

## Table of Standard Fireworks Chemicals

Chemical	Formula	Typical Use
Aluminum (> 53 microns) Ok for use in a break charge and other compositions including report compositions	Al	Fuel
Aluminum ( $\leq$ 53 microns) Report composition only	Al	Fuel
Ammonium Perchlorate (Prohibited if mixed with a Chlorate)	NH <sub>4</sub> ClO <sub>4</sub>	Oxygen Donor
Antimony	Sb	Fuel
Antimony Sulfide: Antimonous Sulfide or Antimony Trisulfide	Sb <sub>2</sub> S <sub>3</sub>	Fuel
Antimony Trioxide	Sb <sub>2</sub> O <sub>3</sub>	Oxygen Donor
Barium Carbonate	BaCO <sub>3</sub>	Neutralizer
Barium Chlorate (only as provided in Table 3.7-1 below)	Ba(ClO <sub>3</sub> ) <sub>2</sub>	Oxygen Donor
Barium Nitrate	Ba(NO <sub>3</sub> ) <sub>2</sub>	Oxygen Donor
Barium Oxalate	BaC <sub>2</sub> O <sub>4</sub>	Color Agent
Barium Phthalate	Ba(C <sub>8</sub> H <sub>5</sub> O <sub>4</sub> ) <sub>2</sub>	Whistle or Color Agent
Barium Sulfate	BaSO <sub>4</sub>	Oxygen Donor
Benzoic Acid Potassium Salt (Potassium Benzoate)	KC <sub>6</sub> H <sub>5</sub> CO <sub>2</sub> or KC <sub>7</sub> H <sub>5</sub> O <sub>2</sub>	Whistle
Benzoic Acid Sodium Salt (Sodium Benzoate)	NaC <sub>6</sub> H <sub>5</sub> CO <sub>2</sub> or NaC <sub>7</sub> H <sub>5</sub> O <sub>2</sub>	Whistle
Bismuth Oxide or Bismuth Trioxide	Bi <sub>2</sub> O <sub>3</sub>	Oxygen Donor
Boric Acid (Boracic Acid)	H <sub>3</sub> BO <sub>3</sub>	Neutralizer
Calcium Carbonate	CaCO <sub>3</sub>	Neutralizer
Calcium Sulfate	CaSO <sub>4</sub>	Oxygen Donor
Calcium Sulfate dihydrate (Gypsum)	CaSO <sub>4</sub> ·2H <sub>2</sub> O	Oxygen Donor
Carbon or Charcoal	C	Fuel
Cationic Asphalt (< 10% Nitrogen)	Not required	Fuel
Chlorinated Paraffin	Not required	Color Intensifier/Chlorine Donor
Chlorinated Rubber	Not required	Color Intensifier/Chlorine Donor
Copper Metal	Cu	Color Agent
<b>Copper Salts (except Copper Chlorate)</b>		
Copper (II) Acetate, Anhydrous (Verdigris)	Cu(OAc) or Cu(CH <sub>3</sub> COO) <sub>2</sub>	
Copper (II) Acetate, Hydrated (Verdigris)	Cu(OAc) <sub>2</sub> ·(H <sub>2</sub> O) <sub>2</sub> or Cu(CH <sub>3</sub> COO) <sub>2</sub> ·(H <sub>2</sub> O) <sub>2</sub>	
Copper Carbonate	CuCO <sub>3</sub>	Color Agent
Cuprous Chloride (Copper Chloride)	Cu <sub>2</sub> Cl <sub>2</sub>	Color Agent
Cupric Chloride (Copper Chloride) (Prohibited if used with a Chlorate)	CuCl <sub>2</sub>	Color Agent
Copper Oxide	CuO	Oxygen Donor/Color Agent
Copper Sulfate (Prohibited if used with a Chlorate)	CuSO <sub>4</sub>	Color Agent
<b>Cryolite (Kryolite)</b>	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Sodium hexafluoroaluminate	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Sodium fluoaluminate	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Sodium aluminofluoaluminate	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Sodium aluminofluoride	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Aluminate (3-), hexafluoro-, trisodium, (OC-6-11)-	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Koyoside	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Kryocide	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Kryolith (German)	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Natriumaluminiumfluorid (German)	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Natriumhexafluoroaluminate (German)	Na <sub>3</sub> AlF <sub>6</sub>	Color Agent
Cryolite: Potassium Cryolite	K <sub>3</sub> AlF <sub>6</sub>	Color Agent
Dextrin or Dextrine	(C <sub>6</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>n</sub> ·xH <sub>2</sub> O or (C <sub>6</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>n</sub>	Binder/Fuel
<b>Diatomaceous Earth</b>	SiO <sub>2</sub> ·nH <sub>2</sub> O	
Diatomaceous Earth: Silica	SiO <sub>2</sub> ·nH <sub>2</sub> O	
Diatomaceous Earth: Hydrated Silica	SiO <sub>2</sub> ·nH <sub>2</sub> O	
Diatomaceous Earth: hydrated Silicon Dioxide	SiO <sub>2</sub> ·nH <sub>2</sub> O	
Diatomaceous Earth: Diatomite	SiO <sub>2</sub> ·nH <sub>2</sub> O	
Diatomaceous Earth: Kieselgur	SiO <sub>2</sub> ·nH <sub>2</sub> O	

