TYPE Your Name:

How does a Pandemic Cause Less CO_2?

An SLPS Daily Task in MS Science

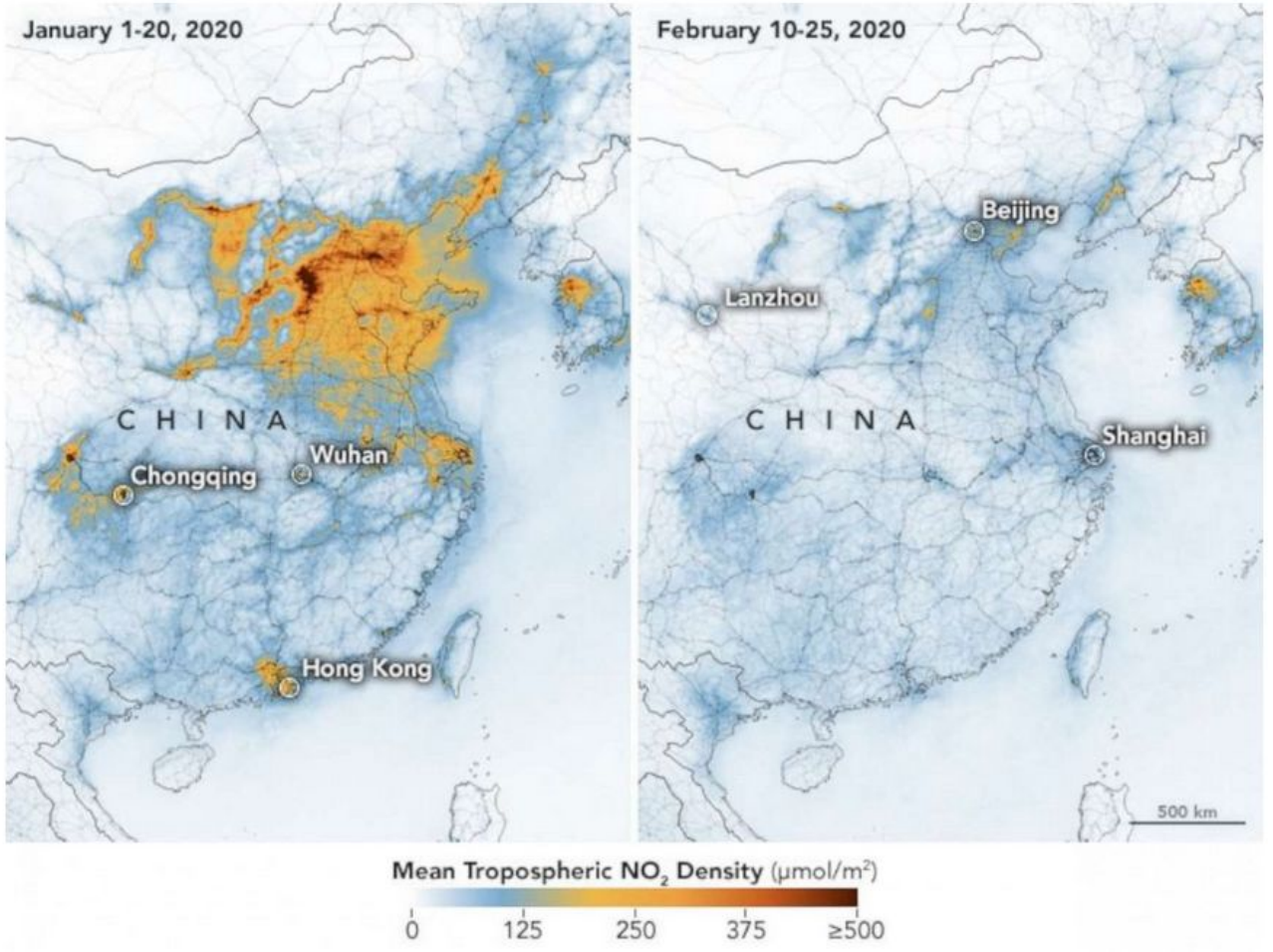
Introduction

- Closed schools and non-essential businesses and official stay-at-home mandates have kept millions of people at home and across the globe. Will we be able to return to our once-familiar daily routines after the pandemic is over? Will we still want to?
- In this task, you and your families make sense of the phenomenon of HOW concentrations of greenhouse gasses are decreasing as the world-wide spread of the coronavirus increases. You will then apply the science ideas they build to design a system or process to decrease their contribution of carbon dioxide to the atmosphere- in other words, reduce your family's carbon footprint.

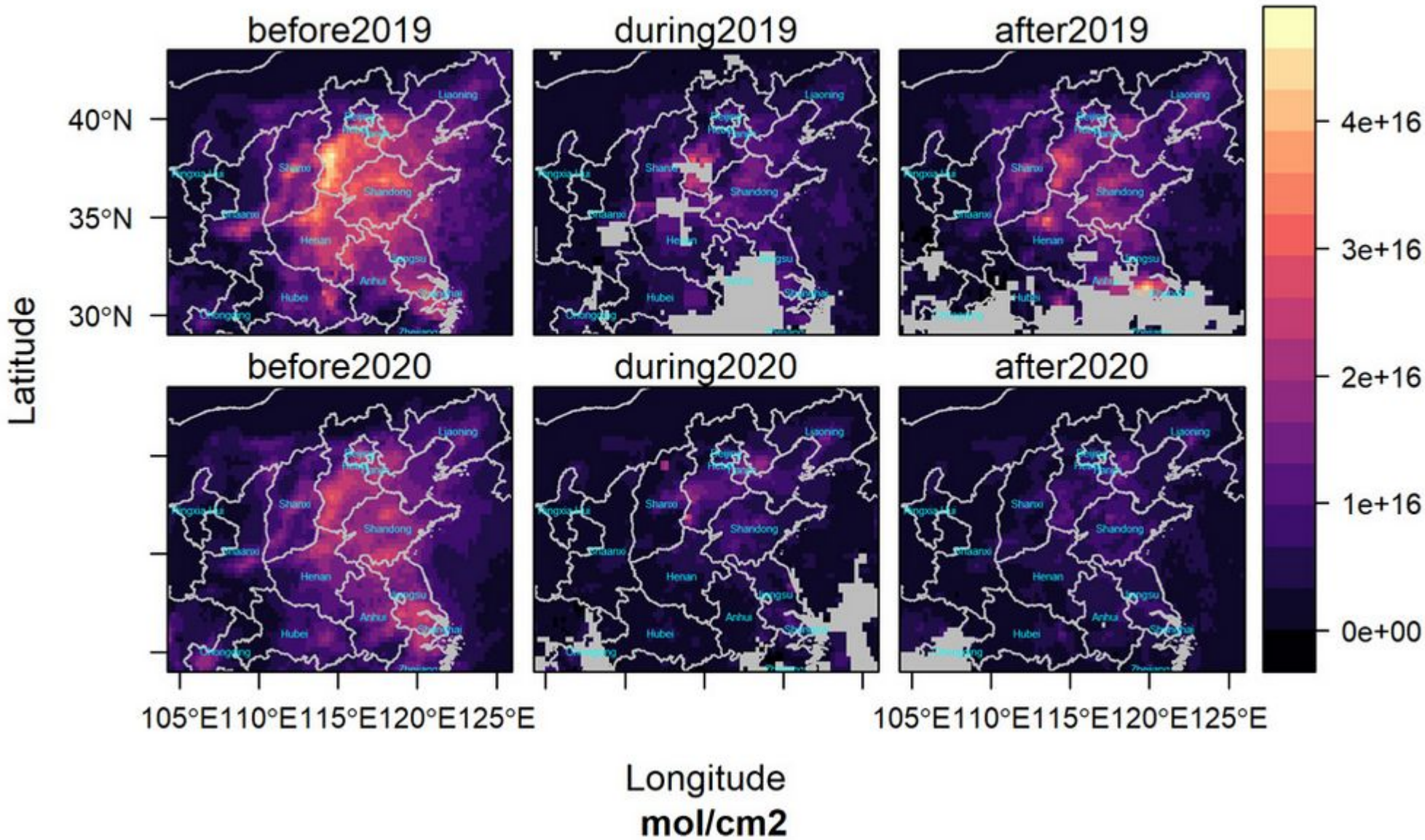
PART I:

Let’s take a look at nitrogen dioxide (NO_2) concentration data for Greater China and Wuhan, China

Please observe the 3 sets of maps very closely and include your observations and wonderings in the following slides.

