SR2S Educator Guide

4-5

IN THIS UNIT

Safe Routes to Schools

Alameda County

What's the Big Idea? 4-5

Safety/Community

Why do so many children get driven to school? In many areas it is estimated that 20 to 30% of morning traffic is school-related. Many parents are concerned about stranger danger, lack of sidewalks, crosswalks, and/or bike paths. In many areas funding is limited for crossing guards or safety patrol programs and general life stresses have become increasingly more complex. Families are rushed and mornings are chaotic with trying to get, in some cases, multiple children to school on time.

A Walk Audit is a Safe Routes to Schools program tool. A formal Walk Audit is conducted by an experienced planning and design firm, that engages parents, school staff, and other community leaders in identifying needed improvements for safer walking and biking routes to school. *Safety Audit* simulates the Walk Audit. It allows students to look closely at the safety issues around their school.

Forty percent of parents polled in a 1999 national survey by the Centers for Disease Control cited traffic danger as a major barrier to allowing children to walk to school. In 9,000 "walkability" audits conducted across the country, the National Safe Kids Campaign found that nearly 60% of parents and children encountered at least one serious hazard on their way to school. Our goal is to work towards making every school we work with as safe as it can be.

In *My Safe Route to School* students do a mapping activity to determine the safest route to school. They assess the route and brainstorm ideas about how to make it safer.

Environment/ Health

Climate change is a serious environmental challenge facing us today. Scientists estimate that the earth's climate has already been raised 1.9 degrees since 1890. We have been experiencing the effects of this phenomenon through longer droughts, more severe storms and melting ice caps. The consequences of drastic global temperature increases are long lasting and disastrous, which is why many scientists agree that reducing greenhouse gas emissions by 80% by 2050 or sooner is crucial for the sustainability of life on earth.

Transportation plays a key role in ensuring that this goal is met, and is something that all of us, including our students can participate in. For every mile driven, approximately one pound of greenhouse gas is emitted. Cars are the number one cause of air pollution in Alameda County. Walking, rolling, carpooling and taking public transit all play a key role in reversing the direction of global warming.

Greenhouse in a Bottle introduces students to the concept of global warming and engages students in an activity that simulates the way the planet is heating at a rapid rate. *What is in Our Air?* provides students the opportunity to look closely at air quality. In a science experiment they will look at what is in the air around their school and what they can do to improve the air quality in their community. They will also look at health issues related to poor air quality. In the *Particles and Asthma* portion students get to see how particles in the air have a direct impact on our health. *Let's Carpool* exposes students to the idea of ride sharing and AVO (*average vehicle occupancy*) and asks them to calculate data for the AVO in their school area. Students are encouraged to think about practical solutions to combat pollution and improve the air quality around their school.

School Safety Audit

Overview

Students will conduct a safety audit of the school neighborhood, assessing it for safety and traffic concerns. They will analyze their results and give their neighborhood a safety score. Students will assume the perspective of various community members and write opinion pieces about the safety of the neighborhood.

Supplies

- ✓ Copies of *School Safety Audit Checklist* for each student
- ✓ Printed maps of school neighborhood
- ✓ Clipboards (*optional*)
- ✓ 2-4 adult volunteers
- ✓ 1 watch per volunteer

Note: There are 3 parts to this activity. Due to time constraints you might not be able to do all 3 parts at once. We recommend trying to do the Discussion and Planning and the Walk Around together, and do the Analysis the next day or at another time.

Two Day Activity: Safety Audit

Time: Day 1- 50 minutes
Time: Day 2 -45 minutes

Day One: Discussion and Planning

Time: 10 Minutes

Define the word "audit" as any thorough check or examination. Introduce the concept of a Safety Audit and explain how this important component of the Safe Routes to School program is often the first step in getting improvements made around a school.

- Ask the class how many people usually walk or roll to school (*bike, scooter, skateboard, etc.*)
- Ask how many people regularly carpool (by carpool we mean more than one family sharing a ride) or take a bus to school.
- Ask students who don't walk or roll to school what kinds of barriers exist that prevent them from walking or rolling.
- Ask students who do walk or roll how safe they think their routes are.
- Brainstorm with students a list of safety hazards that come to mind when they think about their routes and the area around the school. Examples include not enough crossing guards, too much traffic, not enough stop signs, unsafe drop-off and pick-up zones, etc.

Walk Around

Time: 30 Minutes

- Give each student a copy of the *School Safety Audit Checklist*, map and clipboards if you are using them. Divide students into 3-5 groups depending on how many adult volunteers you have.
- Assign each group a different start area, such as different sides of the school, different corners, different entrances, etc. Ask them to locate their area on the map and identify areas of focus for the audit.
- Assign students a role to take on during the audit from the list below and ask that they do their observations from the perspective of that role. Students may benefit from a quick overview of what each person would be concerned about.
    - School Principal
    - Concerned Parent
    - Traffic Engineer
    - City Council Member
    - Teacher
    - Safety Patrol
- Have the groups go to their designated starting points and observe for about 3 minutes, then have each group continue to walk on the blocks immediately around their starting point. Choose blocks to walk on that are frequented by students walking and rolling to school.
- Ask students to complete the *Safety Audit Checklist* while walking in their groups.

Optional: Guiding Questions for Volunteers

- How would you characterize the behavior of drivers at this intersection?
- Do you think the patterns you have observed here are the same all day long, or do you expect that they'd change depending on the time of day? Explain.
- What is the biggest problem you observed?

School Safety Score

Time: 10 Minutes

- When students return from the walk, have them complete the School Safety Score portions of the *School Safety Audit Checklist,* in groups or independently

Day Two: Analysis

- Allow groups time to reconvene and discuss their experiences with the School Safety Audit.
- Have each group select one representative who will report on the following:
    - The top five concerns from their Safety Audit.
    - Comment on how safe the neighborhood is for walking and biking.

> Note: Be sure they cite specific examples such as crossing guards, adding stop signs, bike lanes, or repainting curbs.

- Share ideas about what the school and city can do to improve the neighborhood's safety.
- As a class vote on the top three concerns and discuss specific recommendations that address their concerns. Be creative and do a brainstorm that includes the "impossible" ideas as well as the practical ones.

Opinion Piece

Time: 30 Minutes

- From the perspective of a community member, ask students to write an opinion piece about the safety of their school neighborhood. Encourage students to use supporting details from the *School Safety Audit* to back up their opinions. Instruct students to include recommendations for making the neighborhood safer in their opinion pieces.
- After students finish, ask for volunteers to share their opinion pieces with the class.

Action: Now What?

Possible actions include: writing a letter to the PTA, Site Council, the City Council representative or the Traffic Engineering Department that explains the top 3 concerns of the class and offers specific solutions.

Safe Routes to Schools: Connections and Extensions

AN OFFICAL WALK AUDIT EXPERIENCE

Check with your SR2S Champion to see if your school will be having an official Walk Audit through the Safe Routes to School program. If there is one scheduled, send a student representative to share the class' findings and to report back to the class on the Walk Audit experience.

