Welcome 4-H Leaders!
Welcome to the “Discovering Science in the Kitchen” project. This project focuses on the science behind culinary creations. This guide includes a skills list, background information, activity suggestions, and ways to know if your members have learned the skills identified.

The Leader guide is written with the expectation that the project leader(s) will have a working knowledge about food. This project consists of 14 Builders; members complete Skill Builder 1 and five Skill Builders of their choice.

The 3D’s of Learning - Each Skill Builder has three sections of learning called “Dream it!”、“Do it!” and “Dig it!” Below is a description of each.

Dream it! Plan for Success - This gives members a chance to help plan their activities. A skills checklist, background information, important words, and activating questions are included in the Member Manual so they will be able to think about the topic and decide how they will approach it. The Leader Guide contains in depth background information on the topics, material lists, suggestions, and time requirements for activities. Activating, acquiring, and applying questions are incorporated to engage members’ thinking through each step of the learning process.

Do it! Hands on learning - This is where members are engaged in the activity planned / discussed in the Dream it! Section. Here members are doing the activities and leaders are observing, recording, and providing feedback on how well they are doing. Allow as much individual practice as required; you are assessing the progress and understanding of individual members.

Dig it! What did you learn? - This simply means that members and leaders need to ‘dig into their learning’. For the learning cycle to be completed, both need to reflect on how things went and how well they did. For members, this involves self-assessment, giving feedback, creating meaning from their experiences, and thinking about what they would do differently next time. Once this is done they will be in a good position to apply what they have learned to the next experience.

The sequence of project meetings and specific skill building outcomes for members in this project are on the chart on the following page.
What Skills Will The Member Learn?

Each section, Skill Builder (or Builder) in this project has activities that will help your project group learn to do by doing while learning new skills and having fun!

To complete this project, members must:
- Complete the activities in each Skill Builder OR a similar activity that focuses on the same skills as you and your members may plan other activities
- Plan and complete the Showcase Challenge
- Complete the Portfolio Page
- Participate in your club’s Achievement (See the inside back cover for more information about 4-H Achievements).

<table>
<thead>
<tr>
<th>Skill Builder</th>
<th>Members will be able to...</th>
<th>Activities</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Builder 1</td>
<td>Learn the PEOE Inquiry Technique</td>
<td>• Cookie Comparison</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>• Apply the PEOE Inquiry Technique</td>
<td>• The Perfect Chocolate Chip Cookie</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>• Read a recipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Experiment with ingredients and methods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builder 2</td>
<td>Solid, Liquid, Gas</td>
<td>• The Amazing Water Experiment</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>• Identify the different phases of matter</td>
<td>• Ice Cream in a Bag</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>• Explain why matter changes states</td>
<td>• Butter</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>• Describe freezing and melting points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builder 3</td>
<td>Microorganisms</td>
<td>• Glo Germ Kit</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>• Understand where and how bacteria grow</td>
<td>• Yogurt</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>• Explain why incubation is important</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builder 4</td>
<td>Coagulation</td>
<td>• Curdle Milk</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>• Explain why coagulation is important in cheese making</td>
<td>• Fromage blanc</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>• Name different types of cheeses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builder 5</td>
<td>Fermentation</td>
<td>• Balloon Blow-up</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>• Use proportions</td>
<td>• Sourdough Starter</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>• Understand the process of fermentation</td>
<td>• Friendship Bread</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>• Describe other food products of fermentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Builder 6</td>
<td>Carbonation</td>
<td>• Citrus Reaction</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>• Explain the process of carbonation</td>
<td>• Ginger Ale</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>• Understand why some reactions are bigger than others.</td>
<td>• Root Beer Float</td>
<td>36</td>
</tr>
<tr>
<td>Builder 7</td>
<td>Density Dressing</td>
<td>• Density Column (Part A)</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>• Understand emulsions</td>
<td>• Salad Dressing</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>• Explain why salad dressing separates</td>
<td>• Salad Creation</td>
<td>39</td>
</tr>
</tbody>
</table>
| Skill Builder 8 | Density Dessert | • Explain why density is important in this recipe  
• Describe why people find these recipes appealing | • Density Column (Part B)  
• Impossible Pie  
• Magic Chocolate Flan Cake | 44  
44  
45 |
|----------------|-----------------|------------------------------------------------|-------------------------------------------------|--------|
| Skill Builder 9 | Explore Senses  
• Identify human senses  
• Explain how we taste food | • Flavour Cover-up  
• Mock Apple Pie | 49  
50 |
| Skill Builder 10 | Incorporation of Air  
• Describe how air is incorporated into foods  
• Explain the effects of air in baking | • Meringue Mix Up  
• Meringue Cookies  
• Chocolate fluff | 53  
53  
54 |
| Skill Builder 11 | pH  
• Name acidic and basic foods  
• Explain how acidity and alkalinity are measured  
• Demonstrate how red cabbage juice is a pH indicator | • Red Cabbage Juice pH Scale  
• Red Cabbage Juice pH Test  
• Green Eggs | 57  
57  
58 |
| Skill Builder 12 | Crystallization  
• Define crystallization  
• Explain why rock candy grows | • Saturation  
• Rock Candy | 62  
62 |
| Skill Builder 13 | Caramelization  
• Understand what affects the colour of caramel  
• Explain how baking soda makes caramel become light and foamy | • Caramelization Word Search  
• Sponge Toffee  
• Caramel Corn | 66  
67  
67 |
| Skill Builder 14 | Gelatin and Polymers  
• Understand where gelatin comes from  
• Explain how polymers are formed | • Slime  
• Gelatin Pinwheels  
• Fruit Gummies | 72  
72  
73 |

When you successfully complete your builders, you will showcase what you have learned.

| Showcase & Portfolio | • Explain success in using the skills listed above | • Showcase Challenge  
• My Portfolio Page | 75  
76 |
Showcase Challenge and My Portfolio Page

At the end of the members’ section are the “Showcase Challenge” and “My Portfolio Page”. The Showcase Challenge page gets members to think about their accomplishments and explain or demonstrate how they were successful. There is information to help them decide how they will best “showcase” their learning to family and friends.

Record keeping is an important part of every 4-H project. “My Portfolio Page” is used to keep track of members’ 4-H experiences. As each member learns skills this is recorded on the portfolio page. When the Portfolio Page has been completed and confirmed by the leader, then it becomes a record of the member’s completion of the project and participation in other 4-H activities beyond the project.

4-H leader assessment of members will occur throughout the project as you observe the progress and learning of each member. Record what you see and hear. Your feedback should be positive and specific (not just “well done”). Share feedback with members often so they can act on your suggestions. How you choose to observe and record is up to you. Remember that members may improve over the project year and that records should be updated to reflect when they showed their best learning. You are discussing how well members are meeting the skills checklists that are at the beginning of each of the project books, in each Builder and on the Portfolio Page.

Projects promote technical, communication, meeting management, and leadership skills, as well as community involvement and real-world experiences. In addition to the specific skills members are to learn in each builder, these learning goals for members are important: Following instructions - Working with others - Using supplies safely - Using the key words - Improving with practice - Respecting timelines.

4-H Project Series Skill Development Levels

Each project topic series contains three levels of skill development: explore, discover, and master.

Explore - each project series has one manual outlining the basics. All members will be expected to complete the Explore level before moving into the Discover level. It introduces the basic skills and terms needed by members for other projects in that series.

Discover - each project series has several project options and members are encouraged to take as many as they would like. At this level, members practice specific techniques and gain related skills.

Master - project options encourage members to specialize. The Leader’s role is to look for opportunities for their members to have more in depth experiences.
4-H LEADER TIPS FOR SUCCESS!

- Pages 2 and 3 in each leader guide summarize what the member must do to complete the project.
- Depending on time available, group size and member abilities, you may wish to break the Builders into more than one project meeting.
- The internet has lots of interesting websites and educational activities. We do not endorse any website or any products they may sell. Information/products will be used at your own discretion.
- Safety is a number one priority. Care has been taken to create safe, age appropriate activities throughout this manual. As leaders, it is important for you to emphasize safety rules and adapt activities to safely match your members’ abilities. Ensure members have a good understanding of safe practices when using tools, that they use the right safety equipment when necessary, and that good supervision is provided. A quality experience needs to be a safe experience.
- The multiple intelligences theory teaches us that people learn in at least 8 different ways. All individuals will be stronger in some ways of “intelligences” and weaker in others. It follows that the more ways we teach, the more members we will reach. Throughout this project, you will find a mix of teaching and learning methods. Teaching projects using a broad blend will help increase the learning potential of all members.
- Projects are designed to teach many skills, but the 4-H member is always more important than the subject matter. Stress cooperation in the activities to develop teamwork and cooperation skills. These are valuable life skills. Ensure the work is completed in a manner that members feel good about themselves and their efforts. This can be done by assigning tasks based on member’s individual abilities. Modelling and expecting supportive behaviour (i.e. no “put-downs”) in the group also contributes to a positive experience.
- There will be opportunity for experimentation and applying skills that members have learned throughout this project. Experimenting can be frustrating, but learning through trial and error is an important life skill. Explain to members that it is alright to either go on to the next builder or do the builder again if they need the practice. Help the members work through their challenges until they are satisfied with the final results. Creating inventive 4-H members will be very rewarding.
- Celebrating success is an important but sometimes overlooked part of our lives. We encourage you to use the final section to empower the members by celebrating all they have learned in a fun manner. Anything that you do to add to the spirit of fun and the sense of accomplishment of each member will likely be remembered as the highlight of their 4-H year.

Have fun and thanks for your belief in young people!
Before We Get Started
Food is an integral part of our lifestyle. We eat whether we’re hungry or not, tired, bored, happy, sad, sick, or healthy. Food is consumed sitting, standing, or lying down. We eat alone, in groups, inside, outside, anytime of the day or night.

Today, we forage in supermarkets for food with the world as our marketplace. We demand freshness, quality, quantity, convenience, and healthy safe food from farmers and food processors. With all the choices in the supermarket it is more important than ever to learn to prepare and cook simple, inexpensive, tasty healthy meals and snacks.

We are constantly being challenged by the media to purchase instant, high fat, high sugar, low nutrition fast food. Preparing your own food isn’t just better for your body, it’s easier on your budget and it provides you with the opportunity to socialize by sharing food with friends and family.

And just like learning to ride a bike or speak another language, learning to cook is more effective if we can start early in life and have fun at it!

Guidelines for Food Safety
Because we eat most of our food at home we learn most of our food preparation habits at home including the guidelines for food storage, meal preparation and cooking food. If improper food safety techniques are learned and practised, people can get sick. As a leader, it is important to teach the proper methods of keeping food safe before, after and during meal preparation to young people to ensure they are kept safe from potentially dangerous foodborne illnesses. Smart food safety begins at home!

Food safety at the grocery store!
Thinking about food safety begins at the grocery store. It is important – to keep cold food cold and hot food hot while transporting it to your house. Arrange your shopping trip to get food home quickly and into the refrigerator. For transporting food use: coolers, ice packs and thermos containers. Don’t allow raw meat juices to come in contact with other foods, raw or cooked.

What about The Danger Zone?
The most important factor for safe handling of foods and preventing foodborne illnesses are the result of poor temperature control. Following the simple rule “Keep hot foods hot and cold foods cold” and out of The Danger Zone (4°C to 60°C or 40°F to 140°F) can prevent many foodborne illnesses. Foods that could give you food poisoning should be kept below 4 degrees Celsius or, for hot food, above 60 degrees Celsius (140°F). Low temperatures prevent food poisoning bacteria, which may be present in the food, from multiplying to dangerous levels. High temperatures will kill bacteria and viruses. Because bacteria can grow to unsafe levels between 4 degrees Celsius and 60 degrees Celsius (40°F -140°F) we call it the Temperature Danger Zone. When you get foods home refrigerate and freeze foods immediately. Keep foods in the refrigerator at the temperature of 4°C (40°F) or below. Don’t overload the refrigerator; allow space for the air to circulate. If necessary, remove foods such as soft drinks to make room for potentially hazardous foods.

Is it safe to eat foods, which have been in the Danger Zone?
• Less than 2 hours - Refrigerate immediately
• Between 2 hours and 4 hours - Use immediately
• More than 4 hours - Throw out
• When in doubt throw out!!!!

What are the four simple rules for food safety?
Clean - Clean hands, utensils and surfaces often to keep everything clean and free bacteria
Separate - Keeps foods separate to avoid cross contamination
Cook - Cook foods to proper temperatures
Chill - Refrigerate and freeze perishable foods promptly
**Tips for Food Safety**

Attention to food safety guidelines can add to the educational benefits of the 4-H Foods Project while aiding in the prevention of foodborne illness.

- Hand-washing is one of the best ways to prevent the spread of foodborne illness.
- Have the members wash their hands for at least 20 seconds with soap and warm water before, during and after food preparation.
- Members with long hair should keep it tied back.
- Members with wounds or cuts should be covered properly – rubber gloves food preparation.
- Tasting is an important part of the cooking experience, but can potentially spread germs. Have members use spoons, wooden sticks or tongue depressors for tasting but stress that they should only be used once.
- Do not let the members use their fingers.
- Practice safe food handling: cook, chill, separate and clean all the time.
- Talk about the importance of not coughing or sneezing near food.
- Teach members to cough or sneeze into their sleeves or into a tissue followed by proper hand-washing before returning to the food.

**Guidelines for Kitchen Safety**

- Demonstrate safe cutting techniques (peel away from your hand, keep fingers away from sharp blades, etc) and proper handling of other potentially dangerous blades.
- Practice safe handling techniques of all utensils and appliances (hot stoves, blenders, knives, etc).
- Talk about the importance of preventing choking, by chewing foods well, sitting straight and not talking with food in their mouth.
- Have a First Aid kit available at all times.

**Rules for the Kitchen**

Establish a list of rules for staying safe in the kitchen. Some examples might be:

- No running or horseplay in the kitchen
- Wash hands
- Keep fingers out of the food
- Read recipes all the way through before starting
- Be patient

Have the members agree to and take ownership of the rules by adding their own rules to the list as appropriate.

Make a poster with the rules on it so the members can read them at all times.

Review the rules once the members arrive to each session – have members take turns reading the rules out loud.

**Tips for preparing for recipes:**

- Purchase non-perishable ingredients in bulk at the beginning of your 4-H project.
- Purchase perishable items in quantities as listed in activities/recipes before each cooking session.
- Review the recipe with the members and introduce any new cooking terms, foods and utensils they will be using. Give each member and group a copy of the recipe, if using one other than printed in the manuals.
- Have the members or yourself assemble the equipment and ingredients required on trays or on the table.

Feel free to use your own recipes if you think they are appropriate. Also contact commodity groups for recipes using their food products; Flax Council of Canada, Pulse Canada, Manitoba Pork Council, Canola Council or Canada, etc.
FOOD ALLERGIES:

What is a food allergy?
A food allergy is an immune system response to a food ingredient that the body mistakenly believes to be harmful. Once the immune system decides that a particular food is harmful, it creates antibodies to it. The next time the individual eats that food, the immune system releases massive amounts of chemicals, including histamine, in order to protect the body. These chemicals trigger different allergic reactions.

What are common signs of an allergic reaction?
- Tingling sensation in the mouth
- Swelling of the tongue and throat
- Difficulty breathing
- Hives (small or large red itchy welts)
- Vomiting and diarrhea
- Abdominal cramps

What is anaphylaxis?
Anaphylaxis is a severe reaction to a food that has rapid onset and may cause death without emergency treatment.
Common signs of anaphylaxis
- Sudden development of hives
- Swelling of mouth and throat
- Runny eyes and nose
- Dizziness
- Drop in blood pressure

Anaphylaxis is an emergency and must be treated immediately. Each member should have a specific emergency plan with the doses of medication to be given, and the telephone numbers of the ambulance and medical services to be called. Leaders should be trained to recognize symptoms and to administer an injection of the epinephrine and immediately call for an emergency service for transport to the nearest emergency facility.

What is the best way to avoid food allergy reactions?
Strict avoidance of the allergy causing food ingredient is the only way to avoid a reaction.
Read ingredient labels for all foods is the key to maintaining control.
If a product does not contain an ingredient list, allergic individuals should not eat the food.
If unfamiliar with the terms or ingredients contact the food manufactures.

What are the most common food allergens?
- Peanuts
- Eggs
- Milk
- Tree nuts
- Wheat
- Sesame seeds
- Seafood
- Sulfites


Have members identify and clarify any allergies they may have. If serious food allergies are reported, ensure that these foods are avoided at all meetings. Make certain that all members, leaders, and parent helpers know the treatment for allergic reactions.
What is food intolerance?
Many people think the terms “food allergy” and “food intolerance” mean the same thing; however, they do not. Food intolerance or food sensitivities occur when the body cannot properly digest a certain component of the food – often because there is not enough of a particular digestive enzyme. Common types of food intolerances or sensitivities include lactose (the sugar in milk), gluten (wheat protein), sulfites (used in food preservatives), monosodium glutamate, and artificial food dyes.

What are symptoms of food intolerance?

