

Prevent the Spread of COVID-19

Design Challenge



Healthy Actions • Community
Knowledge • Science

FOR GRADES
9-12

OVERVIEW

Students conduct research using online text resources and media to explore how the virus that causes COVID-19 spreads from person to person. Students apply what they learn to day-to-day decision-making and demonstrate their understanding by redesigning a family restaurant to provide a safer environment for customers and staff.

LEARNING OBJECTIVE

After completing the activity, students will be able to:

- Describe how SARS-CoV-2 spreads from person to person
- Explain current research on the spread of SARS-CoV-2 via droplets, aerosols, and surfaces
- Apply what they have learned to a family restaurant model

SCIENCE, HEALTH AND MATH SKILLS

- Comparing and contrasting
- Interpreting information
- Communicating

COMMON CORE STANDARDS FOR ENGLISH LANGUAGE ARTS

- ELA-LITERACY.RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- ELA-LITERACY.RST.9-10.2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

NGSS SCIENCE AND ENGINEERING PRACTICES

- Analyzing and interpreting data
- Obtaining, evaluating and communicating information

MATERIALS FOR SCIENCE INVESTIGATION

Each student will need:

- Device with internet access
- Colored pens, pencils, markers, or crayons
- Digital or Print copy of the Student Sheet A and B on which to record answers
 - a. How Does COVID-19 Spread?
 - b. Design a Safer Sophie's Place

Teacher will need:

- Accompanying slides to guide student discussion

SET UP AND TEACHING TIPS

This activity can be introduced during one classroom period and completed during the next time you meet with students. Use the accompanying slides to guide a discussion of students' research. As an assessment, students will design a restaurant with appropriate COVID-19 safety precautions. You may want to allocate a separate class period for students to present their designs.

TIME

- 2-3 class periods

PROCEDURE

ENGAGE AND EXPLORE

1. Tell students they are going to learn how SARS-CoV-2, the virus that causes COVID-19 illness, spreads from person to person, and how they can protect themselves from becoming infected.
2. Ask students to complete "Student Research Guide A: How Does SARS-CoV-2 Spread?" before the next class.

EXPLAIN

3. Use the accompanying slides to review what students learned in their online research related to SARS-CoV-2 (Student Sheet A). If students raise a question for which you do not have an answer, have them add it to a "what I want to know" list. You can suggest a possible online source that might have the information they seek.

NOTE: Slide 1 corresponds to the title slide.

SLIDE 2 + 3

2 What Do You Think?

True or False?	Statement
	(1) Drinking or injecting household cleaners or disinfectants can prevent or treat COVID-19.
	(2) Eating spicy foods does not prevent COVID-19 infections.
	(3) Exposing the body to high heat, hot baths, or sunlight will prevent COVID-19 infection.
	(4) Hydroxychloroquine is an effective treatment for COVID-19.
	(5) If you can hold your breath for 10 seconds or more without coughing, you don't have COVID-19.
	(6) Most people who get COVID-19 recover.
	(7) People of ALL ages can be infected by the virus that causes COVID-19.
	(8) Wearing a mask can cause you to breathe too much CO ₂ and too little oxygen.
	(9) Extreme weather (heats, colds, rains, snow, etc.) can kill the COVID-19 virus.
	(10) You can detect COVID-19 using a thermal scanner.

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STEM Teacher Resources from Baylor College of Medicine

Let's Debunk COVID-19 Myths!

- Misconceptions and myths often arise when new diseases are discovered, or begin to affect large groups of people. COVID-19 is no exception. Let's review some of the myths and misconceptions listed at the World Health Organization site.

NOTE: Slide 2 presents the statements and Slide 3 provides the true or false information. Additional explanations are provided in the notes below.

