINTER  
WHEAT



HARD RED SPRING  
WHEAT



SOFT RED WINTER  
WHEAT



DURUM



HARD WHITE  
WHEAT



SOFT WHITE  
WHEAT



Wide range of protein content, good milling and baking characteristics. Used to produce bread, rolls and, to a lesser extent, sweet goods and all-purpose flour. Used to make delicious flat breads.

Contains the highest percentage of protein, making it an excellent bread wheat with superior milling and baking characteristics. Great for baking yeast breads.

High yielding, but relatively low protein. Used for flat breads, cakes, pastries, and crackers.

The hardest of all U.S. wheat. Used to make semolina flour for pasta production.

Closely related to red wheats (except for color genes which keep this whole wheat flour whiter), this wheat has a milder, sweeter flavor, equal fiber and similar milling and baking properties. Used mainly in yeast breads, hard rolls, bulgur, tortillas and oriental noodles.

Low protein, but high yielding. Produces flour for baking cakes, crackers, cookies, pastries, quick breads, muffins and snack foods.

The dominant class in U.S. exports and the largest class produced each year. Major foreign buyers include Russia, China, Japan, Morocco and Poland.

Majority of crop is grown in Montana, North Dakota, South Dakota and Minnesota. Exported largely to Central America, Japan, Taiwan, the Philippines and Russia.

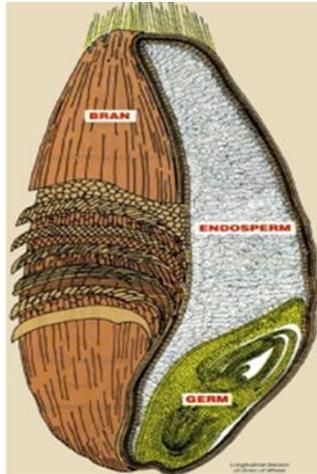
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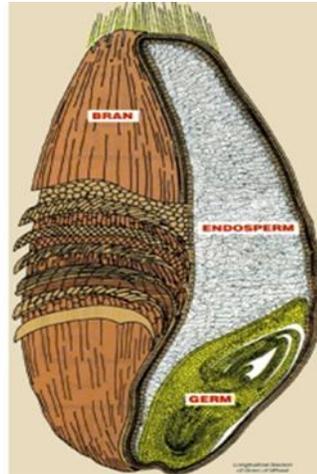
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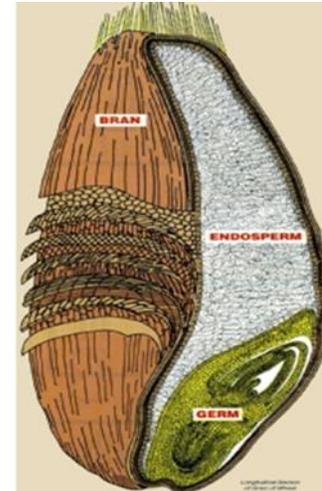
**MONTANA WHEAT**



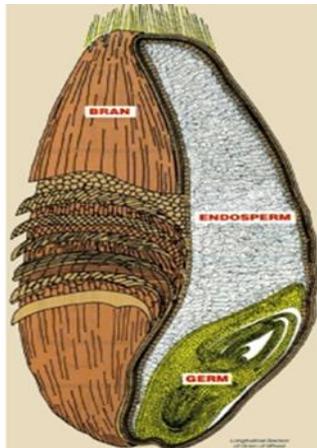
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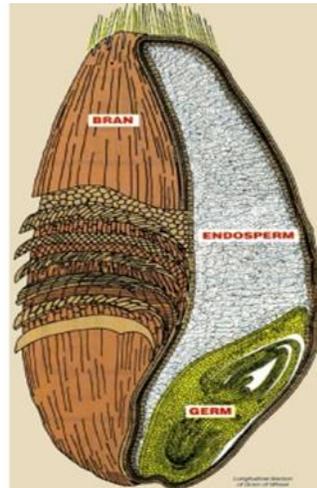
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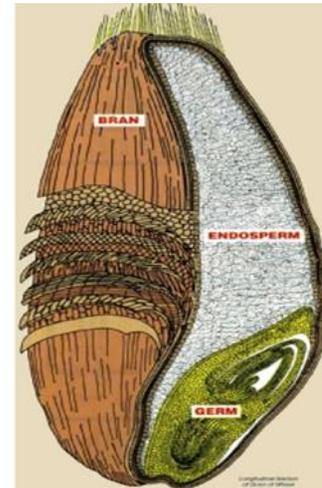
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**MONTANA WHEAT**



