To make artisan breads you will need the following tools and ingredients, some of which are optional

Tools

- Plastic bowl scraper
- Metal pastry blade (also called a bench blade or bencher)
- Various size mixing bowls and dough containers
- Electric mixer (optional)
- Large mixing spoons
- Wire whisk
- Serrated bread and steak knife
- Razor blade knife (French *lame de boulanger*), optional
- Cutting board
- Baking pans, such as sheet pans, loaf pans (and mini-loaf pans, optional), and muffin tins
- Proofing baskets (optional)
- Tea towels or proofing linens (French *couches*)
- Baking stone (optional)
- Small sauce pan
- Rubber spatulas
- Baking parchment or silicone baking mats (ex: Silpats)
- Misting spray bottle (optional)
- Cast iron pan or other steam pan
- Cooking "probe" thermometer (optional)
- Plastic wrap

Ingredients

Each recipe requires its own set of ingredients, such as rye flour, cocoa, nuts, or chocolate chips, etc., so read the recipe you want to make and gather the ingredients as needed. The following are general ingredients that are needed for many of the breads

- Bread flour (use unbleached if possible, for better flavor)
- Cooking spray, such as Pam, Vegaline, etc.
- Olive oil
- Vegetable oil
- Instant yeast (aka rapid rise, instant rise, perfect rise, and bread machine yeast. If using "active dry yeast" you will need to use 25% more and dissolve it first in warm water. If using fresh, compressed yeast, you will need triple the amount.)
- Salt, any type, but the recipes were made with kosher salt, so adjust accordingly
- Milk (if you are lactose intolerant you can substitute soy, almond, or rice milk for cow's milk)
- Unsalted butter (if using salted butter, reduce the salt in the recipe by 1 teaspoon of salt per cup of butter)
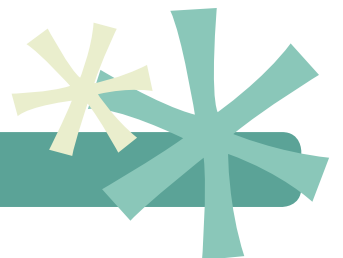
We will refer to these definitions from time to time during the course, so I am gathering them here in one place for easy reference, along with some brief commentary.

Baking: The application of heat to a product in an enclosed environment (the oven), for the purpose of driving off moisture.

There is a lot more that happens when bread dough goes into the oven, as you will see, but the main reason that any product undergoes the process known as baking is to drive off moisture and bring about a series of oven transformations to produce a digestible, safe and delicious product.

**Transformation: A radical change from one thing into something totally different.**

I often refer to bread as a transformational food because it undergoes more radical changes during its journey from "wheat to eat" than any other food. Living wheat is harvested, crushed (killed) and turned into flour. Flour is combined with other ingredients, including leaven (yeast), transformed into dough and brought back to life. Dough undergoes biological and chemical changes as it develops and grows, giving it character. It is then baked, at which time the yeast gives up its life, having completed its mission to raise the dough, and, through a series of chemical (and metaphorical) transformations, the dough is changed into bread. In essence, a caterpillar goes into the oven and a butterfly emerges.

The Baking Triangle: Baking (as in all cooking) is really about the relationship between time, temperature and ingredients, which can be thought of as the points of a triangle.

If you affect one of these points it affects the others. However, knowing this allows you, the baker, to make decisions that can affect the final outcome. You can, in fact, manipulate these points to produce the outcome you desire. For example, if the sugars in the crust caramelize too quickly, before the interior starches in the crumb can fully gelatinize, you can respond by lowering the oven temperature to allow the interior to catch up with the exterior of the loaf. Similar decisions can be made during the fermentation stage as well, since yeast is sensitive to temperature, so that fermentation and flavor development

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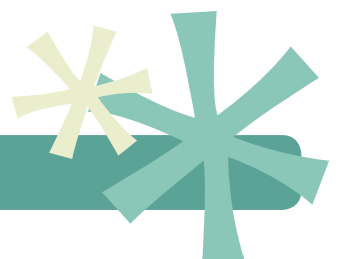
can be controlled by raising or lowering the temperature while adjusting the fermentation time.

Bakers' Math: Ratios and Formulas.

Professional bakers rarely think in terms of recipes, which are specific measurements for a particular batch of dough. Instead, they think in terms of formulas, which are the ratios of each of the ingredients against the weight of the flour. Flour is the primary ingredient in bread so it serves as the base line, the 100% ingredient, and all other ingredients are determined based on their appropriate relationship to the flour. For example, salt is often measured at 2% of the flour weight, so the amount of salt is determined by multiplying the total flour weight by 2%. This will be explained in more detail on the next page. You will be provided with recipes for small batches of bread, but also with the ratios, or

formulas, so that you can make the same bread in any batch size you choose. More important, as you become familiar with the relationship of various ingredients to the flour, it will be easier for you to create your own recipes and formulas for other types of breads.
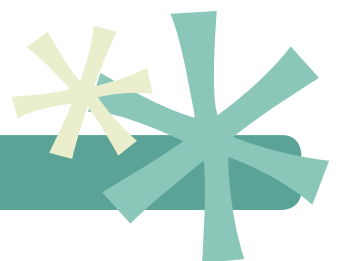
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What is the Bakers' Percentage/ Bakers' Math?
You will see that the breads listed in this course are written up as both recipes and formulas. That is, the recipe is the specific measurement for a small batch while the formula is listed in percentages. This system is known as Bakers' Math, and it allows bakers an instant snapshot of the relationship between each of the ingredients and the total flour weight.

