Westbrook Public Schools
Astronomy & Meteorology Curriculum
Grade 11-12

Unit 1: Structure of the Atmosphere & Hurricanes	**Anticipated Length: 3 weeks**
Standards: 9.1 Energy cannot be created or destroyed; however, energy can be converted from one form to another 9.8 The use of resources by human populations may affect the quality of the environment.	
Knowledge: *Students will know/understand:* • Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life • Energy enters the Earth system primarily as solar radiation, is captured by materials and photosynthetic processes, and eventually is transformed into and escapes as heat • The origin, evolution, dynamics of motion and effects of hurricanes • The safety steps that should be taken to prepare for the arrival of a hurricane	**Skills:** *Students will be able to:* • Identify the thermal structure and chemical composition of the atmosphere • Explain how the composition of Earth's atmosphere has evolved over geologic time and identify photosynthetic processes as the origin of the oxygen in the atmosphere • Explain how the gases in the ozone layer in the upper atmosphere absorb ultraviolet radiation and how this layer varies both naturally and in response to human activities • Explain how the accumulation of carbon dioxide (CO_2) in the atmosphere increases Earth's "greenhouse" effect and may cause climate change (D23) • Explain how energy is transferred by conduction, convection, and radiation (D2) • Describe how some of the solar radiation is reflected back into the atmosphere and some is absorbed by matter and photosynthetic processes • Plot the tracks of hurricanes • Explain the life cycle of a typical hurricane • Explain the main sources of damage from a hurricane • Explain the basic safety steps that should be taken if a hurricane is headed towards an area

Essential Questions:	**Unit Questions:**
• How does temperature vary? • How are hurricanes formed and how do scientists predict their strength and movements?	• How is heat transferred through the environment? • How can the increase of CO_2 and other greenhouse gasses lead to climate change? • How do temperature inversions form? • How do sea and land breezes form? • What is the structure and composition of the earth's atmosphere? • What are isotherms? • What is a hurricane, how does one form, evolve, and move? • What are the main causes of damage from a hurricane? • What are the ways that one can prepare for the arrival of a hurricane? • How are hurricane tracks plotted? • How does the sun provide energy to supply the heat that is distributed in the earth's atmosphere?

Expectations for Student Learning Addressed – *The Westbrook HS student will…*
Demonstrate independence and proficiency in problem solving, reasoning, critical and creative thinking.

Possible Assessments:

- ☒ Teacher Created Tests
- ☐ Unit Tests
- ☒ Quizzes
- ☒ Others: Hurricane track plots
- ☐ Student Presentations
- ☐ Entrance/exit slips
- ☐ Group Projects

Benchmark Assessment:

Performance Task: ☐ **Required** ☐ **Optional**

Goal:

Role:

Audience:

Situation:

Product, Performance, Purpose:

Standards for Success:

Assessment Techniques:
Hurricane Track Plot Rubric
School Wide Problem Solving Rubric

Technology Integration: SMART board, Internet sites

Resources/Materials:

- **Texts:**
  - Earth Science Ch 26 & Ch 30 Topics 6 – 8
- **Internet Sites:**
  - http://weather.unisys.com/hurricane/atlantic/*year*/index.html
  - http://www.weather.com
- **Videos/DVD (Multimedia):**
  - Naked Science: Hurricanes
  - Too Hot Not to Handle (Climate Change video)
- **Speakers:**
- **Other:**
  - NOAA/NWS downloadable Hurricane tracking charts (pdf charts)

Sample Lessons/Learning Activities:

- Hurricane track plotting

Westbrook Public School
Astronomy & Meteorology Curriculum
Grade 11 – 12

<table>
<tr><td>Unit 2: Evaporation, Condensation, and Precipitation</td><td>Anticipated Length: 2 weeks</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Standards:
9.7 Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles
9.1 Energy cannot be created or destroyed; however, energy can be converted from one form into another</td></tr>
<tr><td>Knowledge:
Students will know/understand:
Solar energy causes water to cycle through major earth reservoirs
Energy enters the Earth system primarily as solar radiation.
How to determine relative humidity using the psychrometer method
How clouds form and how air currents and temperature can lead to different types of clouds
How fog forms and the differences between the two main forms of fog formation
How precipitation forms and what the differences are in the different types of precipitation</td><td>Skills:
Students will be able to:
Describe evaporation, condensation, and sublimation.
Describe the water cycle
Describe specific humidity, capacity, and relative humidity
determine the relative humidity using the psychrometer method
Describe the formation of cloud droplets, dew and frost.
Name and describe the main 10 cloud types.
Name and describe the two types of fog.
Describe vertical cloud formation using the dry and moist adiabatic lapse rates.
Describe the warm cloud and ice raindrop formation processes
Name and describe the main forms of precipitations</td></tr>
<tr><td>Essential Questions:
How does the water cycle affect your daily life?
What are clouds?</td><td>Unit Questions:
What are condensation, evaporation, and sublimation?
How does the water cycle involve evaporation, condensation, and precipitation?
What is the difference between specific humidity and relative humidity and how is relative humidity measured?
What are the 10 main cloud types?
How do cumuluoform and stratiform clouds develop?</td></tr>
</table>

