# Unit 3: The Atmosphere and Hydrosphere

Content Area: **Science**
Course(s): **The Earth, Solar System, and Beyond**
Time Period: **Second Marking Period**
Length: **Five – Six Weeks**
Status: **Published**

## Unit Overview

The Atmosphere and Hydrosphere

Unit 3 explores how the orbit, rotation, and revolution of the Earth affect the atmosphere. This unit also explores the mechanisms behind the formation of the atmosphere and its overall composition. Students will explore the critical function that each layer of the atmosphere plays to maintain life on Earth. In addition, the students will explore the impact of geography on local weather patterns and development. The unit will also explore the human impact on local weather and climate by understanding barometric pressures, types of ozone, and Air Pollution Index.

Unit 3 explores how the orbit, rotation, and revolution of the Earth and Moon affect the ocean systems. In order to accomplish this, students will learn about the different 'layers' of the ocean, their ecosystems, currents, and tidal forces. In addition, students will explore how human activity benefits or has any adverse effects upon the hydrosphere. Unit 3 also explores the water cycle and how it is affected by human interaction, this is done through the lens of both surface and groundwater resources.

## STAGE 1 – DESIRED RESULTS

### 2020 New Jersey Student Learning Standards for Science

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|---|---|
| HS-ESS2-1 | Develop a model to illustrate how Earth's internal and surface processes operate at a different spatial and temporal scales to form continental and ocean-floor features |
| HS-ESS2-2 | Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause other changes to Earth systems |
| HS-ESS2-3 | Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection |
| HS-ESS2-4 | Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate |
| HS-ESS2-5 | Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes |

| | |
|---|---|
| HS-ESS2-6 | Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere |
| HS-ESS3-1 | Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity |
| HS-ESS3-3 | Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity |
| HS-ESS3-4 | Evaluate or refine a technological solution that reduces impacts of human activates on natural systems |
| HS-ESS3-5 | Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems |
| HS-ESS3-6 | Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity |

**Science and Engineering Practices**

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

**Crosscutting Concepts**

Earth and Space Science

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and systems models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change

## Disciplinary Core Ideas

### Earth and Space Sciences

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of the Planet
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.A: Earth Materials and Systems
- ESS2.D: Weather and Climate
- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth Systems
- ESS3.D: Global Climate Change

### Engineering, Technology, and Application of Science

- ETS1.B: Developing Possible Solutions

## Essential Questions

Why is weather a system?

How does geography affect natural weather events?

How do humans impact weather systems on Earth?

What techniques do humans use to determine weather patterns? Why are they sometimes incorrect?

What key functions does the atmosphere serve that enable life to exist on the planet?

How does human activity impact weather events and systems?

How does weather differ from climate?

How is water used daily?

How does the water cycle affect the environment?

Why does the quality of surface and groundwater matter?

What is our role in the water cycle?

How do we protect surface and groundwater?

How do ocean currents affect intertidal and pelagic ecosystems?

How do the physical and chemical qualities of the ocean layers affect the ecosystems?

**Enduring Understanding**

Enduring understanding of the atmosphere; it's composition, the mechanisms behind its formation, and its layers. Students will understand how different weather patterns affect cloud formation and how local geography can affect weather patterns. This understanding will help students understand how human activity has effect on local weather and climate through the study of the different types of ozone and barometric pressure.

Enduring understanding of the hydrosphere and how the ocean composition, currents, to better understand the near-shore environments. Students will also have an understanding of the interaction and usage of both surfacewater and groundwater resources. This understanding will help students understand potential threats to the resources caused by human activities and natural events.

**Students Will Know…**

The following vocabulary terms/concepts:

- Weather
- Climate
- Radiation
- Conduction
- Convection
- Ozone Layer
- Albedo
- Isotherm
- Temperature Inversion
- Coriolis Effect
- Barometer
- Jet Stream
- Saturation
- Relative Humidity
- Dew Point
- Troposphere
- Stratosphere
- Mesosphere
- Thermosphere
- Ionosphere
- Exosphere
- Air Pressure
- Equator
- Doldrums

- Trade Winds
- Prevailing Westerlies
- Polar Easterlies
- Horse Latitudes
- Tornado
- The EF Scale
- Hurricane
- Saffir-Simpson Scale
- El Nino
- La Nina
- Aerosols
- Equinox
- Solstice
- Windward
- Leeward
- Low Pressure
- High Pressure
- Doppler Radar
- Air Pollution Index (API)
- Water Cycle
- Infiltration
- Stream Channel
- Discharge
- Flood Plain
- Deposition
- Porosity
- Permeability
- Cone of Depression
- Alluvial Fan
- Dune
- Run-off
- Groundwater
- Surfacewater
- Intertidal Zone
- Pelagic
- Benthic
- Continental Shelf/Slope/Rise
- Trenches
- Thermocline
- Halocline
- Pycocline
- Wave length

- Wave Period
- Wave Base
- Spring Tide
- Neap Tide
- Rip Current
- Surface Current
- Longshore Drift
- Tides
- Diurnal/Semi Dirunal
- Deep Water Current
- Upwelling
- Downwelling
- Gulf Stream
- Gyres
- Hydrostatic Pressure
- Stream
- Freshwater
- Estuaries
- Wetlands
- Agriculture
- Salt water
- Confined Aquifer
- Unconfined Aquifer
- Water Table
- Recharge Area
- Dendritic
- Braided Streams
- Meandering Streams
- Artesian Wells
- Non-Artesian Wells

Predictable Misconceptions:

- Weather and climate are two separate things
- The atmosphere has layers that serve specific functions in order to enable life to exist on Earth
- There are different mechanisms and weather patterns that form each cloud type
- There are differing opinions about how the atmosphere formed
- The atmosphere formed prior to life evolving on Earth
- There are different types of ozone; some beneficial, some bad.
- Surface water and groundwater do interact
- The saltiness of the ocean is not the same as table salt
- Icebergs are not made of saltwater

