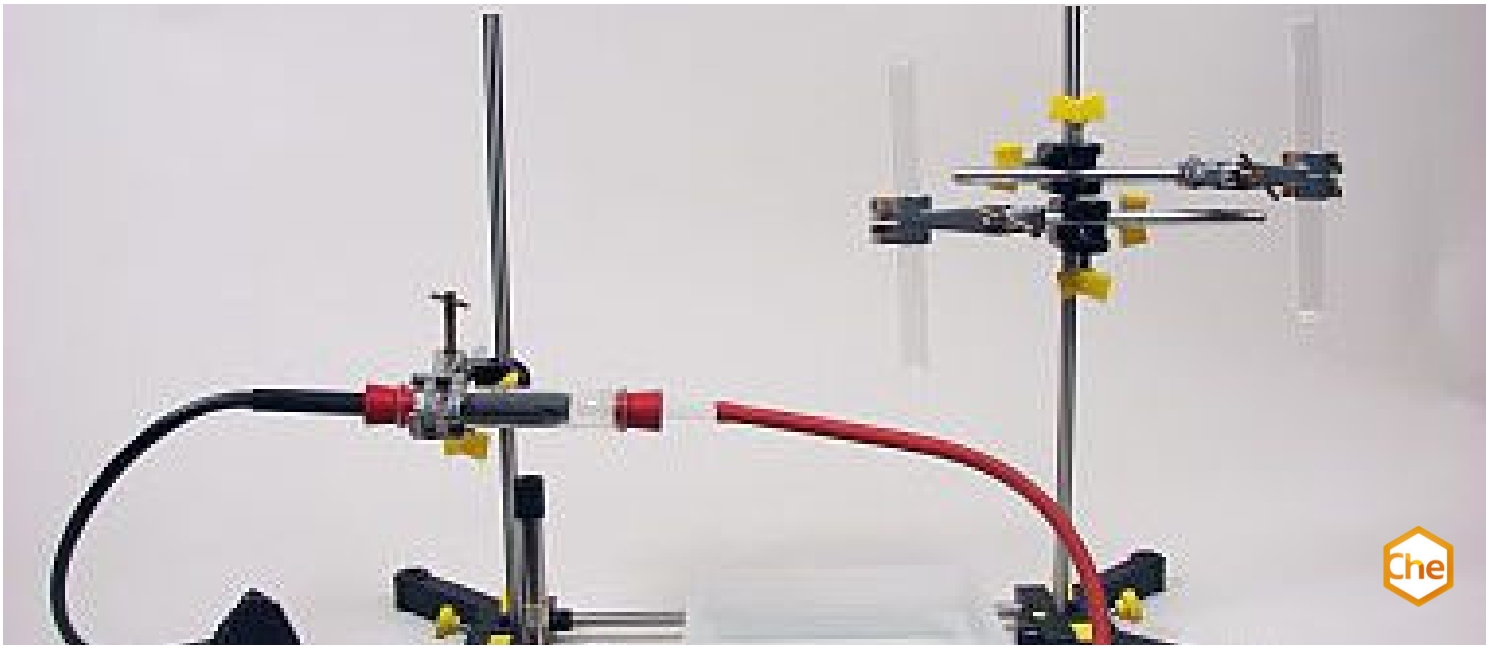
Nitrogen, preparation and properties



In this student experiment, a stream of air is passed over heated steel wool and fed into a pneumatic trough. The nitrogen produced in this way is then examined for its characteristic properties, by which it can be recognised. Nitrogen suffocates combustion, hence its name. It must have a lower density than air, as it escapes upwards from the opened test tube, but not downwards.

Chemistry > Inorganic chemistry > Air, Combustion & Gases

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/6339c7b998d7d40003312d67

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Teacher information

Application

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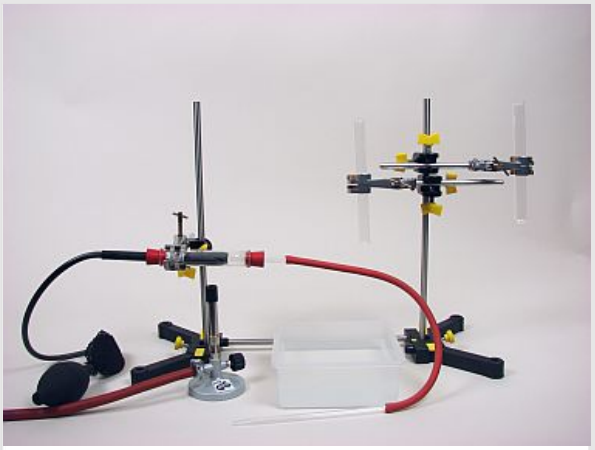

Extraction of nitrogen from the air

Nitrogen is the main component of air and can be extracted from it by removing oxygen. In this student experiment, a stream of air is passed over heated steel wool and fed into a pneumatic trough.

