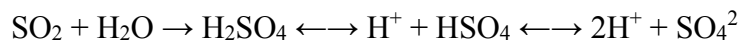


Acid rain and its impacts, control measures for acid rain

1. Acid rain

Normal, clean rain has a pH value of between 5.0 and 5.5, which is slightly acidic. However, when rain combines with sulfur dioxide or nitrogen oxides, produced from power plants and automobiles, the rain becomes much more acidic. Typical acid rain has a pH value of 4.0. The term acid rain refers to what scientists call acid deposition. It is caused by airborne acidic pollutants and has highly destructive results.

Acid rain, one of the most important environmental problems of all, cannot be seen. The invisible gases that cause acidic rain usually come from automobiles or coal burning power plants. In the atmosphere, sulfuric and nitric acids are generated when SO_2 and NO_x , respectively, react with water. The simplest reactions are:



1.2. Causes of acid rain

- The primary cause of acid rain are sulfur dioxide and nitrogen oxides. These chemicals are released by certain industrial processes and as a result more industrialized nations of Europe as well as the US suffer severely from acid rain.
- Most sulfur dioxide comes from power plants that use coal as their fuel. These plants emit 100 million tons of sulfur dioxide, 70% of that in the world.
- Automobiles produce about half of the world's nitrogen oxide. As the number of automobiles in use increases, so does the amount of acid rain.
- Power plants that burn fossil fuels also contribute significantly to nitrogen oxide emissions.
- Human cause is primarily responsible for acid rain, natural causes exist as well. Fires, volcanic eruptions, bacterial decomposition, and lightning also greatly increase the amount of nitrogen oxides on the plant.

1.3. Effects of acid rain

- Acid rain comes down to the earth in the form of rain, snow, hail, fog, frost or dew. Once it reaches the ground, the acidity in the substance can harm and even destroy both natural ecosystems and man-made products, such as car finishes.
- Acid rain is having harmful effects both on people and on the natural ecosystems of the world. Scientists today are convinced that acid rain is severe in many areas and that it is having an adverse effect on the environments of those locations.
- Acid rain affects aquatic ecosystem
- Many ecosystems are affected by acid rain. Bodies of water, such as lakes and rivers, see many of their inhabitants die off due to rising acidity levels.
- Aside from aquatic bodies, acid deposition can significantly impact forests. As acid rain falls on trees, it can make them to lose their leaves, damaging their bark and stunt their growth. By damaging these parts of tree, it makes them vulnerable to disease and extreme weather.
- Acid rain also kills the soil microorganisms.
- Acid rain also has an impact on architecture and art because of its ability to corrode certain materials. As acid lands on buildings (especially those constructed with limestone) it reacts with minerals in the stones sometimes causing it to disintegrate and wash away.

1.4. Important measures to control acid rain

- Reduce amount of sulphur dioxide and oxides of nitrogen released into the atmosphere.
- Use cleaner fuels
- Flue Gas Desulphurisation (FGD)
- Use other sources of electricity (i.e. nuclear power, hydro-electricity, wind energy, geothermal energy, and solar energy)
- Reducing the effects of acid rain by liming

The greenhouse effect and Global warming

2. Greenhouse effect

- The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases.
- The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise be, allowing life on Earth to exist.

2.1. Enhanced greenhouse effect

The problem we now face is that human activities – particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing – are increasing the concentrations of greenhouse gases. This is the enhanced greenhouse effect, which is contributing to warming of the Earth.

2.3. Different steps of Greenhouse effect

Step 1: Solar radiation reaches the Earth's atmosphere - some of this is reflected back into space.

