SoCalGas™

Intermediate Cooking with Gas

Lesson 4: Roasting

Beyond the Blue flame

BEGINNER

Introduction

Welcome to Intermediate Cooking with Gas. Today's topic is understanding how energy is transferred during cooking. Once you learn about energy transference, you will learn how to cook with gas to make your own roasted nut and seed trail mix.

This lesson can be completed in a classroom or at home. Your teacher will provide instructions for completing the assignment from home.

Opening Assessment

1. What is temperature?
   a. the amount of heat a substance has
   b. the type of molecules that make up the substance
   c. the transfer of energy from one substance to another
   d. the motion of the molecules that make up the substance

2. What is heat?
   a. a form of energy
   b. a dial setting on an oven
   c. a measure of how hot an object is
   d. a change in the temperature of an object

3. What is roasting?
   a. food cooked in hot liquids
   b. food cooked in a microwave
   c. food cooked through the hot circulation of air
   d. food cooked through direct contact with a hot surface

4. How is batch cooking beneficial for chefs? Select all that apply.
   a. decreases waste
   b. increases efficiency
   c. increases consistency
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5. How does energy transfer during roasting?
   a. Energy is radiated from the heat source to the food.
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   c. Energy cycles between all sides of the oven to cook food from all directions.
   d. Energy moves in a combination of directly interacting with the food and moving hot air around.

How Is Energy Transferred During Cooking?

Energy describes how things change or move. For example, a water pot, placed on a high burner, eventually boils – the **heat**, a form of energy, moves from the burner to the pot to the water. When food is added to the water, the energy transfers from the water to the food, cooking the food; as energy continues to be applied to the pot of water, the water will increase its temperature and eventually come to a boil. When the burner is turned off, the energy transfer stops, and the water will stop boiling and eventually cool.

Heat and temperature are not the same things, although they are very closely related. Heat is a form of energy transferred and measured in units, including **joules, calories** and **British thermal units (BTUs)**. Because heat is generated from the motions of particles within a substance, heat is a type of **kinetic energy**. Kinetic energy is the energy of motion and is determined by the size of the particles and how fast they are moving.

Objects or substances cannot have heat as heat measures how energy transfers to or from an object or substance. The study of heat and how it moves is called **thermodynamics**. Heat energy always transfers from warmer substances to cooler substances. The transfer or change of heat energy transferred to a substance can change the temperature of that substance. The heat energy from the burner is transferred to a pot of cold water until the water increases its temperature and eventually boils.

On the other hand, the **temperature** measures the average kinetic energy of molecules in Fahrenheit, Celsius or Kelvin. As heat is applied to a substance, the temperature of the substance increases – the particles move faster, increasing the kinetic energy of the particles. As the temperature decreases, the kinetic energy of the particles decreases because the molecules are moving slower.

Heat is transferred in one of three methods: **conduction, convection** and **radiation**. All three methods are utilized in different methods of cooking. Conduction transfers heat when objects are in direct contact with or touching each other. Conduction is ideal for searing or browning foods in short periods or at high temperatures. For example, pancake batter poured on a hot griddle or a steak placed on a hot cast iron pan are cooked by conduction.

Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Heat energy is transferred from hot places to cooler places by convection. For example, water in a pot on the gas burner is heated from the bottom of the pot, and then it rises to the top and cooler water takes its place, where it is heated and then rises in a continual process. Convection in an oven is ideal because the hot air, assisted by a fan, circulates around the food from all sides.

Radiation transfers heat indirectly or when the objects are not in direct contact with each other. Radiation is ideal for cooking foods that may not hold up with direct heat or in appliances such as ovens where the hot air is warmed from the burner. For example, marshmallows roasted over a campfire or hot dogs on a grill are cooked by radiation.

