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The Carbon Cycle is the natural process where carbon is exchanged between the atmosphere, land, oceans, and living organisms. It plays a crucial role in regulating Earth’s climate and supporting life. Understanding the carbon cycle is essential for addressing climate change and sustaining ecosystems. Through processes like photosynthesis, respiration, decomposition, and human activities, carbon is constantly being cycled through various reservoirs on Earth. By studying the carbon cycle, scientists can develop strategies to mitigate the impacts of carbon emissions on the environment. This intricate system highlights the interconnectedness of all living organisms and the delicate balance required to maintain a healthy planet. Join us as we delve deeper into the importance and mechanics of the carbon cycle in this insightful exploration. The carbon cycle is a fundamental process that explains how carbon moves through different parts of the Earth, creating a balanced ecosystem. It involves the exchange of carbon between the atmosphere, oceans, soil, and living organisms. Understanding the carbon cycle is crucial for comprehending the impact of human activities on the environment and the regulation of Earth’s climate. Now, let’s delve into the heart of the matter and explore what exactly the carbon cycle entails. Carbon: The Building Block Of Life Carbon is a versatile element that serves as the foundation of life on Earth. It is present in all living things, from the tiniest microorganisms to the largest mammals. Life as we know it is largely composed of carbon-based compounds. These compounds form the structure of proteins, carbohydrates, lipids, and nucleic acids – the essential building blocks of all living organisms. Understanding The Continuous Cycle The carbon cycle is a continuous and dynamic process that entails several interconnected steps. These include carbon fixation, photosynthesis, respiration, decomposition, and combustion. Through this natural cycle, carbon is constantly exchanged between the atmosphere, living organisms, and the Earth’s crust. This intricate system ensures that carbon remains in a state of equilibrium within the environment, maintaining the delicate balance necessary for sustainable life. The Carbon Cycle involves various Processes to transfer carbon between living organisms and the environment. Photosynthesis: Carbon Uptake By Plants Plants absorb carbon dioxide from the atmosphere during photosynthesis to produce glucose and oxygen. Respiration: Release Of Carbon Dioxide Organisms release carbon dioxide back into the atmosphere through the process of respiration. Decomposition: Breaking Down Of Organic Matter Microorganisms break down organic matter, releasing carbon back into the soil and atmosphere. Combustion: The Role Of Fossil Fuels Fossil fuels, such as coal and oil, release carbon dioxide when burned, contributing to greenhouse gas emissions. The Carbon Cycle plays a crucial role in maintaining the balance of life on Earth. By understanding the impacts of this essential cycle, we can better comprehend the interconnections within our ecosystem. Climate Change: The Carbon Dioxide Connection The excess release of carbon dioxide into the atmosphere from human activities contributes to global warming, altering weather patterns and melting polar ice caps. Ocean Acidification: Disrupting Marine Life Oceans absorb large amounts of carbon dioxide, leading to acidification that harms coral reefs and marine organisms, impacting the entire oceanic food chain. Credit: www.noaa.gov The carbon cycle is a vital natural process that involves the movement of carbon between the atmosphere, land, oceans, and living organisms. However, human activities have significantly disrupted this cycle, leading to an imbalance in the distribution of carbon in the environment. Understanding the impact of human influence on the carbon cycle is crucial in mitigating climate change and its effects.Increasing Carbon Dioxide EmissionsHuman activities, such as the burning of fossil fuels and industrial processes, have led to a substantial increase in carbon dioxide emissions. This unprecedented release of carbon dioxide into the atmosphere has accelerated the greenhouse effect, contributing to global warming and climate change. In addition to industrial activities, the growing number of vehicles on the roads has also significantly contributed to the rising levels of carbon dioxide emissions.Deforestation: Disrupting The BalanceDeforestation has a profound impact on the carbon cycle as it disrupts the balance between carbon dioxide absorption and release. Trees and other vegetation play a vital role in sequestering carbon from the atmosphere. However, deforestation for agricultural expansion, logging, and urban development has resulted in the reduction of carbon sinks, leading to increased carbon dioxide levels in the atmosphere. This disruption further exacerbates the greenhouse effect, contributing to climate change.Carbon Sequestration: Mitigating The EffectsCarbon sequestration is essential in mitigating the effects of human influence on the carbon cycle. This process involves capturing carbon dioxide from the atmosphere and storing it in natural reservoirs such as forests, oceans, and soil. Additionally, the development of carbon capture and storage technologies in industrial processes can aid in reducing carbon emissions. Increasing efforts to conserve and restore forests, as well as promoting sustainable land management practices, are crucial in enhancing carbon sequestration and restoring the balance in the carbon cycle. The carbon cycle is a natural process that plays a crucial role in maintaining the Earth’s climate balance. However, with the increase in human activities, such as burning fossil fuels and deforestation, the carbon cycle has been significantly disrupted. To mitigate the impact of these activities and prevent further climate change, it is essential to manage the carbon cycle effectively. In this article, we will explore three key strategies for managing the carbon cycle: renewable energy, reforestation and afforestation, and carbon offsetting. Renewable Energy: Reducing Fossil Fuel Dependence One of the most effective ways to manage the carbon cycle is by reducing our dependence on fossil fuels and transitioning to renewable energy sources. Renewable energy, such as solar, wind, and hydroelectric power, generates electricity without producing harmful carbon emissions. By promoting and adopting these sustainable energy sources, we can drastically reduce our carbon footprint and slow down the rate of climate change. Reforestation And Afforestation: Restoring Forests Forests play a vital role in the carbon cycle as they absorb and store carbon dioxide from the atmosphere through photosynthesis. However, deforestation has led to a significant reduction in the carbon storage capacity of forests. To restore this balance, reforestation and afforestation efforts are crucial. Reforestation involves planting new trees in areas previously deforested, while afforestation involves establishing forests in areas that were previously devoid of trees. These activities not only help in carbon sequestration but also support biodiversity conservation and ecosystem restoration. Carbon Offsetting: Balancing Emissions Carbon offsetting is another strategy for managing the carbon cycle by balancing the emissions produced in one area with carbon removal or reduction in another. This approach involves investing in projects that remove or reduce greenhouse gas emissions from the atmosphere, such as renewable energy projects, methane capture initiatives, and reforestation efforts. By offsetting our carbon emissions, we can neutralize the impact of our activities and contribute to a more sustainable future. In conclusion, managing the carbon cycle is crucial for mitigating the impact of human activities on climate change. By promoting renewable energy, restoring forests through reforestation and afforestation, and investing in carbon offsetting initiatives, we can take significant steps towards a more sustainable and balanced carbon cycle. It is important for individuals, businesses, and governments to come together and prioritize these strategies to safeguard the health of our planet for future generations. Credit: www.pnnl.gov Credit: en.wikipedia.org The carbon cycle is a natural process in which carbon is exchanged between the atmosphere, oceans, and living organisms. It has been occurring for billions of years and will continue as long as there are plants, animals, and natural processes like respiration and decomposition. Thus, the carbon cycle will not end. The 7 processes of the carbon cycle include photosynthesis, respiration, decomposition, combustion, fossil fuel formation, diffusion, and sedimentation. Each process plays a crucial role in the movement of carbon through the Earth’s atmosphere, biosphere, hydrosphere, and geosphere. The carbon cycle is the natural process where carbon moves between the atmosphere, oceans, plants, animals, and soil. The 4 steps of the carbon cycle are: 1. Carbon fixation 2. Photosynthesis 3. Respiration 4. Decomposition Carbon is exchanged between the atmosphere, oceans, soil, and living organisms in these steps. The carbon cycle is the process by which carbon dioxide moves between