Name: _____

School Safety Audit Checklist

Use this checklist to see how safe it is around your school. Check the correct box. 1 Point for YES, 0 Points for NO

Student Drop-Off and Pick Up Areas:	**YES**	**NO**
• Is there enough space for vehicles to line up?		
• Can students get out of cars safely?		
• Is there a direct and safe route for students to get from the bus drop off zone to the school?		

Total possible points for Drop-off and Pick up areas= 3 points
How many points did your neighborhood get? _____
What fraction of the total points did your neighborhood get? _____

Sidewalk and Bike Routes:		
• Are the sidewalks wide enough and without gaps or cracks?		
• Are there cars sticking out from driveways onto the sidewalks?		
• Are there ramps for wheelchair access?		

Total possible points for Sidewalks and Bike Routes = 3 points
How many points did your neighborhood get? _____
What fraction of the total points did your neighborhood get? _____

Nearby Intersections:		
• Are there painted crosswalks for all directions of crossing?		
• Are there traffic control signs such as stoplights or stop signs?		
• Are pedestrians looking both ways before crossing the street?		

Total possible points for Nearby Intersection = 3 points
How many points did your neighborhood get? _____
What fraction of the total points did your neighborhood get? _____

SUB TOTALS		

Use this checklist to see how safe it is around your school. Check the correct box. 1 Point for YES, 0 Points for NO

Traffic Signs and Speed Control:	**YES**	**NO**
• Are there School Zone signs, School Crossing signs, Flashing Beacons, or No Parking Signs?		
• Are there any signs painted on the pavement of streets near the school such as SLOW SCHOOL XING?		
• Are there any speed control devices such as speed bumps?		

Total possible points for Traffic Sign and Speed Control= 3 points
How many points did your neighborhood get? _____
What fraction of the total points did your neighborhood get? _____

Driver Behavior: Did you see...		
• Drivers driving too fast?		
• Drivers who did not stop at intersections?		
• Drivers parking in zones they shouldn't park in?		
• Double parking in front of the school?		

Total possible points for Driver Behavior= 4 points
How many points did your neighborhood get? _____
What fraction of the total points did your neighborhood get? _____

TOTAL POINTS

Total possible points for entire audit = 16 points
How many total points did your neighborhood get? _____
What fraction of the total possible points did your neighborhood get?_____

Challenge Problems

Mary's neighborhood got ¼ of the 16 total points.
How many points did Mary's neighborhood get? _____

Salvatore's neighborhood got ½ of the total points. Who got more points—your neighborhood or Salvatore's neighborhood? _____How much more? _____
If Jeff's neighborhood got 12 points, what fraction of the total points did his neighborhood get?_____

Name: _____

Community Activists

Community activists help to change their communities.
Have you ever noticed something that you'd like to change? Well, you can!

Some activists work to protect the environment. In one neighborhood, people noticed that trash was polluting their streets. Community activists banded together to pick up the trash and teach people not to litter.

Other activists work to protect the people in their community. When people in one community noticed that their children didn't have a safe place to play, they wrote letters to the city council asking for a playground to be built.

What would you like to change about your neighborhood?

_____

_____

What safety barriers would you like to change about your neighborhood?

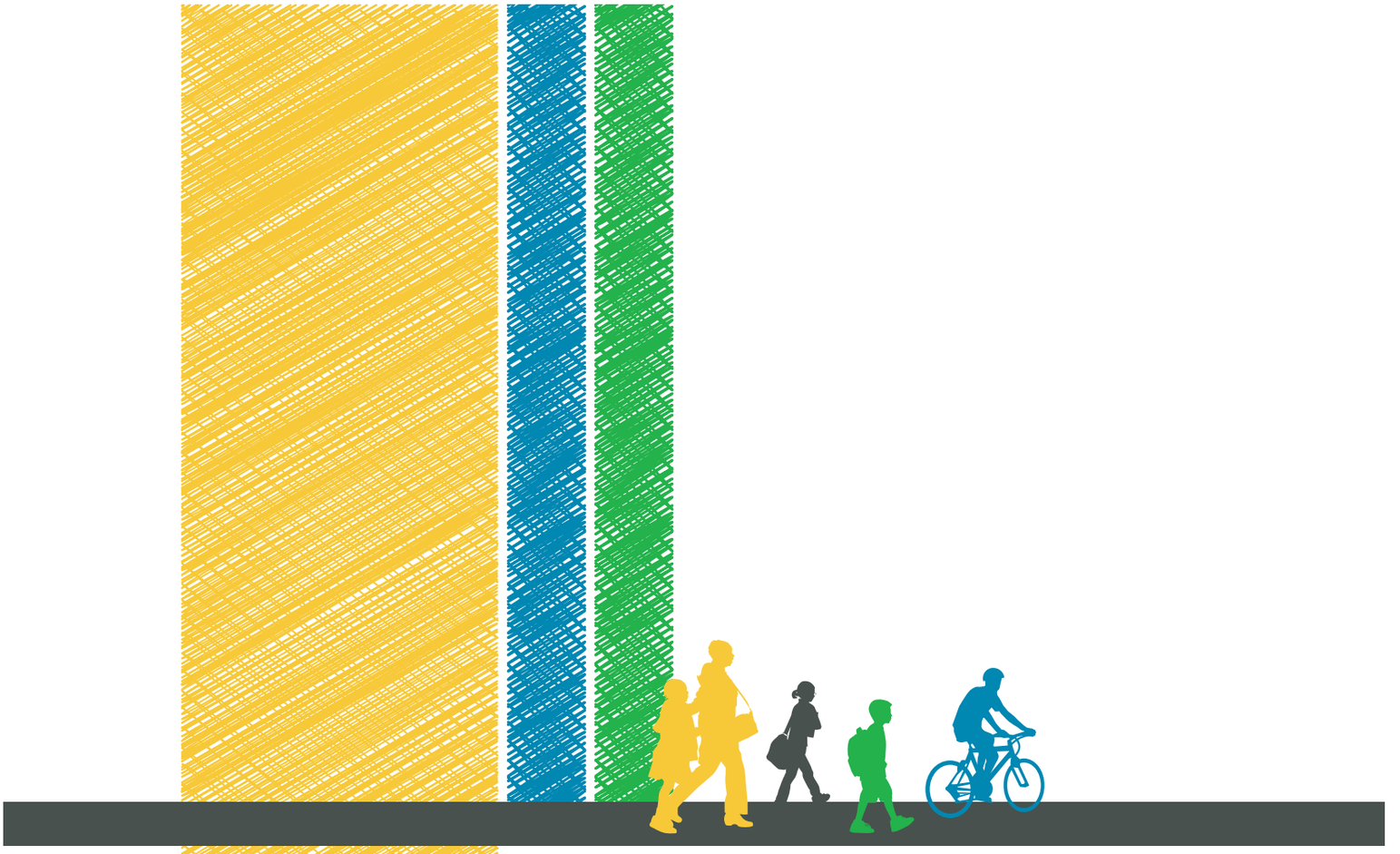
_____

_____

How could you make these changes?

_____

_____



My Safe Route to School

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My Safe Route to School

Overview

Students will use Google Maps to map out the safest route from their home to the school, and assess the route to determine how safe it is. Students will write letters expressing their concerns and think about possible solutions to the problems they encounter on their route.

