

**Richmond Public Schools**  
**Department of Curriculum and Instruction**  
**Curriculum Pacing And Resource Guide – Unit Plan**



**Course Title/ Course #: Earth Science 2 Meteorology**

**Unit Title/ Marking Period # (MP): Meteorology ES. 11a-d, ES.12a-d**

**Start day:**

**Meetings (Length of Unit):**

***Desired Results ~ What will students be learning?***

**Standards of Learning/ Standards**

**ES.11**

The student will investigate and understand the origin and evolution of the atmosphere and the interrelationship of geologic processes, biologic processes, and human activities on its composition and dynamics. Key concepts include

- a) scientific evidence for atmospheric composition changes over geologic time;
- b) current theories related to the effects of early life on the chemical makeup of the atmosphere;
- c) atmospheric regulation mechanisms including the effects of density differences and energy transfer
- d) potential changes to the atmosphere and climate due to human, biologic, and geologic activity.

**ES.12**

The student will investigate and understand that energy transfer between the sun and Earth and its atmosphere drives weather and climate on Earth. Key concepts include

- a) observation and collection of weather data;
- b) prediction of weather patterns;
- c) severe weather occurrences, such as tornadoes, hurricanes, and major storms; and
- d) weather phenomena and the factors that affect climate including radiation, conduction, and convection

**Essential Understandings/ Big Ideas**

**ES. 11**

- The concepts developed in this standard include the following:
- The composition of Earth's atmosphere has changed over geologic time. Earth's atmosphere is unique in the solar system in

that it contains substantial oxygen.

- The most primitive atmosphere was comprised of mainly helium and hydrogen. After the moon was formed, the early atmosphere contained mostly CO<sub>2</sub>, CO, and water vapor. This atmosphere was then modified by early photosynthetic life.
- Early photosynthetic life such as cyanobacteria (blue-green algae) consumed carbon dioxide and generated oxygen. It was only after early photosynthetic life generated oxygen that animal life became possible.
- Earth's atmosphere is 21 percent oxygen, 78 percent nitrogen, and 1 percent trace gases. The composition of the atmosphere can change due to human, biologic, and geologic activity. Human activities have increased the carbon dioxide content of the atmosphere. Man-made chemicals have decreased the ozone concentration in the upper atmosphere. Volcanic activity and meteorite impacts can inject large quantities of dust and gases into the atmosphere.
- The ability of Earth's atmosphere to absorb and retain heat is affected by the presence of gases like water vapor and carbon dioxide.

## **ES. 12**

The concepts developed in this standard include the following:

- Energy transfer between Earth's surface and the atmosphere creates the
- weather.
- Weather and climate are different. Both weather and climate are measurable and, to a certain extent, predictable. Weather describes day-to-day changes in atmospheric conditions. Climate describes the typical weather patterns for a given location over a period of many years. Instrumentation is used to collect weather and climate data.
- The four major factors affecting climate are latitude, elevation,
- proximity to bodies of water, and position relative to mountains. Earth's major climatic zones are the polar, temperate, and tropical zones. Areas near the equator receive more of the sun's energy per unit area than areas nearer the poles.
- Earth's surface is much more efficiently heated by the sun than is the atmosphere. The amount of energy reaching any given point on Earth's surface is controlled by the angle of sunlight striking the surface and varies with the seasons.
- Winds are created by uneven heat distribution at Earth's surface and modified by the rotation of Earth. The Coriolis effect causes deflections of the atmosphere due to the rotation of Earth. Global wind patterns result from the uneven heating of Earth by the sun and are influenced by the Coriolis effect.
- Convection in the atmosphere is a major cause of weather. Convection is the major mechanism of energy transfer in the oceans, atmosphere, and Earth's interior.

## **Key Essential Skills and Knowledge**

## **ES. 11**

In order to meet this standard, it is expected that students will

- analyze the array of climate feedback mechanisms that control the Earth's temperature over time, and compare and contrast these
- feedback mechanisms to those operating on inner planets and the gas giants.
- analyze the evidence for atmospheric compositional change over geologic time including oxygen and carbon sinks and the role

of

- photosynthetic organisms.
- explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth.
- explain how biologic activity, including human activities, may influence global temperature and climate.

**ES. 12**

In order to meet this standard, it is expected that students will

- identify and describe the direction of local winds (land, sea breezes and jet stream).
- read and interpret data from a thermometer, a barometer, and a psychrometer.
- predict weather based on cloud type, temperature, and barometric pressure.
- read and interpret a weather map containing fronts, isobars, and isotherms.
- read and interpret weather station models.
- identify types and origins of air masses, fronts and the accompanying weather conditions.
- read and interpret climate graphs.
- label a diagram of global climate zones and the surface movement of ocean currents.
- label a diagram that demonstrates the interaction of Earth's atmosphere and energy transfer (conduction, convection, and radiation).
- analyze the impact of satellite technology on weather prediction and the tracking of severe storms, including hurricanes, and evaluate the cost and benefits of this technology in terms of lives and property saved. Predict the impact on storm preparedness if there were no weather satellites.