the atmosphere, plants, animals, and the Earth’s surface. Understanding the carbon cycle is crucial for preserving the planet. It shows the interconnectedness of all living beings. By recognizing our impact, we can work towards creating a sustainable and healthier environment. Learning about the carbon cycle empowers us to make informed decisions that benefit both the Earth and future generations. Carbon Cycle Steps (Image Source: Wikimedia) Carbon Cycle Steps: Most of the time, carbon[1] is called as the “chemical building block of life” because living organisms are made up of it. Hence, if that is the case, identifying how carbon molecules work in an environment is an important indication of whether a certain environment can accommodate life. It is important to note that the amount of carbon on earth itself and its atmosphere is fixed but always converted into different compounds, be it living or nonliving in nature. In general, there is a constant amount of carbon present on the planet and in its atmosphere. However, that “constant” amount is always being transformed into other forms and being moved between both living and non-living things. How does this process actually work? What drives the carbon atoms to move? Scroll down to find out more. What is the Carbon Cycle? Carbon Cycle Biosphere (Image Source: Wikimedia) The carbon cycle is a series of events that involves the cyclic movement and transformation of carbon between living organisms and the environment. Essentially, this is a natural way of reusing carbon molecules in different geographic locations. Basically, three major carbon-bearing reservoirs[2] exist in the planet: the lithosphere (land), the hydrosphere (water), and the atmosphere (air). All of which are acted upon out by the biosphere (living organisms). Living organisms, in general, play an important role in maintaining the balance between the other reservoirs. By determining the interaction between these reservoirs and tracing the route through which carbon are transported from the source to the sink, the interconnected carbon cycles on Earth are described precisely. All in all, biological and geological processes are important in maintaining the carbon balance in the planet. The carbon cycle is divided[3] into the following steps: 1. Entry of Carbon into the Atmosphere The entry of carbon (in the form of carbon dioxide) in the atmosphere marks the start of the carbon cycle. Before this, carbon dioxide goes through the process of respiration[4] (process by which organisms release energy from their food) and combustion (process of burning). Such processes both involve the releasing carbon dioxide into the atmosphere. 2. Carbon Dioxide Absorption By Producers The next step is the entry of the carbon dioxide in the photosynthetic process[5]. Photosynthetic organisms like plants and algae (called as producers) transform carbon dioxide into sugars for energy use and for their own reproduction. 3. Passing of the Carbon Compounds in the Food Chain Following the above step is the entry of the carbon compounds from the plants (producers) themselves to the food chain. When animals consume (hence consume) these plants, the carbon compounds are received by them. 4. Return of the Carbon To the Atmosphere The next step is the return of the carbon to the atmosphere due to the decomposers (bacteria and fungi) eating the dead bodies of animals. This is because the process of decomposition gives off carbon dioxide as a by-product. In general, the carbon cycle can be divided (depending on how long it takes to occur) into two types: short term and long term. 1. Short Term This type of carbon cycling involves the annual changes that occur within the atmosphere, terrestrial ecosystems, and the marine ecosystem. This type of cycling is named as such because the movement of carbon across reservoirs only takes relatively short time (minutes, hours, days, months, or years). 2. Long Term This type of carbon cycling is the slower form since it takes thousands to millions of years to occur. The excess carbons from the short term cycling are stored into the “long term” reservoir until they are removed after a long time. Here is the beautiful video produced by the NASA supercomputer project, which shows the CO_2 emission from our earth by combining several Satellite images and earth system models. You can read more about this project here. Importance of Carbon Cycle Like any other naturally cycles, the carbon cycle is essential for living organisms and biological systems in general. Discussed below are some of them: 1. Essential For Life As alluded to earlier, all living organisms are made up of carbon or one way or another; hence, the mere fact of it is very essential for life itself. When the process fails, life may begin to disrupt, and may even cause the cessation of it. 2. Important For the Maintenance of the Balance in Ecosystems The process of carbon cycle is very important in the maintenance of balance[6] in ecosystems due to the movement of carbon in various reservoirs. If ever imbalance happens, serious environmental disasters like global warming may occur. At present, scientists and researchers alike are still searching for novel methods of using other non-carbon sources for energy resource. 3. Critical To Food Chain The close relationship between carbon cycle and food chain boils down to the fact that all living organisms are made up of carbon. Through food chains[7] (and food webs), the carbon present in the producers migrate to the consumers that eat them. Consumers that eat other consumers as well receive the carbon from their food as well. 4. Important For Climate Regulation Carbon dioxide and methane[8] are the two carbon-based gases that significantly contribute to global warming. Since they are made up of carbon, the process of carbon cycle obviously determine the amount of these gases in the atmosphere. When there is a huge amount of carbon released into the atmosphere, the level of greenhouse gases increases, and therefore trapping more heat in the Earth. Hence, the understanding of how carbon cycle occurs in the environment paves the way for the development of the understanding for world climate. Humans, in general, have already disturbed the natural process of the carbon cycle since the start of the industrial revolution. Look around you. It is already becoming apparent how the atmospheric carbon dioxide concentrations (and other greenhouse gases) are increasing due to domestic and other anthropogenic activities. The disadvantages of such activities remain uncertain, but in the long run, we know for sure that it would sooner cause major drawbacks to life. As a concerned human being on this planet, how can you contribute to mitigating the worsening of global climate change? Cite This Page Key References [1] – “What is The Carbon Cycle?”. Accessed June 20, 2017. Link. [2] – “The carbon cycle on early Earthâ€”and on Mars?”. Accessed June 20, 2017. Link. [3] – “The Carbon Cycle steps – The Carbon Cycle”. Accessed June 20, 2017. Link. [4] – “BBC – GCSE Bitesize: A simple carbon cycle”. Accessed June 20, 2017. Link. [5] – “Carbon Cycle – humans, body, used, water, process, Earth, life, plants”. Accessed June 20, 2017. Link. [6] – “Carbon Cycle – Importance Of The Carbon Cycle – Global, Power, Warming, and Change – JRank Articles”. Accessed June 20, 2017. Link. [7] – “The Carbon Cycle – Windows to the Universe”. Accessed June 20, 2017. Link. [8] – “The Importance of Carbon for Climate Regulation”. Accessed June 20, 2017. Link. On a journey through the Carbon Cycle, the cornerstone of Earth’s biosphere, intricately woven into the fabric of life. This comprehensive guide unravels the cycle’s pivotal role in regulating the planet’s climate, supporting ecosystems, and sustaining life. From the depths of the oceans to the heights of the atmosphere, learn how carbon travels through the Earth’s compartments in a mesmerizing dance of exchange. With vivid examples, we illuminate the cycle’s complexities and its significance in balancing ecological harmony. Dive into the world of carbon and discover its myriad pathways, influencing everything from global warming to the air we breathe. Join us to explore the carbon cycle’s wonders, understanding its vital importance in our world’s ecological and climatic equilibrium. The carbon cycle is a natural process through which carbon is exchanged among the atmosphere, oceans, soil, plants, and animals of the Earth. It involves various chemical, physical, geological, and biological processes that transfer carbon compounds and use them in different ways across the planet’s various ecosystems. This cycle plays a key role in regulating the Earth’s climate by controlling the concentration of carbon dioxide in the atmosphere. Carbon Cycle Steps The Carbon Cycle is a fundamental process in Earth’s system, involving the movement of carbon among the atmosphere, oceans, soil, rocks, and living organisms. This cycle plays a crucial role in regulating Earth’s climate, supporting plant life through photosynthesis, and maintaining the balance of carbon dioxide in the atmosphere. Here are the key steps explained: 1. Photosynthesis In this crucial step, plants and other photosynthetic organisms (like some bacteria and algae) absorb carbon dioxide (CO_2) from the atmosphere. Using sunlight as energy, they convert CO_2 and water into glucose and oxygen. This process not only supports the growth of these organisms but also provides oxygen for other living beings. 