GREEN HOUSE EFFECT

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LECTURE

CHEM-431

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Introduction

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Greenhouse (also called a Glasshouse) is a building in which plants are grown.These structures range in size from small sheds to very large bulidings.A miniature greenhouse is known as a cold frame

- Greenhouse a building made mainly of glass, with heat & humidity regulated for growing plants. The atmosphere acts like a glass in a greenhouse.
- Atmosphere, like glass absorbs some of the long wave radiation emitted by earth and radiates the energy back to earth. In this way temperature of earth is maintained.
- The atmosphere surrounding the earth in this manner plays a vital role in maintaining an even temperature on the earth's surface.
- A greenhouse is that body which allows the short wavelength incoming solar radiation to come in, but does not allow the long wave outgoing terrestrial infrared radiation to escape.

Pre-History of Green House

- The idea of growing plants in environmentally controlled areas has existed since Roman times.The Roman gardeners used artificial methods(similar to the green house system) of growing to have it available for his table every day of the year.

  Giant Green houses in the Netherlands

- But the first modern green houses were built in Italy in the 13th century.

Green House Effect

Greenhouse effect, a warming of Earth's surface and troposphere (the lowest layer of the atmosphere) caused by the presence of water vapour, carbon dioxide, methane, and certain other gases in the air. Of those gases, known as greenhouse gases, water vapour has the largest effect.

The sun radiates solar energy on earth. The larger part of this energy (45%) is radiated back into space. Greenhouse gases in the atmosphere contribute to global warming by adsorption and reflection of atmospheric and solar energy. This natural phenomenon is what we call the greenhouse effect. It is agreed that the greenhouse effect is correlated with global temperature change. If greenhouse gases would not exist earthly temperatures would be below –18 ^{o}C.

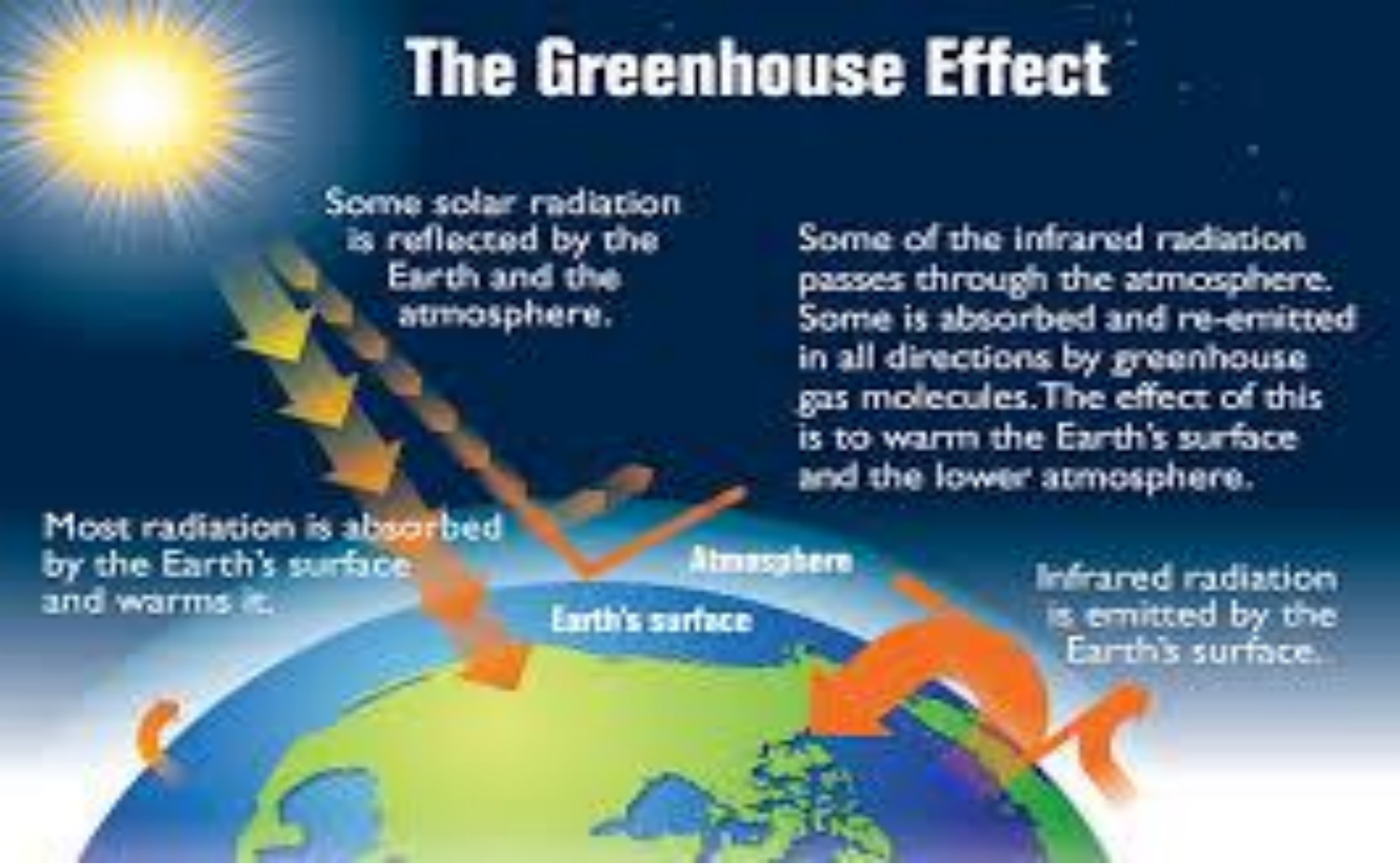
Contd…….

