

Pancakes Around the World

Grades 6-12

ELA, Science, Math, Social Studies, PE



Objectives

Students will read about Pancake Tuesday, conduct further research and write a short play about the event for Pre-K - 2nd grade students and organize a pancake race for those students. Students will learn about pancakes in other cultures and choose one pancake and culture for in-depth research. Students will perform hands-on activities to understand chemical reactions with leavening agents which produce carbon dioxide in baked foods. Students will extract yeast from common foods. Students will apply mathematical principles to increase and decrease a recipe to produce the number of servings needed.

Vocabulary

baking powder—a mixture of baking soda, cream of tartar and cornstarch that forms carbon dioxide (CO_2) when mixed in dough or batter

baking soda—the common name for sodium bicarbonate. When combined with acidic substances, forms CO_2 .

carbon dioxide—a clear gas with no odor or taste that is a byproduct of respiration. In cooking, it is the result of chemical reactions between ingredients or growth of yeast.

leavening—a substance added to food which makes carbon dioxide (CO_2) bubbles form in batter or dough

yeast—a microscopic member of the fungi family that needs food and moisture to grow - used in baked foods to help them rise

Background

Pancakes as we know them today were invented in medieval Europe. Throughout Europe pancakes had a place among Easter foods, especially on Shrove Tuesday, the last day before Lent. Since Lent is a time of reflection, abstinence and sacrifice, everyone prepared by getting rid of perishable rich foods such as eggs, butter, cream and milk. The favorite dish to use up all these ingredients was pancakes. Shrove Tuesday, also known as Mardi Gras (Fat Tuesday), was everyone's last chance to indulge.

Pancakes were an important food to early settlers of New England. They might have starved without the cornmeal cakes they learned to make from local Pawtuxet Indians. When English settlers landed at Plymouth in 1620, most of their wheat brought from England had spoiled on the long voyage. Cornmeal cakes were also called johnnycakes, or journey cakes, because they could be carried on long trips in saddlebags and cooked along the way.

According to legend, cornmeal cakes were sometimes called "hoe cakes," because they were cooked on a flat hoe blade. While it is true that farm laborers likely built a small fire at the edge of a field to cook the dense cornmeal cakes for lunch on a (hopefully) clean hoe, that is not the origin of the name. In some parts of England "hoe" was a slang word for the type of griddle used even today for food cooked in a wood-fired oven.

European settlers brought buckwheat (and buckwheat cakes) to North America in the 1600's. The plant originated in China and grows best in cool, moist climates. Today it is grown primarily in the Northeastern US and Canada. Although it is not a grain (it is actually a member of the rhubarb family) its seed can be milled like wheat. Because it is ready to harvest in as little as 30 days, in the early days

Pancakes Around the World (continued)

it was a particularly important crop in areas where the growing season was too short for wheat or corn.

Some sources group fry bread with these other breads. While ingredients are similar, fry bread is often deep fried rather than cooked on a griddle or skillet. Native American fry bread is a relative newcomer to the bread family. When the Navajos were moved to reservations in the late 1800's, they received large quantities of flour, salt and lard (fat). The soil on the reservations would not support the corn, beans and squash the tribe historically grew so creative cooks used the ingredients and tools they had available to avoid starvation.

When Americans think of pancakes, most think of a light, fluffy buttermilk pancake prepared from batter and cooked on a hot griddle or skillet. Pancakes variations are eaten in many different cuisines around the world. The griddle method of cooking is older than oven baking, and pancakes are an ancient food. Early Romans prepared Alita Dolcia (Latin for another sweet) from a batter of egg, milk, water and a little flour. They were fried and served with pepper and honey.

English pancakes, what we would call crepes, were made without **leavening**. The steam that formed as the pancake cooked was the only thing to make them light. In many parts of Europe, pancakes are still made without leavening. Most of the pancakes we eat in the US are made with some kind of leavener, to make the cakes lighter. Leavening is a chemical reaction caused by the formation of **carbon dioxide**. In pancakes (and other baked goods) carbon dioxide is formed by **baking soda, baking powder or yeast**. These leaveners all work in different ways and need different ingredients to help them work.

Yeast is the oldest known leavener. Its ability to make food lighter was likely discovered by accident when bread dough was mixed up and not used immediately. Wild yeasts in grain and lactobacilli in milk grew in the dough and formed carbon dioxide that made the bread less dense.. It is referenced as "leaven" in the Bible. Until commercial yeast production began in the late 1800's, yeast was kept alive by saving some dough each time bread was made. Yeast grows by "budding" which means that cells reproduce when mature daughter cells grow and separate from the parent cells. One byproduct of fermentation is carbon dioxide, which causes air spaces in the dough. Yeast is killed by cooking.

Baking powder contains sodium bicarbonate, but it also includes an acidifying agent (cream of tartar) and a drying agent (usually cornstarch). Baking powder is available as single-acting baking powder and as double- acting baking powder. Single-acting powders are activated by moisture. With double-acting powder, some gas is released at room temperature when the powder is added to dough, but the majority of the gas is released after the temperature of the dough increases with cooking.

Baking soda is pure sodium bicarbonate. When baking soda is combined with moisture and an acidic ingredient (e.g., yogurt, chocolate, buttermilk, honey), the resulting chemical reaction produces bubbles of carbon dioxide that expand at high temperatures, causing baked goods to rise. The reaction begins immediately after mixing the ingredients.

Additional Reading

Alba, Ken, *Pancake: A Global History*, Reaktion Books, 2008

Field, Simon Quellen, *Culinary Reactions: The Everyday Chemistry of Cooking*, Chicago Review Press, 2012

Rupp, Rebecca, *Hot off the Griddle; Here's the History of Pancakes*, National Geographic, February 27, 2018

Pancakes Around the World (continued)

Websites

<https://www.nationalgeographic.com/culture/food/the-plate/2014/05/21/hot-off-the-griddle-heres-the-history-of-pancakes/#close>

<https://www.historic-uk.com/CultureUK/Pancake-Day/>

<http://olneypancakerace.org/pancake-race-history/>

<https://www.kshs.org/kansapedia/liberal-pancake-race/18238>

Pancakes Around the World

Activity 1

Grades 6-12 Teacher Resources and Standards

Activity 1: Pancake Tuesday (Social Studies, Drama/Theater) 3-4 50 minute class periods

Students will read about Pancake Tuesday, conduct further research and write a short play about the event for Pre-K - 2nd grade students and organize a pancake race for those students.