- Gas
- Bloating
- Abdominal pains/cramps
- Nausea
- Diarrhea
- Slight itching or redness

<table>
<thead>
<tr>
<th>Member Names</th>
<th>Allergy/Intolerance</th>
<th>Symptoms</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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Dream it!
Background for Leaders

Science is all around us. Bakers and chefs use chemistry in their daily work. A better understanding of the scientific effects of each ingredient and method through experiments can lead to more successes in the kitchen.

This builder looks at the science behind baking the perfect chocolate chip cookies. Members will use the PEOE inquiry technique to scientifically measure the performance of each recipe and technique. This project delivers fun activities to foster a new appreciation for science and technology. A scientific approach develops creativity and innovation, problem solving and critical thinking skills, teamwork, and communication skills. This project allows members to engage in the scientific and technologic world, explore ideas, explain plans, and extend their minds.

Scientists ask questions and make observations of things in nature. They record and conduct experiments and use the data they collect to explain why things happen. A model is tested repeatedly and will be refined, confirmed, or discarded. The PEOE inquiry technique analyzes a particular scientific event. The following steps are included in the analysis.

1. PREDICT
Write a prediction statement for the event.
“IF ______________ THEN __________________.”
• Draw a well labeled diagram of your prediction.

2. EXPLAIN
Write an explanation of your prediction drawing from your understanding, experiences, theories, models and/or insights gained from your research on the topic (background info may be provided or your own research may be required) – point form.
• Share your predictions with your group and/or class.
• Modify your prediction or explanation based on the group discussion.

3. OBSERVE
Decide what evidence you can collect or what measurements you will take to check your prediction.
• Carefully collect evidence and take measurements. (You may use scientific equipment and techniques)
• Record your observations.

4. EXPLAIN
Write an explanation for your observations. Use theories or models to help explain your evidence and measurements. (background info may be provided or you may need to complete your own research to support or refute your findings)
Believe your observations – don’t worry about what you were supposed to see. Excellent opportunity for a group note.
• Answer any follow up questions from the activity.
Situation:
If ________ is changed, what will happen to ________?

1. Predict
   What will happen?
   Include a labeled diagram to help show your prediction.

4. Explain
   What are the differences and similarities between “Predict” and “Observe”?
   What have you learned?

2. Explain
   Support your prediction.
   Why do you think this will happen?

3. Observe
   Record all of your observations in detail.
In their quest to find the perfect chocolate chip cookie recipe, members will take a scientific approach to their research as they produce 3 variations of chocolate chip cookies from the basic recipe. They will also experience the importance of accuracy in measurements, consistency in techniques, and detailed observations. A small change or a combination of changes will affect the cookie. Remind members that it is essential that they identify the effects of each change. The new chocolate chip cookie recipe could become their signature treat.

**Important Words**

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Features that helps to distinguish or describe a person, place, or thing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>A scientific procedure to make a discovery or demonstrate a known fact.</td>
</tr>
<tr>
<td>Predict</td>
<td>To say or estimate that a specified thing will happen in the future or will be a consequence of something.</td>
</tr>
<tr>
<td>Observe</td>
<td>To watch carefully.</td>
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</tbody>
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**Age Considerations**

- 12+

**Thinking Ahead**

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

**Preparing for Success**

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

**Activating Strategies**

To get members thinking about this topic, discuss the kinds of cookies that they regularly eat; ask them the following questions:

- What makes a delicious cookie?
- Why don’t all combinations for cookie recipes taste equally delicious?

As they identify with poor and delicious characteristics of chocolate chip cookies, have members compare their visions of cookie qualities.
Do it!

The Perfect Chocolate Chip Cookie

Chocolate Chip Cookies

Time Required: 45 minutes per batch

Ingredients

- 1 cup (250 mL) all-purpose flour
- 1/4 tsp (1 mL) salt
- 1/4 cup (50 mL) granulated sugar
- 1/2 cup (125 mL) light brown sugar
- 1/2 cup (125 mL) Chocolate Chips
- 1 tsp (5 mL) baking soda
- 1/2 cup (125 mL) butter
- 1 tsp (5 mL) vanilla extract
- 1 egg

Directions

1. Heat oven to 350°F (180°C).
2. Cream butter, sugars, egg, and vanilla together until light in texture.
3. Combine flour, baking soda, and salt. Add to creamed mixture; mix well.
4. Stir in chocolate chips.
5. Drop by spoonfuls onto baking sheet.
6. Bake in centre of preheated oven for 9 to 14 minutes or until light golden. Cool 10 minutes, then transfer to racks and cool completely.

Yields: 2 dozen cookies

Instructions: Have members use the above chocolate chip cookie recipe 3 different times, making a change in an ingredient or method each trial. Be sure they accurately record the changes to each unique cookie recipe. A prediction and an explanation or reasoning should be stated prior to baking. During and following baking, observe and explain the effects of the changes to the recipe. Also, rate the tastiness of each cookie. The following pages include information about the effects of the cookie making process that can be shared with members. Watch this video with your members https://www.youtube.com/watch?v=n6wpNhyreDE.

Fat such as butter, margarine, shortening, and oil contributes to the flavor and chewiness of the cookies. Increasing fat leads to chewy cookies, while decreasing fat produces crunchier cookies.

Sugar acts in sweetening, tenderizing, and moisture retention and controls how much the cookie spreads during baking. Increasing the amount of sugar can lead to greater spread, while decreasing the amount of sugar can decrease spread. White sugar yields crispy cookies and brown sugar results in chewy cookies. Often a combination of sugars is used.

Flour controls rise and provides structure as a stabilizer and thickener. A thick tasteless cookie results from too much flour. Too little flour will produce a cookie without shape. You may use all-purpose flour or cake flour depending on the texture you desire.

Rising Agents/Leaveners include baking soda and baking powder. Baking soda increases browning and dough spreads into a flatter cookie. To be active, baking soda requires another acidic ingredient such as sour cream, lemon juice, or buttermilk. Baking powder yields a puffier cookie and has a built in acid.
**Binding Agents** are the liquid content that holds the cookie together. Common binding agents include eggs, milk, honey, and fruit juice. Variations in eggs can affect the characteristics of the cookie that is produced. As more eggs are used in the dough, cookies will rise more and spread less. Using only egg whites will yield crispier cookies and using only eggs yolks will yield chewier cookies.

Some proportions of ingredients should remain constant relative to each other in cookie recipes. Generally, the amount of sugar is equal to the amount of fat. Most recipes will have less than 1/4 cup (60 mL) difference. The amount of flour is often twice the amount of fat. Rising agents can be based on the liquid content or the flour content. Often, a recipe includes 1/2 tsp (2.5 mL) for every cup of liquid or 1 tsp (5 mL) of baking powder for every cup (250 mL) of flour.

**Dig it!**

- After all the taste testing, review the importance of science to bakers and chefs.
- Ask the members what ingredient or method had the greatest effect on the success of the recipe.
- Help members take photos of their cookies to display in their project books.
In the Member Manual

Skill Builder 1: The PEOE Inquiry Technique

Andy Says...
Understanding science is the key to successful baking. Everyone loves chocolate chip cookies. Many factors will affect how tasty your chocolate chip cookies are.

Dream it!
Describe the characteristics of a poor and a delicious chocolate chip cookie.

- Poor Chocolate Chip Cookie
- Delicious Chocolate Chip Cookie

Do it!

The Perfect Chocolate Chip Cookie
Baking often seems like an art. Actually a lot of chemistry is involved. Bakers use the PEOE technique to improve their end product. A good scientist makes predictions of what will happen when they change the recipe. Taking a moment to think about what may happen and to explain what can help a chef avoid disaster can lead to delicious dishes. It is also important that you observe the product as it is baking and once it is finished. A chef must explain what went wrong in an unsuccessful attempt or identify a secret ingredient or method when a wonderful product results.

A basic chocolate chip cookie recipe is included on the following page. Use this chocolate chip cookie recipe 3 different times, making a change in an ingredient or method each trial. Record all differences between recipes on the chart below the recipe. It is important that you note your methods and are precise in your measurements. Once you find your delicious cookie recipe you will want to make them again. It is important that you record your revised recipe carefully so you can make them again.
Chocolate Chip Cookies

Ingredients
- 1 cup (250 ml) all-purpose flour
- 1 tsp (5 ml) baking soda
- 1/4 tsp (1 ml) salt
- 1/4 cup (50 ml) granulated sugar
- 1/2 cup (125 ml) light brown sugar
- 1/2 cup (125 ml) chocolate chips
- 1 tsp (5 ml) vanilla extract
- 1 egg
- 1/2 cup (125 ml) butter
- 1 tsp (5 ml) baking soda
- 1 cup (250 ml) all-purpose flour

Directions
1. Heat oven to 350°F (180°C).
2. Cream butter, sugars, egg, and vanilla together until light in texture.
3. Combine flour, baking soda and salt. Add to creamed mixture; mix well.
4. Stir in chocolate chips.
5. Drop by spoonfuls onto greased baking sheet.
6. Bake in centre of preheated oven for 9 to 14 minutes or until light golden. Cool 10 minutes, then transfer to racks and cool completely.

Your leader will describe the purpose of each ingredient and the effects of increasing or decreasing that ingredient. You may also wish to view the following video to better understand the science behind cookies by visiting [link].

Some variations may include:
- amount of flour
- amount of sugar
- amount of baking powder/soda
- egg white, egg yolk, or both
- type of sugar
- number of chocolate chips
- mixing method
- type of pan
- cooking time
- cooking temperature
- temperature of butter
- temperature of dough

<table>
<thead>
<tr>
<th>Cookie Trial</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predict</td>
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</tr>
<tr>
<td>Explain</td>
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<td>Observe</td>
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<tr>
<td>Explain</td>
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</tr>
<tr>
<td>Rating /10</td>
<td>5</td>
<td></td>
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</tbody>
</table>

Andy's Fun Fact
Chocolate chip cookies were first created in the 1930's by Ruth Wakefield who ran the Toll House restaurant in Whitman, Massachusetts. It grew to be the most popular dessert in the USA.

Dig it!
Why is science important to bakers and chefs?

Did you bake perfect chocolate chip cookies?

What ingredient or method had the greatest effect on the success of the cookies?

Include a picture of your cookies.

More Eats!
Manitoba's Food Development Centre in Portage la Prairie is a one-stop shop for food research and product development. They are an internationally recognized centre of excellence that brings new and innovative products to market. The Food Development Centre helps anyone with a great idea with access to world-class expertise, pilot plant facilities and research. Clients range from first-time entrepreneurs to global corporations. Check them out at [link]
Skills Checklist

- Identify the different phases of matter
- Explain why matter changes states
- Describe freezing and melting points

Dream it!

Background for Leaders

All matter is made of tiny particles. As a substance warms up with the application of heat, each particle gains more energy and moves around more quickly. The particles of a solid have relatively low levels of energy, are tightly packed, and maintain the shape of the object. The higher energy level of a liquid causes its particles to spread out and take up more space. Liquids are pourable and take the shape of their container. The highest energy level of a gas causes it to spread out further. Gases occupy the entire space of their container or the atmosphere. Water changes from liquid water to gaseous vapour through evaporation at approximately 100°C, the boiling point of water. Gaseous water vapour will eventually cool and condense as liquid water again. Liquid water changes to solid ice at 0°C, its freezing point. When the energy of the water molecules is reduced to 0°C, water will freeze. The melting point for water is also 0°C. At this point, molecules in ice regain enough energy to become flowing water. Water molecules can change states many times each day and each year.

Important Words

Help members define the following words and look for members using this vocabulary in their discussions. A few strategies you can use include;

- Teach synonyms by providing a synonym members know.
- Also, teach antonyms. Not all words have antonyms, but thinking about opposites requires the members to evaluate the critical attributes of the words in question.
- Provide non-examples. Similar to using antonyms, providing non-examples requires students to evaluate a word’s attributes. Invite students to explain why it is not an example.

<table>
<thead>
<tr>
<th>Solid</th>
<th>A substance with tightly packed, low energy particles.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid</td>
<td>A pourable substance with less tightly packed, high energy particles.</td>
</tr>
<tr>
<td>Gas</td>
<td>A substance in a physical state in which it does not resist change of shape and will expand indefinitely to fill any container.</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>The temperature or energy level at which a liquid substance becomes solid.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12+

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.
Preparing for Success
• Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies
• What items in this room are solid? Liquid? Gas? Water can be all three. This activity explores how this occurs.

The Amazing Water Experiment!

**Ingredients**
- Zip lock bag
- ice cubes
- antacid tablets

**Directions**
1. Place a handful of ice cubes in the zip lock bag and seal it.
2. Using your hands or other methods melt the ice to a liquid state. How long did this take?
3. Add 2 antacid tablets to the bag and seal it. Observe what happens. What does the gas do?
4. Continue to add antacid tablets to the bag. See how many you can add until the bag explodes. **Caution:** Do this activity in a sink or outdoors. What would happen if you used warm water instead of cold.

Do it!

**Ice Cream in a Bag**

**Time Required:** 20 minutes

**Safety Considerations:** Wear mittens to avoid frostbite.

**Ingredients and Materials (Yields: 3-4 servings)**
- 1/2 cup (125 mL) sugar
- 1 cup (250 mL) half and half
- 1 cup (250 mL) whole milk
- 1/2 tsp (3 mL) vanilla extract
- 1/2 cup (125 mL) coarse salt
- Enough ice to fill large Zip lock bag half full
- 1 large Zip lock bag
- 1 medium Zip lock bag
- mittens

**Directions**
1. Mix sugar, half and half, milk, and vanilla in medium Zip lock bag.
2. Tightly seal the bag and tape over the opening with duct tape.
3. Fill the large Zip lock bag half full with ice. Add salt.
4. Place the small bag in the ice mixture inside the large bag so that it is surrounded by ice. Tightly seal the large bag.
5. Wearing mittens, shake the bag vigorously for 5 minutes.
6. Remove the small bag and enjoy!

**Notes:** In this experiment, liquid milk/cream changes to solid ice cream. The ice surrounding the cream mixture absorbs heat from the cream and from the surrounding air. As the energy is transferred from the cream to the ice, the ice begins melting and the molecules in the cream mixture begin moving more slowly. Adding salt to ice lowers the freezing/melting point of the ice. This means that more energy is required to melt the ice and the ice becomes even colder than it was before. As the ice absorbs more heat from its environment, the cream mixture becomes colder and its particles move so slowly that they form solid ice cream.
Butter

Time Required: 20 minutes

Ingredients and Materials
- 50 mL heavy whipping cream
- Small clear container
- 1/4 tsp (1 mL) salt

Directions
1. Allow the cream to warm to room temperature (5 hours).
2. Add cream to container. There should be an air space in the container. Seal the lid tightly.
3. Shake vigorously for several minutes.
4. When a hardened ball forms, pour off the liquid buttermilk.
5. Keep shaking until no more liquid separates.
6. Add salt.
7. Enjoy on a slice of bread or crackers. Be sure to taste the buttermilk as well.

Notes: Solid butter is formed from liquid cream. As you shake the cream, the fat particles will clump together. First, whipped cream will form. Further shaking will cause the liquid (buttermilk) to separate from the solid fat. The butter making process works best with cream that has warmed to room temperature. Warmer molecules are moving faster and the fat will clump together more quickly. The shaking process can take between 5 and 20 minutes depending on the temperature and fat content of the cream mixture. Refrigerate and consume before rancid; up to 1 week storage.

Dig it!

Discuss the following with the members:
- How does temperature affect the movement of particles?
- How are ice cream and butter similar?
- How are the processes of making butter and ice cream different?

Leader’s Notes
In the Member Manual

Skill Builder 2: Solid, Liquid, Gas

Andy Says...
Food can be solid or liquid. Some foods such as milk can be converted into solid butter or ice cream. These treats are the result of changes in solids, liquids, and gases.

SKILLS CHECKLIST
- Identify the different phases of matter
- Explain why matter changes states
- Describe freezing and melting points

Important Words
Watch for these important words throughout this Skill Builder: Solid, Liquid, Gas Freezing Point

Dream it!
What items in this room are a solid, a liquid or a gas? Water can be all three. In this activity you will explore how this occurs.

The Amazing Water Experiment!

Ingredients
- Zip lock bag
- Ice cubes
- Antacid tablets

Directions
1. Place a handful of ice cubes in the zip lock bag and seal it.
2. Using your hands or other methods melt the ice to a liquid state. How long did this take?
3. Add 2 antacid tablets to the bag and seal it. Observe what happens. What does the gas do?
4. Continue to add antacid tablets to the bag. See how many you can add until the bag explodes. What would happen if you used warm water instead of cold.

Do it!

Ice Cream in a Bag

Ingredients and Materials (Yields: 3-4 servings)
- 1/2 cup (125 mL) sugar
- 1 cup (250 mL) half and half cream
- 1 cup (250 mL) whole milk
- 1/2 tsp (2.5 mL) vanilla extract
- 1/2 cup (125 mL) coarse salt
- Enough ice to fill large Zip lock bag half full
- 1 large Zip lock bag
- 1 medium Zip lock bag
- Mittens

The cream freezes because

Directions
1. Mix sugar, half and half cream, milk, and vanilla in medium Zip lock bag.
2. Tightly seal the bag and tape over the opening with duct tape.
3. Fill the large Zip lock bag half full with ice. Add salt.
4. Place the small bag in the ice mixture inside the large bag so that it is surrounded by ice. Tightly seal the large bag.
5. Wearing mittens, shake the bag vigorously for 5 minutes.