The nitrogen produced in this way is then examined for its characteristic properties, by which it can be recognised. Nitrogen suffocates combustion, hence its name. It must have a lower density than air, as it escapes upwards from the opened test tube, but not downwards.

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Other teacher information (1/2)

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Prior knowledge

This experiment is directly derived from the experiment to determine the air components. It can therefore be discussed again here and given a deeper understanding. It should become clear to the students - especially by working on task 2 - that they are not strictly speaking investigating the properties of nitrogen, but of the residual air. This can be used to deal with one aspect of the problem of analytics in general.

Principle

- Nitrogen is extracted by passing hot air over a steel wool.
- The nitrogen obtained has a lower density than air as it escapes from the reagent glass.
- Nitrogen has the ability to smother fire.

Other teacher information (2/2)

PHYWE

Learning objective

Nitrogen is the main component of air and can be extracted from it by removing oxygen. Nitrogen has characteristic properties by which it can be recognised. Its name is derived from its ability to smother flames.

Tasks

- Extract nitrogen from the air and investigate its properties. Write down your observations.
- Complete the tasks.
- Which substances were still collected in the test tube? Why can the properties of nitrogen still be studied in this way?

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Safety instructions

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- High temperatures are generated when annealing the iron wool. Wear protective goggles!
- Before the student experiment can begin, all potential sources of ignition must be removed !
- Make rubber-glass joints slippery with glycerine. Do not use force!
- The general instructions for safe experimentation in science lessons apply to this experiment.
- For H and P phrases, please refer to the safety data sheet of the respective chemical.

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Student information

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Motivation

PHYWE

Liquid nitrogen in a chemistry laboratory

Nitrogen is a chemical element with great significance for us. Gaseous nitrogen compounds are present in a large proportion in the air that everyone breathes. In addition, liquid nitrogen plays an important role in industry, e.g. in cooling processes.

In addition, numerous nitrogen compounds occur in nature, such as nitrate or nitrite in agriculture. In combustion engines, cars emit nitrogen oxides into the environment, which are harmful to health. In this student experiment, nitrogen gas is produced and examined for various chemical properties.

Tasks

PHYWE

Extract nitrogen from the air and investigate its properties. Write down your observations.

Which substances were still collected in the test tube? Why can the properties of nitrogen still be studied in this way?

Chemical properties of nitrogen.

Nitrogen has a lower density than oxygen.

- False
- True

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Equipment

Position	Material	Item No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	3
3	Boss head	02043-00	3
4	Dish, plastic, 150x150x65 mm	33928-00	1
5	Glass tubes,straight with tip,	MAU-10021402	1
6	Glass tube, straight, l=80 mm, 10/pkg.	MAU-16074541	1
7	Combustion tube, l 120mm,	MAU-16070101	1
8	Test tube, 180x18 mm,100pcs	37658-10	1
9	Test tube rack f. 6 tubes, wood	37685-10	1
10	Universal clamp	37715-01	3
11	Test tube brush w. wool tip,d20mm	38762-00	1
12	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
13	Rubber tubing, i.d. 6 mm	39282-00	1
14	Rubber bulb, double	39287-00	1
15	Protecting glasses, clear glass	39316-00	1
16	Glycerol 99% 100 ml	30084-10	1
17	Iron wool 200 g	31999-20	1
18	Butane burner with cartridge, 220 g	32180-00	1
19	Wood splints, package of 100	39126-10	1

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Set-up (1/7)

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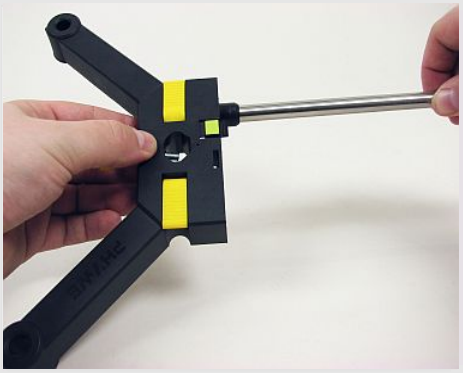
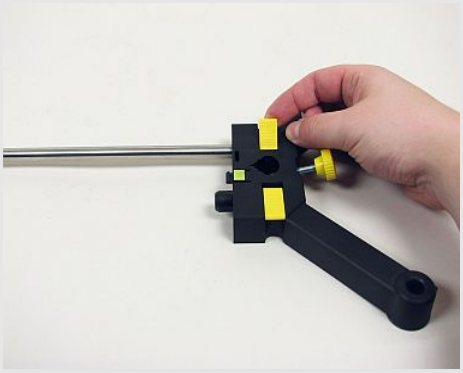
Set up the tripod according to the illustrations below left, centre and right.





