Kemiska bindningar av atomer (chemical bonds).

https://www.thefreedictionary.com/chemical+bond
http://www.dictionary.com/browse/chemical--bond
http://forecast.uchicago.edu/Projects/full_spectrum.html

http://understandingtheforecast.org/Projects/infrared_spectrum.html

https://en.wikipedia.org/wiki/Greenhouse_effect
Växthusgaser.
Om jorden saknade växthusgaser, skulle den vara genomfrusen,
med en medeltemperatur av -18 grC.

Greenhouse gases—including most diatomic gases with two different atoms (such as carbon monoxide, CO) and all gases with three or more atoms—are able to absorb and emit infrared radiation.
Alla gasmolekyler av två eller fler olika atomer kan ta upp och avge infraröd strålning.

Koldioxid och vattenånga är växthusgaser.
En något lättare förklaring från Sveriges metrologiska institut.

Gases, Vibrations, and Light
Most of the mass of an atom is in its nucleus, which resembles conceptually a massive sun at the center of a solar system. Two nuclei of two different atoms always repel each other because of their positive charges. Electrons float in ghostly quantum mechanical probability clouds, called orbitals, around the nucleus. For some combinations of atoms, the electrons fall into orbitals that are shared between the two nuclei. These electrons are the glue that holds together a chemical bond between the atoms.
A chemical bond is like a spring in that the two nuclei on either end of the bond have some freedom to move closer or farther apart. There is an optimum, lowest-energy distance for the nuclei to be from each other. If they are any closer, the positive nuclei will start to repel each other. Farther from each other, you get less energy gain from sharing the electrons. A bond vibrates when the distance between the nuclei oscillates between the nuclei being too close together, then too far apart. This is called a stretching vibration.
An atom may participate in more than one chemical bond. The bonds, and extra electrons that the central atom holds on to, arrange themselves around the atom to find their positions and angles of least energy. Here again there is some flexibility in the angle of the bond, which leads to a bending vibration.

Chemical bonds vibrate at particular frequencies.

Molecular vibrations in gas molecules are like vibrations of a piano string in that they tend to be at specific “ringing” frequencies. For weights and springs, the vibrational frequencies depend on two things: the mass of the weights and the springiness of the spring holding them together. Imagine the weights moving together, nearing the optimal distance but with enough momentum to carry them closer than they would like to be, continuing the oscillation. Heavier weights would have enough inertia to keep moving closer for a longer time than would a lighter pair of weights, so the frequency of the vibration will be slower with heavy weights. If the spring is very stiff, it will reverse the velocity of a vibration more quickly, and the frequency of the oscillation will be higher. Vibrations in chemical bonds depend on the mass of the nuclei and on the energy penalty for stretching or bending the bond, which determines the springiness of the chemical bond.

Most forms of liquid and solid molecules are not so “choosy” about frequency of IR light that they can absorb or emit, because the molecules interact with each other so much that more or less all frequencies of IR light can be absorbed and emitted. Liquids and solids are pretty good blackbodies, in other words. Gases however only absorb and emit specific frequencies of IR light, meaning that they are generally not very good blackbodies.

In fact, most of the gases in the atmosphere do not absorb or emit IR light at all, because vibrations in their bonds do not create an imbalance in the electrical field. Both O_2 and N_2, the most abundant gases in the atmosphere, are symmetric molecules, made of two identical atoms whose electric fields just cancel each other out. Neither atom can hold the electrons any more tightly than the other, so there is no difference between the electrical field on one side of the molecule versus the other. The symmetry is unbroken when you stretch or compress the bond. Symmetrical molecules with only two atoms are never greenhouse gases.

To create or absorb infrared light, the molecule must be electrically lopsided, at least in passing.

If the symmetry is broken by having different types of atoms on each side, like carbon monoxide (CO) or nitrogen oxide (NO), the molecules begin to have some greenhouse properties. Both these types of molecules are very reactive and are not found in enough abundance in the atmosphere to lead to much greenhouse effect, but these are good stepping-stone molecules to think about before moving to more complicated atoms like CO_2. Because the atoms have different charges in their nuclei, their chemistry is different, including how hard they pull on those electrons in their shared chemical bond. One side of the molecule will probably have a slight positive charge, and the other will be slightly negative. This charge imbalance is called a dipole moment. When the bond vibrates, it changes the steepness of the transition from positive to negative, which drives the electric field. Changing the electric field is how greenhouse gases interact with IR light. One could even oscillate the electric field by simply rotating the molecule.

Molecules with three or more atoms must have more than one chemical bond because a single bond never connects more or less than two atoms. Imagine a set of three weights connected in a line with two springs. When this contraption is jiggled, its bonds bend and stretch together, as an integrated system, rather than each bond simply vibrating according to its own springiness and weight, independent of the other. The whole thing rings like a bell, and like a complex bell with a rich tone, there are multiple oscillations with different frequencies all going on at once.

The CO_2 molecule is shaped in a straight line with carbon in the middle (Figure 4-1).

Oxygen tends to pull on electrons more tightly than carbon does, but the oxygen atom on one side pulls the electrons just as tightly as the other oxygen on the other side. The molecule has no permanent electrical field asymmetry (dipole moment). If all you do to the molecule is rotate or stretch it, you have not broken the symmetry and you will have no effect on the electric field.

The CO_2 bending vibration mode is the important one for climate.