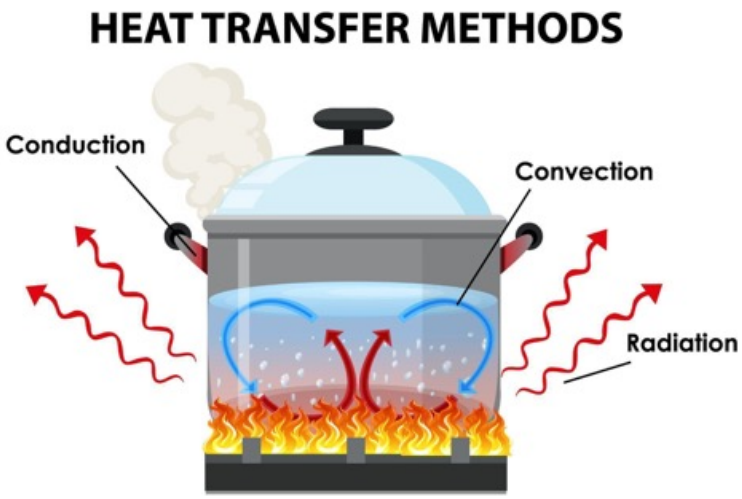


Image credit brgfx

When a pot of water is put over a burner, heat radiates from the flame to the bottom of the pot. The bottom of the pot heats the water through conduction. The warmer water then rises to the top of the pot and releases energy. The water then cools and sinks back to the bottom to be warmed again in convection cycles. Heat is also transferred from the pot to the environment through radiation.

Natural gas ranges and ovens are measured in British thermal units(BTUs) or the amount of heat energy needed to raise one pound of water one degree Fahrenheit. The higher the BTU rating on a range or oven, the more energy can be transferred during the cooking process and the faster the change in the temperature of the food.

In general, the amount of energy needed to raise a single unit of mass by one degree is called **specific heat**. Water, for example, has a specific heat of 1 BTU per pound degree Fahrenheit (1 BTU/lb°F) or 4.186 joules per gram-degree Celsius (4.186 J/g°C). For example, cast iron and stainless steel, two popular cooking materials, have specific heats of 0.110 BTU/lb°F (0.461 J/g°C). Other popular metals used in cookware include copper and aluminum, which have specific heats of 0.090 BTU/lb°F (0.377 J/g°C) and 0.220 BTU/lb°F (0.921 J/g°C), respectively. This is why the pot heats up much more quickly than the water inside the pot. These metals are popular when constructing pots and pans due to their durability, ability to hold and retain a certain temperature, and heat transfer to the food.

Batch Cooking with Natural Gas

Commercial natural gas appliances such as natural gas ranges and ovens typically have higher BTU ratings than natural gas appliances found in homes, as well as larger capacities. To take advantage of the higher amount of energy transfer while reducing the overall energy usage, many professional chefs and commercial foodservice operators prepare food in a **batch cooking** method.

Batch cooking involves preparing food or ingredients for many meals at one time. Batch cooking may involve cooking large batches of an entire meal together and then splitting into individual portions or preparing or cooking individual ingredients separately that can then be combined into a complete meal at a later time. In restaurants, batch cooking allows chefs to be consistent and time-efficient when preparing individual meals. Batch cooking also is beneficial for chefs to maintain the freshness of ingredients and minimize the waste of ingredients. In other scenarios, batch cooking allows several portions of meals to be prepared simultaneously, such as for shops offering grab-and-go meals for busy consumers or large crowds in stadiums and universities.

Several steps in the process of batch cooking are the same, no matter the scenario:

- Determine the menu: Decide ahead of grocery shopping what meals will be cooked, the ingredients and how many portions. If not all ingredients are available at a single location or store, grouping them by where they will be bought can also increase efficiency. If, for example, a small number of ingredients are not available at a specific location, substitutions can be planned ahead of time.
- Food storage containers: If the portions will be served in a grab-and-go style or stored in the freezer, the correct types of containers will be needed to preserve the meals and ingredient freshness.
- Buying ingredients at wholesale and in bulk: When possible, certain ingredients are more economical when bought in large quantities, especially those with long shelf lives, such as dried beans, rice and pasta. A carefully planned grocery list can also decrease trips to one or more locations or stores.
- Prepping ingredients: If multiple recipes call for the same ingredient, prepare that ingredient all at once and then separate it into individual containers.
- Cook time and temperatures: Several different recipes can be put into the oven at the same time and temperature. To save on energy and time, utilize all the oven racks to maximize the food amount cooked at once.

For example, if you were a chef preparing nut and seed trail mix for a large group, the menu would include how many portions of the trail mix will be made and each type of seed, nut, seasonings and other ingredients needed. Large batches of trail mix can be made at once and then split into smaller batches. Convection ovens with multiple racks can be utilized to bake several trays of trail mix at one time. Unused portions of the ingredients can be stored for later use.