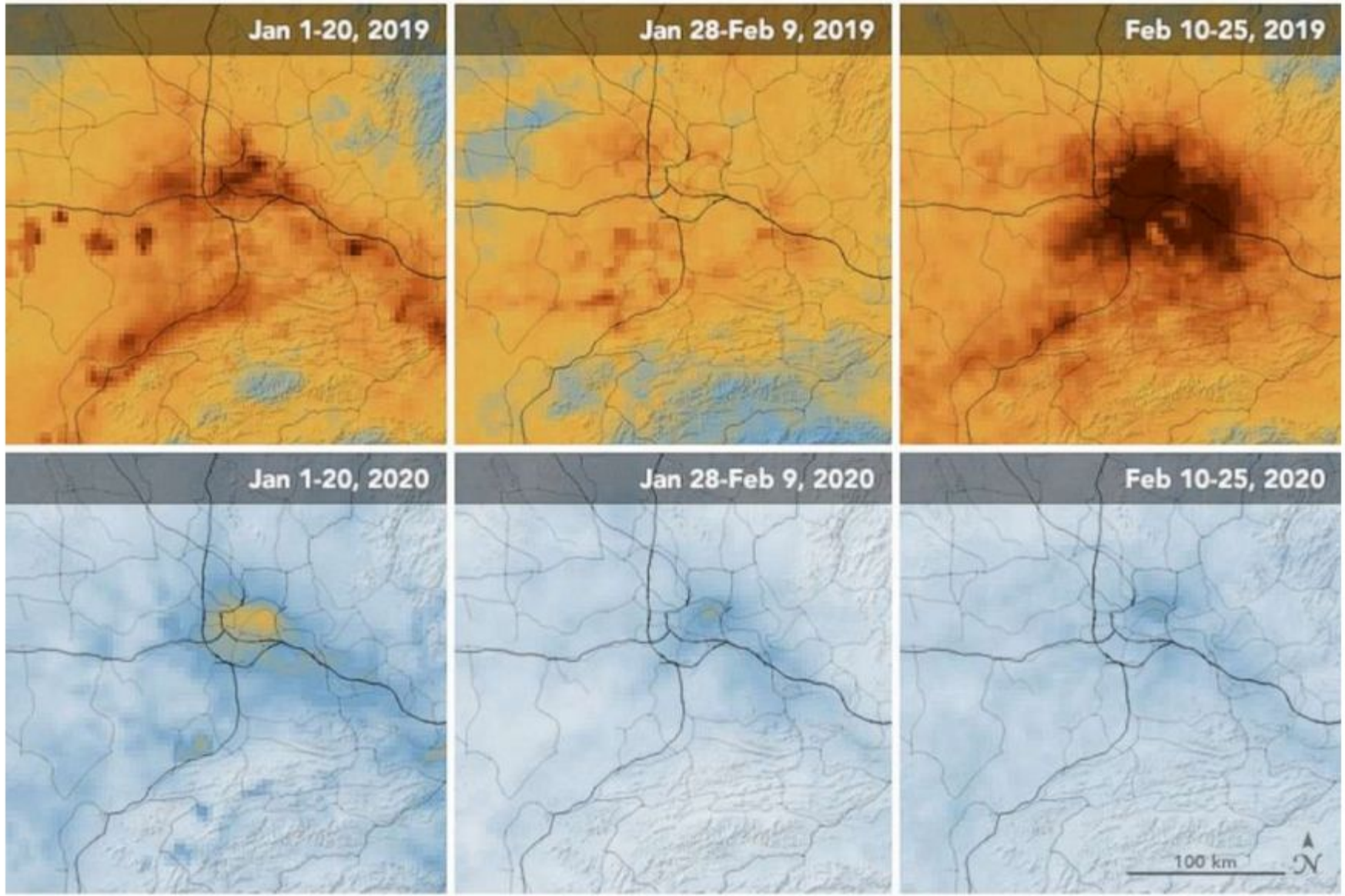


Satellite-based NO2 levels before,during and after the Chinese New Year holiday



Pollutant Drops in Wuhan—and Does not Rebound

Unlike 2019, NO_2 levels in 2020 did not rise after the Chinese New Year.



Nitrogen dioxide (NO_2) concentration data for Greater China and Wuhan, China

NO_2 is a harmful gas emitted by motor vehicles, power plants and industrial facilities into the atmosphere. These same sources also emit carbon dioxide (CO_2).

What patterns do you observe in the data presented in each set of maps?

TYPE your answer here

WHAT QUESTIONS DOES THIS RAISE FOR YOU? LIST AT LEAST 2.

TYPE your answer here

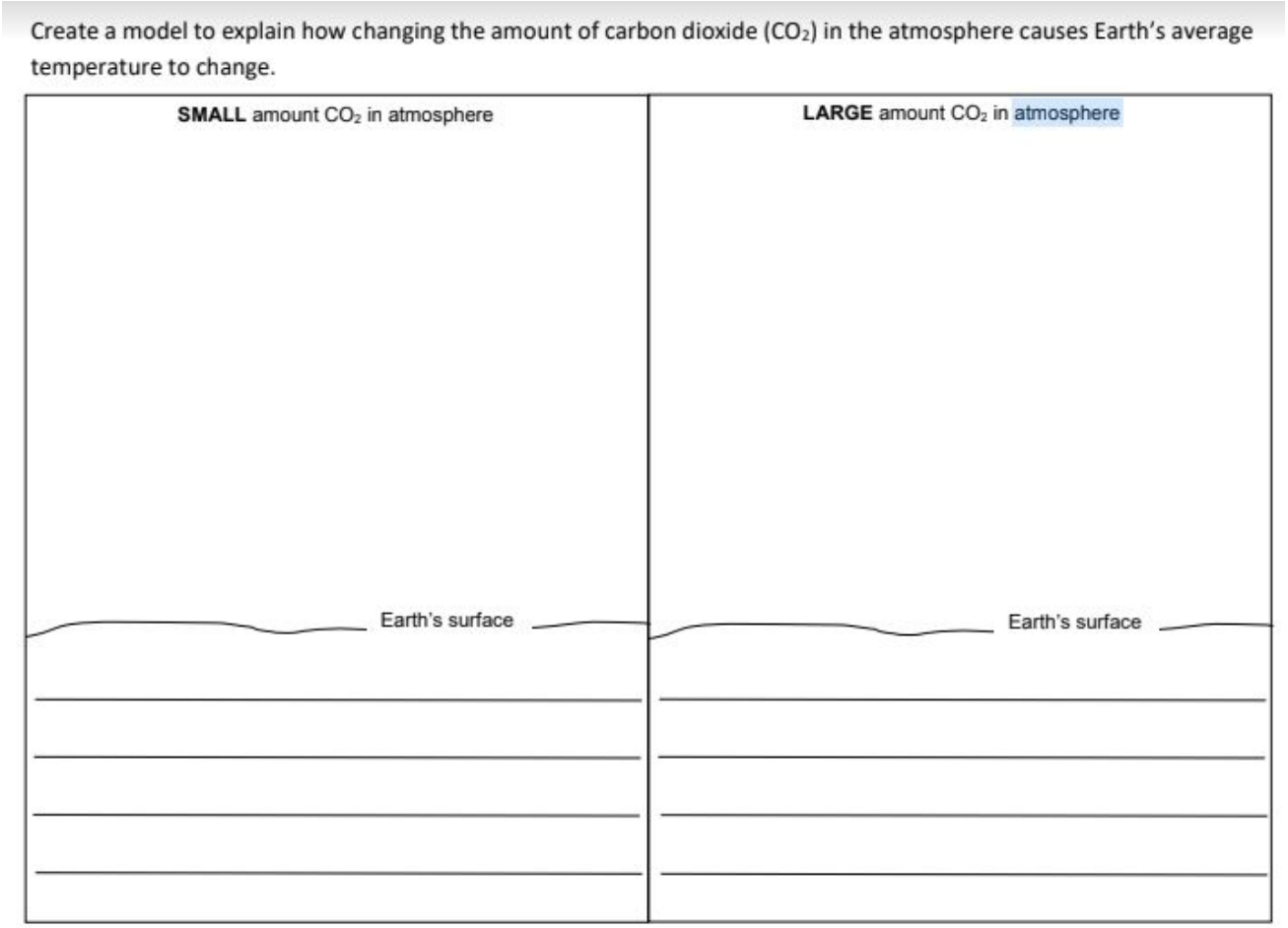
PARTII: Why NO2 is measured and why it's in the news? Let’s investigate this next.

