



# Introduction to Cooking with Gas

Lesson 1: Boiling

**BEGINNER**



## Introduction

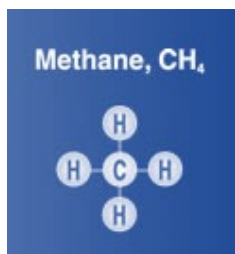
Welcome to Introduction to Cooking with Gas. Today's topic is understanding what natural gas is and where it comes from. Once you learn about natural gas, you will learn how to cook with gas to make your own delicious pasta dish.

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 natural gas?
  - a. a fossil fuel
  - b. an atmospheric gas
  - c. an elemental fuel
  - d. residue from burning coal
2. What does "boiling" mean?
  - a. the bubbling of a liquid
  - b. the temperature of a liquid
  - c. the phase change between liquid and gas
  - d. the amount of heat transferred to a liquid
3. What is an advantage of using natural gas over other energy sources?
  - a. Natural gas is a renewable energy source.
  - b. Natural gas is versatile and has many uses.
  - c. Natural gas is easier to obtain than other energy sources.
  - d. Natural gas can produce more energy than all other sources.
4. What type of equipment do you use to boil water to cook food?
  - a. a shallow pan
  - b. a baking sheet
  - c. a mixing bowl
  - d. a deep pot
5. What is the best way to know if your pasta is perfectly cooked?
  - a. by tasting it
  - b. by seeing if it just starts to break apart
  - c. by throwing it against the wall to see if it sticks
  - d. by using a timer and setting it for the exact time on the package

# What is Natural Gas?

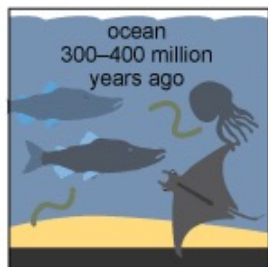


**Natural gas** is formed deep underground. Natural gas is used for cooking, heating and cooling, among other things. Many power plants also use natural gas to generate electricity. It is a gas that is primarily made of methane. Methane is made of one carbon atom and four hydrogen atoms and is written as CH<sub>4</sub>. **Methane** is a type of **hydrocarbon fuel**, which is a fuel made up of hydrogen and carbon atoms. Other fossil fuels such as coal and petroleum are also hydrocarbon fuels. Each hydrocarbon fuel has a different number of carbon and hydrogen atoms.

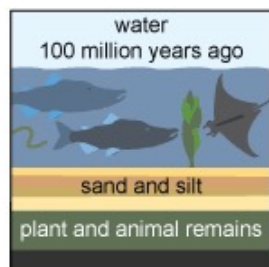
Natural gas is a colorless and odorless **fossil fuel** in its natural state. Fossil fuels formed over hundreds of millions of years ago from the remains of plants and animals deep within Earth's surface. The remains were buried under thick layers of sand, silt and rock. As the remains underwent increasing amounts of heat and pressure, the organic material (carbon, hydrogen, nitrogen and oxygen) turned into coal, oil and natural gas. Due to the very long time and specific conditions needed for fossil fuels to form, they are considered **nonrenewable resources**. Fossil fuels are removed from the deep layers of rock and refined to be used for various purposes, including producing energy.

## Petroleum and natural gas formation

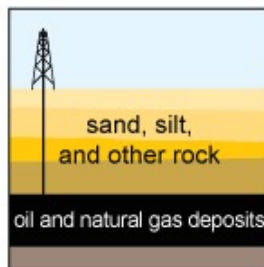
Tiny marine plants and animals died and were buried on the ocean floor. Over time, the marine plants and animals were covered by layers of silt and sand.



Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned the remains into oil and natural gas.



Today, we drill down through layers of sand, silt, and rock to reach the rock formations that contain oil and natural gas deposits.



Source: Adapted from National Energy Education Development Project (public domain)

Image from the [EIA](#)

In its natural state, natural gas is colorless and odorless, which makes it difficult to detect if there is a gas leak. Natural gas leaks are unsafe because it is harmful to breathe in natural gas and the fumes can also cause fires and explosions if ignited. Therefore, all natural gas used for energy is mixed with a gas called mercaptan (CH<sub>4</sub>S), which adds a foul odor similar to rotten eggs. This helps people detect if there is a natural gas leak in their home. Natural gas is not safe to breathe and the added odors allow people to detect and trace the source of the leak so that it is quickly repaired.