More Eats!
Cornell Creme handcrafts delicious artisan ice cream using milk and cream straight from their family farm Cornell Dairy near Anola, Manitoba. It is the first Manitoba dairy producer-processor in Manitoba. Their flavours include: natural vanilla bean, raspberry white chocolate, lemon meringue, velvety chocolate truffle, malty ale pale and strawberry. Visit their website at http://cornellcreme.com/

Butter

Ingredients and Materials
- 1/4 cup (60 mL) heavy whipping cream
- Small clear container with a lid
- 1/4 tsp (1 mL) salt

Directions
1. Allow the cream to warm to room temperature (5 hours).
2. Add cream to container. There should be an air space in the container. Seal the lid tightly.
3. Shake vigorously for several minutes.
4. When a hardened ball forms, pour off the liquid buttermilk.
5. Keep shaking until no more liquid separates.
6. Add salt.
7. Enjoy on a slice of bread or crackers. Be sure to taste the buttermilk as well.

predict that I will need to shake the cream for ____ minutes to make butter.

I shook the cream for _____ minutes.

The butter becomes solid because ________.

Andy Says...
Butter was first manufactured over 4000 years ago. Today, the Notre Dame Creamery in Notre Dame de Lourdes, Manitoba makes and sells butter to Manitobans. http://www.notredamecreamery.com/

Andy Says....
Unsalted butter is used in baking as it is easier to add salt than it is to estimate the amount of salt in the butter. Salted butter is used in cooking and contributes as a small amount of seasoning. Salted butter also has a slightly longer shelf life.

Dig It!
How does temperature affect the movement of particles?
How are ice cream and butter similar?
How are the processes of making butter and ice cream different?
Skill Builder 3: Microorganisms

Skills Checklist
- Understand where and how bacteria grow
- Explain why incubation is important

Dream it!

Background for Leaders

Microorganisms are microscopic living things such as bacteria, fungi, and algae. Our bodies are full of bacteria; the bacteria in our body collectively weighs 4 pounds. Some bacteria such as Listeria, E. coli, Salmonella, and Clostridium can cause food borne illnesses, but many bacteria are beneficial to our bodies. Most antibiotics are made from bacteria. Probiotic bacteria, such as Lactobacillus acidophilus in yogurt, live in our intestines and help improve digestion. Optimal conditions for bacterial growth include warm temperature, moisture, oxygen, and a relatively neutral environment. Bacteria multiply rapidly as a culture. During experiments, the success of bacterial growth depends on the availability of optimal conditions which are often provided through incubation with the use of an incubator, a device which maintains optimal conditions for cell growth. The entire process of making yogurt will take nearly 24 hours.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>A microscopic living thing such as bacteria, fungi, and algae.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incubation</td>
<td>Maintaining optimal temperature and humidity for cell growth.</td>
</tr>
<tr>
<td>Culture</td>
<td>A method for growing a group of microorganisms.</td>
</tr>
<tr>
<td>Probiotic</td>
<td>A group of microorganisms believed to provide health benefits when consumed.</td>
</tr>
</tbody>
</table>

Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies

- What do you already know about microorganisms such as bacteria?
- What do bacteria need to survive?

Some bacteria such as Listeria, E. coli, Salmonella and Clostridium can cause food borne illnesses. When handling food the first step is washing your hands. Dirty hands are a big part of how “bad” bacteria spreads and makes people sick.

Explore the best way to wash your hands before cooking by borrowing the Glow Germ kit from your local MAFRD office or contact 204-726-6613.

GLO-GERM KIT – This resource demonstrates the presence of germs and shows effective hand washing and food handling techniques using either oil or powder and an ultra violet light.

How well do you wash your hands?  
What parts do you miss?  
How long should you wash your hands before working with food?

Do it!

Yogurt

Time Required: about 24 hours

Ingredients and Materials
- 2 L whole milk
- 1/4 cup (60 mL) plain yogurt (without sugar)
- Large glass jar

Yield: 8 cups

Directions
1. Warm whole milk in saucepan until baby bottle warm.
2. Add yogurt and stir.
3. Pour into large glass jar and put on lid.
4. Place in unheated oven with light on for 16-24 hours.
5. Strain through layers of cheesecloth or a thin cotton dish towel until desired consistency is reached (4 hours to make Greek yogurt).
6. Sweeten with jam, honey, or fruit.

Notes: Heating the milk causes the proteins in the milk to be denatured (separated) so the proteins will set together rather than form curds. The heat from the light in the oven will provide conditions similar to incubation and will allow the bacterial culture to grow. The bacteria from the original 1/4 cup (60 mL) of yogurt will feed on the lactose (milk sugar) and will produce lactic acid that will cause the milk to thicken. The bacteria and the acidity of the solution will also contribute to the flavour and aroma and will inhibit growth of undesirable organisms. Yogurt has a natural sourness and you may wish to sweeten the final product with jam, honey, or fruit.

To produce Greek yogurt, strain the yogurt for approximately 4 hours to remove more of the whey (liquid). Greek yogurt contains twice the protein and half the sugar in the same number of calories as regular yogurt.

Yogurt is a healthy alternative to ice cream. Yogurt is rich in protein, calcium, vitamin D, riboflavin, vitamin B6, and vitamin B12. It may reduce high blood pressure, too. Yogurt contains much less lactose (milk sugar) and lasts longer than milk.
Dig it!

Discuss the following questions with the members:
• What are some features of microorganisms?
• Why is incubation of the bacteria important in yogurt making?
• How is Greek yogurt different than regular yogurt?
In the Member Manual

Skill Builder 3: Microorganisms

Andy Says...
Creepy, crawly microorganisms can be disgusting and some are harmful to our health. You wouldn’t eat moldy bread. Some bacteria are the key ingredients to the nutrition of our foods.

SKILLS CHECKLIST
- Understand where and how bacteria grow
- Explain why incubation is important

Important Words
Watch for these important words in this Skill Builder:
Microorganism, Incubation, Culture, Probiotic

Dream it!

Microorganisms are living things such as bacteria, fungi and algae. Our bodies are full of bacteria. The bacteria in our bodies weigh approximately 4 pounds. A bacteria called Probiotic lives in our intestines and helps us to digest our food. Foods that we eat with “good” bacteria include such things as yogurt and blue cheese. Can you think of any others?

Some bacteria such as Listeria, E coli, Salmonella and Clostridium can cause food borne illnesses. When handling food the first step is washing your hands. Dirty hands are a big part of how “bad” bacteria spreads and makes people sick.

Explore the best way to wash your hands before cooking by borrowing the Glow Germ kit from your local MAFRD office or contact 204-726-6613.

GLO-GERM KIT – This resource demonstrates the presence of germs and shows effective hand washing and food handling techniques using either oil or powder and an ultra violet light.

How well do you wash your hands?
What parts do you miss?
How long should you wash your hands before working with food?

Andy Says...
Probiotic bacteria, such as Lactobacilli acidophilus, live in the intestines and improve digestion. They can provide antimicrobial action against Listeria, Salmonella, E. coli and other harmful bacteria.

This Builder will take 2 Days in a row to complete!

Do it!

Yogurt

Ingredients and Materials (Yield: 8 cups)
- 8 cups (2 L) whole milk
- 1/4 cup (60 ml) plain yogurt (without sugar)
- Large glass jar with a lid

Directions
1. Warm whole milk in saucepan until baby bottle warm.
2. Add yogurt and stir.
3. Pour into large glass jar and put on lid.
4. Place in unheated oven with light on for 16-24 hours.
5. Strain through layers of cheesecloth or a thin cotton dish towel until desired consistency is reached (4 hours to make Greek yogurt).
6. Sweeten with jam, honey, or fruit.

Andy Says...
The word ‘yogurt’ comes from the Turkish word ‘yogurt’ meaning ‘to thicken’. The oldest yogurts were produced almost 4500 years ago by wild bacteria. Ancient Indian records refer to yogurt and honey as ‘the food of the gods’.

Greek yogurt, also called strained yogurt or yogurt cheese, has been strained to remove its whey (liquid). Straining also removes some of the sugar. Greek yogurt is thicker in consistency and sour in comparison to regular yogurt.

Andy Says...

Dig it!

What are some features of microorganisms?

Why is incubation of the bacterial culture important in yogurt making?

How is Greek yogurt different than regular yogurt?

More Eats!
For more yogurt recipes go to www.allrecipes.com
Skill Builder 4: Coagulation

Skills Checklist

- Explain why coagulation is important in cheese making
- Name different types of cheese

Dream it!

Background for Leaders

Cheese was first produced more than 9000 years ago in the Middle East. It was likely produced by accident when travellers stored milk in a pouch made from an animal stomach. Later, people travelled from the Middle East to Europe and cheese making began there too. Cheese is an easily transportable and preserved form of milk. Cheese was, and still is, made from milk of cattle, goats, sheep, and other animals.

Cheeses are classified by their age, country of origin, fat content, dairy content, manufacturing methods, texture, and other special characteristics.

Milk consists of two proteins, casein and whey. 80% of milk protein is casein. Cheese is formed as a bacterial culture converts the lactose (milk sugar) into lactic acid. The addition of an acid such as lemon juice or vinegar will cause the casein proteins to separate and reattach in a new configuration. The tangling of proteins is called coagulation and causes the milk to curdle. Rennet, an enzyme from the stomach of calves, has also been used to coagulate milk in cheese making. The curdled mixture is strained and pressed through cheesecloth to separate the curds from the whey (liquid protein solution).

Important Words

Help members define the following words and look for members using this vocabulary in their discussions. Have members describe the words in terms of their experiences to solidify their knowledge.

<table>
<thead>
<tr>
<th>Protein</th>
<th>A chain of many amino acids found in foods such as meat, eggs, milk, and beans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulate</td>
<td>The addition of acid causing proteins to tangle into curds.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12+

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies

- What types of cheese do you enjoy?
- What foods taste better with cheese?
- Discuss the different types of cheese and where it comes from.

Cheese Around the World

Italy- Mozzarella, Romano, Parmesan
India- Paneer
Greece- Feta
Switzerland - Swiss
Denmark- Havarti
United States of America- Colby, Cream Cheese, Monterey Jack
Canada- Oka
England- Cheddar
Netherlands- Gouda
France- Brie

Note: The Swiss began making Emmental cheese. Upon its arrival in North America, it became known as Swiss cheese.

In scientific terms, adding an acid to cause proteins to tangle into curds is called coagulation. In the kitchen, it is often called curdling. Adding an acid to milk will result in curds and whey. Curdling is a good thing when making cheese. It is considered a bad thing when making sauces and custards.

Curdle Milk

**Ingredients**

- 1 1/2 cup (375 mL) whole or 2% milk
- vinegar
- lemon juice
- orange juice
- apple juice
- mineral water
- 5 microwavable small bowls

**Directions**

1. Put 1/4 cup ((60 mL) milk in each bowl
2. In 1st bowl add 1 tsp (5 mL) of vinegar, in 2nd add 1 tsp (5 mL) of lemon juice, in 3rd add 1 tsp (5 mL) of orange juice, in 4th add 1 tsp (5 mL) of apple juice and in the 5th add 1 tsp (5 mL) of mineral water.
3. Stir each bowl and observe what happens.
4. What was most successful? What was the least?
5. Heat the Lemon juice bowl for a few seconds in the microwave to warm up the milk. What do you observe?

Note: When you add heat the curdling process happens faster.
Do it!

**Fromage blanc**

**Time Required:** 5 hours

*Ingredients*
- 4 cups (1 L) whole milk
- 1 cup (250 mL) active culture buttermilk
- 6 tsp (30 mL) lemon juice or vinegar
- 3/4 tsp (4 mL) salt

*Directions*
1. Heat milk and salt until steaming (about 170 F or 75 C).
2. Remove from heat. Add buttermilk. Add lemon juice by the teaspoon until milk curdles.
3. Stir very briefly to combine. Let curdled milk stand 2 hours.
4. Pour into strainer lined with 4 layers of cheesecloth. Scrape down sides and let stand 2 hours.
5. Tie cheesecloth into a pouch and hang from wooden spoon across pot until excess liquid has drained.
6. Use immediately or refrigerate up to 2 weeks.

**Note:** 1 L of milk will yield approximately 1 cup (250 mL) of cheese. Milk with a higher fat content will yield more cheese. Milk that is heated to a higher temperature will result in a firmer cheese.

Dig it!

What is coagulation? What causes milk to curdle?
What part of milk is retained in cheese?
Was your cheese making activity successful? What would you change next time?

**Leader’s Notes**
Skill Builder 4: Coagulation

Andy Says...
Cheese can make anything taste better. There are hundreds of cheeses to choose from around the world. Cheese is made by changing a liquid to a thickened mass.

Skills Checklist
- Explain why coagulation is important in cheese making
- Name different types of cheeses

Important Words
Watch out for these important words in this Skill Builder: Protein, Coagulate

Dream it!
In scientific terms, adding an acid to cause proteins to tangle into curds is called coagulation. In the kitchen, it is often called curdling. Adding an acid to milk will result in curds and whey. Curdling is a good thing when making cheese. It is considered a bad thing when making sauces and custards.

Curdle Milk
Ingredients
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- 5 microwavable small bowls

Directions
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2. In 1st bowl add 1 tsp (5 ml) of vinegar, in 2nd add 1 tsp (5 ml) of lemon juice, in 3rd add 1 tsp (5 ml) of orange juice, in 4th add 1 tsp (5 ml) of apple juice and in the 5th add 1 tsp (5 ml) of mineral water.
3. Stir each bowl and observe what happens.
4. What was most successful? What was the least?
5. Heat the lemon juice bowl for a few seconds in the microwave to warm up the milk. What do you observe?

Andy Says...
Bothwell Cheese is made in New Bothwell Manitoba. Everyday the cheese plant produces 15,000 kg of cheese. Bothwell Cheese make more than two dozen varieties using locally sourced ingredients and processes. They even sell cheese curds.

Do it!

Fromage blanc
Ingredients
- 4 cups (1 L) whole milk
- 1 cup (250 ml) active culture buttermilk
- 6 tsp (30 ml) lemon juice or vinegar
- 3/4 tsp (4 ml) salt
- Cheesecloth

Directions
1. Heat milk and salt until steaming (about 170°F or 75°C).
2. Remove from heat. Add buttermilk. Add lemon juice by the teaspoon until milk curdles.
3. Stir very briefly to combine. Let curdled milk stand 2 hours.
4. Pour into strainer lined with 4 layers of cheesecloth. Scrape down sides and let stand 2 hours.
5. Tie cheesecloth into a pouch and hang from wooden spoon across pot until excess liquid has drained.
6. Use immediately or refrigerate up to 2 weeks.

Predict what would happen if the milk was not heated to the correct temperature.

Andy Says...
A 'cheesemonger' is a tradesperson who specializes in cheese and butter.

From Farming History...
What colour is your favourite type of cheese? Cheese used to appear in different colours depending on the time of year it was produced. In spring and summer, cattle feed on fresh grass. The beta-carotene and vitamin D they consumed resulted in a more desirable yellow cheese. In the fall and winter, cattle fed on hay and pale white-yellow cheeses were produced. Now, most cheeses are coloured with dyes.

Dig it!

What is coagulation? What causes the milk to curdle?

What part of milk is retained in cheese?

Was your cheese making activity successful? What would you change next time?

More Eats!
Visit the Dairy Farmers of Manitoba website for more ideas and recipes.
https://www.milk.mb.ca/dairy-recipes/
Skill Builder 5: Fermentation

Skills Checklist
- Use proportions
- Understand the process of fermentation
- Describe other food products of fermentation

Dream it!

Background for Leaders
Sourdough bread originated in Ancient Egypt. The long fermentation of the dough allows *Lactobacilli* bacteria to produce lactic acid and a sour taste. The sourdough culture of wild yeast and *Lactobacilli* bacteria is maintained and propagated. The bacteria and yeast form a stable culture within a mixture of flour and water through a biological symbiosis. Unsterilized flour contains wild yeast. *Lactobacilli* bacteria are found in the air surrounding us.

A ‘sourdough starter’ begins with flour and water. It is best to make and maintain a starter in a ceramic crock or glass jar with an opening wide enough to stir with a spoon. The container may be covered loosely with material such as cheesecloth and a rubber band. Wheat and flour are converted from starch to maltose sugars to glucose sugars. Bacteria are able to ferment some sugars that yeasts cannot metabolize. By-products of this process include carbon dioxide, ethanol, and lactic acid. Carbon dioxide provides the biological leavening properties and growth of the starter. The starter requires food, water, oxygen, and time to digest. Some starter recipes include a package of dry active yeast to speed up the process.

To maintain the starter at room temperature it must be fed. Feedings include discarding half of the starter and feeding an amount proportional to the amount of starter than is retained. Each feeding will double the volume of the starter and should consist of equal parts of water and flour by weight. This equates to approximately 1 part water to 2 parts sifted flour. Continue feeding it. A good starter should double itself between feedings. Don’t use your starter until it is more than one week old. The starter is ready to use when there are small bubbles all over and on top of the starter. It will also be producing a sour-fruity aroma.