- One reason scientists are excited about the current decrease in NO2 concentrations over China is because it indicates CO2 has also decreased.
- We're going to shift our focus to CO2 because it is a greenhouse gas while NO2 contributes to the formation of a greenhouse gas (ozone) though a series of reactions at an unknown rate.

What do you already know about greenhouse effect or climate change? Draw an initial model.

THINK ABOUT:

- What absolutely needs to be included in your model? In other words, what are the *components* of the model?
- How could you show how the components on your model are interacting? (i.e. arrows, lines, labels, text)



NOTE: You can draw your model by copying the attached empty model to google draw or you can draw on a piece of paper, put your name on it, take a picture of it, and attach it on the next slide.

Watch the 3 videos and make changes/additions to your previous model based on the new information you learned

- NASA's Earth Minute: Gas Problem

https://youtu.be/K9kga9c0u2I

- Greenhouse Gas

https://www.britannica.com/video/185587/characteristics-Earth-atmospheric-gas-molecules-properties-greenhouse

- How Carbon Dioxide Warms Planet Earth

https://www.pbs.org/wgbh/nova/video/carbon-dioxide-warms-earth/

Attach your updated model below

Based on your model, what do you predict caused the CO_2 (and NO_2) to decrease between winter 2019 and winter 2020?

TYPE your answer here. *NOTE: If you are thinking the answer to be just the coronovirus, please elaborate on the implication of virus on daily activities*.

PART III (online option only): How can we measure our carbon footprint?

- It seems like we think people sheltering-in-place is causing the decrease in the amount of CO_2 (and NO_2) being emitted into the atmosphere.
- A carbon footprint is the amount of greenhouse gases - primarily carbon dioxide - released in the atmosphere by all of a person's, family's, community's, or nation's activities.
- Complete the Calculate Your Carbon Footprint survey

(https://coolclimate.berkeley.edu/calculator)

to determine your family's carbon footprint BEFORE the COVID-19 pandemic and AFTER schools and businesses closed. (You will complete the survey twice.)

- The survey results give you the total number of pounds of CO_2 per year emitted to the atmosphere as a result of your family's typical activities (home, travel, eating, and shopping). Students can see how much CO_2 (pounds) each activity contributes to the total.

NOTE: In any event you cannot take the survey due to lack of access to technology/internet, skip to PART IV.

Reflection questions

1. After you finished taking the survey before and after pandemic, what is the percent change in your carbon footprint from pre-COVID-19 pandemic to post-pandemic? (Subtract the amounts)

TYPE your answer here

2. If every household in your community had the same percent change as your family did, what would be the total reduction in CO2 emitted to the atmosphere each year as a result of your community's activities? (NOTE: Students will need to look up their community's population)

TYPE your answer here

3. If every household in Wuhan, China had the same percent change as your family did, what would be the total reduction in CO2 emitted as a result of the Wuhan, China community's activities?

TYPE your answer here

Reflection Questions, continued

4. Return to the Wuhan, China NO_2 data they observed at the start of the task Part 1, last image. Can changes in daily activities explain why the NO_2 emissions (remember CO_2 is closely linked to NO_2) have changed? What is your evidence?

TYPE your answer here

5. Return to their initial models. What would you add to/change to explain how changes in CO_2 causes changes in Earth's average temperature.

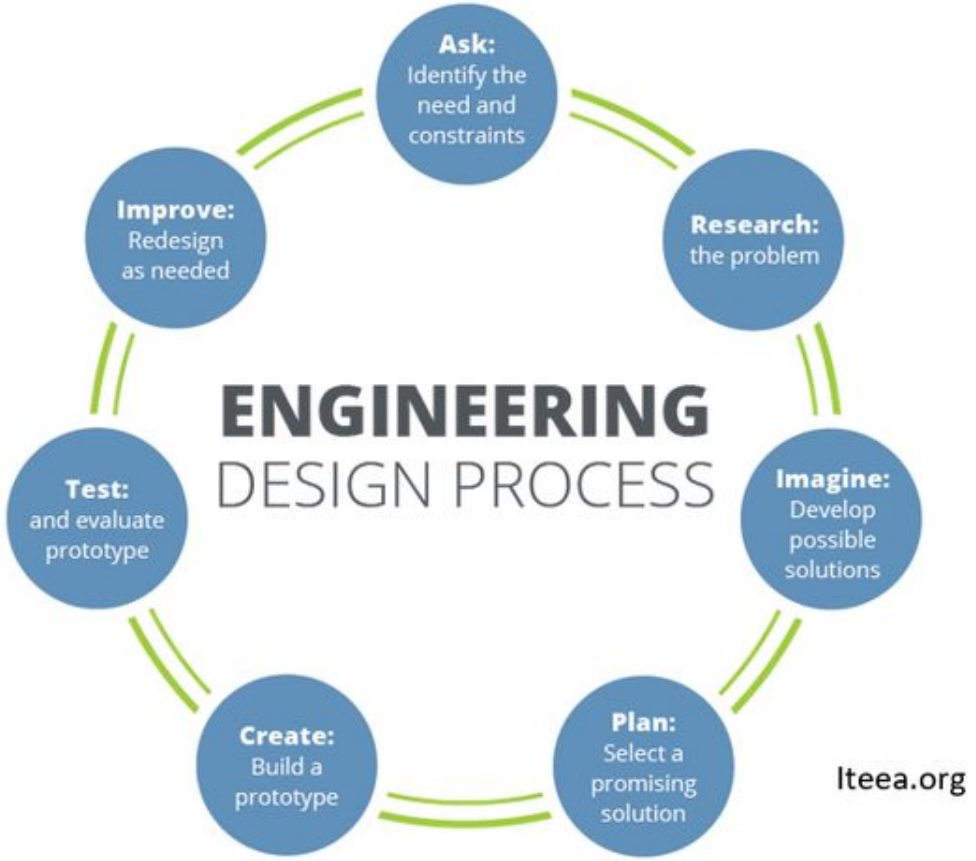
TYPE your answer here

PART IV: Engineer a solution to reduce your family's carbon footprint!

