Scale a Recipe

Description
In this activity, students will be presented with several basic baking recipes. They will be presented with the terminology used as well as learn to adjust the recipes for the required quantity of finished product.

Note: a recipe may also be referred to as a formula.

Lesson Objectives
Students will be able to:

• understand terminology of baking recipes
• calculate conversions from volume to metric and/or imperial measurements
• calculate adjustments needed to scale a recipe for increased or decreased yield, and
• interpret common baking recipes abbreviations.

Safety Considerations
Basic food and kitchen safety

Assumptions
Students know basic math functions (addition, subtraction, multiplication, division) and understand the concept and use of decimals.

Terminology
Conversion: Calculating the different values of the same quantity of an ingredient using different units of measurement.

Formula: A balanced recipe containing the list and weights of ingredients, procedure, and yield; also known as a recipe.

Imperial System: A system of measurements introduced as a standard during the era of the British Empire. The system is only retained, in part, by the UK, Canada, and the US.

Metric System: A system of measurement based on the decimal (power of 10) system.

Portion control: The understanding of serving sizes and the ability to consistently reproduce identical amounts of a product.

Scaling: The act of measuring ingredients by weight or volume; usually the first step in the baking of products.

Sifting: The act of separating lumps and aerating powdered material through a fine mesh screen.

Unit size: The weight or volume of a specific item as it pertains to a recipe.
**Volume measurement:** A system of measuring ingredients (typically) for use in cooking and baking.

**Yield:** The amount of product produced from a specific recipe.

**Estimated Time**

45 minutes

**Recommended Number of Students**

This activity should be done individually or in groups of 2–4.

**Facilities**

- Home Economics lab or cafeteria kitchen
- Internet-accessible computer, projector, and screen

**Resources**

**Ingredient Weight Chart**

http://www.kingarthurflour.com/learn/ingredient-weight-chart.html
Demonstrating Skills And Knowledge

Procedure
1. Refresh students’ knowledge of:
   a. Measuring and basic scaling. Have students weigh given volume quantities of ingredients and log the results to emphasize the variables in the volume method.
   b. Conversion
   c. Use of scales
2. Hand out the recipe of choice. (Three recipes in chart format are included at the end of the activity plan.)
3. Review the recipe to understand the terminology basic production process.
4. Have students modify the recipe.
   a. Start with halving and doubling the quantities as given.
   b. Convert given values from volume to imperial or metric measurements (See conversion guide or make your own).
5. Calculate the yield (if not given) and adjust yield by altering the size of the desired finished product. (e.g., Convert from small cookie to large cookie or from loaf-sized bread to dinner buns.)
6. Increase the difficulty of the scaling up or down. Have the students in groups re-calculate the recipe to make large quantities for a bake sale. Have each group work on a different recipe. (e.g., 100 cookies, 100 muffins.)
7. Verify answers by using the sum of the recalculated values and cross checking the result with desired yield.

Extension
Have the students research a recipe. They can search the web, use a favourite cookbook, or bring a family recipe.

• Write the recipe out on a blank recipe sheet.
• Calculate conversions from volume to weight.
• Scale up or down to make a pre-determined yield.

Evaluation Guidelines
• Turn in sheets for marking. Alternately, have students work in pairs to check each other’s work by comparing answers and redoing calculations if necessary.
• Present home recipe for review and check of calculations (student may wish to make the product at school or at home if appropriate to do so).
# Measurement Conversion Table for Common Baking Ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Ounces per cup</th>
<th>Grams per cup (oz.)</th>
<th>Grams per teaspoon (t)</th>
<th>Grams per tablespoon (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baking powder or soda</td>
<td></td>
<td></td>
<td>4.6</td>
<td>13.8</td>
</tr>
<tr>
<td>Butter</td>
<td>8</td>
<td>227</td>
<td>4.8</td>
<td>14.2</td>
</tr>
<tr>
<td>Flour (all purpose)</td>
<td>5</td>
<td>140</td>
<td>2.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Milk</td>
<td>8</td>
<td>245</td>
<td>5.1</td>
<td>15.3</td>
</tr>
<tr>
<td>Milk powder</td>
<td>3</td>
<td>125</td>
<td>1.5</td>
<td>4.25</td>
</tr>
<tr>
<td>Salt, fine</td>
<td></td>
<td></td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Shortening</td>
<td>8</td>
<td>227</td>
<td>4.3</td>
<td>12.8</td>
</tr>
<tr>
<td>Sugar brown</td>
<td>7</td>
<td>200</td>
<td>4.6</td>
<td>13.4</td>
</tr>
<tr>
<td>Sugar white, granulated</td>
<td>7</td>
<td>200</td>
<td>4.2</td>
<td>12.5</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>7</td>
<td>220</td>
<td>4.5</td>
<td>13.7</td>
</tr>
<tr>
<td>Water</td>
<td>8</td>
<td>237</td>
<td>5.3</td>
<td>14.8</td>
</tr>
<tr>
<td>Yeast instant rapid</td>
<td></td>
<td></td>
<td>2.8</td>
<td>8</td>
</tr>
</tbody>
</table>
# Professional Baking Conversion Chart of Common Values