- Majority of human consumption/usage of water is surface water
- All groundwater is safe for human consumption/usage

**Students Will Be Able To…**

- Understand the overall composition of the atmosphere and what makes it unique in the solar system
- Identify the validity of each hypothesis regarding how the atmosphere first developed and understand the mechanisms behind each theory
- Understand the mechanics behind the formation of extreme weather events and the scales used to measure them
- Understand the correlation between geography and weather patterns
- Identify the different wind currents and how they affect the climate and local/regional weather patterns
- Understand how human activities affect the overall weather patterns and long-term climate across the United States
- Describe the differences between the types of ozone and how it relates to the Air Pollution Index (API)
- Explain the water cycle and apply the knowledge to various scenarios
- Understand the overall composition of the ocean
- Explain the concept and provide examples of longshore drift and how scientists can use these mechanisms to restore and maintain beaches throughout New Jersey
- Discuss the major ocean currents and the benefits they provide for ocean ecosystems
- Understand the influence of the moon on the tidal system
- Explain the importance of surface water and groundwater resources and provide examples of how humans can responsibly utilize these resources

**STAGE 2 – EVIDENCE OF LEARNING**

**Formative Assessments**

- Three-minute pause
- A-B-C Summaries (AlphaBoxes)
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Ticket
- Hand Signals (red-yellow-green cards)
- Idea Spinner
- Index Card Summaries
- Fishbowl Discussions
- Journal Entry
- Misconception Check
- Observation

- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions and Answers
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Concept Maps

**Authentic Assessments**

Students will be able to:

- Follow laboratory procedures
- Complete chapter and unit laboratory experiments
- Complete Project-Based Learning (PBL) assignments
- Collect, graph, and analyze data
- Evaluate the validity of evidence
- Form evidence-based conclusions
- Complete assignments
- Develop and utilize models
- Cooperate in a large or small group setting
- Complete a written scientific journal
- Maintain class notes and vocabulary with a MacBook Air
- Complete Project Based Learning assessments
- Complete quizzes and tests

**Benchmark Assessments**

- Chapter and Unit Tests

**Instructional Map**

2nd Marking Period

- The Atmosphere
    - Composition
    - Atmospheric layers
    - Cloud type and formation
    - Wind patterns
    - Barometric pressure and severe storms
    - Climate vs. weather
    - Air Pollution Index (API)
- The Hydrosphere
    - The water cycle
    - Ocean layers and composition
        - Beach creation and destruction
        - Tides and ocean currents

- Surfacewater resources
  - Introduction
  - Availability and threats
- Groundwater resources
  - Introduction
  - Availability and threats

**Modification /Differentiation of Instruction**

**DI** = ppt/air mac, cooperative learning (mixed ability)
**ESL Students**: speaking, reading, writing, peer tutoring
**SPEDs**: restating, reading aloud, guided questions, additional problems and teacher observation

- Rephrase, clarify, repeat directions
- Study guides
- Extended time on tests and assignments
- Modify tests and assignments
- Visual aides
- Word banks
- Calculator use
- Repeated drill and practice
- Teacher notes
- Preferential seating
- Oral directions
- Use of additional resource materials
- Break down assignments into smaller tasks (chunking assignments)

**Academic Ability**

- Struggling: Think-Pair-Share with gifted students
- Gifted: Think-Pair-Share with struggling students

**Modification Strategies**

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Text
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-Direct
- Repeated Drill and Practice
- Shortened Assignment
- Teacher Notes

- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

**Differentiation Strategies**

**High Preparation**

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research Projects
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations and Centers
- Think-Tac-Toe
- Tiered Activities and Assignments
- Varying Graphic Organizers

**Low Preparation**

- Choice of Book/Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting with Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials

- Work Alone/Together

**Horizontal Integration – Interdisciplinary Connections**

**See Appendix**

**Vertical Integration – Discipline Mapping**

Students will have been exposed to the Performance Expectations for Earth and Space Science, Life Science, Physical Science, and Engineering Design outlined in the New Jersey Student Learning Standards (NJSLS)/Next Generation Science Standards (NGSS) starting in first grade through The Earth, Solar System, and Beyond; which is offered in junior and senior year of high school. Science classes are designed around the Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in the NJSLS/NGSS. Students in grade six study "Weather and Water", "Diversity of Life" and "Waves". These lessons lead into grade seven where the students study "Planetary Science", "Populations and Ecosystems", "Gravity and Kinetic Energy", and "Electromagnetic Force". Grade Eight students study "Earth History", "Chemical Interactions", "Human Body Systems" and "Heredity and Adaptations". The Earth, Solar System, and Beyond; being a half year course, will focus on having students gain a more complete understanding of the Performance Expectations outlined in NJSLS/NGSS, particularly Earth and Space Science and Engineering Design – while reinforcing Life Sciences and potentially Physical Science. Following The Earth, The Solar System, and Beyond students will take either Human Impact on the Environment, Zoology, Forensics, or Anatomy and Physiology.

**Additional Materials**

- Newsela Guided Reading Materials
- National Aeronautics and Space Administration (NASA) Materials
- United States Geological Survey (USGS) Materials
- Delaware Geological Survey (DGS) Materials
- NJDEP – Geological and Water Survey (NJDEP-GWS) Materials
- Woods Hole Oceanographic Institute (WHOI) Materials
- Bureau of Ocean Energy Management (BOEM) Materials
- American Geophysical Union (AGU) Materials
- Rutgers University Department of Earth and Planetary Science (RUDEPS) Material
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