

Michigan Grade Level Content Expectations for Climate Science

1	<ul style="list-style-type: none"> • Analyze information from data tables and graphs to answer scientific questions. S.IA.06.11, S.IA.07.11 • Compare and contrast the difference and relationship between climate and weather. E.ES.07.71 • Describe the difference between weather and climate. E4.p2B • Construct and analyze climate graphs for two locations at different latitudes and elevations in the region to answer geographic questions and make predictions based on patterns. 6-G3.1.1
2	<ul style="list-style-type: none"> • Describe natural processes in which heat transfer in the Earth occurs by conduction, convection, and radiation. E2.2C • Identify the main sources of energy to the climate system. E2.2D • Describe natural mechanism that could result in significant changes in climate. E5.4B • Recognize that, and describe how human beings are part of Earth’s ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems. L3.p4A • Describe the environmental effects of human action on the atmosphere, biosphere, lithosphere and hydrosphere. 6-G5.1.1 7-G5.1.1
3	<ul style="list-style-type: none"> • Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 • Describe the atmosphere as a mixture of gases. E.FE.07.11 • Explain the natural mechanism of the greenhouse effect, including comparisons of the major greenhouse gases (water vapor, carbon dioxide, methane, nitrous oxide, and ozone). E5.4A • Compare and contrast the heat-trapping mechanisms of the major greenhouse gases resulting from emissions (carbon dioxide, methane, nitrous oxide, fluorocarbons) as well as their abundance and heat- trapping capacity. E5.4g • Describe the greenhouse effect and list possible causes. B3.4d
4	<ul style="list-style-type: none"> • Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 • Explain how carbon exists in different forms such as limestone (rock), carbon dioxide (gas), carbonic acid (water), and animals (life) within Earth systems and how those forms can be beneficial or harmful to humans. E2.3A • Explain how carbon moves through the Earth system (including the geosphere) and how it may benefit (e.g., improve soils for agriculture) or harm (e.g., act as a pollutant) society. E2.3d • Compare and contrast the heat-trapping mechanisms of the major greenhouse gases resulting from emissions (carbon dioxide, methane, nitrous oxide, fluorocarbons) as well as their abundance and heat- trapping capacity. E5.4g
5	<ul style="list-style-type: none"> • Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain, and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 • Analyze the empirical relationship between the emissions of carbon dioxide, atmospheric carbon dioxide levels, and the average global temperature over the past 150 years. E5.4C • List the possible causes and consequences of global warming. B3.4e
6	<ul style="list-style-type: none"> • Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information. E1.2C • Analyze the empirical relationship between the emissions of carbon dioxide, atmospheric carbon dioxide levels, and the average global temperature over the past 150 years. E5.4C • Predict the global temperature increase by 2100, given data on the annual trends of CO₂ concentration increase. E5.r4j
7	<ul style="list-style-type: none"> • Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain, and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 • Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information. E1.2C • Analyze the empirical relationship between the emissions of carbon dioxide, atmospheric carbon dioxide levels, and the average global temperature over the past 150 years. E5.4C • Predict the global temperature increase by 2100, given data on the annual trends of CO₂ concentration increase. E5.r4j • List the possible causes and consequences of global warming. B3.4e