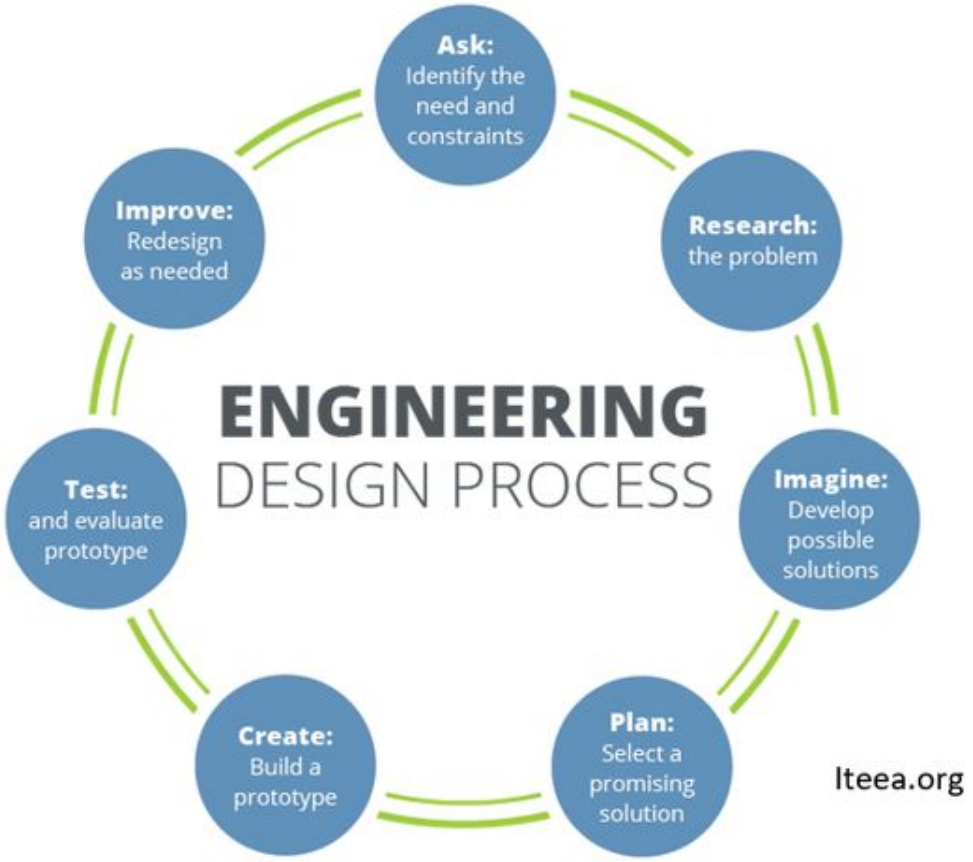
1. When we go back to our normal daily activities, what might you do to continue to reduce your carbon footprint?

TYPE your answer here

The Engineering Design Process (EDP) comes in many forms. Engineers enter the EDP to create a new technology - or improve an existing one - to meet a need or want. Engineers on the job may start at any step, depending on the needs of a particular project.



Watch the video, *A Strict Carbon Diet* (https://www.pbs.org/wgbh/nova/video/a-strict-carbon-diet/) to find out how engineer Saul Griffith is helping his family reduce their carbon footprint. As you watch the video, can you identify the steps of the EDP Griffith uses to design a solution to the problem of lowering his family's carbon footprint? What's your evidence?



TYPE your answer here

Like Griffith, you can use the EDP to reduce your family's or community's carbon footprints and share your plan below. (*Note: address as many steps in the EDP cycle in your response)*

- TYPE your answer here

Take it Further

- You can really make a difference by getting your friends, teachers, school and district thinking about reducing their carbon footprints! One way is to explore even more changes to make by checking out the Energy Star website.

- You can also track and change their carbon footprint in real-time by trying one of these mobile Apps: *Mobile Carbon Footprinting or Carbon Footprint ACP.*

Extension! Explore STEM Careers: Environmental Engineer

- Now that you are engineering ways to help the environment, meet Marielle Thillet and explore her STEM Career as an Environmental Engineer!
- https://youtu.be/z6cJ9IULgMk

- What are some challenges and rewards of job as an Environmental Engineer?

TYPE your answer here

HOW DO WE FIND PATTERNS IN WEATHER?

Your Name:

LESSON PLAN

DAY 1 – INTRODUCTION, EBOOK PAGES 1- 17, SLIDES 3-11

DAY 2 – E-BOOK PAGES 18 – 27, SLIDES 12- 14

DAY 3 –E BOOK PAGES 28 – 5, SLIDE 15

DAY 4 – SLIDES 16 – 22 DESCRIBING WEATHER

SLIDE 14 - WEATHER OBSERVATIONS (CAN BE DONE AS THE LESSON IS GOING ON AFTER DAY 1)

INTRODUCTION:

"WHAT'S THE WEATHER LIKE TODAY?" MOST OF US THINK ABOUT THE WEATHER EVERY DAY. IT INFORMS THE CHOICES WE MAKE LIKE WHAT TO WEAR AND HOW WE'RE GOING TO GET TO SCHOOL, WORK OR THE STORE (WALK, BIKE, TAKE THE BUS, ETC.). WE MIGHT NOT NOTICE IT, BUT WE THINK ABOUT CLIMATE A LOT, TOO. WE MAY MAKE A PLAN TO VISIT SOMEPLACE NEW AT A PARTICULAR TIME OF YEAR TO HELP ENSURE WE'LL EXPERIENCE THE WEATHER WE WANT OR WE MAY WAIT EXCITEDLY FOR WARM MONTHS TO SWIM AND PLAY OUTSIDE.

In today's task, *How do we find patterns in weather?*, students will read the NSTA eBook, *Thinking Like a Scientist: Investigating Weather and Climate* which engages them in science and engineering practices and the use of patterns as a thinking tool (crosscutting concept) to figure out science ideas about weather and how patterns of weather determine the climate of an area.

NSTA'S EBOOK - INVESTIGATING WEATHER AND CLIMATE

If you have access to the book there are many interactive features. If you do not there are activities included in this document.

