Unit 2: Atmosphere, Weather, and Climate Change

Content Area: **Science**
Course(s):
Time Period: **Trimester 1**
Length: **8-10 Weeks**
Status: **Published**

Brief Unit of Summary

Unit Introduction: Earth's Atmosphere, Weather, and Climate Change
In this unit, students will develop a comprehensive understanding of the structure, composition, and functions of Earth's atmosphere. They will explore how the atmosphere supports life, regulates temperature, and interacts with other Earth systems. Students will investigate the causes and effects of air pollution, including both natural and human-induced sources. Exploration will include examining the consequences for environmental and human health.

Students will also study weather patterns, focusing on how the movement and interaction of air masses, landforms, ocean temperatures, and currents influence regional and global weather. Through data analysis and modeling, students will make connections between short-term weather events and long-term climate patterns.

A key focus of this unit is understanding how human activities—particularly the burning of fossil fuels—contribute to global warming and climate change. Students will evaluate scientific data related to climate trends and explore evidence-based strategies to mitigate the impact of human actions. As part of this exploration, students will construct and deliver a persuasive scientific presentation, using data to advocate for sustainable solutions.

Throughout the unit, students will engage in Science and Engineering Practices, including planning and carrying out investigations, analyzing and interpreting data, and developing and using models. They will strengthen their ability to record and analyze observations, draw conclusions, and communicate scientific findings effectively.

Revision Date: July 2025

Essential Questions

Essential Question

What is the structure and function of Earth's atmosphere, and how does it support life?

How do interactions between the atmosphere, oceans, and landforms affect weather and climate?

What causes weather patterns, and how can we predict them using data?

How do human activities impact air quality, contribute to climate change, and what can be done to reduce these impacts?

How can scientific models and data be used to understand and communicate about atmospheric and climate systems?

Enduring Understandings

Earth's atmosphere is a dynamic system that plays a critical role in regulating temperature, protecting life, and supporting weather and climate processes.

Weather patterns result from the movement and interaction of air masses, ocean currents, and landforms, and these patterns can be observed and modeled.

Air pollution can originate from both natural sources (e.g., wildfires, volcanic eruptions) and human activities (e.g., emissions from vehicles and factories), with significant effects on environmental and public health.

Scientific evidence can be used to advocate for sustainable practices and climate solutions to reduce the impact of human activities.

Students can use models, data analysis, and persuasive communication to explain scientific phenomena and influence informed decision-making.

Students Will Know/Students Will be Skilled At

Atmosphere Structure & Composition

Students will know the functions of Earth's atmosphere, including its role in supporting life and regulating temperature.

Students will know the gases that make up Earth's atmosphere and how the ancient atmosphere differs from the present-day composition.

Students will know the five layers of the atmosphere and be able to describe their defining characteristics.

Students will know the importance of the ozone layer and how it protects life from harmful ultraviolet radiation.

Students will know the definitions of mass, density, and pressure, and understand how they relate to atmospheric science.

Students will know how air pressure, temperature, and density change with altitude.

Air Pollution & Environmental Impact

Students will know the natural and human-made causes and effects of air pollution.

Students will know the impact of air pollution on human health and the environment.

Students will be skilled at evaluating strategies to reduce air pollution at both global and local (personal) levels.

Weather & Climate Understanding

Students will know the difference between weather and climate, and how each is measured and observed.

Students will know the different types of air masses and the environmental conditions under which they form.

Students will know the various types of weather fronts and their roles in changing weather patterns.

Students will be skilled at analyzing how human activities contribute to climate change and how it impacts Earth's atmosphere and weather.

Weather Tools & Data Analysis

Students will know common weather instruments (e.g., thermometer, barometer, anemometer, hygrometer) and how they are used to collect weather data.

Students will be skilled at interpreting data from weather tools to describe and predict weather patterns.

Students will be skilled at evaluating the importance of weather forecasting in everyday life, including its roles in agriculture, transportation, and emergency planning.

Evidence/Performance Tasks

Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

Formative Assessments:

- Worksheets/Practice Problems
- Do Nows
- Exit Tickets
- Class Discussions
- Layers of the Atmosphere Quiz
- Weather Masses and Fronts Quiz

Summative:

Unit Tests:

- Weather Test
- Atmosphere Test

Bench Marks:

Formal Lab Reports

- Air Pollution Lab

Alternative:

- Atmosphere Prior Knowledge Chart
- Air Pollution Webquest
- Atmosphere Foldable
- Atmosphere Study Guide
- Weather Study Guide
- Atmosphere Stations Review
- Weather Stations Review
- Weather Instrument Activity
- Check for Understandings

Learning Plan

Atmosphere Composition →Demonstration: Without any discussion or background information, students will complete a chart on the atmosphere to assess their prior knowledge. They will complete it individually first and then compare with their table. Students will then share their answers with the class, but the correct responses will not be shared. Students will discover their answers as we proceed through the chapter. →Notes/Discussion – students will take notes on the atmosphere, its functions, and its importance *Guided notes &PowerPoints for students as needed*

Demonstration: Three candles will be placed under different-sized beakers. Each candle will be lit, and students will watch to see which candle burns out first, second, and third. Discussion Questions: What did you observe? Why did the candles burn out in that order? After watching this demonstration, what can you infer about the composition of the atmosphere? What do candles need to burn? What did this experiment prove?