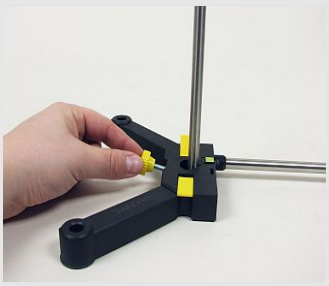
Set-up (2/7)

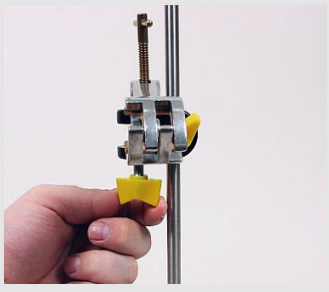
PHYWE

Set up the tripod according to the illustrations top left, top right, bottom left and bottom right.

Make sure that everything has been attached properly and straight and that the tripod is firmly in place.

Place the tripod only on flat surfaces.





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Set-up (3/7)

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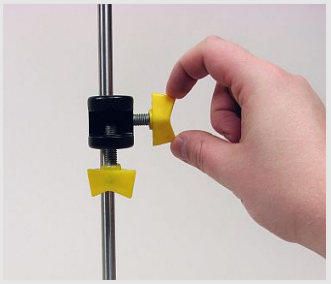
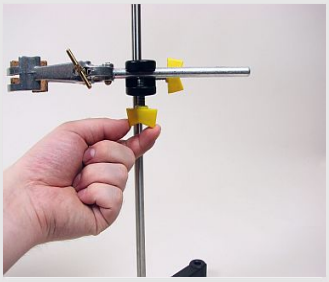
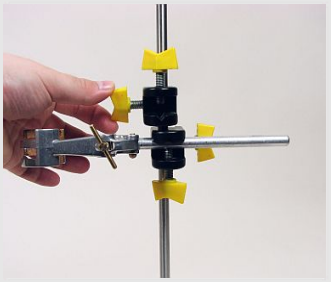
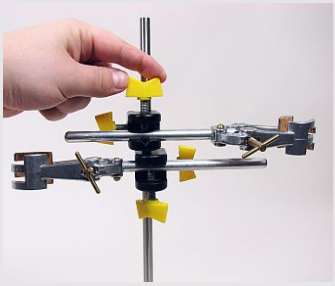
Attach two boss heads to the right-hand stand rod with two universal clamps at right angles to each other (fig. top left, top right, bottom left and bottom right).

Make sure that both the boss heads and the universal clamps are tight and straight.





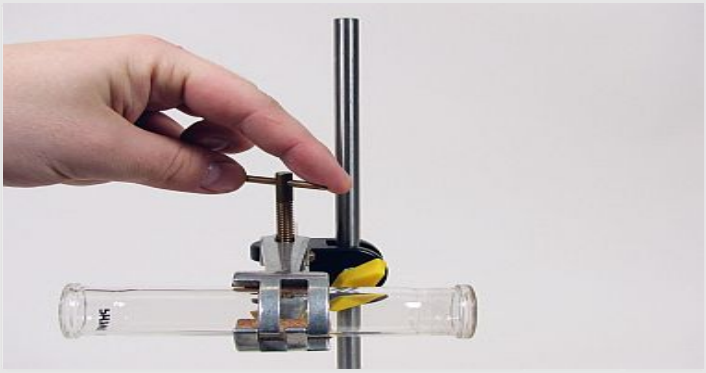


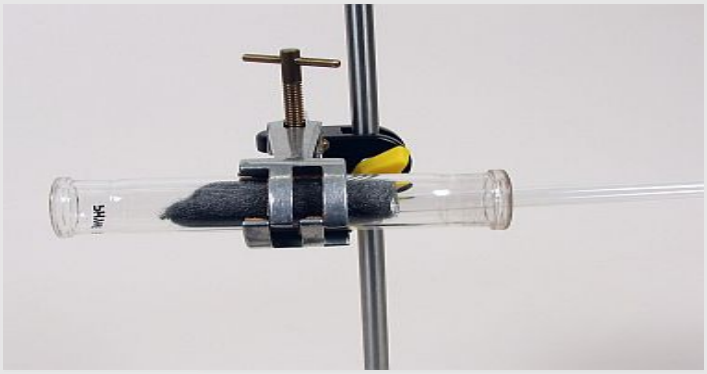


Set-up (4/7)

PHYWE

Clamp the combustion tube to the left-hand stand rod at one end (fig. left). Put a more densely packed amount of iron wool in the middle of the combustion tube (fig. right).





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Set-up (5/7)

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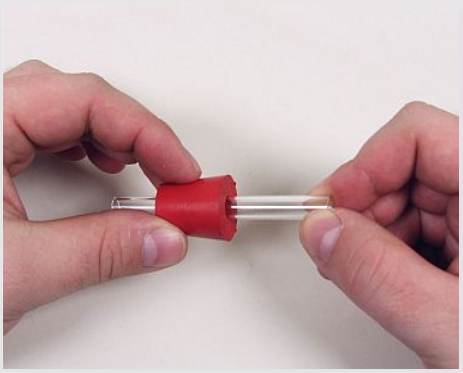
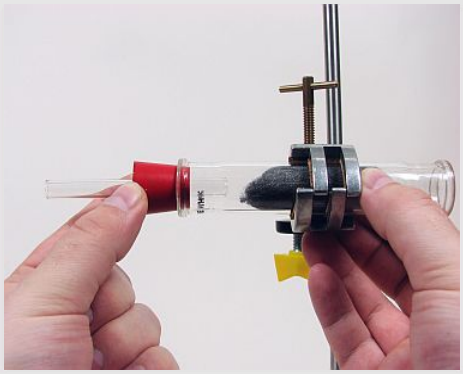
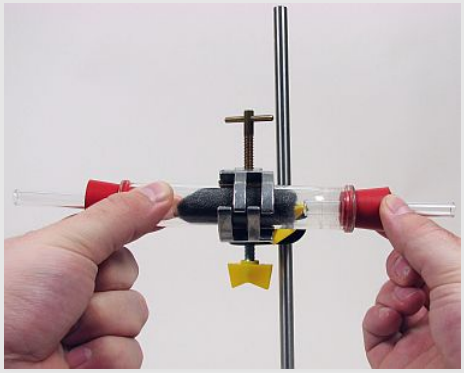
Close this on both sides with a stopper (fig. centre + fig. right) in which there is a short glass tube (fig. left).



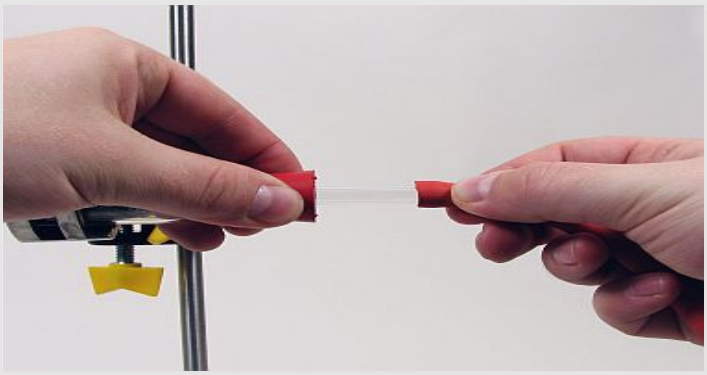


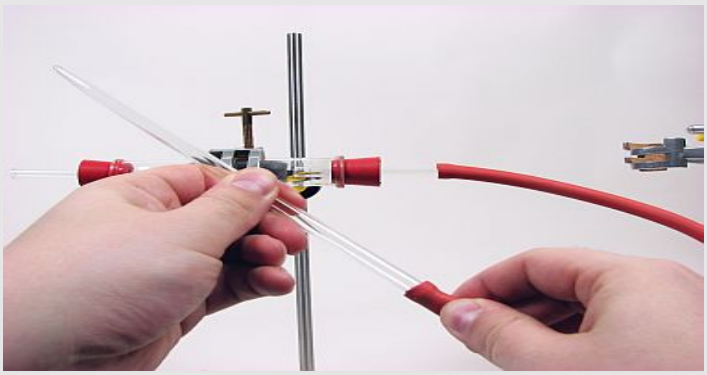


Set-up (6/7)

PHYWE

Slide a short piece of tubing onto the right glass tube (fig. left) and connect this piece of tubing to a glass tube with a tip to form a "gas introduction tube" (fig. right).





