

B2 Greenhouse effect in a drinking cup – A model for illustrating climate change

5 Questions

- a) What influence do the so-called greenhouse gases (for example, water vapor as humidity or the fine droplets of water in clouds, CO₂, methane, and nitrous oxides) have on the emission of the solar energy absorbed by the Earth back into space in the form of long-wave infrared radiation?

Answer: The relatively short-wave light of sunlight is only partially reflected or absorbed by the atmosphere. Most of the light hits the Earth's surface and warms it. The Earth's surface re-emits this energy in the long-wave range. (The lower the temperature of a body is, the longer the wavelengths of the radiation emitted by the body.) The materials used in the experiment have the property of absorbing long-wave radiation in the far infrared range. This is precisely the range of wavelength in which the Earth's warmed surface reradiates its energy. This means that when the Earth's surface radiates the energy, this energy is absorbed, temporarily stored, and mostly reradiated back to the Earth's surface by the molecules of the substances contained in the atmosphere. The more of these "greenhouse gases" that are contained in the atmosphere, the more that the Earth's surface and the layers of air close to the ground heat up; the climate becomes warmer.

- b) What are the differences between natural influences and influences caused by humans (anthropogenic influences)?

Answer: The content of greenhouse gases in the atmosphere attributable to natural sources (primarily CO₂) resulted in the previous average Earth temperature of approx. 15 °C. Human culture adapted to this temperature relatively well. Due to the increasing human production of greenhouse gases, which has risen sharply especially in the last 100 years, the average temperature has already increased by 0.6 °C and, if you believe the experts, it will increase by approx. 3 °C in the coming decades. This will result in an increase in floods, droughts, and storms, which will make human life more difficult. The most important greenhouse gases produced by people are carbon dioxide (CO₂) from the burning of fossil fuels and clearing of rainforests, methane (CH₄) from cattle farming and rice cultivation, and nitrous oxide ("laughing gas," N₂O) from manure and nitrogen fertilizers.