This Bakers' Math system is different from the more conventional system where all the ingredients add up to a total of 100%. In this method, you begin with 100% (the flour) and add on the other ingredients, so that every formula may have a very different total percentage from the others. It's hard to grasp at first, but once you work with it a bit, it starts to make total sense. It is a way to create formulas from scratch based on the accumulated wisdom of centuries of baking and what the proper relationship of each ingredient to the flour should be for optimum flavor.

Note: this system is based on weights of ingredients, not on volume measurements such as cups. Volumes are variable – flour does not weigh the same as water, for example; honey is heaver than water or oil. Bakers almost always work exclusively

in weights, not volumes. However, in small, home-size batches, volumes such as teaspoons, tablespoons and even cups may be more practical, so we list both weights (in ounces and grams), as well as volume measurements in the recipes/formulas.

Here are a few guidelines and key terms for how to understand this system, even if you choose not to use it.

Total Flour Weight (TFW)
This means all the flour used in a dough, whether bread flour, whole wheat, rye, cornmeal, etc. The total amount of flour is considered the 100% ingredient. So, if bread flour is the only flour being used, the weight of that flour will represent 100%. If you are using, for example, 6 ounces of bread flour and 3 ounces of whole wheat flour, the total flour weight is 9 ounces, so the bread flour percentage will be 6 divided by 9, or 66.7% (rounded), and thus the whole wheat will be 3 divided by 9, or 33.3%. Together, the total flour weight is still 100%.

Total Percentage (TP)
Total Percentage (TP): When you add up the percentages of each ingredient weight, beginning with the total flour weight (100%), you end up with a number we call Total Percentage. For example, Lean Dough

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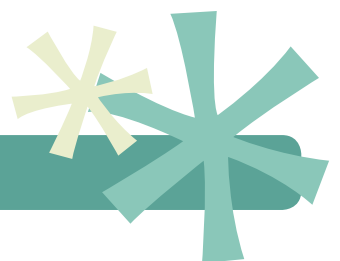
may be listed as 100% flour, 2% salt, 0.65% instant yeast, and 68% water. This adds up to 170.65%, which is the Total Percentage. This number is important when trying to calculate various size batches, as I will explain below.

Ingredient Percentage (IP)

The individual ingredient percentage is determined by dividing the weight of the ingredient (IW) by the total flour weight (TFW), and multiplying by 100 to put it into percentage terms. For example, if the recipe calls for 100 pounds of flour and 2 pounds of salt, you divide 2 by 100 and get 0.02. When you multiply this by 100 you get 2% (0.02 is the same as 2 one-hundredths, which is the same as 2%).

Total Weight (TW)

The total weight of a recipe is determined by adding the weights of all the ingredients or, in some instances, simply by deciding how much dough you want. For example, if you need 10 pounds of dough, that is your total weight. If you know the formula for that bread (that is, the percentages) you can figure out the individual weights, as I will show below.

Ingredient Weight (IW)

The weight of each ingredient (IW) is a necessary piece of information when scaling out a dough. It can be determined, as shown below, even if you don't have a recipe, as long as you have a formula (ratios) and know how much dough you need. The total weight of all the individual ingredients gives you the Total Weight (TW).

How to use this information

You can figure out either the formula percentages or the ingredient weights if you have the other side of the equation. Below are the basic math formulas you will need.

To determine individual ingredient percentages (IP)

IP = IW / TFW x 100. For example: the flour adds up to 10 pounds (160 ounces) and the yeast is 1 ounce. Divide 1 by 160 and you end up with 0.00625. Multiply this by 100 to put it into percentage terms and you end up with 0.625%. Therefore, the yeast equals 0.625% (which might be rounded off to 0.6%).

To determine individual ingredient weights (IW)

IW = TFW X IP. For example, you know that the total flour weight is 20 ounces and that the salt percentage is 2%, Multiply 20 by 2% (or 0.02) and you get 0.4 ounce, which is the weight for the salt.

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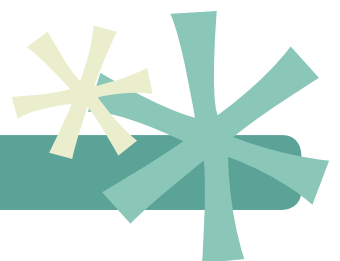
Bakers' Math: Ratios

**To determine the total flour weight for a formula (TFW)**

TFW = TW / TP. For example, you have a formula for French bread that adds up to 170.65%. You want to make 10 pounds of dough. So, divide 10 by 170.65% (or, 1.7065) and you get 5.86. This is the amount of flour you will need, 5.86 pounds. To turn the .86 into ounces, you can multiply 0.86 by 16 (16 ounces in a pound) and you get 13.76 ounces (which can be rounded to 13.75 ounces, or even to 14 ounces). Once you know the total flour weight (TFW) you can easily figure out the remaining ingredient weights by using the math formula above: IW = TFW x IP (example for finding the salt weight: 5.86 pounds x 2% (or 0.02) = 0.1172 pounds. Now, to turn 0.1172 pounds into ounces, multiply it by 16 (0.1172 X 16 = 1.88 ounces).

Other useful math formulas

- To convert pounds into ounces, multiply the number of pounds by 16.
- To convert ounces into pounds, divide the number of ounces by 16
- To convert ounces into grams, multiply the ounces by 28.35
- To convert grams into ounces, divide the grams by 28.35.

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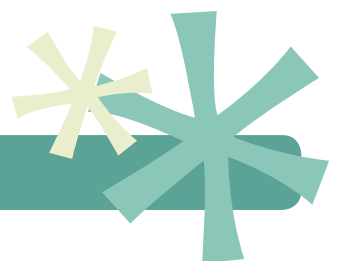
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