

What Every Pyro Should Know

This is a publication of the Western New York Pyrotechnic Association Inc. It may be reproduced in whole or in part without permission or compensation providing credit is given to the Western New York Pyrotechnic Association Inc. It is distributed free. If you plan to make a buck on it, we want a piece of it!! We believe that the information contained herein is true and correct, however it is offered only as a guide and not to be used as a guarantee. We cannot assume responsibility nor liability for the use or misuse of the information contained herein. If you do find an error, PLEASE contact us and we will fix it as soon as possible.

The following is a compilation of information gathered over the years from various research and sources too numerous to remember.

Within these pages you will find descriptions of almost 150 chemicals that are used in Fireworks, Explosives, Rocket Fuels or are explosives in themselves. This list is not complete and is not intended to be complete. All of the uses are not given and only the related purposes of each are stated.

Whenever possible we explain which grades are thought to be the best, the chemical formula, melting temperature, decomposition temperature, form (liquid, powder, crystal, etc.), if it will explode, if it is poisonous and its usage. Some of these chemicals cannot be purchased and are offered as a guide for information purposes only.

Know What You're Handling

CHEMICALS HAVE A CERTAIN PURPOSE TO PERFORM IN FIREWORKS AND CAN BE CLASSIFIED INTO FOUR GROUPS:

GROUP I. These chemicals are the chemicals which produce the oxygen and are called oxidizers.

GROUP II. Those which combine with the oxidizers are called reducers.

GROUP III. These are the chemicals which regulate the rate of burning and help to

produce the desired effect.

GROUP IV. This group of chemicals are those which impart color to the flame.

PLEASE NOTE: ALL REFERENCES TO TEMPERATURE ARE IN DEGREES FARENHEIT.

SAFETY INCOMPATIBLE MATERIALS

Certain combinations of chemicals are remarkable explosive, poisonous or hazardous in some other way, and these are generally avoided as a matter of course. There are many others that are perhaps equally dangerous but do not come to mind as readily. The following list, although not complete, may serve as a memory refresher. Stop and think for a moment before starting any work, especially if one hazardous chemical is involved.

DO NOT CONTACT:

Alkali metals, such as calcium, potassium and sodium with water, carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons.

Acetic Acid with chromic acid, nitric acid, hydroxyl-containing compounds, ethylene glycol, perchloric acid, peroxides and permanganates.

Acetone with concentrated sulfuric and nitric acid mixtures.

Ammonia, Anhydrous with mercury, halogens, calcium hypochlorite or hydrogen fluoride.

Ammonium Nitrate with acids, metal powders, flammable fluids, chlorates, nitrates, sulphur and finely divided organics or other combustibles.

Aniline with nitric acid, hydrogen peroxide or other strong oxidizing agents.

Bromine with ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine or finely divided metals.

Chlorates with ammonium salts, acids, metal powders, sulfur, carbon, finely divided organics or other combustibles.

Chromic Acid with acetic acid, naphthalene, camphor, alcohol, glycerine, turpentine and other flammable liquids.

Chlorine with ammonia, acetylene, butadiene, benzene and other petroleum fractions, hydrogen, sodium carbides, turpentine and finely divided powdered metals.

Cyanides with acids.

Hydrogen Peroxide with copper, chromium, iron, most metals or their respective salts, flammable fluids and other combustible materials, aniline and nitromethane.

Hydrogen Sulfide with nitric acid, oxidizing gases.

Hydrocarbons, generally, with fluorine, chlorine, bromine, chromic acid or sodium peroxide.

Iodine with acetylene or ammonia

Mercury with acetylene, fulminic acid, hydrogen.

Nitric acid with acetic, chromic and hydrocyanic acids, aniline, carbon, hydrogen sulfide, flammable fluids or gases and substances which are readily nitrated.

Oxygen with oils, grease, hydrogen, flammable liquids, solids and gases.

Oxalic Acid with silver or mercury.

Perchloric Acid with acetic anhydride, bismuth and its alloys, alcohol, paper, wood and other organic materials.

