Course: Cost Accounting (1421)
Semester: Spring, 2022

ASSIGNMENT No. 2

Q. 1 a) Differentiate between the following terms.

i Porous and Pervious Rocks

Porosity measures how much space is between rocks. It is taken to be the ratio of the volume of empty space (or pores) in a rock to its total volume, and it is often expressed in terms of a fraction or a percentage. Permeability is a measurement of how easily fluid can flow between rocks. A soil sample with a high permeability allows for liquids to flow through easily, whereas it is harder for liquids to flow through soil with low permeability. Porosity and permeability are both properties of rocks and soil. The main difference between porosity and permeability is that porosity is a measurement of space between rocks whereas permeability is a measurement of how easy it is for fluids to flow between rocks.

ii Consumption and degradation

Level of energy consumption tends to increase environmental degradation thereby confirming the Pollution Haven Hypothesis (PHH). Bidirectional causality was also observed between CO_2 emission and economic growth. Results of this study are variable to different countries and present sound economic policy implications for the improvement of environmental standards.

iii Climate change and atmospheric pollution

Climate change can impact air quality and, conversely, air quality can impact climate change. Changes in climate can result in impacts to local air quality. Atmospheric warming associated with climate change has the potential to increase ground-level ozone in many regions, which may present challenges for compliance with the ozone standards in the future. Emissions of pollutants into the air can result in changes to the climate. Ozone in the atmosphere warms the climate, while different components of particulate matter (PM) can have either warming or cooling effects on the climate. For example, black carbon, a particulate pollutant from combustion, contributes to the warming of the Earth, while particulate sulfates cool the earth's atmosphere.

iv Decay and decomposition

Decay is to deteriorate, to get worse, to lose strength or health, to decline in quality while decompose is to separate or break down something into its components; to disintegrate or fragment.

v Photosynthesis and respiration

The main difference between photosynthesis and respiration is where it occurs, one being in plants and some bacteria and the other being in most every other living thing. The other difference is that plants require sunlight for the process to occur, whereas respiration does not. But there is an important mutual relationship between the two processes because of the ingredients required, and bi-products produced. If plants take carbon dioxide and expel oxygen, and most other living things take in oxygen and expel carbon dioxide, the importance of both systems working in unison is obvious.

b) Define the following terms.

i Volcanic eruption

A volcano is an opening or rupture in the earth's surface that allows magma (hot liquid and semi-liquid rock), volcanic ash and gases to escape. They are generally found where tectonic plates come together or separate but they can also occur in the middle of plates due to volcanic hotspots. A volcanic eruption is when lava and gas are released from a volcano—sometimes explosively. The most dangerous type of eruption is called a 'glowing avalanche' which is when freshly erupted magma flows down the sides of a volcano.

ii Chemical weathering

Chemical weathering is caused by rain water reacting with the mineral grains in rocks to form new minerals (clays) and soluble salts. These reactions occur particularly when the water is slightly acidic. These chemical processes need water, and occur more rapidly at higher temperature, so warm, damp climates are best. Chemical weathering (especially hydrolysis and oxidation) is the first stage in the production of soils.

iii Phytoplankton

Phytoplankton, also known as microalgae, are similar to terrestrial plants in that they contain chlorophyll and require sunlight in order to live and grow. Most phytoplankton are buoyant and float in the upper part of the ocean, where sunlight penetrates the water. Phytoplankton also require inorganic nutrients such as nitrates, phosphates, and sulfur which they convert into proteins, fats, and carbohydrates.

The two main classes of phytoplankton are dinoflagellates and diatoms. Dinoflagellates use a whip-like tail, or flagella, to move through the water and their bodies are covered with complex shells. Diatoms also have shells, but they are made of a different substance and their structure is rigid and made of interlocking parts. Diatoms do not rely on flagella to move through the water and instead rely on ocean currents to travel through the water.

iv Extinction

Extinction is the dying out of a species. Extinction plays an important role in the evolution of life because it opens up opportunities for new species to emerge. When a species disappears, biologists say that the species has become extinct. By making room for new species, extinction helps drive the evolution of life. Over long periods of time, the number of species becoming extinct can remain fairly constant, meaning that an average number of species go extinct each year, century, or millennium. However, during the history of life on Earth, there have been periods of mass extinction, when large percentages of the planet's species became extinct in a relatively short amount of time. These extinctions have had widely different causes.