The starter may be stored in the refrigerator to reduce the number of feedings required. Remove it from the refrigerator two days prior to baking and feed regularly. Upon use, allow the remaining starter to reach optimal leavening power at room temperature before refrigerating. While refrigerated, feed occasionally (at least once a month) to keep the population of yeast and bacteria healthy.

A thin starter will work too quickly and will not have enough strength to rise on its own. A very thick starter produces more flavour, has more strength, is more active, and is more tolerant of missed feedings. A medium starter is easy to work with.

Sourdough yeast is less vigorous and takes longer to leaven. A warm environment will allow a faster and higher rise along with more acid development. In the presence of *Lactobacilli*, yeast produces twice the amount of carbon dioxide which leads to weaker gluten and more dense bread. Because sourdough takes a long time to rise, it is generally unsuitable in bread machines.
Important Words

Here are some examples of how to use the “important words” to increase the members understanding:
• Ask members to form a mental image of the new word.
• Get members to use a dictionary and show them the range of information it provides.
• Have members describe (rather than define) the new word in terms of their experiences.

<table>
<thead>
<tr>
<th><strong>Starter</strong></th>
<th>A mixture of flour, water, yeast, and bacterial culture that is maintained to be used as a leavening agent in bread.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sourdough</strong></td>
<td>A type of bread dough that is allowed to ferment to develop a sour flavour prior to baking.</td>
</tr>
<tr>
<td><strong>Proportion</strong></td>
<td>A measurement compared to another measurement; a ratio.</td>
</tr>
</tbody>
</table>

Age Considerations
• 12+

Thinking Ahead
• What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
• Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in

Activating Strategies

Balloon Blow-Up

Time Required: 1.5 hours

Ingredients/Supplies
• Watch
• 2 balloons
• 2 small plastic pop bottles
• Liquid measuring cup
• 3 glass containers large enough to hold at least 3 cups (750 mL) of liquid and the pop bottle
• Mixing spoon
• 1 package of dry yeast
• 50mL of sugar
• Food thermometer
• 2 cups (500 mL) of room temperature water (21°C/70°F)
• 2 cups (500 mL) of warm water (43°C/109°F to 49°C/120°F)
• 2 cups (500 mL) of ice water (below 4°C/40°F)

Directions on the following page.
Instructions

- If you have a large group you may want to assign volunteers for each step or have small groups each completing the experiment.
- Have members fill in their predictions. An example might be: I predict that the ice water will make the balloon bigger than the warm water will. This is not the result but anything is correct in a prediction.
- Have the members fill a container with 2 cups (500 mL) of room temperature water (make sure to use the food thermometer to check).
- Have the members dissolve the sugar and yeast into the room temperature water. Mix well.
- Have the members pour half of the solution into each of the pop bottles
- Quickly stretch a balloon over the top of each of the pop bottles.
- Place 1 bottle into a container – add 2 cups of warm water in the bottom of the container – make sure it covers the yeast solution.
- Measure the temperature with the thermometer.
- Place 1 bottle into a container – add 2 cups of ice cold water in the bottom of the container – make sure it covers the yeast solution.
- Measure the temperature with the thermometer.
- Have the members observe the balloons at 5, 10 and 30 minutes. They may wish to measure the circumference of the balloon with a flexible ruler.
- Record their findings and observations. Discuss findings with the group.

Do it!

Friendship Bread Starter

Ingredients and supplies

- 1 package of active dry yeast
- 1/4 cup warm water (43°C - 49°C)
- 1 cup (250 mL) white sugar
- 1 cup (250 mL) all purpose flour
- 1 cup (250 mL) milk
- Gallon zip lock bag

Day 10 Directions:

1. Pour the entire bag into a non-metal bowl.
2. Add 1 1/2 cup (375 mL) each of flour, sugar and milk
3. Measure out equal portions of 1 cup (250 mL) each into 4-7 gallon zip lock bags.
4. Keep two bags for yourself. Bake a loaf of friendship bread with one. With the second bag begin the 10 steps over again starting on day 1. You can keep starter for many years doing this. Every 10 days you will be baking bread.
5. Give the other bags to friends along with the 10 starter steps and a recipe to make Friendship Bread.

Time Required: 10 days

Directions

1. Dissolve yeast in water, let stand 10 minutes.
2. Combine sifted flour and sugar together. Mix well so flour is not lumpy.
3. Slowly stir in milk and yeast mixture. Mix well. Put starter in a gallon zip lock bag (Do not refrigerate). Watch the starter very closely at first and let the air out of the bag as needed. It will bubble and ferment a lot the first day. This is day 1. Mark the date on the bag. Follow instruction for the next 9 days.

Day 2
- Let air out and mash the ingredients in the bag.
Day 3
- Let air out and mash the ingredients in the bag.
Day 4
- Let air out and mash the ingredients in the bag.
Day 5
- Let air out and mash the ingredients in the bag.
Day 6
- Add to the bag: 1 cup (250 mL) each of flour, sugar and milk. Mash the ingredients in the bag.
Day 7
- Let air out and mash the ingredients in the bag.
Day 8
- Let air out and mash the ingredients in the bag.
Day 9
- Let air out and mash the ingredients in the bag.
Day 10
- Follow the Day 10 directions

Check out the video at:
https://www.youtube.com/watch?v=iy8Jpc78Xoc
**Friendship Bread**

*Ingredients*
- 1 cup (250 mL) starter
- 1/4 (60 mL) cup oil
- 2 tsp (10 mL) vanilla
- 4 eggs
- 2 cups (500 mL) flour
- 1 tsp (5 mL) baking soda
- 1 tsp (5 mL) baking powder
- 102 gram package instant vanilla pudding

*Topping*
- 1/4 cup (60 mL) brown sugar
- 4 tsp (20 mL) cinnamon

*Directions*
1. Add all ingredients to starter. Mix well
2. Mix together brown sugar and cinnamon.
3. Grease 2 loaf pans.
4. Pour 1/4 of batter into each pan.
5. Sprinkle 1/4 of topping in each loaf.
6. Add remaining batter and sprinkle remaining topping.
7. Swirl knife through batter to give a marbled effect.
8. Bake 1 hour in 325 °F oven or until baked through.

---

**Dig it!**

- Why are bacteria important in the production of our food?
- Name some other foods that are produced by fermentation. Such foods include bread, wine, beer, cider, sauerkraut, dry sausages, yogurt, pickled foods, chocolate, vanilla, and Tabasco.
- What other foods could you make with your starter? Try it. A good website for suggestions is [http://www.friendshipbreadkitchen.com](http://www.friendshipbreadkitchen.com).

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**Leader’s Notes**
In the Member Manual

Skill Builder 5: Fermentation

**Andy Says...**
Let's get started making a yeast starter and participating in the fermentation process to provide biological leavening.

**SKILLS CHECKLIST**
- Use proportions
- Understand the process of fermentation
- Describe other food products of fermentation

**Important Words**
Watch for these important words in this Skill Builder: Starter, Sourdough, Proportion

**Fun Fact**
A sourdough starter is also referred to as a mother, pre-ferment, levain, or head. The starter is composed of flour, water, and *Lactobacillus* bacteria.

**Do it!**

**Friendship Bread Starter**

**Ingredients and supplies**
- 1 package of active dry yeast
- 1/4 cup warm water (43°C - 49°C)
- 1 cup (250 mL) white sugar
- 1 cup (250 mL) all purpose flour
- 1 cup (250 mL) milk
- Gallon zip lock bag

**Day 10 Directions:**
1. Pour the entire bag into a non-metal bowl.
2. Add 1 1/2 cup (375 mL) each of flour, sugar, and milk.
3. Measure out equal portions of 1 cup (250 mL) each into 4-7 gallon zip lock bags.
4. Keep two bags for yourself. Bake a loaf of friendship bread with one. With the second bag, begin the 10 steps over again starting on day 1.
5. Give the other bags to friends along with the 10 starter steps and a recipe to make Friendship Bread.

**Prediction Table**
I predict that the warm / room temperature / cold (circle one) will make the balloon rise most, then the warm / room temperature / cold (circle one) water will.

**Results Table**

<table>
<thead>
<tr>
<th>Time</th>
<th>Ice Water</th>
<th>Warm Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 mins</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions**
1. Fill in the prediction table.
2. Dissolve the yeast in 1 1/4 cups (375 mL) warm water (21°C).
3. Pour half of the solution into each of the pop bottles.
4. Quickly stretch a balloon over the top of each bottle.
5. Place each bottle into a large glass container.
6. Pour the ice water into one container and the warm water into the other.
7. Record your balloon observations in the results table.

Check out the video at [https://www.youtube.com/watch?v=y88Ipc7Rkco](https://www.youtube.com/watch?v=y88Ipc7Rkco)

**Friendship Bread**

**Ingredients**
- 1 cup (250 mL) starter
- 1 1/4 (60 mL) cup oil
- 2 tsp (10 mL) vanilla
- 4 eggs
- 2 cups (500 mL) flour
- 1 tsp (5 mL) baking soda
- 1 tsp (5 mL) baking powder
- 102 gram package instant vanilla pudding Topping

**Directions**
1. Add all ingredients to starter.
2. Mix well
3. Grease 2 loaf pans.
4. Pour 1/4 of batter into each pan.
5. Sprinkle 1/4 of topping in each loaf.
6. Swirl knife through batter to give a marbled effect.
7. Bake 1 hour in 325 °F or until baked through.

**Dig it!**

Why are bacteria important in the production of food?

Name some other foods that are produced by fermentation?

What other foods could you make with your starter? Try it!

**More Eats**
More recipes can be found at [http://www.friendshipbreadkitchen.com](http://www.friendshipbreadkitchen.com)
Skill Builder 6: Carbonation

Skills Checklist

- Explain the process of carbonation
- Understand why some reactions are bigger than others

Dream it!

Background for Leaders

Carbonation is the process of dissolving carbon dioxide, a molecule consisting of one carbon and two oxygen atoms, in a liquid. Generally, this solution forms under high pressure. When the pressure is released, some carbon dioxide is released, too. This is evident when opening a can of pop.

Important Words

Help members define the following words and look for members using this vocabulary in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Carbon Dioxide</th>
<th>A molecule of one carbon atom and two oxygen atoms produced by yeast fermentation and contributing to the fizziness of a drink.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus Fruit</td>
<td>Fruits high in ascorbic acid (Vitamin C), segmented, and containing juice and pulp.</td>
</tr>
<tr>
<td>Reaction</td>
<td>A process that transforms a set of substances to another.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12+

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

- What carbonated beverages do members enjoy?
- Watch the video How It’s Made Soft Drinks at [https://www.youtube.com/watch?v=Mb9IDNOsHhE](https://www.youtube.com/watch?v=Mb9IDNOsHhE).
Citrus Reaction

Time Required: 20 minutes

Safety Considerations: Carefully cut the fruits in half.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon</td>
<td>1. Cut the fruit into manageable pieces for squeezing.</td>
</tr>
<tr>
<td>Orange</td>
<td>2. Use your sense of smell before you begin experimenting. Compare this observation to the final product.</td>
</tr>
<tr>
<td>Lime</td>
<td>3. Squeeze your fruits into small separate containers. Label each container.</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>4. Add 1/2 teaspoons (2.5 mL) of baking soda to each juice. Stir. Continue adding baking soda 1/2 tsp (2.5 mL) at a time to the juices until the reaction stops.</td>
</tr>
<tr>
<td>Baking soda</td>
<td>5. Also try adding baking soda to a slice of unsqueezed fruit for comparison.</td>
</tr>
</tbody>
</table>

Notes: When the ascorbic acid (Vitamin C) from the fruit contacts the baking soda, bubbling, fizzing carbon dioxide gas is produced.

Do it!

Ginger Ale

Time Required: 5 hours

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 cups (1.5 L) water</td>
<td>1. Fill an 8 cup (2 L) pop bottle with 6 cups (1.5 L) room temperature water.</td>
</tr>
<tr>
<td>3 tbsp (45 mL) lemon juice</td>
<td>2. Add lemon juice, dry active yeast, a small amount of grated ginger root, and white sugar.</td>
</tr>
<tr>
<td>2 tbsp (30 mL) dry active yeast</td>
<td>3. Screw the lid on tight and shake vigorously for 30 seconds.</td>
</tr>
<tr>
<td>Grated ginger root</td>
<td>4. Let sit for 4 hours.</td>
</tr>
<tr>
<td>1 cup (250 mL) white sugar</td>
<td></td>
</tr>
</tbody>
</table>

Notes: By the process of fermentation, yeast feeds on sugar to produce gases such as carbon dioxide gas. This produces the fizzy drink. Yeast will not survive in extreme heat or cold. In this recipe, the lemon juice and ginger root are only for flavouring.
Root Beer Float

Time Required: 20 minutes

Ingredients:
- Vanilla ice cream
- Root beer (or any other soft drink such as Ginger Ale above)

Directions
1. Spoon a scoop or two of vanilla ice cream into a tall glass.
2. Slowly pour root beer into the glass, allowing the foam to rise and recede before adding more root beer.
3. Serve with straws and spoons.

Notes: Foam forms because little bubbles of carbonation sticking to the sides of the ice cream attract other bubbles until the bubbles grow very large and float to the surface. Adding root beer to ice cream will produce more foam than adding ice cream to root beer. Also, ice cream floats to the surface of the drink because the air and fat content in the ice cream make it less dense than the water in the soft drink.

Dig it!

Discuss the following questions with the members:
- How does carbon dioxide form in carbonated beverages?
- Why does foam form on top of a root beer float?
- What will happen to the reaction if you use a greater volume of ingredients?
Skill Builder 6: Carbonation

Andy Says...

Our ancestors made their own soda drinks at home. In this Skill Builder, you will learn about the ingredients and processes involved in making a fizzy drink.

**SKILLS CHECKLIST**
- Explain the process of carbonation
- Understand why some reactions are bigger than others.

**Important Words**
Look for these important words in this Skill Builder:
- Carbon Dioxide
- Citrus Fruit

Dream It!

Carbonation is the process of dissolving carbon dioxide, a molecule consisting of one carbon and two oxygen atoms, in a liquid. Generally this solution forms under high pressure. When the pressure is released, some carbon dioxide is released too. You can observe this when opening a can of soft drink. Check out the video How It's Made Soft Drinks at [https://www.youtube.com/watch?v=Mi6d9D0sXHE](https://www.youtube.com/watch?v=Mi6d9D0sXHE).

**Citrus Reaction**

**Ingredients**
- Lemon
- Orange
- Lime
- Grapefruit
- Baking soda

**Directions**
1. Cut the fruit into manageable pieces for squeezing.
2. Use your sense of smell before you begin experimenting. Compare this observation to the final product.
3. Squeeze your fruits into small separate containers. Label each container.
4. Add 1/2 teaspoons (2.5 mL) of baking soda to each juice. Stir. Continue adding baking soda 1/2 tsp (2.5 mL) at a time to the juices until the reaction stops.
5. Also try adding baking soda to a slice of unsqueezed fruit for comparison.

Using all of your senses is a great way to make scientific observations.

Do not drink/eat anything during this experiment.

I predict ___________ because ___________.

__________ happened because ___________.

Do It!

**Ginger Ale**

**Ingredients**
- 6 cups (1.5 L) water
- 3 tbsp (45 mL) lemon juice
- 2 tbsp (30 mL) dry active yeast
- Grated ginger root
- 1 cup (250 mL) white sugar

**Directions**
1. Fill a 2 L pop bottle with 1.5 L of room temperature water.
2. Add lemon juice, dry active yeast, a small amount of grated ginger root, and white sugar.
3. Screw the lid on tight and shake vigorously for 30 seconds.
4. Let sit for 4 hours.

I predict ___________ because ___________.

__________ happened because ___________.

**Root Beer Float**

**Ingredients**
- Vanilla ice cream
- Root beer (or any other soft drink such as Ginger Ale above)

**Directions**
1. Spoon a scoop or two of vanilla ice cream into a tall glass.
2. Slowly pour root beer into the glass, allowing the foam to rise and recede before adding more root beer.
3. Serve with straws and spoons.

Try adding the ice cream and root beer in reverse order. Is the amount of carbon dioxide produced affected? Why?

Dig it!

How does carbon dioxide form in carbonated beverages?

Why does foam form on top of a root beer float?

What will happen to the reaction if you use a greater volume of ingredients?

More Eats!

Check out the How It's Made Soft Drinks video at [https://www.youtube.com/watch?v=oxyTKmlxvkk](https://www.youtube.com/watch?v=oxyTKmlxvkk)
Skill Builder 7: Density Dressing

Skills Checklist
- Understand emulsions
- Explain why salad dressing separates

Dream it!

Background for Leaders
Density refers to the amount of mass (weight) in a volume (contained size). It can be represented mathematically as \( D = \frac{m}{V} \). When comparing equal volumes (equal sized containers), liquids that weigh more and have a higher density will sink below liquids that weigh less and have a lower density. Liquids may form layers as a result of differences in density between the two substances. Substances that are less dense will float on top of liquids that are more dense. Solubility refers to the ability of a substance to dissolve in another substance. An emulsion forms as two normally insoluble (unmixable) liquids, such as oil and water, are mixed together through stirring or shaking. Over time, emulsions will separate into their individual components.

