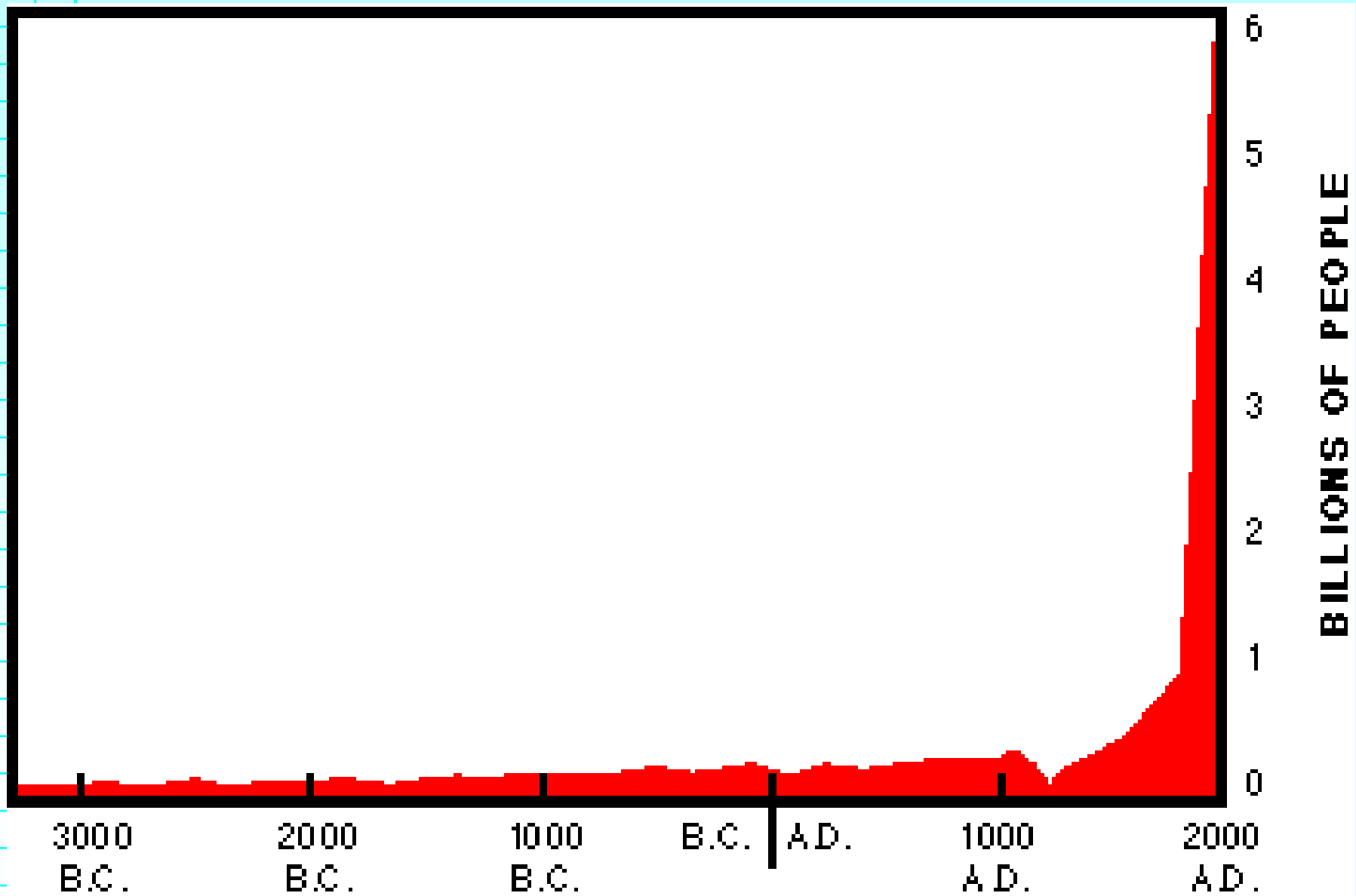
