



Earth Science – Part 2

Michigan State Content Expectations

Course Description

Earth Science Part 2 will consist of the following four units: Atmosphere, Weather, Earth's Oceans, and Space. The student will begin by examining the Earth's atmosphere by identifying its composition, movement of heat, compounds, and water vapor. The student will compare the formation of various types of clouds and patterns of the circulation of air. Next, the student will examine the Earth's weather by identifying air masses, fronts, and storms. In the third unit the student will explore the Earth's Oceans including the properties of salt water, the composition of the ocean floor, and the ocean currents and tides. Finally the student will study space by investigating the moon, sun, solar system, stars and galaxies. All students will demonstrate knowledge of key concepts of Earth Science and how these concepts relate to their everyday lives.

Text Book

Spaulding, Nancy, Samuel N. Namowitz. Earth Science. Evanston: McDougal Littell, 2003.

Unit 1 Description

This unit will explore the processes that shape the atmosphere.

Essential Content and Skills

The learner will:

- Describe how heat moves through the atmosphere.
- Identify the factors that cause the intensity of insolation to vary from place to place.
- Describe the three states in which water can exist in the atmosphere
- Describe three basic forms of clouds and how precipitation forms in warm clouds and in cold clouds.
- Define air pressure and describe how changes in elevation, temperature, and humidity affect air pressure
- Describe the Coriolis effect.
- Identify factors that affect global wind patterns.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Michigan State Content Expectations

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Unit 1 Lesson 1: The Atmosphere is Balance

State Standard	Description
E2.1B	Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.
E2.2A	Describe the Earth's principal sources of internal and external energy (e.g., radioactive decay, gravity, solar energy).
E2.2B	Identify differences in the origin and use of renewable (e.g., solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear [U-235]) sources of energy.
E2.2e	Explain how energy changes form through Earth systems.

Unit 1 Lesson 2: Local Temperature Variations

State Standard	Description
E2.1B	Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.

Unit 1 Lesson 3: Human Impact on the Atmosphere

State Standard	Description
E2.3b	Explain why small amounts of some chemical forms may be beneficial for life but are poisonous in large quantities (e.g., dead zone in the Gulf of Mexico, Lake Nyos in Africa, fluoride in drinking water).
E2.4B	Explain how the impact of human activities on the environment (e.g., deforestation, air pollution, coral reef destruction) can be understood through the analysis of interactions between the four Earth systems.
E2.4c	Explain ozone depletion in the stratosphere and methods to slow human activities to reduce ozone depletion.

Unit 1 Lesson 4: Humidity and Condensation

State Standard	Description
E4.p1A	Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption. (prerequisite)
E4.p2C	Explain the differences between fog and dew formation and cloud formation. (prerequisite)
E4.p2D	Describe relative humidity in terms of the moisture content of the air and the moisture capacity of the air and how these depend on the temperature. (prerequisite)

Unit 1 Lesson 5: Clouds

State Standard	Description
E4.3F	Describe how mountains, frontal wedging (including dry lines), convection, and convergence form clouds and precipitation.
E4.3g	Explain the process of adiabatic cooling and adiabatic temperature changes to the formation of clouds.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 6: Precipitation

State Standard	Description
E4.p1A	Describe that the water cycle includes evaporation, transpiration, condensation, precipitation, infiltration, surface runoff, groundwater, and absorption. (prerequisite)

Unit 1 Lesson 7: Air Pressure and Wind

State Standard	Description
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). (prerequisite)
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. (prerequisite)
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. (prerequisite)
E4.p2I	Identify major global wind belts (trade winds, prevailing westerlies, and polar easterlies) and that their vertical components control the global distribution of rainforests and deserts. (prerequisite)

Unit 1 Lesson 8: Factors Affecting the Wind

State Standard	Description
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). (prerequisite)
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. (prerequisite)
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. (prerequisite)
E4.p2I	Identify major global wind belts (trade winds, prevailing westerlies, and polar easterlies) and that their vertical components control the global distribution of rainforests and deserts. (prerequisite)

Unit 1 Lesson 9: Global Wind Patterns

State Standard	Description
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). (prerequisite)
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. (prerequisite)
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. (prerequisite)
E4.p2I	Identify major global wind belts (trade winds, prevailing westerlies, and polar easterlies) and that their vertical components control the global distribution of rainforests and deserts. (prerequisite)

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 10: Continental and Local Winds

State Standard	Description
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). (prerequisite)
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. (prerequisite)
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. (prerequisite)
E4.p2I	Identify major global wind belts (trade winds, prevailing westerlies, and polar easterlies) and that their vertical components control the global distribution of rainforests and deserts. (prerequisite)

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Description

This unit will explore the processes that affect the weather and climate.

Essential Content and Skills

The learner will:

- Identify factors that determine characteristics of air masses and fronts.
- Describe conditions necessary for the formation of thunderstorms, tornadoes, and hurricanes
- Analyze weather symbols, models, and maps.
- Describe Earth's major climate zones and factors that influence climate.
- Describe how wind shapes the Earth's surface.
- Identify features of waves and wave motion.