Important Words
Help members define the following words and listen for them using these words in their discussions. To increase the members' understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Emulsion</th>
<th>Dispersal of droplets of one liquid in another liquid in which it is not soluble.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separation</td>
<td>When a mixture of liquids returns to its original, unique parts.</td>
</tr>
<tr>
<td>Soluble</td>
<td>The ability of a substance to dissolve in another substance.</td>
</tr>
</tbody>
</table>

Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies

To help the members get thinking about density, ask them:
• Where have you seen something floating or sinking in another substance?

Density Column (Part A)

**Ingredients**
- Honey
- Corn Syrup
- Milk
- Liquid Dish Detergent
- Water (may be coloured)
- Vegetable Oil
- Rubbing Alcohol (may be coloured)

**Directions**
1. First, record your prediction of densities in the space above.
2. Add 1/4 cup (60 mL) of each liquid to a tall cylindrical glass container in the following order: honey, corn syrup, milk, liquid dish detergent, water, vegetable oil, and rubbing alcohol.
3. Observe what happens as you add each liquid.
4. Record your results in the space below.

If you have chosen to complete Skill Builder 8: Density Dessert, you may complete the Dream It! section on page 25 as a continuation of this activity.

**Do not drink/eat anything during this experiment.**

Notes: Have members predict which liquids are the most and least dense. Be sure to observe and record the final results based on your experiment. The final column of liquids should appear from top to bottom as follows: lamp oil, rubbing alcohol, vegetable oil, water, liquid dish detergent, milk, corn syrup, and honey.

Do it!

**Salad Dressing**

**Time Required:** 15 minutes

**Ingredients**
- 1/4 cup (60 mL) canola oil
- 2 tbsp (30 mL) lemon juice
- 2 tbsp (30 mL) honey
- 1 tsp (5 mL) Dijon mustard
- 2 tsp (10 mL) oregano

**Directions**
1. Place canola oil, lemon juice, and honey in a small bowl or jar with lid. Note the layers formed by these ingredients.
2. Add Dijon mustard and oregano.
3. Whisk or shake together.
4. Serve immediately or store in the refrigerator for up to three days.

**Yield:** 1/2 cup (125 mL)

Notes: This dressing will separate if left to rest for a few hours. Add mustard as an emulsifier to maintain the dressing as an emulsion. After tasting the dressing, have members report what they like, what they don’t like, and what they will change when they make salad dressing again.
Salad Creation

Time Required: 20 minutes

Using a combination of the ingredients suggested in the member manual, as well as any other ingredients available at your local grocery, members can create a salad to enjoy with the salad dressing.

Dig it!

- What is an emulsion?
- What happens when an emulsion sits undisturbed for a long period of time?
- Which ingredients in a bottle of separated salad dressing are the most dense?
  Least dense?

Leader’s Notes
In the Member Manual

Skill Builder 7: Density Dressing

Andy Says...
Have you ever wondered why some objects float and others sink when placed in a liquid? The solubility of a substance indicates whether it will dissolve and mix with another substance.

**SKILLS CHECKLIST**
- Understand emulsions
- Explain why salad dressing separates

**Important Words**
Watch for these important words in this Skill Builder: Emulsion, Separation, Soluble

Dream it!

Density refers to how much each litre of a substance weighs. Liquids may form layers as a result of differences in density between the two substances. Substances that are less dense will float on top of liquids that are more dense. An emulsion forms as two normally insoluble (unmixable) liquids are mixed together through stirring or shaking. Over time, emulsions will separate to their individual components.

**Density Column (Part A)**

Look at the list of ingredients below to make a prediction:
I predict that __________________ is the most dense substance and __________________ is the least dense substance.

**Ingredients**
- Honey
- Corn Syrup
- Milk
- Liquid Dish Detergent
- Water (may be coloured)
- Vegetable Oil
- Rubbing Alcohol (may be coloured)

**Directions**
1. First, record your prediction of densities in the space above.
2. Add 1/4 cup (60 mL) of each liquid to a tall cylindrical glass container in the following order: honey, corn syrup, milk, liquid dish detergent, water, vegetable oil, and rubbing alcohol.
3. Observe what happens as you add each liquid.
4. Record your results in the space below.

If you have chosen to complete Skill Builder 8: Density Dessert, you may complete the Dream It! section on page 25 as a continuation of this activity. Do not drink/eat anything during this experiment.

Following this activity, complete the sentence:
I observed that __________________ is the most dense substance and __________________ is the least dense substance.

---

Do it!

**Salad Dressing**

**Ingredients**
- 1/4 cup (60 mL) canola oil
- 2 tbsp (30 mL) lemon juice
- 2 tbsp (30 mL) honey
- 1 tsp (5 mL) Dijon mustard
- 2 tsp (10 mL) oregano

**Directions**
1. Place canola oil, lemon juice, and honey in a small bowl or jar with lid. Note the layers formed by these ingredients.
2. Add Dijon mustard and oregano.
3. Whisk or shake together.
4. Serve immediately or store in the refrigerator for up to three days.

**Yield: 1/2 cup (125 mL)**

**Salad Creation**

Make your own healthy salad to enjoy with your dressing. Record the list of the ingredients you chose to include.

**Suggested ingredients:**
- Lettuce
- Spinach
- Cucumber
- Broccoli
- Cauliflower
- Mushrooms
- Peppers
- Tomatoes
- Carrots
- Celery
- Cranberries
- Nuts
- Sesame Seeds
- Sunflower Seeds
- Chick Peas
- Cucumbers
- Other

**My Salad Creation:**

<table>
<thead>
<tr>
<th>I like this...</th>
<th>I don't like this...</th>
<th>Next time I will change...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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More Eats!

Visit [www.CanolaEatWell.com](http://www.CanolaEatWell.com) for more recipes using canola oil.
In the Member Manual

More Eats!
To learn about how Canola oil is produced from the field to the store shelf check out this link
http://canolagrowers.com/types/educational/#Vh6v-XIFirc

Andy Says...
Buy Manitoba www.buymanitobafoods.ca

Manitoba Food is any food or beverage made entirely from ingredients sourced in Manitoba or composed of more than 85% of main ingredients from Manitoba. All the processing and packaging activities must be done in Manitoba.

Manitoba Made Food – Any food product or beverage processed and packaged entirely in Manitoba. When the main ingredients are available in Manitoba in sufficient quantities they must be used.

💡 Dig it!

What is an emulsion?

What happens when an emulsion sits undisturbed for a long period of time?

Which ingredients in a bottle of separated salad dressing are the most dense? Least dense?
Skill Builder 8: Density Dessert

Skills Checklist
- Explain why density is important in these recipes
- Describe why people find these recipes appealing

Dream it!

Background for Leaders
Density refers to the amount of mass (weight) in a volume (contained size). It can be represented mathematically as $D = \frac{m}{V}$. When comparing equal volumes (equal sized containers), liquids that weigh more and have a higher density will sink below liquids that weigh less and have a lower density. Liquids may form layers as a result of differences in density between the two substances. Substances that are less dense will float on top of liquids that are more dense. Solubility refers to the ability of a substance to dissolve in another substance. An emulsion forms as two normally insoluble (unmixable) liquids, such as oil and water, are mixed together through stirring or shaking. Over time, emulsions will separate into their individual components.

Important Words
Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Mass</th>
<th>A measure of the amount of matter in an object.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>The amount of space a substance takes up. $V = \text{Length} \times \text{Width} \times \text{Height}$</td>
</tr>
<tr>
<td>Density</td>
<td>$D = \frac{m}{V}$ The amount of mass in a volume.</td>
</tr>
</tbody>
</table>

Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies
To help the members get thinking about density ask them:
- Where have you seen something floating or sinking in another substance?
Density Column (Part B)

**Ingredients**
- Honey
- Corn Syrup
- Milk
- Liquid Dish Detergent
- Water (may be coloured)
- Vegetable Oil
- Rubbing Alcohol (may be coloured)
- Ping Pong Ball
- Soda Cap
- Beads
- Cherry Tomato
- Dice
- Popcorn Kernel
- Metal Nut/Bolt

**Directions**
1. Add 1/4 cup (60 mL) of each liquid to a tall cylindrical glass container in the following order: honey, corn syrup, milk, liquid dish detergent, water, vegetable oil, and rubbing alcohol.
2. Observe what happens as you add each liquid.
3. On the following page, make a prediction of where each object will rest.
4. Slowly add the objects in your predicted order of most dense (heaviest) to least dense.
5. Compare the outcome with your prediction.

_Do not drink/eat anything during this experiment._

**Notes:** Have members predict which objects are the most and least dense. Be sure to observe and record the final results based on your experiment.

The final column of liquids should appear from top to bottom as follows: rubbing alcohol, vegetable oil, water, liquid dish detergent, milk, corn syrup, and honey. The objects will settle in the following order from top to bottom: ping pong ball (on surface), soda cap (rubbing alcohol), beads (vegetable oil), cherry tomato (water), dice (liquid dish detergent), popcorn kernel (milk), metal nut/bolt (at bottom).

**Do it!**

**Impossible Pie**

**Time Required:** 1 hour

**Ingredients**
- 2 cups (500 mL) milk
- 1 cup (250 mL) flaked coconut
- 4 eggs
- 1 tsp (5 mL) vanilla extract
- 1/2 cup (125 mL) all-purpose flour
- 6 tbsp (90 mL) margarine
- 3/4 cup (180 mL) white sugar
- 1/4 tsp (1 mL) ground nutmeg

**Directions**
1. Place milk, coconut, eggs, vanilla extract, flour, margarine, and sugar in a blender. Mix well.
2. Pour into greased and floured 10” pie plate.
3. Sprinkle nutmeg on top.
4. Bake at 350°F (175°C) for 45 minutes.

Note: As the pie bakes, the ingredients will separate to form crust, custard and coconut topping layers.
Magic Chocolate Flan Cake

**Time Required:** 2 hours plus 5 hours cooling

Plan ahead because this cake needs to chill for 4 hours after baking.

### Magic Chocolate Flan Cake

**Ingredients**

**Cake:**
- No-stick cooking spray
- 1/2 cup (125 mL) caramel sauce or topping
- 1 box devil’s food chocolate cake mix
- 1 cup (250 mL) water
- 1/2 cup (125 mL) vegetable oil
- 3 large eggs

**Flan:**
- 1 package of cream cheese room temperature
- 4 large eggs, room temperature
- 1 can sweetened condensed milk

**Directions**

1. Preheat the oven to 350°F (175°C). Grease a 12 cup non-stick bundt pan, taking care to grease all of the nooks and crannies. Pour the caramel sauce into the bottom of the pan.
2. In a medium bowl, prepare cake mix according to package directions using the water, oil and eggs. Pour the chocolate batter evenly over the caramel topping.
3. Add all the flan ingredients to a blender and process until smooth.
4. Slowly and carefully pour the flan mixture over the cake batter.
5. Coat a piece of foil with non-stick cooking spray. Cover pan coated side down, tightly with the foil.
6. Place the filled cake pan in a large roasting pan. Place the roasting pan in oven and carefully pour warm water into the roasting pan until it reaches halfway up the sides of the bundt pan.
7. Bake two hours or until toothpick in centre still has a few moist crumbs.
8. Remove the bundt pan from the roasting pan and place it on a wire rack. Cool 15 minutes. Remove foil and invert onto a serving plate. Cool 1 hour at room temperature. Chill 4 hours or overnight.

**Note:** The chocolate cake layer and the flan layer will switch places as the cake bakes.

Have members report their observations of changes to the desserts as they bake. Be sure to use terms relating to density.

### Dig it!

- Why is it important for you as a baker to know about the effects of density?
- Explain how you will describe the process of making these desserts to a friend.
- What would you change if you made these desserts again?
In the Member Manual

Skill Builder 8: Density Dessert

**Andy Says...**
Density refers to how much mass a substance has within a specific volume. Substances that are more dense will support substances that are less dense.

**SKILLS CHECKLIST**
- Explain why density is important in these recipes
- Describe why people find these recipes appealing

**Important Words**
- Density

Dream it!
Density refers to how much each litre of a substance weighs. Liquids may form layers as a result of differences in density between the two substances. Substances that are less dense will float on top of liquids that are more dense.

**Density Column (Part B)**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey, Corn Syrup, Milk, Liquid Dish Detergent, Water (may be coloured), Vegetable Oil, Rubbing Alcohol (may be coloured), Ping Pong Ball, Soda Cap, Beads, Cherry Tomato, Dice, Popcorn Kernel, Metal Nut/Bolt</td>
<td>1. Add 1/4 cup (60 mL) of each liquid to a tall cylindrical glass container in the following order: honey, corn syrup, milk, liquid dish detergent, water, vegetable oil, and rubbing alcohol.</td>
</tr>
<tr>
<td></td>
<td>2. Observe what happens as you add each liquid.</td>
</tr>
<tr>
<td></td>
<td>3. On the following page, make a prediction of where each object will come to rest when dropped into the Density Column.</td>
</tr>
<tr>
<td></td>
<td>4. Slowly add the objects in your predicted order of most dense (heaviest) to least dense.</td>
</tr>
<tr>
<td></td>
<td>5. Compare the outcome with your predictions.</td>
</tr>
</tbody>
</table>

**Impossible Pie**

**Ingredients**
- 2 cups (500 mL) milk
- 1 cup (250 mL) flaked coconut
- 4 eggs
- 1 tsp (5 mL) vanilla extract
- 1/2 cup (125 mL) all-purpose flour
- 6 tbsp (90 mL) margarine
- 3/4 cup (180 mL) white sugar
- 1/4 tsp (1 mL) ground nutmeg

**Directions**
1. Place milk, coconut, eggs, vanilla extract, flour, margarine, and sugar in a blender. Mix well.
2. Pour into greased and floured 10” pie plate.
3. Sprinkle nutmeg on top.
4. Bake at 350°F (175°C) for 45 minutes.

Record your observations of what happened as this dessert baked. Be sure to use terms relating to density.

**Andy Says...**
For something refreshing, colourful and fun Google non-alcoholic layered drinks and give one a try.

**More Eats!**
When it comes to food & health... what's YOUR opinion?

The Manitoba Consumer Monitor (MCM) Food Panel is an online survey that asks questions about your opinions, preferences and experiences with food and health. The research findings will be shared with food growers, processors, developers and governments. Each survey takes only 15 minutes to complete, and will guarantee a strong, healthier future for Manitobans.

To see what they are finding out go to [http://www.mcmfoodpanel.ca/](http://www.mcmfoodpanel.ca/)
In the Member Manual

Magic Chocolate Flan Cake

**Ingredients**
- No-stick cooking spray
- 1/2 cup (125 mL) caramel sauce or topping
- 1 box devil's food chocolate cake mix
- 1 cup (250 mL) water
- 1/2 cup (125 mL) vegetable oil
- 3 large eggs

**Flan:**
- 1 package of cream cheese room temperature
- 4 large eggs, room temperature
- 1 can sweetened condensed milk
- 1 can evaporated milk
- 1 tsp. (5 mL) vanilla extract

**Directions**
1. Preheat the oven to 350°F (175°C). Grease a 12-cup non-stick bundt pan, taking care to grease all of the nooks and crannies. Pour the caramel sauce into the bottom of the pan.
2. In a medium bowl, prepare cake mix according to package directions using the water, oil and eggs. Pour the chocolate batter evenly over the caramel topping.
3. Add all the flan ingredients to a blender and process until smooth.
4. Slowly and carefully pour the flan mixture over the cake batter.
5. Coat a piece of foil with non-stick cooking spray. Cover pan coated side down, tightly with the foil.
6. Place the filled cake pan in a large roasting pan. Place the roasting pan in oven and carefully pour warm water into the roasting pan until it reaches halfway up the sides of the bundt pan.
7. Bake two hours or until toothpick in centre still has a few moist crumbs.
8. Remove the bundt pan from the roasting pan and place it on a wire rack. Cool 15 minutes. Remove foil and invert onto a serving plate. Cool 1 hour at room temperature.

Record your observations of what happened as this dessert baked. Be sure to use terms relating to density.

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**Dig it!**

Why is it important for you as a baker to know about the effects of density?

Explain how you will describe the process of making these desserts to a friend.

What would you change if you made these desserts again?
Skill Builder 9: Explore Senses

Skills Checklist

- Identify human senses and sense organs
- Explain how we taste food

Dream it!

Background for Leaders

Humans have 5 main senses: seeing, hearing, feeling, smelling, and tasting. Our sense organs receive a sensation and send a message to the brain. The brain interprets the message as a perception.

Taste is a chemical sense that is perceived by specialized receptor cells in our tastebuds. Flavour results from information obtained through multiple senses including taste (gustation), olfaction (smell), tactile (touch), heat, and pain (such as in spicy foods).

Taste buds are found inside small bumps on the surface of the tongue. Each consists of approximately 50 receptor cells with a gustatory hair extending through the taste pore. As we eat, molecules from our food enter the taste pore to reach the gustatory hair. This sends a signal to the brain that is interpreted as taste.

