ECOLOGY

6.5 Climate Change

Objectives :

Explain the Greenhouse effect with reference to the following points

- Carbon dioxide and water vapor are the most significant greenhouse gases.
- Other gases including methane and nitrogen oxides have less impact.
- The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere.
- The warmed Earth emits longer wavelength radiation (heat)
- Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere
- Global temperatures and climate patterns are influenced by concentrations of greenhouse gases

Explain the causes of the enhanced greenhouse effect with reference to :

- The correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures.
- Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter.

Describe the consequences of the enhanced greenhouse effect

Modelling the greenhouse effect

Resources

Book pages 139 , 140

The concentration of the atmospheric "greenhouse" gases affects the Earth's climates. Although the greenhouse effect is a natural phenomenon, it is being enhanced by human activities.

The greenhouse effect

The greenhouse gases, which include carbon dioxide, water vapor, methane and nitrogen oxides, in combination with radiation from the Sun, cause the greenhouse effect (figure 11). This natural phenomenon occurs when the Sun's radiation is trapped by the Earth's atmosphere increasing the Earth's temperature until it reaches a level that is suitable for life on Earth. Carbon dioxide and water vapour are the most significant greenhouse gases because of their high concentration in the atmosphere. The effect of any greenhouse gas is determined by its ability to absorb longwave radiation and its concentration in the atmosphere.

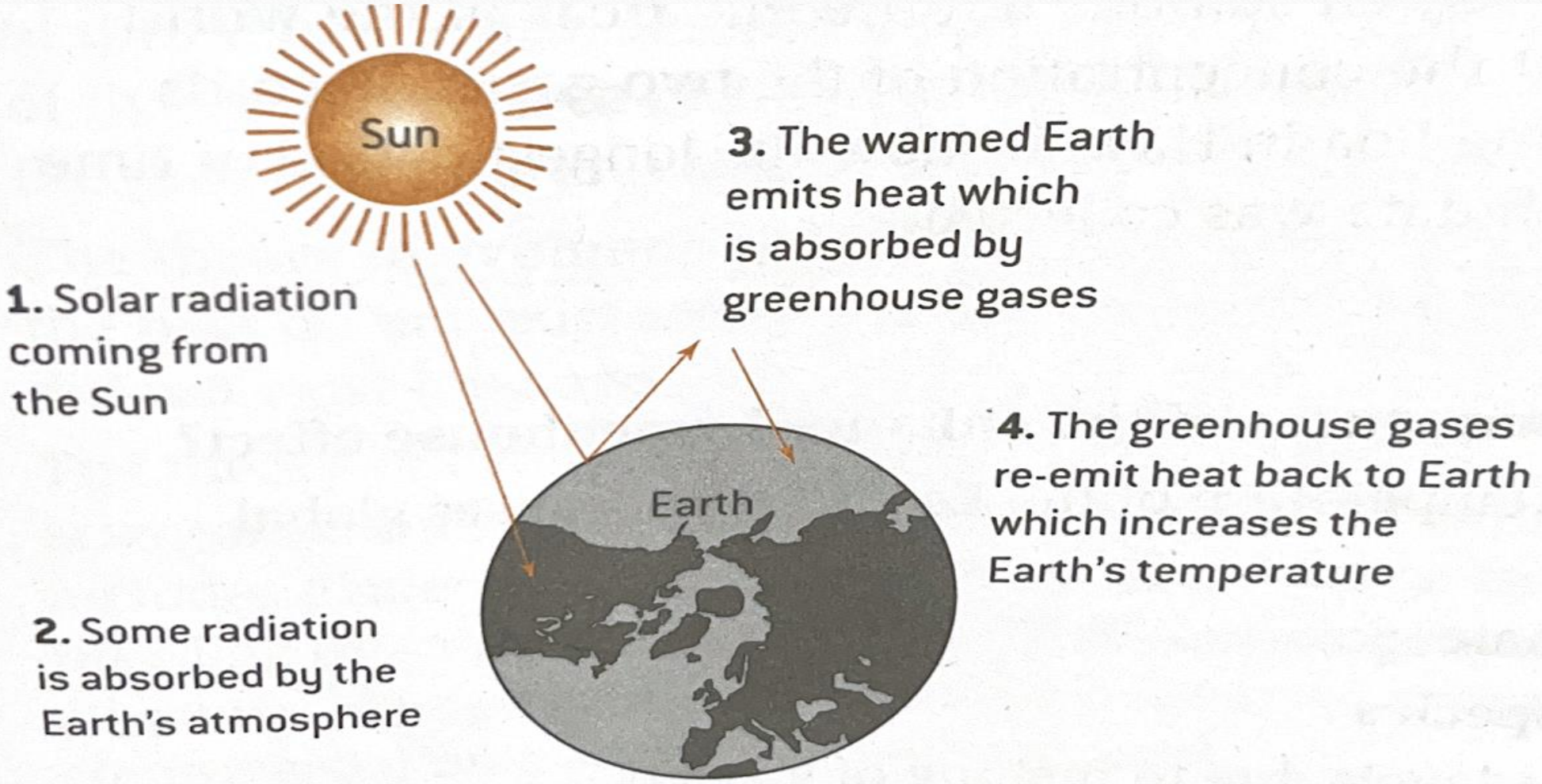

Figure 11. The greenhouse effect

The Sun's radiation along with the greenhouse gases is the cause of the greenhouse effect:

1. The radiation travels through the atmosphere to warm the surface of the Earth.
2. The warmed Earth then emits heat as infrared radiation.
3. The greenhouses gases in the atmosphere absorb the infrared radiation and the atmosphere heats up.
4. The heated atmosphere then re-emits heat back to Earth.

This cycle of heating and reheating is the greenhouse effect, and is necessary to maintain the average mean temperature on Earth. Changes in the levels of greenhouse gases result in changes to the Earth's temperature.

A rise in the concentration of greenhouse gases in the atmosphere results in an increase of the greenhouse effect, increasing the Earth's temperature
further.

What causes the enhanced greenhouse effect?

The enhanced greenhouse effect is caused by human activities that result in an increased concentration of greenhouse gases in the atmosphere. Such activities include:

- Increased carbon dioxide production due to the burning of fossil fuels and cutting down trees (deforestation)
- Increased methane production due to the leakage of methane from natural gas systems and the raising of livestock. Methane is also produced by anaerobic respiration of methanogenic archaea.

Methane is then oxidized to carbon dioxide and water in the atmosphere

- Increased production of nitrogen oxides due to industrial processes.

What are the consequences of the enhanced greenhouse effect?

- Increasing the temperature of the Earth, which causes global warming
- Change in climate
- Extinction of species
- Increase in sea levels due to melting of glaciers.

https://www.youtube.com/watch?v=jAa58N4Jlos climate change 1

https://www.youtube.com/watch?v=Ok8rMT2KCy0 climate change 2

https://www.youtube.com/watch?v=SN5-DnOHQmE green house