

Give an account of the carbon and nitrogen cycles, and of how human activity involving carbon- and nitrogen-compounds can have adverse effects on the environment.

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9 Thirteen points, with at least six in each section.

The cycles:

Carbon cycle:

- much carbon is “locked” in organic molecules especially cellulose
- respiration releases carbon dioxide
- particularly of decomposers
- photosynthesis removes carbon dioxide from the atmosphere

Nitrogen cycle:

- decomposers release ammonium
- converted by nitrifying bacteria to nitrate
- taken up by plants
- used to manufacture proteins/nitrogenous organic compounds
- denitrifying bacteria in anaerobic conditions remove nitrate converting it to ammonia/nitrogen gas
- nitrogen fixing bacteria convert nitrogen from the atmosphere into organic form

Adverse effects on the environment:

Greenhouse effect (global warming):

- results from increased levels of carbon dioxide in the atmosphere
- due to the combustion of fossil fuels
- and deforestation since less carbon dioxide is absorbed by this hugely productive ecosystem
- longer wavelength infra-red is absorbed by greenhouse gases and re-radiated back towards the Earth’s surface
- global warming results in extremes in weather patterns
- global warming should result in the melting of the polar ice caps with a consequent rise in sea levels and coastal flooding

Acid rain:

- combustion of fossil fuels will release NO_2 into the atmosphere
- where it reacts with water in clouds to form nitrous acid which may be precipitated as acid rain some hundreds of miles from the source of production
- acid rain results in the defoliation and death of trees
- mainly due to the acidity resulting in an imbalance of soil nutrients (some minerals such as calcium and magnesium become more soluble and are leached out of the soil)
- the acidification of soils causes a release of aluminum ions
- aluminium is directly toxic to plant roots/aluminium causes mucus to coagulate on fish gills and consequent asphyxiation

Eutrophication:

- eutrophication refers to the condition of waterways such as lakes becoming nutrient-rich
- resulting from the leaching of nitrogenous fertilisers from agricultural land
- high levels of nutrients will result in massive growth of algae (and blue-green algae) forming algal blooms which die
- decomposition of the dead algae by bacteria causes anoxia in lakes
- resulting in fish kills and death of other aquatic organisms
- further, high nitrate (and nitrite) levels in drinking water have been linked with possible health risks

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