TRUE / FALSE	STATEMENT
Drinking or injecting household cleaners or disinfectants can prevent or treat COVID-19.	<u>False:</u> None of these items is safe to drink or inject. In fact, most are poisonous. None of them will prevent or treat COVID-19. Several effective vaccines have been developed The medical community continues to find new ways to treat COVID-19 and most patients do well and recover.
Eating spicy foods does not prevent COVID-19 infections.	<u>True:</u> No foods can prevent a viral infection. However, eating healthy foods can help keep your immune system strong to help fight off infections.
Exposing the body to high heat, hot baths, or sunlight will prevent COVID-19 infection.	<u>False:</u> The heat required to inactivate the virus would damage your skin.
Hydroxychloroquine is an effective treatment for COVID-19.	<u>False:</u> Hydroxychloroquine was developed to treat malaria, lupus, and certain types of arthritis. Data show it is not effective in preventing or treating COVID-19.
If you can hold your breath for 10 seconds or more without coughing, you don't have COVID-19.	<u>False:</u> People infected with COVID-19 may have few or no symptoms, and they can also be contagious.
Most people who get COVID-19 recover.	<u>True:</u> Fewer than 3% of all COVID-19 patients worldwide and in the US die from the disease.
People of ALL ages can be infected by the virus that causes COVID-19.	<u>True:</u> Anyone can get COVID-19.
Wearing a mask can cause you to breathe too much CO2 and too little oxygen.	<u>False:</u> Wearing a mask does not deprive a person of oxygen or cause a build-up of CO2. The CDC makes three exceptions to wearing a mask: children younger than 2 years old, someone who is unconscious or incapacitated, and someone who is unable to remove their own mask.
Extreme weather (warm, cold, rainy, snowy, etc.) can kill the COVID-19virus.	<u>False:</u> SARS-CoV-2 is not killed by cold or hot weather.
You can detect COVID-19 using a thermal scanner.	<u>False:</u> A thermal scanner only measures temperature. It is effective in detecting people who have a higher body temperature than normal (fever).

SLIDE 4

4 How Are Viruses Transmitted?

Viruses can be transmitted from host to host in different ways.

Another Organism (vector)

- Mosquitoes carry yellow fever from human to human. Fleas carried plague from infected rats to humans.

Body Fluids

- Hepatitis B and HIV/AIDS are examples.

Through Contaminated Food or Water

- Cholera and E. coli infections are examples.

In the Air (Respiratory)

- Influenza and colds caused by rhinoviruses are transmitted by respiratory droplets in air and on highly touched surfaces.



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How Are Viruses Transmitted?

- Viruses can be transmitted from host to host in different ways.
 - a. Vector: Mosquitos carry yellow fever from human to human. Fleas carried plague from infected rats to humans.
 - b. Body fluids: Hepatitis B and HIV-AIDS.
 - c. Contaminated food or water, as with Cholera and E. coli.
 - d. Airborne/droplets, as with influenza, rhinoviruses (colds), and coronaviruses.

SLIDE 5

5 How Is SARS-CoV-2 Transmitted?

Respiratory Droplets in Air (Close Contact)

- Respiratory droplets are expelled when a person with the infection coughs, sneezes, sings, talks, or breathes.
- Droplets are inhaled and reach the mouth, nose or lungs.

Asymptomatic Transmission ALSO Can Lead to Infection

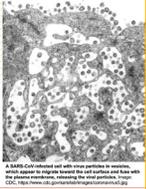
- Very small expelled droplets called aerosols can linger in air for hours, especially in enclosed spaces.
- The droplets can accumulate over time in an enclosed space.

Surface Contamination (ECS) & Very Close Proximity

- Respiratory droplets land on surfaces and contaminate them with virus.
- Touching a contaminated surface and then your eyes, nose or mouth could potentially lead to COVID-19 infection.

Transmission by Contact with Infected Animals is Very Unlikely

- Keep pets away from other people.
- If someone in your home gets COVID-19, keep pets away from them.



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How Is SARS-CoV-2 Transmitted?

- From person-to-person: more easily than flu but not as fast as measles.
- Primarily through close contact — most likely route:
 - a. Within 6 feet of an infected person.
 - b. Respiratory droplets expelled when the infected person coughs, sneezes, sings, talks, or breathes.
 - c. Droplets are inhaled and reach lung or mucous membranes in mouth and nose.
 - d. Larger respiratory droplets can fall out of the air due to gravity.
 - e. Over time, viral particles in the droplets can become inactive.
- Airborne transmission also can lead to infection.
 - a. Small droplets = “aerosols”.
 - b. Can linger in air for hours.
 - c. Especially likely in enclosed spaces, and where air circulation is limited.
 - d. Singing, exercising, etc. can increase number of particles in an enclosed area.
- Surface contamination is less likely but possible.
 - a. Respiratory droplets land on surfaces and contaminate them with virus.
 - b. Touching a contaminated surface and then your eyes, nose or mouth can lead to COVID-19 infection.
- Contact with infected animals: very unlikely.
 - a. Keep pets away from other people.
 - b. If someone in your home gets COVID-19, keep pets away from them.