Dyes for Smokes (See Smoke Dyes: Colored)		
Epoxy (Thermosetting polymer – two part – resin & hardener)	Not required	Binder
Flour (Wheat Flour, Rice Flour)	Not required or $(C_6H_{10}O_5)_n$ or $(C_6H_{10}O_5)_n \cdot xH_2O$	Binder
Hexachlorophene (Nabac)	$C_{13}H_6Cl_6O_2$	Fuel
Hexamethylenetetramine (Hexamine)	$C_6H_{12}N_4$	Fuel
Iron (Ferrum is Latin for Iron)	Fe	Fuel
Iron Alloy (Ferro/Titanium)	Fe/Ti	Fuel
Iron Oxide	$Fe_2O_3$	Oxygen Donor
Lactose	$C_{12}H_{22}O_{11} \cdot H_2O$	Binder/Fuel
Linseed Oil	Not required	Drying Agent/Fuel
Magnalium (Magnesium/Aluminum) (> 53 microns) Ok for use in a break charge and other compositions including report composition	Mg/Al	Fuel
Magnalium (Magnesium/Aluminum) ( $\leq$ 53 microns) Report Composition only	Mg/Al	Fuel
Magnesium (in Fireworks, UN0335, 1.3G and Article Pyrotechnic, UN0431, 1.4G)	Mg	Fuel
Magnesium Carbonate	$MgCO_3$	Neutralizer
Magnesium Sulfate	$MgSO_4$	Oxygen Donor
Nitrated Asphalt (< 10% Nitrogen)	Not required	Fuel
Nitrated Asphaltum (< 10% Nitrogen)	Not required	Fuel
Nitrated Bitumen (< 10% Nitrogen)	Not required	Fuel
Nitrated Pitch (< 10% Nitrogen)	Not required	Fuel
Nitrated Tar (< 10% Nitrogen)	Not required	Fuel
Naphthol Pitch (< 10% Nitrogen)	Not required	Fuel
Nitrocellulose (The amount of Nitrocellulose must be less than 15 g per article/item. Nitrocellulose may not contain more than 12.6% nitrogen by mass.)	Not required	Binder
Nitrocellulose Based Lacquers (The amount of Nitrocellulose in a Nitrocellulose based lacquer must be less than 15 g per article/item. Nitrocellulose in Nitrocellulose Based Lacquers may not contain more than 12.6% nitrogen by mass.)	Not required	Binder
Parlon: (A Chlorinated rubber)	Not required or $(C_4H_6Cl_2)_n$	Color intensifier/Chlorine Donor
Phosphorus, Red (only as provided in table 3.7-1)	P	Fuel
Polyvinyl Chloride (PVC)	$(C_2H_3Cl)_n$ or $(CH_2CHCl)_n$	Color Intensifier/Chlorine Donor
Potassium Benzoate	$KC_6H_5CO_2$ or $KC_7H_5O_2$	Whistle
Potassium Dichromate or Potassium Bichromate (not to exceed 5% of formulation)	$K_2Cr_2O_7$	Oxygen Donor
Potassium Chlorate (only as provided in Table 3.7-1 below)	$KClO_3$	Oxygen Donor
Potassium Fluorosilicate	$K_2SiF_6$	
<b>Potassium Hydrogen Phthalate (KHP)</b>	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: hydrogen potassium phthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: potassium acid phthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: phthalic acid potassium salt	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: potassium biphthalate	$KC_8H_5O_4$	Whistle
Potassium Hydrogen Phthalate: 1,2-benzenedicarboxylic acid, mono-potassium salt	$KC_8H_5O_4$	Whistle
Potassium Nitrate	$KNO_3$	Oxygen Donor
Potassium Oxalate	$K_2C_2O_4$	Color Agent
Potassium Perchlorate	$KClO_4$	Oxygen Donor
Potassium Silicofluoride	$K_2SiF_6$	
Potassium Sulfate	$K_2SO_4$	Oxygen Donor
Red Gum	Not required	Binder
Resinox (Also considered a Phenolic Resin or a Phenol-formaldehyde Resin)	Not Required	Binder
Rice Hull (Non-impregnated)	Not Required	Density Control