2. Respiration Respiration is the reverse of photosynthesis and occurs in plants, animals, and fungi. These organisms consume oxygen and glucose, which produces energy, carbon dioxide, and water. This process returns CO_2 to the atmosphere or ocean, completing a part of the cycle. 3. Decomposition When plants, animals, and other organisms die, decomposers like bacteria and fungi break down their bodies. This decomposition process releases carbon stored in the dead organisms as CO_2 back into the atmosphere or converts it into compounds in the soil, contributing to the soil’s carbon storage. 4. Ocean Uptake The oceans play a significant role in the carbon cycle by absorbing CO_2 from the atmosphere. Through physical and biological processes, dissolved CO_2 is either used by marine organisms in the form of carbonate for shells and skeletons or stored in deep ocean waters for hundreds to thousands of years. 5. Sedimentation and Burial Over long time periods, carbon gets trapped in the Earth’s crust. Dead plant material and marine organisms can get buried under layers of sediment. Over millions of years, this organic material can turn into fossil fuels (coal, oil, and natural gas) through heat and pressure. 6. Volcanic Eruption Volcanic eruptions release carbon stored deep within the Earth back into the atmosphere in the form of CO_2. This process, although less frequent, contributes to the atmospheric carbon levels and is part of the long-term carbon cycle. 7. Combustion of Fossil Fuels Human activities, especially the burning of fossil fuels for energy, release significant amounts of CO_2 into the atmosphere. This process has accelerated the movement of carbon into the atmosphere, contributing to climate change by enhancing the greenhouse effect. Oceanic Carbon Cycle The oceanic carbon cycle is a critical component of the global carbon cycle, involving the exchange of carbon among the Earth’s oceans, atmosphere, and marine organisms. Here’s a detailed explanation broken down into key points: Absorption and Dissolution CO_2 Absorption: The ocean’s surface absorbs carbon dioxide (CO_2) from the atmosphere due to physical processes and the chemical solubility of CO_2 in seawater. Carbonate System: Once absorbed, CO_2 reacts with seawater to form carbonic acid, which further dissociates into bicarbonate and carbonate ions, contributing to the ocean’s alkalinity. Photosynthesis and the Biological Pump Marine Photosynthesis: Phytoplankton, microscopic marine plants, utilize sunlight and dissolved CO_2 in the process of photosynthesis, producing organic matter and oxygen. Biological Pump: This refers to the process by which organic carbon (from the dead biomass of marine organisms) sinks to deeper ocean layers, effectively removing carbon from the surface and storing it in deep ocean waters and sediments. Carbonate Sedimentation Formation of Carbonate Shells: Many marine organisms, such as plankton and corals, build shells or skeletons from calcium carbonate ($CaCO_3$) using the carbonate ions in seawater. Sedimentation: When these organisms die, their carbonate shells sink to the ocean floor, contributing to sediment layers that can store carbon for millions of years. Upwelling and Mixing Upwelling: Deep ocean currents and upwelling processes bring cold, nutrient-rich, and CO_2-laden waters from the deep to the surface, where the CO_2 can be released back into the atmosphere or used in photosynthesis. Thermohaline Circulation: This large-scale ocean circulation, driven by differences in water density due to temperature (thermal) and salinity (haline), plays a vital role in the mixing and distribution of carbon within the ocean. Human Impact Increased CO_2 Absorption: Human activities, especially the burning of fossil fuels, have increased atmospheric CO_2 levels, leading to greater absorption of CO_2 by the oceans. Ocean Acidification: The increased uptake of CO_2 lowers the pH of seawater, a process known as ocean acidification, which can have detrimental effects on marine life, particularly organisms that build calcium carbonate shells or skeletons. Importance of Carbon Cycle The carbon cycle is fundamental to Earth’s climate, ecosystems, and life forms. Its importance can be understood through several key points: Regulation of Atmospheric CO_2 Climate Control: The carbon cycle plays a critical role in regulating the Earth’s climate by controlling the concentration of carbon dioxide (CO_2) in the atmosphere. CO_2 is a greenhouse gas that traps heat in the atmosphere, and its levels significantly influence global temperatures. Supports Life Photosynthesis: Carbon is a key ingredient in photosynthesis, the process by which plants and other photosynthetic organisms convert CO_2 and sunlight into energy in the form of glucose, thereby supporting the base of the food web. Building Block of Life: Carbon is a fundamental component of all known life on Earth, forming the molecular backbone of DNA, proteins, carbohydrates, and lipids. Carbon Sequestration Natural Storage: Through processes such as photosynthesis and the sedimentation of carbonates in the ocean, the carbon cycle contributes to the sequestration (or storage) of carbon in long-lasting forms. This helps mitigate the impact of greenhouse gas emissions on global warming. Soil Carbon Storage: The carbon cycle enriches soil fertility by cycling organic carbon through decomposition, providing essential nutrients for plant growth. Ocean Health Regulation of Ocean Chemistry: The carbon cycle is integral to maintaining the chemical balance of the oceans. By absorbing CO_2, the oceans reduce the amount of greenhouse gases in the atmosphere, although this leads to ocean acidification, impacting marine life. Marine Ecosystems: The biological aspects of the carbon cycle support marine ecosystems, particularly through the growth and decay of phytoplankton, which are a crucial part of the marine food chain. Impact on Biodiversity Ecosystem Diversity: The carbon cycle influences the distribution and health of Earth’s ecosystems. For example, the growth and decay of plant life in forests are part of the carbon cycle, affecting habitat diversity and species richness. Buffer Against Climate Change Moderating Temperature Increases: By absorbing additional CO_2 produced by human activities, the oceans and forests help slow the rate of climate change, acting as buffers that moderate global temperature increases. Key Points on Carbon Cycle Fundamental to Climate Regulation: The carbon cycle plays a crucial role in regulating the Earth’s climate by controlling the levels of carbon dioxide (CO_2) in the atmosphere, a major greenhouse gas. Involves Multiple Reservoirs: Carbon is stored in various reservoirs, including the atmosphere, oceans, living organisms, soils, and the Earth’s crust, moving between these through various processes. Photosynthesis and Respiration: Plants absorb CO_2 from the atmosphere for photosynthesis, producing oxygen and carbohydrates. Animals and plants then release CO_2 back into the atmosphere through respiration. Oceanic Absorption: The oceans absorb a significant amount of CO_2 from the atmosphere, where it is used by marine organisms or stored in water as dissolved carbon. Carbon Sequestration: Natural processes such as the formation of fossil fuels and sedimentation of organic matter in the oceans remove carbon from the cycle for long periods, effectively acting as carbon sinks. Human Impact: Human activities, notably the burning of fossil fuels and deforestation, significantly accelerate the release of CO_2 into the atmosphere, disrupting the natural balance of the carbon cycle. Decomposition: Decomposers break down dead organisms, releasing carbon back into the atmosphere or soil, contributing to the nutrient cycle and allowing for new life. Carbonate Sedimentation: The formation of carbonate rocks like limestone from the shells and skeletons of marine organisms is another long-term carbon storage process. Volcanic Activity: Volcanoes release carbon from the Earth’s mantle into the atmosphere as CO_2 during eruptions, contributing to the atmospheric carbon pool. Climate Change Indicator: Changes in the carbon cycle are closely monitored as indicators of climate change, guiding efforts to predict and mitigate the impacts of global warming. FAQ of Carbon Cycle What is the Carbon Cycle? The Carbon Cycle is a natural process where carbon is exchanged among Earth’s atmosphere, oceans, soil, and living organisms, crucial for maintaining the planet’s climate and life. How does the Carbon Cycle work? Through photosynthesis, respiration, decomposition, ocean uptake, volcanic activity, and human activities, the Carbon Cycle balances atmospheric CO_2, supporting life and climate. Why is the Carbon Cycle important? It regulates Earth’s climate, supports ecosystems, and controls CO_2 levels, essential for life’s sustainability and climate stability. How do human activities affect the Carbon Cycle? Human activities, like burning fossil fuels and deforestation, increase atmospheric CO_2, disrupting the natural balance and contributing to climate change. Can the Carbon Cycle help in combating climate change? Enhancing carbon sinks and reducing emissions can balance the Carbon Cycle, mitigating climate change impacts