- Earth's atmosphere bottles up the energy of the sun, & is said to act like a greenhouse.
- Carbon-dioxide present in the atmosphere acts like glass windows.
- Carbon-dioxide and water vapours in the atmosphere transmit short wavelength solar radiation but reflect the longer wavelength heat radiation from warmed surface of the earth.

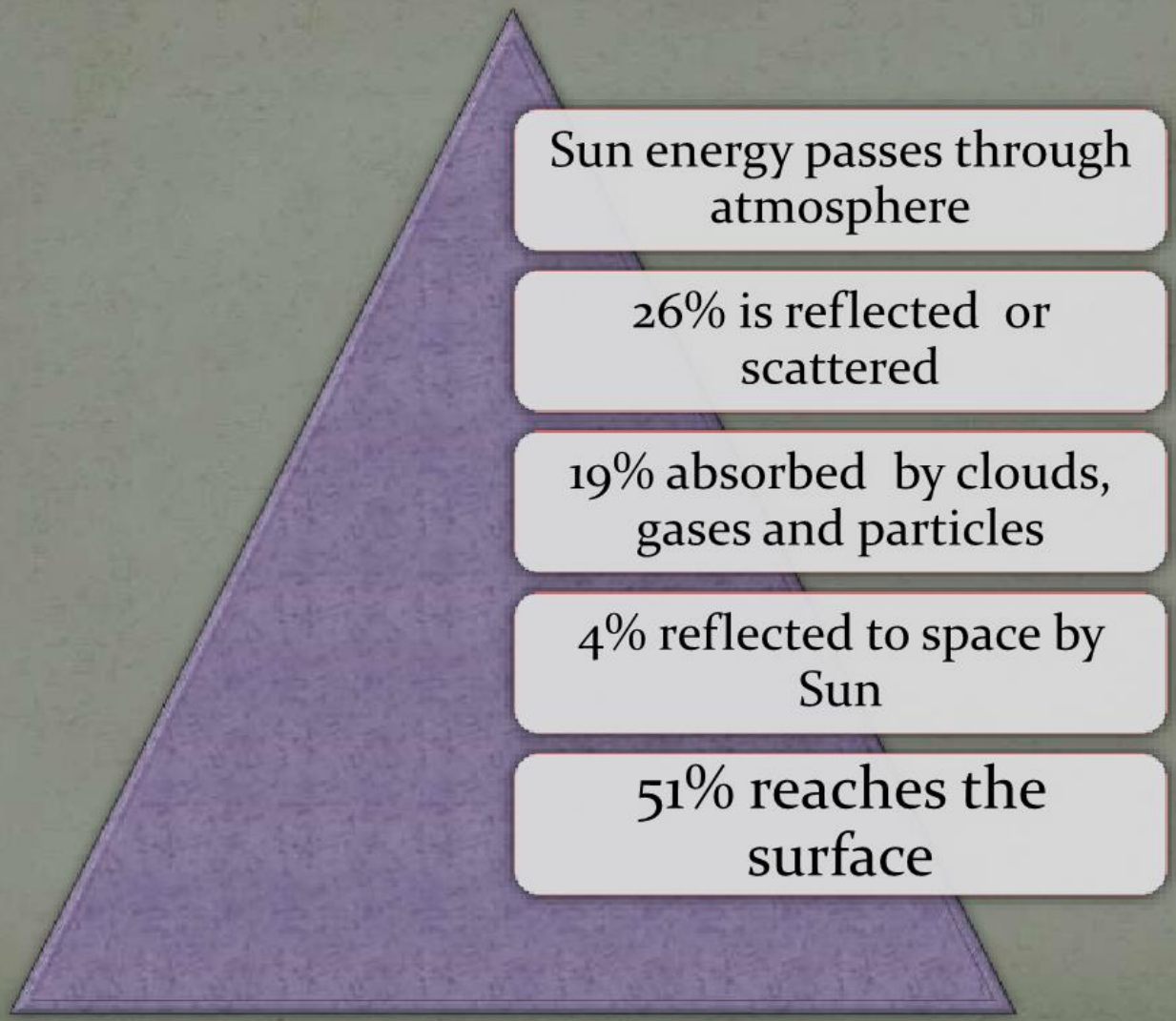
Contd…..