v Deforestation

Deforestation is the purposeful clearing of forested land. Throughout history and into modern times, forests have been razed to make space for agriculture and animal grazing, and to obtain wood for fuel, manufacturing, and construction. Deforestation has greatly altered landscapes around the world. Deforestation can result in more carbon dioxide being released into the atmosphere. That is because trees take in carbon dioxide from the air for photosynthesis, and carbon is locked chemically in their wood. When trees are burned, this carbon returns to the atmosphere as carbon dioxide. With fewer trees around to take in the carbon dioxide, this greenhouse gas accumulates in the atmosphere and accelerates global warming.

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vi Water logging

Waterlogging is excess water in the root zone accompanied by anaerobic conditions. The excess water inhibits gaseous exchange with the atmosphere, and biological activity uses up available oxygen in the soil air and water – also called anaerobiosis, anoxia or oxygen deficiency.

Soils don't have to be saturated (waterlogged) for gas exchange to be inhibited.

These conditions affect agricultural plants in several ways:

- Nutrient deficiencies or toxicities
- Root death
- Reduced growth or death of the plant.

Waterlogging that causes death of deeper roots in winter can lead to droughting of plants in spring and early senescence of annual crops and pastures in the Mediterranean climate of south-west of Western Australia.

vii Mutation

Mutation, an alteration in the genetic material (the genome) of a cell of a living organism or of a virus that is more or less permanent and that can be transmitted to the cell's or the virus's descendants. (The genomes of organisms are all composed of DNA, whereas viral genomes can be of DNA or RNA; see heredity: The physical basis of heredity.) Mutation in the DNA of a body cell of a multicellular organism (somatic mutation) may be transmitted to descendant cells by DNA replication and hence result in a sector or patch of cells having abnormal function, an example being cancer.

viii Biodiversity

The term biodiversity refers to the variety of life on Earth at all its levels, from genes to ecosystems, and can encompass the evolutionary, ecological, and cultural processes that sustain life. Biodiversity includes not only species we consider rare, threatened, or endangered but also every living thing—from humans to organisms we know little about, such as microbes, fungi, and invertebrates. Biodiversity is important to most aspects of our lives. We value biodiversity for many reasons, some utilitarian, some intrinsic. This means we value biodiversity both for what it provides to humans, and for the value it has in its own right. Utilitarian values include the many basic needs humans obtain from biodiversity such as food, fuel, shelter, and medicine.

Ix Endemic species

Endemic species are plants and animals that exist only in one geographic region. Species can be endemic to large or small areas of the earth: some are endemic to a particular continent, some to part of a continent, and others to a single island. Usually an area that contains endemic species is isolated in some way, so that species have difficulty spreading to other areas, or it has unusual environmental characteristics to which endemic species are uniquely adapted. Endemism, or the occurrence of endemic animals and plants, is more common in some regions than in others. In isolated environments such as the Hawaiian Islands , Australia , and the southern tip of Africa, as many of 90% of naturally occurring species are endemic. In less isolated regions, including Europe and much of North America, the%age of endemic species can be very small.

X Migration

Migration is defined as the movement of people over some distance (or at least from one "migration-defining area" to another) and from one "usual place of residence" to another. At the other end of the spectrum the definition of migration discards the requirements that migration must involve a change of residence and a move across some distance. In this article a compromise between these two positions is suggested. Migration is defined here as the crossing of the boundary of a predefined spatial unit by one or more persons involved in a change of residence.