Cooking Methods

There are three types of cooking methods that utilize natural gas:

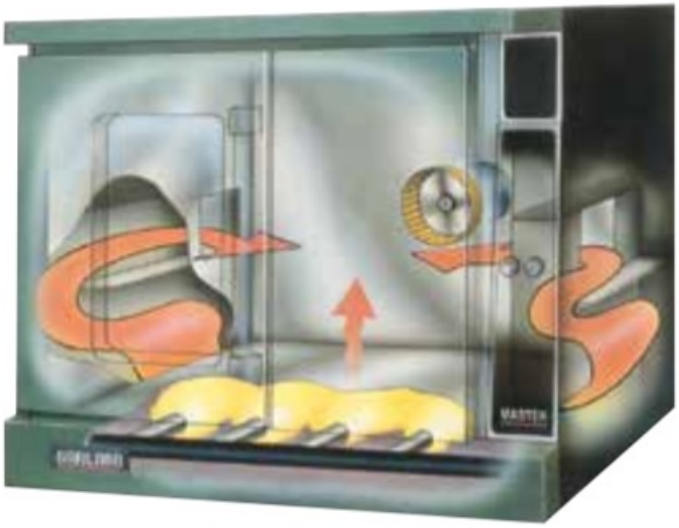
1. **Moist cooking** involves cooking with moisture in either liquid or steam form.
2. **Dry cooking** involves cooking without any moisture.
3. **Combination cooking** combines moist and dry heat cooking.

Today, you will be learning about and preparing food using a dry cooking method.

Dry Cooking: Roasting

Dry cooking methods include broiling, grilling, griddling, roasting, baking, sautéing and deep-frying. Each method utilizes dry, hot air or hot fat in order to cook the food. This lesson will use a convection oven and the dry cooking method.

Natural gas convection ovens, often found in commercial kitchens, use fans to circulate hot air inside the oven, and roast, bake, or reheat food more quickly and evenly.



The gas convection oven baking chamber maximizes airflow with the built-in fan by directing heat and evenly channeling it through the entire oven cavity, resulting in even cooking/baking/roasting throughout the entire cavity.

Full size rotating rack ovens accommodate entire racks/trolleys of food to be rolled in and out at once. This ensures that all of the food on the rack/trolley cooks for the same amount of time. A locking mechanism at the top of the oven locks the rack/trolley in place, and spins within the oven. The fans circulate hot air from the burners, top to bottom and front to back, for consistent roasting and baking. Mini rack ovens roast and bake in the same manner, but the rack is not removable. Sheet pans slide onto the rack carriage.

Deck ovens use conduction heat, a process in which heat travels directly from a hot stone or deck to the food. Deck ovens also utilize radiant heat, a process that incorporates infrared heat waves to penetrate food, heating it throughout.

Baking and roasting are nearly identical methods of cooking that use dry, indirect heat for cooking foods. When baking or roasting in a convection oven, a fan's hot air is circulated to provide even cooking on all sides. The term roasting is used for meats and vegetables, and baking is used for bread, pastries, cakes and cookies. Typically, baking uses lower temperatures than roasting.

Foods like large cuts of meat, poultry, vegetables, nuts and seeds roast well. You will learn how to use many forms of dry heat to cook various proteins, vegetables and starches throughout your lessons on dry cooking.

Instructor Demonstration

Watch the instructor's demonstration on proper natural gas range safety and how to roast nuts and seeds to make trail mix. Answer the following questions as you watch the demonstration.

- What safety tips did the instructor give during the demonstration?
- What type of oven did the instructor use during the demonstration?
- At what temperature did the instructor set the oven?
- What tips did the instructor give with roasting nuts and seeds?
- What tips did the instructor give about adding other ingredients to the trail mix?
- How did the instructor determine how long to cook the nuts and seeds?
- What cooking tips did the instructor give during the demonstration?

Selecting and Preparing a Recipe

The following section can be completed at home if the preparing and cooking can be performed safely. Residential and commercial cooking equipment vary; while the information focuses on natural gas equipment, electric ranges and stoves may also be used to complete the cooking assignment.

Now you are going to make your trail mix. You will select several nuts and/or seeds and any optional mix-ins.

Your teacher will review your recipe and dish based on the criteria listed below. If you are learning remotely, your teacher will provide you with instructions on how to submit your recipe and images or video of your completed dish.

