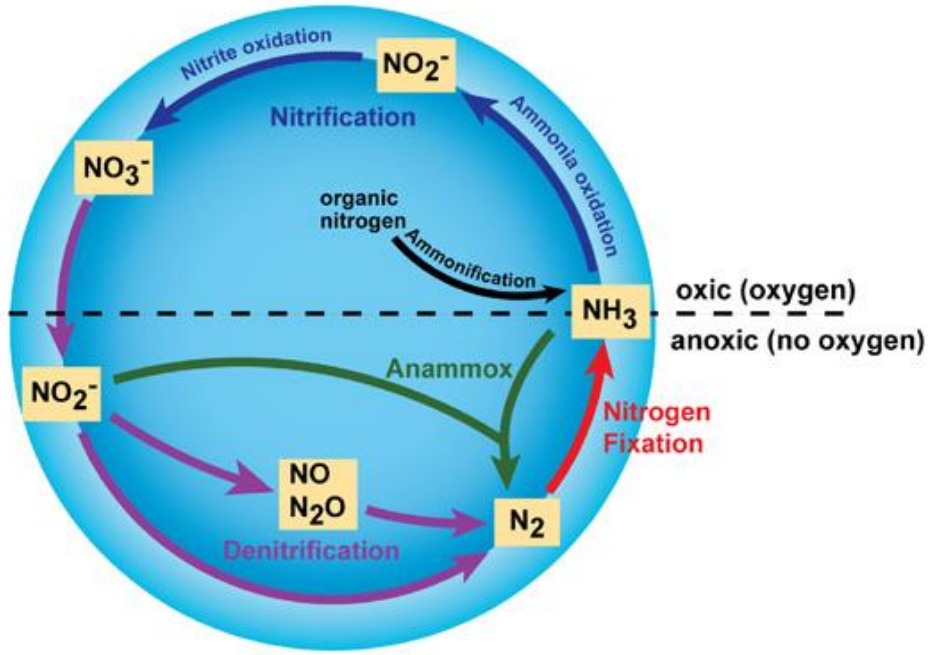
Nitrogen Oxides

What will be covered:

- Different forms of nitrogen oxide.
- How they're produced (and the reactions behind them)
- Environmental effects.
- What can be done to reduce them.

The Different Forms... (at least the ones you need to know, according to the textbook)

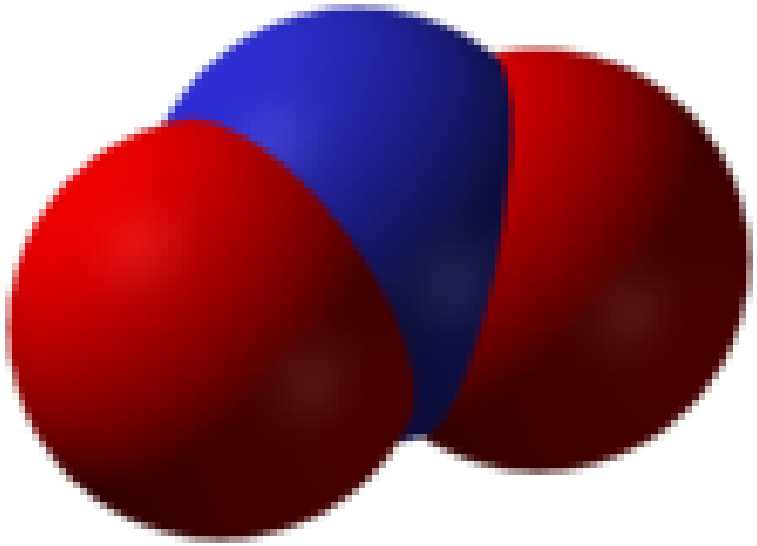


- NO
- NO2
- N2O

Nitrogen Oxide (NO)

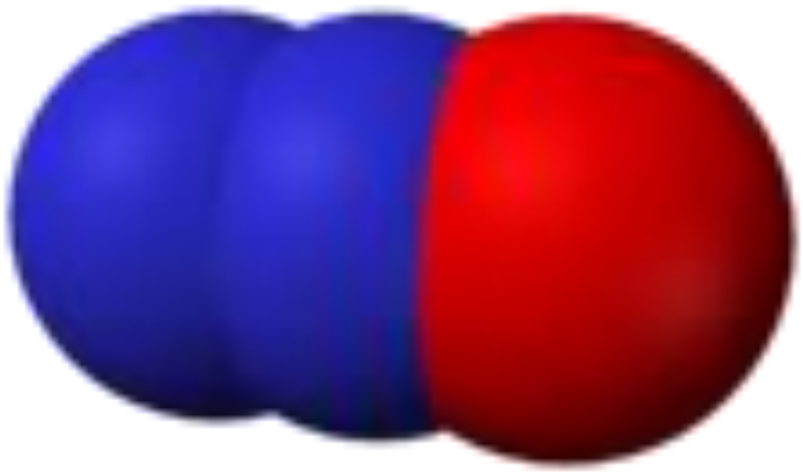
- NO is quite reactive but nevertheless quite stable when isolated.
- Colourless Gas, turns into brown NO_2 in the Air.
- Formed Via Combustion I.e. engines, lightning. Also formed in the soil by denitrifying Bacteria.
- Becomes part of photochemical smog (Primary Pollutant)

Nitrogen Dioxide (NO_2)



- NO_2 is quite reactive but nevertheless quite stable when isolated.
- Brown Gas (Toxic)
- Formed by the oxidation of NO in the air.
- Becomes part of photochemical smog (secondary pollutant)

Nitrous Oxide (N_2O)



- N_2O is stable and rather un-reactive at room temperature.
- Colourless gas.
- Formed in the soil by denitrifying bacteria.
- Reacts with Oxygen to form NO.
  $N_2O + O \Rightarrow 2NO$

How Are They Formed?

- In general terms, this...
- Nitrogen + Oxygen ⟶ Nitrogen Oxide

Immense Temperature (1000 degrees)

and Pressure

$N_2 (g) + O_2 (g) \longrightarrow 2NO_2 (g)$

- This reaction is from the air that enters the engine of the car during the combustion of hydrocarbons.
- As well as appearing out of the end of exhausts, lightning causes nitrogen and oxygen to react as well from the large amount of heat produced.

KAPOOW!

Nitrogen Oxide Formed

So What Do They Do?

- Oxides of Nitrogen cause many undesired effects on humans;

In Humans, once inhaled and in the lungs, they can cause a lot of damage to lung tissue – this is due to once in the lungs, NO_2 is converted into Nitric Acid (HNO_3) which cause toxic effects on the ciliated airway cells.

- Also Induces Methemoglobinemia

- Unburnt Hydrocarbons + Nitrogen Oxides + Presence of Sunlight=> Photochemical Smog.

How Can We Stop This Madness?

- Catalytic Converters
- The converter cause the weakened bonds of the nitrogen (and carbon) to break and form radicals. Rejoining to form N2 and CO2 from being adsorbed.
- $2NO(g) + 2CO(g) \longrightarrow N_2(g) + 2CO_2$
- In turn this creates more CO2.....woops!
- Lean Burn Engines
- Higher Air-Fuel ratio – combined with a acetylic converter, this helps lower NOx emissions, but will also increase CxHy emissions.....again not great!

Bibliography

- http://en.wikipedia.org/wiki/Nitrogen_oxide
- Chemistry Ideas Textbook
- Chemistry Storylines Textbook
- And George Found A Load Of Stuff, But Won't Tell Me Where He Found It.