https://my.nsta.org/ebook/109161/investigating-weather-and-climate/

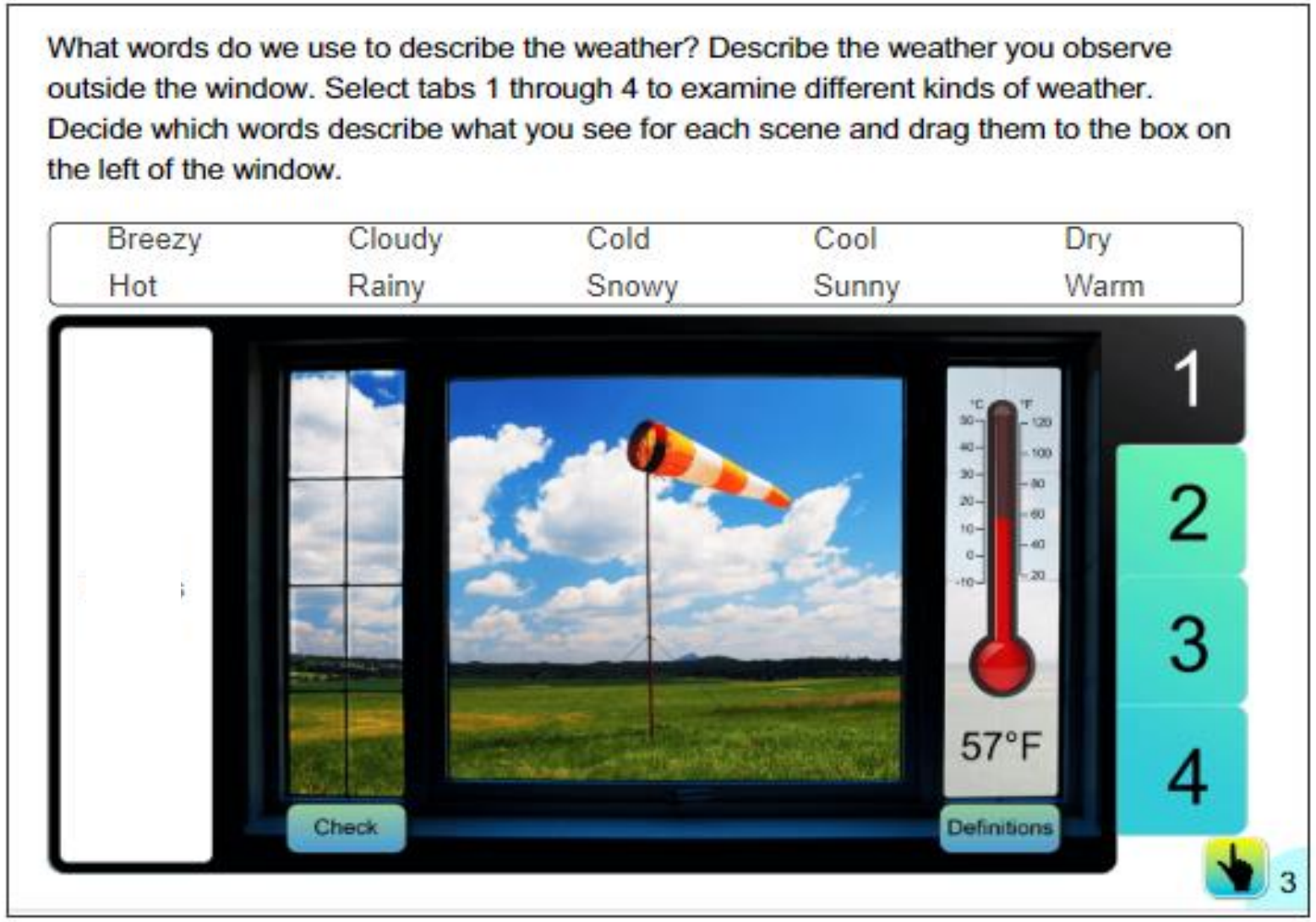
ENGAGE STUDENTS IN THE EBOOK

What do you see on the cover that makes you think about weather and why?

MAKE AT LEAST 3 OBSERVATIONS ABOUT TODAY'S WEATHER

Remember an observation is what you can feel, smell, see.

PAGE 3 OF EBOOK



On the next four slides compare the weather describing words on the page with the words they used to describe the day's weather.

What words do we use to describe the weather? Describe the weather you observe outside the window. Select tabs 1 through 4 to examine different kinds of weather. Decide which words describe what you see for each scene and drag them to the box on the left of the window.

Breezy	Cloudy	Cold	Cool	Dry
Hot	Rainy	Snowy	Sunny	Warm

What words do we use to describe the weather? Describe the weather you observe outside the window. Select tabs 1 through 4 to examine different kinds of weather. Decide which words describe what you see for each scene and drag them to the box on the left of the window.

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Breezy	Cloudy	Cold	Cool	Dry
Hot	Rainy	Snowy	Sunny	Warm

3

PAGE 5 OF EBOOK

Meteorologists use many tools to observe and measure the weather. Look below.

What types of weather do you think these tools measure?

Write the correct instrument name under the instrument.

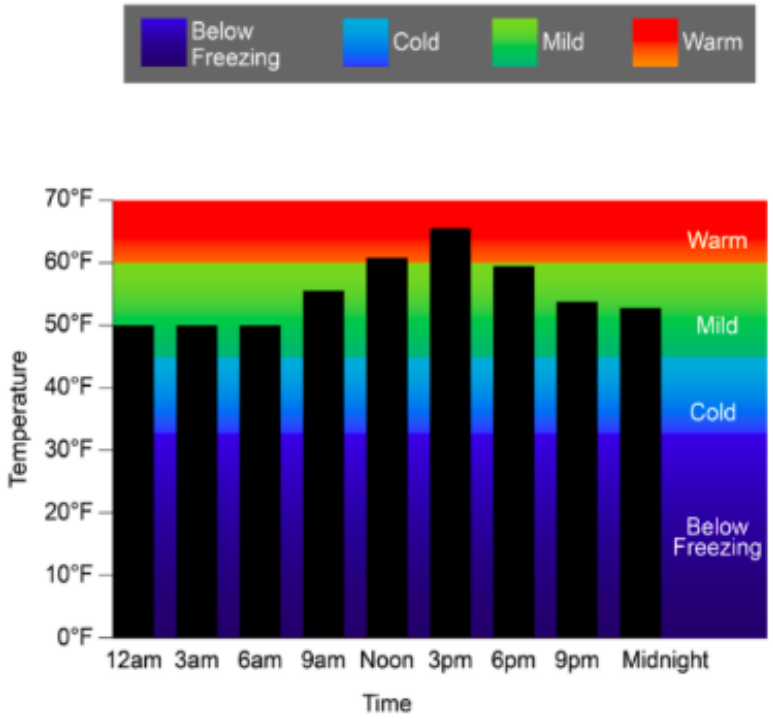
RAIN GAUGE | ANEMOMETER | THERMOMETER | WIND VANE

5

Match each weather instrument with it's proper name

PAGE 7 OF EBOOK

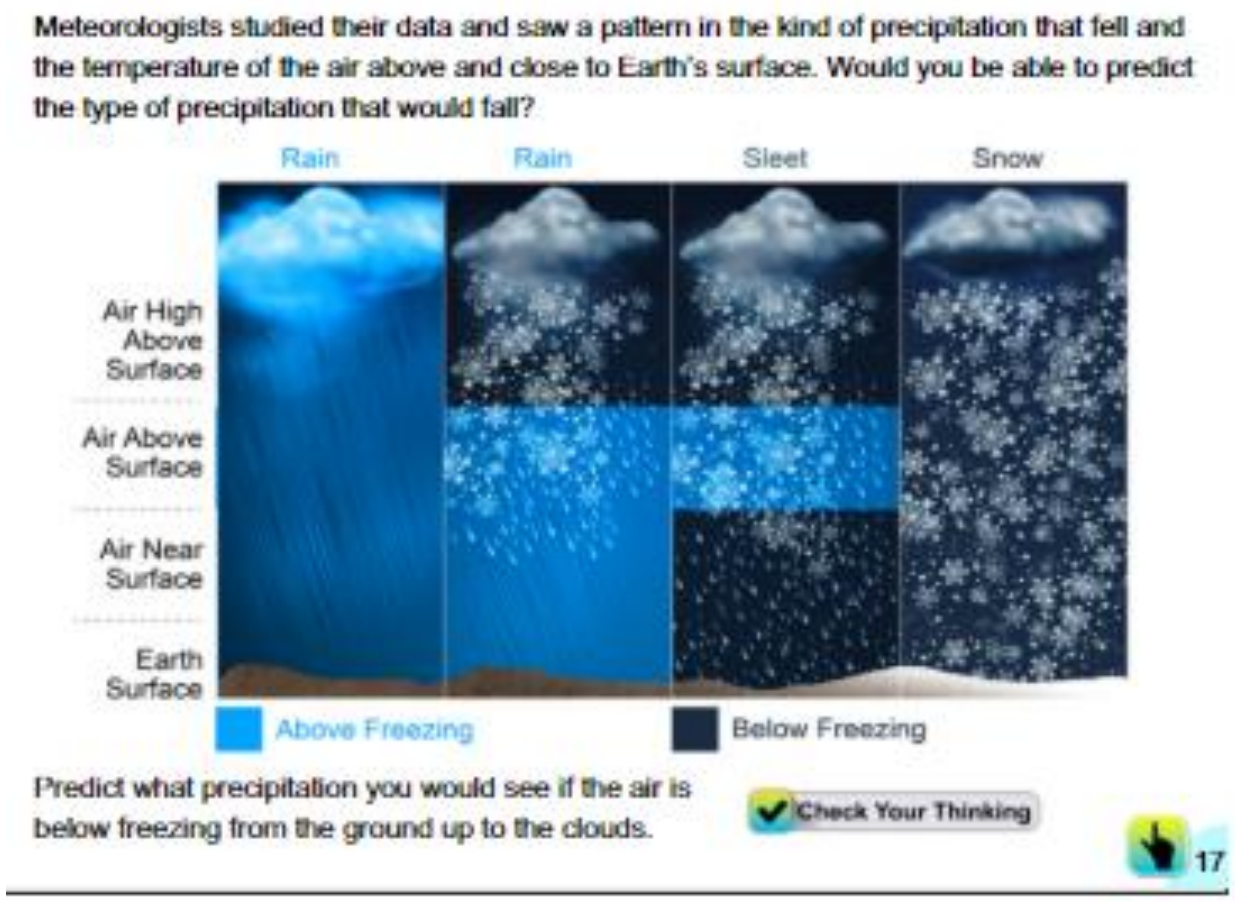
Time (Hour)	Temperature (°F)
12:00am	50
3:00am	50
6:00am	50
9:00am	55
Noon	61
3:00pm	65
6:00pm	59
9:00pm	54
Midnight	52



Above we see a **data table** and a **graph.** Both show the same information about temperature over a single day. Explore how they each show that information in different ways by tapping a bar in the graph or a row in the data table.