Foods taste better when you are hungry. Our sense of taste is able to detect a lower concentration of specific molecules when we haven’t eaten for many hours. The sense of bitterness is always very responsive.

Humans generally have 5 tastes. Foods that taste sour may be healthy such as oranges or spoiled such as rotten milk. Salty foods often contain vitamins and minerals. Sweet foods contain many calories. The bitter taste of a food may warn of poison. Umami, the most recently discovered taste, refers to the glutamic acid flavour of savoury seaweed. Umami is the Japanese word for delicious.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Flavour</th>
<th>The sensation resulting from multiple senses including taste, smell, touch (texture, pain, and heat).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texture</td>
<td>The feel or appearance of a surface or substance.</td>
</tr>
<tr>
<td>Gustation</td>
<td>The sense of taste perceived by cells of taste buds.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12 +
Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

To help the members get thinking about their senses, ask them some of the following:

- What sense do you think you use the most?
- How can your senses make food taste delicious? Disgusting?

Flavour Cover-up

**Ingredients**
- Tonic water
- salt
- 4 drinking glasses

**Directions**
1. Fill 4 glasses with the same amount of tonic water.
2. Line the glasses up and number them 1 through 4.
3. Put a pinch of salt in glass #2, half a teaspoon of salt in glass #3, and a whole teaspoon of salt in #4.
4. Take sip or two of the unsalted tonic water in glass #1. Does it taste bitter?
5. Take sips of the other glasses of tonic water, and fill in the chart of how the bitter flavour changes as the amount of salt increases.
6. Try tasting from the glasses in reverse order starting at #4. Does it taste any different?

**Notes:**
The basic tastes of sweet, salty, sour and bitter complement each other. For example, if a dish is too salty, add a pinch of sugar to balance the flavour. Salt will balance sour flavours. Next time you have a grapefruit, sprinkle salt on it instead of sugar. You will be surprised by the result!

Heat will destroy the bitter compounds in some food, making them taste better. That is why coffee tastes better hot than cold.
Mock Apple Pie

Time Required: 50 minutes

Recipe from www.kraftcanada.com

Directions
1. Preheat oven to 400°F (205°C).
2. Filling: Mix water, granulated sugar, and cream of tartar in a large saucepan. Bring to boil on medium-high heat. Add crackers; simmer on medium-low heat for 5 minutes, stirring occasionally.
3. Line a 9” pie plate with crust as directed on package; fill with cracker mixture. Sprinkle with lemon juice and cinnamon.
4. Topping: Combine all remaining ingredients except Cool Whip; sprinkle over filling.
5. Bake 15 minutes. Reduce oven temperature to 350°F (175°C); bake 20 minutes or until golden brown. Cool. Serve topped with Cool Whip.

Notes: Your taste buds won’t detect the difference between this and real apple pie. The flavours and textures of apple pie including cinnamon are included in this recipe.

Dig it!

• Discuss whether members were able to fool anyone when they served their Mock Apple Pie.
• What would you change if you made this pie again?
• How else can taste be effected by ingredients or cooking methods?

Leader’s Notes
In the Member Manual

Skill Builder 9: Explore Senses

Andy Says...
We enjoy our food by how it tastes. Flavour is a complex mixture of taste, smell, texture and temperature. In this builder you will explore the science of how our senses and the flavour of food work together.

Skills Checklist
- Identify human senses
- Explain how we taste food

Dream it!

Your nose and mouth work together to deliver signals that your brain translates into the flavour of a food. Chefs and food scientists think about how one flavour in a dish is affected by other flavours. Finding the right balance is the key. Salt and sugar are often used to change the flavour of a dish.

Flavour Cover-up

Ingredients
- Tonic water
- Salt
- 4 drinking glasses

Directions
1. Fill 4 glasses with the same amount of tonic water.
2. Line the glasses up and number them 1 through 4.
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4. Take sips or two of the unsalted tonic water in glass #1. Does it taste bitter?
5. Take sips of the other glasses of tonic water, and fill in the chart of how the bitter flavour changes as the amount of salt increases.
6. Try tasting from the glasses in reverse order starting at #4. Does it taste any different?
7. Next time you have a grapefruit, sprinkle salt on it instead of sugar. You will be surprised by the result!

Results Table

<table>
<thead>
<tr>
<th></th>
<th>First taste test</th>
<th>Second taste test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonic water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonic water and pinch of salt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonic water and 1/2 tsp (2.5 ml) of salt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonic water and 1 tsp (5 ml) of salt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Andy Says...
Processsed foods often contain more salt than you'd think from tasting them. The salt is used to cover the bitter flavour of ingredients like preservatives that are used in

Do it!

Mock Apple Pie

Recipe from www.kraftcanada.com

Ingredients
- 2 cups (500 mL) water
- 3/4 cup (180 mL) granulated sugar
- 2 tsp (10 mL) cream of tartar
- 30 Ritz Crackers, whole
- 1 pie crust, box or make your own
- 1 tbsp (15 mL) lemon juice
- 1 tsp (5 mL) ground cinnamon

Topping
- 25 Ritz Crackers, crushed
- 1/2 cup (125 mL) packed brown sugar
- 1/2 tsp (2.5 mL) ground cinnamon
- 3/8 (80 mL) cup non-hydrogenated margarine, melted
- 2 cups (500 mL) whipped topping

Directions
1. Preheat oven to 400°F (205°C).
2. Filling: Mix water, granulated sugar, and cream of tartar in a large saucepan. Bring to boil on medium-high heat. Add crackers; simmer on medium-low heat for 5 minutes, stirring occasionally.
3. Line a 9" pie plate with crust as directed on package; fill with cracker mixture. Sprinkle with lemon juice and cinnamon.
4. Topping: Combine all remaining ingredients except Cool Whip; sprinkle over filling.
5. Bake 15 minutes. Reduce oven temperature to 350°F (175°C); bake 20 minutes or until golden brown. Cool. Serve topped with whipped topping.

More Eats!

To try some new tastes check out Great Tastes of Manitoba at http://grettastesmb.ca/

Dig it!

Did you fool anyone with your Mock Apple Pie?

What would you change if you made this pie again?

How else can taste be affected by ingredients or cooking methods?
Skill Builder 10: Incorporation of Air

Dream it!

Background for Leaders

Meringue dates back to 1720 when a Swiss pastry chef began using the fluffy egg mixture. Making meringue is a delicate process with limits to the amount of air that can be incorporated into the egg mixture.

Egg whites are made of proteins that are physically denatured by beating. Denaturation refers to the process of untangling or unraveling the strands of protein. The addition of sugar to the proteins provides greater strength to the new arrangement of protein molecules. Beating the egg whites also causes air to become trapped as tiny bubbles and a foam is produced. The egg protein has a limit to how much it can stretch. If it is stretched too much, bonds will break and the meringue will collapse. Meringue will appear smooth, glossy, and slightly springy following beating.

Meringue topping on a pie is baked at 325°F (165°C). As it bakes, air bubbles expand, steam evaporates, and proteins coagulate (form new, firm arrangements) at an even rate. The final product is a delicate, melt-in-your-mouth confection.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Denature</th>
<th>The untangling of strands of protein molecules.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meringue</td>
<td>An airy egg white and sugar mixture.</td>
</tr>
<tr>
<td>Expand</td>
<td>To become larger in size.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12 +

Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies

To help the members get thinking about incorporation of air, ask them about the following:
- What foods have you eaten or baked that had air in them?
- Why is air important in baking?

Meringue Mix Up

Place the following steps to make meringue in order.

1. Crack eggs.

4. The beating process with add air to the whites causing them to increase in volume.

6. Bake at 325 F. Air bubbles expand, steam evaporates, and proteins form stronger bonds.

2. Separate egg white from yolk. Keep whites and discard yolks.

5. Slowly add sugar while you continue to beat the eggs. Proteins will form a new, stronger arrangement.

3. Beat egg whites to physically denature (untangle) the proteins.

7. Enjoy the puffy, sugar-protein mesh of meringue.

Do it!

Meringue Cookies

Time Required: 30 minutes plus overnight

Ingredients:
- 2 egg whites
- 1 pinch salt
- 1/4 cup (60 mL) white sugar
- 1 tsp (5 mL) vanilla extract
- 1 cup (250 mL) semi-sweet chocolate chips

Yield: 3 dozen cookies

Directions
1. Preheat oven to 325°F (170°C).
2. Beat egg whites with salt until foamy.
3. Slowly add sugar, one tablespoon at a time, beating after each addition until the meringue stands in stiff peaks. Remove a small portion of meringue to experiment by overbeating.
4. Gently stir in vanilla and fold in chocolate chips.
5. Drop by teaspoonfuls on two lined baking sheets and place on sheet in preheated oven.
6. Bake half of your cookies for 2 minutes. Remove from the oven.
7. Bake half of the cookies for 2 minutes. Leave them in the oven and turn the oven off. Let cool in the oven for 2 to 3 hours. Remove.
8. Which cookie baking method was most successful?
9. Store in a cookie tin lined with paper towel.
Chocolate Fluff

Time Required: 2 hours 30 minutes

Ingredients
- 2 cups (500 mL) chocolate chips
- 1 cup (250 mL) heavy whipping cream

Directions
1. In a mixing bowl add chocolate chips and set aside.
2. In a sauce pan over medium heat, heat whipping cream to a simmer and remove from heat.
3. Pour heated whipping cream over chocolate chips and allow to set for 2-3 minutes
4. Whisk together the chocolate and the whipping cream until smooth.
5. Refrigerate for 1 hour.
6. Remove from refrigerator and using a hand mixer beat until light and fluffy
7. Cover and refrigerate for 1 hour before serving

Dig it!

Discuss the following questions with members:
- Was your first attempt at making meringue successful?
- What tips do you have for someone who has never made meringue?
- What is your favourite way to enjoy meringue?

Leader’s Notes
In the Member Manual

Skill Builder 10: Incorporation of Air

**Andy Says...**
Air is an important ingredient, but it is never listed in a recipe. Our baking methods allow us to add air to a mixture with delicious results!

**SKILLS CHECKLIST**
- Describe how air is incorporated into foods
- Explain the effects of air in baking

**Important Words**
Watch for these important words in this Skill Builder: "Denature, Meringue, Expand"

**Dream it!**
When air is added into foods it creates a light and fluffy end result. This is usually done by beating, whipping, folding, or temperature.

**Meringue Mix-Up**
Place the following steps to make meringue in order.

___ Crack eggs.
___ The beating process with add air to the whites causing them to increase in volume.
___ Bake at 325°F (165°C). Air bubbles expand, steam evaporates, and proteins form stronger bonds.
___ Separate egg white from yolk. Keep whites and discard yolks.
___ Slowly add sugar while you continue to beat the eggs. Proteins will form a new, stronger arrangement.
___ Beat egg whites to physically denature (untangle) the proteins.
___ Enjoy the puffy, sugar-protein mesh of meringue.

**Andy Says...**
Beating the egg whites to make meringue can cause them to swell up to 8 times the volume of unbeaten eggs.

---

Do it!
**Meringue Cookies**

**Ingredients**
- 2 egg whites
- 1 pinch salt
- 1/4 cup (60 ml) white sugar
- 1 tsp (5 ml) vanilla extract
- 1 cup (250 ml) semi-sweet chocolate chips

**Yield:** 1 dozen cookies

**Directions**
1. Preheat oven to 325°F (170°C).
2. Beat egg whites with salt until foamy.
3. Slowly add sugar, one tablespoon at a time, beating after each addition until the meringue stands in stiff peaks. Remove a small portion of meringue to experiment by overbeating.
4. Gently stir in vanilla and fold in chocolate chips.
5. Drop by teaspoonfuls on two lined baking sheets and place on sheet in preheated oven.
6. Bake half of your cookies for 2 minutes. Remove from the oven.
7. Bake half of the cookies for 2 minutes. Leave them in the oven and turn the oven off. Let cool in the oven for 2 to 3 hours. Remove.
8. Store in a cookie tin lined with paper towel.

Separate a small portion of meringue and continue beating. Record what happens.

Which cookie baking method was the most successful?

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**Chocolate Fluff**

**Ingredients**
- 2 cups (500 ml) chocolate chips
- 1 cup (250 ml) heavy whipping cream

**Directions**
1. In a mixing bowl add chocolate chips and set aside.
2. In a sauce pan over medium heat, heat whipping cream to a simmer and remove from heat.
3. Pour heated whipping cream over chocolate chips and allow to set for 2-3 minutes.
4. Whisk together the chocolate and the whipping cream until smooth.
5. Refrigerate for 1 hour.
6. Remove from refrigerator and using a hand mixer beat until light and fluffy.
7. Cover and refrigerate for 1 hour before serving.

**This Builder will take 3 Hours to complete!**

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Dig it!

Was your first attempt at making meringue successful?

What tips do you have for someone who has never made meringue?

What is your favourite way to enjoy meringue?
Skill Builder 11: pH

Dream it!

Background for Leaders

All substances are acidic, neutral, or basic (alkaline). Acids taste sour and bases taste bitter and feel slippery. Strong acids and strong bases can be very dangerous as they can burn your skin or mouth. It is important to use caution when handling these substances.

pH stands for the “power of Hydrogen”. A substance with a lot of hydrogen atoms is very acidic. A substance with few hydrogen atoms is very basic. The pH scale ranges from 1 to 14. 1-6 represent acidic substances, 7 is neutral, and 8-14 represent bases. A change in pH of 1 degree means that a substance is 10 times more or less acidic. A change in pH of 3 values means that substance is 1000 times more or less acidic.

Red cabbage juice can act as a pH indicator, a substance that changes colour depending on the pH of the liquid to which it is added. Red cabbage leaves contain flavin, and anthocyanin pigment. Flavin appears purple when it is in a neutral solution such as water. The exact colour of the pigment will depend upon the chemical composition of the water such as added chlorine and metals. A solution of red cabbage juice and water will appear red, purple, or blue. As red cabbage juice is added to acidic or basic substances, the colour of the solution will change to reflect the pH of the substance. The change in colour occurs as the indicator pigment molecules interact with the solution, change shape, and reflect different wavelengths (energies) of light. Adding the red cabbage pH indicator to a strong acid or base, such as bleach, will eventually destroy the pigment completely.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>A measure of the “power of hydrogen” in a substance. Ranges on a scale from 1 to 14.</td>
</tr>
<tr>
<td>pH Indicator</td>
<td>A substance that shows the level of acid or base in another substance.</td>
</tr>
<tr>
<td>Acid</td>
<td>A substance containing a lot of hydrogen atoms. It has a low pH and tastes sour.</td>
</tr>
<tr>
<td>Base</td>
<td>A substance containing few hydrogen atoms. It has a high pH and tastes bitter.</td>
</tr>
<tr>
<td>Alkaline</td>
<td>A soluble base with a pH greater than 7.</td>
</tr>
</tbody>
</table>
Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies
To help the members get thinking about foods they enjoy, ask them some of the following:
- Do you like sour or bitter tasting foods?
- Would you eat foods that were odd colours? Purple carrots? Red peas?
- Have the members colour the Red Cabbage Juice pH scale.

Red Cabbage Juice pH Test

Time Required: 1 hour

Materials
- 3 leaves Red Cabbage
- 6 cups (1.5 L) water
- 3 tbsp (45 mL) of each test material (lemon juice, baking soda and water solution, vinegar, apple juice, pop, milk, soap, laundry detergent, bleach, antacid (dissolved in water)

Directions
1. Coarsely chop cabbage leaves.
2. Place leaves and water in large casserole dish.
3. Microwave for 10 minutes, stirring occasionally.
4. Strain and collect the liquid from the cabbage.
5. Place a test material in a small dish. You may wish to prepare dishes of each material while heating the cabbage. Be sure to label each dish. Prior to each test, predict whether the substance is acidic, basic, or neutral. Record your prediction in the table below.
6. Add 2 tbsp (30 mL) cabbage solution to the test dish and observe the reaction.
7. Record your results in the table.

<table>
<thead>
<tr>
<th>Test Substance</th>
<th>Observed Colour</th>
<th>Actual pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon Juice</td>
<td>Pink</td>
<td>2</td>
</tr>
<tr>
<td>Vinegar</td>
<td>Pink</td>
<td>2</td>
</tr>
<tr>
<td>Apple Juice</td>
<td>Red</td>
<td>3</td>
</tr>
<tr>
<td>Pop</td>
<td>Red</td>
<td>3</td>
</tr>
<tr>
<td>Milk</td>
<td>Violet</td>
<td>6.5</td>
</tr>
<tr>
<td>Soap</td>
<td>Violet</td>
<td>7</td>
</tr>
<tr>
<td>Laundry Detergent</td>
<td>Blue</td>
<td>8</td>
</tr>
<tr>
<td>Antacid</td>
<td>Blue-Green</td>
<td>10.5</td>
</tr>
<tr>
<td>Baking Soda</td>
<td>Blue-Green</td>
<td>10.5</td>
</tr>
<tr>
<td>Bleach</td>
<td>Green-Yellow</td>
<td>12</td>
</tr>
</tbody>
</table>

Safety Precautions: Do not consume any portion of this experiment. Additions of acids and bases can be dangerous. Use extreme caution when handling strong substances such as bleach and borax.
Do it!