Rice Hull Impregnated (Must specify any chemical compound(s) or chemical formulations involved in the impregnation)		
Rice Starch (Rice Flour/Glutinous Rice Flour/Starch)	$(C_6H_{10}O_5)_n$ or $(C_6H_{10}O_5)_n \cdot xH_2O$	Binder
Shellac	$C_{18}H_{32}O_5$ or $C_{16}H_{24}O_5$ or $C_{15}H_{20}O_6$ or $C_{16}H_{32}O_5$ or $C_{30}H_{50}O_{11}$	Binder
Silicon	Si	Fuel
Silver Fulminate	AgCNO	Explosive
<b>Smoke Dyes (Colored)</b>		
Smoke Dye (Blue): Methylene Blue	$C_{16}H_{18}ClN_3S \cdot 3H_2O$	Blue Smoke Dye CAS# 61-73-4
Smoke Dye (Blue): Phthalocyanine (Blue)	$C_{32}H_{16}CuN_8$	Blue Smoke Dye
Smoke Dye (Green): 1,4-di-p-toluidino-anthraquinone (Solvent Green 3)	$C_{26}H_{20}O_2(NH)_2(CH_3)_2$	Green Smoke Dye
Smoke Dye (Orange): $\alpha$ -xylene-azo- $\beta$ -naphthol (Orange 7) or Sodium 4-[(2-Hydroxy-1-naphthyl)azo]benzenesulphonate	$C_{16}H_{11}N_2NaO_4S$	Orange Smoke Dye CAS# 633-96-5
Smoke Dye (Orange): Oil Orange Pigment	$C_{26}H_{28}N_2O_2$	Orange Smoke Dye CAS# 84632-59-7
Smoke Dye (Red): 1-methylamino-anthraquinone (Disperse Red 9)	$C_{15}H_{11}NO_2$	Red Smoke Dye
Smoke Dye (Red): Para Red (Pigment Red1 or p-nitroaniline red)	$C_{16}H_{11}N_3O_3$	Red Smoke Dye CAS# 6410-10-2
Smoke Dye (Violet): 1,4-diamino-2,3-dihydroanthraquinone (Violet)	$C_{14}H_{12}N_2O_2$	Violet Smoke Dye
Smoke Dye (Violet): Rhodamine B (Basic Violet 10)	$C_{28}H_{31}N_2O_3 \cdot Cl$	Violet Smoke Dye
Smoke Dye (Yellow): 2-(2-quinolyl)-1, 3-indandione (Chinoline Yellow or Solvent Yellow 33)	$C_{18}H_{11}O_2N$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Vat Yellow 4)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Golden Yellow GK)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Tyrian Yellow I-GOK)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Dibenzochrysenedione)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Dibenzo(a,h)pyrene-7,14-dione (Dibenzpyrenequinone)	$C_{24}H_{12}O_2$	Yellow Smoke Dye
Smoke Dye (Yellow): Methyl Yellow (Butter Yellow)	$C_{14}H_{15}N_3$	Yellow Smoke Dye CAS# 60-11-7
Smoke Dye (Yellow): Auramine (Basic Yellow 2)	$C_{17}H_{22}ClN_3$	Yellow Smoke Dye
Sodium Chlorate (Only as provided in Table 3.7-1)	$NaClO_3$	Oxygen Donor
<b>Sodium Salts (except Sodium Chlorate)</b>		
Sodium Benzoate	$NaC_6H_5CO_2$ or $NaC_7H_5O_2$	Whistle
Sodium Bicarbonate (Sodium Hydrogen Carbonate)	$NaHCO_3$	Neutralizer
Sodium Fluorosilicate	$Na_2SiF_6$	
Sodium Nitrate	$NaNO_3$	Oxygen Donor
Sodium Oxalate	$Na_2C_2O_4$	
Sodium Salicylate	$C_7H_5NaO_3$	Whistle
Sodium Silicofluoride	$Na_2SiF_6$	
Sodium Sulfate	$Na_2SO_4$	Oxygen Donor
Starch (Amylum) (includes Wheat, Corn and Rice)	$(C_6H_{10}O_5)_n$ or $(C_6H_{10}O_5)_n \cdot xH_2O$	Binder/Fuel
Stearic Acid (Octadecanoic Acid)	$C_{18}H_{36}O_2$ or $CH_3(CH_2)_{16}CO_2H$	Fuel
<b>Strontium Salts (except Strontium Chlorate)</b>		
Strontium Carbonate	$SrCO_3$	Color Agent
Strontium Chloride	$SrCl_2$	Color Agent