through sustainable practices and renewable energy. How long does carbon stay in the atmosphere? Carbon dioxide can linger in the atmosphere for centuries, with its removal dependent on natural processes like photosynthesis and ocean absorption. The carbon cycle is a crucial planetary system that regulates climate, supports life, and maintains ecological balance. Human activities have significantly impacted this cycle, emphasizing the urgent need for sustainable practices to restore equilibrium. Understanding and protecting the carbon cycle is essential for preserving environmental health, mitigating climate change, and ensuring the future prosperity of our planet. Add Tone Friendly Formal Casual Instructive Professional Empathetic Humorous Serious Optimistic Neutral Importance of Carbon Cycle What process in the carbon cycle involves plants taking in carbon dioxide from the atmosphere? Choose the correct answer Which of the following processes releases carbon dioxide back into the atmosphere? Choose the correct answer What role do decomposers play in the carbon cycle? Choose the correct answer They convert carbon dioxide into organic matter They break down dead organisms and return carbon to the soil They absorb carbon dioxide for photosynthesis How does combustion affect the carbon cycle? Choose the correct answer It decreases atmospheric carbon dioxide It converts carbon dioxide into oxygen It releases carbon dioxide into the atmosphere It increases the amount of carbon stored in soils Which process in the carbon cycle helps remove carbon dioxide from the atmosphere and store it in oceans? Choose the correct answer What is the term for the process by which carbon is stored in the form of fossil fuels? Choose the correct answer How do human activities contribute to the carbon cycle imbalance? Choose the correct answer By reducing carbon dioxide levels in the atmosphere By increasing the rate of photosynthesis By releasing excess carbon dioxide through deforestation and fossil fuel use By enhancing natural carbon sinks Which of the following processes is part of the natural carbon cycle? Choose the correct answer What happens to carbon stored in plants when they die and decompose? Choose the correct answer It is converted into fossil fuels It is released into the atmosphere as carbon dioxide It is used for new plant growth It is absorbed by the oceans In which part of the carbon cycle does carbon dioxide dissolve into water? Choose the correct answer In the oceanic absorption process The carbon cycle is the process that moves carbon between plants, animals, and microbes; minerals in the earth; and the atmosphere. Carbon is the fourth most abundant element in the universe. With its ability to form complex molecules such as DNA and proteins, carbon makes life on Earth possible. Carbon in the form of carbon dioxide (CO_2) is also an important part of our atmosphere, where it helps to control the Earth’s temperature.Because only a tiny number of atoms reach the Earth from space, our planet is called a closed system. This means the Earth does not gain or lose carbon. But carbon does move constantly. Most carbon on Earth is stored in rocks and sediments. The rest is in the ocean, atmosphere, and in living organisms. Scientists use the term “carbon sinks” to refer to places where carbon is stored away from the atmosphere.Plants constantly exchange carbon with the atmosphere. Plants absorb carbon dioxide during photosynthesis and much of this carbon dioxide is then stored in roots, permafrost, grasslands, and forests. Plants and the soil then release carbon dioxide when they decay. Other organisms also release carbon dioxide as they live and die. For example, animals exhale carbon dioxide when they breathe and release carbon dioxide when they decompose. The oceans also exchange carbon with the atmosphere by absorbing carbon, which then sinks as it cools. In addition, carbon is stored in rocks and other geological deposits. For example, coal and other fossil fuels are made of carbon from plants that has been stored under the Earth’s surface for millions of years.Humans have a huge effect on the carbon cycle when we burn wood, fossil fuels (such as oil, coal, and natural gas), and other forms of carbon. This action releases the stored carbon into the atmosphere, where it becomes a greenhouse gas. Greenhouse gases are gases in the atmosphere that absorb and release heat.Where carbon is in the cycle shapes our climate. As a greenhouse gas, carbon dioxide in the atmosphere helps to determine how warm the Earth is. Too little carbon dioxide and other greenhouse gases and the Earth would be frozen. Too much would turn the atmosphere into a furnace. That’s why understanding the carbon cycle—and our role in that cycle—is critical to the Earth’s future.DOE Office of Science: Contributions to Carbon Cycle ResearchThe Department of Energy (DOE) supports research on the carbon cycle primarily through the Office of Science Biological and Environmental Research (BER) program. BER supports research into atmosphere carbon dioxide and other greenhouse gases. BER also supports systems biology research focusing on plant processes that remove CO_2 from the atmosphere and convert it into more stable forms of carbon as well as the complex relationships between plants, their associated microbes (i.e., plant microbiomes), and broader communities of soil microbes that impact carbon cycle processes. In addition to BER, DOE’s Advanced Scientific Computing Research (ASCR) program plays a vital role in studying the carbon cycle with its efforts to improve Earth systems and climate models to better understand how carbon dioxide and other factors shape our planet. DOE also participates in the U.S. Carbon Cycle Science Program, a multi-agency effort to coordinate U.S. carbon cycle science.Carbon Cycle FactsCarbon dioxide is one of the main greenhouse gases, along with methane, nitrous oxide, and a series of industrial gases called fluorinated gases. These are gases that trap heat in the atmosphere.Carbon can be removed from the atmosphere using a series of technologies called carbon sequestration, including direct air capture that pulls carbon dioxide straight from the atmosphere.In the past, about 25 percent of carbon emissions from human sources have historically been captured by forests, grassland, and farms. And about 30 percent of the carbon dioxide we produce has been captured by the ocean. These percentages will change in the future as humans continue to release carbon dioxide into the atmosphere.Resources and Related TermsScientific terms can be confusing. DOE Explains offers straightforward explanations of key words and concepts in fundamental science. It also describes how these concepts apply to the work that the Department of Energy’s Office of Science conducts as it helps the United States excel in research across the scientific spectrum. It appears that your browser doesn't support HTML5 video. Here's a direct link to the video instead. VIDEO: The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Human activities have a tremendous impact on this cycle. Burning fossil fuels, changing land use, and using limestone to make concrete all transfer massive quantities of carbon into the atmosphere. As a result, the amount of carbon dioxide in the atmosphere is rapidly rising — it is now greater than at any time in the last 3.6 million years. Transcript Blue carbon is the term for carbon captured by the world's ocean and coastal ecosystems. Sea grasses, mangroves, salt marshes, and other systems along our coast are very efficient in storing CO_2. These areas also absorb and store carbon at a much faster rate than other areas, such as forests, and can continue to do so for millions of years. The carbon found in coastal soil is often thousands of years old. When these systems are damaged or disrupted by human activity, an enormous amount of carbon is emitted back into the atmosphere, contributing to climate change. Carbon is the foundation of all life on Earth, required to form complex molecules like proteins and DNA. This element is also found in our atmosphere in the form of carbon dioxide (CO_2). Carbon helps to regulate the Earth’s temperature, makes all life possible, is a key ingredient in the food that sustains us, and provides a major source of the energy to fuel our global economy. The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change. Where the carbon is located — in the atmosphere or on Earth — is constantly in flux. On Earth, most carbon is stored in rocks and sediments, while the rest is located in the ocean, atmosphere, and in living organisms. These are the reservoirs, or sinks, through which carbon cycles. Carbon is released back into the atmosphere when organisms die, volcanoes erupt, fires blaze, fossil fuels are burned, and through a variety of other mechanisms.In the case of the ocean, carbon is continually exchanged between the ocean’s surface waters and the atmosphere, or is stored for long periods of time in the ocean depths. Humans play a major role in the carbon cycle through activities such as the burning of fossil fuels or land development. As a result, the amount of carbon dioxide in the atmosphere is rapidly rising; it is already considerably greater than at any time in the last 3.6 million years. What is the carbon cycle? Carbon is the chemical backbone of all life on