

# STEM Public Tabling Event Instructions: Understanding Air and Health

## Teaching Goals for Station 1

*This station is simple, and good for the youngest children.*

**Activity Description: Guess what is in air! Learn the relative amounts of the gases in air. Make a LEGO model of air. Find out how much CO<sub>2</sub> is in air.**

Engage + Give Context

Introduce yourself! “Hello, my name is \_\_\_\_\_! What is your name?” Comment about the event. It’s IMPORTANT to get responses to gauge the verbal/intellectual age of your visitor. You can also draw shy kids in with, “Would you like to build with these LEGO bricks?”

**1. Air is mostly nitrogen, some oxygen, and less than 1% other molecules (like carbon dioxide and water). Carbon dioxide levels are rising. Teach the number 350 PPM. It is the amount of CO<sub>2</sub> that keeps our climate in balance.**

**Step 1. Help people think about air.** Introduce the subject so they think about air as tiny molecules!

- For younger children say, “Take a deep breath of air! Feel the air going down your nose and filling up your lungs? You have just felt some tiny air molecules.”
- For older children and adults say, “Have you ever felt the air brushing against your face from a fan? Then you know air is real,” or, “Air isn’t nothing! Air is a mixture of different kinds of molecules.”

Question + Active Solution

**Step 2. Now ask the question on the mat, “What is air made of? Guess!”**

- Make your visitor comfortable. They may guess wrong. You can say, “Most people don’t know the correct answer.” This is true. A question with an unexpected answer alerts the visitor to pay attention.
- Point to the pie chart: A) Mostly hydrogen, B) Mostly nitrogen, C) Mostly oxygen and carbon dioxide, D) Mostly oxygen.

**Step 3. Give the answer by turning over the mat!** They will see that air is mostly nitrogen, answer B.

- Teach that each brick is an atom. Use the color key. Atoms bind together to make molecules. Teach that water = H<sub>2</sub>O. Two hydrogen atoms and one oxygen atom are stuck together in a specific shape.
- Place bricks on top of their pictures on the mat. Young children will be satisfied doing a matching game even if they are too young to understand about atoms.
- Go over the results with the learners, “Now, which molecule makes up most of the air?” Answer: nitrogen gas.

Optional

*This optional conversation is for older students and adults (age 12+).*

**Step 4. CO<sub>2</sub> levels are rising. 350 parts per million is the level needed to keep the earth in balance.**

- If you had 1 million molecules of air, 350 of those molecules would be CO<sub>2</sub>.
- Show the graph and discuss how CO<sub>2</sub> is changing over time. Time in years is shown across the bottom. CO<sub>2</sub> levels in PPM is shown going up. Find 350 PPM.
- Are we above 350 PPM now? Look up the CO<sub>2</sub> level on your phone! Go to [co2.earth](http://co2.earth), or use this QR code.



# STEM Public Tabling Event Instructions: Understanding Air and Health

## Teaching Goals for Station 2

*For younger children, invite them to build first, then begin the discussion.*

**Activity Description: Model complete combustion. Learn how hydrocarbon fuels will burn with oxygen to produce water and carbon dioxide molecules.**

Engage + Discussion

Introduce yourself! “Hello, my name is \_\_\_\_\_! What is your name?” Comment about the event. It’s IMPORTANT to get responses to gauge the verbal/intellectual age of your visitor. You can also draw shy kids in with, “Would you like to build with these LEGO bricks?”

### **1. Cars with gas engines use fuel made of hydrocarbons. Oxygen is needed to burn the gas.**

**Step 1. Introduce fuel molecules.** Point to the fuel molecule on the mat. “Why do you think the fuel in a car’s gas tank or in a barbeque tank is called a hydrocarbon?” Tell them to look at the kinds of atoms in this fuel molecule and show them the Atom Key.

#### **Step 2. Discuss different kinds of fuel.**

- The example on the mat is propane, and it has 3 carbon atoms. Propane tanks are familiar to kids from seeing barbeque grills.
- With older students you might talk about car fuels. They are a mix of different hydrocarbons. A familiar one is called octane, and it has 8 carbon atoms.

**Step 3. Ask what else is needed to burn fuel?** “What happens if you put a drinking glass upside down over a candle? Why will it stop burning?” Point to an oxygen on the mat. Oxygen is needed to burn fuel.

Active Learning

### **2. Combustion is a chemical reaction.**

**Step 1. Explain that in chemical reactions, the atoms change partners.** Burning gas is a chemical reaction. No atoms are gained or lost. New products will appear!

#### **Step 2. Ask visitors to build the molecules on the mat and complete the chemical reaction.**

- Use the Complete Combustion Mat and have them build all the molecules on Side 1.
- Clap to signal the spark!
- Turn over the mat to Side 2 to burn the fuel. Have them build the products with the same atoms! Make sure they build the H<sub>2</sub>O first.