Oklahoma Academic Standards

Activity 1: Pancake Tuesday (Social Studies, Drama/Theater)

- | | |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SS6.3.2 | Identify and describe cultural traits of language, ethnic heritage, religion, and traditions practiced among peoples. |
| SS7.3.2 | Compare common cultural traits, including language, ethnic heritage, social systems, and traditions. |
| 6.DT.CR.1.1
7.DT.CR.1.1
8.DT.CR.1.1 | Conceptualize a unified piece of drama/theatre by articulating creative ideas in playwriting, improvisation, oral and written form, staging, and design. |
| 6.DT.PR.3.1 | Present a rehearsed original or scripted drama/theatre work for a classroom or community audience and engage in shared reflection. |
| 7.DT.PR.3.1
8.DT.PR.3.1 | Analyze the elements of plot, character, thought/theme, diction, indirect music, spectacle, and design/production elements in preparation to present a rehearsed original or scripted drama/theatre work for a classroom or community audience. |

Materials:

- Activity 1 Reading Page 1 “**Pancake Tuesday**”
- Activity 1 Worksheet 1 “**Pancake Tuesday**”
- Activity 1 Worksheet 2 “**A Pancake Play**”
- costumes, props, etc for play production as determined by committees
- supplies for Pancake Race (skillets, pancakes, etc.)

Procedures

1. Read and discuss background.
2. Read and discuss Reading Page 1 “**Pancake Tuesday**,” and complete Worksheet 1 “**Pancake Tuesday**” by conducting research on pre-Lent celebrations and foods associated with those celebrations.
3. Divide class into committees to produce a play about Pancake Day for younger students. Use Worksheet 2 “**A Pancake Play**” to organize ideas. Committees could include:
 - a. Researchers
 - b. Writers
 - c. Actors
 - d. Costumes
 - e. Props/set
4. Have students organize a Pancake Race (perhaps with teams from Olney, England and Liberal, Kansas) for younger students.



Lent begins 40 days before Easter. This day is known as Ash Wednesday. For many people, Lent is a time for reflection, sacrifice and fasting. In the early days, people gave up rich foods like eggs, milk, cream and butter during Lent. Since these foods are highly perishable, they needed to be used up before Lent began. Pancakes, waffles and crepes were logical foods to deplete their supplies.

Before Lent begins there are celebrations of indulgence like Shrove Tuesday, Mardi Gras, Fat Tuesday and Pancake Day all over the world.. The town of Olney, England held their first pancake race on Shrove Tuesday in 1445. The race has been held every year since then. The inspiration for a Pancake Race came from this story:

A woman was cooking the family's traditional Shrove Tuesday pancakes as the church bell summoning the townspeople to the shroving service began to ring. Anxious to get to the church on time, the woman quickly ran out the door. She was still wearing her apron and she still had the skillet containing a pancake in her hand. Her race to the church turned into a Pancake Race tradition.

We do not know how many people were in the first race, but today 25 women run 415 yards from the Olney Marketplace to the Parish Church. They race by carrying a frying pan with a pancake in it. They must flip the pancake before the start of the race and again as they cross the finish line. While many races include celebrities and professional athletes, only women 18 and older who are Olney residents can enter the Olney Pancake Race. The original winner of the race received a kiss from the church bell ringer as she served him her pancake, but today's participants receive a new skillet and the winner receives prizes from corporate sponsors.

Since 1950, women of Liberal, Kansas have competed with the women in Olney in a Pancake Race. The Liberal arm of the "International Pancake Race" has expanded to a four-day event which includes a carnival, pancake eating contest, pancake flipping contest, a men's race in addition to the main event held simultaneously with the race in Olney.



Civic groups and restaurants also hold pancake day celebrations on Pancake Tuesday to raise money for charities and community activities.

Source: <https://www.historic-uk.com/CultureUK/Pancake-Day/>
<http://olneypancakerace.org/pancake-race-history/>
<https://www.kshs.org/kansapedia/liberal-pancake-race/18238>

Pancakes Around The World

Activity 1 Worksheet 1: Pancake Tuesday



Name: _____ Date: _____

After reading about Pancake Tuesday and the Olney Pancake Race, do additional research and answer the following questions:

1. What does the term Shrove Tuesday mean?
2. When does Lent begin?
3. Which religious denominations observe Lent?
4. Why did families make pancakes right before Lent began?
5. What are the names of other events held before Lent begins?
6. Besides pancakes, what other foods are associated with pre-Lent celebrations?
7. Do any restaurants or civic organizations in your community conduct Pancake Day events to raise money for charity?

Pancakes Around The World

Activity 1 Worksheet 1: Pancake Tuesday

ANSWER KEY



Name: _____ Date: _____

After reading about Pancake Tuesday and the Olney Pancake Race, do additional research and answer the following questions:

1. What does the term Shrove Tuesday mean?
The word shrove is a form of the English word shrive, which means to obtain absolution for one's sins through Confession and doing penance. Thus Shrove Tuesday was named after the custom of Christians to be "shriven" before the start of Lent.
2. When does Lent begin?
Lent begins 40 days before Easter. Easter is traditionally celebrated on the first Sunday after the first full moon on or after the Spring (March) equinox.
3. Which religious denominations observe Lent?
Lent is observed by Anglicans, Roman Catholics, Eastern Orthodox, Lutherans, and Methodists.
4. Why did families make pancakes right before Lent began?
Because they were encouraged to give up rich foods, which included highly perishable eggs, milk and butter, pancakes were a good way to use up those foods before Lent.
5. What are the names of other celebrations held before Lent begins?
Carnival (Karneval, Carnevale), Mardi Gras, Fasching, Fiesta de las Flores y las Frutas
6. Besides pancakes, what other foods are associated with pre-Lent celebrations?
King Cake (Alabama, Mississippi & Louisiana), fritters (Italy), beignets (Belgium), pfannkuchen (Germany) and traditional meat dishes in cultures that discourage meat consumption during Lent.
7. Do any restaurants or civic organizations in your community conduct Pancake Day events to raise money for charity?

Pancakes Around the World

Activity 1 Worksheet 2: A Pancake Play



Name: _____ Date: _____

Using the details from the **Pancake Tuesday** Reading Page, do additional research about the pancake day activities in Olney, England and Liberal, Kansas. Write a play to perform for PreK-2nd grade students on Pancake Tuesday. Use the space below to outline your thoughts.

Research

(new information which completes the story)

Characters

Costumes

Props/set/supplies

Pancakes Around the World

Activity 2

Grades 6-12 Teacher Resources and Standards

Activity 2: Pancake Geography (World Geography, World Languages, FACS)

1-2 50 minute class periods

Students will learn about pancakes in other cultures and choose one pancake and culture for in-depth research.