## Cooking with Natural Gas

Natural gas is the preferred fuel source for cooking by both commercial foodservice operators and professional chefs. It is adjustable, abundant, reliable and is more cost-effective and energy efficient.

There are several fuels to power cooking appliances in commercial kitchens: natural gas, electricity and induction. Each of these types of appliances has their advantages and disadvantages, but natural gas is seen as the preferred standard for cooking appliances, particularly ranges, ovens and fryers.

Natural gas also offers flexibility when controlling the temperature – the heat can instantly be turned on or off and the temperature can be precisely controlled. Electric stoves, for example, take time to heat up and cool down, and any changes in temperature take additional time. The ability to quickly turn a natural gas stove on or to adjust the temperature by changing the size of the flame allows cooking times to decrease, which also leads to higher efficiencies. The ability to precisely control the temperature is also important for the heat to be evenly distributed while cooking or baking.

Most natural gas stoves can also be used during power outages, even though most stoves use electric burner ignitors. A match can be used carefully to light the gas and allow you to cook on a stovetop. Note, however, that natural gas ovens use additional electric components to function and will not be usable during a power outage. It is never advised to stick a match in a gas oven.

Investing in energy efficient natural gas cooking appliances whenever possible can not only lower your energy bills each month but allows for less time for the appliances to be used while cooking. It is also important that gas appliances be properly maintained to avoid gas leaks.



# 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 moist cooking method.

## Moist Cooking: Boiling

Moist cooking methods include poaching, simmering, boiling, steaming and blanching. Each method utilizes liquid or steam in order to cook the food. This lesson will utilize a range or stovetop and the boiling cooking method. A natural gas range or stovetop in commercial kitchens is either found in combination with an oven or as a separate appliance built into a countertop. The burners are connected to a gas line with a valve controlled by a knob. To turn on the burner, the knob is turned to the ignition setting to start the flow of gas and produce a spark to ignite the gas. The size of the flame is controlled by the knob, which adjusts the temperature of what you are cooking.



The amount of heat energy a gas stove has is measured in British thermal units (BTUs). BTUs are defined as the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit. Each gas range can have a different amount of BTUs, and each burner on a gas range can also have different amounts of BTUs. This is important to keep in mind as varying amounts of BTUs can lead to different cooking times: the higher the BTU, the higher the temperature the stove can get and the faster the water will boil or the food will cook.

Water boils when it reaches a temperature of 212°F. Boiling is the result of a phase change when the water changes from liquid to gas. The water in the pot will continue absorbing heat from the flame but its temperature will not rise above 212°F. Instead, the water will change into steam.

Water is typically boiled in a pot for use in cooking. When water boils you will see many large, rapidly forming bubbles in the pot – this is when the water is ready for use in your recipe!

Foods like root vegetables, pasta and eggs cook well in boiling water. You will learn how to utilize boiling water, as well as other forms of moist heat, to cook various proteins, vegetables and starches throughout your lessons on moist cooking.

## **Instructor Demonstration**

Watch the instructor demonstration on proper natural gas stove safety and how to boil water to cook pasta. Answer the following questions as you watch the demonstration.

- What safety tips did the instructor give during the demonstration?
- How much water did the instructor put into the pot?
- How high did the instructor have the flame underneath the pot?
- How did the instructor determine how long to cook the pasta?
- 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 own delicious pasta dish using dried spaghetti noodles. Once cooked, the noodles will be tossed with a little butter or olive oil. You can optionally top the pasta with some vegetables, proteins or flavorings.

Your teacher will review your recipe and dish based on the criteria listed on the following page. 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

For this recipe you will need to choose one item from the pasta and one item from the fat categories. You can choose to add any additional toppings or flavors based on your 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 a pasta:

spaghetti

gluten-free  
spaghetti

### Select a fat:

olive oil

butter

### Select extra flavors and toppings (optional):

black pepper or chili flakes  
jarred roasted peppers, sliced

lemon zest  
fresh basil or parsley, finely chopped  
parmesan cheese  
roasted garlic  
frozen peas, thawed  
canned beans, drained and rinsed  
cooked chicken, sliced  
caramelized onions

**Safety first:**

- Always keep a Class ABC fire extinguisher nearby.
- Make sure the pot of water is not filled to the top so it doesn't spill when it comes to a boil or overflow when you add the pasta.
- Make sure there are no pot holders, towels or other flammable materials next to the burner.
- Make sure there are no plastic or meltable objects next to the burner.
- Always use potholders to protect your hands from burning on the hot pot.
- Always pour hot liquids away from you.