Supplies

- ✓ Internet access
- ✓ Printed Google maps for each student
- ✓ Copies of *How Walkable is Your Route to School* for each student
- ✓ Copies of *Community Activist* for each student

Activity: What is My Safest Route?

Discussion Prompts

Time: 10 Minutes

- Ask, how many people usually walk or roll to school (*bicycles, scooters, skateboards, etc.*)
- Ask, how many people regularly carpool (*by carpool we mean more than one family sharing a ride.*)

- Ask, students who don't walk or roll to school what types of barriers prevent them from walking or rolling.
- Ask, how could you overcome the barriers that prevent you from walking or rolling to school? If you can't walk or roll to school, how do you get to school?
- Discuss what makes a route safe. Some factors to consider are roads with few cars, roads with bike lanes, streets that have a crossing guard, roads that are well maintained, houses with dogs behind fences, streets with less crime, streets that many students use as their walking or rolling routes, etc.

Mapping

Time: 20 Minutes

Use Google to print out a map of the school vicinity that includes anywhere between a 1-3 miles radius around the school depending on how far away most students live. If needed, print out customized maps. Once all students have acquired a map, have students do the following:

- Have students find and mark the school and their house on the map
- Trace the safest route to school (*based on the criteria from the previous discussion*) using a colored pen or pencil or yellow highlighter.
- If students take the bus or live too far to walk or roll, they can alternatively map out a route from their house to a nearby location that they often drive to, or they could map out the last 1/4 to 1/2 mile of the route to school.
- Discuss some of the safety concerns that students have along their route.
- Brainstorm solutions to these safety concerns.

Note: Many students will have more than one route because they rely on different modes of transportation. Have them use different colors for each route and create a key. For example: Yellow = driving route, Red = biking route.

Note: Alternatively, students could take their maps home and trace their route as they come to school the following day.

- Ask how many students who regularly drive could commit to walking or rolling at least one day per week.
- Ask students to figure out how many pounds of CO_2 they can conserve when they walk or roll to school. Using the equation that approximately 1 mile of driving = 1 lb. of CO_2.
- If students live too far to walk or ride or take the bus, brainstorm where they could walk or roll to on the weekends.
- Conclude with a discussion of how cities could be more pedestrian and bicycle-friendly. Examples include: wider sidewalks, more crossing guards, more bike lanes, better and cheaper public transit, stop lights or stop signs as ways to slow down traffic, etc.

Action: Now What?

Time: 20 Minutes

- Ask students, "What is an activist?" Tell students that activists take action to make changes.
- Pass out *Community Activists* handouts. Have students read the paragraph and answering the questions on the handouts.

Assessment of Routes

Time: Allow a week to complete

Hand out the *How Walkable is Your Route to School*. It's a good idea to give students about a week to complete the assessment. After students have filled out the sheet, have a class discussion using the following questions:

- Did you have a place to walk or roll?
- Was it easy to cross streets?
- Did you feel safe and have fun?
- Did the drivers behave well?
- What could you do so that your route receives a higher score next time?

Safe Routes to Schools: Connections and Extensions

DREAM CITIES

Have students plan and design a bike and pedestrian friendly city. Ask them to dream big! What would they like to see? How will they ensure safety? How will drivers behave? Will there be cars? After planning and designing their city have them write a paragraph to accompany the design explaining their process and the decisions they made.

TRACKING DATA

active4.me
Individual students and classes can track all types of data related to using alternative and active transportation to get to school and other destinations.

MAPPING FUN WITH GOOGLE EARTH

gelessons.com/lessons
Google Earth has many different lessons on how to use Google Earth in the classroom. It is a resource for mapping and traveling to other parts of the world from the comfort of your classroom.

Name:_____

How Walkable is Your Route to School?

Use this Walkability Checklist to rate your route. List your recommendations on the back.

RATING SCALE: **1** many problems **2** some problems **3** good **4** very good **5** excellent

LOCATION OF WALK:_____

1. Did you have room to walk?

☐ Yes No

- ☐ Sidewalks or paths started and stopped
- ☐ Sidewalks were broken or cracked
- ☐ Sidewalks were blocked with poles, signs, shrubbery, dumpsters, etc.
- ☐ No sidewalks or paths
- ☐ Too much traffic
- ☐ Something else_____

Location of problems _____

_____

Rating: 1 2 3 2 5 (circle one)

2. Was it easy to cross streets?

☐ Yes No

- ☐ Road was too wide.
- ☐ Traffic signals didn't give us enough time to cross, or made us wait too long.
- ☐ Parked cars or trees blocked our view of traffic.
- ☐ Intersection needed crosswalk or traffic signal.
- ☐ Need for marked pedestrian crosswalks.
- ☐ Cars were going too fast.
- ☐ Something else_____

Location of problems_____

_____

Rating: 1 2 3 4 5 (circle one)

3. Did drivers behave well?

☐ Yes No, drivers...

- ☐ backed out of driveways without looking.
- ☐ drove too fast.
- ☐ did not yield (wait) for people crossing the street,
- ☐ sped up to make it through traffic lights or drove through traffic lights.
- ☐ Something else_____

Location of problems_____

_____

Rating: 1 2 3 4 5 (circle one)

4. Was your walk pleasant?

☐ Yes No

- ☐ There were scary dogs.
- ☐ It was dirty with a lot of trash on the sidewalks and in the streets.
- ☐ I saw scary people.
- ☐ Not well lighted (if walking at night.)
- ☐ Something else_____

Location of problems:_____

_____

Rating: 1 2 3 4 5 (circle one)

How does your neighborhood rate?
Add up your ratings and decide.

1._____
2._____
3._____
4._____

18-20	Celebrate! You have a great neighborhood for walking!
14-17	Clap your hands! Your neighborhood is good for walking.
10-13	Your neighborhood needs work!
5-9	Your neighborhood needs a lot of work before you can walk there safely!

Total _____

Recommended Improvements for My Route:

EXERCISE YOUR FRACTIONS

What fraction of total points did your route receive? _____

Keith's route received 3/4 of the 20 total points. Did your route receive more or less points? How many more or less points did your route receive? _____

Patricia's route received 3/5 of the 20 total points. Did your route receive more or less points? How many more or less points did your route receive? _____

Greenhouse in a Bottle

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THEMES: Environment, Health
STANDARDS CORRELATIONS: ELA, Science,

Greenhouse in a Bottle

Overview

Students will learn about the impact of global warming by simulating the phenomenon of the greenhouse effect. In groups they will create a mini greenhouse. They will learn about the Carbon Dioxide and Oxygen Cycles and look at some of the primary causes of global warming and climate change. Students will look at what can be done to be part of the solution.

Supplies

- ✓ Between 6-8 thoroughly washed and cleaned recycled clear plastic bottles with a small neck (*clear juice bottles or 2-liter soda bottles work well.*)
- ✓ Plastic caps for half of the bottles to designate vented from non-vented
- ✓ Index Cards
- ✓ 6-8 scissors
- ✓ Potting soil
- ✓ Two different colored markers
- ✓ A small bag of loose gravel
- ✓ Wide tape and scissors
- ✓ Double sided copies of *Mini Greenhouse Observation* and *The Greenhouse Effect* for each student

Greenhouse Gases: What are They?