Oklahoma Academic Standards

Activity 2: Pancake Geography (World Geography, World Languages, FACS)

- | | |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| WG.5.3 | Analyze settlement patterns associated with major agricultural regions and linkages among regions of food production and consumption. |
| WG.3.5 | Explain how cultural characteristics, such as language, ethnicity, and religion impact different regions. |
| WL4.2 | Identify cross-cultural similarities and differences in the products of the target culture. |
| WL2 2 | Identify and investigate products and geographic features from civilizations, countries, regions and tribes associated with the target language studied. |
| FACS 14.1.4 | Analyze the effects of global and local events and conditions on food choices and practices |

Materials:

- Activity 2 Reading Page “**Pancake Geography**”
- Activity 2 Worksheet 1 “**Pancake Comparison**”
- Activity 2 Worksheet 2 “**Pancakes on the Map**”

Procedures

1. Read and discuss Activity 2 Reading Page “**Pancake Geography**”
2. Complete Worksheet 1 “**Pancake Comparison**” by researching one of the pancakes on the reading page. Students will research agricultural products grown in the country where the pancake is eaten and compare the recipe ingredients with the commodities available.
3. Students will use Worksheet 2 “**Pancakes on the Map**” to locate the country of origin for each pancake listed.

If we go beyond traditional thinking about pancakes (light, fluffy with fruit or syrup), it's possible Stone Age cooks mixed ground up grain and dried grasses with water and baked them on a hot rock to make the first pancakes. Not as tasty as what we have today, but the idea is the same - a flat cake, made from batter, baked on a hot surface.

Regardless of the finished product, all pancakes start with the same basic ingredients:

- **Flour** - In the US, we think of wheat, but in other parts of the world, the flour might be made from rice, corn, buckwheat, potato, coconut, legumes (like soybeans and chickpeas), etc.
- **Liquid** - can be as simple as water or complex as a mixture of eggs, milk or cream, and fats
- **Leavening agents** - many, like crepes, depend on eggs for leavening, but some recipes include baking powder, baking soda or yeast to make pancakes rise when cooked. Other pancakes depend on fermentation as the dough "rests" for a few hours to a few days to allow the natural yeast from the ingredients to grow.
- **Cooking method** - In the strictest sense, pancakes are cooked on a griddle or skillet and flipped to cook the other side. However, crepes are only cooked on one side and some European pancakes are baked in the oven

Pancakes in italics are pictured above the list.



Fluffy Pancakes

Buttermilk Pancakes - USA
Crempog - Wales
Drop scones - Scotland
Pfannkuchen - Germany
Pikelets - Australia



Unleavened Pancakes

Arepas - Colombia
Bahn xeo - Vietnam
Blintz - Ukraine
Cachapas - Venezuela
Crepes - France
Crespelle - Italy
Farinata - Italy
Filloas - Spain
Palacsinta - Hungary
Roti - India
Serabi - Indonesia
Tortillas - Mexico



Oven Baked Pancakes

Dutch baby - Netherlands
Pannukakku - Finland



Non-Traditional Pancakes

Aebleskiver - Denmark
Beavertails - Canada
Chorreadas - Costa Rica
Latkes - (Germany, Austria, Russia and Poland)
Pupusa - El Salvador, Honduras
Raggmunk - Sweden



Fermented Pancakes

Bings - China
Dosa - India
Hotteok - Korea
Injera - Ethiopia

Pancakes Around the World

Activity 2 Worksheet 1: Pancake Comparison



Name: _____ Date: _____

Choose one of the pancakes listed on the the Pancake Geography reading page. Use the internet to learn more about that country and its version of the pancake.

Name of Food:

Name country or countries where the food originated or is eaten today:

List the top agricultural products grown in this country:

Find a recipe for this pancake. List the main ingredients in the recipe.

Are most of the main ingredients produced in the country where it originated?

If flour is the main ingredient, is it made from a wheat or something else?

Does the recipe use leavening? If so, what kind?

Would you expect pancakes without leavening to be lighter or heavier than those which include baking powder, baking soda or yeast?

Pancakes Around the World

Activity 2 Worksheet 2: Pancakes on the Map



Name: _____ Date: _____

Pancakes and their cousins go by many names around the world. In the space below, match the name of the pancake with the country where you would be most likely to find it on a map and write the pancakes number in the correct country. Your internet research may show some foods in more than one country. If so, mark all countries where they are eaten.



1. Aebleskiver
2. Arepas
3. Beavertails
4. Bings
5. Blintz
6. Cachapas
7. Chorreadas
8. Crempog
9. Crepes
10. Crespelle
11. Filloas
12. Hotteok
13. Injera
14. Latkes
15. Pannukakku
16. Pfannkuchen
17. Pikelets
18. Raggmunk
19. Roti
20. Tortillas