Demonstration/Discussion: Lead a discussion by asking students about atoms and mass. Discussion Questions: What is matter? What is mass? What has mass? How do we measure mass? Does everything have mass? Does "air" have mass??? These questions will lead to a poll of the class, usually divided, on whether or not "air" has mass. Demonstration: Teacher will weigh an "empty" balloon on a balance. Then, the teacher will blow up the balloon and weigh the balloon again. Discussion Questions: What did you observe? Does "air" have mass? Why? What is in the air? What is oxygen or carbon dioxide? What do gases have to do with matter? What are the three states of matter? What happens to water when you boil it? Do the water molecules disappear or just

change into a different form?

Notes/Discussion– students will take notes on the composition of Earth's ancient atmosphere and how it has changed since then. Students will complete a review worksheet on the material learned thus far. (most likely homework) *Guided Notes & PowerPoints for students as needed* *Peer review of homework, answer sheet provided for student support as needed*

Demonstration/Discussion/Notes – students will represent air molecules, and there will be two differently sized boxes on the ground. Students will stand in different boxes and be asked different questions to determine the mass/density of the boxes based on the number of students in the box. Discussion Questions: What is mass? What is volume? What is density? What do the students represent? Which box has more mass? More density? How do you know? How can we increase the mass? How can we increase the density? Is the volume the same for each box? What does the volume have to do with density? What makes something more or less dense?

Writing Assessment – students will write two paragraphs about the atmosphere using the notes and information they have learned so far. The paragraphs will include information on how the atmosphere has changed, how it is important, and how it is structured based on density and pressure. (most likely homework assignment) *Students with IEPs will have a guideline to follow and fill out as they write

Ozone Lab – Students will collect data around the school related to ground-level ozone. Students will create Schonbein slips using potassium iodine and detect traces of ground-level ozone at marked locations within the school. This is a multiple-day lab where students can collect data and relate the production of ozone to concepts such as pollution, climate change, and human impact on the Earth.

Layers of the Atmosphere →Notes/Discussion– students will take notes on the layers of the atmosphere and the characteristics of each. Students will practice learning the names of the layers in the correct order from bottom to top with their table. (each table will be challenged to first write the five layers down correctly, and then put them in order. They will repeat this multiple times. *Guided Notes &PowerPoints for students as needed*

Review/Self Assessment – students will complete a review activity with their table, matching the description cards with the layer cards. This will be used on a few different days as an intro to class. Students will use it to see how well they know the material and to help them prepare for their quiz

Layers of the Atmosphere Foldable – Students will create a foldable on the layers of the atmosphere to use as a visual representation and a study guide. It will include a diagram of the layers along with information on each layer. *visual aid for studying/learning*

Stations Activity – Students will rotate through 4 stations reviewing the atmosphere characteristics and layers. Station 1: Quizizz, Station 2: Quizlet, Station 3: Tic Tac Toe, Station 4: Heads Up Game. Students will record their work at each station in a packet that will be checked for completion.

Scaling the Atmosphere – Students will scale the layers of the atmosphere to the hallway and/or any athletic field on school property.

Air Pollution →Air Pollution IQ Pre-Test & Introduction– Without any prior discussion on air pollution, students will take a quiz to assess their knowledge of the subject. They will share their answers with their table, and then the correct answers will be discussed with the class.

Air Pollution Activity – Students will be given cards with different pollution-related items on them. They will then walk around the room and tape them to the appropriate board. Each board will have a different heading (i.e., sources, pollutants, causes, solutions, etc.) and students will try their best to match their cards to the correct heading. Each board will be discussed along with the correct answers.

Air Pollution Discussion & Notes – Students will continue discussing air pollution and take notes on different types of pollutants and their effects on the Earth.

Wind Turbine Design Challenge – Students will be given a set of common materials (paper plates, index cards, PVC pipe, wooden dowels, popsicle sticks, toothpicks, foam, corks, pipe cleaners, etc.) They will work in groups to design the wind turbine that lifts the most weight. They will have 3-4 days to design, build, test, redesign & rebuild as much as needed. On the last day, they will test their designs using a fan. A string will be attached to their turbines, with a paper cup attached, and a weight will be added to the cup as needed. A discussion will be held about which design worked best and why. The winning group will explain their design process and why they think their design lifted the most weight.