Provide students with some background information on greenhouse gases. You can have them investigate on their own, or share the following information with them.

Greenhouse gases, mainly water vapor and carbon dioxide- CO_2, are key to the earth's atmosphere because they trap energy from the sun, creating a natural "greenhouse effect." Without this effect, temperatures would be much lower than they are now, and life as we know it today would not be possible. However, the natural balance of greenhouse gases in the atmosphere has been disturbed by human activity. Since the mid 1800's (*the Industrial Revolution*), humans have been burning fossil fuels, which adds much more CO_2 to the atmosphere than there was before. This increased CO_2 traps additional energy in the lower atmosphere, making temperatures higher than normal.

A greenhouse is a building especially constructed for growing plants when the weather is cold. The walls are made of glass or clear plastic, which allows sunlight to pass through. The sun's rays are absorbed by the soil and plants, and are then emitted as heat energy which warms the air inside the greenhouse. The walls trap the heated air inside the greenhouse.

The earth is similar to a greenhouse in that the rays from the sun come and enter the earth's thin atmosphere. The rays get absorbed in the surface of our planet and then create new rays, called infrared rays. When these infrared rays try to go back into space, they get trapped in the atmosphere, and come back down to earth again.

The reason the rays bounce back is because our atmosphere is filled with greenhouse gases, such as carbon dioxide. These gases trap the rays inside the earth causing the earth to get hotter. As previously mentioned, this is a natural cycle that helps to maintain the temperature on the earth that is necessary for human, animal and plant life, but human beings have caused an imbalance in this natural process by adding vast quantities of Carbon Dioxide and other greenhouse gasses to the atmosphere. For example, when we use fossil fuels such as gasoline to fuel our vehicles we create carbon dioxide and other toxic gases, which come out of the tailpipe of the car and go into the atmosphere. This dramatic increase of greenhouse gases is causing overall temperatures to increase, causing climate change.

It is also important to remember the significance of the CO_2 / O_2 cycle. In the human respiration process we breathe in oxygen and breathe out carbon dioxide. Plants do the opposite, they take in carbon dioxide and put out oxygen, which is why having trees and plants is so important to our health and the health of the environment. When there is a good balance with this exchange the air is clean.

Activity: Mini Greenhouse

Time: Part 1 - 50 Minutes
Time: Part 2 - 30 Minutes (to be done later in the day)

Discussion Questions:

Time: 10 Minutes

Use the following discussion questions to explore student understanding of the greenhouse effect.

- What does the CO_2 and 0_2 cycle look like?
- We have more CO_2 now and less trees, what happened?
- What is a greenhouse?
- Who has heard of the greenhouse effect? Ask for an explanation.
- What is causing the greenhouse effect and global warming?

Note: Ask parents/students to bring in clear plastic bottles.

How to Make a Mini Greenhouse

Time: 20 Minutes

Note: It is best to do this activity when the weather is warm.

- Divide the class into 6-8 groups and give each group a clear bottle and pair of scissors. Let them know that each person in the group will have a task. It is easiest to set up stations for the gravel and dirt. Walk students through the following steps of creating a mini greenhouse.

1. Cut all the way around the bottle to carefully remove the top one-third of the bottle.

2. Place about 1 inch of loose gravel in the bottom of the bottle, then add about 3 inches of potting soil.

3. Add a few drops of water in the bottle, but do not soak the soil. As the bottle will be almost an enclosed garden, only a little bit of water is necessary.

4. Gently place the top part of the bottle back in place on top of the bottom section. Use the wide clear tape to secure the two parts of the bottle together. (*You may need an extra pair of hands for this part.*)

5. Ask half of the groups to make 3 holes near the top of their bottle, place the cap on the bottle and use a marker to color the top. Ask the other half to just put the cap on their bottles without cutting holes in the bottle. Using the other colored marker, have them color the top of their cap.

6. Pass out *Mini Greenhouse Observations* and have each student write down their prediction of what will happen to the bottles, which ones might get hotter, and which ones might be cooler.

7. Place the mini greenhouses in a sunny warm location inside or outside the classroom for several hours.

8. While bottles are bathing in the sun, have a discussion about the role of air pollution in global warming. Use the following questions:

- What are some causes of air pollution?
- What happens to air pollution? Where does it go?
- Which bottles represent the earth before there was so much pollution in our air? (*The vented bottles.*)
- Why do the un-ventilated bottles represent the earth now? (*Pollution in the air is insulating the earth and trapping the sun's heat.*)

Effects of Greenhouse Gases

Time: 20 Minutes

- Have students read or read to the class the passage about Climate Change and the Effects of Greenhouse Gases. After reading, ask students to share what they learned. Ask students to share how they feel about greenhouse gases.
- Take ideas for how students could help to reduce air pollution.

Part II: Anaylsis

Time: 20 Minutes

- Return to the handout and retrieve the bottles from the sun and have students observe all of the bottles to determine which bottles are hotter. Have then write down the details of their observations.
- Are some bottles warmer than others? How can you tell? (*Condensation)*
- Have students look at their predictions. Were their predictions accurate?
- How does this process simulate global warming?
- What does driving have to do with the greenhouse effect and climate change?
- What are some alternatives to driving?
- Driving is easy and convenient, so sometimes we forget how it affects the environment. How can we remember and share the impact that driving has on air pollution?

Reflection:

Time: 10 Minutes

- Hand each student an index card. Have students write one thing they learned about greenhouse gases.
- Have students write if their prediction was accurate on the *Mini Greenhouse Observations* handout.

Safe Routes to Schools: Extensions and Connections

POLLUTION SOLUTION AMBASSADORS

Do this activity or remind students about this activity prior to a Walk and Roll to School Day. Encourage your students to be Pollution Solution Ambassadors by helping other students figure out how they can get to school in the greenest way possible.

Name: _____

Mini Greenhouse Observations

1. Write your predictions for the greenhouses: the bottles with holes for ventilation and those without ventilation.

2. After you bring in the bottles from the sun, compare the bottles and write down your observations with as much detail as you can.