Phosphorous Pentoxide with water

Sodium Peroxide with any oxidizable substances, for instance: methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerine, ethylene glycol, ethyl acetate, furfural, etc.

Sulfuric Acid with chlorates, perchlorates, permanganates and water.

ALL FLASH POWDERS ARE EXTREMELY HAZARDOUS. THEY WILL IGNITE FROM FRICTION, IMPACT, OR FLAME.

While it is assumed that the individual who is dispensing these materials is responsible and knowledgeable as to their use, the following pointers will prove helpful:

Always use electrical ignition, either a commercial squib or Nichrome hot wire. The use of a squib is preferred because it provides a more positive ignition.

Always use an approved flash pot, made from transite or other similar material.

Always use the minimum amount of powder required to achieve the desired effect. In general, one quarter of a teaspoon will be sufficient.

Always have only one person who is responsible for dispensing and storing the flash powders.

Never pour the powder directly from the bottle into the flash pot. Measure the correct amount using a non-sparking metal, not plastic, spoon.

Never confine or compact the powder in any way. To do so may lead to a violent explosion.

Never return unused powder to the original bottle.

Never mix two different colors of flash powder. In many cases, the chemicals in the two materials are incompatible with each other.

Never pour flash powder from its plastic bottle onto plastic film or into another plastic container. The material is packed in plastic to reduce the danger of serious injury in case the powder should ignite in the bottle

Be extra careful on dry or low humidity days, when the chance of ignition by static electricity is high.

CHEMICALS

Aluminum

Al

An element used for brilliancy in the fine powder form. It can be purchased as a fine silvery or gray powder. All grades from technical to superpure (99.9%) can be used. The danger is from inhaling the dust and explosive room condition if too much dust goes into the air.

Aluminum Chloride

AlCl₃

This chemical must not come in contact with the skin as severe burns can result. The yellowish-white crystals or powder have a strong attraction for water. Purchase only in

the anhydrous grade.

Amber

This is a fossil resin of vegetable origin and is yellowish-brown in color. It is used in fireworks to a small extent.

Ammonium Bichromate and Dichromate $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$

A mild poison used in the manufacture of tabletop volcanoes (sometimes called Vesuvius Fire). It is available as orange crystals in a technical grade. Also used in smoke formulas.

Ammonium Chloride NH_4Cl

The common name is sal ammoniac. Comes as colorless crystals or a white powder. The technical grade is used to manufacture safety explosives and smokes.

Ammonium Oxalate $(\text{NH}_4)_2\text{C}_2\text{O}_4$

This compound takes the form of colorless, poisonous, crystals. The technical grade is suitable for the manufacture of safety explosives.

Ammonium Perchlorate $(\text{NH}_4\text{ClO}_4)$

This chemical can be made to explode by either heat or shock. Besides exploding in itself, it is used to manufacture other explosives.

Ammonium Permanganate NH_4MnO_4

A moderate explosive which can be detonated by either heat or shock.

Ammonium Picrate $(\text{NH}_4\text{C}_6\text{H}_3\text{O}_7)$

These bright orange crystals are used in armor piercing shells and fireworks. If heated to 300 degrees it will explode or it can be set off by shock. If you do any work with this chemical, it is advisable to keep it wet.

Aniline Dyes

These are used in smoke powder formulas. They are organic coal tar derivatives. Available in many different colors. Also suspected or proven carcinogens....use with caution.

Aniline Green $\text{C}_{23}\text{H}_{25}\text{ClN}_2$

Also known as Malachite Green. One of the many Aniline dyes. The green crystals are used in smoke formulas.

Anthracene

A coal tar derivative used as a source of dyestuff and for colored smokes. Available as colorless crystals which melt at 217 degrees.

Antimony Sb

Another name for this metal element is Antimony Regulus. Purchase the black powder in 99% purity. Not the yellow variety. It is used in pyrotechnics.

Antimony Fulminate

One of a group of unstable, explosive compounds related to Mercury Fulminate.

Antimony Potassium Tartrate

Also known under the name of Tartar Emetic. These poisonous, transparent, odorless crystals (or white powder) are used to make Antimony Fulminate. The moisture that is present can be driven off by heating to 100 degrees. Do not exceed this temperature or the chemical will decompose.