*Note:* Imperial units are US, not UK (verify source of web searched material).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Abbreviation</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pint</td>
<td>pt</td>
<td>16 (fl) oz.</td>
</tr>
<tr>
<td>1 pint (water)</td>
<td></td>
<td>1 lb.</td>
</tr>
<tr>
<td>1 pint</td>
<td></td>
<td>2 cups</td>
</tr>
<tr>
<td>1 cup</td>
<td>c</td>
<td>8 oz.</td>
</tr>
<tr>
<td>1 gallon</td>
<td>gal</td>
<td>8 pt</td>
</tr>
<tr>
<td>1 quart</td>
<td>qt</td>
<td>2 pt</td>
</tr>
<tr>
<td>4 quarts</td>
<td></td>
<td>1 gal</td>
</tr>
<tr>
<td>1 litre</td>
<td>L</td>
<td>1000 mL</td>
</tr>
<tr>
<td>1 litre (water)</td>
<td></td>
<td>1 kg</td>
</tr>
<tr>
<td>1 litre (water)</td>
<td></td>
<td>2.2 lb.</td>
</tr>
<tr>
<td>1 pint</td>
<td></td>
<td>472 mL</td>
</tr>
<tr>
<td>1 cup</td>
<td></td>
<td>236 mL</td>
</tr>
<tr>
<td>1 teaspoon</td>
<td>tsp or t</td>
<td>5 mL</td>
</tr>
<tr>
<td>3 teaspoons</td>
<td></td>
<td>1 T</td>
</tr>
<tr>
<td>4 tablespoons</td>
<td>Tbsp or T</td>
<td>¼ c</td>
</tr>
<tr>
<td>2 cups</td>
<td></td>
<td>1 pt</td>
</tr>
<tr>
<td>4 cups</td>
<td></td>
<td>1 qt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measure</th>
<th>Abbreviation</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pound</td>
<td>lb.</td>
<td>454 g</td>
</tr>
<tr>
<td>1 ounce</td>
<td>oz.</td>
<td>28 g</td>
</tr>
<tr>
<td>1 kilogram</td>
<td>kg</td>
<td>1000 g</td>
</tr>
<tr>
<td>1 kilogram</td>
<td></td>
<td>2.2 lb.</td>
</tr>
<tr>
<td>¼ pound</td>
<td></td>
<td>4 oz.</td>
</tr>
<tr>
<td>½ pound</td>
<td></td>
<td>8 oz.</td>
</tr>
<tr>
<td>¾ pound</td>
<td></td>
<td>12 oz.</td>
</tr>
<tr>
<td>1 pound</td>
<td></td>
<td>16 oz.</td>
</tr>
</tbody>
</table>
Important note for students: When reviewing imperial measurements, remember that there are 16 ounces (oz.) to 1 pound (lb.).

To convert ounces (oz.) to a decimal fraction of 1 pound (lb.), divide the number of ounces by 16.

**Example**

1.5 lb. = 1 lb. + (0.5 × 16) oz.
= 1 lb. 8 oz.

To convert decimals of a pound into ounces, multiply by 16.

**Example**

3.625 lb. = 3 lb. + (.625 × 16) oz.
= 3 lb. 10 oz.

<table>
<thead>
<tr>
<th>Ounces</th>
<th>Decimal Fraction of a Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0625</td>
</tr>
<tr>
<td>2</td>
<td>0.125</td>
</tr>
<tr>
<td>3</td>
<td>0.1875</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
</tr>
<tr>
<td>5</td>
<td>0.3125</td>
</tr>
<tr>
<td>6</td>
<td>0.375</td>
</tr>
<tr>
<td>7</td>
<td>0.4375</td>
</tr>
<tr>
<td>8</td>
<td>0.5</td>
</tr>
<tr>
<td>9</td>
<td>0.5625</td>
</tr>
<tr>
<td>10</td>
<td>0.625</td>
</tr>
<tr>
<td>11</td>
<td>0.6875</td>
</tr>
<tr>
<td>12</td>
<td>0.75</td>
</tr>
<tr>
<td>13</td>
<td>0.8125</td>
</tr>
<tr>
<td>14</td>
<td>0.875</td>
</tr>
<tr>
<td>15</td>
<td>0.9375</td>
</tr>
<tr>
<td>16</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Empress Hotel Famous High Tea Scone Recipe

Yield

1800 g = 2 dozen (24) × 75 g scones

Use the chart below to double (×2) and halve (÷2) the recipe. Your teacher will give you the final multiple, or decide on your own.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Volume</th>
<th>Metric</th>
<th>Imperial</th>
<th>×2</th>
<th>÷2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter*</td>
<td>1 c</td>
<td>225 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>1 c</td>
<td>210 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All purpose flour</td>
<td>4½ c</td>
<td>540 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baking powder</td>
<td>2 Tbsp</td>
<td>28 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Salt (omit if using salted butter)</td>
<td>1 tsp</td>
<td>5 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raisins</td>
<td>¾ c</td>
<td>120 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg</td>
<td>4 eggs</td>
<td>200 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whipping cream</td>
<td>2 c (450 ml)</td>
<td>476 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beaten egg for egg wash)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Method

