yeast breads for traditional or block schedules

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Yeast and Fermentation

Yeast (a single celled fungus) ferments dough under favorable conditions of warmth, moisture, and abundant food in the form of simple sugars. It is the only living organism in dough. Enzymes, primarily amylase, break down the complex carbohydrates in flour to produce the simple sugars on which the yeast feed**.** **Fermentation occurs when yeast converts simple sugars into carbon dioxide, alcohol, energy (heat and life energy for the yeast cell) and organic acids.** Lactic and acetic acid are the main organic acids that are created and are largely responsible for the aromas and flavors of bread.

The CO_2 gas produced during fermentation is trapped in the gluten matrix of the dough, and as this gas builds up, the dough rises. The accumulation of CO_2 is relatively slow during fermentation outside the oven, but the heat of the oven stimulates a yeast feeding frenzy. During this rapid fermentation in the first minutes of baking, large amounts of carbon dioxide accumulate rapidly in the gluten matrix and the dough inflates (this is called 'oven spring'). (Oven spring is greatly aided by the volume increase of water turning to steam.) Yeast activity or fermentation continues to increase as the temperature increases, until the yeast is killed at 138 ° F at which time fermentation ceases.

Fermentation

	enzymes		**yeast**	
complex carbohydrates	**→**	**sugar**	**→**	**CO_2 + alcohol + energy + organic acids**

Types of Yeast

'Wild' Yeast *(Saccharomyces exxigus)* is the ambient yeast that settles on growing grain and is visible as the white film on grapes, plums, etc. It is the yeast used in sourdough production. There are fewer natural yeast cells per unit of weight than of domestic yeast cells they also metabolize sugars more slowly so more time needs to be devoted to all phases of sourdough production compared to yeasted breads.

Bakers Yeast *(Saccharomyces cerevisiae)* 'domestic' or manmade yeast; available in several forms. *Active Dry*, *Instant Active and Osmotolerant yeast* have a longer shelf life than *Fresh yeast*. Store unopened at room temperature, and in the refrigerator once opened. Fresh yeast must be refrigerated at all times.

Fresh or cake yeast
-contains 70% water
-tan in color
-firm, with clean breaks

Active dry yeast
- same strain as cake yeast but dehydrated
-must 'reactivate' in warm water before being added to dough. 5 water: 1 yeast.
- the dehydration process kills yeast cells in the outer layer of each granule; the reactivation period allows time for water to permeate the layer of dead yeast and reach the viable yeast so it can begin the fermentation process.
- use 40-50% less by weight than cake yeast.

Instant active dry yeast
-no reactivation required before adding to dough, as the drying process is more gentle than for active dry yeast.
-use about 30%to 40% by weight of cake yeast

Osmotolerant
-used in dough with high percentages of sugar
-resists hygroscopic pull of sugar
-use about 30%to 40% by weight of cake yeast.

Water Temperature Formula for achieving Desired Dough Temperature

Dough temperature is one of the most important factors to control in order to follow a recipe's timeline and achieve the desired results. When dough temperature is too low, fermentation is inhibited; dough that is too warm will overferment. In either case, the recipe timeline will be off because the dough will be moving too slowly or too quickly.

At the end of the mixing cycle, desired dough temperature is 75° F for most yeasted breads and 78° F for most sourdoughs. This final dough temperature is determined by the temperature of the room and all ingredients (flour, water, preferment) as well as the 'friction factor', the amount of heat added to the dough by mixing. So how best to modify these temperatures to end up with the desired dough temperature? The easiest way is by adjusting the temperature of the water going into the final dough.

The following Water Temperature Formula is a simple equation used to determine the water temperature necessary to achieve the desired final dough temperature. *Note: the following formula is for a dough without a preferment—often called a straight dough. A slightly modified version is used for breads that contain a preferment. Simply multiply the desired dough temperature by 4 instead of 3 and subtract the temperature of the preferment from this value.*

$$\mathbf{T_{water} = (3 \times T_{final}) - (T_{flour} + T_{room} + \text{friction factor})}$$

The friction factor of your particular mixer or hand mixing method is equal to the change in temperature of a dough before and after mixing. To determine the friction factor, take the temperature after the dough has been brought together and is homogenous, and again when mixing is complete. The difference is the friction factor. In general, mixers increase the dough temperature roughly 22° to 30° F, and hand mixing increases the dough temperature about 5° to 15° F.