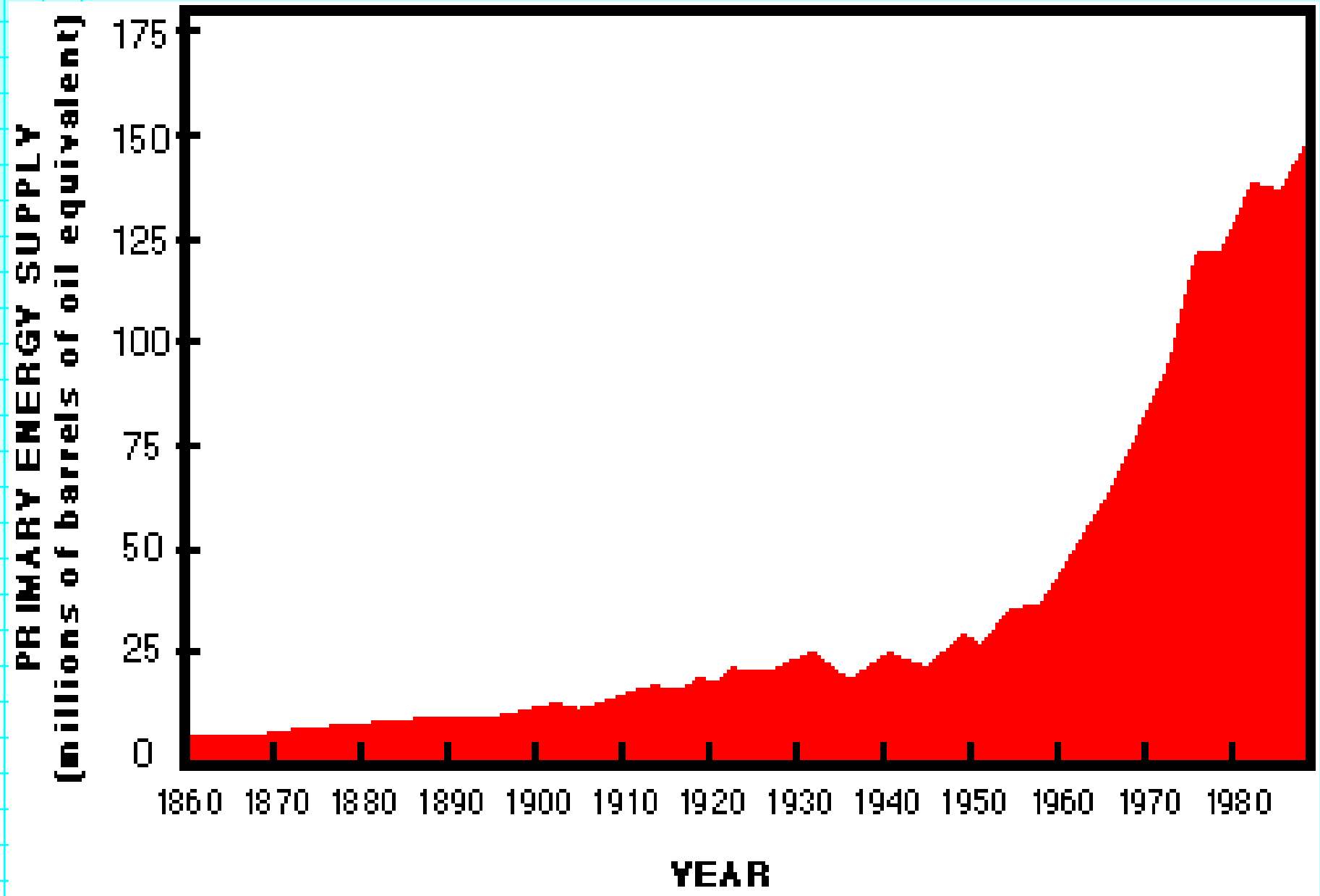