Antimony Sulfide (Sb₂S₃)

This has usefulness in sharpening the report of firecrackers, salutes, etc. or to add color to a fire. The technical black powder is suitable. Avoid contact with the skin; dermatitis or worse will be the result.

Aqua Regia

A strong acid containing 1 part concentrated Nitric Acid and 3 parts concentrated Hydrochloric Acid. Store in a well closed glass bottle in a dark place. This acid will attack all metals, including gold and platinum. It is used in making some explosives.

Arsenic Sulfide, Red

The common name is Realgar and it is also known as Red Arsenic. Purchase the technical grade, which is available as a poisonous orange-red powder. It is used in fireworks to impart color to the flame.

Arsenic Sulfide, Yellow (As₂S₃)

This Chemical is just as poisonous as its red brother and is also used in fireworks, somewhat. The common name is Kings Gold.

Arsenious Oxide (As₄O₆)

A white, highly poisonous powder used in fireworks. It is also known as Arsenic Trioxide, Arsenious Oxide and Arsenous Acid. Its uses are similar to Paris Green.

Asphaltum

A black bituminous substance, best described as powdered tar.

Auramine Hydrochloride

Also known as Auramine. It is used in smoke formulas. Available as yellow flakes or powder, which readily dissolves in alcohol.

Auramine

A certified Biological stain used in smoke cartridges.

Barium Carbonate BaCO₃

This is a poisonous salt of Barium, which decomposes at a fairly high temperature, 1300 degrees. It is available as a fine white powder in the technical grade. It is used in

fireworks as a color imparter.

Barium Chlorate $\text{Ba}(\text{ClO}_3)_2 \cdot 2\text{H}_2\text{O}$

Available as a white powder. It is poisonous, as are all Barium salts. It is used in fireworks, both as an oxidizer and color imparter. It is as powerful as Potassium Chlorate and should be handled with the same care. Melting point is 414 degrees.

Barium Nitrate $\text{Ba}(\text{NO}_3)_2$

The uses and precautions are the same as above with a comparison equal to Potassium Nitrate instead of the Chlorate. It melts at 500 degrees.

Bismuth Fulminate

One of a group of unstable, explosive compounds derived from Fulminic Acid.

Brass This is an alloy of Copper and Zinc. Some also contain a small percentage of Tin. The commercial grade is suitable in powdered form. It is used in some fireworks formulas.

Calcium Carbide CaC_2

These grayish, irregular lumps are normally packed in waterproof and airtight metal containers. It is used in toy cannons. Mixed with water it forms Acetylene Gas (EXPLOSIVE).

Calcium Carbonate CaCO_3

This occurs as the mineral Calcite. It is used for Phosphorous Torpedoes, but does not have any dangerous properties in itself. Also as an acid absorber in fireworks.

Calcium Fluoride CaF_2

This finds its use in a smokeless firework mixture and is not used elsewhere. It is a white powder, also known as Fluorspar.

Calcium Phosphide Ca_3P_2

This compound, which comes as gray lumps, must be kept dry. Upon contact with water it will form the flammable gas, Phosphine (highly toxic!). It is used in signal fires.

Camphor $\text{C}_{10}\text{H}_{16}\text{O}$

A ketone found in the wood of the Camphor tree, native to Taiwan and a few of our states. For the best results, buy the granulated, technical grade. Used in explosives and fireworks.

Castor Oil

The common drug store variety is used in some powders to reduce the sensitiveness and to waterproof the mixture.

Charcoal C

A form of the element, Carbon, it is used in fireworks and explosives as a reducing agent.

It can be purchased as a dust up to a coarse powder. The softwood variety is best and it should be black, not brown.

Chrysoidine

An organic dye available as a red-brown powder. It is used in smoke formulas.

Clay

This can be purchased in the powdered form. It is used dry for chokes, nozzles and sealing firework cases. You can mix it with water to form paste if so desired.