Pancakes Around the World

Activity 2 Worksheet 2: Pancakes on the Map

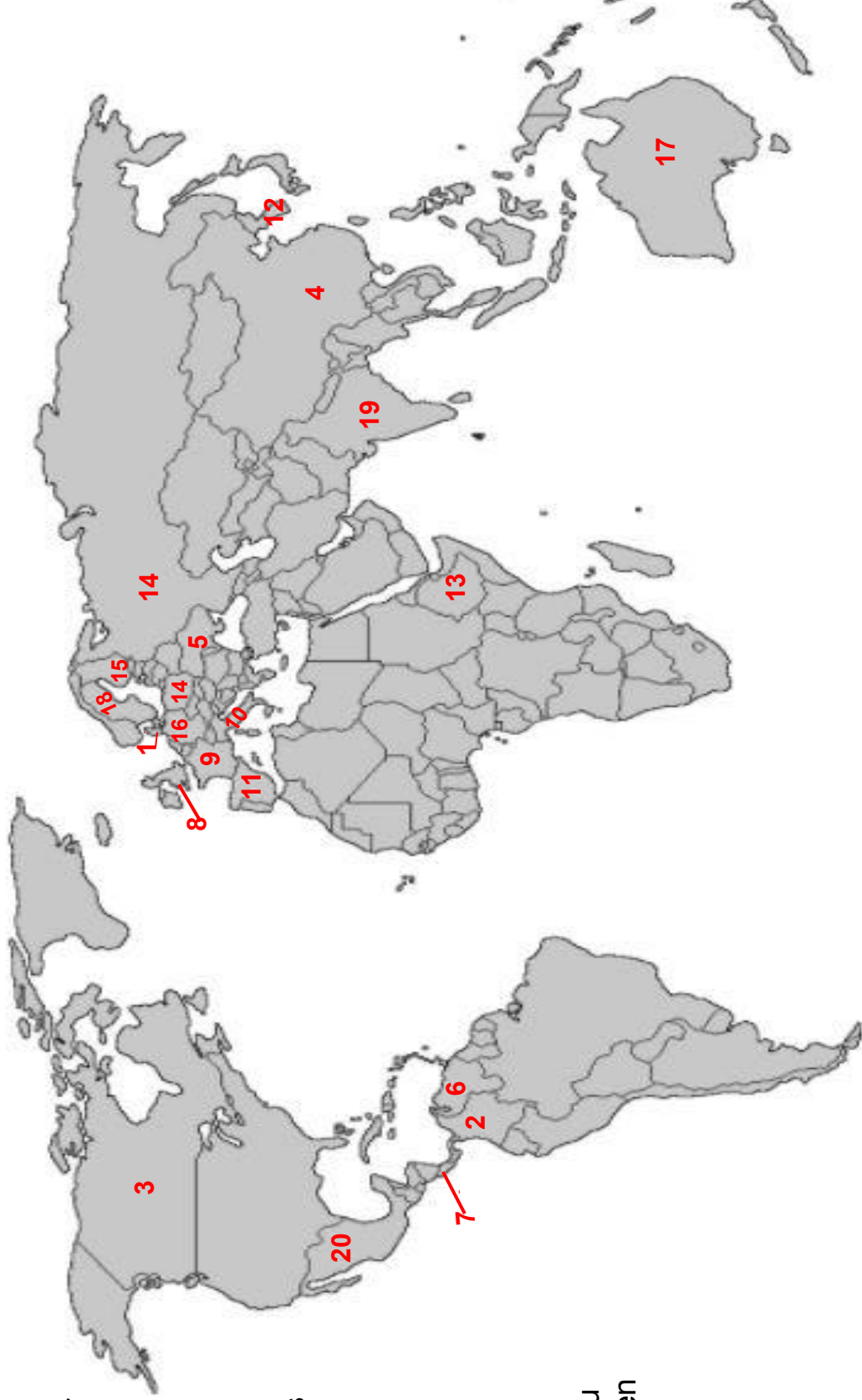
ANSWER KEY

Name: _____ Date: _____



Pancakes and their cousins go by many names around the world. In the space below, match the name of the pancake with the country where you would be most likely to find it on a map and write the pancakes number in the correct country. Your internet research may show some foods in more than one country. If so, mark all countries where they are eaten.

1. Aebleskiver
2. Arepas
3. Beavertails
4. Bings
5. Blintz
6. Cachapas
7. Chorreadas
8. Crempog
9. Crepes
10. Crespelle
11. Filloas
12. Hotteok
13. Injera
14. Latkes
15. Pannukakku
16. Pfannkuchen
17. Pikelets
18. Raggmunk
19. Roti
20. Tortillas



Pancakes Around the World

Activity 3

Grades 6-12 Teacher Resources and Standards

Activity 3: Kitchen Chemistry (Science, FACS) 2-3 50 minute class periods

Students will perform hands-on activities to understand chemical reactions with leavening agents which produce carbon dioxide in baked foods. Students will extract yeast from common foods.

Oklahoma Academic Standards

Activity 3: Kitchen Chemistry (Science, FACS)

- 6.PS1.4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- 7.PS1.2 Analyze and interpret patterns of data related to the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- PS.PS1.5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs
- CH.PS1.2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, knowledge of the patterns of chemical properties, and formation of compounds.
- B.LS1.4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms
- FACS 8.5.10 Prepare breads, baked goods and desserts using safe handling and professional preparation techniques.
- FACS 9.3.5 Analyze recipe/formula proportions and modifications for food production.

Materials:

- Activity 3 Worksheet 1 “**Kitchen Chemistry**”
- Activity 3 Worksheet 2 “**Make Your Own Yeast**”
- Activity 3 Worksheet 3 “**Yeast Comparison**”
- **Recipe Pages**
- liquid and dry measuring cups
- measuring spoons
- clear plastic cups
- measuring tape (sewing) or string and ruler
- balloons
- clean soda or water bottles
- gallon zip top bags
- electric skillets or griddles (or hot plates and skillets)
- spatulas (pancake turners) for each group
- wire whip or fork to combine liquid ingredients
- disposable plates and forks
- quart jars with lids
- coffee filters or lightweight fabric

Experiment supplies

- baking soda
- vinegar
- buttermilk
- milk
- yeast
- sugar
- warm water
- baking powder
- cream of tartar
- medium potato
- distilled or filtered water
- raisins or diced apples

Ingredients for recipes are listed on recipe pages.

Pancakes Around the World (continued)

Procedures

1. Students will use Worksheet 1 “**Kitchen Chemistry**” to conduct experiments with baking soda, baking powder and yeast.

BAKING SODA

2. Use this experiment to demonstrate what baking soda needs in order to form carbon dioxide. For best results, ingredients should be at room temperature or slightly warmer. Vinegar should react immediately. If buttermilk is slow to react, place the bottle with buttermilk in a cup of hot water to speed up the reaction. Most regular milk does not react with baking soda.
 - A. Put 1/2 cup buttermilk in one soda or water bottle. Label it bottle A.
 - B. Put 1/2 cup regular or low fat milk in another soda or water bottle. Label it bottle B.
 - C. Put 1 tablespoon vinegar in the last soda or water bottle. Label it bottle C.
 - D. Put 1 teaspoon baking soda in each of three balloons.
 - E. Cover the mouth of each pop bottle with a balloon, shaking the balloon to be sure all the baking soda falls into the bottle.
 - F. Shake bottles slightly to mix baking soda with the liquids.
 - G. Watch the bottles for about 10 minutes.
 - H. Have students observe and record observations

BAKING POWDER

3. Baking powder contains sodium bicarbonate, but it also includes an acidifying agent (cream of tartar), and a drying agent (usually cornstarch). Baking powder is either single acting or double acting. Most baking powder sold today is double acting, which means there is a small reaction when combined with liquids, but most of reaction occurs during cooking. If you are out of baking powder, you can make your own if you have baking soda and cream of tartar. Combine 1/2 teaspoon cream of tartar with 1/4 teaspoon baking soda to substitute for 1 teaspoon of baking powder. This is an example of a single-acting baking powder. Without the cornstarch to keep moisture in the air from reacting, this emergency substitution should be used immediately.
 - A. Stir 1 teaspoon baking powder into 1/3 cup hot water.
 - B. Stir 1/2 teaspoon cream of tartar and 1/4 teaspoon of baking soda into 1/3 cup of hot water
 - C. Have students observe and record observations.