Earth. All of the carbon we currently have on Earth is the same amount we have always had. When new life is formed, carbon forms key molecules like protein and DNA. It's also found in our atmosphere in the form of carbon dioxide or CO_2. The carbon cycle is nature's way of reusing carbon atoms, which travel from the atmosphere into organisms in the Earth and then back into the atmosphere over and over again. Most carbon is stored in rocks and sediments, while the rest is stored in the ocean, atmosphere, and living organisms. These are the reservoirs, or sinks, through which carbon cycles. The ocean is a giant carbon sink that absorbs carbon. Marine organisms from marsh plants to fish, from seaweed to birds, also produce carbon through living and dying. Over millions of years, dead organisms can become fossil fuels. When humans burn these fuels for energy, vast amounts of carbon dioxide are released back into the atmosphere. This excess carbon dioxide changes our climate — increasing global temperatures, causing ocean acidification, and disrupting the planet’s ecosystems. Carbon is one of the essential components that is found in every life on Earth. Scientists believe that the vast majority, approximately 99.9%, of all life forms on Earth are comprised of carbon. The carbon content in a planet is limited (i.e., 0.03%). Therefore, to fulfill the carbon requirement on the Earth, it is continuously used and recycled, termed the carbon cycle by Joseph Priestley and Antoine Lavoisier.Therefore, the carbon cycle is a bio-geo-chemical cycle in which carbon travels (in the form of CO_2) from the atmosphere into organisms and, after their death, back to the atmosphere. This cycle is essential for maintaining the Earth’s ecosystem by sustaining plants and animals. It occurs through various processes such as; oceanic gas exchange, photosynthesis, respiration, decomposition, combustion, rock weathering, and volcanism.The carbon cycle only completes in a single step. To compete for a single carbon cycle, many steps take place that is as follows;Carbon cycleCarbon enters the atmosphere as CO_2: Carbon enters the atmosphere through respiration by living organisms (exhales CO_2) via industries that release CO_2.Carbon present in the atmosphere is absorbed by autotrophs (which use CO_2 to make their food): Autotrophs utilize the absorbed CO_2 via the process known as photosynthesis. Photosynthesis converts atmospheric CO_2 into glucose molecules. These glucose molecules are either converted into other substances or used to provide energy to produce other biologically important molecules. $CO_2 + H_2O + energy \rightarrow (CH_2O)_n + O_2$Animals consume autotrophs: Carbon present in plants moves through the food chain. The animal consumes plants as a carbon source. Animals that eat other animals also get the carbon from their food. Furthermore, most of the carbon from animals is released into the atmosphere through respiration in the form of CO_2.Carbon released to the atmosphere: When these plants and animals die, and upon decomposition by decomposers, carbon is released back into the atmosphere.Some carbon becomes fossil fuel: In some cases, dead plants and animals remain on the Earth as fossil fuel used for future combustion.Microorganisms play an essential role in the carbon cycle. These microorganisms are involved in various steps of the carbon cycle that include;Carbon fixation: Some microorganisms, such as cyanobacteria and algae, can fix carbon through photosynthesis. Such organisms capture carbon dioxide from the atmosphere and convert it into organic carbon compounds.Respiration: Microorganisms release carbon dioxide as a byproduct during the metabolic process in order to obtain energy. Therefore, respiration helps to release carbon dioxide in the atmosphere.Decomposition: Microorganisms play a vital role in decay. They help to decay dead plants and animals into simpler forms, such as amino acids and sugars, by secreting enzymes.Methane production: Some microorganisms, such as methanogenic archaea and methanogens under anaerobic conditions, decompose organic matter into methane. Thus, released methane contributes to the carbon cycle by remaining in the soil or being released back into the atmosphere.Some examples of microorganisms that are involved in the carbon cycle are Algae: Cyanobacteria, Diatoms, etc.Bacteria: Bacillus spp, Pseudomonas spp, etc. Fungi: Aspergillus spp, Trichoderma, etc.The carbon cycle is essential not only for terrestrial life it equally plays a significant role in aquatic life. The carbon cycle occurs in different ways in marine life (i.e., in low-depth rivers and the deepest oceans). In normal aquatic life, the carbon cycle initiates when aquatic plants use carbon dioxide to make food. Animals then eat these plants. When the animal dies, their body decomposes, and carbon is finally returned to the atmosphere.Whereas, at the deepest level of the ocean, the oceanic carbon cycle occurs differently; carbon intake is more than releasing it to the atmosphere, which is known as a carbon sink. Marine animal utilizes carbon to calcium carbonate to build hard shells. When an organism with a hard shell dies, its body decomposes, but the hard shell accumulates in sea ground, turning into limestone under high pressure. Thus formed limestones, when exposed to the atmosphere, get weathered. As a result, carbon is released back into the atmosphere as carbon dioxide.In the oceanic carbon cycle, microorganisms transfer and exchange carbon between the atmosphere, ocean, and marine organisms. The primary role of microorganisms in the oceanic carbon cycle are as follows;Carbon fixation: Some of the phytoplanktons are microscopic that help to convert atmospheric carbon dioxide to organic compounds through photosynthesis.Respiration: Ocean microorganisms contribute to the carbon cycle by releasing carbon dioxide into the atmosphere as a byproduct during the metabolic process.Export of carbon: Microorganisms are also involved in carbon exportation from the surface ocean to the deep sea. Decomposition: Majorly bacteria decompose organic matter through an enzymatic process in the ocean. The decay helps release carbon dioxide, nutrients, and other substances that dissolve into the water.Some examples of microorganisms involved in the oceanic carbon cycle are;Algae: Diatoms, Green algae (e.g., Chlamydomonas and Spirogyra), Coccolithophores, Red Algae (e.g., Corallina and Porphyra)Bacteria: SAR11 Bacteria, Prochlorococcus, Rosebacter, Thaumarchea, Sulphate reducing bacteria, etc.Fungi: Aspergillus spp.The carbon cycle plays a crucial role in the Earth’s ecosystem that is as follows;It helps to regulate the Earth’s temperature: The carbon cycle is one of the important ways of maintaining the concentration of carbon dioxide in the atmosphere. Therefore, it significantly impacts reducing global warming and the greenhouse effect on the Earth.It helps to make food to sustain us: Almost all foods (i.e., plants or animals) are the carbon source.It helps to provide energy: Carbon is also the fuel source. Therefore, it also plays a significant role in sustaining the global economy.It facilitates the existence of all life on Earth.References Home » Microbiology » Environmental Microbiology » Biogeochemical Cycling » Carbon cycle – Definition, Steps, Importance, ExamplesCarbon cycle is the process by which carbon compounds move between the earth’s atmosphere, biosphere, geosphere, pedosphere, and hydrosphere.The biogeochemical process by which carbon moves between the Earth’s biosphere, pedosphere, geosphere, hydrosphere, and atmosphere is called the carbon cycle.Carbon is the most important part of all living things and a big part of many minerals, like limestone.Along with the nitrogen cycle and the water cycle, the carbon cycle is a series of important events that make it possible for life to exist on Earth. It talks about how carbon moves around the biosphere as it is recycled and reused, as well as the long-term processes of carbon being stored in carbon sinks and released from them.At the moment, carbon sinks on land and in the ocean each take in about a quarter of the carbon dioxide that people make.Humans have been messing with the biological carbon cycle for hundreds of years by changing how land is used and by mining fossil carbon (coal, oil and gas extraction, and making cement) on an industrial scale from the geosphere.By 2020, the amount of carbon dioxide in the atmosphere was nearly 52% higher than it was before people started using factories. This meant that the Sun had to heat the atmosphere and Earth’s surface more.Due to dissolved carbon dioxide, carbonic acid, and other compounds, the increase in carbon dioxide has also made the surface of the ocean about 30% more acidic. This is changing the chemistry of the ocean in a big way.Most of the fossil carbon has been taken out in the last 50 years, and the rate of taking it out keeps going up quickly, which contributes to climate change caused by people.Due to the large but limited inertia of the Earth system, the biggest effects on the carbon cycle and the biosphere, which is essential for human civilization, are still to come.The Paris Climate Agreement and Sustainable Development Goal 13 both say that restoring balance to this natural system is a top international goal.Properties of CarbonPhysical Properties of CarbonCarbon