Example:
You are making pita with a desired dough temperature (T_{final}) of 77° F.
Ambient room temp is 72° F, the flour is 70° F.
From previous testing you know that the friction factor of your mixer is 26° F. Using the Water Temperature Formula, you determine the water temperature as follows:

$$\mathbf{T_{water} = (3 \times T_{final}) - (T_{flour} + T_{room} + \text{friction factor})}$$
$$= (3 \times 77° \text{ F}) - (72° \text{ F} + 70° \text{ F} + 26° \text{ F})$$
$$= 231° \text{ F} - 168° \text{ F}$$
$$= 63° \text{ F}$$

Minimum water temp for use in bread dough is 32° F, and maximum is 138° F. (Yeast can be killed when water temp exceeds 138° F.) If your calculation results in a temp outside these limits, one or more of the other temps must be modified. Flour temperature is the easiest to modify; chill or warm it as needed.

The Steps of Breadmaking

1. *Scaling* -accurate measurement of all ingredients is the first necessary step for successful baking. Weighing ingredients is more accurate and faster than measuring ingredients volumetrically. Weighing also allows us to use the system of baker's percentage.

2. *Mixing* -methods vary from product to product. A well written formula will thoroughly but succinctly describe the mixing method.

3. *Primary Fermentation* -the period directly after mixing but before the dough is divided into loaf size pieces. The majority of the dough's fermentation occurs during this time. The dough should be covered and placed in a proper environment (approximately 75°F to 77°F) during this period. Primary fermentation can be punctuated by one or more 'folds' or 'stretch and folds,' a step that strengthens the dough, stimulates fermentation by incorporating oxygen and gives the baker an opportunity to monitor the process of fermentation. *Also called 'floor time.'*

4. *Dividing* -the step of cutting bulk dough into individual loaves. It should be quickly and accurately performed with a dough cutter or bench scraper.

5. *Preshaping* -each piece is worked into a tight, smooth piece in anticipation of final shaping. Pieces are placed on lightly floured proofing boards and placed onto a covered rack. *Also called 'rounding.'*

6. *Bench rest* -a period that allows the gluten to relax to facilitate final shaping. *Also called 'intermediate proofing.'*

7. *Shaping* -relaxed dough is formed into a tight, well shaped loaf as efficiently as possible.

8. *Panning* -dough is placed on or in appropriate parchment, couche, basket or pan.

9. *Final proof* -the period directly after shaping and immediately preceding baking, when the dough achieves maximum fermentation. The bread should increase in volume by about 66%.-75%. A 75° F-78° F and slightly humid environment is the ideal proofing environment. Immediately before baking, loaves are scored with a double edge razor blade cutting instrument called a *lame (pronounced lahm, rhymes with 'mom')*.

Scoring the loaf:

- *allows the loaf to expand fully during the oven spring period of baking, creating more volume.*
- *provides a predictable spot for the loaf to burst, otherwise the loaf will split at the weakest spot creating a distorted loaf or not split at all, yielding a dense crumb.*

10. *Baking-* dough is changed into bread. Factors such as type of oven, richness and size of loaf determine the times and temperatures of baking. Yeast raised dough benefits from an injection of steam into the oven chamber just before loading.

The attributes of steam injection on yeast raised dough:

- *creates a humid environment that allows the crust to stay supple so it can expand to its greatest volume during oven spring. Dough that is placed in a dry oven quickly develops a skin that prevents the loaf from continuing to expand.*
- *promotes a shiny crust.*
- *cuts open dramatically and form 'ears'*

Note: Too much steam may cause cuts to stick together, failing to open. In this case, the crust becomes chewy.

(11.) *Cooling and storage*- products may continue to bake after being removed from the oven during the carry over baking period. All cooling items should be well ventilated. Sweet dough should be glazed when hot. Soft doughs, such as brioche, should be bagged in plastic bags. Hearth breads should be bagged in paper bags so that the crust stays crisp.