Chemistry and the Environment

- The air we breathe
- The ozone layer
- Climate change
- Energy - fossil fuels, nuclear, hydrogen
- Water - water quality, acid rain
- Polymers



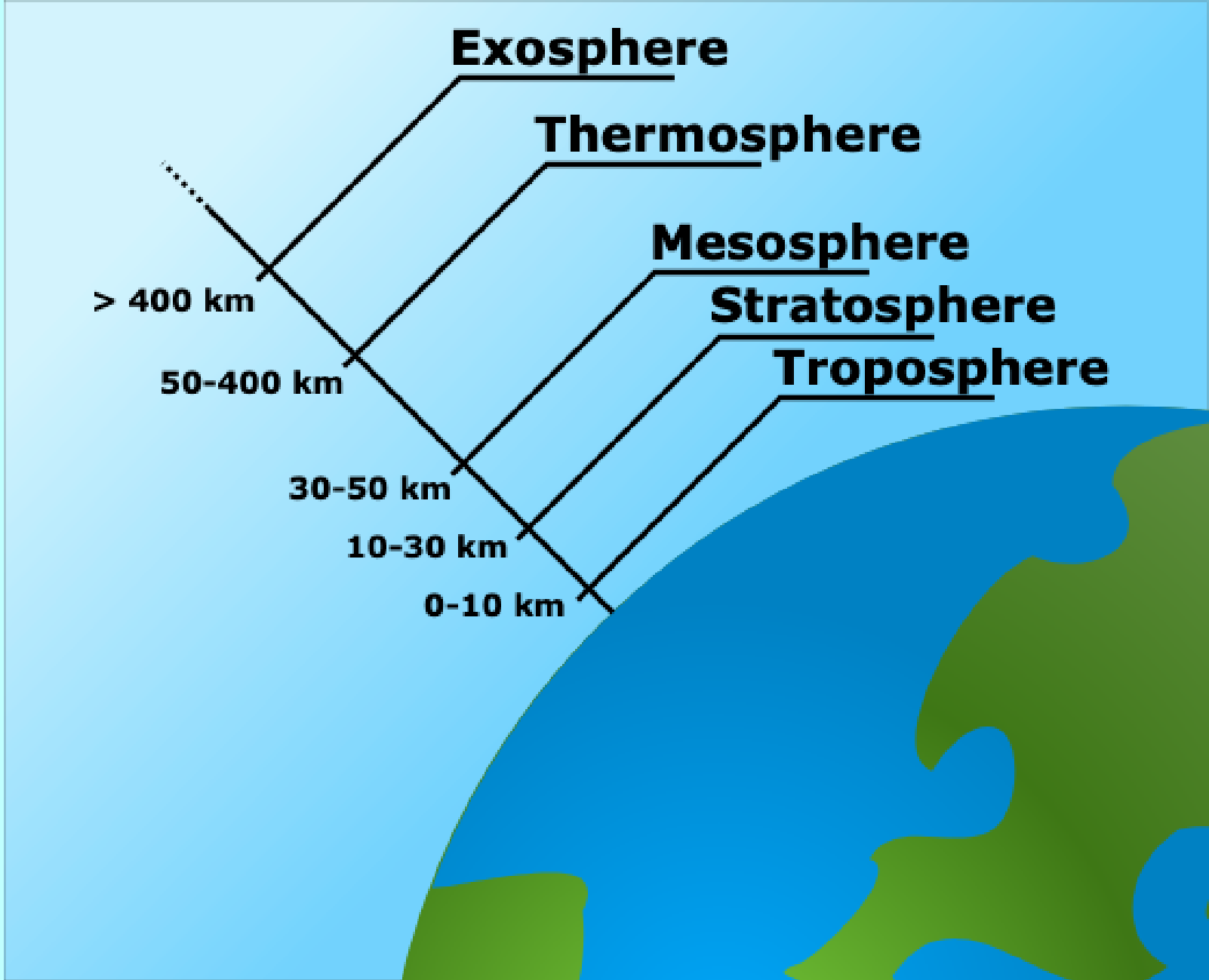


Air

What we should be breathing

vs.

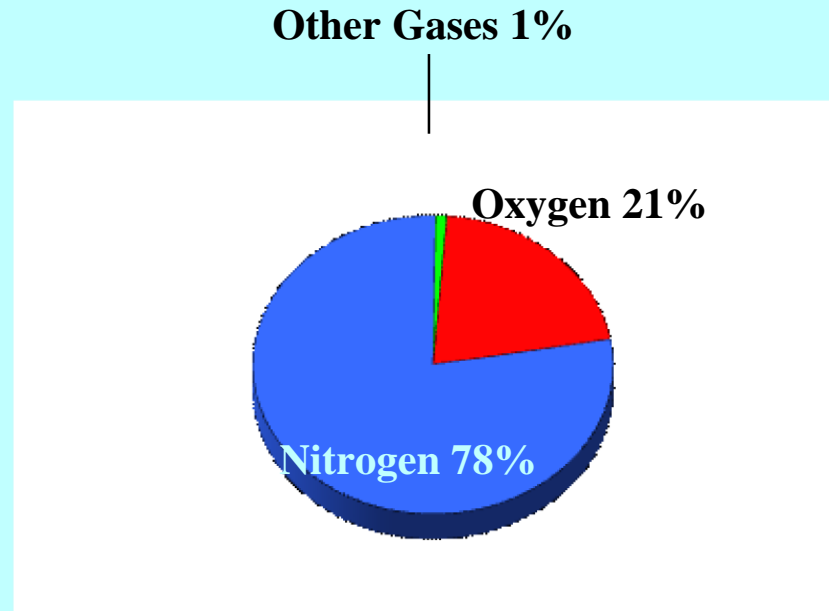
What we are breathing



Air

- mostly nitrogen, oxygen, argon, carbon dioxide, water.
- gaseous water vapor: 0 (trace) to 4 %

The composition of dry air



Major common air pollutants (small parts of the 1%)

- Carbon monoxide (oxygen delivery)
- Ozone (respiratory)
- Sulfur oxides (respiratory)
- Nitrogen oxides (respiratory)