**Equipment:**

- a large pot (a general rule is 4-5 quarts of water in a 6-8 quart pot for one pound of dried pasta)
- pot holders
- colander
- a large fork, tongs or pasta spoon
- a gas range or cooktop

**Ingredients:**

- choice of pasta (note the cook time on the pasta package)
- choice of fat and other toppings
- water
- salt (approximately 1 tablespoon per 4 quarts of water depending on the type of salt –add a little more if using kosher salt or slightly less if using table salt or sea salt)

**Procedure:**

1. Fill the pot about  $\frac{3}{4}$  of the way with water. Place it on the burner, then turn the burner on and move the knob to high.
2. When the water comes to a boil, stir in the salt.
3. Add the dried pasta and give it a few stirs to avoid it sticking together. Cook according to the directions and time given on the pasta package.
4. Reserve about  $\frac{1}{2}$  cup of the pasta water while draining the pasta and place off to the side. Put the pasta back in the pot.
5. Toss about 4 tablespoons of olive oil or butter along with a couple tablespoons of the reserved pasta water into the pasta. Add more olive oil/butter and/or pasta water as needed to ensure the pasta is fully coated. Stir in any of your chosen additional toppings. Taste and add more salt if needed based on your preference.
6. Serve immediately.



### Tips:

- If you prefer, salt the water before you cook the pasta to add flavor.
- If you prefer, reserve some of the pasta water – the starch in the water from cooking the pasta will help the sauce, olive oil or butter to coat the pasta.
- Put a lid on your pot while the water is heating to bring it to a boil faster, but do not cover the pot with the lid while the pasta is cooking or it will change the cook time.
- Note the cook time of the pasta on the package before putting the pasta in the water, but start testing the pasta about a minute or two before the time on the package because the pasta will cook slightly differently in different conditions. Tasting the pasta is the best way to determine that it is perfectly al dente ("to the tooth") and ready to be drained, finished with sauce and served.

## Activity

After you finish cooking your pasta dish, select one prompt to write about:

1. Write about your pasta dish as if you were getting ready to promote your dish at your restaurant. Include descriptive words about the tastes, textures, visual appeal and aromas so that potential customers would know what to expect if they ordered your dish.
2. If your pasta recipe did not turn out as you expected, write about the differences between your expectations (better or worse) and the results. Include specific details about how your procedure/ingredients made the recipe better than you expected or how you could change your procedure and/or ingredients in order to make your results closer to your expectations the next time you cook it.

## Additional Activity

Match each vocabulary word with its definition. Then use your answers to make flashcards to help you practice the vocabulary words.

Vocabulary Word	Definition
-----------------	------------

natural gas	Fuels made over hundreds of millions of years from the remains of plants and animals
methane	An appliance with burners that you put a pot or pan on to cook in
hydrocarbon	A gas that formed deep underground
fossil fuels	When an appliance uses less energy to run
efficient	The phase change between liquid and gas
moist cooking	The amount of heat needed to raise the temperature of one pound of water 1°F
boil	Natural gas is primarily made of this
BTU	A fuel made up of different configurations of carbon and hydrogen
stovetop	A cooking method utilizing liquid or steam

## Final Assessment

1. What is natural gas?
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# **Introduction to Cooking with Gas—Beginner**

## **Lesson 1: Boiling**

### **Teacher-facing Materials**

(1-2 class sessions depending on setting)

## **Introduction**

This lesson covers a basic understanding of natural gas, including where it is found. Then students will learn how natural gas is used on a stovetop to boil water and cook pasta. Keep in mind that students may have dietary preferences, restrictions or allergies that may need to be accommodated in order for them to complete the recipe. Note that students may have different types of appliances at home, such as an electric or induction range, 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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## **What is Natural Gas?** (5 minutes)

Students will read about natural gas, including what it is and how it is formed. The following questions could be used for a class discussion or given to students to complete individually.

- Why does natural gas only form deep underground?
- Why is natural gas considered a nonrenewable resource?
- Why is it important to note that natural gas is colorless and odorless in its natural state?

## **Cooking with Natural Gas** (5 minutes)

Students will read about the benefits of cooking with natural gas appliances. The following questions could be used for a class discussion or given to students to complete individually.

- Why is natural gas more efficient than electricity for cooking appliances?
- Why are natural gas cooking appliances more precise than electrical cooking appliances?
- Why is it important to properly maintain natural gas cooking appliances?