Unit 2 Michigan State Content Expectations

Unit 2 Lesson 1: Air Masses

State Standard	Description
E4.p2F	Describe the characteristics and movement across North America of the major air masses and the jet stream. (prerequisite)

Unit 2 Lesson 2: Fronts and Lows

State Standard	Description
E4.p2E	Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded). (prerequisite)

Unit 2 Lesson 3: Thunderstorms and Tornadoes

State Standard	Description
E4.3A	Describe the various conditions of formation associated with severe weather (thunderstorms, tornadoes, hurricanes, floods, waves, and drought).
E4.3E	Describe conditions associated with frontal boundaries that result in severe weather (thunderstorms, tornadoes, and hurricanes).

Unit 2 Lesson 4: Hurricanes and Winter storms

State Standard	Description
E4.3A	Describe the various conditions of formation associated with severe weather (thunderstorms, tornadoes, hurricanes, floods, waves, and drought).
E4.3E	Describe conditions associated with frontal boundaries that result in severe weather (thunderstorms, tornadoes, and hurricanes).

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 5: Forecasting Weather

State Standard	Description
E4.p2G	Interpret a weather map and describe present weather conditions and predict changes in weather over 24 hours. (prerequisite)

Unit 2 Lesson 6: Climate Zones

State Standard	Description
E4.p2B E4.2B	Describe the difference between weather and climate. (prerequisite) Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO ₂ reservoir.
E4.2e	Explain the differences between maritime and continental climates with regard to oceanic currents.

Unit 2 Lesson 7: Climate Changes

State Standard	Description
E4.p2B E4.2B	Describe the difference between weather and climate. (prerequisite) Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO ₂ reservoir.
E4.2e	Explain the differences between maritime and continental climates with regard to oceanic currents.
E5.4B	Describe natural mechanisms that could result in significant changes in climate (e.g., major volcanic eruptions, changes in sunlight received by the earth, and meteorite impacts).
E5.4D	Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans (including the results of increased evaporation, shoreline and estuarine impacts, oceanic algae growth, and coral bleaching) and changing climatic zones (including the adaptive capacity of the biosphere).
E5.r4i	Explain the causes of short-term climate changes such as catastrophic volcanic eruptions and impact of solar system objects. (recommended)

Unit 2 Lesson 8: Wind as an Agent of Change

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 9: Waves in the Sea

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape. Identify factors affecting seawater density and salinity and describe how density affects oceanic layering and currents. Explain the differences between maritime and continental climates with regard to oceanic currents.
E4.2d	
E4.2e	

Unit 2 Lesson 10: Shoreline Features

State Standard	Description
E3.p1C	Describe how coastal features are formed by wave erosion and deposition. (prerequisite)

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Description

This unit will explore the processes that shape the Earth's oceans

Essential Content and Skills

The learner will:

- Summarize the beginnings of oceanography.
- Contrast the densities of liquid water and ice.
- Explain how the polarity of water molecules affects the behavior of water and how the properties of water change when it combines with ocean salts.
- Explain the importance of phytoplankton to ocean life.
- Describe how certain bacteria living near deep-sea vents produce food.
- Identify methods scientists use to map the ocean floor.
- Describe the parts of the continental margin.
- Describe the features of the ocean basin.
- Explain how ocean basin features change over time.
- Describe three sources of ocean sediments
- Describe the relationship between winds and surface currents.
- Describe patterns of different types of surface currents.
- Describe the flow of density currents and identify factors that affect the density of ocean water.
- Explain how the moon and the sun affect tides.
- Compare and contrast tidal ranges of different bodies of water.

Unit 3 Michigan State Content Expectations

Unit 3 Lesson 1: Oceanography and Properties of Water

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape. Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO ₂ reservoir.
E4.2B	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 2: Properties of Ocean Water

State Standard	Description
E4.2d	Identify factors affecting seawater density and salinity and describe how density affects oceanic layering and currents.

Unit 3 Lesson 3: Ocean Life

State Standard	Description
E.5.4D	Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans (including the results of increased evaporation, shoreline and estuarine impacts, oceanic algae growth, and coral bleaching) and changing climatic zones (including the adaptive capacity of the biosphere).

Unit 3 Lesson 4: Studying the Ocean Floor

State Standard	Description
E5.4D	Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans (including the results of increased evaporation, shoreline and estuarine impacts, oceanic algae growth, and coral bleaching) and changing climatic zones (including the adaptive capacity of the biosphere).

Unit 3 Lesson 5: Continental Margin

State Standard	Description
E3.p1C	Describe how coastal features are formed by wave erosion and deposition. (prerequisite)
E3.3B	Explain why tectonic plates move using the concept of heat flowing through mantle convection, coupled with the cooling and sinking of aging ocean plates that result from their increased density.
E4.2c	Explain the dynamics (including ocean-atmosphere interactions) of the El Niño-Southern Oscillation (ENSO) and its effect on continental climates. Explain the differences between maritime and continental climates with regard to oceanic currents.
E4.2e	Explain the differences between maritime and continental climates with regard to oceanic currents.

