MYP/3D Science Unit 4 Planner

Marietta City Schools

Grade & Course: Environmental Science	**Topic:** U4: Earth's Climate	**Duration:** 4 weeks
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Georgia Standards and Content: **SEV2. Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.** a. Analyze and interpret data related to short-term and long-term natural cyclic fluctuations associated with climate change. (Clarification statement: Short-term examples include but are not limited to El Niño and volcanism. Long-term examples include but are not limited to variations in Earth's orbit such as Milankovitch cycles.) b. Analyze and interpret data to determine how changes in atmospheric chemistry (carbon dioxide and methane) impact the greenhouse effect.		
Narrative / Background Information		
Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT) Understanding of ecosystems, biodiversity, climate patterns and atmospheric chemistry		
Year-Long Anchoring Phenomena: (LEARNING PROCESS) Human activities have negatively impacted ecosystems, global climate, energy resources, and population.		
Unit Phenomena (LEARNING PROCESS) The rapid melting of Arctic ice serves as a critical indicator of global climate change, illustrating the interconnectedness of Earth's atmospheric and climate systems.		
MYP Inquiry Statement: The rapid melting of Arctic ice highlights the interconnectedness of Earth's atmospheric and climate systems and the significant impact of human activities on global climate change.		
MYP Global Context: Orientation in Space and Time, Scientific and Technical Innovation		
Approaches to Learning Skills: **Research Skills**: Students will locate, evaluate, and select relevant climate data and scientific research on natural cycles. **Thinking Skills**: Students will analyze and interpret data related to long-term and short-term climate fluctuations, as well as atmospheric chemistry changes	**Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)** Weather and Climate Global Climate Change Chemical Reactions	**Crosscutting Concepts: (KNOWLEDGE & SKILLS)** Cause and Effect Stability and Change Energy and Matter Patterns System and System Models **MYP Key and Related Concepts:** Change Systems

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Communication Skills: Students will practice using accurate scientific terminology and explaining complex processes like the greenhouse effect and climate cycles **Collaboration Skills**: Many tasks in this unit will involve group work, requiring students to collaborate effectively, share responsibilities, and work towards common goals **Science and Engineering Practices** Obtain, evaluate, and communicate Develop and use a model Asking Questions and Defining Problems Analyze and Interpret Data		Global Interactions Causality

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Weather vs. Climate: Students may believe that weather and climate are the same. They might not understand that weather refers to short-term atmospheric conditions, while climate refers to long-term patterns over decades or centuries.
Understanding of Greenhouse Gasses: Students might already know that greenhouse gasses (like CO_2 and methane) contribute to warming the planet, but may not fully understand the mechanisms behind the greenhouse effect or the importance of natural processes like the carbon cycle in regulating atmospheric CO_2.
The Greenhouse Effect is Entirely Negative: Students may think that the greenhouse effect is a harmful phenomenon, not understanding that it is a natural and necessary process that keeps Earth warm enough to support life. The issue is the enhanced greenhouse effect caused by excess greenhouse gasses due to human activities.
All Climate Change is Rapid: Some students may assume that all climate change occurs quickly, when in fact, natural climate cycles (e.g., Milankovitch cycles) operate over thousands to millions of years, and the current rapid climate change is unusual in its speed due to human influence.
Local Cold Weather Means No Global Warming: Students may believe that a cold winter or a cool summer disproves global warming, misunderstanding the concept of global average temperature and that short-term weather events do not represent long-term climate trends.