## **Cooking Methods** (2 minutes)

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

## **Moist Cooking: Boiling** (5 minutes)

Students will read about cooking with moist heat and the boiling 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 moist heat?
- What occurs when water reaches its boiling point?
- Do you think water will boil more slowly or more quickly using a natural gas burner versus an electric burner? Why?

## Instructor Demonstration (10 minutes)

The demonstration can either be performed in class or recorded for remote use. If the demonstration is done in person, consider bringing large pots of water to a boil while the students complete their readings so that the water is boiling in time for your demonstration.

You may also consider boiling the water for the students during this time so that the students will be able to cook along with the demonstration, or having the students start boiling their water during the demonstration so that they may begin cooking directly following the demonstration rather than waiting for the water to boil.

The demonstration should include:

- how a gas stove/range works
- safety tips when using a gas stove/range
- how to boil water, including tips for how much to fill a pot
- benefits of using boiling as a cooking technique
- how to cook pasta, noting the instructions on the pasta package and how to check the pasta for doneness
- benefit of reserving pasta water to use in the sauce
- finishing the pasta with butter or olive oil, reserved pasta water and incorporating other optional ingredients

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?
- How much water did the instructor put into the pot?
- How high did the instructor have the flame underneath the pot?
- How did the instructor determine how long to cook the pasta?
- What cooking tips did the instructor give during the demonstration?

## Selecting and Preparing a Recipe (20 minutes)

If the students will be cooking in the classroom, ensure that the 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 will be cooking at home, be sure to provide the list of ingredients or the “mise en place” ahead of time to give the students time to assemble the ingredients. Take into consideration 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 demonstration as a guide to cook their own pasta dishes. Students will select a pasta, a fat and optional flavorings and toppings from a list in order to complete their recipe.

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

Scoring Rubric:

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

## Activity (10 minutes or as homework)

Students will select one of the prompts and write about their experiences in cooking their pasta recipe. Share out the short answer scoring rubric with students before they complete their writing activity.

1. Write about your pasta dish as if you were getting ready to promote your dish at your restaurant. Include descriptive words about the tastes, textures, visual appeal and aromas so that potential customers would know what to expect if they ordered your dish.
2. If your pasta recipe did not turn out as you expected, write about the differences between your expectations (better or worse) and results. Include specific details about how your procedure/ingredients made the recipe better than you expected or how you could change your procedure and/or ingredients in order to make your results closer to your expectations the next time you cook it.

### Scoring Rubric:

4	3	2	1
<p>The student response ...</p> <ul style="list-style-type: none"><li>• fully responds to each part of the writing prompt with relevant, strong details</li><li>• has logical organization</li><li>• uses effective language and word choice for purpose and audience</li><li>• contains no errors in usage or grammar</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• addresses each part of the writing prompt with sufficient details</li><li>• has sufficient organization</li><li>• uses mostly effective language and word choice for purpose and audience</li><li>• contains minor errors in usage or grammar that do not affect meaning</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• addresses some of the writing prompt with weak details</li><li>• attempts organization</li><li>• uses some language and word choice for purpose and audience</li><li>• contains minor errors in usage or grammar that slightly affect meaning</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• does not address a large portion of the writing prompt</li><li>• lacks organization</li><li>• rarely uses appropriate language and word choice for purpose and audience</li><li>• contains major errors in usage or grammar that greatly affect meaning</li></ul>

## Additional Activity: Answer Key (5 minutes or as homework)

This additional activity is provided to be used either in the classroom during any down-time, or as homework. In this activity, students will match the vocabulary words to their definitions. Students can then use their answer key to make flashcards.

Vocabulary Word	Definition
1. natural gas	4. Fuels made over hundreds of millions of years from the remains of plants and animals
2. methane	9. An appliance with burners that you put a pot or pan on to cook in.
3. hydrocarbon	1. A gas that formed deep underground
4. fossil fuels	5. When an appliance uses less energy to run
5. efficient	7. The phase change between liquid and gas
6. moist cooking	8. The amount of heat needed to raise the temperature of one pound of water 1°F
7. boil	2. Natural gas is primarily made of this
8. BTU	3. A fuel made up of different configurations of carbon and hydrogen
9. stovetop	6. A cooking method utilizing liquid or steam



## 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.

1. What is natural gas?
  - a. a fossil fuel
  - b. an atmospheric gas
  - c. an elemental fuel
  - d. residue from burning coal
2. What does "boiling" mean?
  - a. the bubbling of a liquid
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