

Arctic Ice Released Item Set

Constructed Response Anchor Papers

- 12 Use the data and models to predict the future effect of global carbon emissions on Earth's systems.**

Type your answer in the space provided.

Score Level 0 Anchor Paper

Based off of the two graphs i can infer that due to weather conditions and the heat from the sun the sea ice will completely melt one day in the future

This response demonstrates that the student has no understanding of the question. The student response contains no data and no connection to global emissions. The response is too vague for credit.

Score Level 0 Anchor Paper

According to the data models, Over the years the Global Carbon Emissions will go up and become more harmful over the years. It will affect how humans act because they will be breathing in more carbon dioxide and same with animals. Some animals may have trouble flying in the air because of smog and other prominint pollutants.

This response demonstrates that the student has no understanding of the question. The response goes to an extreme, not showing that the student understands the process. The student response is also too vague and contains misconceptions. Statements used as evidence from the stimulus are not used effectively.

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Score Level 1 Anchor Paper

In the future as the Global Carbon Emissions increase then the Arctic Atmosphere Mean Temperature will also increase. This is because of Precipitation. When the Global Carbon Emissions increase then the Earth will become hotter which melts ice and evaporates water. This will result in the Arctic Atmospheric Mean Temperature increase.

This response demonstrates a minimal understanding and constructs a minimal explanation of the question. The explanation is minimally based on disciplinary core ideas when it states that the "Earth will become hotter which melts ice" but the student attributes this process to precipitation. The student demonstrates no integration of the science and engineering practices by citing information from the stimulus in the response but not cite specific data. The response reflects little synthesis of complex ideas or crosscutting concepts.

Score Level 1 Anchor Paper

The more carbon emissions on earth will cause the Increase of Arctic Atmosphere Mean Temperature as shown in the graph the temperature has risen from -1 Degrees to about 1 degrees from 1975 to 2015.

This response demonstrates a minimal understanding and constructs a minimal explanation of the question. The explanation is minimally based on disciplinary core ideas when it states that arctic temperature is increasing but is too vague about the cause and effect of this change. The student demonstrates no integration of the science and engineering practices by not use any data in the response. The response reflects a little synthesis of crosscutting concepts by mentioning a rate of change in the atmospheric temperature.

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Score Level 2 Anchor Paper

Using the provided data, graphs, and article, one can make a logical prediction on what the future effect of global carbon emissions will have on the Earth's systems. As more sea ice melts due to an increase in atmospheric temperature- an example of what causes this to increase being the use of fossil fuels and carbon being released into the atmosphere- the sea ice begin to melt at a rapid pace. Less ice means that sunlight is not effectively being reflected off of the ice. Instead, the sunlight is being absorbes, which is causing the surface temeratures of the earth and its waters to increase. This Chain of cause and effect continues, as carbon emmision begins to increase dramatically. This will eventuall cause a warmer atmosphere, which could have drastic effects on our environment.

This response demonstrates that the student has a partial understanding and constructs a partial explanation of the question. The explanation is adequately based on disciplinary core ideas with the circular cause and effect between melting ice, warmer temperatures and sunlight reflectivity/absorption. The student response fails to connect CO₂ emissions to the greenhouse effect. The student demonstrates some integration of the science and engineering practices but with no mention of hurricanes or extreme precipitation, the student does not use all the data provided to them. The response reflects some synthesis of understanding of complex ideas and crosscutting concepts by mentioning a rate of ice melt.

Score Level 2 Anchor Paper

The future effect of global carbon emissions on Earth's systems is severe. As the carbon emissions are already harming the Earth during present times, the situation will only worsen if measures are not taken to prevent such events from occuring. There is a direct relationship between sea ice melting and environmental changes in the world. As the ocean temperature rises, so does hurricane power. Since the carbon emissions are negatively impacting our planet by causing the melting of sea ice, the reflectivity of the ocean's surface decreases due to the ice not being there to reflect the solar energy back into space. Since the reflectivity decreases, more solar energy hits the water and the water temperature keeps on rising. This will only keep on occuring unless something is done to reduce carbon emissions.

This response demonstrates that the student has a partial understanding and constructs an explanation of the question. The explanation is adequately based on disciplinary core ideas with the direct relationship between ice caps melting, solar energy reflectivity, temperatures increasing, and hurricane power. The response fails to connect a process with these relationships. The student demonstrates some integration of the science and engineering practices by mentioning the trend data but is missing specific data from the stimulus to support the answer. The response reflects some synthesis of understanding of complex ideas and crosscutting concepts by mentioning how carbon emissions are causing things to change.

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Constructed Response Anchor Papers

Score Level 3 Anchor Paper

The more carbon that is emitted from human industrial uses will have a negative impact on our systems. Since carbon emissions are increasing at a very fast rate, the environment can't keep up with the changing conditions which could lead to extinction of many species. Also, human-induced deforestation is a big problem because by getting rid of these vast forests, you're getting rid of the only things that are extremely efficient at taking carbon out of the atmosphere and using it to create something beneficial. Furthermore, since carbon dioxide is a greenhouse gas, it causes more and more heat to be trapped inside of our atmosphere. Because of this, Earth's surface temperatures are gradually increasing and it's causing major weather problems as was proven by the data that as the ocean surface temperature increases, so does the severity of extreme weather events like hurricanes. Also, increasing carbon emissions cause sea ice to melt, since the excess carbon traps heat and therefore causes the Earth's surface temperature to increase. This then causes the sea levels to rise which could eventually lead to major torrential flooding in some coastal cities.

This response demonstrates that the student has a general understanding and constructs a complete explanation of the question. The explanation is mostly coherent based on disciplinary core ideas by citing the environmental effects caused by ice caps melting, temperatures increasing, extreme weather events, and sea level rising. The student does mention the relationship between carbon dioxide and the greenhouse effect which is causing many of the changes seen in the Earth's systems. The student demonstrates some integration of the science and engineering practices by mentioning the trend data but is missing specific data from the stimulus to support the answer. The response reflects a synthesis of understanding of complex ideas and crosscutting concepts by mentioning the rate of carbon emissions impacting the rate of environmental change. The response demonstrates an understanding of all three dimensions.

Score Level 3 Anchor Paper

as global carbon emissions increase due to an increasing population that is becoming more and more industrialized, the sea ice and the habitat it provides is severely threatened. CO₂ is a greenhouse gas that when in the atmosphere can trap heat which in return warms the earth. as more heat is trapped, the atmospheric temperature increases. this melts sea ice and causes the warming of surface water temperatures because of the albedo effect; less heat is reflected and more is absorbed. the future of the ice caps is very grim as shown in tab one, it is predicted that sea ice will melt almost completely by the year 2100. this will damage the arctic ecosystem and threaten any wildlife, such as the polar bear that depends on its existence. increased surface water temperatures will also limit what species can live within our oceans which can alter how humans fish in the future. in total, as sea ice melts, habitat will continue to be disrupted and humans will have to face weather changes, loss of food sources, and loss of land due to a rise in sea levels.

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This response demonstrates that the student has a general understanding and constructs a complete explanation of the question. The explanation is mostly coherent based on disciplinary core ideas with the environmental effects caused by ice caps melting, sunlight reflectivity/absorption, temperatures increasing, and sea level rising. The student does mention the relationship between carbon dioxide and the greenhouse effect which is causing many of the changes seen in the Earth's systems. The student demonstrates integration of the science and engineering practices but lacks data to support the causes and effects that are being mentioned in the response. The response reflects a synthesis of understanding of complex ideas and crosscutting concepts but only once refers to the stimulus to support the response. The response demonstrates an understanding of all three dimensions.

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Constructed Response Anchor Papers

Score Level 4 Anchor Paper

Based on the given data, an increase in global carbon emissions can easily be linked to an increase in arctic temperatures. The carbon in the carbon emissions is in the form of CO₂, which is greenhouse gas that when added to the atmosphere traps heat which warms the earth. The graphs given in "Atmosphere Observations" show that as global carbon emissions rise, so do arctic atmosphere temperatures. This increase in arctic temperatures results in the melting of sea ice, which in turn causes the ocean to reflect less energy from the sun's rays. This results in an increase in ocean surface temperature, as can be seen on the graph in "Environmental Changes". This increase in ocean surface temperatures can, in turn, be linked to several natural disasters, most notably hurricane power and extreme precipitation occurrences. As the ocean surface temperature increases over the years (first graph), so too does the hurricane power (second graph), and the extreme precipitation events (third graph). It can therefore be concluded that, if the global carbon emissions continue to rise, then that will cause sea ice to melt, cause arctic temperatures to increase, cause increased hurricane power, and cause an increase in the occurrence of extreme precipitation events.

This response demonstrates that the student has a full and complete understanding and constructs a full and complete explanation of the question. The explanation is coherent and based on disciplinary core ideas with the relationship between ice caps melting, solar energy reflectivity, temperatures increasing, and increasing hurricane power. The student also mentions the relationship between carbon dioxide and the greenhouse effect which initiates many of the changes seen in the Earth systems, this reflects a complete synthesis of understanding of complex ideas and crosscutting concepts. The student demonstrates complete integration of the science and engineering practices by referring to the graphs where the data supports the trends discussed in the explanation even though they did not specifically cite data. The response demonstrates a complete understanding of all three dimensions.

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Score Level 4 Anchor Paper

Global carbon emissions cause more carbon dioxide to be present in the atmosphere. In 2015, almost 10,000 million metric tons of carbon was released into the atmosphere by global carbon emissions. This has several negative effects, such as acid rain, lowering of pH in the oceans, and contributing to the greenhouse gas effect. This article relates to the latter. Carbon dioxide and other greenhouse gases trap energy from leaving the Earth. When light enters our atmosphere and bounces off the surface, these gases reflect it to keep it inside. This causes warmer temperatures in the atmosphere. Since 1975 there has been over a 1 degree C increase in mean arctic atmosphere temperature. These warmer temperatures mean that ice will begin to melt. Because ice is ten times a more reflective surface than water, more of that light will be absorbed in the Earth and even less of it will escape. This will also increase surface temperatures and atmospheric temperatures. This rapidly escalates into an uncontrollable positive feedback cycle. Carbon emissions cause warmer temperatures which cause warmer temperatures which cause warmer temperatures etc. Ocean surface temperatures have continued to increase by over a half degree C in the last forty years. This means that global carbon emissions are dangerous to our planet and must be stopped.

This response demonstrates that the student has a full and complete understanding and constructs a full and complete explanation of the question. The explanation is coherent and based on disciplinary core ideas with an explanation of the positive feedback cycle between melting ice, warmer temperatures, and sunlight reflectivity/absorption. The student mentions the effect of greenhouse gases on many of the issues seen in the Earth systems. The student demonstrates complete integration of the science and engineering practices by using specific data from the stimulus to support the explanation and the feedback cycle. The response reflects a synthesis of understanding of complex ideas and crosscutting concepts in their discussion of the positive feedback cycle. The response demonstrates a complete understanding of all three dimensions.