Weather & Climate →Weather versus Climate – Students will work with their table to come up with a definition for weather and for climate. They will write their definitions on a whiteboard for the table. Definitions will be shared with the class, and the best definition will be determined. Once students write down the correct definitions in their notes, they will practice this concept. Ten statements will be posted on the smart board, and students will record whether the statement describes weather or climate. Answers will be shared and gone over. Discussion Questions: What is weather? What is climate? How are they different? How are they the same? How do we measure each one? Why are they important to measure and study?

Notes/Discussion – Students will take notes on the cause of weather, weather versus climate, and all of the factors that are studied to determine weather. *Guided notes & power-points as needed*

Demonstration– Teacher will demonstrate how air moves and creates wind. A candle will be placed in a convection box and lit. Then rolled-up paper will be lit on fire and then blown out, and held over one of the openings in the convection box. The smoke from the burnt paper will travel into the box and out the other opening. Discussion Questions: What do you observe? Why is this happening? What is the candle doing to the air inside the box? Why is the smoke from the paper flowing into the box? Where is the air temperature hotter? Colder? Why does the smoke rise out of the second tube? Think about density. How does that relate to "sinking" and "floating"?

Notes/Discussion – Students will take notes on air masses and fronts. Students will view several video clips on the different types of fronts. Students will view maps on the board and determine what type of air mass forms in different locations. Students will discuss the relationship between air masses and fronts. Students will fill in a chart describing the different types of fonts and then draw pictures/symbols to go along with each type. *Guided Notes & power-points for students as needed*

Foldable Activity – Students will construct a foldable to review the types of fronts. The student will then use the foldable to complete a review worksheet. *outline to fill in on foldable for students with IEPs*

Heating the Globe – Students will tape thermometers to a larger inflatable globe and heat (using lamps) the globe, much like the Sun heats the Earth. Students can observe temperatures and relate the heating patterns on the globe to those of the Earth. Climate zones can be established, as well.

Relative Humidity Lab – Students, using psychrometers, can collect relative humidity data around the school at various locations. Students can then do this collection over multiple days to create a time series of data. Students can then graph data and interpret trends/relationships.

Rain Gauge – Students will place a rain gauge in a controlled location around the school grounds. Students can collect data on daily rainfall and plot results. Students can then interpret rain totals and relate the cause of the rain to weather patterns (www.rap.ucar.edu/weather/model or earth.nullschool.net)

Student Meteorologist Project– Students will create weather maps and interpret weather patterns. Students will need to create a 5-day weather forecast and properly interpret weather symbols on their maps, as well as use commonly-used weather vocabulary such as fronts, air masses, pressure, uplift, downdrafts, storm cells, jet stream, polar, climate zone, etc.

all lab activities will review lab safety prior to beginning the lab activity

Materials

Elevate Science Textbook and online textbook

Guided note packets (teacher-developed)

Technology (student & teacher laptops, iPads, SmartBoard, document camera)

Thermometer

Balances

Meter sticks

Flasks, graduated cylinders, & beakers

Calculators

Lab bins/trays

Rulers

Art supplies

Graph paper

Lab goggles

Dry-erase markers

Globe

Rain gauge

Digital Weather station

NOAA archived data

PVC pipe

Paper plates

Matches

Candles

Toothpicks

Balloons

Test tubes

- - Gauze .

Standards

MATH.K-12.1	Make sense of problems and persevere in solving them
ELA.L.SS.6.1	Demonstrate command of the system and structure of the English language when writing or speaking.
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
ELA.L.KL.6.2	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
ELA.L.VI.6.4	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
ELA.R	Reading
SCI.MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
	Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth’s materials.
SCI.MS.ESS2.A	Earth’s Materials and Systems
	All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms.
SCI.MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
SCI.MS.ESS2.C	The Roles of Water in Earth’s Surface Processes
SCI.MS.ESS2.D	Weather and Climate
SCI.MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
SCI.MS.ESS3.B	Natural Hazards
	Graphs, charts, and images can be used to identify patterns in data.
SCI.MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
	Human activities have significantly altered the biosphere, sometimes damaging or

	destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
	Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
SCI.MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
SCI.MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused climate change over the past century.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
TECH.9.4.2.CT	Critical Thinking and Problem-solving
TECH.9.4.2.TL.1	Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).
TECH.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
TECH.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
	Digital tools and media resources provide access to vast stores of information that can be searched.
	Digital tools can be used to display data in various ways.

Suggested Strategies for Modification

See attached document

https://docs.google.com/spreadsheets/d/1wZeK2sYMgTDgqPB3B9-_tnn4GVTjdlgfbgsWmnSKX2E/edit?usp=sharing