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Set-up (7/7)

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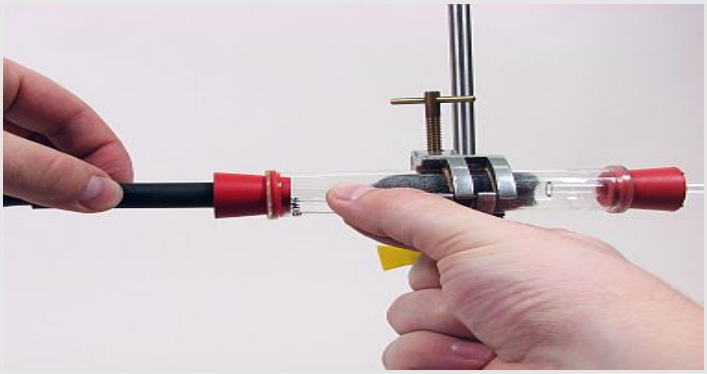
Connect the left glass tube to the double fan (fig. left). Place the burner under the combustion tube and adjust its height (fig. right). Fill the pneumatic tub to a good half with water. Place three test tubes in the tub so that they are completely filled with water.

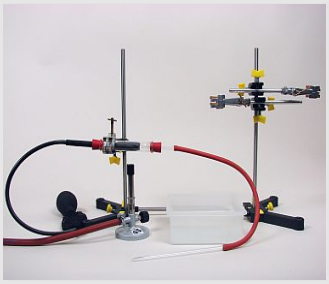


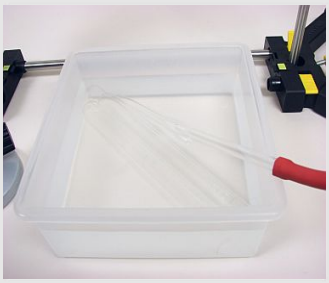
Procedure (1/2)

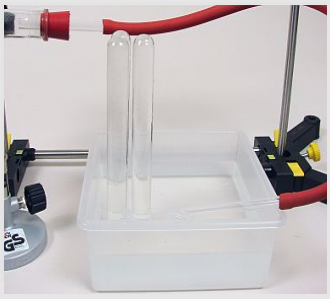
PHYWE

Heat the iron wool vigorously (fig. top left). During the first glow, slowly blow air over it with the help of the fan (fig. top right). Ensure a regular flow of air during heating.

Place the gas introduction tube in the tub (fig. bottom left). Close the test tubes filled with water one after the other with your thumb, hold them in the tub with the opening facing downwards so that no water flows out (fig. bottom right).







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Procedure (2/2)

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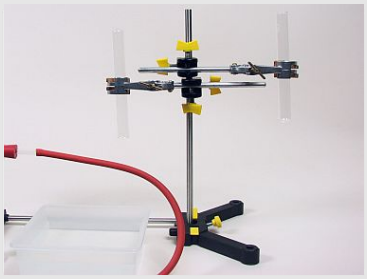

After about two minutes, pneumatically direct the gas into the test tubes until they are completely filled with gas (fig. above). Remove the gas inlet tube first, then stop heating!

Take out a test tube and insert a burning wood chip.

Clamp the other two test tubes, one with the opening facing upwards, the other downwards, to the right-hand stand rod (Fig. below). After about one minute, insert a burning wood chip.

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Report

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Task 1

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Write down your observations.

Task 2

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Which substances were still collected in the test tube? Why can the properties of nitrogen still be studied in this way?

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Task 3

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Properties of nitrogen?

Nitrogen is present in gaseous form at room temperature

○ True ○ False

Check

Task 4

PHYWE

Substance properties of nitrogen

Which substance property does nitrogen not have?

- ☐ Nitrogen is a typical non-metal
- ☐ Boiling temperature from - 196°C
- ☐ caustic
- ☐ flammable

Check

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Task 5

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Fill in the gaps.

Nitrogen occurs in elemental form as a _____. It has a lower _____ than _____ and is capable of _____ fire.
Nitrogen is in the _____ of the periodic table of the elements.

atomic gas
oxygen
density
smothering
15th group

Check

Slide	Score / Total
Slide 8: Density of nitrogen	0/1
Slide 22: Aggrgate state of nitrogen	0/1
Slide 23: Substance property of nitrogen	0/2
Slide 24: Profile of the nitrogen	0/5

Total 0/9

Solutions Repeat Export text

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