"What patterns do you observe in the data presented in this bar graph?“

PAGE 17 OF EBOOK



"What patterns do you notice in the data presented in this model?“

PAGE 23

Choose the student they most agree with and record your thinking (you can use words, picture, symbols, graphs, etc.)
Each individual student response is on the next page.

PAGE 23 OF EBOOK- STUDENT RESPONSES

Student A

There's no way to predict the weather using this data.

Student B

I think the weather is always the same from year to year. That's how they know what the weather will be like.

Student C

I think the weather from year to year is similar but not exactly the same.

Student D

I think that the weather forecast is probably nothing like what is was last year on this date.

PAGE 26 OF EBOOK

What do you think the colors tell us about the weather patterns at different places on Earth? For example, what might the weather pattern be for the dark green areas?"

Complete the following prompt for the tan, dark green and light green areas on the map.

I think _____

because _____

I think _____

because _____

I think _____

because _____

PAGE 50 OF EBOOK

How would you describe the climate in St. Louis?

How would you describe the usual weather during the winter months? The summer months?

Do we have a wet or dry season?"

DESCRIBING WEATHER

Listen to the weather BROADCAST

1. Make observations (what you see and hear).

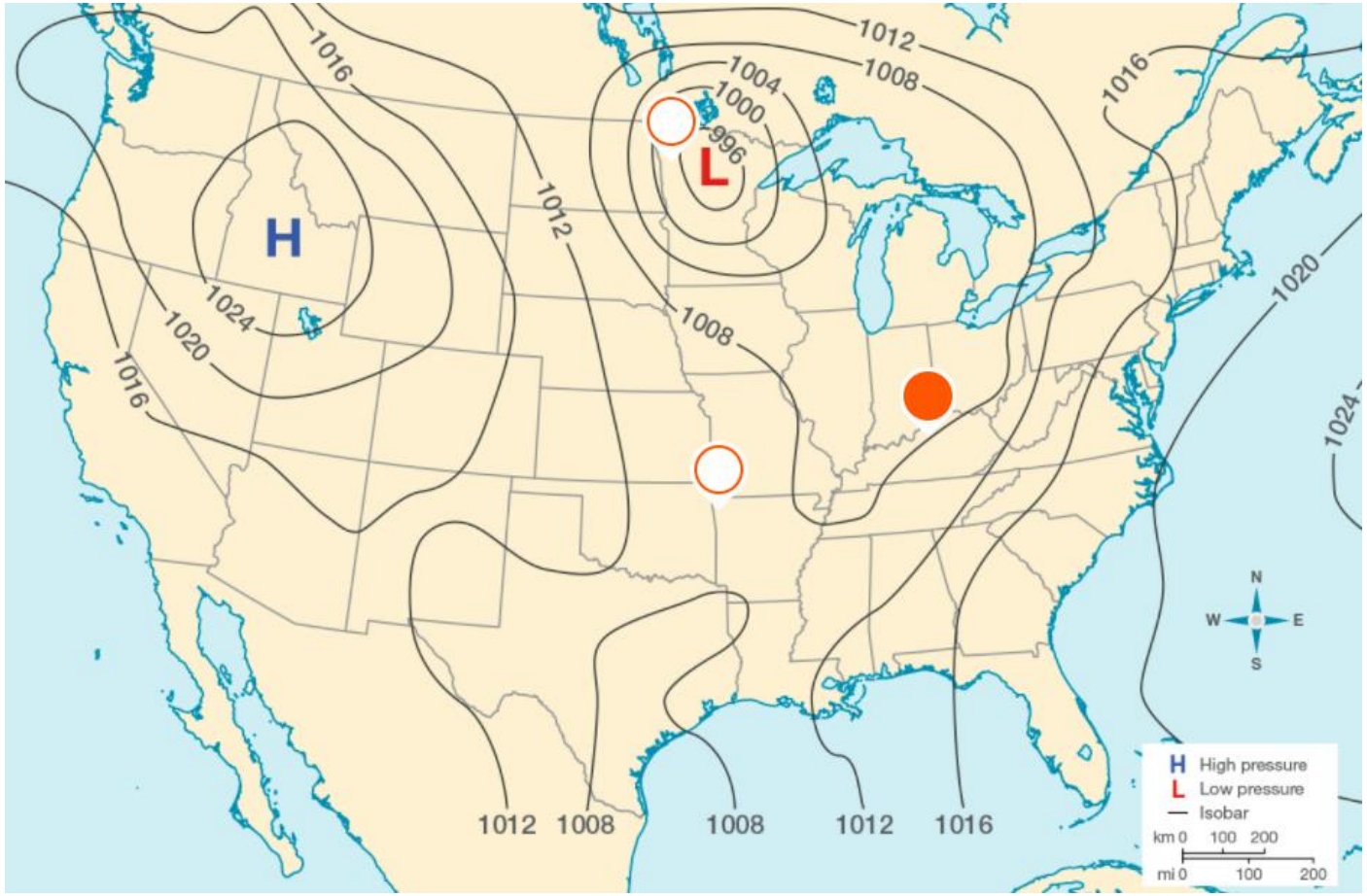
2. Based on the observations you made what can you predict is going to happen in St. Louis later in the evening?

Air Pressure

Air temperature varies because the sun warms Earth's surface unevenly. Because temperature affects pressure, differences in air temperature result in differences in air pressure. Differences in air pressure cause wind to blow. Wind moves clouds and precipitation from one place to another.

Weather Maps

- On weather maps, an “H” shows where the air pressure is highest. An “L” shows where it is lowest. An isobar is a line that follows along points of equal air pressure. Observe the patterns in air pressure on the map. The numbers show the measured air pressure in millibars (mb).



Pressure Systems

High Pressure

- A high-pressure system forms where air sinks toward the surface.
- As air in a high-pressure systems sinks, it gets warmer.
- Relative humidity decreases, and if there were any clouds, they evaporate.
- These conditions usually bring clear skies and calm or gentle winds.