Confectioners Sugar

Commonly called powdered sugar, it can be purchased at your local food store. The fineness is graded by the symbol XXXX. It is used in explosives.

Copper Cu

As any pure metal used in fireworks, this must also be in a powdered state. It is reddish in color, in fact, it is the only element to be found in nature having that color.

Copper Acetoarsenite $(\text{Cu})_3\text{As}_2\text{O}_3\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$

The popular name for this is Paris Green. It is also called Kings Green or Vienna Green. It is readily available as an insecticide or as a technical grade, poisonous, emerald green powder. It is used in fireworks to add color.

Copper Arsenate $\text{Cu}_3(\text{AsO}_4)_2$

A fine, light green, poisonous powder. It is used in the technical grade for fireworks.

Copper Carbonate $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$

Also known as Cupric Carbonate or Artificial Malachite. It is a green powder used in fireworks.

Copper Chlorate $\text{Cu}(\text{ClO}_3)_2 \cdot 6\text{H}_2\text{O}$

Or, technically, Cupric Chlorate. A poison used in fireworks as an oxidizer and to add color.

Copper Chloride CuCl_2

An oxidizer and color imparter used in fireworks. Purchase the brownish-yellow technical grade. This is a poisonous compound.

Copper Nitrate $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$

Or Cupric Nitrate. These blue crystals absorb water, as you can see from the formula. It is used in fireworks.

Copper Oxide CuO

When ordering be sure to specify the black powder. It is also available in red. The technical grade will serve the purpose for fireworks.

Copper Oxychloride

A green powder used to impart oxygen and color especially to blue star formulas. It is a poison and the dust should not be inhaled.

Copper Sulfate $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Known as Blue Vitriol, this poisonous compound is available as blue crystals or blue powder. It can be purchased in some drugstores. Used in fireworks for blue stars.

Copper Sulfide CuS

As are the other copper salts, this is also used in fireworks to add color. The technical grade is suitable and is black in color. You can make your own by passing Hydrogen Sulfide into a Copper salt.

Decaborane $\text{B}_{10}\text{H}_{14}$

This chemical is classed as a flammable solid and is used for rocket fuels. It will remain stable indefinitely at room temperature.

Dextrin

This can be purchased as a white or yellow powder. It is a good cheap glue for binding cases and stars in fireworks.

Diazoacetic Ester $\text{C}_4\text{H}_6\text{N}_2\text{O}_2$

A very severe explosive in the form of a yellow oil. It will explode on contact with Sulfuric acid or when heated. Very volatile and explosive.

Diazoaminobenzene $\text{C}_6\text{H}_5\text{N}:\text{N}:\text{NH} \cdot \text{C}_5$

These golden yellow crystals will explode when heated to 150 degrees.

P-Diazobenzenesulfonic Acid $\text{C}_6\text{H}_4\text{NSO}_3\text{N}$

Another severe explosive. It can be exploded by rubbing the white paste or powder, or by heating.

Diazodinitrophenol $\text{HOC}_6\text{H}_3(\text{NO}_2)_2\text{N}(:\text{N})$

An organic explosive in the same group as the above compound. Also very sensitive to shock or heat.

Diazomethane CH_2

Also known as Azimethylene. This yellow gas is also in the above group and can be exploded by heat or shock.

Dinitrotoulene

Known as DNT for short. These yellow crystals are used in the manufacture of other explosives.

Ethyl Alcohol

This alcohol is the only one that is useful for fireworks. It should be about 95% pure. It is

poisonous because of the impurities. It is clear, like water, and also a very flammable liquid.

Fluorine Perchlorate FCIO_4

A very sensitive colorless gas which will explode on the slightest contact with a rough surface. It can also be detonated by heating to 168 degrees. Avoid all contact with this gas, as even a trace of it will attack the lungs.

Gallic Acid $\text{C}_7\text{H}_6\text{O}_5 \cdot \text{H}_2\text{O}$

A white or pale fawn colored powder used in fireworks to make whistles. When mixed with some chlorates, Permanganates or Silver salts, it may explode.