YEAST

4. Yeast is a member of the fungi family and needs food and water to grow. When we use yeast in recipes, the sugar and water provide food for the yeast. The yeast digests the sugar and gives off carbon dioxide gas bubbles. These gas bubbles cause air spaces that help the dough rise. The yeasts themselves are killed by heat in cooking.
 - A. Prepare 3 clear cups by adding the following:
 - o 1/2 cup cold tap water in cup A
 - o 1/2 cup warm (100-105°F) water in cup B (check with thermometer if possible)
 - o 1/2 cup hot (150°F or hotter) water in cup C
 - B. Dissolve 1 teaspoon sugar in each cup.
 - C. Sprinkle a package of yeast on top the water in each cup.
 - D. Allow the yeast to dissolve (about 10-15 minutes). Do not stir.
 - E. After yeast has dissolved, have students use a ruler to measure the height of the yeast and water mixture in the cup at 5-minute intervals and record the results.
5. Ask students why the yeast grows best in warm water. The yeast dissolved in cold water should grow very slowly and there should be little if any growth in hot water because the yeast has been killed by the heat.

Pancakes Around the World (continued)

Procedures, continued

6. Students will make pancakes using the three different kinds of leaveners. (Recipes included with this lesson.)
7. Divide students into groups, and assign each group one of the recipes included with this lesson. Unless a student has food allergies and cannot sample pancakes, you should plan for one pancake per student from each recipe you use, so they can taste test.
8. For ease of cleanup, have students mix dry ingredients together in a gallon zip top bag by shaking several times.
9. Mix liquid ingredients together in a bowl or large measuring cup and then pour liquids into the bag.
10. Mix ingredients by gently squeezing the bag until all of the dry ingredients are moistened. Note: if possible, yeast pancakes should be made a day ahead of time and refrigerated to give the yeast time to grow.
11. Cook the pancakes
 - Lightly-grease a griddle or electric skillet for each group before turning on the heat.
 - Make a small diagonal cut across one corner of each pancake batter bag.
 - Students take turns squeezing the batter into a 4-inch circle onto the hot griddle or skillet.
 - When the edges start to dry and bubbles form throughout, flip the pancakes.
 - Cook pancake about one minute more after turning.

Alternate pancake activity:

Compare traditional buttermilk or baking powder pancakes with hoe cakes, buckwheat pancakes or crepes (rather than comparing pancakes made with the three types of leaveners) and compare taste and texture of each.

Yeast Experiment - Know your students and community demographics before using this activity. *The fermentation process produces a little alcohol as a by-product. In the classroom this alcohol can be easily removed and discarded with a turkey baster. It is not necessary to remove the alcohol from the mixture for baking, because the alcohol evaporates during baking. Prior to the availability of commercial yeast, all bread was prepared using this process. It crossed the Atlantic Ocean with European settlers and went west with wagon trains as “everlasting yeast.” Making yeast is a good lesson in food history as well as science - but because of the alcohol component, may be an unwelcome lesson in some communities. Vodka is made from a similar potato mixture, because potatoes are more plentiful source of starch than grain in Russia.*

Have students make yeast using the instructions on Worksheet 2 “**Make Your Own Yeast.**” It will take only a few minutes to mix up the ingredients, but students will need to observe the samples for 7-10 days as the yeast grows in the samples. Start the process on a Monday so students will have a better chance of seeing the first bubbles of fermentation, which should appear in 3-5 days.

Observe and record changes in the mixtures over a 2-week period on Worksheet 3 “**Yeast Comparison.**” At that point you could bake bread using one of the samples and another recipe using commercial yeast for comparison purposes. The homemade yeast will take longer to rise.

If your community has someone known for his/her bread baking skill, it's possible they may have experience with everlasting yeast, or its cousin, sourdough starter. Someone with this background could enrich this activity with the art, as well as the science, of working with yeast and yeast breads.

Pancakes Around the World

Activity 3 Worksheet 1: Kitchen Chemistry



Name: _____ Date: _____

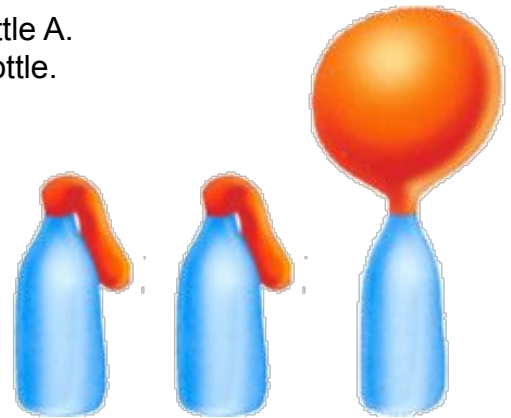
Pancakes and baked foods (like cakes, cookies and bread) have a light texture because of chemical reactions which cause carbon dioxide bubbles to form. In cooking, these chemical reactions are called leavening. Common leaveners include baking soda, baking powder and yeast. These leaveners work in combination with different ingredients to make foods “rise.”

BAKING SODA

Baking soda is the common name for sodium bicarbonate. When baking soda is combined with moisture and an acidic liquid, like yogurt, buttermilk, vinegar or honey, the chemical reaction produces carbon dioxide bubbles which expand within the batter or dough, causing foods to rise. The reaction starts as soon as ingredients are mixed, but speeds up when the food is baked.

Use this experiment to demonstrate what baking soda needs in order to form carbon dioxide. For best results, ingredients should be at room temperature or slightly warmer.

1. Put 1/2 cup buttermilk in one soda or water bottle. Label it bottle A.
2. Put 1/2 cup regular or low fat milk in another soda or water bottle. Label it bottle B.
3. Put 1 tablespoon vinegar in the last soda or water bottle. Label it bottle C.
4. Put 1 teaspoon baking soda in each of three balloons.
5. Cover the mouth of each pop bottle with a balloon, shaking the balloon to be sure all the baking soda falls into the bottle.
6. Shake bottles slightly to mix baking soda with the liquids.
7. Watch the bottles for about 10 minutes.
8. Record results on the table below. Use a sewing tape measure or a piece of string and a ruler to measure the circumference of the balloons.



	Bottle A	Bottle B	Bottle C
Measurement at 1 minute			
Measurement at 5 minutes			
Measurement at 10 minutes			

9. Was carbon dioxide formed in every bottle?
10. If the answer to question 9 was “no,” which bottle(s) did not form carbon dioxide?
11. Which bottle had the fastest reaction?