Prediction:

_____

_____

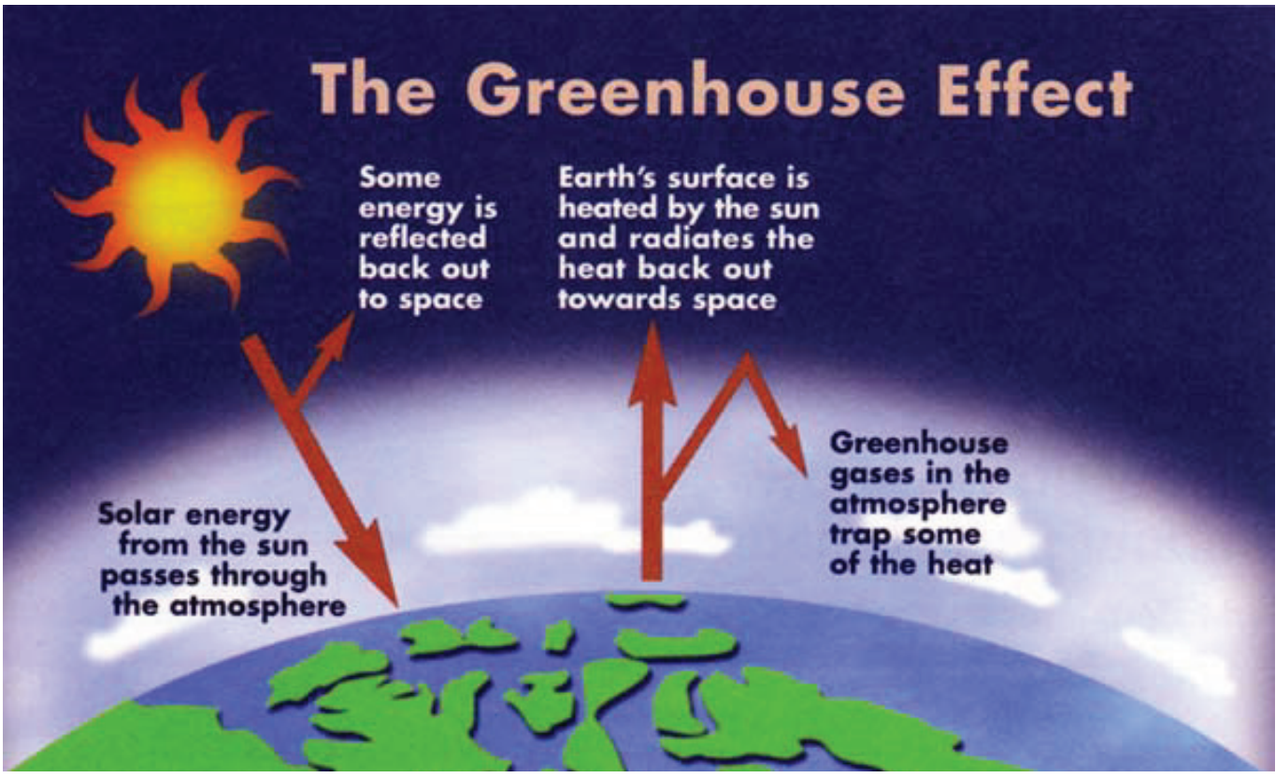
Bottles with holes: | Bottle without holes:

Was your prediction accurate? Explain.

_____

_____

Name: _____



Greenhouse gases, (*mainly water vapor, and carbon dioxide, CO_2*) are key to the earth's atmosphere because they trap the sun's energy, creating a natural "greenhouse" effect. Without this effect, temperatures would be much lower than they are now, and life as we know it today would not be possible.

However, the natural balance of greenhouse gases in the atmosphere has been disturbed by human activity. Since the Industrial Revolution, humans have been burning fossil fuels, which adds much more CO_2 to the atmosphere than there was before. This increased CO_2 traps additional energy in the lower atmosphere, which is making temperatures on earth higher than normal.

List some specific changes we are seeing in our environment due to these higher temperatures on Earth?

_____

_____

_____

_____

Climate Change

“Will Antarctica completely melt because of global climate change?”

Scientists worldwide agree human driven behaviors such as transportation and deforestation have caused changes in Earth’s atmosphere. Increases in greenhouse gas emissions such as carbon dioxide, methane and nitrous oxide have made the Earth warmer. These greenhouse gases remain in Earth’s upper atmosphere and trap the sun’s heat. This increase in temperature has melted ice in Antarctica, as well as at the North Pole.

According to the Environmental Protection Agency, the warmer temperatures have also changed weather patterns throughout the world. As temperatures rise, more moisture evaporates into the air from the land and the oceans. The extra moisture in the air comes back down as additional snow and rainfall, but the extra precipitation is not spread equally around the world. For example, the northeast United States is getting more rainfall than it has in the past, but Hawaii is getting less.

Changes in rain and snowfall patterns can cause serious problems such as flooding. Additionally, people depend on snow and rainfall for drinking water and for crops.

NASA Scientists report that if all greenhouse gas emissions stopped immediately, the Earth would continue to warm for at least the next fifty years because many gases are still trapped in the oceans. Every car trip saved stops the problem from becoming worse.

Sources:
EPA, http://www.epa.gov/climatestudents/impacts/signs/index.html
NASA, http://climate.nasa.gov/climatechangeFAQ

What's in Our Air?

Educator Guide

4-5

THEMES: Environment, Health
STANDARDS CORRELATIONS: ELA, Math, Science, Health

What's in Our Air?

Overview

Students will learn about air quality and the way that it affects our health. *What's in Our Air?* will reinforce the concept of excess CO_2 in the air and its impact on the environment. Students will hypothesize about the specific impact of cars on the air quality outside the school and test these theories with simple particle boards. Students will also connect these results to high asthma rates and learn about ways to mitigate particulate emissions around the school.

Supplies

- ✓ Copies of *Alameda County Air Quality* for each student
- ✓ Copies of *Our Actions, Our Pollution* for each student
- ✓ Copies of *Particle Board Observation* for each student
- ✓ Copies of *Particles and Asthma* and a package of drinking straws
- ✓ Particle Board supplies: 4x6 index cards, petroleum jelly, wax paper, paper clips, glue sticks
- ✓ Chart paper

Two Day Activity: What is in Our Air?

Time: Day 1-40 minutes;
Time: Day 2 -60 minutes

Day One: Warm Up

- Write "Know" on one piece of chart paper and "Want to Know" on another. Ask them to share how air pollution is created and what the impacts are on human health. List these facts on the "Know" paper. Ask students to think about what they would like to know about the air in their community and list these questions on the "Want to Know" piece of chart paper.
- Reinforce the idea that CO_2 is not "bad" – we need it as part of the natural exchange among living things – but that too much creates a situation that is contributing to climate change.
- Review the *Alameda County Air Quality* sheets. Have the students read the facts and fill out the questions. Discuss their answers and then look at the pie chart on the worksheet. Examine the large percentage of greenhouse gases that are emitted by cars (46%.) Ask why they think there is almost as much CO_2 coming from cars as it takes to heat and cool the commercial and residential buildings combined.
- Pass out the Venn diagram sheet *Our Actions*, *Our Pollution*. Have students list the various actions that humans participate in that lead to pollution and have them categorize these by element. After the students have filled it out, make a large version on the board of the diagram and fill it out with as many actions as possible. Ask students to identify activities that affect all three listed elements.

Name: _____

Alameda County Air Quality

Carbon dioxide (CO_2) is the dominant greenhouse gas that causes climate change.

What else do you know about climate change?

_____

_____

_____

_____

Burning fossil fuels—coal, oil and natural gas—is the main source of human-produced CO_2 emissions.

Why do we burn fossil fuels?

_____

_____

_____

_____

Controlling CO_2 emissions from personal vehicles is key to addressing global warming.