Criteria	Excellent 3	Proficient 2	Emerging 1
Procedure	clearly followed given instructions and the example provided in the demonstration	somewhat followed given instructions and/or the example provided in the demonstration	did not follow given instructions and/ or the example provided in the demonstration
Content (submitted photos, procedure, videos, etc.)	content and explanations were thorough and well detailed	included content and explanation but included few specific details	included little to no additional content or explanations and/or no specific details
Organization	organized when preparing and making their recipe	somewhat organized when preparing and/or making their recipe	not organized when preparing and/or making their recipe

Create Your Recipe

You will need to choose at least one item from the nut and seed category for this recipe. You can choose to add any additional mix-ins based on your preference, dietary preferences, allergies and available ingredients. Before starting to cook, it is important to have all of your ingredients, tools and equipment prepared ahead of time, what chefs call "mise en place" or "everything in its place."

Select nuts and seeds:

almonds

walnuts

cashews

pistachios

hazelnuts

pecans

peanuts

pumpkin seeds

sunflower seeds

sesame seeds

flax seeds

hemp seeds

pine nuts

Select extra mix-ins or flavorings (optional):

chocolate or peanut butter or white chocolate chips

small dried fruits such as raisins, cranberries, currants or blueberries

chopped dried fruits such as apples, mangoes, papaya, pineapple, cherries, peaches, persimmons, dates or apricots

freeze-dried berries

banana chips

toasted coconut pieces

pretzel pieces or popcorn

crystallized sugar

cereal pieces such as rice or wheat squares

small chocolate or other candies

salt or herb and spice blends

honey or syrup

hot sauce

Safety first:

- Always keep a Class ABC fire extinguisher nearby.
- Always use dry, flame retardant potholders to protect your hands from burning.
- Never use wet or moist potholders, oven mitts or towels as they will conduct heat, burning your hands.
- Practice knife safety when cutting any ingredient and use properly sharpened knives.
- Always keep a kitchen-specific fire extinguisher in a safe, easily accessible location.

Equipment:

- sheet pan
- potholders
- oven
- spatula or large spoon
- mixing bowl
- sharp knife

Ingredients:

- choice of nuts and/or seeds
- any other optional flavorings or mix-ins of your choice

Procedure:

1. Preheat the oven to the temperature indicated by the instructor.
2. Mix the nuts and seeds in the bowl. Add any salt, spices or liquid flavorings and mix well.
3. Evenly spread the nuts and seeds on the sheet pan.
4. Put the sheet pan in the hot oven. Roasting time will differ depending on the temperature of the oven.
5. When the nuts and seeds start to turn golden brown, carefully remove the sheet pan from the oven.
6. Let the nuts and seeds cool.
7. Add the nuts, seeds and any other mix-ins to a large mixing bowl. Stir to combine evenly.

Tips:

- Don't add chocolate or other ingredients that easily melt until the nuts and seeds are completely cool, or the chocolate will melt.
- Nuts can burn very quickly, so keep a close eye on them while they are in the oven.

Activity

After you finish making your trail mix, you decide to start a line of fun trail mixes to sell. Describe three different trail mixes you would make, including at least one savory and one sweet. Be creative and think of some ingredients that are not included in the list on page 10.

Final Assessment

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2. What is heat?
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4. How is batch cooking beneficial for chefs? Select all that apply.
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5. How does energy transfer during roasting?
   a. Energy is radiated from the heat source to the food.
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Intermediate Cooking with Gas—Beginner
Lesson 4: Roasting
Teacher Guide

(1-2 class sessions depending on setting)

Introduction

This lesson covers a basic understanding of how energy is transferred during cooking. Then, students will learn how natural gas is used in a rack or deck oven to roast nuts and seeds to make trail mix. Keep in mind that students may have dietary preferences, restrictions or allergies that may need to be accommodated to complete the recipe. Note that students may have different types of appliances at home, such as an electric oven, which will not prevent them from completing the assignment. If the student is preparing food at home, ensure that appropriate adult supervision will be available.

This lesson could be completed in a classroom or at home. Suggestions and instructions will be given for both scenarios.

Opening Assessment Answer Key (3 minutes)

Use these questions to obtain a baseline for what your students know before beginning the lesson. The correct answers are highlighted.

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How Is Energy Transferred During Cooking?