Activity 3 Kitchen Chemistry (continued)

BAKING POWDER

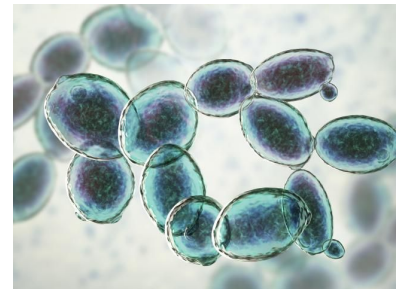
Baking powder contains sodium bicarbonate (baking soda), but it also includes an acid (cream of tartar), and a substance to absorb moisture to prevent a chemical reaction during storage (usually cornstarch). If you are out of baking powder, you can make your own by mixing $\frac{1}{2}$ teaspoon cream of tartar with $\frac{1}{4}$ teaspoon baking soda to use in place of 1 teaspoon of baking powder. Baking powder is either double-acting or single acting. Double-acting powder releases some carbon dioxide at room temperature when it is added to dough, but the majority of the gas is released after the temperature of the dough increases with cooking or baking. Single-acting baking powder begins to react as soon as it is combined with liquid. Compare the reactions of two types of baking powder below:

- A. Stir 1 teaspoon baking powder into $\frac{1}{3}$ cup hot water.
 - B. Stir $\frac{1}{2}$ teaspoon cream of tartar and $\frac{1}{4}$ teaspoon of baking soda into $\frac{1}{3}$ cup of hot water
 - C. Observe and record the results.
1. Did one sample form bubbles first? If so, which one?
 2. Were new bubbles still being formed after 5 minutes?
 3. Were new bubbles still being formed after 10 minutes?

YEAST

Yeast are very tiny plants which need food and water to multiply. When we use yeast in bread and other recipes, the sugar and water provide food for the yeast. The yeast digests the sugar and gives off carbon dioxide gas bubbles. These gas bubbles cause air spaces which help the dough rise. The yeasts themselves are killed by heat in cooking.

- A. Prepare 3 clear cups for the experiment by adding the following:
 - a. $\frac{1}{2}$ cup cold tap water in cup A
 - b. $\frac{1}{2}$ cup warm ($100-105^{\circ}\text{F}$) water in cup B
 - c. $\frac{1}{2}$ cup hot (150°F or higher) water in cup C
- B. Dissolve 1 teaspoon sugar in each cup.
- C. Sprinkle a package of yeast on top the water in each cup.
- D. Allow the yeast to dissolve (about 15-20 minutes). Do not stir.
- E. Use a ruler to measure the height of the yeast and water mixture
- F. in the cup and record your results below.



	Sample A	Sample B	Sample C
Growth at 10 minutes			
Growth at 15 minutes			
Growth at 20 minutes			

4. Which sample grew the fastest?
5. Did any sample fail to grow at all?

Pancakes Around the World

Activity 3 Worksheet 2: Make Your Own Yeast



Name: _____ Date: _____

Thousands of yeasts occur naturally in the environment. Bakers, wine makers, and brewmasters depend on yeast to create their products. Commercial yeast has been available just over 100 years. However, “leaven” is mentioned in the Bible, so yeast was used for thousands of years prior to the availability of packaged yeast. Use the recipes below to make your own yeast. Keep the jars in a warm place for 7-10 days and compare the mixtures during the fermenting process. *When using homemade yeast, allow 2-3 times as long for bread to rise.*

Chlorinated water (all public water supplies) will inhibit yeast growth. Use distilled water or bottled drinking water without chlorine for best results.

Potato Yeast

Ingredients

- 1 medium-sized potato, peeled and diced
- 4 C warm water (distilled or filtered)
- 1 tsp sugar
- Clean 1-quart jar with lid

Instructions

1. Fill jar with boiling water to sterilize. Let jar cool enough to handle and drain water.
2. Cook potato in 4 cups of water until soft
3. Drain and save the cooking water.
4. Mash potato and add sugar and salt.
5. Allow potato to cool to room temperature
6. Add most of the cooking water to the potato and blend.
7. Drain water from jar and add mashed potato mixture. Used saved potato water to fill jar to 1 inch from the top.
8. Loosely cover jar with clean cloth or coffee filter. Let sit in a warm place out of direct sunlight for several days.

Once it is full of bubbles, it is ready to use or refrigerate. Replace cloth with lid for storage.

To substitute for packaged yeast in a recipe:

Use the potato yeast water in place of the water or milk in a bread recipe.

To refresh or “feed” the yeast to keep it active and growing, add 1-2 tablespoons of sugar and enough filtered/distilled water to fill the jar. Let stand for 2-3 days. It is ready to use in a recipe or refrigerate at this point.

Raisin/Fruit Yeast

Ingredients

- 2-3 Tablespoons raisins or chopped apple.
- 1 Tablespoon sugar or honey
- 2 1/2 cups water (distilled or filtered)
- Clean 1 quart jar with lid

Instructions

1. Fill jar with boiling water to sterilize. Let jar cool enough to handle and drain water.
2. Put fruit, sugar and water in the jar.
3. Put lid on jar and shake to blend
4. Loosen lid so gas can escape
5. Put jar in a warm place away from direct sunlight.
6. Each day, open the lid for a few minutes to allow oxygen into jar and carbon dioxide out.
7. Replace lid and shake mixture to restore oxygen to water.
8. Continue this process for several days. The water should become cloudy and the fruit should be floating.

At this point, liquid should smell “fermented” and be ready to use or refrigerate.

To substitute for packaged yeast in a recipe:

Replace 1 package of yeast with 1/2 cup yeast water and decrease total liquids by 1/2 cup.

To refresh or “feed” the yeast to keep it active and growing, when there is about 1 cup left in the jar, add 1 teaspoon sugar and 1 cup of distilled or filtered water. Let stand for 2-3 days. It is ready to use or refrigerate at this point.

Pancakes Around the World

Activity 3 Worksheet 3: Yeast Comparison



Name: _____ Date: _____

Mix each homemade yeast recipe on Worksheet 2 and record your observations about the two jars over a 2-week period of time:

	Potato Yeast	Raisin/Fruit Yeast
Bubbles first appear in liquid	_____ days	_____ days
Liquid is full of bubbles	_____ days	_____ days
Liquid develops a "yeasty" aroma	_____ days	_____ days
Layer of clear liquid appears at top	_____ days	_____ days
Describe any change in appearance of the liquid (thicker, thinner, cloudy, clearer, fruit floats, etc.) and when the change occurred		

It is normal for liquid to darken as fermentation occurs. However, any unusual colors (green, red, blue, orange, etc.) indicate the sample is contaminated with mold or bacteria and the sample should be discarded.