Michigan Grade Level Content Expectations for Climate Impacts

8	<ul style="list-style-type: none"> • Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 • Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans and changing climatic zones. E5.4D • Examine the negative impact of human activities B3.4C • List the possible causes and consequences of global warming. B3.4e • Describe the environmental effects of human action on the atmosphere, biosphere, lithosphere and hydrosphere. 6 - G5.1.1 • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 6 - G5.2.1 • Describe the environmental effects of human action on the atmosphere, biosphere, lithosphere and hydrosphere. 7 - G5.1.1 • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 7 - G5.2.1
9	<ul style="list-style-type: none"> • Identify the factors in an ecosystem that influence changes in population size. L.EC.06.32 • Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans and changing climatic zones. E5.4D • Describe common ecological relationships between and among species and their environments (competition, territory, carrying capacity, natural balance, L3.p2B population, dependence, survival, and other biotic and abiotic factors). (prerequisite) • Explain how two organisms can be mutually beneficial and how that can lead to interdependency. (prerequisite) L3.p2D • Explain how stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents. B2.3C • List the possible causes and consequences of global warming. B3.4e • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 6 - G5.2.1 • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 7 - G5.2.1
10	<ul style="list-style-type: none"> • Predict how changes in one population might affect other populations based upon their relationships in the food web. L.EC.06.23 • Identify the factors in an ecosystem that influence changes in population size. L.EC.06.32 • Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans and changing climatic zones. E5.4D • Describe common ecological relationships between and among species and their environments (competition, territory, carrying capacity, natural balance, population, dependence, survival, and other biotic and abiotic factors). L3.p2B • Explain how stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents. B2.3C • List the possible causes and consequences of global warming. B3.4e
11	<ul style="list-style-type: none"> • Predict how changes in one population might affect other populations based upon their relationships in the food web. L.EC.06.23 • Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans and changing climatic zones. E5.4D • List the possible causes and consequences of global warming. B3.4e • Describe the environmental effects of human action on the atmosphere, biosphere, lithosphere and hydrosphere. 6 - G5.1.1 • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 6 - G5.2.1 • Describe the environmental effects of human action on the atmosphere, biosphere, lithosphere and hydrosphere. 7 - G5.1.1 • Describe the effects that a change in the physical environment could have on human activities and the choices people would have to make in adjusting to the change. 7 - G5.2.1

12	<ul style="list-style-type: none"> Describe renewable and nonrenewable sources of energy for human consumption (electricity, fuels), compare their effects on the environment, and include overall costs and benefits. E2.4A Examine the negative impact of human activities B3.4C Conduct and research on contemporary global topics and issues, compose persuasive essay, and develop a plan for action 6 – G6.1.1 Clearly state an issue as a question or public policy, trace the origins of an issue, analyze various perspectives, and generate and evaluate alternative resolutions. Deeply examine policy issues in group discussions and debates to make reasoned and informed decisions. Write persuasive/argumentative essays expressing and justifying decision on public policy, report the results, and evaluate effectiveness. 6 – P3.1.1 Demonstrate knowledge of how, when, and where individuals would plan and conduct activities intended to advance views in in matters of public policy, report the results, and evaluate effectiveness. 6 – P4.2.1 Participate in projects to help or inform others. 6 – P4.2.3 Clearly state an issue as a question or public policy, trace the origins of an issue, analyze various perspectives, and generate and evaluate alternative resolutions. Deeply examine policy issues in group discussions and debates to make reasoned and informed decisions. Write persuasive/argumentative essays expressing and justifying decision on public policy, report the results, and evaluate effectiveness. 7 – P3.1.1 Demonstrate knowledge of how, when, and where individuals would plan and conduct activities intended to advance views in in matters of public policy, report the results, and evaluate effectiveness. 7 – P4.2.1 Participate in projects to help or inform others 7 – P4.2.3. Clearly state an issue as a question or public policy, trace the origins of an issue, analyze various perspectives, and generate and evaluate alternative resolutions. Deeply examine policy issues in group discussions and debates to make reasoned and informed decisions. Write persuasive/argumentative essays expressing and justifying decision on public policy, report the results, and evaluate effectiveness. 8 – P3.1.1 Demonstrate knowledge of how, when, and where individuals would plan and conduct activities intended to advance views in in matters of public policy, report the results, and evaluate effectiveness. 8 – P4.2.1 Participate in projects to help or inform others. 8 – P4.2.3
13	<ul style="list-style-type: none"> Evaluate data, claims, and personal knowledge through collaborative science discourse. S.IA.06.12 Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere (car exhaust, industrial emissions, acid rain and natural sources) and how pollution impacts habitats, climatic change, threatens or endangers species. E.ES.07.42 Based on evidence of observable changes in recent history and climate change models, explain the consequences of warmer oceans and changing climatic zones. E5.4D Recognize that, and describe how, human beings are part of Earth’s ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems (prerequisite) L3.p4A Examine the negative impact of human activities B3.4C
14	<ul style="list-style-type: none"> Evaluate data, claims, and personal knowledge through collaborative science discourse. S.IA.06.12, S.IA.07.12 Evaluate the strengths and weaknesses of claims, arguments, and data. S.RS.06.11, S.RS.07.12 Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information. E1.2C Evaluate the future career and occupational prospects of science fields. E1.2E Analyze how science and society interact from a historical, political, economic, or social perspective E1.2k Identify the point of view (perspective of the author) and context when reading and discussing primary and secondary sources. 6 - H1.2.3, 7 - H1.2.3