stands alone as a chemical element. It manifests itself in a wide variety of manifestations. Coal and soot are two materials that contain pure carbon.It’s either a muted grey or a flat black, and it’s quite boring and subtle.Charcoal, produced by burning carbon in the absence of air, is one of the most useful carbon compounds.It manifests in a variety of allotropic manifestations. Various allotropes of a given element exist, each with its own unique set of chemical and physical properties.Carbon densities vary depending on where the element was first created. There are pure forms of carbon like diamonds and emeralds, and impure forms like coal, which combines carbon and hydrogen.Chemical Properties of CarbonCarbon compounds generally show 4 reactions, they areCombustion reactionOxidation reaction,Addition reactionsSubstitution reaction.As everyone knows, carbon requires oxygen, heat, and light to make carbon dioxide. When something is burned in the air to produce carbon dioxide, this process is known as combustion.Let us illustrate this with a few scenarios when it is burned in the air: When methane is burned in the presence of oxygen, carbon dioxide, heat, and light are produced.Steps of Carbon Cycle Steps of Carbon Cycle1. Carbon in the AtmosphereFor carbon atoms to enter the carbon cycle, they must first exist in a gaseous state.CO_2 can be produced either by inorganic mechanisms or by the metabolic processes of living organisms.Carbon dioxide gas likely originated from volcanic activity and asteroid collisions before life existed on Earth.Carbon is currently released into the atmosphere through the activity of living things, such as animal exhalations, decomposer organisms, and human combustion of wood and fossil fuels.Regardless matter how carbon dioxide enters the atmosphere, CO_2 gas is the beginning of the carbon cycle.2. Producers Absorb CarbonOrganisms that make food from sunlight, such as plants, absorb carbon dioxide from the atmosphere and use it to construct carbohydrates, lipids, proteins, and other important biomolecules.CO_2 is absorbed by plants through pores in their leaves known as stomata. Carbon dioxide enters the plant through the stomata and, with the aid of solar energy, is integrated into carbon-containing molecules.The ability of plants and other producer organisms such as cyanobacteria to convert atmospheric carbon into living matter is essential to life on Earth.3. Producers are EatenConsumers are species that consume other organisms. Animals are the most obvious sort of consumer in our ecosystems, however numerous species of microorganisms also belong to this category.Incorporating carbon molecules from plants and other dietary sources is a function of ingestion. They use some of these carbon molecules from food to construct their bodies, but the majority of the food they consume is broken down to release energy, which is virtually the opposite of what producers do.Animals break these bonds to liberate the energy they contain, converting sugars, lipids, and other carbon molecules into single-carbon units. These are eventually discharged into the atmosphere as carbon dioxide.4. Decomposers Release CarbonPlants and animals that die without being consumed by other organisms are decomposed by other organisms known as “decomposers.”Decomposers consist of numerous bacteria and a few fungi. They typically exclusively decompose dead stuff, as opposed to catching and devouring living animals or plants.Decomposers, like mammals, degrade the chemical bonds in their food molecules. They produce numerous chemical byproducts, including CO_2 in some instances.5. Human ActivitiesHumans have recently made significant modifications to the carbon cycle on Earth. By burning vast quantities of fossil fuels and removing about half of the Earth’s forests, people have reduced the planet’s ability to remove carbon from the atmosphere, while releasing vast quantities of carbon that had been stored in solid form as plant matter and fossil fuels.This would increase the amount of carbon dioxide in the Earth’s atmosphere, which is problematic because carbon dioxide is a “greenhouse gas” that regulates the Earth’s temperature and weather patterns.The scientific community has expressed concern that by significantly altering the Earth’s carbon cycle, we may end up altering our climate or other crucial components of the ecosystem on which our survival depends.As a result, many experts suggest reducing carbon emissions by reducing automobile use and electricity use, and investing in non-combustible energy sources such as solar and wind power.The carbon cycle process consists of the following major steps:Plants absorb carbon from the atmosphere during photosynthesis.These plants are then devoured by animals, resulting in the bioaccumulation of carbon within their bodies.These organisms eventually perish, and their decomposition releases carbon back into the atmosphere.Some of the carbon that is not returned to the atmosphere becomes fossil fuels over time.These fossil fuels are subsequently utilised in human activities, which release additional carbon into the atmosphere.Syntrophy and MethanogenesisMost organic compounds are oxidized in nature by aerobic microbial processes. However, because oxygen (O_2) is a poorly soluble gas and is actively consumed when available, much organic carbon still ends up in anoxic environments. Methanogenesis, the biological production of CH_4, is a major process in anoxic habitats and is catalyzed by a large group of Archaea, the methanogens, which are strict anaerobes.Most methanogens can use CO_2 as a terminal electron acceptor in anaerobic respiration, reducing it to CH_4 with H_2 as electron donor. Only a very few other substrates, chiefly acetate, are directly converted to CH_4 by methanogens. To convert most organic compounds to CH_4, methanogens must team up with partner organisms called syntrophs that function to supply them with precursors for methanogenesis.What is the Fast carbon cycle?There are both rapid and sluggish carbon cycles.The fast cycle occurs in the biosphere, whereas the slow cycle occurs in rocks.The rapid or biological cycle can be completed within a few years, transferring carbon from the biosphere to the atmosphere and back again.The fast carbon cycle involves biogeochemical activities between the environment and living organisms in the biosphere that are particularly short-term (see diagram at start of article).It comprises carbon exchanges between the atmosphere, terrestrial and marine ecosystems, soils, and sediments on the seafloor.The fast cycle is comprised of annual cycles of photosynthesis and decadal cycles of vegetative growth and breakdown.Many of the more immediate effects of climate change will be determined by the rapid carbon cycle’s responses to human activities.Fast carbon cycle | Image Credit: Diagram adapted from U.S. DOE, Biological and Environmental Research Information System., Public domain, via Wikimedia CommonsWhat is the Slow carbon cycle?It can take millions of years for the slow or geological cycle to move carbon through the Earth’s crust through rocks, soil, ocean, and atmosphere.The slow carbon cycle involves geochemical processes with a medium to long timescale that are part of the rock cycle (see diagram on the right).The interchange between the water and atmosphere can take centuries, whereas rock weathering can take millions of years.Carbon in the ocean precipitates to the ocean floor, where it can form sedimentary rock and be subducted into the mantle of the earth.This geological carbon returns to Earth’s surface as a result of mountain-building processes. There, rocks are eroded and carbon is returned to the atmosphere through degassing and to the ocean via rivers.Other geologic carbon returns to the ocean via hydrothermal calcium ion emission.In a given year, 10 to 100 million tonnes of carbon circulate through this sluggish cycle. This includes volcanoes releasing geologic carbon as carbon dioxide directly into the atmosphere.However, this represents less than one percent of the carbon dioxide produced by the combustion of fossil fuels.Terrestrial carbon in the water cycleAs cloud condensation nuclei, atmospheric particles promote cloud formation.Raindrops acquire organic and inorganic carbon through particle scavenging and vapour absorption as they fall to Earth.Burning and volcanic eruptions generate highly condensed polycyclic aromatic molecules (i.e., black carbon), which are returned to the environment alongside greenhouse gases such as CO_2.Terrestrial plants fix atmospheric CO_2 via photosynthesis and return a portion to the atmosphere via respiration. Lignin and celluloses account for up to 80% of the organic carbon in forests and 60% of the organic carbon in pastures.Litterfall and root organic carbon combine with sedimentary material to generate organic soils in which plant-derived and petrogenic organic carbon is both stored and changed by the activities of microorganisms and fungi.Water absorbs dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC) as it flows over forest canopies (i.e. throughfall) and along plant trunks/branches (i.e. stemflow). Biogeochemical changes occur as water percolates into soil solution and groundwater reservoirs. Overland flow happens when soils are totally saturated or when precipitation comes faster than soil saturation.Organic carbon