Pancakes Around the World

Activity 4

Grades 6-12 Teacher Resources and Standards

Activity 4: Recipe Math (Math, FACS) 1 50 minute class periods

Students will apply mathematical principles to increase and decrease a recipe to produce the number of servings needed.

Oklahoma Academic Standards

Activity 4: Recipe Math (Math, FACS)

- 6.A.3.1 Represent real-world or mathematical situations using expressions, equations and inequalities involving variables and rational numbers.
- 6.GM.3.2 Solve problems in various real-world and mathematical contexts that require the conversion of weights, capacities, geometric measurements, and time within the same measurement systems using appropriate units.
- 7.N.2.3 Solve real-world and mathematical problems involving addition, subtraction, multiplication and division of rational numbers; use efficient and generalizable procedures including but not limited to standard algorithms.
- 9.3.5 FACS Analyze recipe/formula proportions and modifications for food production.

Materials:

- Activity 4 Reading Page “**Recipe Adjustment**”
- Activity 4 Worksheet 1 “**Recipe Math - Increasing a Recipe**”
- Activity 4 Worksheet 2 “**Recipe Math - Decreasing a Recipe**”
- **Recipe Pages**
- measuring cups and spoons
- recipe ingredients (see recipe sheets)
- gallon zip top bags
- electric skillets or griddles (or hot plates and skillets)
- spatulas (pancake turners) for each group
- wire whip or fork to combine liquid ingredients

Procedures

1. Read and discuss Reading Page “**Recipe Adjustment**,” included with this lesson. Demonstrate the correct way to measure dry and liquid ingredients.
2. Divide students into groups and assign each group a recipe to either enlarge or reduce.
3. Using the **Recipe Adjustment** reading page as a guide, half of the students should use Worksheet 1 “**Recipe Math - Increasing a Recipe**” to increase a recipe to serve each student in the class two pancakes each.
4. Using the Recipe Adjustment reading page as a guide, half the students should use Worksheet 2 “**Recipe Math - Decreasing a Recipe**” to decrease a recipe to serve two people two pancakes each. (Note: of the recipes provided, only Buttermilk Pancakes and Crepes use more than one egg. They will be the easiest to reduce without dividing an egg.)
5. Have students prepare one of the increased recipes and one of the decreased recipes to check the accuracy of their calculations.

Pancakes Please (continued)

Procedures, continued

5. For ease of cleanup, have students mix dry ingredients together in a gallon zip top bag by shaking several times.
6. Mix liquid ingredients together in a bowl or large measuring cup and then pour liquids into the bag.
7. Mix ingredients by gently squeezing the bag until all of the dry ingredients are moistened. Note: if possible, yeast pancakes should be made a day ahead of time and refrigerated to give the yeast time to grow.
8. Cook the pancakes
 - Lightly-grease a griddle or electric skillet for each group before turning on the heat.
 - Make a small diagonal cut across one corner of each pancake batter bag.
 - Students take turns squeezing the batter into a 4-inch circle onto the hot griddle or skillet.
 - When the edges start to dry and bubbles form throughout, flip the pancakes.
 - Cook pancake about one minute more after turning.

Cooking is a tasty blend of math and science. Most recipes depend on accurate measurement so the proportion of dry and liquid ingredients is correct for the end product - thin for crepes, thicker for pancakes, very thick for beavertails.

If you are cooking for a lot of people, it may be more convenient to increase (double or triple) a recipe than to make it two or three times. Sometimes, you may want to decrease a recipe to eliminate left over or wasted food. Recipe math involves fractions, different units of measure (cups, tablespoons, teaspoons) and “whole” items like eggs or a package of yeast. As you make a recipe larger or smaller, remember to keep the proportion of liquid to dry ingredients the same.



Egg Measurements

- **Medium:** 3 tablespoons
- **Large:** 3 1/2 tablespoons
- **Extra-Large:** 4 tablespoons

Equivalent Measurements

	Dry ingredients	Liquid Ingredients
1 cup	16 tablespoons	8 fluid ounces
3/4 cup	12 tablespoons	6 fluid ounces
2/3 cup	10 tablespoons + 2 teaspoons	5 1/3 fluid ounces
1/2 cup	8 tablespoons	4 fluid ounces
1/3 cup	5 tablespoons + 1 teaspoon	2 2/3 fluid ounces
1/4 cup	4 tablespoons	2 fluid ounces
1/8 cup	2 tablespoons	1 fluid ounce
1 tablespoon	3 teaspoons	1/2 fluid ounce
1/2 tablespoon	1 1/2 teaspoons	1 1/2 teaspoons

Common Ingredients in Recipes

Ingredient	Function in a Recipe
Flour	Starch in flour “sets” as it heats to provide structure and shape
Sugar	Improves taste and browning, holds moisture, improves tenderness
Liquid	Helps flour form bonds and act as steam in baking to make product light/fluffy
Eggs	Provide leavening, proteins hold food together as it cooks
Leavening	Chemical reactions cause CO ₂ to form. Gas is held in place by pockets of fat, gluten and starch in the batter that “set” as the food heats.
Fat	Coats gluten (protein in flour) to keep baked foods tender, can make foods lighter in texture when whipped with sugar before adding other ingredients
Salt	Helps activate baking soda, controls yeast growth, strengthens the cell structure and improves taste in baked goods.

Pancakes Around the World

Activity 4 Worksheet 1: Recipe Math - Increasing a Recipe



Name: _____ Date: _____

Name of Recipe: _____

Yield: Recipe makes _____ pancakes

Number of pancakes needed _____

Divide number of pancakes needed by recipe yield

- Example: 28 pancakes needed \div 10 pancakes per recipe = 2.8
- To get conversion factor - round answer to the closest whole number - 3
- Multiply all ingredients in recipe by conversion factor

Ingredient	Recipe Measurement	Conversion factor	Total	Simplified Total
<i>Example: milk</i>	<i>1 ½ cup</i>	<i>3</i>	<i>$3/2 \times 3/1 = 9/2$</i>	<i>4 ½ cups</i>

- Mix dry ingredients together in a large zip-top bag by shaking several times
- Mix liquid ingredients together in a large measuring cup or a bowl, using a fork or wire whip
- Pour liquids into bag and squeeze bag to mix ingredients until all ingredients are mixed
- Make a small cut diagonally across the one corner of the bag.
- Squeeze the bag until a 4-inch pancake is on the pan.
- When edges are dry and surface bubbles begin to break, turn pancakes and brown other side

Pancakes Around the World

Activity 4 Worksheet 2: Recipe Math - Decreasing a Recipe



Name: _____ Date: _____

Name of Recipe: _____

Yield: Recipe makes _____ pancakes

Number of pancakes needed _____

Hint

If a recipe contains eggs, it is difficult to reduce to less than one egg (a portion of an egg). Choose the proportion that does not divide eggs.