	• What are the main forms of precipitation and how do they form? • How do changes in air temperatures due to convection and other factors lead to the formation of clouds and fog? • What causes precipitation?

Expectations for Student Learning Addressed – *The Westbrook HS student will…*
Demonstrate independence and proficiency in problem solving, reasoning, critical and creative thinking

Possible Assessments:

- ☒ Teacher Created Tests
- ☐ Unit Tests
- ☒ Quizzes
- ☒ Others: Relative Humidity Lab
- ☐ Student Presentations
- ☐ Entrance/exit slips
- ☐ Group Projects

Benchmark Assessment:

Performance Task: ☐ **Required** ☐ **Optional**

Goal:

Role:

Audience:

Situation:

Product, Performance, Purpose:

Standards for Success:

Assessment Techniques:
Relative Humidity Lab Scoring Key
School Wide Problem Solving Rubric

Technology Integration: Video, SMART board

Resources/Materials:

- **Texts:**
  - Earth Science Ch 27
- **Internet Sites:**
- **Videos/DVD (Multimedia):**
  - Wonders of Weather: Rain & Floods
- **Speakers:**
- **Other:**

Sample Lessons/Learning Activities:

Westbrook Public Schools
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Grade 11 – 12

Unit 3: Atmospheric Pressure, Wind, Air Masses, Fronts, and Storms	**Anticipated Length: 4 weeks**
Standards: • Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. • Climate is the long term average of a region's weather and depends on many factors.	
Knowledge: *Students will know/understand:* • Air pressure is a measure of the weight of the atmosphere on an object and it is measured using a barometer • Winds are due to differences in pressure and larger differences lead to stronger winds • Large scale winds are deflected from a straight line path by the Coriolis Effect • Air spirals into and upwards in a low pressure; downwards and outwards with a high pressure • The Coriolis Effect leads to 6 main worldwide wind belts and pressure belts • Local winds are due to daily pressure differences over the land and ocean and these are not deflected by the Coriolis Effect • Monsoons are due to seasonal pressure differences between the land and ocean • An air mass is a large region of the troposphere with similar weather throughout that form over large uniform surfaces • A front is the boundary between two air masses. There are four types of fronts, cold, warm, stationary, and occluded • Mid-latitude low pressure systems form and develop along fronts • Severe weather conditions (except hurricanes) are generally associated with strong pressure gradient fronts	**Skills:** *Students will be able to:* • Describe air pressure and how it is measured using various forms of barometers • Describe how pressure differences lead to winds and describe how wind speed and direction are measured • Describe a sea breeze and a land breeze and their effects on the local weather • Describe the Coriolis Effect and how it changes wind directions • Describe what a high and a low pressure region are and label the world's main wind and pressure belts • Describe seasonal winds (monsoons) and the effect these can have on a region's climate • Describe the origins and types of air masses • Describe the 4 main front types and the weather changes that are associated with them • Describe how a mid-latitude low pressure forms and evolves • Describe the formation of, conditions associated with, and the precautions that need to be taken when encountering a blizzard, tornado, and thunderstorm • Describe how to read a weather map and how it use used in forecasting

• Weather maps are developed from a large amount of data and are used as a tool in forecasting	
Essential Questions: • What are weather patterns?	**Unit Questions:** • How is air pressure measured using a barometer? • How does wind form and how is it measured? • How does a sea breeze affect local conditions on a summer day? • What is the Coriolis Effect? • What is an air mass? • What is a monsoon? • What are the four types of fronts? • How does a mid-latitude low form and evolve? • What are dangers associated with severe weather? • What are the main components of a weather map? • How does the interaction of air masses lead to the formation of mid-latitude low pressure (storm) systems? • What causes winds?
Expectations for Student Learning Addressed – *The Westbrook HS student will…* Demonstrate independence and proficiency in problem solving, reasoning, critical and creative thinking	
Possible Assessments: ☒ Teacher Created Tests ☐ Unit Tests ☒ Quizzes ☒ Others: Relative Humidity Lab ☐ Student Presentations ☐ Entrance/exit slips ☐ Group Projects	
Benchmark Assessment: • Teacher Generated Unit Test	
Performance Task: Weather Data	☒ **Required** ☐ **Optional**
Goal: Identify patterns in the local weather Role: Rookie Meteorologist Audience: Weather channel viewers Situation: Graph and analyze data of several weather parameters that were taken on a daily basis for at least 30 days. Look for specific patterns in the results. Product, Performance, Purpose: Completed worksheet analyzing graphs of weather data. Are patterns (if present) identified properly? To determine if the student can recognize pattern in real weather data. Standards for Success: Properly recognize obvious patterns and recognize subtle patterns 60% of the time	