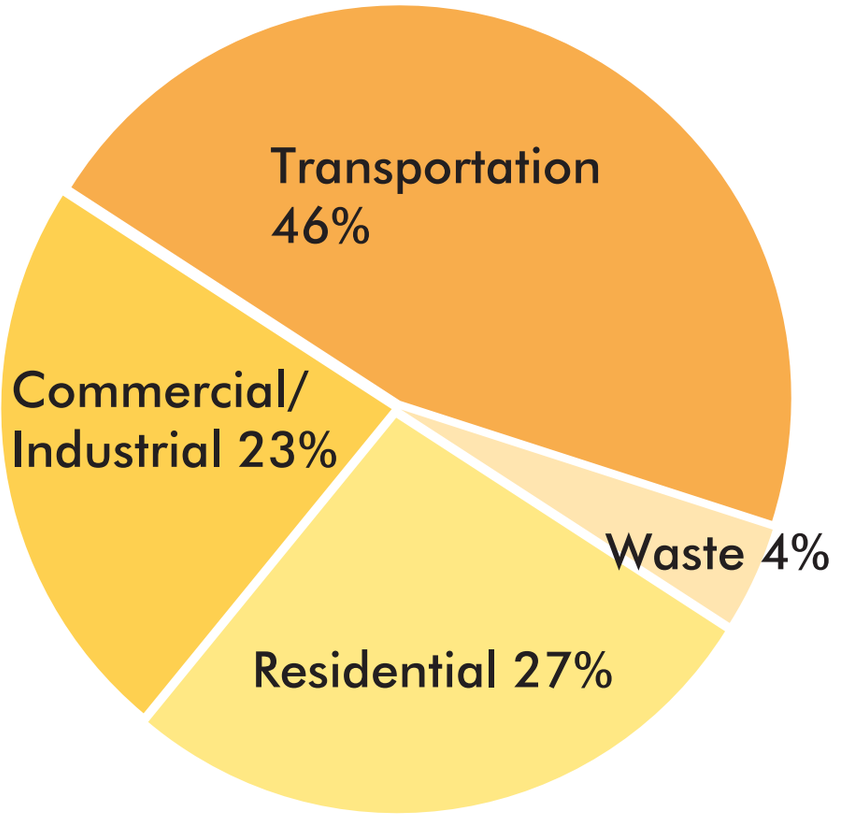
List ways of doing this:

_____

_____

_____

_____



Alameda County Greenhouse Gas Emissions

1. What percent of Alameda County's greenhouse gas emissions are from transportation?

_____

2. What fraction of Alameda County's greenhouse gas emissions are from transportation?
Hint: Percent means "out of 100." _____

3. What percent of Alameda County's greenhouse gas emissions are from waste?
Write this percent as a decimal. _____

4. What percent of Alameda County's greenhouse gas emissions are from waste?
Write this percent as a decimal. _____

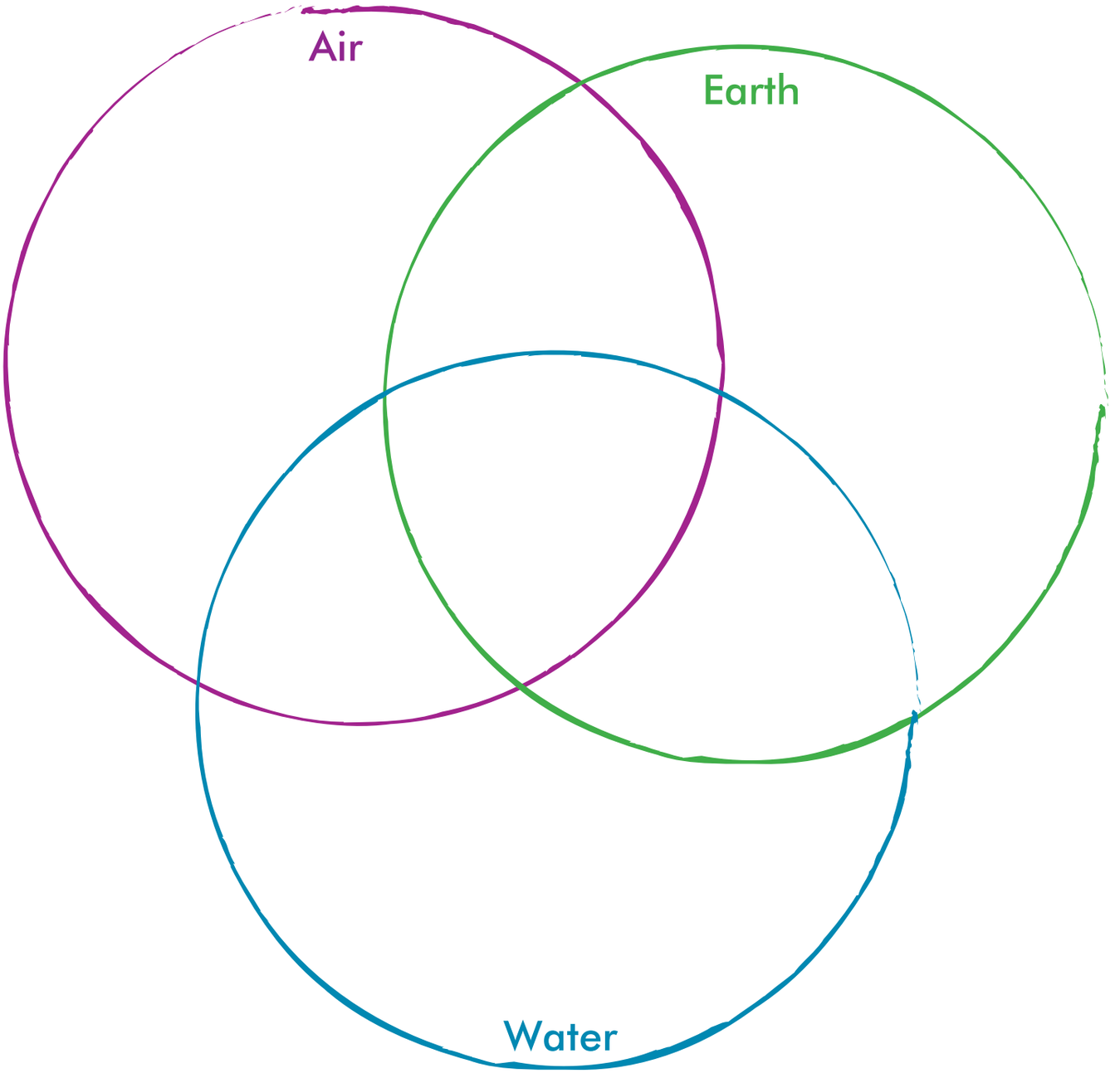
5.What percent of Alameda County's greenhouse gas emissions are from residences?
Write this percent as a decimal. _____

6. Do more of Alameda County's greenhouse gas emissions come from waste or residences?
How much more? _____

Name: _____

Our Actions, Our Pollution

Make lists of activities that pollute these three elements, such as burning oil, throwing things away, pouring out chemicals, etc. Try to find activities that affect all three elements and list them in the middle.



