

a WOW Lab

BLUEPRINT

The Chemical (KNO_3)-How

Student Handout

In the following handout, students will be required to:

- Research uses of potassium nitrate
- Fill out a chart about the advantages and disadvantages of different information sources

Provided in this document are sample answers (pages 2-3) and a blank handout (page 4). The blank handout should be made available to each student prior to the activity.

Potassium Nitrate - KNO_3

There are many uses to potassium nitrate (Figure 1):

- 1) Burning paper
- 2) Food preservative
- 3) Treating angina
- 4) Fertilizers
- 5) Fireworks
- 6) Stump remover
- 7) Toothpaste for sensitive teeth

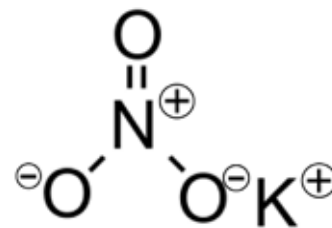


Figure 1

There are more uses to potassium nitrate but these are some of the most common ones. Research at least five of the ones above and describe how potassium nitrate contributes to the function of each one.

1) Burning paper

Potassium nitrate (KNO_3) contains three atoms of oxygen (O_3), one atom of nitrogen (N) and one atom of potassium (K). When potassium nitrate is painted onto the paper and then dried, a thin layer of potassium nitrate remains on the paper. It is then sparked or lit by a hot needle, which burns the oxygen atoms of potassium nitrate and uses that energy to burn through the paper. However, there is not enough energy to ignite the rest of the paper that does not contain a trail of potassium nitrate.

2) Food preservative

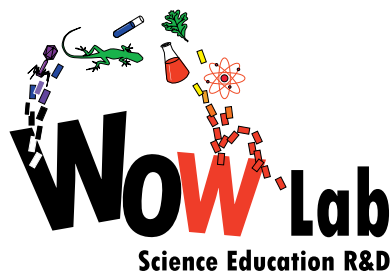
Potassium nitrate is sometimes used to cure meat. The nitrate helps to kill unwanted bacteria, which prevents the meat from rotting. Additionally, it produces a characteristic flavour and gives the meat a pink or red colour. The nitrate (NO_3^-) is used as a source for nitrite (NO_2^-), which then breaks down into nitric oxide (NO). The nitric oxide binds to the iron atom in the centre of the myoglobin's heme group, reducing oxidation and causing the pink colour.

3) Angina

Angina refers to a constriction in the airway or restriction of blood flow. Angina pectoris refers specifically to severe chest pain due to ischemia (a lack of blood and hence a lack of oxygen supply) of the heart muscle due to obstruction of the heart's blood vessels. Nitrates acts on the smooth muscles surrounding the blood vessels and help them relax, which dilates (opens up) the coronary arteries and veins, increasing blood flow to the heart.

4) Fertilizers

Potassium nitrate contains nitrogen and potassium, which are two of the macronutrients required by plants. Potassium nitrate is 13% nitrogen and 38.7% potassium by mass. Nitrogen is considered a primary limiting nutrient in plant growth - without it, plants don't grow. Nitrogen is needed to make nucleotides, which are part of DNA. DNA is necessary to make amino acids, which are needed to make proteins.



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The Chemical (KNO_3)-How - Handout Answers

5) Fireworks

Fireworks require the use of gunpowder in order to propel the firework rocket into the sky. Gunpowder is a mixture of 75% potassium nitrate, 15% charcoal (carbon), and 10% sulfur. The gunpowder is lit by a match or a wooden stick with a coal-like red-glowing tip. Potassium nitrate (KNO_3) contains three atoms of oxygen (O_3), one atom of nitrogen (N), and one atom of potassium (K). The oxygen atoms provide the "air" that the gunpowder uses to burn the other two ingredients, carbon and sulfur. The burning produces hot expanding gases which then escape the rocket through the nozzle and propel the rocket into the air.

6) Stump remover

Potassium nitrate is the main component of tree stump remover, because it accelerates the natural decomposition of the stump. The availability of nitrogen is the rate-limiting factor in the breakdown of all woody materials - which means that without nitrogen, woody materials will not break down. Potassium nitrate helps make the stumps porous, after which the stump can be easily removed or burned.

7) Toothpaste for sensitive teeth

Potassium nitrate contains potassium ions which are some of the main components of a functional neuron (nerve cell). Certain toothpastes for sensitive teeth have a small concentration of potassium nitrate, which travels into the dentinal tubules of the teeth and reaches the A-delta fibers. A-delta fibers are a type of sensory fiber which can transmit information about coldness and pressure to the brain. The potassium ions from the toothpaste are believed to stop the A-delta fibers from firing when stimulated, thus stopping the fibers from sending information about pain to the brain, causing the person using the toothpaste to not feel pain.

Fill out the following chart:

| Information Source | Advantage | Disadvantage |
|--------------------|--|--|
| Book (non-fiction) | More reliable and substantive information | Can be out of date, depending on when it was published; harder to search through quickly |
| Magazine | Focused on the important details | Limited amount of space, not as detailed and only most current information |
| Journal | Scholarly publishings, so the information can be more reliable | Limited amount of space, often only most current information |
| Newspaper | Current and broad information | Not very substantial |
| Internet | Easily accessible, wide variety of information | Can be unreliable, because anyone can post on the internet |

Potassium Nitrate - KNO_3

There are many uses for potassium nitrate (**Figure 1**):

- 1) Burning paper
- 2) Food preservative
- 3) Treating angina
- 4) Fertilizers
- 5) Fireworks
- 6) Stump remover
- 7) Toothpaste for sensitive teeth

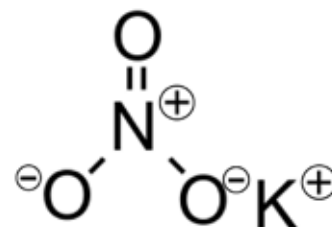


Figure 1

There are more uses for potassium nitrate but these are some of the most common ones. Research at least five of the ones above and describe how potassium nitrate contributes to the function of each one.

Be creative about where you do your research - the internet isn't the only place you can look. Here are some ideas:

- MSDS (Material Safety Data Sheet)
- label on chemicals (KNO_3)
- pharmacist
- chemist/scientist (ask about nitrates)
- label on stump remover
- dentist (about the toothpaste)

Fill out the following chart about the advantages and disadvantages of using the following sources of information:

| Information Source | Advantage | Disadvantage |
|--------------------|-----------|--------------|
| Book (non-fiction) | | |
| Magazine | | |
| Journal | | |
| Newspaper | | |
| Internet | | |