Q. 2 Write down the human impact on environment. What is nutrient cycle?

Humans impact the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water. These negative impacts can affect human behavior and can prompt mass migrations or battles over clean water. A nutrient cycle is defined as the cyclic pathway by which nutrients pass-through, in order to be recycled and reutilized. The pathway comprises cells, organisms, community and ecosystem."In the process, nutrients get absorbed, transferred, released and reabsorbed. It is a natural recycling system of mineral nutrients. Nutrients consumed by plants and animals are returned to the environment after death and decomposition and the cycle continues. Soil microbes play an important role in nutrient recycling. They decompose organic matter to release nutrients. They are also important to trap and transform nutrients into the soil, which can be taken up by plant roots. Nutrient cycling rate depends on various biotic, physical and chemical factors. Examples of a nutrient cycle: carbon cycle, nitrogen cycle, water cycle, oxygen cycle, etc. The energy flow refers to the transfer of energy from one trophic level to another in the food chain and food web. It is unidirectional and energy is lost from one trophic level to another in the form of heat. Sunlight is the ultimate energy source. Nutrient cycling is a cyclic process that encompasses the movement of nutrients from the physical environment to living organisms and back to the environment. Nutrients are present on the earth where they are recycled, transformed into different forms and reutilized. Nutrient recycling involves both biotic and abiotic components. The main abiotic components are air, water, soil.Recycling of Carbon, Hydrogen, Nitrogen and Oxygen occurs in water, air and soil, whereas calcium, phosphorus, potassium, etc. are recycled mainly in soil and are available locally.

The 4 main nutrient cycles are:

Carbon Cycle

Carbon is the main constituent of all the living cells. All the organic matter and biomolecules contain carbon.

- Carbon is present mainly as carbon dioxide and methane in the atmosphere
- There is a continuous exchange of carbon between biotic and abiotic components by the process of photosynthesis and respiration
- Atmospheric carbon dioxide is fixed by plants in the process of photosynthesis

- All the living organisms release carbon dioxide during respiration
- Carbon is released into the atmosphere by burning of fossil fuels and auto emissions
- Organic carbon from dead and decaying organisms and waste products is released into the atmosphere after decomposition

Nitrogen Cycle

Nitrogen is also an essential component of life. Nitrogen cannot be directly utilised by living organisms and has to be converted to other forms.

- By the process of nitrogen fixation, nitrogen-fixing bacteria fix atmospheric nitrogen to ammonia and nitrifying bacteria convert ammonia to nitrate. It is then taken up by plants
- Atmospheric nitrogen is converted to nitrates directly by lightning and assimilated by plants
- Decomposers break down proteins and amino acids of dead and decaying organic matters and waste product
- Denitrifying bacteria convert ammonia and nitrates to nitrogen and nitrous oxide by the process of denitrification. In this way, nitrogen is released back into the atmosphere

Oxygen Cycle

Oxygen is essential for life. Aquatic organisms are dependent on oxygen dissolved in water. Oxygen is required for decomposition of biodegradable waste products.

- Photosynthesis is the main source of oxygen present in the atmosphere
- Atmospheric oxygen is taken up by living organisms in the process of respiration and release carbon dioxide which is used for photosynthesis by plants

Hydrologic or Water Cycle

Water is an essential element for life to exist on earth.

- Water from oceans, lakes, rivers and other reservoirs is continuously converted to vapour by the process of evaporation and transpiration from the surface of plants
- Water vapours get condensed and return by precipitation and the cycle continues
- The water falling on the ground is absorbed and stored as groundwater

Importance of Nutrient Cycling

All living organisms, biomolecules and cells are made up of carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus. These elements are essential for life. It is important to recycle and continuously replenish nutrients into the environment for life to exist.

Nutrient cycling is important for:

- It is required for the transformation of nutrients from one form to another so that it can be readily utilised by different organisms, e.g. plants cannot take atmospheric nitrogen and it has to be fixed and converted to ammonium and nitrate for uptake.
- Transfer of nutrients from one place to another for utilisation, e.g. air to soil or water
- Nutrient cycles keep the ecosystem in equilibrium and help in storing nutrients for future uptake
- Through nutrient cycling, living organisms interact with the abiotic components of their surroundings

Q.3 What are the levels of biological diversity?

Biodiversity, or Biological Diversity, is the sum of all the different species of plants, animals, fungi and microbial organisms that live on Earth, including the various ecosystems in which they live on. Biodiversity also includes the genetic information that these organisms contain.

Therefore, on a smaller scale, you can use biodiversity to describe the variation in the genetic makeup of an organism. On a larger scale, you can use it to describe various types of ecosystems.

Biodiversity plays an integral role in the way ecosystems work and in the benefits they provide. Some of the benefits of biodiversity include:

- Regulating elements such as climate, water quality, disease, and pollination
- Provisioning resources such as food, clean water, industrial raw materials, and genetic resources
- Cultural promotion such as recreational, aesthetics, spiritual benefits

Levels of Biodiversity

Biodiversity is wide-ranging and is normally divided into three types or levels:

- Genetic Diversity
- Species Diversity
- Ecological Diversity

Let's have a detailed look at them:

1. Genetic Diversity

All species on Earth are somewhat related through genetic connections. And the more closer a species is related to another, the more genetic information the two species will share. These species will also look more similar.