Pita

Ingredient	Grams	Pounds & Ounces	Final Dough%
Bread Flour	750g	1 lb, 10 oz	50%
Whole Wheat Flour	750g	1 lb, 10 oz	50%
Water	975g	2 lb, 2 oz	65%
Yeast, fresh	15g	0.5 oz	1%
Salt	30g	1.1 oz	2%
Total	*2520g*	*5 lb, 7.6 oz*	*168%*

Method of Preparation:

1. Gather all ingredients and equipment.
2. Scale ingredients.
3. Desired dough temperature is 77° F (25° C).
4. Combine water, yeast, flour and salt in a 20 qt. bowl of a stationary mixer.
5. Mix on 1st speed for 3 minutes.
6. Mix on 2nd speed for 3 minutes.
7. Place dough in a covered bin, and allow to ferment for 45 minutes.
8. Divide the doung into 125g pieces and shape into tight balls.
9. Allow to rest for 20-25 minutes.
10. Roll each piece into a flat disk about 1/8th of an inch (3mm) thick.
11. Gently stack pita on a couche lined board, taking care that they don't stick to each other.
12. Once all the pita are rolled, immediately bake in a 500° F (260° C) oven, with 2-3 seconds of steam.
13. The pita should expand and make a pocket after a minute or two of baking.
14. Once they expand, flip the pita and bake on the opposite side for approximately one minute. Take care to not overbake.
15. Remove from the oven and stack to prevent pita from becoming dry and hard.
16. Store in plastic bags after the pita have cooled.

Note: This formula is written for class period of 1.5 hours.
Longer classes have the option of increasing the length of primary fermentation in step 7 from 45 minutes to 90 minutes.

Pita with Poolish

Poolish

Ingredient	*Metric*	*Pounds & Ounces*	*%*
Bread Flour	375 g	13 oz	100
Water 70º F	375 g	13 oz	100
Yeast, fresh	0.375 g	Pinch	.1
Total	*750.4 g*	*1 lb, 10 oz*	*200.1*

1. Gather all the ingredients and equipment.
2. Scale ingredients.
3. Combine water and yeast and stir to dissolve the yeast.
4. Add flour and mix until thoroughly incorporated.
5. Cover and ferment at room temperature until mature, approximately 14 to 16 hours.

Final Dough

Ingredient	Grams	Pounds & Ounces	Final Dough%	Overall %
Bread Flour	375 g	13 oz	33%	50%
Whole Wheat Flour	750 g	1 lb, 10 oz	67%	50%
Water	600 g	1 lb, 5 oz	53%	65%
Yeast, fresh	15 g	0.5 oz	1.3%	1%
Salt	30 g	1.1 oz	2.7%	2%
Poolish	750.4 g	1 lb, 10 oz	67%	--
Total	*2520.4 g*	*5 lb, 7.6 oz*	*224 %*	*168 %*

Method of Preparation:

1. Gather all ingredients and equipment.
2. Scale ingredients.
3. Desired dough temperature is 77° F (25° C).
4. Combine water, yeast, flour and salt in a 20 qt. bowl of a stationary mixer.
5. Mix on 1st speed for 3 minutes.
6. Mix on 2nd speed for 3 minutes.
7. Place dough in a covered bin, and allow to ferment for 45minutes.
8. Divide the dough into 125g pieces and shape into tight balls.
9. Allow to rest for 20-25 minutes.
10. Roll each piece into a flat disk about 1/8th of an inch (3 mm) thick.
11. Gently stack pita on a couche lined board, taking care that they don't stick to each other.
12. Once all the pita are rolled, immediately bake in a 500° F (260° C) oven, with 2-3 seconds of steam.
13. The pita should expand and make a pocket after a minute or two of baking.
14. Once they expand, flip the pita and bake on the opposite side for approximately one minute. Take care to not overbake.
15. Remove from the oven and stack to prevent pita from becoming dry and hard.
16. Store in plastic bags after the pita have cooled.

Note: This formula is written for class period of 1.5 hours.
Longer classes have the option of increasing the length of primary fermentation in step 7 from 45 minutes to 90 minutes.