Strontium Nitrate	$\text{Sr}(\text{NO}_3)_2$	Oxygen Donor
Strontium Oxalate	$\text{SrC}_2\text{O}_4$	Color Agent
Strontium Phthalate	$\text{Sr}(\text{C}_8\text{H}_5\text{O}_4)_2$	Whistle or Color Agent
Strontium Sulfate	$\text{SrSO}_4$	Oxygen Donor
Sulfur	S	Fuel
Titanium (>149 microns) Ok for use in a break charge and other compositions	Ti	Fuel
Ultramarine	$\text{Na}_2\text{S}_2 \cdot 3\text{NaAlSiO}_4$	Color Agent
Wood Powder (Cellulose)	$(\text{C}_6\text{H}_{10}\text{O}_5)_n$	

**MISCELLANEOUS COMPOUNDS:** Organic compounds may be a combination of carbon with hydrogen, oxygen and/or chlorine. Nitrogen may be present in organic compounds if it accounts for less than 10-percent (by weight) of the compound.

**RESTRICTION NOTICE:** Fireworks UN0336, 1.4G and Fireworks UN0335, 1.3G - Nitrocellulose may not contain more than 12.6% nitrogen by mass, that meets the criteria for classification as a 4.1 flammable solid, is permitted as a propelling or expelling charge provided there is less than 15 g of nitrocellulose per article. Nitrocellulose as a binder or the Nitrocellulose component of a Nitrocellulose based lacquer must be less than 15 g per article. These restrictions are not additive.

