The Ministry of Education and Science of the Republic of KAZAKHSTAN
KHOJA AKHMET YASSAWI INTERNATIONAL KAZAKH-TURKISH UNIVERSITY
FACULTY OF NATURAL SCIENCES

DEPARTMENT OF ECOLOGY AND CHEMISTRY

Topic of the lecture:

Nitrogen. Phosphorus.

Specialty, Code of specialty : **5B011200 (Ғ) – Chemistry**

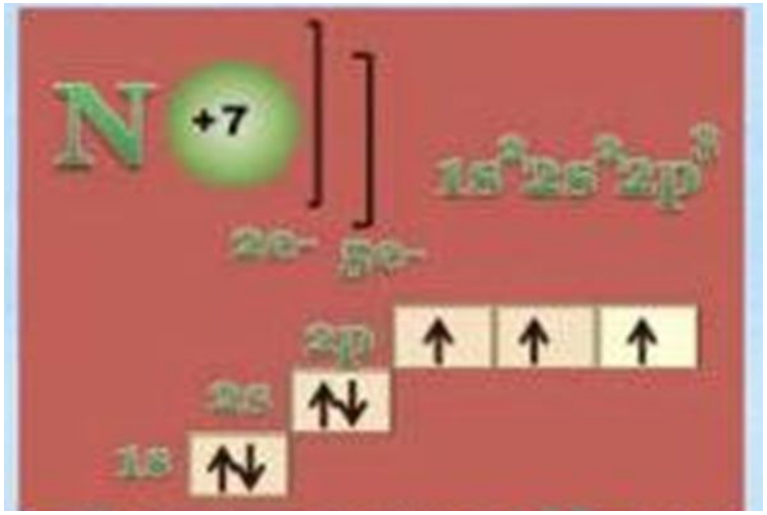
Discipline Teacher: **Sarbayeva M.T**

TURKESTAN 2017 y.

The content of the lecture:

Nitrogen

Atomic Number: 7
Atomic Symbol: N
Atomic Weight: 14.00674 Electron Configuration: [He]2s22p3



Objectives and tasks of the lecture:

History

Nitrogen was discovered by chemist and physician Daniel Rutherford in 1772. He removed oxygen and carbon dioxide from air and showed that the residual gas would not support combustion or living organisms. At the same time there were other noted scientists working on the problem of nitrogen. These included Scheele, Cavendish, Priestley, and others. They called it “burnt or dephlogisticated air,” which meant air without oxygen.

Sources

Nitrogen gas (N2) makes up 78.1% of the Earth's air, by volume. The atmosphere of Mars, by comparison, is only 2.6% nitrogen. From an exhaustible source in our atmosphere, nitrogen gas can be obtained by liquefaction and fractional distillation. Nitrogen is found in all living systems as part of the makeup of biological compounds.

The Element

The French chemist Antoine Laurent Lavoisier named nitrogen azote, meaning without life. However, nitrogen compounds are found in foods, fertilizers, poisons, and explosives. Nitrogen, as a gas is colorless, odorless, and generally considered an inert element. As a liquid (boiling point = minus 195.8oC), it is also colorless and odorless, and is similar in appearance to water. Nitrogen gas can be prepared by heating a water solution of ammonium nitrite (NH_4NO_3).

Nitrogen Compounds and Nitrogen in Nature

Sodium nitrate ($NaNO_3$) and potassium nitrate (KNO_3) are formed by the decomposition of organic matter with compounds of these metals present. In certain dry areas of the world these saltpeters are found in quantity and are used as fertilizers. Other inorganic nitrogen compounds are nitric acid (HNO_3), ammonia (NH_3), the oxides (NO, NO_2, N_2O_4, N_2O), cyanides (CN^-), etc.

The nitrogen cycle is one of the most important processes in nature for living organisms. Although nitrogen gas is relatively inert, bacteria in the soil are capable of “fixing” the nitrogen into a usable form (as a fertilizer) for plants. In other words, Nature has provided a method to produce nitrogen for plants to grow. Animals eat the plant material where the nitrogen has been incorporated into their system, primarily as protein. The cycle is completed when other bacterial convert the waste nitrogen compounds back to nitrogen gas. Nitrogen has become crucial to life being a component of all proteins.

Ammonia

Ammonia (NH_3) is the most important commercial compound of nitrogen. It is produced by the Haber Process. Natural gas (methane, CH_4) is reacted with steam to produce carbon dioxide and hydrogen gas (H_2) in a two step process. Hydrogen gas and nitrogen gas are then reacted in the Haber Process to produce ammonia. This colorless gas with a pungent odor is easily liquefied. In fact, the liquid is used as a nitrogen fertilizer. Ammonia is also used in the production of urea, NH_2CONH_2, which is used as a fertilizer, in the plastic industry, and in the livestock industry as a feed supplement. Ammonia is often the starting compound for many other nitrogen compounds.