SLIDE 6

6 #COVID STOPS WITH ME



#COVID STOPS WITH ME

- Stay at least 6 feet away from others whenever possible.
- Cover your mouth and nose with a mask when around others.
- Wash your hands often with soap and water (or 60% alcohol hand sanitizer).
- Avoid crowded indoor spaces.
- Ensure indoor spaces are properly ventilated by bringing in outdoor air as much as possible.
- Stay home and isolate from others when sick.
- Routinely clean and disinfect frequently touched surfaces.

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#CovidStopsWithMe

- Viruses can be transmitted from host to host in different ways.
- Stay at least 6 feet away from others whenever possible.
- Wash your hands often with soap and water. (Or 60% alcohol hand sanitizer.)
- Avoid crowded indoor spaces.
- Ensure indoor spaces are properly ventilated by bringing in outdoor air as much as possible.
- Stay home and isolate from others when sick.
- Routinely clean and disinfect frequently touched surfaces.

SLIDE 7

7 How Long Does SARS-CoV-2 Last on Surfaces?

Especially important for medical and dental offices, restaurants and anyone who handles or packs materials.

- Cardboard: 24 hours
- Copper (coins): 4 hours
- Plastic or stainless steel, countertops: 72 hours (3 days)



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How Long Does SARS-CoV-2 Last on Surfaces?

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SLIDE 8

8 Aerosolized Particles

Aerosolized particles are very tiny droplets that float in air for hours to days.

Aerosols are not the primary way that SARS-CoV-2 spreads—but transmission through aerosols becomes more of a risk in small or poorly ventilated indoor spaces.



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Aerosolized Particles

- Aerosolized particles are not the primary way that COVID-19 spreads, but they become more of a risk in small or poorly ventilated indoor spaces.
- If feasible, show students the CBS News report and/or New York Times simulation. Discuss why air circulation, ventilation, and open windows can be important in helping to prevent COVID-19 transmission indoors.

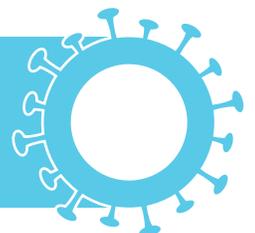
EXTEND

4. An extend activity is given as a challenge question on the “Student Research Guide A: How Does COVID-19 spread?”

EVALUATE

5. The “Evaluate” activity provides another real-life scenario. It encourages students to apply what they learned about aerosol transmission of the virus to make a family restaurant safer. Have students work individually or in teams to redesign a restaurant to create a safer environment for staff and customers.
6. Have students present their designs to the class.

Misconceptions and myths often arise when new diseases are discovered or begin to affect large groups of people. COVID-19 is no exception. No foods can prevent a viral infection. However, eating healthy foods can help keep your immune system strong to help fight off infections.



COVID HEALTHY ACTIONS, COMMUNITY KNOWLEDGE AND SCIENCE

■ A SCIENCE-BASED CURRICULUM FOR THE COVID-19 PANDEMIC

We are grateful to Laura and John Arnold and other community donors for their generous support, which enabled development of the COVID HACKS curriculum materials. We also thank the many scientists, educators and physicians from Baylor College of Medicine (BCM) who provided content, feedback and technical reviews.

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How Does COVID-19 Spread?

Student Research Guide A



LEARNING OBJECTIVES

After completing this exploration, you will be able to:

- Describe how the virus that causes COVID-19 spreads from person to person
- Explain current research on the spread of the virus that causes COVID-19 via droplets, aerosols, and surfaces
- Apply what you have learned to a family restaurant model

ENGAGE

1. Take a look at the statements below. Indicate your best estimate of whether each statement is true or false.

TRUE / FALSE	STATEMENT
	Drinking or injecting bleach, methanol, ethanol, or disinfectants can prevent or treat COVID-19.
	Eating spicy foods does not prevent COVID-19 infections.
	Exposing the body to high heat, hot baths, or sunlight will prevent COVID-19 infection.
	Hydroxychloroquine is an effective treatment for COVID-19.
	If you can hold your breath for 10 seconds or more without coughing, you don't have COVID-19.
	Most people who get COVID-19 recover.
	People of ALL ages can be infected by COVID-19.
	There is currently no medication that can cure COVID-19.
	Wearing a mask can cause you to breathe too much CO ₂ and too little oxygen.
	Extreme weather (warm, cold, rainy, snowy, etc.) can kill the COVID-19 virus.
	You can detect COVID-19 using a thermal scanner.

Now, Read the information on this World Health Organization (WHO) website:

(<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>).

Then, check your responses, and correct any statements based on what you have learned.

2. Where you surprised by any of the information you found? Why or why not?

BEFORE YOU CONTINUE: Does the WHO meet appropriate criteria for a reliable source of science information?

For example, does it provide current information, written by people with scientific credentials or authority, and provided without bias?

EXPLORE

When the virus that causes COVID-19 began spreading in China, and then around the world, one of the first questions scientists focused on was, “How is it transmitted?” It’s an important question because not all viruses spread the same way. Some are carried by a “vector,” or carrier. For example, a mosquito that carries the yellow fever virus can transfer it from person to person in the blood it draws when it bites. Other viruses, such as hepatitis B and HIV, are transmitted via direct contact with an infected person’s blood or certain body fluids. Viruses that attack the gastrointestinal system, such as norovirus, usually are transmitted via food, water, or hands contaminated with the virus. Respiratory viruses like influenza (flu), rhinoviruses (which cause colds), and coronaviruses (which also cause colds) are transmitted in multiple ways, but especially through virus-laden droplets released into the air when an infected person coughs, shouts or sneezes.¹

Even among respiratory viruses, transmission routes can vary. Measles is highly contagious. When an infected person coughs or sneezes, the measles virus particles they expel can survive for up to two hours on surfaces and in tiny droplets that can hang in the air.² Patients with measles are contagious up to four days even before the typical rash appears,³ making measles a major public health challenge. Measles is strictly a human disease, and does not occur in animals. By contrast, Middle East respiratory syndrome coronavirus (MERS-CoV) is transmitted through direct contact between camels and humans, and from humans to humans.

Scientists and research laboratories around the world have worked hard to understand how the virus that causes COVID-19 spreads. Among other things, they want to know what happens to the SARS-CoV-2 particles breathed or coughed out by patients. When COVID-19 became a pandemic in March 2020, scientists and medical personnel knew little about this new virus. Since then, researchers in many areas of life sciences and medicine, environmental science, engineering, and other fields have focused their work on understanding what SARS-CoV-2 is, how it replicates and affects the human body, how it spreads in hospitals, restaurants, and other buildings, and how it can be killed (inactivated).

You will explore how the SARS-CoV-2 virus spreads.

- Watch this video from scientists at Scripps Research about how coronaviruses invade through the airways. <https://www.scripps.edu/covid-19/science-simplified/how-the-novel-coronavirus-infects-a-cell/index.html>
- *What we know about how the virus that causes COVID-19 spreads?* Read this article from the U.S. Centers for Disease Control and Prevention (CDC): <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html>.

Then, answer the following questions, based on what you learned.

- BEFORE YOU CONTINUE:** *Does the WHO meet appropriate criteria for a reliable source of science information? For example, does it provide current information, written by people with scientific credentials or authority, and provided without bias?*
- On what date was the article updated?*

¹ Morens & Fauci, 2020 Cell article

² <https://newsnetwork.mayoclinic.org/discussion/infectious-diseases-a-z-why-the-measles-virus-is-so-contagious/>

³ <https://www.cdc.gov/measles/transmission.html>

- c. According to the CDC, *What is the most common way that SARS-CoV-2 virus spreads from person-to-person?* Describe how this happens.

- d. *What is “airborne transmission”? What are aerosols?*

- e. *What kinds of locations and situations put people at greatest risk from getting COVID-19 through airborne transmission?*

- f. *How can you catch SARS-CoV-2 by touching a contaminated surface?*

- g. *How can you avoid catching SARS-CoV-2 from surface contact?*

- h. Describe at least three ways to protect yourself and your family and friends from COVID.

EXPLORE

PICK A SEAT: You and your little sister are walking to the corner market to pick up an order for your mom. You both are wearing your masks. On the way, you plan to get lunch at your favorite fast-food place. You order the food on your phone app as you walk. When you get to the restaurant, you pick up your food at the counter, then use hand sanitizer to clean your hands. You suggest eating at the outdoor tables since it's a nice day. However, your sister wants to sit inside. The only indoor table available is right under an air conditioning vent and there are no open windows. *Which is safer, indoors or out? Why?*

How Does COVID-19 Spread?

Remodeling Sophie's Place



OVERVIEW

Your aunt Sophie's small restaurant, Sophie's Place, has a few tables and does a lot of carry-out business. During the initial COVID-19 stay-at-home period, Sophie kept her business going by offering online or telephone ordering and payment, and by delivering packaged orders to customers' cars at curbside. She followed strict guidelines for her staff, checking temperatures daily and asking any staff with symptoms to stay home. She implemented public health guidelines for cleaning. Her staff used masks and gloves to further protect themselves and customers, and they kept as much distance between themselves as possible. Sophie was very pleased that she and her staff made it through the first wave of the pandemic without illness and that her business was able to survive, thanks to her great food and loyal customers.

Public health officials now have moved Sophie's county to "Stage 2." This means that Sophie's Place can have a limited number of customers in the restaurant at one time. Sophie knows that curbside and carry-out orders will still be the main part of her business, but she also wants to make the restaurant as safe as possible for her staff and those who dine-in. She has received a permit to move half of the ten tables in her restaurant to the sidewalk/parking spaces out front. She also received a state emergency fund grant to support renovations that promote social distancing and improved air circulation in the restaurant.

Sophie is aware that indoor dining still is considered a considerable risk factor for SARS-CoV-2 transmission. So, her three goals are to **(1)** provide spaces that are as safe as possible for "dine-in" customers to be seated and eat; **(2)** make it safe and easy for carry-out customers to pick up orders; and **(3)** reduce the chance that SARS-CoV-2 aerosols will hang in the restaurant air.

CHALLENGE

Sophie asks you to help design a quick “remodel” of her restaurant. She gives you the following tasks:

1. Use the materials and supplies provided by her grant to redesign Sophie’s Place in a way that meets her goals for a safe indoor environment. Use Diagram B (below), which is a floorplan of the restaurant to draw your design. All features shown in Diagram B are fixed and cannot be moved or removed. Diagram A shows you the current restaurant layout with tables and counter.
NOTE: You do NOT need to design the outside table space.
2. Describe in detail how your revisions will meet Aunt Sophie’s three goals.
3. Create a promotion (flyer, Facebook post or ad, Tweet, etc.) to inform the public that Sophie’s Place is now open for carry out, dine-in and curbside customers. The flyer also must explain the important precautions being taken to make Sophie’s Place as safe as possible for customers from COVID-19.

More information to guide your work:

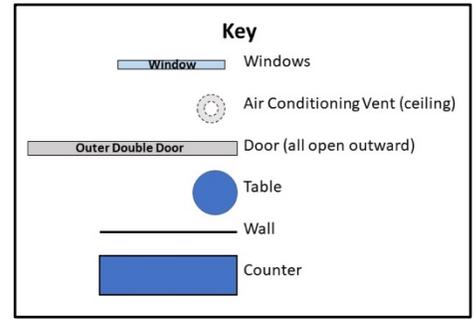
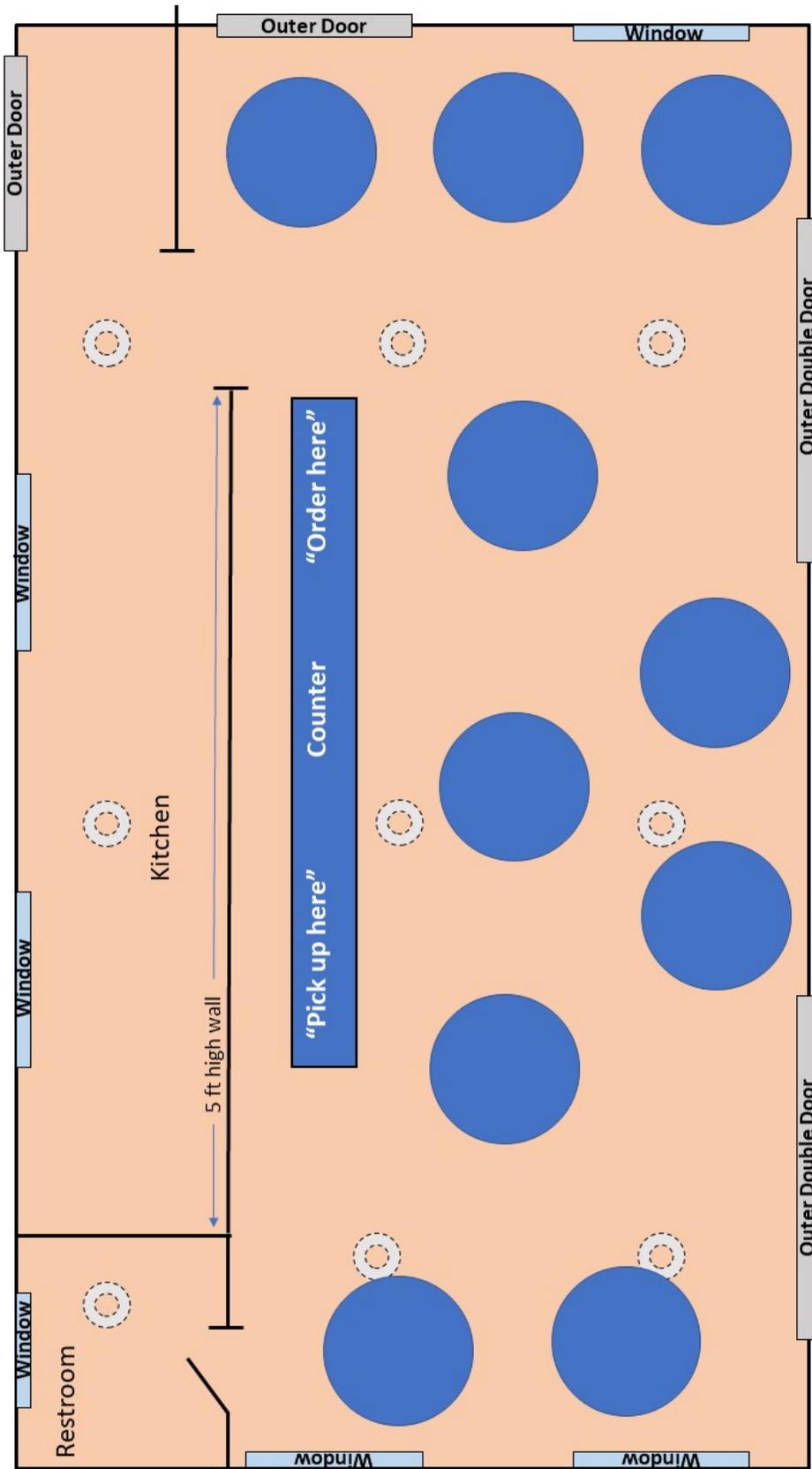
- Sophie’s Place is in central California, where the temperature is moderate year-round (60-80 degrees F).
- The state emergency grant will cover the following items:
 - a. Addition of window fans or air circulators.
 - b. Indoor and outdoor signs.
 - c. Moving, modifying or adding tables and counters.
 - d. Building or moving walls.
 - e. Adding plastic panels or barriers at counter tops.
 - f. Changing or revising door locks.
- The grant will not cover the following items:
 - a. Adding new windows or doors.
 - b. Moving or adding air conditioning ducts.
 - c. Adding filters or UV lights to the air conditioning system.
 - d. Moving the kitchen internal wall or kitchen equipment.
- Air conditioning outlets blow air down into the room.
- Overall, the restaurant is 50 feet wide by 36 feet deep, not counting outdoor space. You cannot move outside walls.
- A key of the features shown on the restaurant diagram, and a copy of Sophie’s Place logo are provided below.

To complete this assignment, carry out the following steps:

1. Draw a revised restaurant layout on Diagram B, showing where tables and countertops will be placed, and indicating where any new window fans or air circulators will be added. Use a drawing program or colored pen or marker to show the flow of:
 - a. Air through the restaurant, including air from windows and air conditioning units (draw black arrows).
 - b. Pathways and locations for “dine-in” customers, who enter the restaurant and sit at tables (use red).
 - c. Pathways and locations for “carry-out” customers, who order food inside the restaurant or via phone, and pick up their orders in the restaurant to take home (use blue).
2. Create a promotion (flyer, Facebook post or ad, Tweet, etc.) that incorporates the logo below to inform the public that Sophie’s Place is now open for carry out, dine-in and curbside customers. The flyer also must explain the important precautions being taken to protect Sophie’s Place customers from COVID-19.

EXPLORE

SOPHIE'S PLACE: DIAGRAM A



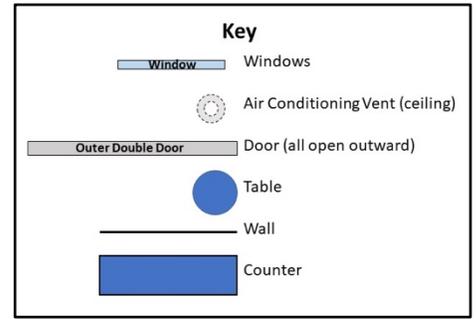
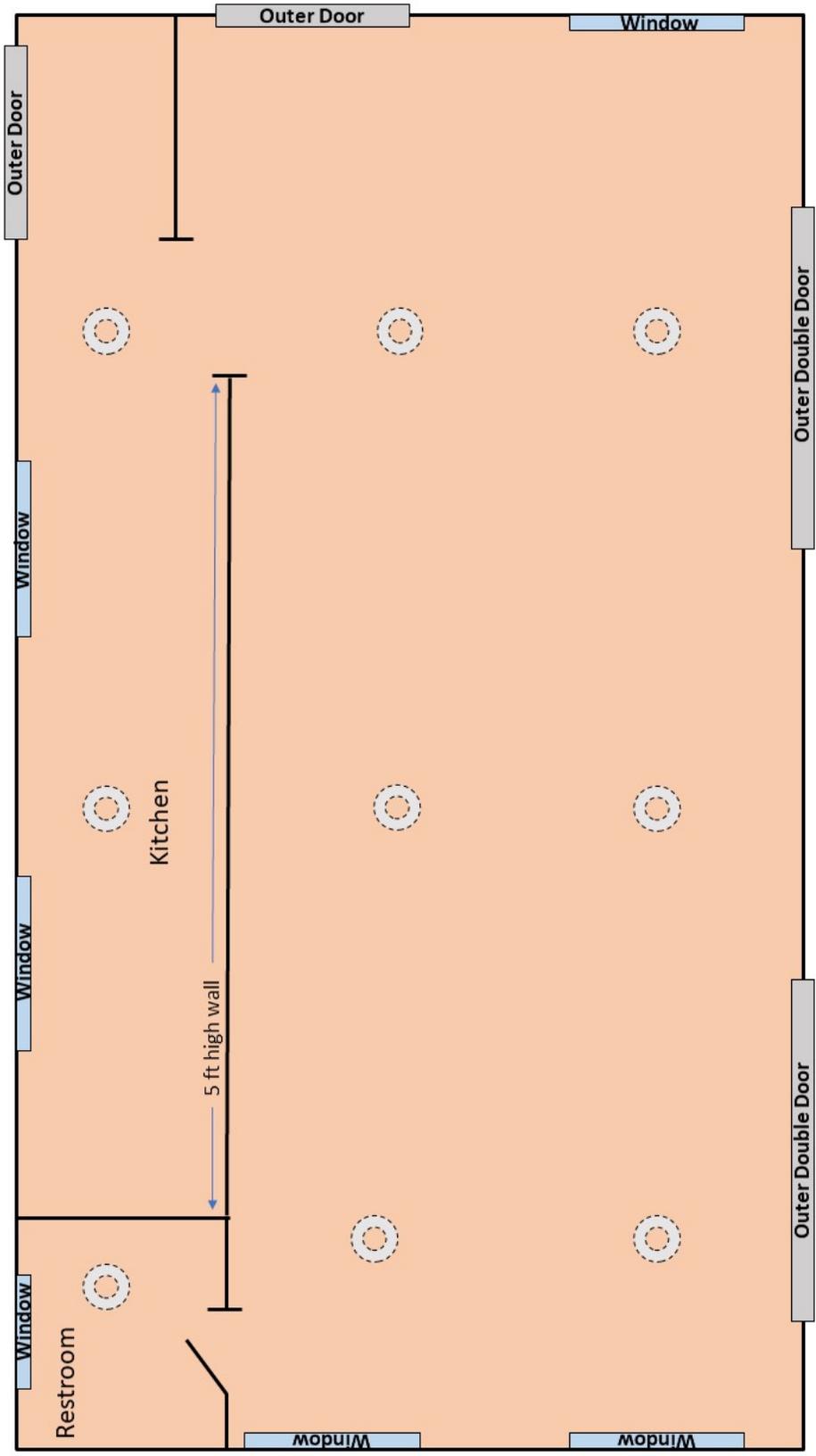
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EXPLORE

SOPHIE'S PLACE: DIAGRAM B



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