Green Eggs and Ham

Time Required: 20 minutes

Directions
1. Crack the egg and separate the white from the yolk. Keep both parts as you will need them later.
2. Mix cabbage juice into the egg white.
3. Pour the white into the pan. Add the yolk. Cook.
4. Fry ham over high heat with a small amount of oil.
5. Enjoy!

Yield: 1 serving

Notes: Eggs are made of two main components, the egg white and egg yolk. Egg yolk is composed of proteins, water, and fat and is relatively neutral. Egg yolk is largely proteins and water and quite basic. Therefore, the egg whites turn green when red cabbage juice pH indicator is added.

Dig it!

- Why is it important that you, as a scientist, record observations accurately?
- Did you accurately identify the pH levels of your test substances?
- Does the appearance of a food affect how it tastes?

Leader’s Notes
In the Member Manual

**Skill Builder 11: pH**

**Andy Says:**
Do you enjoy sour foods? In this Skill Builder, sour foods will create the red portion of the rainbow of colour in this chemistry lesson.

**SKILLS CHECKLIST**
- Name acidic and basic foods
- Explain how acidity and alkalinity are measured
- Demonstrate how cabbage juice is a pH indicator

**Dream it!**
Substances around us are acidic, neutral, or basic (alkaline). Acids taste sour and bases taste bitter and feel slippery. Strong acids and strong bases can be very dangerous as they can burn your skin or mouth. It is important to use caution when handling these substances.

**pH** stands for the “power of Hydrogen”. A substance with a lot of hydrogen atoms is very acidic. A substance with few hydrogen atoms is very basic. The pH scale ranges from 1 to 14. 1-6 represent acidic substances, 7 is neutral, and 8-14 represent bases.

**Red Cabbage Juice pH Scale**
Red cabbage juice can act as a pH indicator, a substance that changes colour depending on the pH of the liquid to which it is added. Colour the scale below and indicate with arrows which end of the scale is the most acidic and which end of the scale is the most basic.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Pink</th>
<th>Dark Red</th>
<th>Violet</th>
<th>Blue</th>
<th>Blue-Green</th>
<th>Green-Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate pH</td>
<td>1-2</td>
<td>3-4</td>
<td>5-7</td>
<td>8</td>
<td>9-10</td>
<td>11-12</td>
</tr>
</tbody>
</table>

**What else do you have in your household that could be tested?**
Use caution when mixing substances.

**Andy Says...**
Red cabbage leaves contain pigments, coloured particles, called flavones. They have a pH of approximately 7 and will cause water to be coloured red, purple, or blue depending on how your water has been treated.

**Red Cabbage Juice pH Test**

**Materials**
- 3 leaves red cabbage
- 6 cups (1.5 L) water
- 3 tbsp (45 mL) of each test material (lemon juice, baking soda and water solution, vinegar, apple juice, pop, milk, dish detergent or liquid hand soap, laundry detergent, bleach, antacid (dissolved in water))

**Directions**
1. Coarsely chop cabbage leaves.
2. Place leaves and water in large casserole dish.
3. Microwave for 10 minutes, stirring occasionally.
4. Strain and collect the liquid from the cabbage.
5. Place a test material in a small dish. You may wish to prepare dishes of each material while heating the cabbage. Be sure to label each dish. Prior to each test, predict whether the substance is acidic, basic, or neutral. Record your prediction in the table below.
6. Add 2 tbsp (30 mL) cabbage solution to the test dish and observe the reaction.
7. Record your results in the table below.

<table>
<thead>
<tr>
<th>Test Substance</th>
<th>Prediction (Acid, Neutral, Base)</th>
<th>Observed Colour</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon Juice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baking Soda</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinegar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple Juice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dish Detergent/Liquid Hand Soap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry Detergent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antacid</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Following the experiment, your leader will provide the pH value of each substance for comparison with your results.

The most acidic substance: __________________, Its pH was _______.

The most basic substance: __________________, Its pH was _______.

27

28
Do it!

**Green Eggs and Ham**

**Ingredients**
- 1 egg
- 1 tbsp (15 ml) red cabbage juice pH indicator solution
- 1 or 2 slices breakfast ham

**Directions**
1. Crack the egg and separate the white from the yolk. Keep both parts as you will need them later.
2. Mix cabbage juice into the egg white.
3. Pour the white into the pan. Add the yolk. Cook.
4. Fry ham over high heat with a small amount of oil.
5. Enjoy!

**Yield**: 1 serving

“Try them, try them, and you may! Try them and you may, I say.”
- Dr. Seuss, *Green Eggs and Ham*

**Dig it!**

Why is it important that you, as a scientist, record observations accurately?

Did you accurately identify the pH levels of your test substances?

Does the appearance of a food affect how it tastes?

---

**More Eats**

Manitoba Egg Farmers (MEF) represents nearly 170 regulated egg and pullet farmers. Egg farmers are the primary caregivers of 2.3 million hens in Manitoba that produce about 57 million dozen eggs each year. This represents 11% of Canada’s egg supply.

[www.mibegg.mib.ca](http://www.mibegg.mib.ca)
Skill Builder 12: Crystallization

Skills Checklist
- Define crystallization
- Explain why rock candy grows

Dream it!

Background for Leaders

Many substances can be dissolved in a liquid. For example, salt dissolves in water. When this happens, we do not see the salt crystals in the water, but we can taste them. A glass of water can dissolve a maximum amount of salt. If only a small amount of salt is added to water, the solution is unsaturated. If the maximum amount of salt is added, the solution is saturated. If more salt is added, it will not dissolve. A supersaturated solution is produced when salt is added to warm water and is allowed to cool. Warm water can dissolve more than cold water. As the water cools, all of the salt will remain dissolved until another salt crystal is added to the glass. Then, all of the extra salt that is above the dissolution point of water will precipitate (undissolve) from the salt water solution. Crystallization occurs as solid crystals precipitate from a solution.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Crystal</th>
<th>An organized solid such as snowflakes, diamonds, or salt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitate</td>
<td>Particles joining together to form a solid within a liquid.</td>
</tr>
<tr>
<td>Solution</td>
<td>A mixture of a liquid and another substance dissolved within it.</td>
</tr>
</tbody>
</table>

Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success
- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.
Activating Strategies

To help the members get thinking about crystallization, ask them about the Following:

- When have you dissolved a substance in a liquid? Did you add too much of that substance?

**Saturation**

*Ingredients and Materials*
- Water
- Salt
- Glasses

*Directions*

1. Measure 1 cup (250 mL) of cold water and pour it into a glass.
2. Add salt by the teaspoon (5 mL) to the cup (250 mL) of cold water. Stir after each addition to dissolve the salt. Continue adding salt until it will no longer dissolve.
3. Record the amount of salt added to the water and the type of solution produced in the table below.
4. Measure 1 cup (250 mL) of hot water and pour it into a glass.
5. Repeat steps 2 and 3.
6. Allow the glass of hot water to cool. Once cool, add a few grains of salt and record what happens.

Have members complete the following table:

<table>
<thead>
<tr>
<th>Amount of Salt Added</th>
<th>Cold Water</th>
<th>Hot Water</th>
<th>Cooled Hot Water</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Solution</th>
<th>Saturated</th>
<th>Saturated</th>
<th>Supersaturated</th>
</tr>
</thead>
</table>

Unsaturated solutions are present prior to the addition of the maximum amount of dissolvable salt. When salt is added to the supersaturated solution (cooled hot water), salt will precipitate out of the solution until the new point of dissolution is reached.

**Do it!**

**Rock Candy**

*Time Required: 1 week*

*Ingredients and Materials*
- Long Stick or Pencil
- Cotton String
- Lifesaver
- Glass Jar
- 1 cup (250 mL) water
- 3 cups (750 mL) white or brown sugar
- Colouring (optional)
- Flavouring (optional)

Food colouring may be added to colour the candy. Flavourings such as cinnamon, mint, or lemon extracts may be used.
Directions
1. Twist and tie a piece of cotton string around the center of the stick. The string should be long enough so that when the stick is placed across the top of the glass jar the string will hang just short of the bottom. Tie a Lifesaver candy at the bottom end.
2. Wet the string and roll it in sugar.
3. Lay the stick over the top of the glass jar so the string hangs down inside the jar but doesn’t touch the bottom.
4. In a pot, boil the water. When boiling, remove from heat and let settle.
5. Add sugar by the half cup (125 mL) and stir. Continue adding sugar until it starts collecting at the bottom of the pot and will not dissolve.
6. If you want to add flavouring or colour, stir it in now.
7. Pour the sugar syrup solution into the glass until it is about 2.5 cm from the top.
8. Place the pencil over the jar and allow the string to dangle into the solution. Be sure the string does not touch the bottom or sides.
9. Place the glass in a place where it can sit undisturbed. After a day you should start to see crystal growth forming on the string.
10. Leave the string in the solution until the crystals have completely stopped growing.
11. Remove the string from the glass and allow to dry before eating.

Yield: 1 rock candy treat

Notes: The sugar and water mixture is a supersaturated solution. Gradually the sugar will precipitate from the solution and collect as crystals on the suspended string. Over time, water will evaporate from the solution. This will cause the solution to become more saturated and more sugar will precipitate. The rock candy crystals will grow molecule by molecule. The final product will be made of about a quadrillion molecules attached to the string.

Dig it!

- What is a saturated solution?
- Why does crystallization occur?
- Why does rock candy grow?

Leader’s Notes
### Skill Builder 12: Crystallization

**Andy Says...**
I love eating these rocks. They are delicious. Do you know what kind of rock grows? Rock Candy!

#### Skills Checklist
- Define crystallization
- Explain why rock candy grows

#### Important Words
Watch for these important words in this Skill Builder: Crystal, Precipitate, Solution

### Dream it!

Many substances can be dissolved in liquids. Salt can be dissolved in a glass of water. When a small amount of salt is dissolved, we call it an unsaturated solution. When the maximum amount of salt is dissolved, the solution is saturated. If a solution contains more salt that what can normally be dissolved, the solution is supersaturated.

#### Saturation

**Ingredients and Materials**
- Water
- Salt
- Drinking Glasses

**Directions**
1. Measure 1 cup (250 mL) of cold water and pour it into a glass.
2. Add salt by the teaspoon (5 mL) to the cup (250 mL) of cold water. Stir after each addition until dissolved. Continue adding salt until it will no longer dissolve.
3. Record the amount of salt added to the water and the type of solution produced in the table below.
4. Measure 1 cup (250 mL) of hot water and pour it into a glass.
5. Repeat steps 2 and 3.
6. Allow the glass of hot water to cool. Once cool, add a few grains of salt and record what happens.

<table>
<thead>
<tr>
<th>Amount of Salt Added</th>
<th>Cold Water</th>
<th>Hot Water</th>
<th>Cooled Hot Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Types of Solutions include: Unsaturated, Saturated, Supersaturated

What happened when salt was added to the cooled hot water solution? _______________

### Do it!

#### Rock Candy

**Ingredients and Materials**
- Long Stick or Pencil
- Cotton String
- Lifesaver Candy
- Glass jar
- 1 cup (250 mL) water
- 3 cups (750 mL) white or brown sugar
- Colouring (optional)
- Flavouring (optional)

**Directions**
1. Twist and tie a piece of cotton string around the center of the stick. The string should be long enough so that when the stick is placed across the top of the glass jar the string will hang just short of the bottom. Tie a Lifesaver candy at the bottom end.
2. Wet the string and roll it in sugar.
3. Lay the stick over the top of the glass jar so the string hangs down inside the jar but doesn’t touch the bottom.
4. In a pot, boil the water. When boiling, remove from heat and let settle.
5. Add sugar by the half cup (125 mL) and stir. Continue adding sugar until it starts collecting at the bottom of the pot and will not dissolve.
6. If you want to add flavouring or colour, stir it in now.
7. Pour the sugar syrup solution into the glass jar until it is about 2.5 cm from the top.
8. Place the pencil over the jar and allow the string to dangle into the solution. Be sure the string does not touch the bottom or sides.
9. Place the glass in a place where it can sit undisturbed. After a day you should start to see crystal growth forming on the string.
10. Leave the string in the solution until the crystals have completely stopped growing.
11. Remove the string from the glass and allow to dry before eating.

Yield: 1 rock candy treat

**Andy Says...**
The rock candy crystals will grow molecule by molecule. The final product will be made of about a quadrillion molecules attached to the string.

#### Dig it!

**What is a saturated solution?**

**Why does crystallization occur?**

**Why does rock candy grow?**

**Andy Says...**
Whatever your choice of snack, remember to floss and brush your teeth after eating!
Skill Builder 13: Caramelization

Skills Checklist

- Understand what affects the colour of caramel
- Explain how baking soda makes caramel become light and foamy.

Dream it!

Background for Leaders

Caramelization is a process of converting sugar to a new, flavourful compound. The overall process is not well understood, but its effects are very much appreciated by those who enjoy sweet treats. The process begins as sugar is heated. When sugar reaches a specific temperature, 338°F (170°C), it will break apart and form new compounds. These compounds have the characteristics of caramel including its aroma, colour, and texture. A well produced caramel will appear a rich brown colour. If sugar is heated too much, the product will be bitter as the sugars are destroyed. The aroma and flavour depend upon the chemical groups that are formed during the rearrangement of sugars. Flavours include butter/butterscotch, sweet, nutty, and toasty. The texture also depends on the rearrangement of the sugars. Ideally caramel is sticky, but easy on the teeth.

Thermometers are often used when making candy as temperature is crucial to the success of the sugar rearrangement. The sugar stage is referred to by specific terms such as thread, soft ball, firm ball, hard ball, soft crack, hard crack, clear liquid, brown liquid, and burnt sugar. Each stage occurs within a specific temperature range.

In both recipes in this Skill Builder, baking soda will be added when caramelization is complete. Baking soda reacts with acids present in the caramel mixture to produce carbon dioxide and a foamy, pourable caramel sauce. The trapped air bubbles will result in a softer candy.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Caramel</th>
<th>Brown, nutty flavoured, liquid sugar produced by heating sugar to a specific stage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foam</td>
<td>Trapped gas and bubbles causing an increase in volume.</td>
</tr>
<tr>
<td>Hard Crack Stage</td>
<td>A sugar stage between 300 and 310°F (149 and 155°C). When the sugar mixture is placed in cold water it will form hard threads that break when bent.</td>
</tr>
</tbody>
</table>

Age Considerations

- 12 +
Thinking Ahead

- What will you discuss with members? Gather observations and think of examples that will help support your discussion.

Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

To help the members get thinking about caramelization, ask them some of the following:

- What are your favourite candies?
- Have you ever made your own candy?

Remind members that whatever snack they choose, they need to brush and floss their teeth before going to sleep.
**Do it!**

### Caramel Corn

**Time Required:** 2 hours

**Ingredients**
- 1 cup (250 mL) margarine
- 2 cups (500 mL) brown sugar
- 1/2 cup (125 mL) corn syrup
- 1 tsp (5 mL) salt
- 1/2 tsp (2.5 mL) baking soda
- 1 tsp (5 mL) vanilla
- 6 quarts (6 L) of popcorn

**Directions**
1. Pop popcorn.
2. Combine margarine, brown sugar, corn syrup, and salt in a heavy pot.
3. Bring to a boil, stirring constantly.
4. Turn heat down. Boil 5 minutes without stirring.
5. Add baking soda and vanilla. Stir to mix.
6. Pour over popcorn. Stir to spread evenly.
7. Bake in two 9x13 cake pans at 250°F (120°C) for 1 hour stirring every 15 minutes.
8. Remove from oven, pour into large bowls, and stir as it cools to break apart.

**Yield:** Two 4 L pails

### Sponge Toffee

**Time Required:** 3 hours

**Ingredients**
- 1 cup (250 mL) margarine
- 2 cups (500 mL) brown sugar
- 1/2 cup (125 mL) corn syrup
- 1 tsp (5 mL) salt
- 1/2 tsp (2.5 mL) baking soda
- 1 tsp (5 mL) vanilla
- 6 quarts (6 L) of popcorn

**Directions**
1. In 3 L saucepan, stir together sugar, corn syrup, water, and vanilla over medium heat just until sugar dissolves.
2. Bring to a boil; cook, without stirring but brushing down side of pan occasionally with pastry brush dipped in cold water, until candy thermometer reaches hard-crack stage of 300°F (149°C), or when 1 tsp (5 mL) hot syrup dropped into cold water forms hard brittle threads, about 10 minutes.
   **CAUTION:** Stand back, holding face a distance away from the pot.
4. Pour into greased foil-lined 9x13” metal cake pan. Let cool in pan on rack without disturbing, about 2 hours.
5. Break in 1 1/2” (4 cm) pieces.
6. Make ahead and store layered between wax paper in airtight container for up to 1 month.

**Yield:** 48 pieces
Dig it!

- What changes do you observe as sugar becomes caramel?
- What happens if the sugar is heated to a higher temperature than stated in the recipe?
- What affect does the addition of baking soda have on a mixture?
In the Member Manual

Skill Builder 13: Caramelization

Andy Says...
Candy making, including the process of caramelization, is highly temperature specific. Pay close attention to the thermometer during these activities.