(4 minutes)

Students will read about the different ways energy is transferred during the cooking process, including conduction, convection and radiation. The following questions could be used for a class discussion or given to students to complete individually.

- What is the difference between temperature and heat?
- What are the different ways heat can be transferred?
- What is the difference between heat being transferred through direct contact versus indirect contact?
- How do conduction, convection and radiation differ?
- How is specific heat related to how quickly substances warm up?

Batch Cooking with Natural Gas (4 minutes)

Students will read about the benefits of batch cooking and how professional chefs and foodservice operators utilize it. The following questions could be used for a class discussion or given to students to complete individually.

- What is batch cooking?
- What are the benefits of batch cooking in a restaurant?
- What are the benefits of batch cooking for large crowds?
- What are the steps of batch cooking?

Cooking Methods (1 minute)

Students will understand that there are three cooking methods that utilize natural gas: moist cooking, dry cooking and combination cooking.

Dry Cooking: Roasting (5 minutes)

Students will read about cooking with dry heat and the roasting technique. The following questions could be used for a class discussion or given to students to complete individually.

- What are the benefits of cooking with dry heat?
- What is the difference between baking and roasting?
- How does heat transfer during roasting?
- How does the inclusion of a fan in the oven affect roasting?

Instructor Demonstration (7 minutes)

The demonstration can either be performed in class or recorded for remote use. If the demonstration is done in person, consider preheating the oven while the students complete their readings so that the oven will be at the proper temperature in time for your demonstration. Prepare the nuts, seeds and any mix-ins or seasonings that you will use during your demonstration before class.

You may also consider preheating the students' ovens during this time so that they can cook along with the demonstration. Or have them preheat their ovens during the demonstration. So, they can cook after the demonstration instead of waiting for the ovens to come to the proper temperature. Also, consider prepping the nuts, seeds and mix-ins ahead of time for the students to use.

The demonstration should include:

- how a gas convection oven works
- safety tips when using a gas convection oven
- knife techniques and safety when cutting ingredients
- how to roast, including tips for how different temperatures affect different ingredients when roasting
- benefits of using roasting as a cooking technique
- how to roast nuts and seeds, noting how to check the nuts and seeds for doneness
- tips for adding in seasonings and other flavorings before roasting the nuts and seeds
- tips for adding in mix-ins after the roasted nuts and seeds have cooled

Students will use the following questions as a guide to either a class discussion after the demonstration or note taking during the demonstration:

- What safety tips did the instructor give during the demonstration?
- What type of oven did the instructor use during the demonstration?
- At what temperature did the instructor set the oven?
- What tips did the instructor give with roasting nuts and seeds?
- What tips did the instructor give about adding other ingredients to the trail mix?
- How did the instructor determine how long to cook the nuts and seeds?
- What cooking tips did the instructor give during the demonstration?

Selecting and Preparing a Recipe (15 minutes)

If the students will be cooking in the classroom, ensure ingredients are available to the students ahead of time. Make sure that student allergies, dietary restrictions and preferences are taken into account. Also, be sure to plan a few minutes at the end of class for cleanup.

If the students are cooking at home, be sure to provide the ingredients or the "mise en place" ahead of time to give the students time to assemble the ingredients. Consider the time the recipe typically takes to cook and the ability for students to purchase their ingredients from the grocery store.

Students will use the instructor's demonstration as a guide to roast their nuts and seeds to make their own trail mix. Students will select nuts and/or seeds and optional toppings from a list to complete their recipe.

Students cooking at home can submit a description of the ingredients and the procedure they used along with pictures of their completed dishes or a video of themselves cooking the recipe. Be sure to share instructions on what to submit and how to share it with you.

Scoring Rubric:

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Activity (7 minutes or as homework)

Students will take inspiration from their trail-mix recipes to describe three creative trail mixes that they will use to start their own products. At least one of the trail mixes will be savory, and at least one of the trail mixes will be sweet. Students are encouraged to consider some ingredients in their recipes not included on the ingredient list.

Final Assessment: Answer Key (3 minutes or as homework)

Use these questions in conjunction with the discussion questions in each section to formatively assess student growth over the course of the lesson. Address any student misconceptions that remain at the end of the lesson. Consider having students compare their opening assessment with their final assessment to see how their understanding of cooking with gas improved over the course of the lesson.

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