Assessment Techniques:
School Wide Problem Solving Rubric

Technology Integration: Internet site, SMART board, Video

Resources/Materials:

- **Texts:**
  - Earth Science Ch 28, 29, 30 Topics 1-5 and 9-14
- **Internet Sites:**
  - Weather.com
- **Videos/DVD (Multimedia):**
  - Wonders of Weather: Weather Machine
- **Speakers:**
- **Other:**

Sample Lessons/Learning Activities:

- Correlation of weather data

Westbrook Public Schools
Astronomy & Meteorology Curriculum
Grade 11 – 12

<table>
<tr><td>Unit 4: Cosmology</td><td>Anticipated Length: 2 weeks</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Standards:
Earth-based and space-based astronomy reveal the structure, scale and changes in stars, galaxies and the universe over time.</td></tr>
<tr><td>Knowledge:
Students will know/understand:
The historical background of our knowledge of the origin, evolution and fate of the universe
The ‘Big Bang Theory’
The difference between a geocentric and heliocentric model
Dark matter
Dark energy</td><td>Skills:
Students will be able to:
Name the contributions of various historical figures in the field of cosmology
Describe the ‘Big Bang Theory’
Describe the differences between a geocentric and heliocentric model of the universe
Describe what dark matter and dark energy are and explain the reasons behind these constructs</td></tr>
<tr><td>Essential Questions:
How have the theories about how the universe has evolved changed over time as new information has been discovered and synthesized?
What is our place in the universe?</td><td>Unit Questions:
What is cosmology?
What is the Big Bang Theory?
What is a geocentric model?
What is a heliocentric model?
What is dark matter?
What is dark energy?</td></tr>
<tr><td colspan="2">Expectations for Student Learning Addressed – The Westbrook HS student will…
Communicate and process ideas and information effectively</td></tr>
<tr><td colspan="2">Possible Assessments:
☐ Teacher Created Tests
☐ Unit Tests
☒ Quizzes
☐ Others:
☐ Student Presentations
☐ Entrance/exit slips
☐ Group Projects</td></tr>
<tr><td colspan="2">Benchmark Assessment:
Teacher Generated Unit Quiz</td></tr>
</table>

Performance Task:	☐ **Required** ☐ **Optional**
Goal: Role: Audience: Situation: Product, Performance, Purpose: Standards for Success:	
Assessment Techniques: Poster Biography Rubric School Wide Communication Rubric Teacher Created Criteria	
Technology Integration: Videos, SMART board	

Resources/Materials:
• **Texts:**
  ○ Earth Science Ch 21 Topics 18
• **Internet Sites:**
• **Videos/DVD (Multimedia):**
  ○ Universe: Big Bang
• **Speakers:**
• **Other:**	

Sample Lessons/Learning Activities: • Poster biography instructions	

Westbrook Public Schools
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Grade 11 – 12

<table>
<tr><td>Unit 5: Stars and the Sun</td><td>Anticipated Length: 3 weeks</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Standards:
The sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.</td></tr>
<tr><td>Knowledge:
Students will know/understand:
Constellations are historical/mythological patterns in the stars that are helpful guideposts to finding ones way in the night sky
The sun is an average star near the middle of its life
Stars have a wide range of sizes, colors, densities, and lifetimes
Stars evolve along somewhat set paths depending on their mass
The Hertzsprung-Russell diagram is a guide to stellar evolution and classification
Spectral analysis of the light from stars is used to determine their makeup, temperature, and class</td><td>Skills:
Students will be able to:
Describe the 3 main types of telescopes
Locate some of the major constellations in the night sky
Determine the type of gas in a spectrum tube from its spectral emission lines
Describe the evolution of the sun and of more massive stars
Interpret the Hertzsprung-Russell diagram</td></tr>
<tr><td>Essential Questions:
How do astronomers learn about stars?
What happens during a star's life span?
What affect does the solar wind have on the earth system?</td><td>Unit Questions:
What are the main parts of a refracting, reflecting, and Schmidt-Cassegrain telescope?
What is a constellation?
What is the expected fate of the sun?
How is the Hertzsprung-Russell diagram used to classify stars?
How are spectral lines used to identify the constituents of a star?
Is the sun an average star whose structure and evolution are similar to other stars of its type?</td></tr>
</table>