Low Pressure

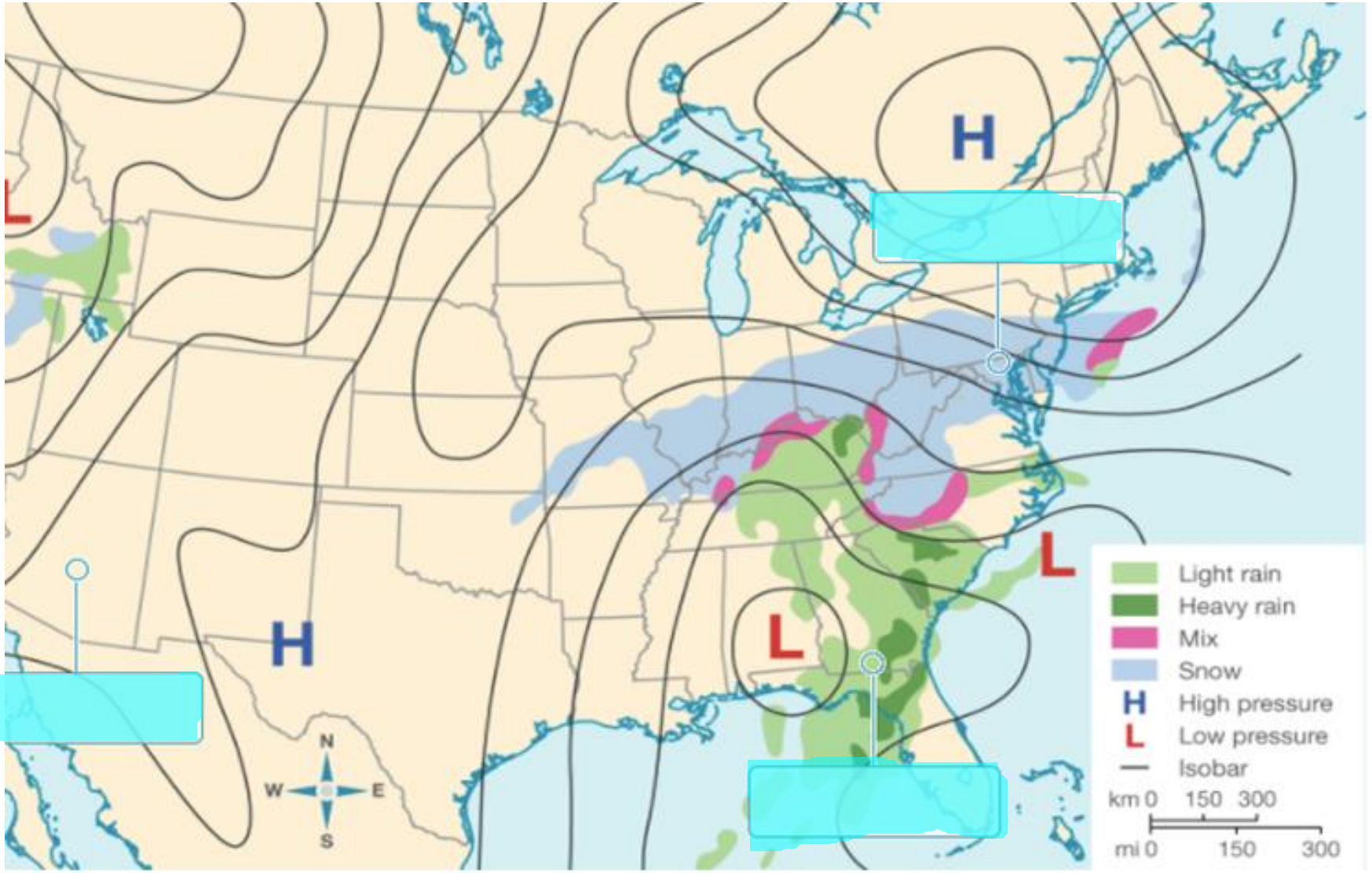
- Where warm, less dense air rises from Earth's surface, a *low-pressure system* forms.
- The air in a low-pressure system rises and cools.
- Clouds and rain form if the air rises and cools enough.

Earth rotates, so wind does not blow in a straight line. In the Northern Hemisphere, air spirals counterclockwise around a low-pressure system and clockwise around a high-pressure system.

Question 3

Complete the table to show whether each statement is associated with a **high-pressure system** or a **low-pressure system** in the Northern Hemisphere. The first one is done for you.

Sinking air becomes warmer	**High-pressure system**
Rising air becomes cooler	
Clear, sunny weather	
Cloudy, rainy weather	
Clockwise winds spread out	
Counterclockwise winds move in	



The map (to the left) shows precipitation and air pressure. Which label best describes the pressure system in Arizona, Georgia, Maryland?

- **Sunny and calm;**
- **Rainy;**
- **Snowstorms / Windy**

WEATHER LOG

Record the weather for the next three days and make predictions.

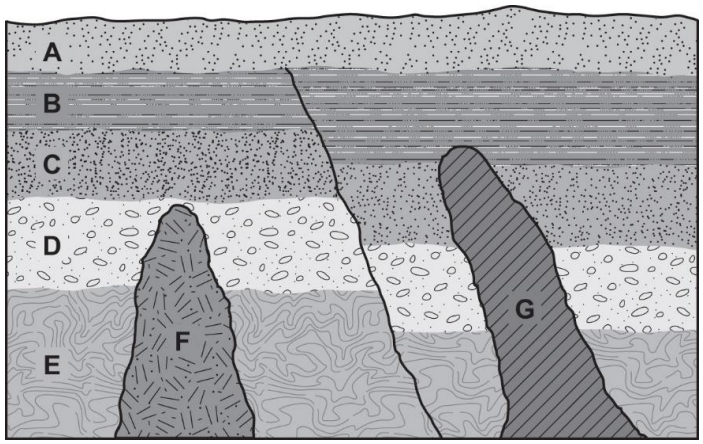
Date and Time	Temperature	Wind Speed	Wind Direction	Precipitation Type	Sky Conditions (sunny, cloudy, partially cloudy)
May ___					
Tomorrow's prediction					
May___					
Tomorrow's prediction					
May___					

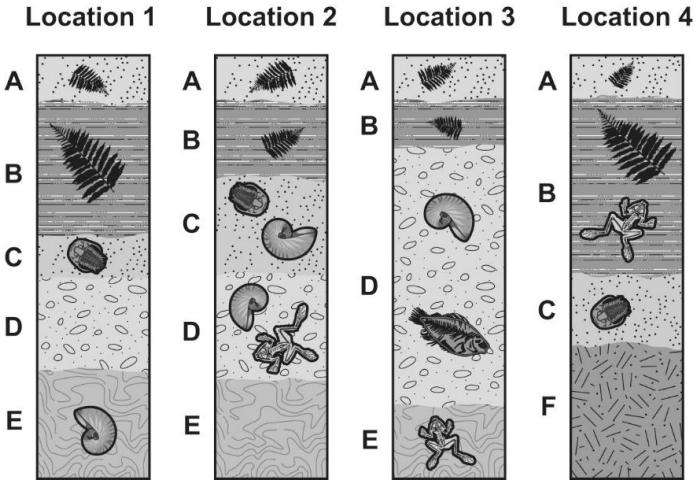
Directions: Read the passage, then answer the questions that follow.

Layers of Rock, Layers of Fossils

A geologist is studying the history of an area in the southeastern United States. He looks at rock strata to learn about the geologic history of the area.

The geologist wants to determine the relative and absolute ages of the different layers of rock that he sees. He examines the five different fossils that are located throughout the rock layers at different locations.





1. Which conclusion could be made about the layers of rock in the sample based on the information in the passage?

Circle the letter of the correct answer.

A. The absolute age of the rock is 100 million years.

B. A volcanic eruption disrupted the rock layers sometime in history.

C. The environment has remained an ocean throughout the time being studied.

D. The layers at the base of the sample are older than the layers at the top of the sample.

2. Type the letters of the layers in the rock strata that are likely a result of an intrusion of magma from the very top model?

3. The geologist uses other dating techniques to determine that layer E is 90 million years old and the fault occurred 65 million years ago. Based on this information, during what time span was layer D deposited?

Write your answers on the lines.

Between _____ million years ago and _____ million years ago.

4. Fossils are shown in various layers for four locations in the area of the given rock strata.

Write one letter in each blank to explain what information can be learned from these fossils and their locations.

The **1.** _____ can be used as an index fossil because it is found **2.** _____. The index fossil can

be used to determine the **3.** _____ age of the rock strata. Based on the fossils located in this strata, the environment was likely **4.** _____ historically.