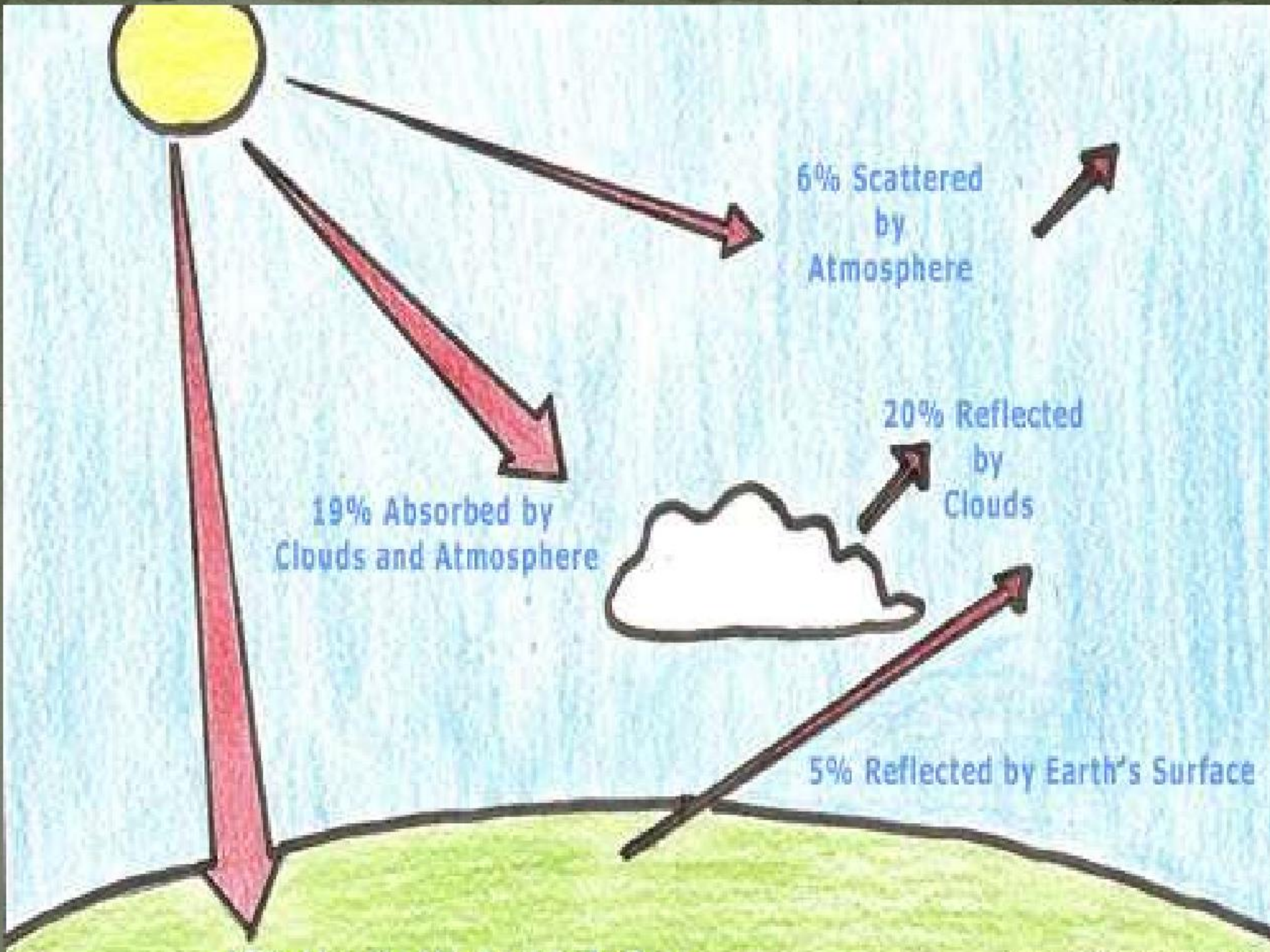
- Carbon-dioxide molecules are transparent to sunlight but not but not to the heat radiation. They trap the re-enforce the solar heat.