Glycerol $\text{C}_3\text{H}_8\text{O}_3$

Commonly known as Glycerin. It is obtained from oils and fats as a by-product when making soaps. It is a sweet warm tasting syrupy liquid which is used in several explosives. Contact with Chromium Trionide or potassium Permanganate may cause an explosion.

Gold Explosive

A dark brown powder which explodes when heated or rubbed. Upon exploding, it yields Gold, Nitrogen and Ammonia. The exact composition is unknown because it is too explosive to be dried.

Guanidine Nitrate $\text{CH}_5\text{N}_3 \cdot \text{HNO}_3$

Guanidine is found in turnip juice, rice hulls and earthworms. It is used in the preparation of this chemical, or, it can be made from Ammonium Nitrate and Dicyanodiamide. To be of any value, it should be 95% pure. Guanidine Nitrate is not explosive itself, but is used in the manufacture of explosives. It is a white powder which melts at 210 degrees.

Gum Arabic

A dried, gummy, exudate from tropical trees. It is available as flakes, fragments and powder. It is used as a binder in firework formulas.

Hexachlorethane $\text{CCl}_3 \cdot \text{CCl}_3$

Also known as Carbon Hexachloride, this chemical is used in smoke formulas It can be obtained in either powder or crystals. Treat as toxic.

Indigo

A dark blue crystalline powder which is a commercial dye. You can purchase either the technical or pure grade for smokes.

Iodine

Heavy grayish metallic looking crystals or flakes. Poisonous. Purchase the U.S.P. grade. It is being used in making explosives.

Iron Fe

The granular powder (at least 99% pure) is needed for several firework pieces. It is not a

dangerous element but will rust very easily, making it useless.

Iron Oxide FeO

These black crystals are used in thermite mixtures. When ordering, it may be listed as Ferrous Oxide. Black.

Kieselguhr

This is a whitish powder used in dynamites. It is a siliceous earth, consisting mainly of diatoms. A good grade will absorb about four times its own weight.

Lactose

Also called milk sugar. This white powder has a sweet taste. The crude grade will work for smoke formulas.

Lampblack

This is another name for the element, carbon. It is a finely powdered black dust, resulting from the burning of crude oils. It is used for special effects in fireworks.

Lead Azide PbN₆

This is a poisonous white powder which explodes by heating to 350 degrees or by concussion. The main usage is in primers. It can be made from Sodium Azide and Lead Nitrate.

Lead Bromate Pb(BrO₃)₂.H₂O

Poisonous, colorless crystals. Pure Lead Bromate is not explosive unless it is made from precipitated Lead Acetate with an alkali bromate. Made in this manner, it can be exploded by rubbing or striking.

Lead Chloride PbCl₂

It is available as a white crystalline, poisonous powder which melts at 501 degrees. It is used in fireworks.

Lead Dioxide PbO₂

Also known as Brown Lead Oxide, this dark brown powder is used as an oxidizer in matches and fireworks. Poisonous.

Lead Nitrate Pb(NO₂)₂

Available as white or colorless crystals in the technical grade. The uses include matches and explosives. Poisonous.

Lead Oxide Pb₃O₄

Also known as Red Lead or Lead Tetroxide. A 95% purity is desired for matches. Also poisonous.

Linseed Oil

Available in many forms: Brown, boiled, raw and refined. All are made from the seed of

the flax plant. The cheapest form is suitable for fireworks. Purchase from a paint store.

Lithium Chloride LiCl

The technical grade is sometimes used to add color to fireworks compositions. Available as a white powder.

Manganese Dioxide MnO_2

Used in pyrotechnic mixtures, matches and match box friction surfaces. Available as a technical grade, black powder. This oxidizer decomposes at 535 degrees.

Magnesium Mg

This metal is used in a powdered state for brilliancy in flares and will even burn vigorously underwater.

Mercuric Chloride HgCl_2

A white, poisonous powder. Also known as Corrosive Sublimate. It can be made by subliming Mercuric Sulfate with ordinary table salt and then purified by recrystallization. The U.S.P. grade is used for some firework compositions.

Mercuric Oxide HgO

Available in two forms; red and yellow. Both forms give the same oxidizing effects in fireworks. The technical grade is suitable.. All forms are poisonous.

Mercuric Oxycyanide $\text{HgO} \cdot \text{Hg}(\text{CN})_2$

In the pure state it is a violent poison which will explode when touched by flame or friction.

Mercuric Thiocyanate $\text{Hg}(\text{SCN})_2$

A poisonous, white odorless powder used in the making of Pharaoh's Serpents. Use the technical grade.

Mercurous Chloride Hg_2Cl_2

Also known as Calomel or Mercuric Monochloride. This white, non- poisonous powder will brighten an otherwise dull colored mixture. Sometimes it is replaced by PVC or Hexachlorobenzene and even Antimony Sulfide, for the same purpose. Note that it is non poisonous only when it is 100% pure. Never confuse this chemical with Mercuric Chloride, which is poisonous in any form.

Mercury Fulminate $\text{Hg}(\text{ONC})_2 \cdot 2\text{O}$

A crystalline compound used in primers, percussion caps, blasting caps and other detonators. Explodes very easily from heat or shock.

Methylene Blue $\text{C}_{16}\text{H}_{18}\text{N}_3\text{SCl}$

This dark green powder is used for smokes in the technical grade. Also called Methylthionine Chloride.

Mineral Jelly Also known as Vaseline, Petrolatum or Petroleum Jelly. This acts as a stabilizer in fireworks and explosives.

Naphthalene This is a tar product that you may know better as Moth Flakes. Only the 100% pure form should be used in making smoke powders. The melting point is 100 degrees.

Nitric Acid HNO_3

Also known as Aqua Fortis. It is a clear, colorless corrosive liquid, which fumes in moist air. It can react violently with organic matter such as Charcoal, Alcohol or Turpentine and consequently must be handled Very carefully. It is available in three forms: White fuming, Red Fuming and Concentrated (70 to 71%). The latter, with a specific gravity of 1.42, is the proper grade to buy. Whatever grade, avoid contact with the fumes or the liquid. Contact with the skin will cause it to burn and turn yellow. It is used to manufacture many explosives.

Nitroglycerin $\text{C}_3\text{H}_5\text{N}_3\text{O}_9$

A liquid with a sweet burning taste, but do not taste it or it will produce a violent headache or acute poisoning. It can be made to explode by rapid heating or percussion. It is used as an explosive and also to make other explosives.

Nitroguanidine $\text{H}_2\text{NC}(\text{NH})\text{NHNO}_2$

A yellow solid made by dissolving Guanidine in concentrated Sulfuric Acid and then diluting with water. Dangerous Explosive.

Nitromethane CH_3NO_2

An oily, poisonous liquid, which is used as rocket fuel.

Oil of Spike

This is a volatile oil obtained from the leaves of certain trees. Keep this colorless (or pale yellow) liquid well closed and away from light. It is used in some fireworks.

Paraffin

This is a white or transparent wax. It is normally sold in a solid block. You can use it to make the required powder.

Paranitroaniline Red $(\text{H}_2\text{NC}_6\text{H}_4)_3\text{COH}$

A dye used in smoke formulas. It dissolves in alcohol and will melt at 139 degrees. It is also known as P-Aminophenyl.

Pentaerythritol Tetranitrate $\text{C}_5\text{H}_8\text{N}_4\text{O}_{12}$

A high explosive known as PRTN. Besides being an explosive itself it is used in a detonating fuse called Primacord.

Perchloryl Fluoride ClFO_3

A gas under normal air pressure. When brought in contact with alcohol, explosions have

resulted.

Phosphorus P

This element comes in three forms, with three different ways of reacting. They resemble each other in name only. Red Phosphorous is the only suitable form for fireworks and matches. It is a non-poisonous violet-red powder. It will ignite at 260 degrees. When making a formula containing Phosphorous, be sure to work with it in a WET STATE. This is a most dangerous chemical to work with and should be handled only by the most experienced. Oxidizers have been known to detonate violently without warning when mixed with Red Phosphorous.

Phosphorous Pentasulfide

Also known as Phosphoric Sulfide. These light yellow crystals are used in matches.

Phosphorus Trisulfide P₂S₃

This chemical can catch fire from the moisture that is present in air, therefore the container should be kept tightly capped. The technical grade, purchased as grayish-yellow masses, is used in making matches.

Picric Acid

This is used to bring out and improve the tone of colors in various fireworks. It is also used to make other chemicals that are used in fireworks and explosives. Picric Acid can explode from heat or shock. It is interesting to note what it is called in other countries: Britain - Lyddite; France - Melinite; Japan - Shimose.

Plaster of Paris

This is a white powder, composed mostly of Calcium Sulfate. It is used, by mixing with water, for end plugs in fireworks and also in some formulas.

Potassium K

A soft silvery metal element. It will react vigorously with water and several acids. It is not used directly except for some experiments.

Potassium Chlorate KClO₃

This, perhaps, is the most widely used chemical in fireworks. Before it was known, mixtures were never spectacular in performance. It opened the door to what fireworks are today. It is a poisonous, white powder that is used as an oxidizer. Never ram a mixture containing Potassium Chlorate. Do not store mixtures which contain this chemical for any great length of time, as they may explode spontaneously.

Potassium Dichromate K₂Cr₂O₇

Also known as Potassium Bichromate. The commercial grade is used in fireworks and matches. The bright orange crystals are poisonous. Also used in smokes. Carcinogenic.

Potassium Ferrocyanide 4Fe(CN)₆·3H₂O

Lemon yellow crystals or powder which will decompose at high temperatures. It is used

in the manufacture of explosives.

Potassium Nitrate KNO_3

Commonly called Saltpeter; this chemical is an oxidizer which decomposes at 400 degrees. It is well known as a component in gunpowder and is also used in other firework pieces. Available as a white powder.

Potassium Perchlorate KClO_4

Much more stable than its Chlorate brother, this chemical is a white or slightly pink powder. It can often substitute for Potassium Chlorate to make the formula safer. It will not yield its oxygen as easily, but to make up for this, it gives off more oxygen. It is also poisonous.

Potassium Picrate $\text{C}_6\text{H}_2\text{KN}_3\text{O}_7$

A salt of Picric Acid, this chemical comes in yellow, reddish or greenish crystals. It will explode when struck or heated. It is used in fireworks.

Potassium Thiocyanate KCNS

Colorless or white crystals which are used to make the Pharaoh's Serpent. The commercial grade or pure grade is suitable.

n-Propyl Nitrate $\text{C}_3\text{H}_7\text{NC}_2$

Prepared from Silver Nitrate and n-Propyl Bromide and is used as a jet propellant

Red Gum

Rosin similar to shellac and can often replace it in many firework formulas. Red gum is obtained from the bark of trees.

Rhodamine B

A basic fluorescent organic pigment also known as Rhodamine Red. Available in green or red crystals or powder. It is used in smoke formulas.

Shellac

An organic rosin made from the secretion of insects which live in India. The exact effect it produces in fireworks is not obtainable from other gums. The common mixture of Shellac and Alcohol sold in hardware stores should be avoided. Purchase the powdered variety, which is orange in color.

Silver Fulminate AgONC

A crystalline salt similar to Mercury Fulminate but more sensitive. In fact, too sensitive for commercial blasting. It is used for toy torpedoes and poppers.

Silver Oxide Ag_2O

Dark brown, odorless powder. It is potentially explosive and becomes increasingly more so with time. Keep away from Ammonia and combustible solvents. The technical grade, which is about 92% pure, is suitable.

Sodium Aluminum Fluoride Na_3AlF_6

Also known as mineral, Cryolite. It is used in fireworks in the white powdered form.

Sodium Bicarbonate NaHCO_3

When a formula calls for this chemical, you can use Baking Soda (NOT Baking Powder). It is a white, non-poisonous powder.

Sodium Carbonate Na_2CO_3

This white powder is used in fireworks, but not to any great extent. The anhydrous grade is best.

Sodium Chlorate NaClO_3

An oxidizer similar to Potassium Chlorate, although not as powerful and also with the disadvantage of absorbing water. Decomposes at 325 degrees.

Sodium Chloride NaCl

This is used in fireworks. You can use the common form, table salt (or rock salt if made into a powder).

Sodium Nitrate NaNO_3

Also known as Chile Saltpeter; very similar to Saltpeter, (Potassium Nitrate). It is used where large amounts of powder are needed in fireworks and explosives. It will absorb water as do other sodium salts.

Sodium Oxalate $\text{Na}_2\text{C}_2\text{O}_4$

This is not a strong poison, but is poisonous, and you should not come in contact with it or breathe the dust for any prolonged period. The technical grade is best for making yellow fires.

Sodium Perchlorate $\text{NaClO}_4 \cdot 4\text{H}_2\text{O}$

This chemical is used in fireworks and explosives. It is very similar to Potassium Perchlorate with the exception that it will absorb water.

Sodium Peroxide Na_2

A yellowish-white powder. It can explode or ignite in contact with organic substances.

Sodium Picrate

Very similar to Potassium Picrate and should be handled with the same precautions. It is also known under the name of Sodium Trinitrophenolate.

Sodium Silicate $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$

This chemical, commonly called water glass, is used as a fireproof glue. It is available in syrupy solution and can be thinned with water if necessary. When dry it resembles glass, hence the name. It can, when desired, be thickened with calcium carbonate, zinc oxide, powdered silica, or fiberglass (chopped) if extra strength is desired.

Stearin

Colorless, odorless, tasteless, soapy crystal or powder. Sometimes referred to as Stearic Acid. Purchase the technical grade, powder. It can often take the place of Sulphur and Charcoal in fireworks.

Strontium Carbonate SrCO_3

Known in the natural state as Strontianite, this chemical is used for adding a red color to fires. It comes as a white powder in a pure, technical or natural state.

Strontium Chloride $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$

A colorless or white granulated chemical used in pyrotechnics. It will absorb water and is not used often.

Strontium Nitrate $\text{Sr}(\text{NO}_3)_2$

By far the most common chemical used to produce red in flares, stars and fires. Available in the technical powder grade. An oxidizer with 45% oxygen and absorbs water.

Strontium Sulfate SrSO_4

This does not absorb water as quickly as nitrate and is used when storage is necessary. In its natural state it is known as Celestine, which compares to grades used in fireworks.

Sulphur (Sulfur) S

For example type II burns at 250 degrees giving off choking fumes. Purchase good pyro grades low in acid. Used in many types of fireworks and explosives.

Sulfuric Acid H_2SO_4

Also called Oil of Vitriol, it is a clear liquid with the consistency of a thin syrup. Bottles should be kept tightly closed as it is a very corrosive and dangerous chemical. It has a great affinity for water and will absorb it from any source. The effect can be a charred surface or fire. The grade used in explosives is 93-98%.

Sulfur Trioxide SO_3

This powder will combine with water with explosive violence to form Sulfuric Acid. If brought in contact with wood flour and a drop of water is added, a fire will start. It is used to make some explosives.

Trinitrotoluene $(\text{NO}_2)_3\text{C}_6\text{H}_2\text{CH}_3$

Commonly known as TNT. The poisonous crystals are colorless in the pure state. It is more powerful and expensive than Dynamite. If not confined it will burn like dynamite. Used as a high explosive and to make others.

Wood Flour

This is merely another name for sawdust or wood meal. It is used in fireworks and explosives.

Zinc Zn

Of all the forms, only the dust is suitable in the technical or high purity grade. It is a gray powder used in star mixtures and for fuel in model rockets.

Zinc Borate $3\text{ZnO} \cdot 2\text{B}_2\text{O}_3$

A white amorphous powder used in making smoke formulas. A relatively safe compound to handle.

Zinc Carbonate ZnCO_3

Another white Zinc compound used in some smoke formulas. Also a safe compound to handle.

Zinc Oxide ZnO

Sometimes called Flowers of Zinc. This is a white or yellowish powder used in some firework formulas. It has also found use as a thickening agent in water glass when a stronger pyro paste is desired.