1.	**2.**	**3.**	**4.**
A. fish **B.** fern **C.** trilobite	**D.** consistently in one layer **E.** in different layers in each location	**F.** relative **G.** absolute	**H.** desert **I.** ocean

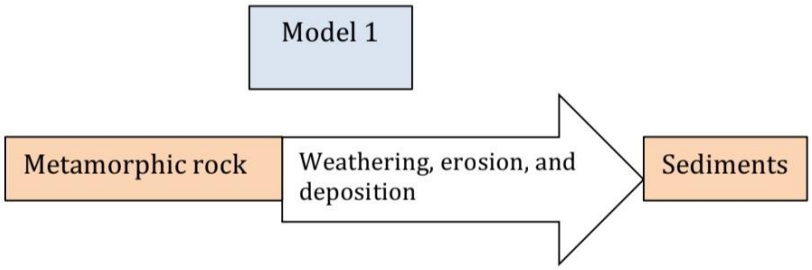
Directions: Read the passage, then answer the questions that follow.

New York, New York

A group of students in New York City are learning about earth science. They believe that processes they are learning about can only be seen in wild and far-away places. But, in fact, evidence of ways that matter is cycled through the earth can be seen in even the biggest cities and busiest neighborhoods.

The picture shown here is New York City's Coney Island. The sand came from a 1.1 billion year old metamorphic rock. A glacier broke the rock into pieces (sediments or sand) and moved it to this beach.

Begin with the sand on Coney Island. To help the students understand how this sand is an example of the cycling matter, you show them Model 1 below.

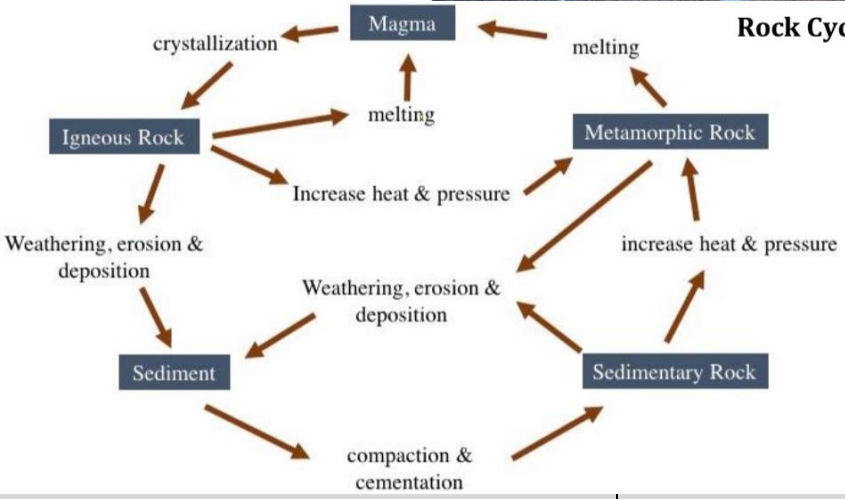


1. Describe to the students what Model 1 shows about how matter was changed to form sand on Coney Island.

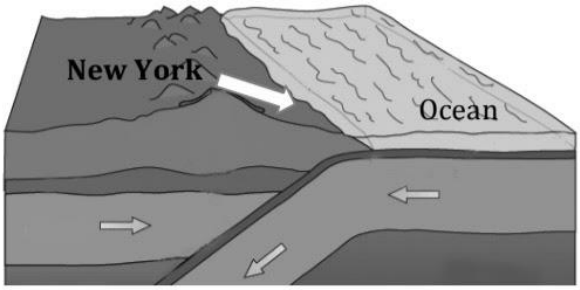
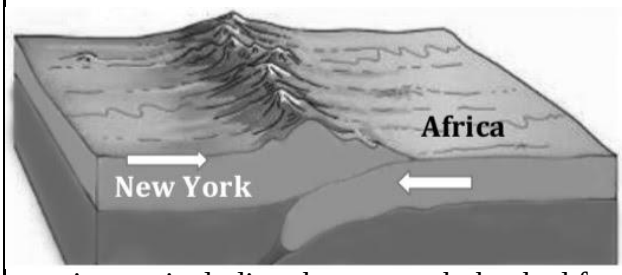
2. Glaciers changed some of the bedrock into sand in New York, but some bedrock is still there. In fact, most of the all buildings in the city sit on part of the 450 million year old bedrock shown here call Manhattan Schist.

Final Assessment for MS Science Name _____

This rock did not always look the way it does today. Two processes that formed it are described in the table below. Answer the questions in the table to describe some of the ways matter was changed over time to form the Manhattan Schist.
You can use the rock cycle model **above** to help you answer the questions in the second column of the table.



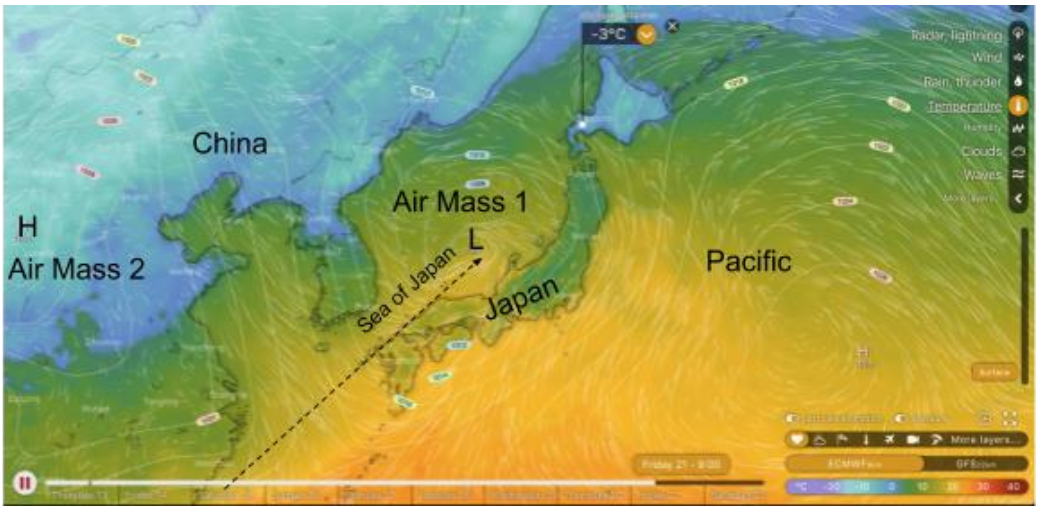
Rock Cycle Model

How the Manhattan Schist formed		Analysis of changes
	Sediments were broken from the land by wind and water and were moved into the ocean at the edge of New York. The sediments were buried deeper under more and more sediments.	What type of new rock formed? What process caused the new rock to form?
	Later, the African Plate began moving toward the North American Plate until the two continents collided. This collision compressed all of the rock at the edges of the continents, including the new rock that had formed under the ocean next to New York.	What type of new rock formed? What process caused the new rock to form?

Final Assessment for MS Science Name _____

BONUS Question 1 (on *How does a pandemic cause less CO2?* task*)*: In this task you learned that during the COVID19 pandemic levels of NO2 and, hence, CO2 (greenhouse gas) dropped significantly compared to last year and previous months. What action steps (at least 2) will you continue to take to reduce your and or your family's carbon footprint?

BONUS Question 2 (on *How do we find patterns in weather?* Task): Use evidence from the map to answer the questions below about Niseko's weather over the course of the 2-day period. Type/Write the correct set of characteristics of **Air Mass 1** (path travelled identified by the arrow) that is moving toward Niseko on ***9AM Friday, December 21st.***



i. **Moisture**	humid	dry
ii. **Temperature**	warm	cold
iii. **Pressure**	low	high

ACADEMIC INTEGRITY STATEMENT

By signing or typing my name below, I certify that this assessment was completed independently, without the use of outside help (including, but not limited to: web searches, peer assistance, adult help, and copying).

_____ _____

Student Name (Type or Sign) **Today's Date (Type or Print)**