Divide number of pancakes needed by recipe yield

- Example: 6 pancakes needed \div 12 pancakes per recipe = .5
- To get conversion factor - round answer to the closest whole number - 3
- Multiply all ingredients in recipe by conversion factor

Ingredient	Recipe Measurement	Conversion factor	Total	Simplified Total
<i>Example: milk</i>	<i>1 1/2 cup</i>	<i>0.5</i>	<i>3/2 x 1/2 = 3/4</i>	<i>3/4 cup</i>

- Mix dry ingredients together in a large zip-top bag by shaking several times
- Mix liquid ingredients together in a large measuring cup or a bowl, using a fork or wire whip
- Pour liquids into bag and squeeze bag to mix ingredients until all ingredients are mixed
- Make a small cut diagonally across the one corner of the bag.
- Squeeze the bag until a 4-inch pancake is on the pan.
- When edges are dry and surface bubbles begin to break, turn pancakes and brown other side

Baking Powder Pancakes

Yield: Makes 12-14 pancakes

Ingredients

- 2 cups all-purpose flour
- 2 1/2 teaspoons baking powder
- 1/2 teaspoon salt
- 1 egg, slightly beaten
- 1 1/2 cups milk
- 2 tablespoons melted butter

Instructions

1. Preheat a lightly oiled griddle or pan.
2. Sift or stir together flour, baking powder, and salt
3. In a separate bowl, combine egg and milk; add to flour mixture, stirring only until smooth.
4. Blend in melted butter.
5. Cook on a hot, greased griddle, using about 1/4 cup of batter for each pancake.
6. Turn pancakes when surface bubbles begin to break.
7. Turn and brown the other side.

Buttermilk (Baking Soda) Pancakes

Yield: Makes 12-14 pancakes

Ingredients

- 2 cups all-purpose flour
- 2 tablespoons sugar
- 1 teaspoon salt
- 1 teaspoon baking soda
- 2 eggs
- 2 cups buttermilk
- 1/4 cup butter, melted

Instructions

1. Preheat a lightly oiled griddle or fry pan.
2. Sift together flour, salt and baking soda.
3. Beat egg in medium bowl.
4. Blend in buttermilk.
5. Add dry ingredients, beating until smooth
6. Blend in melted butter.
7. Cook on lightly oiled griddle or fry pan.
8. Turn pancakes when surface bubbles begin to break.

Yeast Pancakes

Yield: Makes 12-14 pancakes

Ingredients

- 2 1/4 cups all-purpose flour
- 3 tablespoons sugar
- 1 teaspoon salt
- 1 teaspoon ground cinnamon
- 2 1/4 teaspoons rapid rise yeast
- 1 teaspoon vanilla extract
- 1 1/2 cups warm milk
- 1/4 cup butter, melted
- 1 egg

Instructions

1. In a large bowl combine flour, sugar, salt, cinnamon and yeast; mix well.
2. Add vanilla, milk, butter, and egg until well blended.
3. Cover and place in refrigerator overnight.
4. Heat a lightly oiled griddle or frying pan over medium high heat.
5. Stir the batter with a whisk.
6. Pour or scoop the batter onto the griddle, using approximately 1/4 cup for each pancake.
7. Brown on both sides and serve hot.

Basic Crepes

Yield: Makes 6-8 crepes

Ingredients

1 c. all-purpose flour
2 large eggs
1 tbsp. granulated sugar
1/4 tsp. kosher salt
1 1/2 c. whole milk
1 tbsp. butter
Fresh fruit, for serving
Powdered sugar, for serving

Directions

1. In a large mixing bowl whisk the flour, sugar and salt until combined. Then create a well with flour and add the eggs. Gradually pour in milk, whisking to combine after each addition. Let batter stand at room temperature until slightly bubbly on top, 15 to 20 minutes.
2. In a small skillet over medium heat, melt butter. About 1/4 cup at a time, drop batter evenly onto pan, swirling it to evenly coat.
3. Cook 2 minutes, then flip and cook 1 minute more. Repeat with remaining batter.
4. Serve crepes warm with fresh fruit and powdered sugar.

Hoecakes

Yield: Makes 2 cakes

Ingredients

- 1 cup fine-ground white or yellow cornmeal
- ¼ teaspoon salt
- boiling water
- 3 tablespoons vegetable oil

Instructions

1. Bring a kettle of water to a boil. Put the cornmeal and salt in a large bowl, and whisk in 1 cup plus 2 tablespoons of the boiling water. Let rest about 10 minutes.
2. Stir in 1 tablespoon of the vegetable oil. The mixture should be just pourable, but thick enough that you'll need to use a spoon or spatula to help spread it out once it's in the pan. If it seems too thick, add another tablespoon or two of hot water.
3. Put the remaining 2 tablespoons oil in an 8- to 12-inch skillet over medium heat. When the skillet is hot, spoon in about half of the cornmeal mixture, and, using a spatula or the back of a spoon, spread it into a round about 6 inches in diameter.
4. Cook until the hoecake is golden around the edges and looks set throughout, about 10 minutes, then begin to loosen the edges with a spatula. When you've fully released the hoecake from the pan, gently flip it. Cook another 8 to 10 minutes, then transfer to a plate. Repeat with the remaining cornmeal mixture. Serve warm.

Buckwheat Pancakes

Yield: Makes 6-8 pancakes

Ingredients

- 1 cup buckwheat flour
- 1 ½ teaspoons white sugar
- 1 teaspoon baking powder
- ¼ teaspoon salt
- ¼ teaspoon baking soda
- 1 ¼ cups buttermilk
- 1 large egg, beaten
- ¼ teaspoon vanilla extract
- 1 tablespoon unsalted butter, or as needed

Instructions

1. Whisk buckwheat flour, sugar, baking powder, salt, and baking soda together in a bowl.
2. Beat buttermilk, egg, and vanilla extract together in another bowl. Pour flour mixture into buttermilk mixture; whisk until batter is thick and smooth. Let batter rest for 5 minutes until bubbles form and batter relaxes.
3. Melt butter on a griddle over medium heat. Drop batter by large spoonfuls onto the griddle and cook until bubbles form and the edges are dry, 3 to 4 minutes. Flip and cook until browned on the other side, 2 to 3 minutes. Repeat with remaining batter.