Day One Activity: Making Particle Boards

Time: 20 Minutes

Tips for this activity:

- ✓ Find a good location near traffic on the street for the experiment group (*location #1*) A second location with less exposure to cars (*location #2)*, either in an internal courtyard or a window near a playground with trees is ideal.
- ✓ The boards need to be left out for a minimum of 24 hours and 48 hours is strongly recommended. If there is rain in the forecast, wait to put them out. If it rains on these boards, all of the data will be lost.

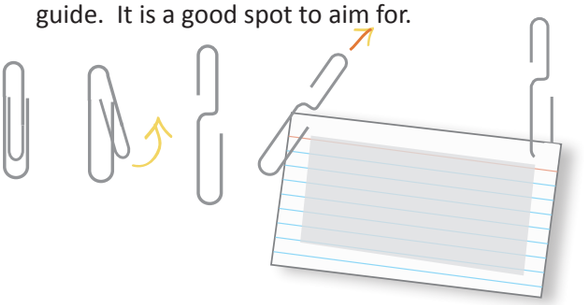
- Explain to students that they will be making particle boards to get a sense of how much dirt is in the air around the school. Explain that cars and trucks put particles into the air when their engines are running and that idling (*when a car's engine is on but the car is not moving*) can exacerbate this, which happens at every red light and curbside drop off.
- Pass out 4x6 index cards and assign each student a partner: one partner will be part of the experimental group *(location #1 - card facing the street*) and the other will be the control group (*location # 2 - card facing inside away from the street*.) To make it easy for partners to find their pair of cards when they are collected, have them create a symbol that they draw on each pair of cards.
- On the lined side of the card have them write their names, and a 1-2 sentence prediction about what they think both of the cards will look like after being outside for a day or two. They should list predictions for Location #1 and Location #2.
- Follow these step-by-step instructions to make the particle board.
- Hang the boards in the two locations for at least 24 hours, if possible 48 hours or more when no rain is predicted. If it rains on these boards, all of the data will be lost.

Preparing the Particulate Matter Board

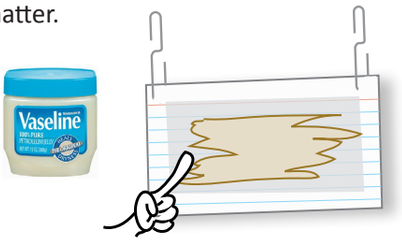
1) On the lined side of the card, write your name. Then write what you think you will find on the card after leaving it outside for a few days.

2) Cut out a wax paper rectangle slightly smaller than the card, and use a glue stick to glue it to the unlined side of the card.

3) Open up a paper clip and stick it through the card to make a hook. Put it in far enough down to not tear the paper. Use the red line as a guide. It is a good spot to aim for.



4) Cover the middle of the wax paper with a very light coat of petroleum jelly. This thin coat will be just the right amount to catch particulate matter.



Day Two: Analyzing Particle Boards

Time: 30 Minutes

- Before you begin with the students, bring the boards in from where they have been hanging. They can be messy - and if the experiment went well, very messy.
- Students should find their boards and sit with their partner. They should take a minute to discuss their observations and check these against their original predictions.
- Particle cards will have yellowish particles from pollen and organic matter. They will have a grayish or black look to them when they have been exposed to car particles. If you are on a major avenue or busy street, they will get very dark. Otherwise, the results will be less dramatic. What is important is to compare the two boards to each other.
- Students should describe what they see using the Particle Board Observations handout. There should be a difference between the two locations. If there is, ask them to write WHY they think this happened.

Activity: Particles and Asthma

Time: 30 Minutes

Note: If you have asthmatic students have them do only the recording portion of this activity.

Discussion

Time: 10 Minutes

- Ask the students to raise their hands if they know someone with asthma (*note: don't ask who has asthma, because this is considered a private medical issue.*) Ask students what they know about asthma. Connect the high numbers of asthma in Alameda County to car exhaust. The particles that come from idling cars are specifically linked to asthma and can lead to asthma attacks.
- Explain that you are going to have students experience what it is like to have asthma. Explain that asthma is a condition that affects the lungs and makes it difficult to breath because the air passages get inflamed.

Breathing and Asthma Worksheet

Time: 20 Minutes

- Explain respiratory rate and how to take it—the number of breaths a person takes in a given amount of time, usually measured in breaths per minute. One breath is counted as 1 inhale and 1 exhale. You can also take a moment here to talk about the lungs, what they do and how important they are to our health and well-being.
- Pass out *Breathing and Asthma*. Working in pairs or teams, each student will measure their respiratory rate when seated. Students should hold their noses so they can only breathe through their mouths. The partner (or rest of the team) should count how many breaths are taken per minute and record them as "No Straw, At Rest." Each person should do this in the pair or team.
- Now have the students repeat the exercise breathing through a straw with their noses closed. Remind students that this is meant to simulate what it feels like to breathe when you are having an asthma attack. Record this as "With Straw, At Rest." Repeat with members of the team or pair.
- Each person should perform 20 jumping jacks and then immediately take their respiratory rate. These should be recorded in the "No Straw, Exercise" category. The rest of the group/pair should do the same.
- Lastly, each person should do 20 jumping jacks and then immediately take their rate with the straw in their mouth. This should be recorded for each member of the pair/team in the "With Straw, Exercise" category.
- Students should take a look at the numbers and see the difference in their breathing rates. The group should discuss their results and how the students felt throughout this experiment.

Safe Routes to Schools: Extensions and Connections

PARTICULATES AND OUR HEALTH

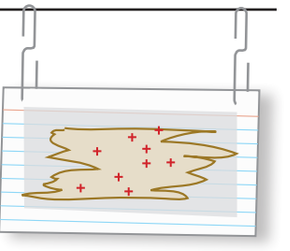
Connect this activity to the particle board activity. Ask students to think of ways to reduce the particles outside the school. Consider organizing an idling awareness campaign.

READ ALOUD

Read *A Hot Planet Needs Cool Kids* by Julie Hall. Ask students to share what they learned about climate change, how they feel about climate change, and how they can take action to protect the planet.

Name: _____

Particle Board Observations



Compare Locations

Compare the particles from different locations. Write down your observations.

Location 1:	Location 2:

Why do you think the two particle cards are so different?

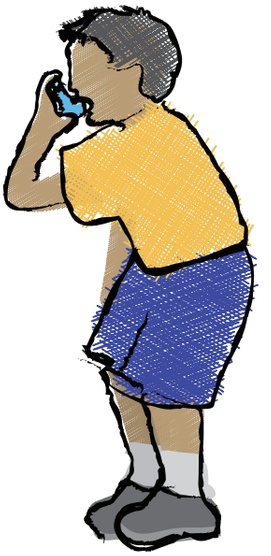
_____

_____

_____

Name: _____

Breathing and Asthma



Fill in how many breaths you take in 1 minute for each section. One inhale and one exhale is counted as 1 breath. Your partner will keep the time while you count your breaths.

	Number of Breaths 1 MINUTE
No straw, at rest	
With straw, at rest	
No straw, exercise	
With straw, exercise	

How did you feel when you were breathing through the straw?