Phosphorus

Atomic Number: 15
Atomic Symbol: P
Atomic Weight: 30.97376 Electron Configuration: [Ne]3s23p3

History

(Gr. phosphoros, light bearing; ancient name for the planet Venus when appearing before sunrise) Brand discovered phosphorus in 1669 by preparing it from urine.

Properties

Phosphorus exists in four or more allotropic forms: white (or yellow), red, and black (or violet). Ordinary phosphorus is a waxy white solid; when pure it is colorless and transparent. White phosphorus has two modifications: alpha and beta with a transition temperature at -3.8oC.

It is insoluble in water, but soluble in carbon disulfide. It takes fire spontaneously in air, burning to the pentoxide.

Sources

Never found free in nature, it is widely distributed in combination with minerals. Phosphate rock, which contains the mineral apatite, an impure tri-calcium phosphate, is an important source of the element. Large deposits are found in Russia, in Morocco, and in Florida, Tennessee, Utah, Idaho, and elsewhere.

Handling

It is very poisonous, 50 mg constituting an approximate fatal dose. Exposure to white phosphorus should not exceed 0.1 mg/m3 (8-hour time-weighted average - 40-hour work week). White phosphorus should be kept under water, as it is dangerously reactive in air, and it should be handled with forceps, as contact with the skin may cause severe burns.

When exposed to sunlight or when heated in its own vapor to 250oC, it is converted to the red variety, which does not phosphoresce in air as does the white variety. This form does not ignite spontaneously and is not as dangerous as white phosphorus. It should, however, be handled with care as it does convert to the white form at some temperatures and it emits highly toxic fumes of the oxides of phosphorus when heated. The red modification is fairly stable, sublimes with a vapor pressure of 1 atm at 17C, and is used in the manufacture of safety matches, pyrotechnics, pesticides, incendiary shells, smoke bombs, tracer bullets, etc.

Production

White phosphorus may be made by several methods. By one process, tri-calcium phosphate, the essential ingredient of phosphate rock, is heated in the presence of carbon and silica in an electric furnace or fuel- fired furnace. Elementary phosphorus is liberated as vapor and may be collected under phosphoric acid, an important compound in making super-phosphate fertilizers.

Uses

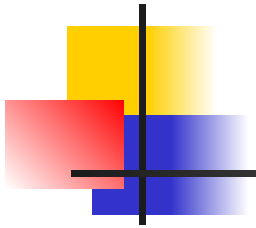
In recent years, concentrated phosphoric acids, which may contain as much as 70% to 75% P2O5 content, have become of great importance to agriculture and farm production. World-wide demand for fertilizers has caused record phosphate production. Phosphates are used in the production of special glasses, such as those used for sodium lamps.

Bone-ash, calcium phosphate, is used to create fine chinaware and to produce mono-calcium phosphate, used in baking powder.

Phosphorus is also important in the production of steels, phosphor bronze, and many other products. Trisodium phosphate is important as a cleaning agent, as a water softener, and for preventing boiler scale and corrosion of pipes and boiler tubes.

Phosphorus is also an essential ingredient of all cell protoplasm, nervous tissue, and bones.

Tiered assignments:



Questions of the first level:

Questions of the second level:

Questions third level:

References:

Primary:

1. Alekseev V.N., The course of qualitative chemical micro-analysis. M.: Chemistry, 2013
2. Hanina T.I., Nikitina N.G. Analytical chemistry. - Moscow, 2012
3. Kreshkov A.P., Fundamentals of analytical chemistry. T.1-3, M.: High School 2000
4. Lyalikov Y.S., Physico-chemical methods of analysis. M.-L.: 2005
5. Tolstousov V.N., Efros S.M., The collection of problems in qualitative analysis. -L., 2008
6. Alekseev V.N., Quantitative analysis. M.: Chemistry, 2002
7. Karnauhov A.S., Kosyakina O.A., Chernova L.P., The collection of problems and exercises in qualitative analysis. Moscow, 2005: IKTU, 2003. - 118 p.
8. Zhanbekov H.N., Practical work of Analytical Chemistry, Ed. Kazakparat, A.,2000
9. Sarbayeva G.T., Bayeshov A.B., Sarbayeva K.T. Analytical chemistry, Shymkent, 2013.

Additional:

10. Olshanova K.M., Piskarev S.K., Barashkov K.M. Analytical chemistry. M., 2001
11. Baeshov A.B., Sarbaeva G.T. Electrochemical analysis methods. Shymkent, 2003
12. Eginbayev Zh.E., Baeshov A.B. Physico-chemical analysis methods: Textbook. - Shymkent: IKTU, 2003. - 118 p.
13. http://www.learn4good.com/bookstore/ecology_books_cds_for_academic_students.htm
14. http://www.press.uchicago.edu/ucp/books/book/chicago/T/bo11161054.html

Thank you for attention!

НАЗАРЛАРЫҢЫЗҒА РАХМЕТ!