Unit 3 Lesson 6: The Ocean Basin

State Standard	Description
E4.2d	Identify factors affecting seawater density and salinity and describe how density affects oceanic layering and currents.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 7: Ocean Floor Sediments

State Standard	Description
E3.2C	Describe the differences between oceanic and continental crust (including density, age, composition).

Unit 3 Lesson 8: Surface Currents

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape. Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO reservoir.
E4.2B	
E.4.2f	

Unit 3 Lesson 9: Currents under the Surface

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape. Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO reservoir.
E4.2B	
E.4.2f	

Unit 3 Lesson 10: Tides

State Standard	Description
E4.2A	Describe the major causes for the ocean's surface and deep water currents, including the prevailing winds, the Coriolis effect, unequal heating of the earth, changes in water temperature and salinity in high latitudes, and basin shape. Explain how interactions between the oceans and the atmosphere influence global and regional climate. Include the major concepts of heat transfer by ocean currents, thermohaline circulation, boundary currents, evaporation, precipitation, climatic zones, and the ocean as a major CO reservoir.
E4.2B	
E.4.2f	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Description

This unit will explore the Earth's moon, the sun, the solar system, stars, and galaxies.

Essential Content and Skills

The learner will:

- Explain various hypotheses about how the moon formed and describe features and properties of the moon.
- Describe the motions of the moon in relation to the moon's phases, solar eclipses, and lunar eclipses.
- Explain Newton's Law of Gravitation.
- Explain some of the sun's features, such as sunspots, flares, and prominences.
- Examine images of impact crater to predict the results of each impact.
- Describe the structure of the sun and its energy source.
- Describe characteristics of the four inner planets and compare the positions of the inner planets in orbit.
- Describe characteristics of the outer planets.
- Describe the satellites of the planets.
- Explain techniques for analyzing light to obtain information about stars.
- Compare and contrast the life cycle of a star such as the sun and of a star more massive than the sun.

Unit 4 Michigan State Content Expectations

Unit 4 Lesson 1: Origins and Properties of the Moon

State Standard	Description
E5.p1A	Describe the motions of various celestial bodies and some effects of those motions. (prerequisite)

Unit 4 Lesson 2: The Moon's Motion

State Standard	Description
E5.p1A	Describe the motions of various celestial bodies and some effects of those motions. (prerequisite)

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 3: Phases of the Moon

State Standard	Description
E5.p1A	Describe the motions of various celestial bodies and some effects of those motions. (prerequisite)

Unit 4 Lesson 4: The Sun's Size, Heat, and Structure

State Standard	Description
E5.2A E5.2B E5.2C E5.2D	Identify patterns in solar activities (sunspot cycle, solar flares, solar wind). Relate events on the Sun to phenomena such as auroras, disruption of radio and satellite communications, and power grid disturbances. Describe how nuclear fusion produces energy in the Sun. Describe how nuclear fusion and other processes in stars have led to the formation of all the other chemical elements.

Unit 4 Lesson 5: Observing the Solar System: A History

State Standard	Description
E5.1A	Describe the position and motion of our solar system in our galaxy and the overall scale, structure, and age of the universe.

Unit 4 Lesson 6: The Savage Sun

State Standard	Description
E5.4B	Describe natural mechanisms that could result in significant changes in climate (e.g., major volcanic eruptions, changes in sunlight received by the earth, and meteorite impacts).

Unit 4 Lesson 7: The Inner Planets and the Outer Planets

State Standard	Description
E5.1A	Describe the position and motion of our solar system in our galaxy and the overall scale, structure, and age of the universe.

Unit 4 Lesson 8: Planetary Satellites and Solar System Debris

State Standard	Description
E5.1A	Describe the position and motion of our solar system in our galaxy and the overall scale, structure, and age of the universe.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 9: A Closer Look at Light and Stars and their Characteristics

State Standard	Description
E5.2D	Describe how nuclear fusion and other processes in stars have led to the formation of all the other chemical elements.
E5.2e	Explain how the Hertzsprung-Russell (H-R) diagram can be used to deduce other parameters (distance).
E5.2f	Explain how you can infer the temperature, life span, and mass of a star from its color. Use the H-R diagram to explain the life cycles of stars. Compare the evolution paths of low-, moderate-, and high-mass stars using the H-R diagram.
E5.2h	

Unit 4 Lesson 10: Life Cycle of Stars

State Standard	Description
E5.2e	Explain how the Hertzsprung-Russell (H-R) diagram can be used to deduce other parameters (distance).
E5.2f	Explain how you can infer the temperature, life span, and mass of a star from its color. Use the H-R diagram to explain the life cycles of stars.
E5.2g	Explain how the balance between fusion and gravity controls the evolution of a star (equilibrium).
E5.2h	Compare the evolution paths of low-, moderate-, and high-mass stars using the H-R diagram.