**Vocabulary**

**ES. 11**

absorption	dissociation	nitrogen cycle	stratosphere
ammonia	Exosphere	oxygen	troposphere
carbon dioxide	ionosphere	ozone	ultraviolet radiation
chlorofluorocarbon	jet streams	ozone layer	volcanoes
cyanobacteria	methane	reflection	water vapor
decayed bacteria	nitrogen		

**ES. 12**

air mass	fog	meteorologist	station model
anemometer	front	occluded front	stationary front
cold front	greenhouse effect	precipitation	temperature zone
Coriolis effect	hurricane	relative humidity	tornado
deforestation	isobars	saturated	warm front
dew point	isotherms	sea breeze	weather
El Niño	land breeze		

***Assessment Evidence ~ What is evidence of mastery? What did the students master & what are they missing?***

**Assessment/ Evidence**

**Evidence of mastery:** Students will display mastery by consistently scoring at a “C” or above on all assessments. Success and mastery will also be shown by increasing scores from the beginning of the unit to the end of the unit. Overall mastery of the content and targeted objectives will be assessed during final unit assessment.

**Assessment Methods:**

- Teacher created IA Test/Quiz
- Group Discussions
- Predict and Explain Assessments- students apply principles and evidence
- Research Reports & Presentations
- Visual Displays- Concept maps, Diagrams, Models

**Possible learning Gaps/Misconceptions**

ES. 11

- A common misconception is that land plants generate most of the oxygen in the atmosphere.
- Most people falsely believe that direct sunlight heats the atmosphere.

Greenhouse gases make up a major portion of the atmosphere

ES. 12

- Thunder occurs when two clouds collide.
- Air and oxygen are the same thing.
- Humidity is moisture in the air.
- Humid air is heavy or more dense than dry air.
- Hot air weighs less than cold air.
- The atmosphere is made up solely of air.
- Clouds block wind and slow it down.
- Cold temperatures produce fast winds.
- Snow and ice make it cold.
- Cold days are caused by the clouds covering the sun.
- The seasons cause the weather to change.

- Clouds form because cold air doesn't hold as much water as warm air.
- Clouds are made of water vapor.
- Clouds always predict rain.
- Raindrops look like tear drops.
- Rain falls when clouds become too heavy.
- Rain falls because we need it.
- Lightning never strikes the same place twice.
- Thunder occurs when two clouds collide.
- Air and oxygen are the same thing.
- Humidity is moisture in the air.
- Humid air is heavy or more dense than dry air.
- Hot air weighs less than cold air.
- The atmosphere is made up solely of air.
- Clouds block wind and slow it down.
- Cold temperatures produce fast winds.
- Snow and ice make it cold.
- Cold days are caused by the clouds covering the sun.

## **Learning Plan ~ What are the strategies and activities you plan to use**

### **Learning Experiences/ Best Practice**

- Have students to analyze the array of climate feedback mechanisms that control the Earth's temperature over time, and compare and contrast these feedback mechanisms to those operating on inner planets and the gas giants.
- Have students to analyze the evidence for atmospheric compositional change over geologic time including oxygen and carbon sinks and the role of photosynthetic organisms.
- Have students to explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth.
- Have students to explain how biologic activity, including human activities, may influence global temperature and climate.
- Have students to identify and describe the direction of local winds (land, sea breezes and jet stream).
- Have student to read and interpret data from a thermometer, a barometer, and a psychrometer.
- Have students to predict weather based on cloud type, temperature, and barometric pressure.
- Have students to read and interpret a weather map containing fronts, isobars, and isotherms.
- Have students to read and interpret weather station models.
- Have students to identify types and origins of air masses, fronts and the accompanying weather conditions.
- Have students to read and interpret climate graphs.
- Have students to label a diagram of global climate zones and the surface movement of ocean currents.

- Have students to label a diagram that demonstrates the interaction of Earth's atmosphere and energy transfer.
- Have students to analyze the impact of satellite technology on weather prediction and the tracking of severe storms.
- Have the student predict the impact on storm preparedness if there were no weather satellites.

### Technology Integrations

#### **Web Resources**

[Satellite altimetry](#)

[Average temperature data](#)

[What is a sea breeze?](#)

[Land and sea breezes](#)

[Wind power](#)

[Wind power in Denmark](#)

[Humidity](#)

[Relative humidity:](#)

[Relative humidity and dew point:](#)

[Build psychrometer](#)

[Hurricanes](#)

[What are hurricanes?](#)

### Resources

#### **Sample Lesson Plans (VDOE)**

[Hydrologic cycle](#)

### Cross Curricular Connection

**English-** *Students can write a life story of a raindrop or snowflake as it goes through its life.*

**Math-** *Using Data from a weather map(newspaper)*

*Draw a picture graph and a bar graph (with single unit scale) to represent a data set with up to four categories.*

**English-** *Students will read current astronomy articles and analyze and interpret the main ideas.*

**Social Studies** Students will investigate and evaluate a number of different methods of increasing water availability and access. Form research groups to gather three positive and three negative issues about the following methods of increasing water availability: collection of household rainwater, dams, recycling, desalination, icebergs and groundwater.