Key Vocabulary: (KNOWLEDGE & SKILLS)

Climate: The long-term average of weather patterns in a particular region, usually measured over decades or centuries.
Weather: The day-to-day atmospheric conditions in a specific place, including temperature, precipitation, and wind.
Greenhouse Effect: The process by which greenhouse gasses (e.g., carbon dioxide, methane) trap heat in Earth's atmosphere, keeping the planet warm enough to support life.
Greenhouse Gasses (GHGs): Gasses in Earth's atmosphere that trap heat, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor (H_2O).
Methane (CH_4): A potent greenhouse gas emitted during the production and transport of coal, oil, and natural gas, as well as from livestock and other agricultural practices.
Milankovitch Cycles: Long-term variations in Earth's orbit and axial tilt that influence the planet's climate over tens of thousands to hundreds of thousands of years, contributing to natural climate changes such as ice ages.
El Niño: A short-term climate pattern in the Pacific Ocean that causes changes in global weather patterns, including warmer ocean temperatures and shifts in precipitation.
Volcanism: The process through which molten rock (magma) and gasses are expelled from the Earth's interior to its surface, which can temporarily influence climate by releasing aerosols and other particles that affect solar radiation.
Feedback Loop: A process in which the output of a system influences its own input. In climate science, feedback loops can be positive (amplifying changes, e.g., ice melt reducing albedo) or negative (stabilizing the system).
Albedo: The measure of how much sunlight is reflected by a surface. Ice and snow have high albedo, meaning they reflect most of the sunlight, while darker surfaces like oceans absorb more heat.
Anthropogenic: Caused or influenced by humans. For example, anthropogenic climate change refers to the warming of Earth's climate due to human activities, particularly the emission of greenhouse gasses.

Inquiry Questions:

Factual

1. What are Milankovitch cycles, and how do they affect Earth's climate?
2. What are the primary greenhouse gasses, and how do they contribute to the greenhouse effect?
3. How have carbon dioxide (CO_2) levels in the atmosphere changed over the past century?

Conceptual

1. How do changes in atmospheric chemistry affect global climate patterns over time?
2. In what ways does global warming influence biodiversity and ecosystem stability?
3. How can climate models help scientists predict the long-term effects of climate change?

Debatable

1. Are natural climate cycles, such as the Milankovitch cycles, predictable enough to accurately forecast future climate patterns?
2. Do short-term climate fluctuations, like El Niño and volcanic eruptions, have a greater impact on ecosystems than long-term climate cycles?
3. Is biodiversity more resilient to changes caused by long-term climate cycles or short-term natural events like volcanism or ocean current shifts?

MYP Objectives	**Summative assessment**	
	Assessment Task: **Criterion C: Processing and Evaluating** ● Strand C.i: Present collected and processed data. Students can analyze and present data related to climate cycles, changes in atmospheric gasses, or climate patterns over geological timescales. ● Strand C.ii: Interpret data and explain results using scientific reasoning. They can interpret data on long-term climate patterns or greenhouse gas concentrations and explain the relationships between these variables. **Criterion D: Reflecting on the Impacts of Science** ● Strand D.i: Explain the ways in which science is applied and used to address a specific problem or issue. Students can reflect on how understanding natural climate cycles helps predict future climate events and their potential effects on ecosystems or resource management. ● Strand D.ii: Discuss and evaluate the implications of using science and its application to solve a specific problem or issue, interacting with a factor such as environmental, ethical, social, economic, political, cultural, or technological. They can discuss the implications of scientific models that predict long-term climate changes based on natural cycles and their potential influence on global decision-making (e.g., biodiversity conservation, agriculture planning).	Relationship between summative assessment task(s) and statement of inquiry: Summative assessments and Group presentations will allow students to demonstrate their understanding of unit material. Students will also reflect on the implications of science.
Unit Objectives:		

- **Students will analyze data on short-term and long-term climate cycles to explain their effects on Earth's climate.**
- **Students will develop models to illustrate how long-term climate cycles, like Milankovitch cycles, influence global climate patterns.**
- **Students will compare the impacts of short-term fluctuations and long-term cycles on Earth's climate.**
- **Students will evaluate evidence from historical data to explain the role of long-term climate cycles in shaping Earth's past climate.**
- **Students will communicate their understanding through written and oral explanations using climate data and scientific terminology.**

