

NITROGEN - DEFINITION

- ☐ **General information about nitrogen**
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General information about nitrogen

Symbol: N

Atomic Number: 7

Atomic Weight: 14.0067

Electron Configuration: $1s^2 2s^2 p^3$

Classification: Non-metal

Group: Pnictogen

Number of Protons/Electrons: 7

Isotopes: N-13 (half-life 9.97 min.), N-14 (stable), N-15 (stable), N-16 (half-life 7.13 sec.)

Crystal Structure: Hexagonal

Name Origin: from Greek: *nitron* (potassium nitrate, KNO_3) + *genes* (former, producer)

Nitrogen (N) is an important constituent of organic compounds (ex.proteins) of the living organisms. DNA molecules forming the genetic code contain nitrogen. Nitrogen forms 78% of of the earth atmosphere. Nitrogen was discovered in 1772 by Daniel Rutherford (and independently by Carl Wilhelm). Molecules of gaseous nitrogen are normally diatomic N_2 . Gaseous nitrogen is a colorless, odorless, tasteless gas. Nitrogen has low chemical activity (inert) at normal temperatures.

Extraction (isolation) of nitrogen

- ☐ **Cryogenic Distillation of air**

Cryogenic Distillation is the most popular method of extraction of nitrogen. About 85% of nitrogen is produced by this method.

Cryogenic distillation utilizes differences in boiling points of the air components.

The air is cooled down to the state of boiling liquid. The vapors are condensed and reboiled for several times. Compositions of the liquid and the vapors are different. This technique permits to separate air to its constituents: nitrogen, oxygen and argon.

☐ **Membrane separation of air**

The method is based on differences in the permeability of the molecules composing air.

Air flows through thousands of hollow-fiber polymer membranes installed in a tube. Oxygen molecules permeate through the membranes faster than molecules of nitrogen. Thus the air stream is separated into two parts, one of which is enriched with oxygen and another is enriched with nitrogen.

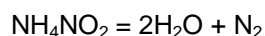
☐ **Pressure Swing Adsorption**

The method uses filters made of a material capable to adsorb molecules of oxygen. When air passes through the adsorbent oxygen is caught by the filter while nitrogen (together with argon) is collected at the outlet.

☐ **Decomposition of Ammonium nitrate**

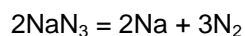
This method is used for laboratory preparation of nitrogen.

Heating ammonium nitrate causes its decomposition according to the reaction:



☐ **Decomposition of azides**

Very pure nitrogen may be prepared by decomposition of sodium azide (NaN_3) at 572°F (300°C) :



Applications of nitrogen

☐ **Manufacture of ammonia (NH_3)**

Ammonia is produced by the reaction between nitrogen and Hydrogen (Haber process). Ammonia is then used for fabrication of fertilizers, nitric acid (Ostwald process), nitro-glycerine (explosive).

☐ **Liquid nitrogen**

Liquid nitrogen is used for freezing food products, preservation and storage of biological samples.

☐ **Protective (shielding) gas**

Nitrogen is used as an inert gas protecting liquid metals and hot metal parts from oxidation (Metal joining technologies (welding, brazing, soldering), Foundry technologies).

Nitrogen cycle

Nitrogen is an essential component of the living nature.

Bacteria living in the soil are capable to convert the gaseous nitrogen into fertilizing compounds (**nitrogen fixation**).

Plants then use the fertilizer for their growth.

Animals eating the plants use nitrogen contained by the plants for building proteins.

Nitrogen of animals bodies is then converted by bacteria into gaseous form (**denitrification**).

Source : <http://www.substech.com/dokuwiki/doku.php?id=nitrogen>