The closest relations of an organism are members of its own species. Members of a species share genes. Genes are the bits of biochemical information that partly determine how an organism looks, behaves, and lives.

Moreover, members of a species share intricate mating behaviors. These behaviors help them to identify each other as potential partners. Virtually every species in an environment has a similar and closely related species in a neighboring environment. Every animal has the same cell structure as fungi, plants, and some microorganisms. Lastly, all organisms have ribonucleic acid (RNA) molecule. Moreover, most of them have deoxyribonucleic acid (DNA).

All these imply that species have come from one, common ancestor. However, they diverge and develop distinctive attributes with time, and hence promote biodiversity in their own unique way. Even when placed in the same environment, eastern and western squirrels don't mate because they are two different species.

Additionally, every species has other, more distantly related species. These two species share a more general set of traits. The squirrel family, for example, encompasses chipmunks, prairie dogs, and gray squirrels.

These animals share various features such as muscle anatomy, number of teeth, as well as shape and details of the skull. And all of them are rodents, which are in turn related to a broader group known as mammals.

Mammals share characteristics such as hair, three bones in the middle ear, and breastfeeding their young. Likewise, all mammals are distantly related to vertebrates. Vertebrates are animals with backbones.

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2. Species Diversity

A wide variety of species exists in an environment. And that's what is referred to as species diversity. Species are the standard measure of biological diversity in light of the fact that they are the basic units of biological classification.

The number of various species in a given ecosystem or environment is described as Species Richness. The total number of species in the world is about 10 million. However, only 1.75 million species have been named scientifically to date.

Ecological Diversity

Ecological or ecosystem diversity is the variety of ecosystems in an area. It involves the complex network of various species present in the ecosystems and the dynamic interactions between them. An ecosystem is made up of organisms from several different species living together in an environment and their connections through the flow of nutrients, energy, and matter.

An ecosystem can cover a small area, like a pond, or a large area, like an entire forest. The primary source of energy in virtually every ecosystem is the sun whose radiant energy is transformed into chemical energy by the plants.

Animals eat the plants, allowing the energy to flow through the systems. The animals are, in turn, eaten by other animals. Fungi decompose organisms to obtain energy and in the process recycle nutrients back into the soil.

Hence, an ecosystem is a collection of living components and non-living components that are connected by energy flow. It is difficult to measure ecological diversity because every ecosystem on earth merges into the surrounding ecosystems.

Q. 4

a. How biological evolution occurred? Explain in detail.

Evolution theory in biology postulating that the various types of plants, animals, and other living things on Earth have their origin in other preexisting types and that the distinguishable differences are due to modifications in successive generations. The theory of evolution is one of the fundamental keystones of modern biological theory.

The diversity of the living world is staggering. More than 2 million existing species of organisms have been named and described; many more remain to be discovered—from 10 million to 30 million, according to some estimates. What is impressive is not just the numbers but also the incredible heterogeneity in size, shape, and way of life—from lowly bacteria, measuring less than a thousandth of a millimetre in diameter, to stately sequoias, rising 100 metres (300 feet) above the ground and weighing several thousand tons; from bacteria living in hot springs at temperatures near the boiling point of water to fungi and algae thriving on the ice masses of Antarctica and in saline pools at −23 °C (−9 °F); and from giant tube worms discovered living near hydrothermal vents on the dark ocean floor to spiders and larkspur plants existing on the slopes of Mount Everest more than 6,000 metres (19,700 feet) above sea level.The virtually infinite variations on life are the fruit of the evolutionary process. All living creatures are related by descent from common ancestors. Humans and other mammals descend from shrewlike creatures that lived more than 150 million years ago; mammals, birds, reptiles, amphibians, and fishes share as ancestors aquatic worms that lived 600 million years ago; and all plants and animals derive from bacteria-like microorganisms that originated more than 3 billion years ago. Biological evolution is a process of descent with modification. Lineages of organisms change through generations; diversity arises because the lineages that descend from common ancestors diverge through time.