## Prohibited Chemicals and Components

**Prohibited Chemicals** - Consumer fireworks devices offered or intended for sale to the public may not contain a chemical enumerated in Table 3.7-1, except for small amounts (less than 0.25% by weight) as impurities, and except as specified therein.

**Note:** Display fireworks and theatrical pyrotechnics are not subject to the provisions of this section (Table 3.7-1).

### **TABLE 3.7-1 Prohibited Chemicals for Consumer Fireworks**

1. Arsenic sulfide, arsenates, or arsenites
2. Boron
3. Chlorates, except:
  - a. In colored smoke mixtures in which an equal or greater weight of sodium bicarbonate is included
  - b. In party poppers
  - c. In those small items (such as ground spinners) wherein the total powder content does not exceed 4 g of which not greater than 15% (or 600 mg) is potassium, sodium, or barium chlorate
  - d. In firecrackers
  - e. In toy caps
4. Gallates or gallic acid
5. Magnesium (magnesium/aluminum alloys, called magnalium, are permitted)
6. Mercury salts
7. Phosphorus (Yellow or white are prohibited; red phosphorus is permissible in caps and party poppers)
8. Picrates or picric acid
9. Thiocyanates
10. Titanium, except in particle size that does not pass through a 100-mesh sieve or greater than 149 microns
11. Zirconium
12. Lead tetroxide (red lead oxide) **and other lead compounds**

**Note:** For transportation purposes the term, forbidden devices, may also include mixtures or devices that contain a chlorate and an ammonium salt, or an acidic metal salt, or devices that contain yellow or white phosphorus, devices that combine an explosive and a detonator or blasting cap, and any device that has not been approved by DOT.

**NOTE: For All Fireworks UN0336, 1.4G and Fireworks UN0335, 1.3G - Nitrocellulose with not more than 12.6% nitrogen by mass, that meets the criteria for classification as a 4.1 flammable solid, is permitted as a propelling or expelling charge provided there is less than 15 g of nitrocellulose per article. Additionally, Nitrocellulose as a binder or Nitrocellulose based lacquers may not 15 g of nitrocellulose per article. These restrictions are not additive.**

### **PROHIBITED CHEMICALS IN ALL FIREWORKS:**

- 1.) Methylene Chloride, Ethylene Chloride and Xylene are liquids. If this chemical is used in the manufacturing process, but is removed during the drying process, should not be listed as part of a chemical composition.
- 2.) Benzene Hexachloride (C<sub>6</sub>Cl<sub>6</sub>) also known as Hexachlorobenzene or Phenyl Hexachloride or Perchlorobenzene – Prohibited in all fireworks devices.
- 3.) Hexachlorocyclohexane - (C<sub>6</sub>H<sub>6</sub>Cl<sub>6</sub>) also known as Lindane - Prohibited in all fireworks devices.
- 4.) Nitric Acid is a liquid and is prohibited in all fireworks devices.
- 5.) Sodium Percarbonate (Na<sub>2</sub>CO<sub>3</sub>·1.5H<sub>2</sub>O<sub>2</sub>) sometimes it is shown as (Na<sub>2</sub>CO<sub>3</sub>·H<sub>2</sub>O<sub>2</sub>)
- 6.) Acacia – The plant's sap and leaves contain large amounts of tannins, which contains Gallic Acid. Gallic Acid and Gallates are forbidden chemicals.

- 7.) Sodium Complex - Name is too vague. Specify what the "Complex" is.
- 8.) Rice – Name is too vague. Specify what "Rice" means (Rice flour, Rice Starch, Rice Hull, etc.). **NOTE: Rice Hulls may or may not be impregnated with a chemical composition, which is permitted, but applicant must specify any chemical compound(s) or chemical formulations involved in the impregnation.**
- 9.) Resin – Name is too vague. Specify the chemical name for the "Resin".
- 10.) Lac – Name is too vague. Need to specify what the chemical component is, such as, shellac or lactose.
- 11.) Olefin Chloride – Chemical name is too vague. Provide actual chemical name.