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)
Week 1: Short Term Natural Climate Cycles	**Asking Scientific Questions:** Students will begin by formulating questions about short-term natural climate cycles, such as: What causes El Niño events, and how do they impact global weather patterns? How do volcanic eruptions affect atmospheric chemistry and temperature? This inquiry-based approach encourages curiosity and sets the stage for further investigation. **Researching Reliable Sources:** Students will obtain information from various scientific sources, such as climate databases, NOAA (National Oceanic and Atmospheric Administration), or peer-reviewed scientific articles. This may include obtaining historical data on El Niño events or volcanic eruptions. They will learn to evaluate the reliability of different sources, practicing media literacy and information literacy skills. **Interpreting Climate Data:**	**Climate Data Investigation:** Students will be provided with real data on sea surface temperatures or volcanic eruption outputs (e.g., ash or gasses) and asked to interpret the effects on weather patterns during specific short-term events. This will lead to a discussion about how different natural cycles contribute to fluctuations in global climate patterns.	**Students will create and present a visual model**: Students will create a visual model (e.g., diagrams, infographics) to illustrate how a specific short-term climate cycle, like El Niño or a volcanic eruption, impacts global climate patterns. They will present their model to the class, explaining the connections between the event and its short-term effects on weather, ocean currents, and ecosystems. **Students will engage in scientific discourse**: In small groups or as a class, students will discuss the causes and effects of short-term natural climate events. They will share their interpretations of climate data, ask questions of their peers, and justify their conclusions using evidence from case studies or climate models. **Students will write a scientific explanation**: Students will compose a short written explanation detailing how short-term natural climate cycles (such as El Niño or volcanic eruptions) influence weather patterns and atmospheric conditions. They will use scientific terminology and evidence from their research or data analysis to support their explanations.

	Students will obtain and interpret real-world climate data sets related to short-term natural cycles (e.g., El Niño patterns, volcanic ash cloud impact on solar radiation). They will begin exploring how these short-term fluctuations influence climate and weather patterns globally and locally. **Using Models to Visualize Climate Patterns:** Students may use simplified climate models or simulations to understand the mechanisms behind short-term natural climate cycles. For example, they could investigate how changes in ocean temperature during an El Niño event lead to disruptions in global weather patterns. This process allows them to develop a model-based inquiry approach, visually connecting their research to observed climate phenomena. **Collecting Case Study Information:** Students will review case studies of significant short-term natural events (e.g., the 1997-98 El Niño or the eruption of Mount Pinatubo) to explore the immediate and short-term climate impacts of these events. They may compare data from multiple case studies to look for patterns or similarities in effects.		**Students will create a case study repor**t: Students will analyze a real-world case study of a significant short-term climate event (e.g., the 1991 eruption of Mount Pinatubo or the 1997-98 El Niño event).They will write a report summarizing the causes, immediate impacts, and subsequent recovery related to the event, highlighting the key scientific processes involved. **Students will present data interpretations**: Students will interpret and present climate data sets related to short-term climate cycles (e.g., sea surface temperature changes during El Niño or global temperature shifts after a volcanic eruption). They will explain the data's significance to the class, communicating the effects of these cycles on local and global climates.