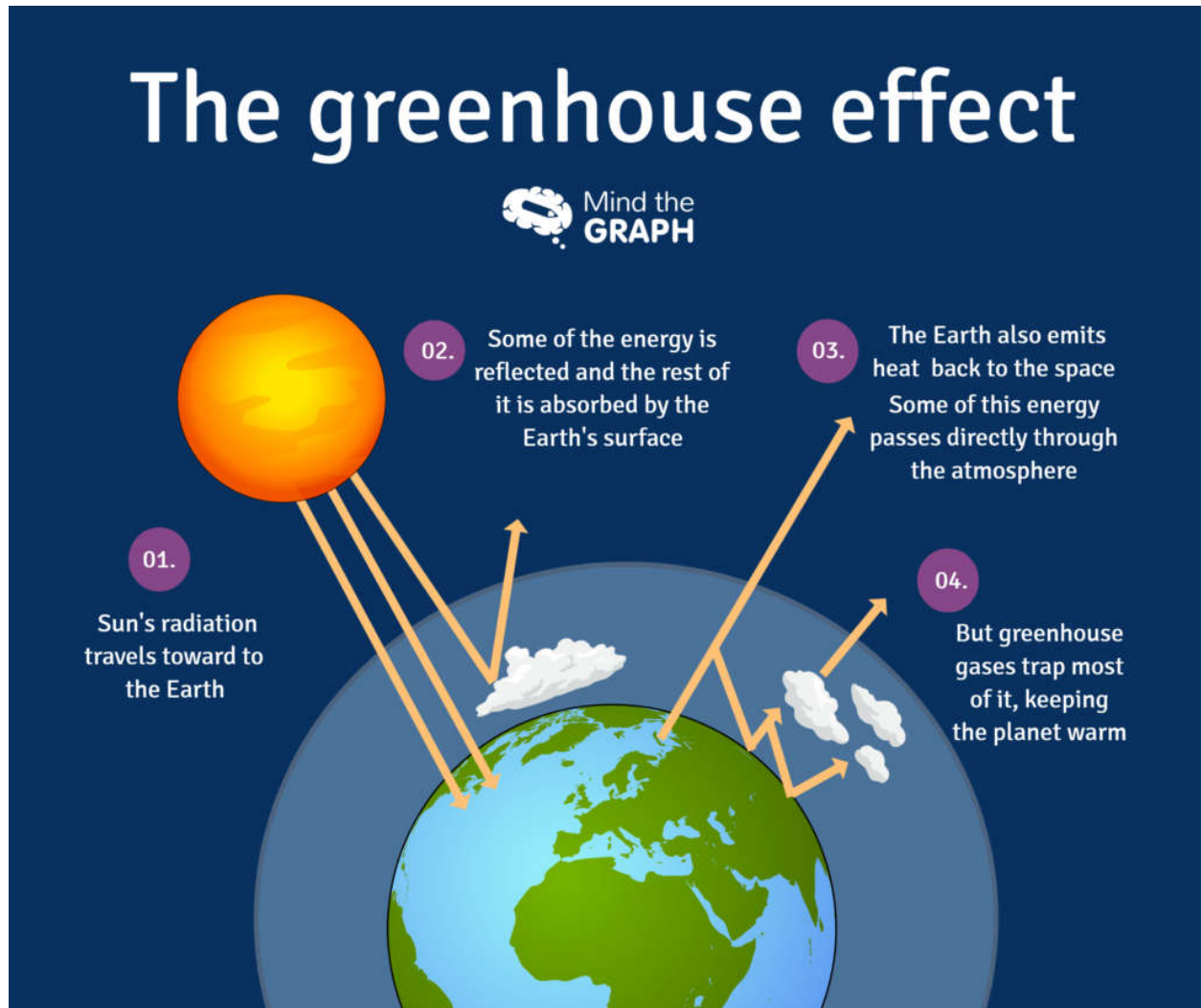
Step 2: The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.

Step 3: Heat radiates from Earth towards space.

Step 4: Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.

Step 5: Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.

Step 6: This is trapping extra heat and causing the Earth's temperature to rise.



2.4. Greenhouse gases

- Water vapors
- Carbon dioxide
- Methane
- Nitrous oxide
- Chlorofluorocarbons (CFCs)

2.5. Causes of greenhouse gases

i. Deforestation

Cutting down of trees, thus, leads to an increase in the carbon dioxide level in the atmosphere, eventually enhancing the greenhouse effect

ii. Burning of fossil fuels

Greenhouse gases can also be released into the atmosphere due to burning of fuels, oil, coal and gas.

iii. Population growth

With increase in in population the needs and wants of people increase which consequently increases deforestation, manufacturing and industry processes.

3. Global warming

Global warming refers to continuing rise in the average temperature of Earth's climate system. Since the early 20th century, the global are and sea surface temperature has increased about 0.8°C. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. Emission of greenhouse gases grew 2.2% per year between 2000 and 2010, compared with 1.3% per year from 1970 to 2000.

Global warming is called the greenhouse effect because the gases that are gathering above the earth make the planet comparable to a greenhouse. By trapping heat near the surface of the earth, greenhouse effect is warming the planet and threatening the environment.

3.1. Causes of global warming

- Carbon dioxide emissions from fossil fuel burning power plants
- Carbon dioxide emissions from burnig gasoline for transportation
- Methane emissions from animal waste, agriculture such as rice paddies
- Deforestation