

[TP] Which do you think is true about the atmosphere?

13% 1. Human activity has added greenhouse gases
13% 2. Reducing water content would lower temperature
13% 3. Reducing greenhouse gas content would lower temperature
13% 4. Temperature will continue to rise
13% 5. 2 and 3
13% 6. 1, 2, and 3
13% 7. 2, 3, and 4
13% 8. 1, 2, 3, and 4

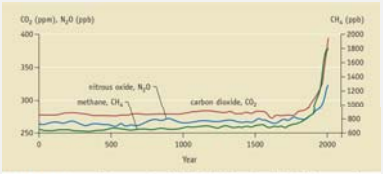


FIGURE 4.4 Atmospheric concentration of CH_4 (ppb), CO_2 (ppm), and N_2O (ppb) gases over the past 2000 years.

Response Counter 10

Lecture 10 CH101 A2 (MWF 11:15 am)

Wednesday, September 26, 2018

For today ...
- Ch4: (secs 1, 3, and 4 only): Atmospheric warming
- Think about It e4.4: Collisional heating: https://goo.gl/zgTkGr
- Think about It e4.5: IR windows: https://goo.gl/4yfQQG

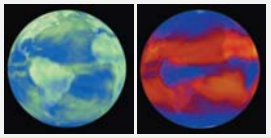
Next lecture: Begin ch5: Chemical reaction, chemical equations

Representative questions: 5.4, 5.7, 5.11, 5.17, 5.37, 5.43, 5.47

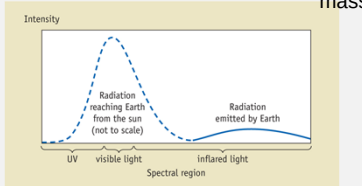
How the atmosphere warms

Earth's radiation balance

Atmosphere **transparent** to **visible** light



IR light **emitted** from heated land masses



e4.4: Heating due to Greenhouse Gases

Think about It e4.4: https://goo.gl/zgTkGr

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e4.5: IR spectral windows

e4.5: https://goo.gl/4yfQQG

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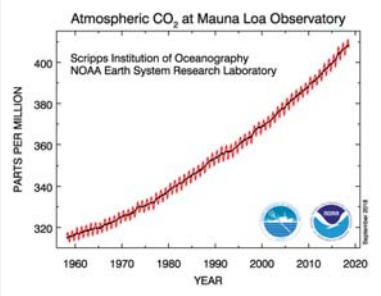
Atmospheric CO_2 at Mauna Loa Observatory



1958: 315 ppm → 2018: 409 ppm

Increase = **94 ppm**, 94/315 x 100% = **30%**

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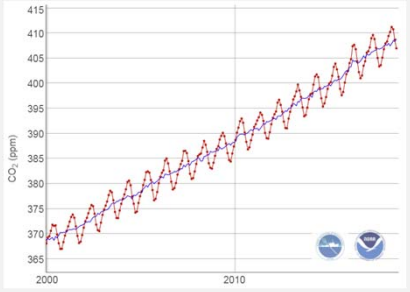
Atmospheric CO_2 at Mauna Loa Observatory



2000: 368 ppm → 2018: 409 ppm

Increase = **41 ppm**, 41/368 x 100% = **11%**

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2000 → 2018: 41 ppm additional CO_2

41 ppm = 41 μmol CO_2/(mol air)

Atmosphere is 5.2×10^{18} kg, 29 g/mol (~ 80% N_2, 20% O_2)

How many kg of CO_2 added to atmosphere since 2000?

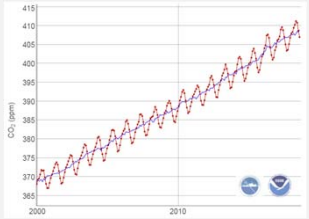
mol of air = 1.8×10^{20} mol

mol of CO_2 = $41 \times 10^{-6} \times$ mol air

mass of CO_2 = …

mol CO_2 x 0.044 kg/mol = …

3.2×10^{14} kg



[Quiz] Which is true?

25% 1. Only methane and other carbon containing molecules contribute to atmospheric heating

25% 2. Water molecules contribute to atmospheric heating

25% 3. Absorption of IR light by N_2 and O_2 causes atmospheric heating

25% 4. Only 2 and 3 are true

Isotopic analysis of atmospheric CO_2

Plants preferentially convert $^{12}CO_2$ to organic matter.

Fossil fuels originate from organic matter.

Combustion of fossil fuels convert their carbon to CO_2.

Isotopic analysis of atmospheric CO_2

How have the relative amounts of ^{12}C and ^{13}C in atmospheric CO_2 changed?