The evidence for evolution. Darwin and other 19th-century biologists found compelling evidence for biological evolution in the comparative study of living organisms, in their geographic distribution, and in the fossil remains of extinct organisms. Since Darwin's time, the evidence from these sources has become considerably stronger and more comprehensive, while biological disciplines that emerged more recently—genetics, biochemistry, physiology, ecology, animal behaviour (ethology), and especially molecular biology—have supplied powerful additional evidence and detailed confirmation. The amount of information about evolutionary history stored in the DNA and proteins of living things is virtually unlimited; scientists can reconstruct any detail of the evolutionary history of life by investing sufficient time and laboratory resources.

The fossil record

Paleontologists have recovered and studied the fossil remains of many thousands of organisms that lived in the past. This fossil record shows that many kinds of extinct organisms were very different in form from any now living. It also shows successions of organisms through time (see faunal succession, law of; geochronology: Determining the relationships of fossils with rock strata), manifesting their transition from one form to another.

When an organism dies, it is usually destroyed by other forms of life and by weathering processes. On rare occasions some body parts—particularly hard ones such as shells, teeth, or bones—are preserved by being buried in mud or protected in some other way from predators and weather. Eventually, they may become petrified and preserved indefinitely with the rocks in which they are embedded. Methods such as radiometric dating—measuring the amounts of natural radioactive atoms that remain in certain minerals to determine the elapsed time since they were constituted—make it possible to estimate the time period when the rocks, and the fossils associated with them, were formed.

The fossil record is incomplete. Of the small proportion of organisms preserved as fossils, only a tiny fraction have been recovered and studied by paleontologists. In some cases the succession of forms over time has been reconstructed in detail. One example is the evolution of the horse. The horse can be traced to an animal the size of a dog having several toes on each foot and teeth appropriate for browsing; this animal, called the dawn horse (genus Hyracotherium), lived more than 50 million years ago. The most recent form, the modern horse (Equus), is much larger in size, is one-toed, and has teeth appropriate for grazing. The transitional forms are well preserved as fossils, as are many other kinds of extinct horses that evolved in different directions and left no living descendants.

Structural similarities

The skeletons of turtles, horses, humans, birds, and bats are strikingly similar, in spite of the different ways of life of these animals and the diversity of their environments. The correspondence, bone by bone, can easily be seen not only in the limbs but also in every other part of the body. From a purely practical point of view, it is incomprehensible that a turtle should swim, a horse run, a person write, and a bird or a bat fly with forelimb structures built of the same bones. An engineer could design better limbs in each case. But if it is accepted that all of these skeletons inherited their structures from a common ancestor and became modified only as they adapted to different ways of life, the similarity of their structures makes sense. Comparative anatomy investigates the homologies, or inherited similarities, among organisms in bone structure and in other parts of the body. The correspondence of structures is typically very close among some organisms—the different varieties of songbirds, for instance—but becomes less so as the organisms being compared are less closely related in their evolutionary history. The similarities are less between mammals and birds than they are among mammals, and they are still less between mammals and fishes. Similarities in structure, therefore, not only manifest evolution but also help to reconstruct the phylogeny, or evolutionary history, of organisms.

b. Categorize the benefits of biodiversity.

Biodiversity is the variety of life. It includes all living things all around us: the soaring eagle, the leaping salmon, the towering Scots pine, the burring earthworm, and the soil-producing protozoa. It's all life in our forests and mountains, our rivers and seas, our gardens, parks, and our soils – the great mixture of habitats make up our rich and varied landscapes in Scotland. Biodiversity underpins the services nature provides that sustain our lives, so it's essential that we protect it and work to improve it.

Physical goods

Nature provides physical, consumable goods and services that we could not live without such as - breathable air, drinkable water and food. Beyond these, healthy ecosystems also provide us with many other consumable benefits including - trees that provide us with material to build and fuel to burn, and plants that provide medicines. These physical goods and services are known as provisioning ecosystem services.

Regulating the natural world

Like tourism, biodiversity's role in agriculture and food production is also vital to our economy. Growing crops and rearing animals, would not be possible without the numerous and complex interactions that happen below and above ground between different species. Fertile soils, pollination of crops, natural control of agricultural pests and the detoxification and decomposition of waste all contribute to cost and resource-effective production. These interactions between biodiversity and the landscape, known as regulating and supporting ecosystem services, go beyond agriculture and food production, underpinning all life on this planet.