derived from the terrestrial biosphere and in situ primary production is decomposed by microbial communities in rivers and streams in conjunction with physical decomposition (i.e. photo-oxidation), resulting in a flux of CO_2 from rivers to the atmosphere of the same magnitude as the amount of carbon sequestered annually by the terrestrial biosphere.Macromolecules produced from the earth, such as lignin and black carbon, are broken into smaller components and monomers, which are ultimately transformed to CO_2, metabolic intermediates, or biomass.Lakes, reservoirs, and floodplains often store substantial quantities of organic carbon and sediments, but also experience net heterotrophy in the water column, resulting in a net flow of CO_2 to the atmosphere that is approximately one order of magnitude lower than rivers.In addition to floodplains, lakes, and reservoirs, anoxic sediments of floodplains, lakes, and reservoirs are often rich in methane generation. Typically, the export of fluvial nutrients causes an increase in primary production in river plumes. Nonetheless, estuary waters represent a global source of CO_2 for the atmosphere. Blue carbon is both stored and exported by coastal wetlands. Globally, marshes and wetlands are believed to release the same amount of CO_2 into the atmosphere as rivers.Typically, continental shelves and open oceans absorb CO_2 from the atmosphere.The marine biological pump stores a tiny but significant portion of the absorbed CO_2 in marine sediments as organic carbon (see next section).Terrestrial carbon in the water cycle | Image Credit: Nicholas D. Ward, Thomas S. Bianchi, Patricia M. Medeiros, Michael Seidel, Jeffrey E. Richey, Richard G. Keil and Henrique O. Sawakuchi, CC BY-SA 4.0 via Wikimedia CommonsWhat is the Deep Carbon cycle?The deep carbon cycle is the geochemical transport of carbon through the mantle and core of the Earth.It is intricately tied to the transport of carbon on the Earth’s surface and in the atmosphere as part of the carbon cycle.By returning carbon to the deep Earth, it serves a crucial role in preserving the conditions on Earth required for life. Without it, carbon would build up in the atmosphere, reaching extraordinarily high quantities over extended time periods.Due to the inaccessibility of the deep Earth to drilling, little is clearly known about the role of carbon un it.Nonetheless, multiple pieces of evidence, the most of which originate from laboratory models of deep Earth conditions, have shown the mechanisms for the element’s journey down into the lower mantle and the shapes that carbon takes at the severe temperatures and pressures of this layer.In addition, tools such as seismology have improved our understanding of the possible presence of carbon in the Earth’s core.Studies of the composition of basaltic lava and the flux of carbon dioxide from volcanoes indicate that the amount of carbon in the mantle is one thousand times greater than that on the Earth’s surface.Effects of human activities and environmental phenomenaCarbon dioxide (CO_2), a greenhouse gas, is rapidly released into the atmosphere by the combustion of fossil fuels, which raises average world temperatures and causes ocean acidification.Agricultural practises that generate carbon dioxide and methane (CH_4, a greenhouse gas) emissions. For instance, methane is produced through the digestion of plant matter by cows and the proliferation of bacteria in rice fields. Carbon dioxide is emitted by the combustion of fossil fuels to power agricultural machinery, the mining of minerals, and the production of fertiliser. Crop production and livestock husbandry also influence local productivity and biomass, as well as the rates of photosynthesis, respiration, and decomposition of organic matter.Deforestation reduces photosynthesis rates and consequently the amount of carbon dioxide collected by plant growth. As trees develop, they absorb atmospheric carbon dioxide and store it in their wood, leaves, bark, and roots. Carbon is returned to the atmosphere when downed trees are allowed to rot or when they are deliberately set on fire, a typical method of deforestation. Therefore, deforestation typically results in the emission of carbon dioxide, unless all of the wood is used for construction or paper products.The area of permafrost (permanently frozen soil) that contains methane (CH_4, a greenhouse gas). When temperatures remain cold throughout the year, organic matter decomposes very slowly and remains in the soil. Methane is released when permafrost melts, which is occurring as global temperatures rise. Increasing temperatures also accelerate the rate of decomposition, which raises the concentration of greenhouse gases in the atmosphere.Changes in the rates of sedimentation and burial of organic matter impact the quantity of carbon available for decay and the amount of carbon stored in the rock record over millions of years. Increased burial of dead plants and plankton, for instance, reduces decomposition, hence accelerating the creation of fossil fuels.Over millions of years, the rock cycle can alter the concentration of carbon dioxide in the atmosphere. Under heat and pressure, for instance, metamorphic events can release carbon dioxide. In contrast, the weathering of rocks that occurs when carbon dioxide dissolves in rainwater to generate carbonic acid (H_2CO_3) reduces the atmospheric concentration of carbon dioxide. These weathering reactions can be accelerated by warming, but not at a rate sufficient to offset the increase in carbon dioxide caused by human activities.Geologic variations in the pace of volcanism, caused by plate tectonics, can significantly influence the amount of carbon dioxide in the atmosphere, but over millions of years, not human timescales.Examples of Carbon Cycle The carbon cycle is composed of numerous parallel processes that can absorb or release carbon. Together, these processes maintain the relative stability of the Earth’s carbon cycle, temperature, and biosphere. Listed below are ecological components that can absorb carbon, convert carbon to living matter, or release carbon back into the atmosphere.AtmosphereCarbon dioxide in the Earth’s atmosphere is an important reservoir of carbon. In conjunction with two oxygen atoms, carbon produces a stable, gaseous molecule.This gas is released in nature by volcanic activity and by the breathing of animals, which attach carbon molecules from the food they ingest to oxygen molecules before exhaling it.Plants can remove carbon dioxide from the atmosphere by converting atmospheric carbon into sugars, proteins, lipids, and other life-sustaining chemicals.Carbon dioxide can also be removed from the atmosphere by absorption in the ocean, where water molecules can combine with carbon dioxide to generate carbonic acid.LithosphereThe Earth’s crust, which is known as the “lithosphere” from the Greek words for “stone” and “globe,” can also leak carbon dioxide into the atmosphere.This gas can be produced by chemical reactions in the crust and mantle of the Earth.Volcanic activity can result in natural carbon dioxide emissions.Some experts suggest that widespread volcanism may have contributed to the global warming that triggered the Permian extinction.However, the Earth’s crust may also take carbon from the atmosphere. Movements of the Earth’s crust can bury carbon-containing compounds far underground, where their carbon cannot escape back into the atmosphere.Over millions of years, these subsurface organic matter stores transform into coal, oil, and gasoline.In recent years, people have began releasing a significant portion of this carbon back into the atmosphere by burning these materials to power automobiles, power plants, and other equipment.Some organisms extract carbon dioxide from the atmosphere, while others release it. Plants and animals are the most prominent members of this ecosystem.Carbon is removed from the atmosphere by plants. This is not a benevolent gesture; plants actively need atmospheric carbon as “food” to produce sugars, proteins, lipids, and other vital components for life.Carbon dioxide and other trace elements are used to create these organic compounds by plants through photosynthesis, which harvests the energy of sunshine. Indeed, “photosynthesis” is derived from the Greek terms “photo” for “light” and “synthesis” for “to combine.”In a delicately balanced series of chemical events, animals consume plants (and other animals) and then disassemble these newly created molecules.During photosynthesis, plants store chemical energy in the bonds between carbon atoms and other atoms. Animals obtain their energy from these bonds.To accomplish this, animal cells break down complex compounds such as carbohydrates, lipids, and proteins into single-carbon units — molecules of carbon dioxide, which are formed by the reaction of carbon-containing food molecules with oxygen in the air.OceansThe oceans are capable of both absorbing and emitting carbon dioxide. When atmospheric carbon dioxide comes into touch with ocean water, it can react with the water molecules to generate carbonic acid, a liquid form of carbon that is dissolved.When there is more carbonic acid in the ocean than carbon dioxide in the atmosphere, some carbonic acid may be released as carbon dioxide into the atmosphere.In contrast, when atmospheric carbon dioxide levels rise, more carbon dioxide will be