Expectations for Student Learning Addressed – *The Westbrook HS student will…*
Access and evaluate information through the use of technology and various media

Possible Assessments:

- ☒ Teacher Created Tests
- ☐ Unit Tests
- ☒ Quizzes
- ☐ Others:
- ☐ Student Presentations
- ☐ Entrance/exit slips
- ☐ Group Projects

Benchmark Assessment:

- Teacher Generated Unit Test

Performance Task: ☐ **Required** ☐ **Optional**

Goal:

Role:

Audience:

Situation:

Product, Performance, Purpose:

Standards for Success:

Assessment Techniques:
Spectra Lab Rubric
School Wide Technology Rubric
Teacher Created Criteria

Technology Integration: Internet sites, Videos, SMART board

Resources/Materials:

- **Texts:**
  - Earth Science Ch 20, 21, 22
- **Internet Sites:**
  - skyandtelescope.com
- **Videos/DVD (Multimedia):**
  - Universe: Constellations
  - Tour of the Sky, Video Universe: the Sun
- **Speakers:**
- **Other:**

Sample Lessons/Learning Activities:

- Specta lab instructions

Westbrook Public Schools
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Grade 11 – 12

<table>
<tr><td>Unit 6: Solar System & Earth’s Motions</td><td>Anticipated Length: 3 weeks</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Standards:
The differences and similarities among the sun, the terrestrial planets and the gas giants may have been established during the formation of the solar system.
Evidence from earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.
Asteroids and meteorites had a significant role in shaping the surface of planets and moons and in mass extinctions of life on earth.</td></tr>
<tr><td>Knowledge:
Students will know/understand:
The objects that make up the solar system
The Protoplanet Hypothesis
Causes of the phases of the moon and eclipses
Causes for tides
How the motions of the earth are related to the day and the year
The origin and reasons for time zones, the International Date Line and daylight savings time</td><td>Skills:
Students will be able to:
Name the 8 planets in order from the sun
Describe the Protoplanet Hypothesis
Describe the difference between a meteoroid, meteor, and meteorite
Describe the sequence of the moon’s phases and their cause
Describe the cause of solar and lunar eclipses
Describe the causes of the tides
Define the year and day in terms of the earth’s motions
Describe the origin and general make-up of time zones and the International Date Line
Describe the origin and reasons for daylight savings time.</td></tr>
<tr><td>Essential Questions:
How is the earth similar to other planets or moons in the solar system and how is it unique?
What are the results of the motions of the earth and moon around the sun?</td><td>Unit Questions:
What is the accepted idea on the origin of our solar system?
What are the 8 planets called?
What are a meteoroid, meteor, and meteorite?
What are the phases of the moon?
What is the alignment of the sun/earth/moon during a solar and a lunar eclipse?
Why are there tides?
What is a day? A year?</td></tr>
</table>

	• What is the average degree separation between time zones? • What happens at the International Date Line? • What is daylight savings time? • How do the motions of the earth/moon/sun system determine our system of time, the tides, eclipses, and moon phases?

Expectations for Student Learning Addressed - *The Westbrook HS student will…*
Demonstrate independence and proficiency in problem solving, reasoning, critical and creative thinking

Possible Assessments:

- ☒ Teacher Created Tests
- ☐ Unit Tests
- ☒ Quizzes
- ☐ Others
- ☐ Student Presentations
- ☐ Entrance/exit slips
- ☐ Group Projects

Benchmark Assessment:

- Teacher Generated Unit Test or Quiz

Performance Task: ☐ **Required** ☐ **Optional**

Goal:

Role:

Audience:

Situation:

Product, Performance, Purpose:

Standards for Success:

Assessment Techniques:
School Wide Problem Solving Rubric
Teacher Created Criteria

Technology Integration: Videos, SMART board

Resources/Materials:

- **Texts:** Earth Science Ch 23, 24, 25
- **Internet Sites:**
- **Videos/DVD (Multimedia):**
  - Wonders of the Universe: Solar System Superlatives
  - Elegant Universe, Part 1
- **Speakers:**
- **Other:**

Sample Lessons/Learning Activities:

- Scale Model of the Solar System