Atoms and Molecules

- we will normally deal with them in terms of their chemical symbol
- examples:
 - Carbon = C
 - Carbon Monoxide = CO
 - Carbon Dioxide = CO₂

chemistry

- Chemical Reactions

reactants \longrightarrow products

- Law of Conservation of Matter

atoms on left = atoms on right

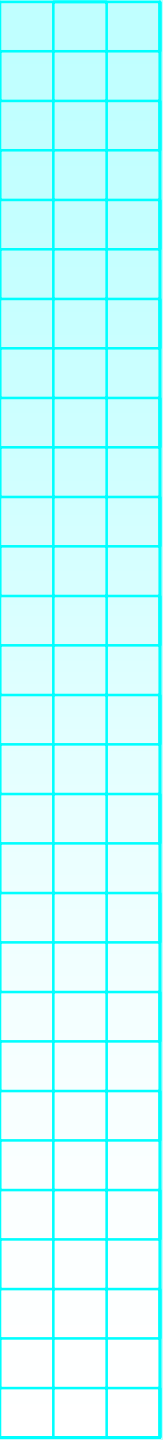
Coal = carbon, trace sulfur

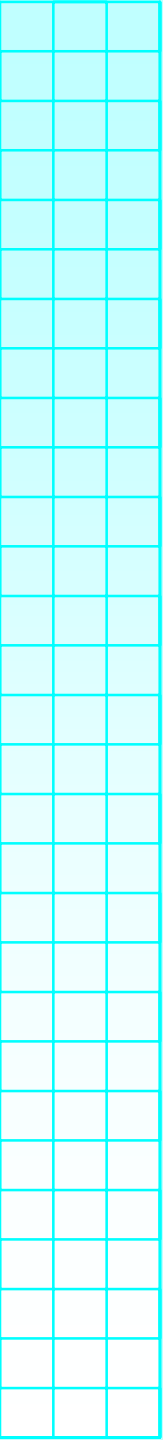


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Major common air pollutants (components of the 1%)

- Carbon Monoxide (oxygen delivery)
- Ozone (respiratory)
- Sulfur Oxides (respiratory)
- Nitrogen Oxides (respiratory)

- 
- What is the balanced chemical reaction for the combustion of methane (CH_4)?

- 
- Write the balanced chemical reactions for the combustion of ethane (C_2H_6), ethanol (C_2H_5OH), and octane (C_8H_{18}).

Catalytic Converter

Exhaust emission device that facilitates the conversion of toxic pollutants to less toxic substances.

Catalyst

- a substance that increases the rate of a chemical reaction, but does not itself undergo permanent change.

Concentration Terms

Parts per hundred (percent)

1 g of NaCl as part of 100 g of solution is a 1% NaCl solution

$$1 \text{ in } 100 = 1 \text{ in } 1 \times 10^2$$

Parts per million (ppm)

1 part solute in 1,000,000 parts solvent = 1 in 1×10^6

Parts per billion (ppb)

1 part solute in 1,000,000,000 parts solvent = 1 in 1×10^9

Ex: The maximum contaminant level [MCL] for dioxin in drinking water is set at 3×10^{-8} ppm. A sample of drinking water is found to contain 2×10^{-4} ppb. Is the sample of water safe to drink?

The 1 %

- For example, present carbon dioxide concentrations in air ~ 0.040 %

The 1 %

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- Q - if the indoor CO₂ concentration in a building is measured at 4002 ppm, would this be considered normal?

The 1 %

- For example, present carbon dioxide concentrations in air ~ 0.040 %
- Q - if the indoor CO₂ concentration in a building is measured at 4002 ppm, would this be considered normal?
 - ie. What is the 0.040 % concentration expressed as ppm?

The 1 %

- For example, carbon dioxide = 0.040 % or 400 ppm.

So, the measurement of 4002 ppm is 10 times the normal tropospheric [CO₂].
(most likely, more outside air would need to be introduced to the building)

- The permissible upper limit for concern for ground level carbon monoxide is given as 0.009 ppt. A researcher finds the level in Winnipeg one day to be measuring at 6 ppm. What is the measured value in ppt and is this permissible?
 - A. 0.06 ppt, this is not permissible
 - B. 0.06 ppt, this is permissible
 - C. 0.006 ppt, this is not permissible
 - D. 0.006 ppt, this is permissible
 - E. 0.0006 ppt, this not permissible

- The permissible upper limit for ground level ozone is 0.12 ppm. A researcher finds the level in Toronto one day to be measuring at 580 ppb. What is the measured value in ppm and is this of concern?
 - A. 58 ppm, this is of concern
 - B. 0.00058 ppm, this is of no concern
 - C. 0.58 ppm, this is of concern
 - D. 58 ppm, this is of no concern
 - E. 0.58 ppm, this is of no concern.