converted to carbonic acid, and ocean acidity levels will rise.Some experts have expressed concern that ocean acidity is rising in some regions, possibly as a result of human activity-induced increases in atmospheric carbon dioxide.Although these fluctuations in ocean acidity may seem negligible by human standards, many species of marine life rely on chemical reactions that require a very specific acidity level in order to exist. In fact, ocean acidification is currently causing the demise of numerous coral reef ecosystems.Carbon Cycle on LandCarbon is present in the atmosphere in the form of carbon dioxide. Natural activities such as respiration and industrial applications such as the combustion of fossil fuels release carbon into the atmosphere.Photosynthesis is the process through which plants absorb CO_2 to generate carbohydrates. The equation looks like this: $CO_2 + H_2O + energy \rightarrow (CH_2O)_n + O_2$Carbon molecules are transferred from producers to consumers along the food chain. The bulk of carbon in the body resides as carbon dioxide as a result of respiration. Decomposers are responsible for consuming deceased organisms and returning the carbon from their bodies to the atmosphere. This process has the following equation: $(CH_2O)_n + O_2 \rightarrow CO_2 + H_2O$Process of Carbon CycleThe carbon cycle in nature consists of two primary processes:The conversion of oxidized form of carbon into reduced organic form by photosynthetic organisms.Restoration of original

oxidized form through mineralization of the organic form by the micro-organisms.1. Conversion of Oxidized form of Carbon (CO2) into Reduced Organic FormPhotosynthesis is principally responsible for converting CO2 into organic carbon molecules.The most significant agents of carbon dioxide fixation are photosynthetic algae and higher plants.In the ocean, phytoplanktons, microscopic free-floating algae, are the dominant carbon-fixing plants. It is estimated that they fix around 1.2 x 1010 tonnes of carbon every year.Approximately 1.6 x 1010 tonnes of carbon are reportedly fixed annually by photosynthetic land plants.Conversion of Oxidized form of Carbon (CO2) into Reduced Organic FormIn addition, both autotrophic and heterotrophic bacteria may produce organic matter from inorganic carbon. In addition to the presence of photosynthesis among microorganisms, these organisms also provide as an example of CO2 fixation into the following chemical compounds:The only source of carbon for autotrophic bacteria is carbon dioxide. In a reduction reaction, the latter fix CO2 to carbohydrates. CO2 + 2H2 → (CH2O)x + H2OCommonly, heterotrophic bacteria fix carbon dioxide. CH3COCOOH + CO2 → HOOCCH2. COCOOH2. Restoration of Original Oxidized Form (CO2) through Mineralization of the Organic FormThere are three distinct mechanisms by which organic matter mineralizes and CO2 is discharged into the environment. They are: the respiratory processUnintentional (forest fire) and deliberate (fuel) combustion.The breakdown of organic material by microbes.The process of respiration in plants and animals, as well as the unintentional and intentional combustion of plants and their parts, leads to the breakdown of organic carbon molecules and the subsequent release of carbon dioxide into the atmosphere.Decomposition of Organic Matter by MicroorganismsMicroorganisms, primarily bacteria and fungus, breakdown organic carbon compounds that are eventually deposited in the soil. CO2 is discharged into the atmosphere and the soil.The most prevalent organic substance in plants is cellulose. Numerous species of fungus and bacteria can easily infect it.The degradation of cellulose to carbon dioxide can be summarised by the following reactions:Cellulose DecompositionPrimarily Trichoderma, Aspergillus, Penicillium, Fusarium, Chaetomium, and Verticillium breakdown cellulose in soil. Rhizoctonia, Myrothecium, Merulius, Pleurotus, Fomes, etc.Bacteria such as Clostridium, Cellulomonas, Streptomyces, Cytophaga, Bacillus, Pseudomonas, Nocardia, Micromonospora, Sporocytophaga, Polyangium, Cellfalcicula, etc. are responsible for cellulose degradation in soil.Hemicelluloses are the sugar polymers pentoses, hexoses, and uronic acid.The breakdown of hemicelluloses by bacteria is facilitated by extracellular enzymes known as hemicellulases.Examples of fungi that decompose hemicelluloses in soil include Chaetomium, Aspergillus, Penicillium, Trichoderma, Fusarium, and Humicola, among others. The bacteria that breakdown hemicelluloses in soil include Bacillus, Pseudomonas, Cytophaga, Vibrio, Erwinia, Streptomyces, and Actinomyces, among others.Lignin is the third most abundant plant component. It is extremely resistant to microbial decomposition.Nevertheless, it is known that certain fungus (Aspergillus, Penicillium, Fusarium, Lenzites, Clavaria, Polyporus, etc.) and bacteria (Streptomyces, Nocardia, Flavabacterium, Xanthomonas, Pseudomonas, Micrococcus, etc.) breakdown lignin at slow rates.Importance of Carbon CycleThe carbon cycle depicts the movement of carbon between the biosphere, hydrosphere, atmosphere, and geosphere of the planet. It is essential for several reasons:Carbon is a vital element for all life, therefore understanding its movement helps us comprehend biological processes and their influencing influences.Carbon dioxide, a greenhouse gas, is one type of carbon. Increased carbon dioxide levels insulate the planet, resulting in a rise in temperature. Understanding how carbon dioxide is absorbed and emitted helps us predict climate change and comprehend the climate.Carbon is out of balance, so it is essential to discover where it is stored and released. Carbon is not returned to the Earth at the same rate that it is deposited in living beings. Carbon is approximately 100 times more abundant in living organisms than on Earth. The combustion of fossil fuels releases vast quantities of carbon into the atmosphere and onto the planet.The carbon cycle is dependent on the presence of other elements and molecules. For instance, the carbon cycle is dependent on the oxygen content of the atmosphere. During photosynthesis, plants absorb carbon dioxide from the atmosphere and convert it into glucose (stored carbon) while emitting oxygen.Application of CarbonIt is a cost-free component with multiple applications. These include the use of diamonds or black pigment to embellish automobile rims or printer ink.Graphite is an additional form of carbon that has been utilised in high-temperature crucibles, arc lamp electrodes, dry cells, and pencil leads.Vegetal carbon is another amorphous form of carbon that is utilised as a bleaching agent and gas absorbent.To carbonate beverages, they utilise carbon dioxide and a fire extinguisher.Carbon in the solid state is referred to as dry ice.Carbon monoxide is also used in a variety of metallurgical reduction processes.In industrial solvents, carbon disulphide and carbon tetrachloride are two significant components.Key Points on Carbon CycleThe carbon cycle describes the transfer of carbon between the biosphere, geosphere, hydrosphere, and atmosphere of the planet.Carbon is an essential component of life.Green plants and other photosynthetic organisms absorb atmospheric carbon dioxide and transform it into organic molecules that move through the food chain. Carbon atoms are then expelled as carbon dioxide during respiration.For very long periods, the creation of fossil fuels and sedimentary rocks contributes to the carbon cycle.The carbon cycle is related to the availability of additional chemicals.FAQHow Carbon Enters in the Non-Living Environment?The nonliving environment consists of substances that have never been alive as well as carbon-containing components that persist after creatures perish. The non-living portions of the hydrosphere, atmosphere, and geosphere contain carbon as:Carbonate (CaCO3) rocks include coral and limestone.Organic stuff that has died, such as humus in soil.fossil fuels derived from decomposed organic materials (coal, oil, natural gas).Carbon dioxide in the atmosphere.HCO3 is formed when CO2 is dissolved with water.How Carbon Enters Living Matter?Carbon enters living matter via autotrophs, which are creatures capable of synthesising their own nourishment from inorganic substances.Photoautotrophs are responsible for the majority of carbon to organic nutrient conversion. Photoautotrophs, which are largely plants and algae, use sunlight, carbon dioxide, and water to produce organic carbon molecules (e.g., glucose).Chemoautotrophs are bacteria and archaea that transform carbon from carbon dioxide to an organic form, but derive their energy for the reaction from the oxidation of molecules rather than through photosynthesis.How Carbon Is Returned to the Non-Living Environment?Carbon is returned to the atmosphere and water by:Burning (as elemental carbon and various carbon molecules) (as elemental carbon and several carbon compounds).respiratory processes in plants and animals (as carbon dioxide, CO2).Decay (as carbon dioxide if oxygen is present or as methane, CH4, if oxygen is not there) (as carbon dioxide if oxygen is present or as methane, CH4, if oxygen is not present).ReferencesAmelse, Jeffrey. (2020). Achieving Net Zero Carbon Dioxide by Sequestering Biomass Carbon. 10.20944/preprints202007.0576.v1. Carlson, C. A., Bates, N. R., Hansell, D. 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