Resilient ecosystems

All the great benefits from biodiversity highlighted above depend on our nature being just that, diverse. For any ecosystem to function it needs a lot of components, and removing any of these will make this complex system weaker, or even make it collapse. Environments that are poor in diversity, like commercial monocultures of a single species of tree, crop or fish, have proven to be very fragile and can provide fewer, and lesser quality, benefits to people. So the more biodiverse an ecosystem or landscape is, the greater its resilience to pressures such as climate change.

Often when we talk about biodiversity the focus is on species and ecosystems, but genetic diversity is just as important. To ensure we have resilient ecosystems we need a rich diversity of plants and animals.

Q.5

a. Write down a comprehensive note on carbon cycles and its impacts.

Carbon is transferred between the ocean, atmosphere, soil, and living things over time scales of hours to centuries. For example, photosynthesizing plants on land remove carbon dioxide directly from the atmosphere, and those carbon atoms become part of the structure of the plants. As plants are eaten by herbivores and herbivores are eaten by carnivores, carbon moves up the food web. Meanwhile, the respiration of plants, animals, and microbes returns carbon to the atmosphere as carbon dioxide (CO_2). When organisms die and decay carbon also returns to the atmosphere, or is integrated into soil along with some of their waste. The combustion of biomass during wildfires also release large amounts of carbon stored in plants back into the atmosphere.On longer timescales, significant amounts of carbon are transferred between rocks and the ocean and atmosphere, typically over thousands to millions of years. For example, the weathering of rocks removes carbon dioxide from the atmosphere. The resulting sediments, along with organic material, can be transported (eroded) from the land to enter the ocean where they sink to the bottom. This carbon from land, as well as carbon atoms in CO_2 absorbed by the ocean from the atmosphere, can become incorporated into calcium carbonate ($CaCO_3$) shells made by algae, plants, and animals. These shells become buried. As the successive layers of sediment are compressed and cemented they are turned into limestone rock. Over millions of years these carbon-bearing rocks can be exposed to sufficient heat and pressure to melt, causing them to release their carbon back into the atmosphere as carbon dioxide via volcanism. Some of these rocks will also be exposed at the surface of the Earth through mountain building and weathering, and the cycling begins again. Carbon from the mantle (see plate tectonics) is also released into the atmosphere as carbon dioxide through volcanic activity. Carbon is also transferred to rocks from the biosphere, via the formation of fossil fuels, which form over millions of years. Fossil fuels are derived from the burial of photosynthetic organisms, including plants on land (which primarily forms coal) and plankton in the oceans (which primarily forms oil and natural gas). While buried, this carbon is removed from the carbon cycle for millions of years to hundreds of millions of years. Human activity, especially the burning of fossil fuels, has dramatically increased the exchange of carbon from the ground back into the atmosphere and oceans. This return of carbon back into atmosphere as carbon dioxide is occurring at a rate that is hundreds to thousands of times faster than it took to bury it, and much faster than it can be removed by the carbon cycle (for example, by weathering). Thus, the carbon dioxide released from the burning of fossil fuels is accumulating in the atmosphere, increasing average temperatures through the greenhouse effect, as well as dissolving in the ocean, causing ocean acidification.

b. Write down a note on sulfur cycle.

The sulfur cycle is a biogeochemical cycle in which the sulfur moves between rocks, waterways and living systems. It is important in geology as it affects many minerals and in life because sulfur is an essential element (CHNOPS), being a constituent of many proteins and cofactors, and sulfur compounds can be used as oxidants or reductants in microbial respiration.[1] The global sulfur cycle involves the transformations of sulfur species through different oxidation states, which play an important role in both geological and biological processes. Steps of the sulfur cycle are:

- Mineralization of organic sulfur into inorganic forms, such as hydrogen sulfide (H_2S), elemental sulfur, as well as sulfide minerals.
- Oxidation of hydrogen sulfide, sulfide, and elemental sulfur (S) to sulfate ($SO^{2-}{}_4$).
- Reduction of sulfate to sulfide.
- Incorporation of sulfide into organic compounds (including metal-containing derivatives).
- The isotopic composition of sedimentary sulfides provides primary information on the evolution of the sulfur cycle.