Week 2: Long Term Natural Climate Cycles	**Research historical climate data:** Students will obtain and examine long-term climate data from geological records, such as ice cores, sediment layers, or fossil records. They will investigate how these data provide evidence of Earth's climate cycles over tens of thousands to millions of years. **Ask critical scientific questions:** Students will develop questions such as, How do Milankovitch cycles influence Earth's glacial and interglacial periods? or What natural processes drive the shift between ice ages and warmer periods? These questions will guide their research and analysis. **Analyze climate models:** Students will obtain information from climate models that simulate long-term changes in Earth's orbit, axial tilt, and precession. They will explore how these models predict the occurrence of ice ages and warming periods, helping them understand the connection between orbital variations and climate shifts. **Gather evidence from scientific literature:** Students will read and summarize key findings from scientific articles, textbooks, or online resources that explain long-term natural climate cycles. They will focus on understanding the role of external forces, such as solar radiation and Earth's orbital changes, in driving these cycles.	**Students will complete formative assessments:** Educators will give students short quizzes or exit tickets to evaluate their understanding of long-term climate cycles, such as Milankovitch cycles or the causes of ice ages. These assessments will help the teacher gauge students' comprehension and provide feedback for improvement. **Students will engage in self-assessment:** Students will reflect on their learning by using self-assessment checklists or journaling about key concepts such as long-term climate variability and the evidence that supports these ideas. This self-evaluation will allow them to identify areas where they need more clarity or deeper understanding. **Students will complete data interpretation exercises:** Educators will evaluate students' ability to interpret data sets related to long-term climate changes, such as glacial and interglacial periods. By analyzing students' responses to data interpretation tasks, teachers will assess their analytical skills and understanding of how long-term cycles affect Earth's climate. **Students will participate in peer evaluation:** After completing group work or model-based presentations on long-term natural climate cycles, students will provide feedback to their peers. They will evaluate the clarity, accuracy, and depth of their classmates' explanations, helping them develop critical evaluation skills and improving communication.	**Students will present climate models:** Students will create and present visual or physical models of long-term climate cycles, such as the Milankovitch cycles. They will explain how changes in Earth's orbit, axial tilt, and precession influence long-term climate patterns, using their models to illustrate key concepts. **Students will engage in class discussions:** Students will participate in class discussions, sharing their insights on the causes and effects of long-term climate cycles. They will articulate their understanding by responding to teacher-guided questions and exchanging ideas with their peers, using evidence from their research or data analysis. **Students will write a scientific explanation:** Students will write a detailed explanation of a specific long-term climate cycle, such as the transition between glacial and interglacial periods. They will use scientific language and evidence to explain the mechanisms driving these climate changes and their impact on Earth's systems. **Students will participate in peer review:** After completing written or visual assignments, students will engage in peer review, providing feedback on their classmates' work. Through this process, they will communicate their understanding by evaluating the accuracy and clarity of their peers' explanations, while receiving feedback on their own work.

	Obtain data on past climate shifts: Using case studies of past climate events (e.g., the last glacial maximum or the Pleistocene Ice Age), students will obtain information on how long-term natural cycles contributed to significant changes in Earth's climate over millennia.		
Week 3: **Greenhouse Gasses and Atmospheric Chemical Composition**	**Research greenhouse gasses**: ● Students will investigate the properties and sources of key greenhouse gasses (e.g., **carbon dioxide, methane, nitrous oxide, water vapor**). They will obtain information on how these gasses are produced, how long they persist in the atmosphere, and their relative contribution to the greenhouse effect. **Analyze real-time atmospheric data**: ● Using data from sources like NASA, NOAA, or the Mauna Loa Observatory, students will access and interpret current data on **atmospheric CO_2 levels**, **methane concentrations**, and global temperature trends. They will analyze how these variables have changed over time. **Ask scientific questions**: ● Students will develop inquiry questions such as *How do increases in greenhouse gas concentrations affect Earth's temperature?* These questions will guide their research and data collection.	**Peer review**: ● After group research projects or model presentations, students will evaluate each other's work using a **peer review rubric**. This process encourages them to think critically about their classmates' interpretations of atmospheric chemistry, while also receiving constructive feedback on their own understanding. **Self-assessment**: ● Students will complete a **self-assessment** checklist or reflection, evaluating their own understanding of concepts such as greenhouse gasses, the carbon cycle, and the greenhouse effect. This process helps them identify areas where they feel confident and areas where they need further clarification. **Group discussions and collaborations**: ● Teachers will observe students during group work and classroom discussions, evaluating their ability to apply key concepts, collaborate effectively, and articulate their understanding of how atmospheric chemistry impacts climate. Educators will provide informal feedback based on their observations.	**Group presentations**: ● In small groups, students will research specific greenhouse gases or atmospheric processes and present their findings to the class. They will communicate their understanding by explaining the role of gases like **carbon dioxide** and **methane** in the greenhouse effect and how these gases influence global warming. **Class discussions**: ● During teacher-guided discussions, students will articulate their understanding of atmospheric chemistry by sharing their insights on the impact of changing gas concentrations on Earth's climate. They will use scientific language to explain concepts such as the **enhanced greenhouse effect** and support their ideas with data. **Create visual models or infographics**: ● Students will design **visual models** or **infographics** that represent the greenhouse effect and the changes in atmospheric chemistry. They will use these visuals to communicate their understanding of how greenhouse gases trap heat and contribute to global warming, and they may present these visuals to the class.

	Investigate the enhanced greenhouse effect: ● Students will research the difference between the **natural greenhouse effect** and the **enhanced greenhouse effect** caused by human activities. They will explore how anthropogenic emissions amplify the natural process, leading to global warming. **Review scientific literature**: ● Students will obtain information from peer-reviewed articles, textbooks, and scientific reports on atmospheric chemistry and climate change. They will explore how changes in greenhouse gas concentrations are measured and studied over time. **Examine case studies of climate impacts**: ● Students will review case studies of regions significantly affected by changes in atmospheric chemistry (e.g., **the Arctic**, where melting ice and permafrost release additional methane). They will obtain information on how these changes affect ecosystems, weather patterns, and human communities. **Gather collaborative information through group research**: ● In small groups, students will collaborate to research different greenhouse gasses and their sources, then share their findings with the class.	**Analyze and interpret data sets**: ● Students will be evaluated on their ability to **analyze real-world climate data**, such as atmospheric CO_2 concentrations and temperature trends, and interpret how changes in these variables affect the greenhouse effect. Educators will assess their reasoning and accuracy in drawing conclusions from the data. **Scientific explanation assignment**: ● Students will write a **scientific explanation** detailing the relationship between changes in atmospheric chemistry and global temperature increases. Educators will evaluate their use of evidence, clarity of communication, and depth of understanding. **Class discussions and Q&A sessions**: ● Teachers will assess students' contributions to **class discussions** or **question-and-answer sessions** on atmospheric chemistry. Educators will evaluate students based on their ability to explain the enhanced greenhouse effect, respond to peer questions, and support their claims with scientific evidence. **Evaluate case studies**: ● After reviewing case studies on regions affected by atmospheric chemistry changes, students will be asked to **evaluate the outcomes** and propose solutions. They will be assessed on their ability to critically analyze the data presented in the case study and apply their understanding of atmospheric chemistry to real-world scenarios.	**Write scientific explanations**: ● Individually or in groups, students will write short scientific explanations addressing how changes in the concentration of **greenhouse gasses** (e.g., CO_2, methane) impact global temperatures. These written explanations will require them to use evidence from their research or data analysis to support their understanding. **Create and interpret graphs**: ● Students will obtain climate data (e.g., historical CO_2 levels, global temperature changes) and create graphs to represent these trends. They will then communicate their interpretations of these graphs in written or oral form, explaining how changes in atmospheric chemistry over time have contributed to climate change. **Engage in peer review**: ● After completing written assignments or presentations, students will participate in a **peer review** process, providing feedback on each other's work. They will evaluate the clarity and accuracy of their peers' explanations, and use scientific reasoning to suggest improvements, practicing how to communicate constructive feedback. **Answer inquiry questions during Q&A sessions**: ● After group presentations or during class discussions, students will participate in **Q&A sessions** where they respond to questions from their peers and teachers. This process encourages them to clearly articulate their understanding of atmospheric chemistry and defend

	This collaborative inquiry process encourages students to obtain diverse perspectives and a broader understanding of atmospheric chemistry.	**Group evaluations**: • In group work settings, students will evaluate the effectiveness of their collaboration by reflecting on their group's research process, communication, and problem-solving. This can be done using a group evaluation form where students reflect on how well their group functioned and how their contributions impacted the final outcome.	their explanations with scientific evidence. **Create scientific posters**: • Students will design **scientific posters** that communicate the impact of atmospheric changes on Earth's climate. These posters may include diagrams, data visualizations, and explanations, and they can present their posters to the class or display them for peer review.
Week 4: Review and Assess	**Students will revisit previous learning materials**: • Students will **review notes, diagrams, models, and data** from the previous weeks on short-term and long-term natural climate cycles, atmospheric chemistry, and the greenhouse effect. This process allows them to obtain a deeper understanding of the material by revisiting and clarifying key concepts. **Students will use review guides and study sheets**: • Educators will provide **review guides** or **study sheets** that summarize important concepts, vocabulary, and processes. Students will use these guides to organize their thoughts and focus on critical areas of the unit as they prepare for the test. **Students will participate in review games**: • Interactive **review games** (such as Kahoot, Jeopardy, or Quizlet) will be used to help	**Students will engage in self-assessment**: • Students will complete **self-assessment checklists** or reflection prompts where they evaluate their confidence and understanding of the unit's key concepts. This process allows them to reflect on what they've learned and recognize areas where they may need more review or clarification. **Students will receive peer feedback**: • During review activities such as group discussions or collaborative study sessions, students will provide **peer feedback** on each other's explanations or practice questions. This allows students to evaluate their peers' understanding and reflect on their own learning based on the feedback they receive. **Educators will conduct informal checks for understanding**: • Teachers will lead **class discussions** or **question-and-answer sessions** where they ask students to explain key concepts or answer review questions. Based on	**Students will participate in group discussions**: • During review sessions, students will communicate their understanding by discussing key concepts, such as **climate cycles**, **greenhouse gasses**, and **atmospheric chemistry**, with their peers. They will explain ideas, ask clarifying questions, and compare their understanding with others. **Students will explain concepts during review games**: • In review games (e.g., **Kahoot, Jeopardy**), students will be encouraged to **explain their reasoning** for specific answers, either to the class or in small groups. This will give them the opportunity to practice communicating their knowledge in a clear and concise manner. **Students will write summary explanations**: • Students will write brief **summary explanations** of the major concepts from the unit, such as how **Milankovitch cycles** influence long-term climate change or how **greenhouse gases** contribute to global warming. These summaries will help them communicate their

	students recall and obtain important facts and concepts in a fun, engaging way. These games will allow students to actively retrieve information and test their knowledge on topics like climate cycles, atmospheric chemistry, and the greenhouse effect. **Students will work in study groups**: ● Students will form **study groups** where they collaborate to review key concepts and obtain information from one another. Group members can share notes, explain difficult concepts to each other, and quiz one another in preparation for the test. **Students will analyze sample data sets**: ● Students will obtain and review sample **climate data** or **case studies** previously discussed in the unit. They will analyze the data one more time to reinforce their ability to interpret trends, draw conclusions, and apply scientific reasoning to the content. **Students will participate in teacher-led review sessions**: ● Teachers will conduct **review sessions** where key concepts are re-taught or reinforced. Students will obtain a final overview of the most important ideas from the unit, and teachers will address common misconceptions or difficult topics to ensure clarity before the test.	students' responses, teachers will evaluate how well they grasp the material and provide real-time feedback to address misconceptions or gaps in knowledge. **Students will participate in formative assessments during review games**: ● In interactive review games (e.g., **Kahoot, Jeopardy, Quizlet**), students will be evaluated on their ability to recall information and apply their knowledge to answer questions. These games provide a formative assessment that gives both the teacher and students insight into which areas still need work.	understanding in a written format, practicing clear and accurate scientific communication.

Resources (hyperlink to model lessons and/or resources):
Discovery Education Science Techbook

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
Unit Objectives and Alignment: ● Ensure that the **unit objectives** align with the **Georgia Standards of Excellence** and the **MYP Science Criterion**. Educators should clearly define what students need to know and be able to do by the end of the unit, such as analyzing climate data, constructing models, and understanding the role of greenhouse gasses. **Assessment Design**: ● Plan formative and summative assessments that allow students to demonstrate their understanding of both **long-term climate cycles** and **atmospheric chemistry**. The assessments should evaluate inquiry skills (e.g., analyzing data, constructing explanations) and scientific knowledge. **Inquiry-Based Learning Approach**: ● Structure the unit to foster **inquiry-based learning**, where students actively ask questions, gather and analyze data, and draw conclusions. Educators should plan activities that encourage students to take ownership of their learning through hands-on investigations, model creation, and critical thinking. **Resources and Materials**: ● Identify and prepare **resources**, such as data sets, models, and scientific literature, that will support student inquiry. Interactive simulations, real-time climate data, and visual aids can help make abstract concepts more tangible for students. **Differentiation and Scaffolding**: ● Consider the varying needs of students, including their prior knowledge, learning styles, and levels of scientific literacy. Plan for **differentiated instruction** by providing additional support or extensions for students who need them, and	**Facilitating Student-Driven Inquiry**: ● Allow students to explore their own **inquiry questions** as they engage with the material. As students investigate climate cycles and atmospheric chemistry, encourage them to ask deeper questions and seek answers through data collection, research, and analysis. ● Offer opportunities for students to pursue areas of personal interest within the broader unit, such as specific climate events, greenhouse gases, or historical case studies. **Modeling Scientific Practices**: ● Demonstrate **scientific inquiry practices** such as how to analyze data, construct models, and evaluate sources. Show students how scientists gather and interpret evidence, guiding them in the use of climate data, simulations, and models. ● Emphasize critical thinking by modeling how to question assumptions and look for patterns in data related to climate trends and atmospheric chemistry. **Providing Scaffolding and Support**: ● Throughout the unit, offer **scaffolding** for complex topics, especially for challenging concepts like **Milankovitch cycles** or the **greenhouse effect**.	**Reviewing Summative Assessment** ● Analyze the results of the **summative assessments** (e.g., tests, projects) to evaluate how well students met the unit objectives. Look for patterns in student performance to identify areas where they excelled and areas where further review may be necessary. ● Provide students with individualized feedback on their summative assessments, highlighting both their strengths and areas for growth. **Reflecting on Learning Outcomes**: ● Guide students through a **reflection** on their learning process. Encourage them to think about: ○ What they learned about **natural climate cycles** and **atmospheric chemistry**. ○ How their understanding of **climate science** has evolved. ○ Any remaining questions or curiosities they have about the topic. ● This could be done through reflective writing, discussions, or short surveys where students evaluate their own progress and learning journey. **Self-Assessment and Peer Feedbac** ● Have students complete a **self-assessment** of their performance during the unit. They can reflect on how well they engaged with inquiry-based learning, collaborated with

scaffolding complex concepts like the **Milankovitch cycles** or **greenhouse effect** for deeper understanding.	Use analogies, visual aids, or hands-on activities to break down these concepts. ● Regularly check for understanding, ensuring that students grasp foundational ideas before moving on to more complex aspects of the unit. **Encouraging Collaboration and Discussion**: ● Promote **collaborative learning** by encouraging students to work together in groups to solve problems, analyze data, or create models. Peer collaboration fosters deeper engagement with the material and helps students articulate their understanding through communication. ● Use **Socratic questioning** or class discussions to challenge students' thinking and help them refine their ideas, supporting a community of inquiry.	peers, and applied scientific thinking. ● Facilitate a **peer feedback** session where students review each other's work or contributions to group projects, reinforcing communication and critical evaluation skills. **Revisiting Key Concepts**: ● After assessing the summative results, revisit any **key concepts** that were challenging for students. Provide additional examples or activities to reinforce understanding, particularly if misconceptions persisted. ● Engage students in short follow-up activities to clarify these areas, using the insights gained from the assessments to guide the review process.