- The Greenhouse effect defined as the progressive warming up of the earth's surface due to blanketing effect of manmade CO2 in the atmosphere


The Greenhouse Effect
Some solar radiation is reflected by the Earth and the atmosphere.
Some of the infrared radiation passes through the atmosphere. Some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.
Most radiation is absorbed by the Earth's surface and warms it.
Atmosphere
Earth's surface
Infrared radiation is emitted by the Earth's surface.

Process of the Green House Effect




6% Scattered by Atmosphere
20% Reflected by Clouds
19% Absorbed by Clouds and Atmosphere
5% Reflected by Earth's Surface

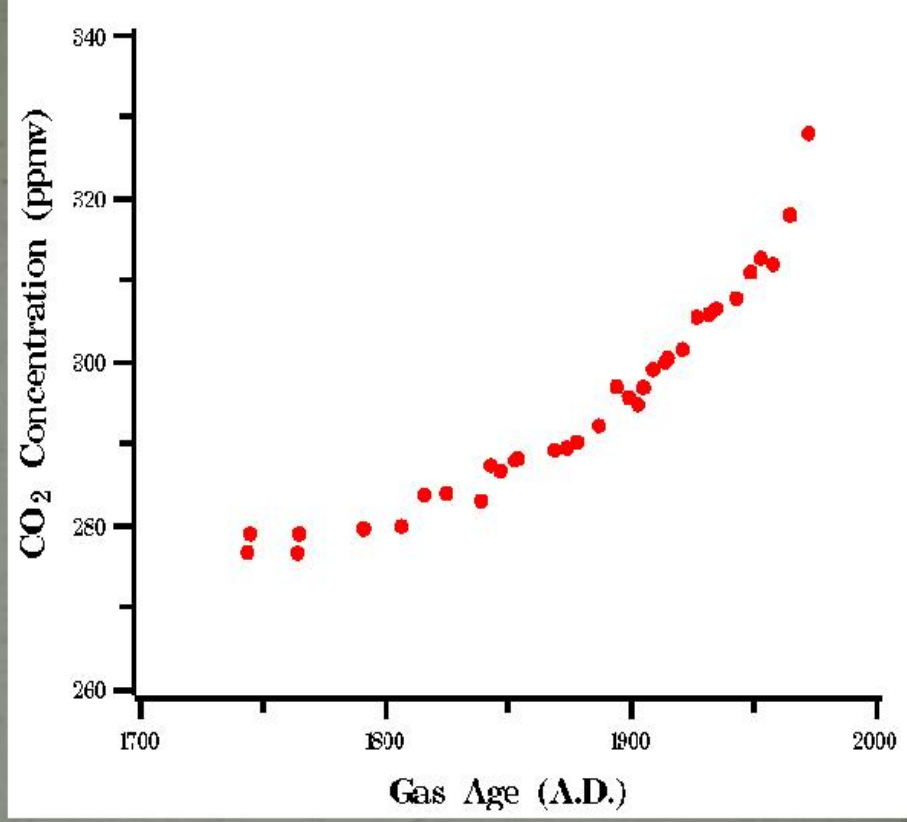
Causes of Green House Effect

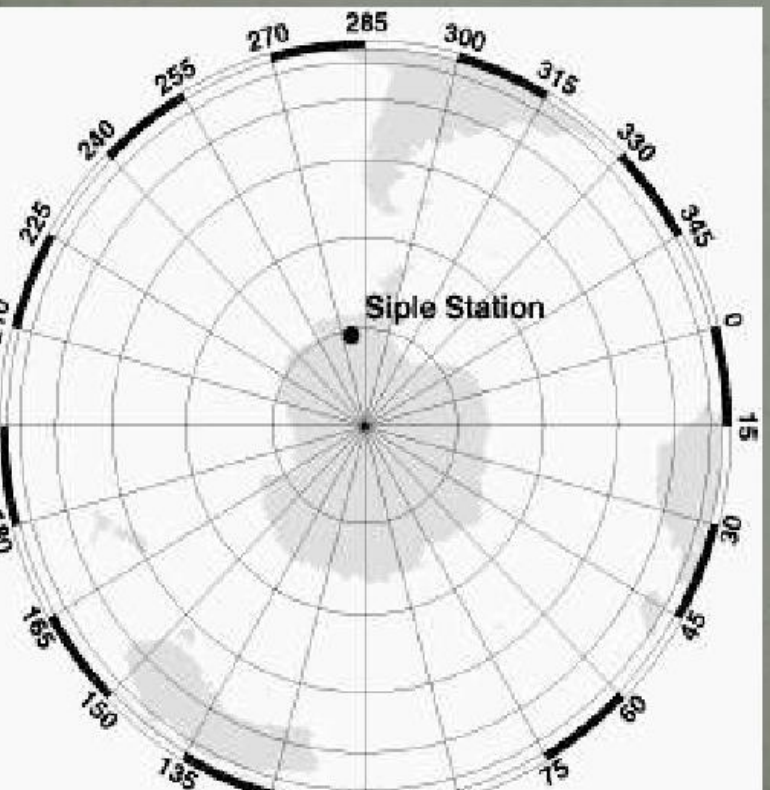
- Deforestation
- Burning of fossils
- Population Growth
- Electrical Appliances
- Landfills and Industrial wastes
- Farming

CO_2 plays a Role

- Most scientists agree that co_2 plays a role in warming the earth through the green house effect.
- However, the somewhat controversial hypothesis is that increased(anthropogenic?) Co_2 in the atmospheremay enhance the warming of our planet.

The figure shows that the concentration of CO_2 in the atmosphere has been steadily increasing since the mid-1700's. This corresponds with the Industrial Revolution and the increased use of fossil fuels (especially coal).