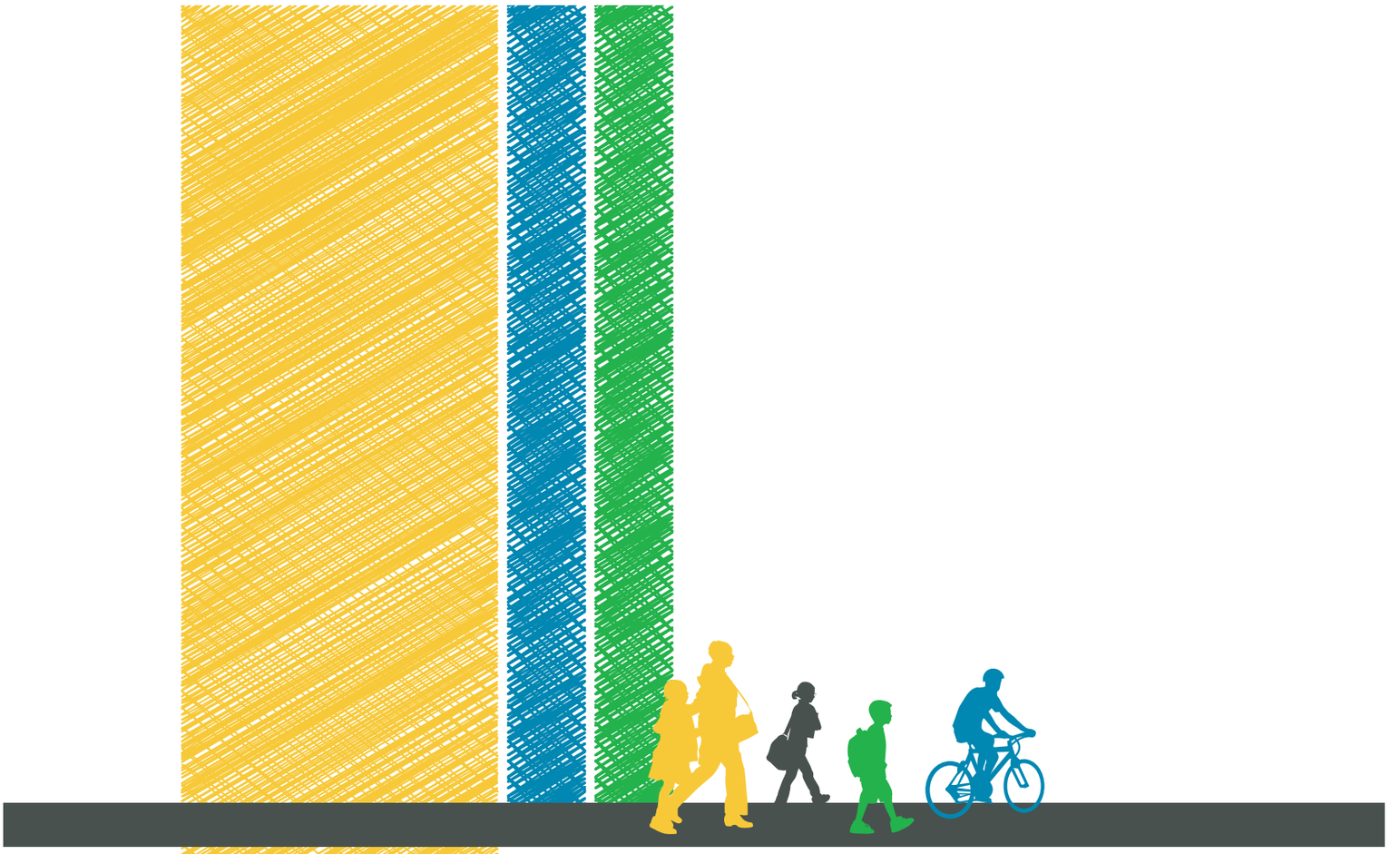
_____

_____

How about after exercise?

_____

_____



Let's Carpool!

Educator Guide

4-5

THEMES: Community
STANDARDS CORRELATIONS: ELA, Math

Let's Carpool!

Overview

Students will learn about Average Vehicle Occupancy (AVO) - the average number of people in a given car- and will discuss ways that this impacts the air around the school. Students will collect data, analyze this data and formulate hypotheses around transportation issues near the school.

Supplies

- ✓ Copies of the *Who Is Driving Here?* for each student
- ✓ Clipboards and pencils for outdoor work
- ✓ Calculators (*optional)*

Activity: Who is Driving Here?

Time: 40 Minutes

Define the word carpool as a group of people who share one car to get a number of people to one or more destinations. Discuss the benefits of carpooling connected directly to CO_2 emissions. Ask students why carpooling makes sense if we are trying to reduce our impact on the air quality around the school.

- Pass out the *Who is Driving Here?* worksheet and assign each student a partner and explain to them that they will be calculating Average Vehicle Occupancy to find out if people are carpooling in the area.
- Once outside, have students stand with their partner on a sidewalk with a good view of the street.
- Ask students to do their best to record the number of occupants in each of the next 30 vehicles that go by. Be sure to write the specific vehicle type in the chart. For example: "car, one person," or, "SUV, four people." [waiting clarification from Lily on change to this bullet]
- Calculating Mode: Once each pair has their 30 readings, have students look at their sheets and find the mode. In most cases, the dominant number will be "one."
- Calculating Average: For groups that are working with long division to calculate average, have partners add up the total number of people counted in the vehicles, and divide that number by the total number of vehicles counted (*30 total vehicles.*) Walk students through an example about how to calculate the average. For example, present the following data about vehicle occupants: 1, 1, 1, 3, 2, 3. Show students how to calculate the average by solving 1+1+1+3+2+3=11/5=2.2
- Help students connect the data they have collected with the environmental impact of the driving behavior in the neighborhood. Have students share their information with each other. How many people are sharing their cars in the neighborhood? What could be done to improve the situation? What personal changes can we make when traveling to and from school?

Note: It is probably not possible for the students to record every single car they see. What's important is that they have 30 accurate recordings. Because of this, no pair's data sheets will look alike.

Reflection

Time: 20 Minutes

- Have students reflect on the data they collected about vehicle occupancy by writing an action-oriented informational piece. Tell students that they will write an essay to share with their families. Their essay should convince adults about the importance of carpooling.
- In their essays, students should share the data they collected about vehicle occupancy and incorporate what they learned about air pollution from previous lessons.

Safe Routes to Schools: Connections and Extensions

AVO OF CARS COMING TO SCHOOL

To look at direct impact to the school, you can organize students to do AVO readings right before school starts in the drop off zone or right after school in the pick up zone.

IT'S COOL TO POOL TO SCHOOL

Work with your Parent Champion to encourage more families to carpool by using schoolpool.511.org to help connect families.

Name: _____

Who is Driving Here?

For each vehicle that drives by, write the type of vehicle (car, SUV, van, truck, taxi) and the number of occupants inside.

	Vehicle Type	# of Occupants
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

	Vehicle Type	# of Occupants
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Calculate the average:

Find the mode (*most common number)*:

_____

Find the average (*add up the total number of occupants and divide by 30)*:

_____

Conclusion: