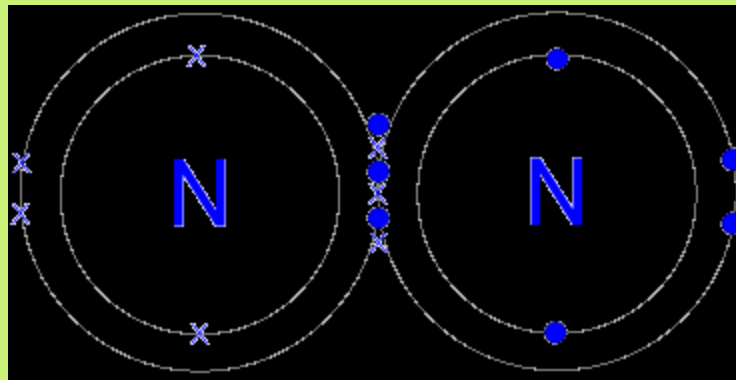


# NITROGEN AND SULFUR

## CHAPTER 12

# NITROGEN GAS 12.1

- 78% of the Earth's atmosphere
- Diatomic molecule= $N_2$
- It is unreactive and dilutes the reactive nature of oxygen.

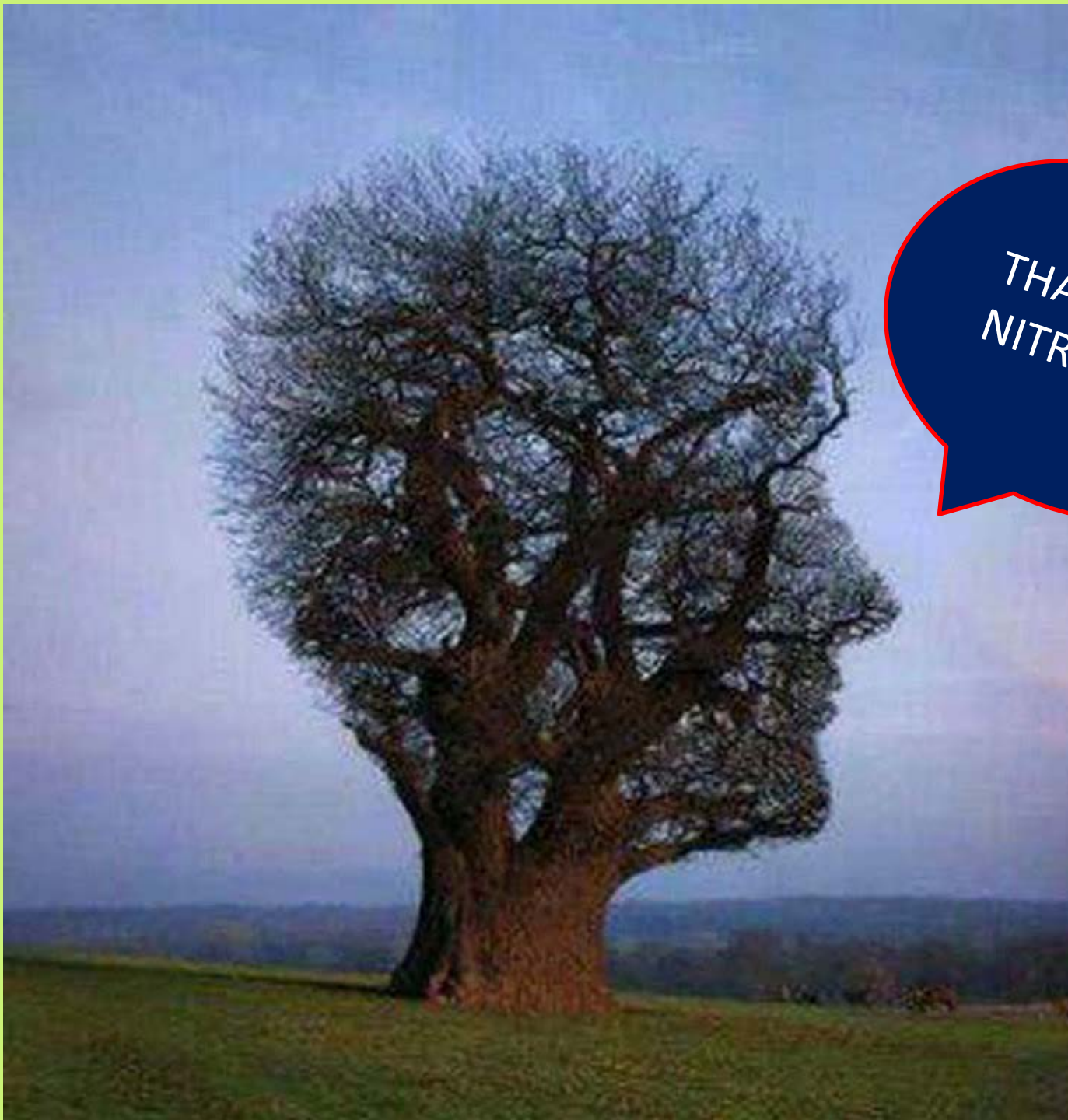


# Why is nitrogen unreactive?

- Nitrogen needs 3 electrons to achieve a noble gas configuration
- A triple covalent bond is formed between two nitrogen atoms
- The bond is very strong and a lot of energy (1000 kJ/mol) is required to break the bonds, therefore, it can only react under harsh conditions

# Reactions with Nitrogen and Oxygen

- When lightning strikes enough activation energy is produced to cause a reaction between  $N_2$  and  $O_2$  forming Nitrogen Oxide.
- $N_2O_2$  is further oxidized by oxygen to create nitrogen (iv) oxide
- Nitrogen (iv) oxide dissolves in water to form nitric acid which falls to Earth as rain.
- Plants absorb this nitric acid to make chlorophyll as well as DNA and RNA.



THANKS,  
NITROGEN !

# AMMONIA AND CREW 12.2

- very important compound of nitrogen-  $\text{NH}_3$
- made with the Haber Process
- Dative bond between ammonia and hydrogen ion where one atom has a lone pair of electrons and a second atom has an unfilled orbital to accept the lone pair.
- Hydrogen ion is electron deficient so it can bond with nitrogen's lone pair.

# AMMONIA AND FERTILIZERS

- important fertilizers
- Nitrogen is removed by plants and when harvested the soil is depleted so plants don't grow well, ammonia is used to restore nitrogen to the soil.
- Common ammonia salts are ammonium chloride, ammonium nitrate and ammonium sulfate
- When we heat ammonium salt with a base ammonia gas is produced. If an unknown compound contains ammonia ions, it will give off ammonia gas which is alkaline and turn a red litmus paper, blue

# THE HABER PROCESS

- used in industry to produce ammonia

<https://www.youtube.com/watch?v=Ou2U0pkCC88>

<https://www.youtube.com/watch?v=Bv8Wybi4I94>

- Iron is a catalyst used to speed up forward and reverse actions...it does not yield ammonia yet it increases the rate that it's formed



# AMMONIA AND IT'S USES

- 85% of the millions of tons of ammonia produced yearly is used for fertilizer; however, a small amount of ammonia is actually used. The ammonia combines with acids to make salts which are used in fertilizers.
- 10% of ammonium nitrate is used to make trinitrotoluene, TNT, and other explosives



# ENVIRONMENTAL CONCERNS

**"WE ARE LIVING ON THIS  
PLANET AS IF WE HAD  
ANOTHER ONE TO GO TO."**

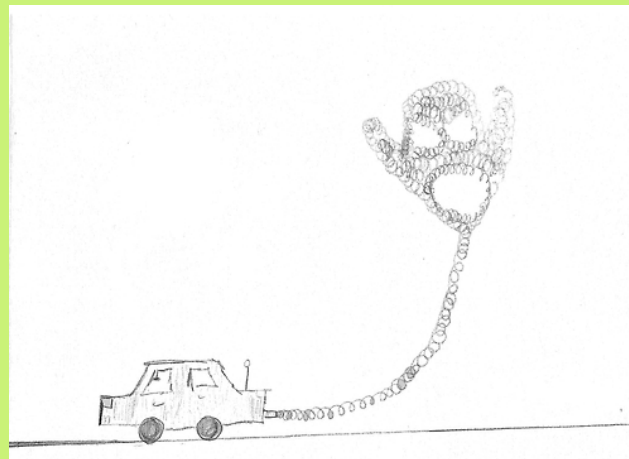


**- TERRI SWEARINGEN**

**POLITICAL  
LOUDEMOUTH**

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- Ammonium salts must be soluble in water in order to work however, these salts can be washed out of the soil by rain into groundwater which promotes growth of water plants on freshwater sources, which causes a whole slew of reactions and problems.
- Nitrogen and oxygen react in the engine of a car which forms nitrogen oxide which pollutes the air. They cause acid rain and smog! Some modern cars have a catalyst in the engine that reduces the amount of pollutants released in the air.

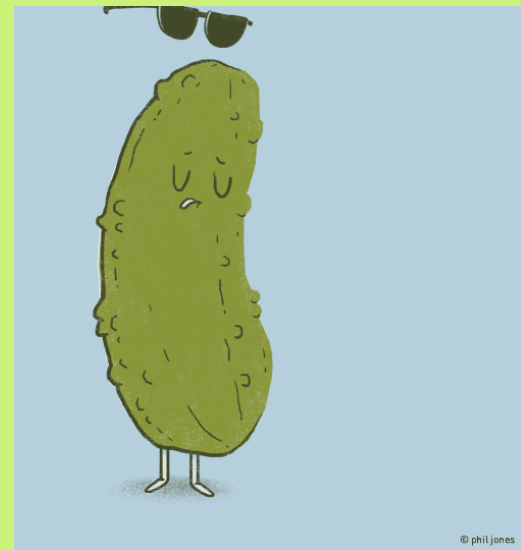


# SULFUR AND IT'S OXIDES 12.3

- When sulfur oxide reacts with water in the air, sulfuric acid is formed which causes acid rain.
- Sulfur dioxide is formed when we burn fossil fuels. Most contain sulfur and when burned, they are released into the air where it oxidizes.
- Acid rain is bad and can alter the pH of water and kill life there- it can even kill insect larve!  
No!

# Sulfur Oxide and Food

- Sulfur dioxide is used to preserve many foods, mmmm.
- Used in wines, dried fruits, “fruit juice”, PICKLES, syrups and sometimes sausages.
- Prevents the growth of yeast, bacteria fungi and microbes in highly acidic foods.



# SULFURIC ACID 12.4

- Super important, widely used throughout the world
- Made through the contact process
- [http://www.youtube.com/watch?v= zj3bMjFcIA](http://www.youtube.com/watch?v=zj3bMjFcIA)

# USES OF SULFURIC ACID

- Fertilizers, detergents, paints, pigments, dyes synthetic fibers, car batteries, tanning leather and cleaning metal surfaces.