These data were obtained from trapped air bubbles in ice layers from Simple Station (Antarctica)

Selective Absorbers/Heat trapping gases

- The four major greenhouse gases, which causes adverse effects are carbon-dioxide, methane, nitrous oxide and chlorofluorocarbon.
- For the earth, **water vapour** is the most important of all greenhouse gases.
- Water vapour absorbs IR in the region 2.5 to 3.5 µm 5 to 7 µm, as well as over a broad range above 13 µm.
- **CARBON-DIOXIDE** □ It is a major contributor to greenhouse effect because it absorbs IR in the range of 14 to 19 µm, and completely blocks the radiation flux between 15 to 16 µm. The burning of fossil fuels such as coal, tar, and natural gases release CO2 Burning of wood, waste materials and tress release CO2.

Continued…

- **Methane** absorb radiation in the wavelength ranges from 3 to 4 µm and 7 – 8.4 µm (in the window region). Methane gas increases stratospheric water vapour on oxidation and the rise in water vapour is more important source of greenhouse effect than the direct effect of methane gas.
- **NITROUS OXIDE** Nitrous oxide absorb IR radiation in the ranges 3 to 5 µm and 7.5 to 9 µm (infrared window).
- The major sources of nitrous oxide are microbial denitrification, conversion of nitrate to nitrous oxide soils, lake and oceans.
- Methane gas is 24 times & nitrous oxide is around 320 times aggressive greenhouse gas than carbon dioxide.