The total inventory of sulfur compounds on the surface of the Earth (nearly 10^{19} kg of sulfur) represents the total outgassing of sulfur through geologic time.[24][19] Rocks analyzed for sulfur content are generally organic-rich shales meaning they are likely controlled by biogenic sulfur reduction. Average seawater curves are generated from evaporites deposited throughout geologic time because again, since they do not discriminate between the heavy and light sulfur isotopes, they should mimic the ocean composition at the time of deposition. 4.6 billion years ago (Ga) the Earth formed and had a theoretical $\delta^{34}S$ value of 0. Since there was no biologic activity on early Earth there would be no isotopic fractionation.[21] All sulfur in the atmosphere would be released during volcanic eruptions. When the oceans condensed on Earth, the atmosphere was essentially swept clean of sulfur gases, owing to their high solubility in water. Throughout the majority of the Archean (4.6–2.5 Ga) most systems appeared to be sulfate-limited. Some small Archean evaporite deposits require that at least locally elevated concentrations (possibly due to local volcanic activity) of sulfate existed in order for them to be supersaturated and precipitate out of solution.

The Great Oxygenation Event (GOE) is characterized by the disappearance of sulfur isotope mass-independent fractionation (MIF) in the sedimentary records at around 2.45 billion years ago (Ga). The MIF of sulfur isotope ($\Delta^{33}S$) is defined by the deviation of measured $\delta^{33}S$ value from the $\delta^{33}S$ value inferred from the measured $\delta^{34}S$ value according to the mass dependent fractionation law. The Great Oxidation Event represented a massive transition of global sulfur cycles. Before the Great Oxidation Event, the sulfur cycle was heavily influenced by the ultraviolet (UV) radiation and the associated photochemical reactions, which induced the sulfur isotope mass-independent fractionation ($\Delta^{33}S \neq 0$). The preservation of sulfur isotope mass-independent fractionation signals requires the atmospheric O_2 lower than 10^{-5} of present atmospheric level (PAL). The disappearance of sulfur isotope mass-independent fractionation at ~2.45 Ga indicates that atmospheric pO_2 exceeded 10^{-5} present atmospheric level after the Great Oxygenation Event. Oxygen played an essential role in the global sulfur cycles after the Great Oxygenation Event, such as oxidative weathering of sulfides. The burial of pyrite in sediments in turn contributes to the accumulation of free O_2 in Earth's surface environment. Human activities have a major effect on the global sulfur cycle. The burning of coal, natural gas, and other fossil fuels has greatly increased the amount of sulfur in the atmosphere and ocean and depleted the sedimentary rock sink. Without human impact sulfur would stay tied up in rocks for millions of years until it was uplifted through tectonic events and then released through erosion and weathering processes. Instead it is being drilled, pumped and burned at a steadily increasing rate. Over the most polluted areas there has been a 30-fold increase in sulfate deposition.

Although the sulfur curve shows shifts between net sulfur oxidation and net sulfur reduction in the geologic past, the magnitude of the current human impact is probably unprecedented in the geologic record. Human activities greatly increase the flux of sulfur to the atmosphere, some of which is transported globally. Humans are mining coal and extracting petroleum from the Earth's crust at a rate that mobilizes 150 x 10^{12} gS/yr, which is more than double the rate of 100 years ago. The result of human impact on these processes is to increase the pool of oxidized sulfur (SO_4) in the global cycle, at the expense of the storage of reduced sulfur in the Earth's crust. Therefore, human activities do not cause a major change in the global pools of sulfur, but they do produce massive changes in the annual flux of sulfur through the atmosphere.

When SO_2 is emitted as an air pollutant, it forms sulfuric acid through reactions with water in the atmosphere. Once the acid is completely dissociated in water the pH can drop to 4.3 or lower causing damage to both man-made and natural systems. According to the EPA, acid rain is a broad term referring to a mixture of wet and dry deposition (deposited material) from the atmosphere containing higher than normal amounts of nitric and sulfuric acids. Distilled water (water without any dissolved constituents), which contains no carbon dioxide, has a neutral pH of 7. Rain naturally has a slightly acidic pH of 5.6, because carbon dioxide and water in the air react together to form carbonic acid, a very weak acid.