SKILLS CHECKLIST
- Understand what affects the colour of caramel
- Explain how baking soda makes caramel become light and foamy

Dream it!
Caramelization is a process of converting sugar to a new, flavoured compound. Sugar is heated to 338°F (170°C). If too high a temperature is applied the sugar will burn.

Find the following words in the puzzle:

M E L T J A P N U T T Y P N Q
Q I B T U L M S A O F K O S
T T E E W S Y C A R T B C I R
M C L M H G A O D A X R A T U
G U E P P M Z R O E A O R A O
W G W E O F T N S D U W C Z V
P H J R Z I F S G Y W N D I A
Z F A A B D D Y N R F P R L L
T Y R T O Y L R I Y E V A E F
R A G U S E B U K U V Z H M Q
L W G R O I L P A B O R Q A D
A T U E V L I Y B J L C Q R Z
T E N H A G O T H X U Q R A O
M P L N Q T B C U M Y P C U
B U I V W E R U T X E T I Q R

Andy Says...
As sugar is heated, water evaporates from the pot as steam. If sugar is heated to a very high temperature, above that of hard-crack and caramel, the sugar will burn. It will taste bitter because the sugars are destroyed.

Important Words
Watch for these important words in this Skill Builder: Caramel, Foam, Hard Crack Stage

Do it!

Caramel Corn
Ingredients
- 1 cup (250 ml) margarine
- 2 cups (500 ml) brown sugar
- 1/2 cup (125 ml) corn syrup
- 1 tsp (5 ml) salt
- 1 tsp (2.5 ml) baking soda
- 1 tsp (5 ml) vanilla
- 6 quarts (6 L) of popcorn

Yield: Two 4 L pails

Directions
1. Pop popcorn.
2. Combine margarine, brown sugar, corn syrup, and salt in a heavy pot.
3. Bring to a boil, stirring constantly.
4. Turn heat down. Boil 5 minutes without stirring.
5. Add baking soda and vanilla. Stir to mix.
6. Pour over popcorn. Stir to spread evenly.
7. Bake in two 9x13 cake pans at 250°F (120°C) for 1 hour stirring every 15 minutes.
8. Remove from oven, pour into large bowls, and stir as it cools to break apart.

I like this... I don't like this... Next time I will change...

Sponge Toffee
Ingredients
- 2 1/2 cups (625 ml) granulated sugar
- 2 3/4 cup (150 ml) white corn syrup
- 1/3 cup (75 ml) water
- 2 tsp (10 ml) vanilla
- 4 tsp (18 ml) baking soda

Directions
1. In 3 L saucepan, stir together sugar, corn syrup, water, and vanilla over medium heat just until sugar dissolves.
2. Bring to a boil; cook, without stirring but brushing down side of pan occasionally with pastry brush dipped in cold water, until candy thermometer reaches hard-crack stage of 300°F (149°C), or when 1 tsp (5 ml) hot syrup dropped into cold water forms hard brittle threads, about 10 minutes.
3. Remove from heat. Whisk in baking soda. CAUTION: When whisking the baking soda into the caramel in step 3, Stand back, holding face a distance away from the pot.
4. Pour into greased foil-lined 9x13 metal cake pan. Let cool in pan on rack without disturbing, about 2 hours.
5. Break in 1 1/2" (4 cm) pieces.
6. Make ahead and store layered between wax paper in airtight container for up to 1 month.

I like this... I don't like this... Next time I will change...
In the Member Manual

Andy Says...
Whatever your choice of snack, remember to floss and brush your teeth after eating!

More Eats!
For more caramel recipes go to www.allrecipes.com

Dig it!
What changes do you observe as sugar becomes caramel?

What happens if the sugar is heated to a higher temperature than stated in the recipe?

What effect does the addition of baking soda have on a mixture?
Skill Builder 14: Polymers & Gelatin

Skills Checklist
- Understand where gelatin comes from
- Explain how polymers are formed

Dream it!

Background for Leaders

A polymer is a series of many molecules linked together to form a chain. Some examples of polymers include plastic, hair, finger nails, DNA, rubber, and silly putty.

Gelatin is a polymer. Gelatin is produced by boiling animal bones and connective tissue to extract a protein rich pale, yellow, dry powder. The powder, consisting mainly of collagen protein, forms a polymer as its triple spiralling chains join together as a gel. The word ‘gelatin’ comes from the Latin word ‘gelatus’ meaning stiff or frozen. Gelatin was first used in the 14th century. The first recorded making of gelatin was in 1680 when bones were cooked and the extract solidified. Gelatin dissolves in hot water and sets as a gel when it is cooled. Gelatin is used in cosmetics, bakery products, medicine emulsions, jams, jellies, marshmallows, and as a sponge to treat wounds.

Fruit flavoured gelatin is a colloid suspension; a mixture in which particles are too large to dissolve completely, but small enough to remain suspended in the liquid. As the molecules hook together, the substance is not pourable and acts as a rubbery solid. If enough pressure is applied, the joining junctions will break. Other examples of colloid suspensions include fog, mayonnaise, and meringue.

Important Words

Help members define the following words and listen for them using these words in their discussions. To increase the members’ understanding, try providing a synonym members know or provide examples. The more personalized the examples the better.

<table>
<thead>
<tr>
<th>Polymer</th>
<th>A long chain of molecules linked together.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelatin</td>
<td>A protein extracted by boiling animal bones and connective tissue.</td>
</tr>
<tr>
<td>Colloid Suspension</td>
<td>A mixture in which particles are too large to dissolve but small enough to remain suspended in the liquid.</td>
</tr>
<tr>
<td>Dissolution</td>
<td>The ability of a substance to disperse in a liquid.</td>
</tr>
</tbody>
</table>

Age Considerations
- 12 +

Thinking Ahead
- What will you discuss with members? Gather observations and think of examples that will help support your discussion.
Preparing for Success

- Linking back to the Skills Checklist, help members identify how they will know they have been successful in learning from this Skill Builder. Discuss what success in these activities might look like, sound like, or feel like.

Activating Strategies

To help the members get thinking about polymers and gelatin, ask them some of the following:
- Are there any similarities between plastic and silly putty?
- What makes things stretchy?

CAUTION: Do not eat slime. It is made of chemicals not food.

Slime

**Ingredients**

- 1/2 cup (125 mL) white glue
- 1 1/2 cup (375 mL) water (divided)
- 1 tsp (5 mL) borax
- Food colouring (optional)

**Directions**

1. Mix glue and 1/2 cup (125 mL) water. Add food colouring if desired.
2. In another bowl, mix borax and 1 cup (250 mL) water.
3. Add the glue mixture to the borax mixture, stirring slowly.
4. Stir as much as possible. Then, knead with your hands until it becomes less sticky.

Have members try squeezing, bouncing, and stretching their slime. Have them record their observations in their books.

Notes: Glue contains polyvinyl acetate, a liquid polymer. Borax links the polyvinyl acetate molecules together to form a long, stretchy polymer. If you wish to store the slime, keep in a plastic bag and refrigerate.

Fruit Gummies

**Time Required:** 2 hours

**Ingredients**

- 2 cups (500 mL) fruit juice
- 1 oz (30 mL) gelatin

**Directions**

1. Spray a 9” square pan with cooking spray. Wipe away most of the spray with a paper towel.
2. Pour 1 1/2 cups (375 mL) juice in small sauce pan. Heat over medium heat until it reaches a gentle boil.
3. In another bowl, pour 1/2 cup (125 mL) juice and gelatin. Let bloom for 5 minutes.
4. Add gelatin to heated juice and stir until fully dissolved.
5. Take a small taste of the juice mixture to test its sweetness. You may choose to add honey.
6. Pour into 9x9 metal baking pan.
7. Chill for 1-2
8. Slice into squares of desired size.
9. Store in refrigerator for up to 3 to 4 days.
Do it!

Gelatin Pinwheels

Time Required: 1 hour

**Ingredients**
- 1 package fruit flavoured gelatin
- 1/2 cup (125 mL) warm water
- 1 cup (250 mL) miniature marshmallows

**Yield:** 16 pinwheels

**Directions**
1. Spray an 8” square pan with cooking spray. Wipe away most of the spray with a paper towel.
2. Stir gelatin and water in medium microwavable bowl.
3. Microwave on High for 1 1/2 minutes; stir until gelatin is completely dissolved.
4. Stir in marshmallows.
5. Microwave on High for 30 seconds until marshmallows are partially melted.
6. Stir with whisk until marshmallows are completely melted.
7. Pour into pan.
8. Refrigerate 45 minutes or until set.
9. Run sharp knife around edge of pan to loosen gelatin layer. Starting at one edge, roll up gelatin layer tightly.
10. Cut into 1/2 inch (2.5 cm) slices using thread or dental floss (cinnamon bun method).
11. Refrigerate and cover until served.

**Note:** Both marshmallows and fruit flavoured gelatin are products made from animal bones and connective tissue.

**Leader’s Notes**
**Skill Builder 14: Polymers & Gelatin**

**Andy Says...**
Polymers are very long chains of monomers. Poly- means many. Mono- refers to one single unit or molecule.

**Skills Checklist**
- Understand where gelatin comes from
- Explain how polymers are formed

**Important Words**
Watch out for these important words in this Skill Builder: Polymer, Gelatin, Colloid Suspension, Dissolution

**Dream it!**
Polymers are formed as long strands of molecules link together in winding chains. In the slime experiment the Borax links the polyvinyl acetate in the glue to form a long stretchy polymer.

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- 1 1/2 cup (375 mL) water (divided)
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**Directions**
1. Mix glue and 1/2 cup (125 mL) water. Add food colouring if desired.
2. In another bowl, mix Borax and 1 cup (250 mL) water.
3. Add the glue mixture to the Borax mixture, stirring slowly.
4. Stir as much as possible. Then, knead with your hands until it becomes less sticky.

**Do not eat your slime. These are chemicals, not food.**

Try squeezing, bouncing, and stretching your slime. Write two sentences to report your observations.

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**Gelatin Pinwheels**
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**Dig it!**

What is a polymer?

How did your Gelatin Pinwheels and Fruit Gummies turn out?

What would you do differently?
In the Member Manual

Showcase Challenge

Bringing it all together!

Now that you have finished the project, it is time to think about how you will share your experiences and knowledge with others. You may put your new skills to work by helping at a community event or at your club achievement or teaching others about your topic. The goal of the Showcase Challenge is to help highlight your new skills and help you understand how you can use them. It can be an opportunity to receive feedback from others on your project. So go back through your manual and find some highlights of your learning (what you are proud of) and think about how you will "showcase" it.

Dream It!

Here are some Showcase Challenge Suggestions:

- Demonstrate something you made or learned about
- Act out a play
- Create a game
- Use your new skills to help with the Club Achievement plan
- Make a poster or display
- Make a video or slideshow
- Compose a song
- Or come up with your own idea! It is up to you and your leader!

Dig It!

Now that you have showcased your project skills:

- How did your Showcase Challenge go?
- What would you do differently next time?
- How will you use your new skills in the future? (in different situations?)

My Showcase Challenge Plan

My showcase idea:

What materials and resources do I need?

Who do I need to help me?

When do I need to have things done by?

Do It!

Insert or attach your finished product or a photo of you sharing your skills in your Showcase Challenge.

Showcase Challenge

In the Member Manual

Have members use their member project books to help them in organizing what they have learned. The form of presentation can vary according to the wishes of the leaders and member's ability. Information could be presented in many forms, some of which are: posters, pamphlets, written reports, speeches, computer presentations, displays, etc. Suggestions are listed on the Showcase Challenge page at the back of the member workbook. The best results are almost always obtained when members are allowed to present their information in the style of their choice.
Once members have completed all the builders they will have a lot of information recorded in their manuals. These are products of their learning. As a final project activity, members and leaders will pull together all this learning in completing the portfolio page in the Member Manual. There is a skills chart that lists the skills members are expected to complete by the end of the project. Leaders must indicate how they know the member was successful at a particular skill. Leaders will find evidence if they think about what they have observed members doing, what discussions they have had with members, and what members have produced. If leaders think that members need to go back and improve on any skill, this chart helps them clarify what needs to be done.

### Discovering Science in the Kitchen Project Skills Chart

To be completed by the leader and the member based on observations and conversations throughout the project.

<table>
<thead>
<tr>
<th>Skill Builder</th>
<th>Members will be able to...</th>
<th>We know this because...</th>
</tr>
</thead>
</table>
| 1            | • Apply the POOE Inquiry Technique  
• Read a recipe  
• Experiment with ingredients and methods | Identify activities completed and record observations and information from discussions about activities. |
| 2            | • Identify the different phases of matter  
• Explain why matter changes states  
• Describe freezing and melting points | |
| 3            | • Understand where and how bacteria grow  
• Explain why reproduction is important | |
| 4            | • Explain why coagulation is important in cheese making  
• Name different types of cheeses | |
| 5            | • Use proportions  
• Understand the process of fermentation  
• Describe other food products of fermentation | |
| 6            | • Explain the process of carbonation  
• Understand why some reactions are bigger than others. | |
| 7            | • Understand emulsions  
• Explain why salad dressing separates | |
| 8            | • Explain why density is important in this recipe  
• Describe why people find these recipes appealing | |
In the Member Manual

### Discovering Science in the Kitchen Project Skills Chart
To be completed by the leader and the member based on observations and conversations throughout the project.

<table>
<thead>
<tr>
<th>Skill Builder</th>
<th>Members will be able to...</th>
<th>We know this because...</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Identify human senses</td>
<td>Identify activities completed and record observations and information from discussions about activities.</td>
</tr>
<tr>
<td>10</td>
<td>Explain how we taste food</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Describe how air is incorporated into foods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explain the effects of air in baking</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Name acids and basic foods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explain the relationship between acids and bases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demonstrate how red cabbage juice is a pH indicator</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Define crystallization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explain why rock candy grows</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Understand what affects the colour of caramel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explain how baking soda makes caramel becomes light and foamy</td>
<td></td>
</tr>
<tr>
<td>Showcase Challenge</td>
<td>Explain success in using the skills listed above</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments/Activities:**

### Above and Beyond!
In addition to project skills, 4-H also increases skills in meeting management, communications, leadership, community involvement through participation in club, area, or provincial 4-H events or activities. List below any activities you participated in this year in 4-H. (Some examples include Executive Positions Held, Workshops, Communications, Community Service, Rally, Bonspiels, Conferences, Judging, Camps, Trips, Awards, Representation to Area or Provincial Councils, etc.)

**Feel Free to add additional pages that include awards, certificates, new clippings, photos or other items that describe your 4-H involvement.**

### Member Point of Pride!

**What I learned...**

**What I need to improve on...**

**What I want others to notice...**

**Member's Signature:**

### Point of Praise! Another's perspective on your achievements in 4-H.
(community professionals, 4-H club head leaders, friends of 4-H)

**I am most impressed by...**

**I believe that you have learned...**

**In the future I encourage you to...**

**Signature:**
4-H Achievement

4-H Achievement is... a 4-H club celebration when members have completed their projects. Achievements are planned by the club to give recognition to members and leaders for their accomplishments in their 4-H projects and club activities.

A 4-H Achievement can take many different formats: from choosing a theme, to member project displays, to members using their new skills for the event (entertainment, food, decorating, photographer, etc.), to members presenting their project to the whole group, the options are endless and open to the creativity of the members and leaders in each club!

Clubs may also plan their Achievement to promote 4-H to the community or to recognize sponsors and others who have helped the club.

Members and leaders - be sure to check your project books for the project completion requirements, so you will be ready for your club’s Achievement celebration!

If you have any questions, comments or suggestions for this or other 4-H projects contact:

Manitoba 4-H Projects
Manitoba Agriculture Food and Rural Development
1129 Queens Avenue
Brandon, MB R7A 1L9

Email: 4h@gov.mb.ca

Phone: 204-726-6613
Fax: 204-726-6260

This manual is for educational use only and is not intended as professional advice.

For more information about 4-H and the many 4-H opportunities available please visit

http://www.gov.mb.ca/agriculture/4-h/
What is 4-H?

4-H is an international youth organization involving more than 7 million members in 80 countries around the world.

In Canada, 4-H began in 1913 in Roland, Manitoba as a community-based organization dedicated to growth and development of rural youth. Today’s 4-H program reaches both farm and non-farm youth across Canada. The motto of “Learn To Do By Doing” is embodied in the program, as 4-H focuses on skill development as well as personal development of life skills such as communications, leadership and citizenship.

4-H Motto

“Learn To Do By Doing”

4-H Pledge

I pledge,
My HEAD to clearer thinking,
My HEART to greater loyalty,
My HANDS to larger service,
My HEALTH to better living,
For my club, my community, and my country.

4-H Quality Equation Principles

Quality People

- Promote responsibility, respect, trust, honesty, fairness, sportsmanship, citizenship, teamwork and caring.

Quality Experiences

- Provide members with personal development and skill development experiences.

Quality Projects

- Promote and value quality effort.
- Promote high quality, safe food production within industry standards.

Manitoba 4-H project material is developed by
Manitoba Agriculture, Food and Rural Development (MAFRD)