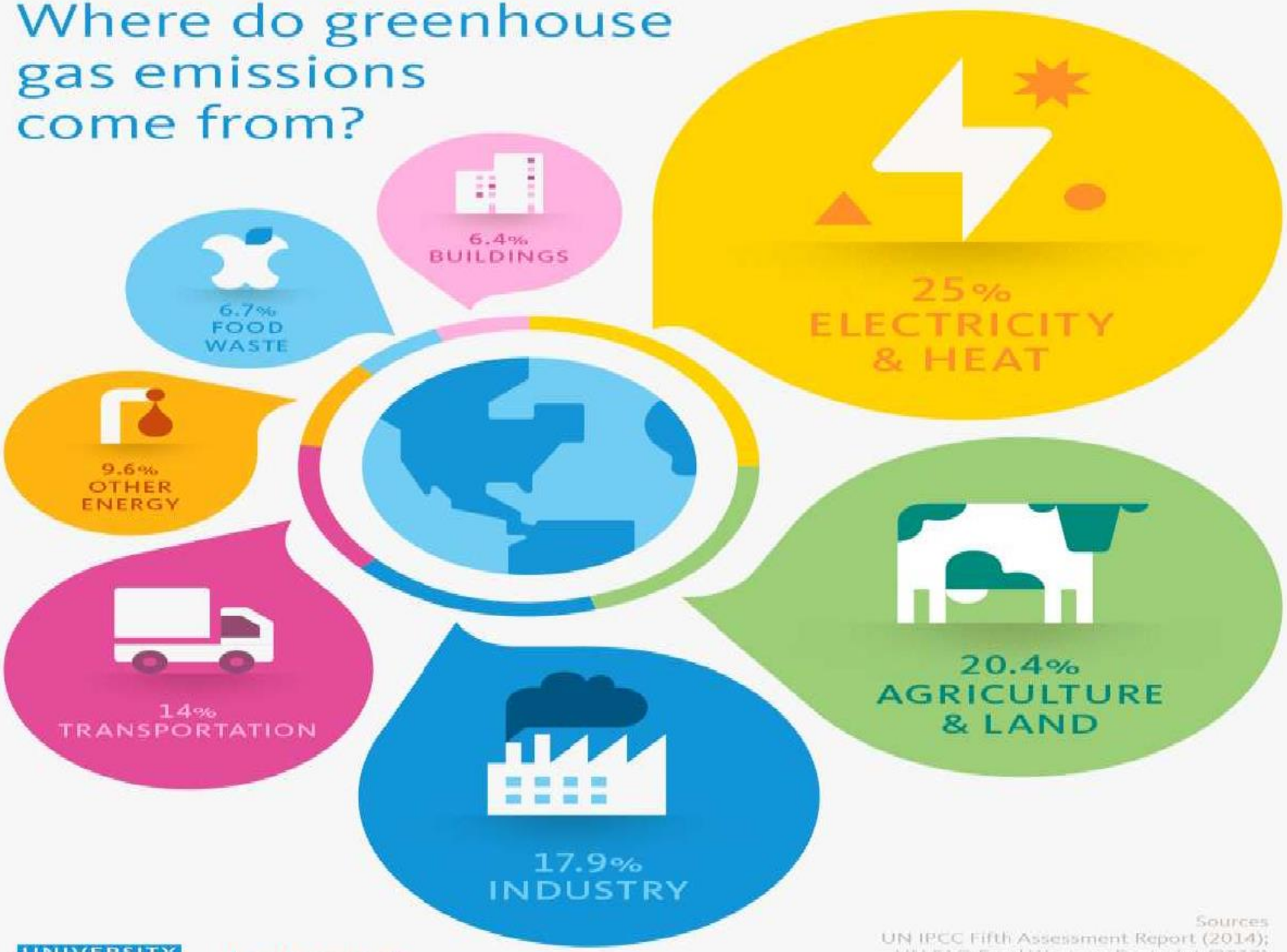
CHLOROFLUROCARBONS (CFCS)

- CFCs absorb in the range 8 to 12 µm with each CFC having specific absorption bands in the region.
- CFCs are released into the atmosphere during the operations and maintenances of appliances and equipments using these molecules as coolants and propellants.

HYDROCHLOROFLUROCARBONS (HCFCS)

- The HCFCs also attenuate radiation within the same range, but their in the troposphere is much shorter than that of the CFCs.
- The rate of increase of CFCs has declined by a factor greater than two in the past decade, but HCFC concentrations are increasing at a much higher rate.

Where do greenhouse gas emissions come from?