### **3. During combustion, carbon dioxide is produced.**

**Step 1. Point out that water and carbon dioxide are produced when fuel burns.**

**Step 2. Carbon dioxide is a gas that helps to hold heat in the atmosphere.** Carbon dioxide is called a greenhouse gas. Combustion engines are making a lot of carbon dioxide. We need to fix this problem to keep the earth from getting too warm. Go to Station 3 to see what else cars and trucks put in the air!

# STEM Public Tabling Event Instructions: Understanding Air and Health

## Teaching Goals for Station 3

**Activity Description: Model incomplete combustion. Learn how hydrocarbon fuels can burn with less oxygen to produce soot and carbon monoxide. These molecules are bad for your health.**

Engage + Discussion

Introduce yourself! “Hello, my name is \_\_\_\_\_! What is your name?” Comment about the event. It’s IMPORTANT to get responses to gauge the verbal/intellectual age of your visitor. You can also draw shy kids in with, “Would you like to build with these LEGO bricks?”

**1. Engines burn fuels called hydrocarbons. Oxygen is needed for burning. When there is less oxygen, the burning produces pollution.**

**Step 1.** Ask visitors to name different vehicles that use gas. Answers might include airplanes, motorcycles, boats, trains, buses, trucks, etc. Ask what happens when vehicles idle in one place for a while. “Do you see smoke? Does the air smell bad or is it harder to breathe?”

**2. Combustion with less oxygen can create different products that are bad for your health.**

**Step 1.** In chemical reactions, the atoms change partners. No atoms are gained or lost. New products will appear!

**Step 2.** Ask visitors to build the molecules on the mat and complete the chemical reaction.

- Use the Incomplete Combustion Mat and have them build all the molecules on Side 1. Point out there is one fewer oxygen atom than before. Sometimes there is not enough oxygen for the fuel.
- Clap to signal the spark!
- Turn over the mat to Side 2 to burn the fuel. Have them build the products with the same atoms! Make sure they build the H<sub>2</sub>O first.
- This time, they have a choice for the remaining atoms. Because there are not enough oxygens to produce only CO<sub>2</sub>, students will end up with one of these two possibilities:
  - Two CO<sub>2</sub> molecules and a single carbon atom (soot particles are carbon atoms stuck together)
  - One CO<sub>2</sub> molecule and two CO molecules (carbon monoxide)

**Step 3.** Because there is not enough oxygen, the new products can cause health problems. Particulates like soot and poisonous gases like carbon monoxide are not good for people to breathe.

**Step 4.** Ask, “How can we fix this problem? What can we do?” Answers for kids: walk, bike, ride the bus, use electric vehicles, carpool. Answers for older visitors: not idling cars, don’t step too hard on the gas, and get your car’s emissions checked every year.

Active Learning

# STEM Public Tabling Event Instructions: Understanding Air and Health

## Teaching Goals for Station 4

*This station is simple, and good for the youngest children.*

**Activity Description: Model molecules that create human health problems (nitrogen dioxide, sulfur dioxide, ozone). See where the molecules come from.**

Engage + Active Learning

Introduce yourself! “Hello, my name is \_\_\_\_\_! What is your name?” Comment about the event. It’s IMPORTANT to get responses to gauge the verbal/intellectual age of your visitor. You can also draw shy kids in with, “Would you like to build with these LEGO bricks?”

### **1. Introduce some common air pollutants.**

#### **Step 1. Ask visitors to build common air pollutants.**

- Have younger students build all the molecules on Side 2 (has colored bricks) of the Air Pollution Mat.
- Have older students build all the molecules on Side 1 (has white outlines) of the Air Pollution Mat.

### **2. Burning coal is dirtier than burning gas.**

**Step 1. Introduce coal as a fuel.** “Can you find something on this mat that is not burning gas? What is it burning?” Answer: coal.

**Step 2. Teach about the results of burning coal.** Burning coal adds these pollutants to the air:

- Point out sulfur compounds (with yellow bricks) and small particles/soot (black bricks).
- Burning coal also releases mercury into the air (not shown on this mat.) Mercury pollutes lakes and accumulates in fish. Eating fish with lots of mercury causes health problems.

### **3. Ozone molecules can be found in 2 different places on this mat! Ozone is just three oxygen atoms stuck together, O<sub>3</sub>.**

**Step 1. Ozone found very high in the atmosphere is good for you.** Ozone forms a shield that helps protect the earth from the sun’s UV rays. UV rays damage the DNA in your skin cells. This is why you should wear sunscreen!

**Step 2. Ozone found at ground level is bad for you,** because it makes it hard to breathe and harms lung tissue. On hot days, more ground level ozone is produced.

Question + Discussion

*This optional conversation is for older students and adults (age 12+).*

### **4. Smog is a health problem.**

**Step 1. Nitrogen oxides + ozone + soot = smog,** which you can see in the air. Diesel fuels used by trucks make lots of smog.

**Step 2. The EPA (Environmental Protection Agency) has an Air Quality Index for common pollutants (QR code).**

Optional