<table>
<thead>
<tr>
<th>Key Stage</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Mixing (rubbing in or 'scone' method) | 1. In a large bowl, rub the butter, sugar, baking powder, and salt until a sandy texture is formed but there are still pea-sized lumps of butter in the mix.  
2. Fold in the raisins.  
3. Blend the cream and eggs.  
4. Make a well in the dry mix and pour the liquid in, stirring until a smooth dough is formed.  
5. Let rest for 10 minutes. |
| Make-up and panning       | 1. Roll out to ½" (13 mm) thickness on a floured bench.  
2. Cut with round cutter to desired size. For variety roll out round but cut wedges before baking.  
3. Place on cookie sheet. |
| Baking                    | Bake at 177°C or 350°F for approximately 15 minutes. **Do not over bake!** |
Peanut Butter Cookies

Yield
2957 g or 3072 g with chocolate chips = 5 dozen (24) × 50 g cookies

Use the chart below to double (×2) and halve (÷2) the recipe. Your teacher will give you the final multiple, or decide on your own.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Volume</th>
<th>Metric</th>
<th>Imperial</th>
<th>×2</th>
<th>÷2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter</td>
<td></td>
<td>450 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
<td>450 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown Sugar</td>
<td></td>
<td>340 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanut Butter</td>
<td></td>
<td>500 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg</td>
<td></td>
<td>200 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanilla</td>
<td></td>
<td>20 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All purpose flour</td>
<td></td>
<td>740 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baking powder</td>
<td></td>
<td>32 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chopped Peanuts</td>
<td></td>
<td>225 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option: Chocolate Chips</td>
<td></td>
<td>115 g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Method

<table>
<thead>
<tr>
<th>Key Stage</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Mixing (creaming method) | 1. Cream the butter and sugar until smooth. (Don’t over beat as this will make the cookies spread too much.)  
2. Add peanut butter.  
3. Add eggs and vanilla slowly (room temperature).  
4. Mix until smooth, scraping bottom of bowl if using a mixing machine.  
5. Sift together flour and baking powder and fold into first mixture.  
6. Add chopped peanuts and chocolate chips. |
| Panning              | 1. Drop, scoop at 50 g leaving space between cookies (one dozen per 13 × 18 cookie sheet).  
2. Press with fork for decoration. |
| Baking               | Bake at 177°C or 350°F for approximately 15 minutes. Do not over bake! |
White Pan Bread

Yield
2957 g or 3072 g with chocolate chips = 5 dozen (24) × 50 g cookies

Use the chart below to double (×2) and halve (÷2) the recipe. Your teacher will give you the final multiple, or decide on your own.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Volume</th>
<th>Metric</th>
<th>Imperial</th>
<th>×2</th>
<th>÷2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread flour</td>
<td>4 c</td>
<td>600 g</td>
<td>600 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yeast Instant (rapid)</td>
<td>2 t</td>
<td>6 g</td>
<td>6 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>2½ t</td>
<td>12 g</td>
<td>12 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>1¾ c (400 ml)</td>
<td>400 g</td>
<td>400 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>1018 g</td>
<td>1018 g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Method

<table>
<thead>
<tr>
<th>Key Stage</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Mixing by hand (kneading)        | 1. In two separate bowls weigh flour and salt.  
2. Then weigh the water (22°C) and yeast and evenly disperse into the water.  
3. Add the flour and salt to the water and yeast and mix by hand until coarse dough is formed. Cover and rest the dough for a few minutes.  
4. Knead the dough for 20 seconds or until it resists. Form into a ball, cover and allow resting for 5 minutes. Repeat this process five to 6 times. Examine gluten development. |
| Mixing by machine                | 1. Put all the ingredients into the mixing bowl using the hook attachment. Mix for one minute on slow speed.  
2. Adjust hydration if necessary.  
3. Scrape down bowl taking care to scrape right down at the bottom.  
4. Examine gluten development.  
5. Continue mixing for 2 minutes.  
6. Turn to second speed and mix for another 2 minutes. |
| Bulk fermentation                | Cover dough and let rise until double in volume.                                                                                                                                                        |
| Stretch and Fold (AKA punch-down or degas) | Fold the dough once at 30 minute interval if required.                                                                                                                                                   |
| Dividing and shaping             | Shape and mould the dough to fit into a greased loaf pan.                                                                                                                                               |
| Final fermentation               | Allow the loaves to rise until almost double size.                                                                                                                                                      |
| Baking                           | 1. Bake on middle shelf at 220°C for 30 to 40 minutes or 200°C in convection oven.  
2. Check internal temperature should be 94–98°C.  
3. De-pan immediately and cool on wire rack.  
4. Wait 10 minutes before cutting, eating and evaluating. |