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Learn more at
climate.universityofcalifornia.edu

Sources
UN IPCC Fifth Assessment Report (2014);
UN FAO Food Wastage Footprint (2013)

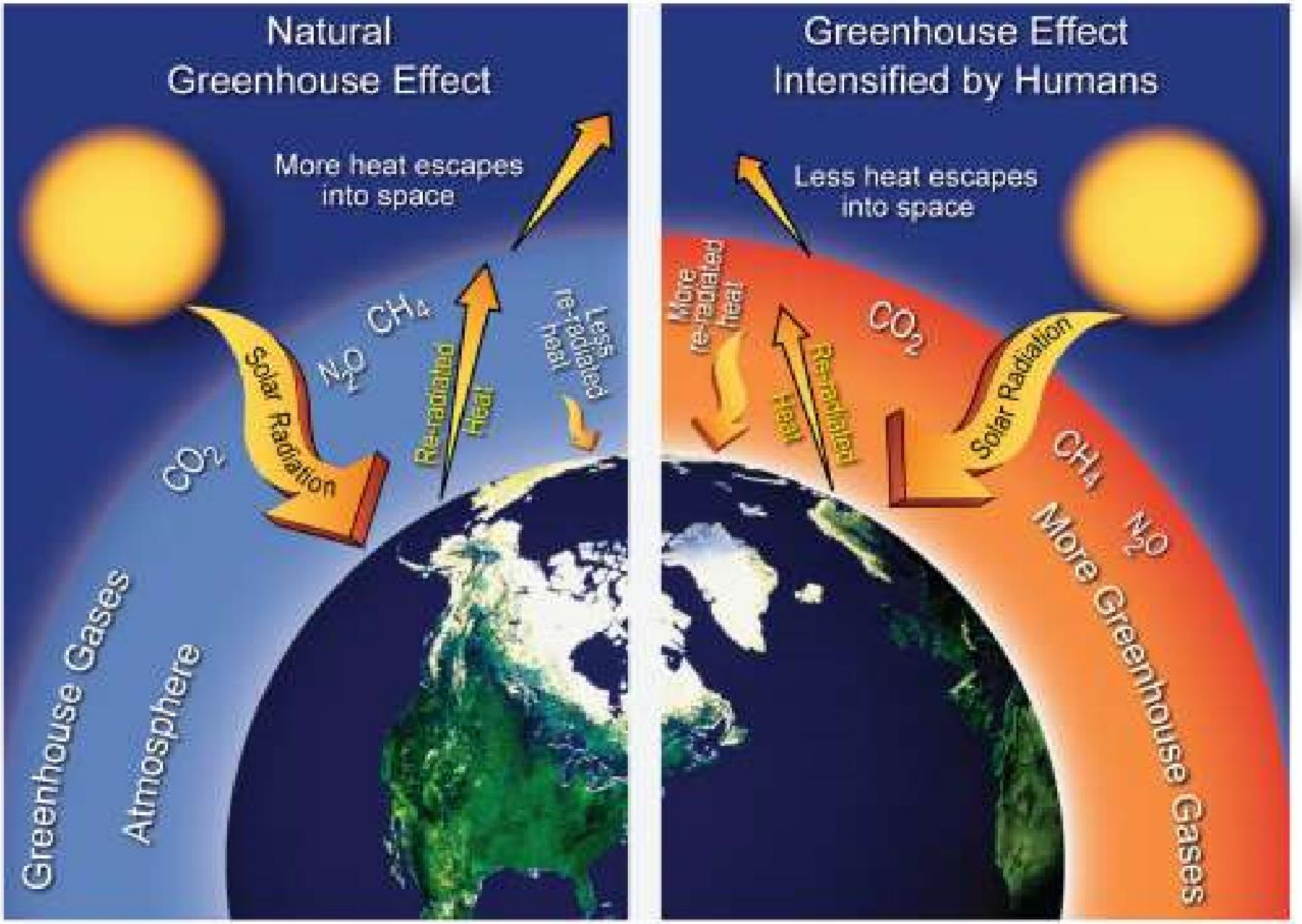
Percent of global greenhouse gas emissions.

Green House Effect & Climate Change

The greenhouse effect will bring about the following important changes in the climate of the Earth.

- As a result of rise in temperature of the earth due to greenhouse effect the oceans get warm up and sea level would rise flooding low lying regions.
- In temperate regions, the winter will be shorter and warmer and the summer will be longer and hotter.
- There will be enormous increase in rainfall but the problems of desertification, drought and soil erosion will further worsen.
- The tropics may become wetter and the subtropics, which are already dry, are expected to be drier.
- The plants & animals will also be affected resulting in the disruption of the whole ecosystem.

Human Influence on the Greenhouse Effect



Results of Green House Effect

- Global Warming
- Sea Level rise
- Economic impact
- Effect on aquatic system
- Health
- Effect on hydrological cycles
- Ozone depletion
- Effect on Biodiversity