**MONTANA WHEAT**



# Goodness Gracious! Great Balls of Gluten Experiment!

Adapted from: <http://www.exploratorium.edu/cooking/bread/activity-gluten.html>

Why is gluten so important? Without it, there would be nothing to hold the gas that makes bread rise.

Think of gluten as the rubber of a balloon: The stronger it is, the more gas it can hold.

But stronger isn't always better. For many baked goods, like pastries and pie crusts, it's important to avoid gluten development.

That's why different flours contain different amounts of protein, depending on how they are meant to be used. A high-protein flour will make a dough with strong gluten, good for hearty yeast breads. Pastry chefs, on the other hand, prefer low-protein flours that yield delicate, tender doughs.

The following activity is a great way to get a feel for gluten, and to find out why using different flours can lead to such different results.

## Ingredients:

- Hard Red Winter Wheat Flour
- Hard Red Winter Wheat Flour
- Hard Red Spring Wheat Flour
- Hard White Wheat Flour
- Durum (semolina)
- Water
- Bowls (one for each type of flour you will be using)
- Measuring cups (one each for liquid and dry)
- Baking Sheet

## Directions:

1. Complete the following graph while conducting this experiment.
2. Into separate bowls, measure out 1 cup of each of your flours. Label each bowl with the flour type.
3. Slowly add about 1/2 to 3/4 cup water to the flour in each bowl, and knead each mixture until it forms a soft, rubbery ball of dough. Let the dough balls sit for about 10 minutes.
4. In the sink, run cold water over one of the dough balls. Be careful not to let the dough disintegrate; try cupping your hands around the ball and squeezing gently to remove the starch.
5. You'll notice the water turning milky as it washes away the starch in the dough. Keep pouring out the cloudy water that collects in the bottom of the bowl. Slowly, your dough ball will become a gummy, slimy network of gluten strands.
6. When the water no longer becomes milky, you know there's no more starch in the dough, leaving nearly pure gluten. Notice how much smaller your ball has become—and how much more stretchy!
7. Repeat steps 3 to 5 for each of your flour types. How does the texture of each one differ as you wash away the starch? Does it take the same amount of time for each one? Are the gluten balls all the same size, or are some larger than others?
8. Preheat oven to 450 degrees.
9. Bake gluten balls in the oven for about 15–30 minutes at 450° F. When you take them out of the oven, you'll notice they've puffed up and hardened, which is exactly what happens to the gluten in a loaf of bread as it bakes.

# Great Balls of Gluten!

## Experiment Chart

	Total Points Earned
	Total Points Possible
	Percentage

Name(s) \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

Directions: Complete the following graph while conducting experiment...

Type of Flour...	Record the <b>length</b> of washing time to eliminate starch	Describe the <b>texture</b> of the dough after washing	Rank in numerical <b>size</b> order after washing. Smallest To Largest	Rank in numerical order of <b>protein</b> content. Smallest To Largest	What might be a good use of this flour in baking?
A.					
B.					
C.					
D.					
E.					

### Things to ponder...

- ✓ Shortening-whether its butter, margarine, or lard-interferes with the way the gluten-forming proteins in flour interact with water. This makes for short strands of gluten, which is the key to flaky pastries and crusts.
- ✓ Whole wheat flour contains about 14% protein, while pastry flour might contain half as much.
- ✓ Gluten is both plastic—able to change shape—and elastic—able to spring back into place.
- ✓ Gluten is not only used in baking. It's also great for "beefing up" vegetarian cooking.
- ✓ Recipes for cornbread and pancakes often warn you not to mix the batter too much. For these breads, overmixing can make the gluten too strong, which makes for a tough, chewy finished product.