Chemical Incompatibility Table and Storage Recommendations

When certain hazardous chemicals are stored or mixed together, violent reactions may occur because the chemicals are unsuitable for mixing, or are incompatible. Classes of incompatible chemicals should be segregated from each other during storage, according to hazard class. Refer to the suggested shelf storage patterns for guidance.

No single method of determining chemical compatibility is perfect. The reasons for this are varied and include:

- Many chemicals belong to more than one hazard class. This can lead to confusion as to which class is appropriate for the chemical in question. Examples: Nitric acid is both an acid and an oxidizer; Benzoyl chloride is a combustible liquid, a corrosive, and a lachrymator.
- The hazard class that is most important can change depending on factors such as quantity of material, and other chemicals in the storage area.
- Not all chemicals in a given class are compatible. For example, sodium dichloroisocyanurate and calcium hypochlorite are both oxidizers and belong to no other class of chemical, yet the mixing of these two materials can lead to the formation of nitrogen trichloride, a shock sensitive explosive.
- Rigid adherence to a classification scheme often leads to inefficient work practices. An example is the prohibition of storing acids and bases together. While this is a good practice, it is not practical when one has numerous dilute solutions, as in atomic absorption standards made up in both dilute nitric acid and dilute ammonium hydroxide. Clearly, mixing of these acid and base solutions will not result in a hazardous reaction, and forcing workers to store such standards separately is inconvenient and unnecessary.
- The sheer number of exceptions to any classification scheme prevents listing all of them in a convenient reference table.

Relying solely on compatibility classification schemes might provide a false sense of security and it is important that those working with chemicals and those responsible for using and maintaining chemical storage facilities be familiar with the limitations of the classification system and the properties of the materials they are working with.

The following guidelines are provided for the safe storage of hazardous materials in accordance with their hazard classes (consult the Office of Environmental Health & Safety for additional guidance):

Acids:

- Segregate acids from reactive metals such as sodium, potassium, magnesium, etc.
- Segregate oxidizing acids (e.g., nitric acid) from organic acids, flammable and combustible materials.
- Segregate acids from chemicals which could generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, etc.
- Segregate acids from bases.

Bases:

- Segregate bases from acids, metals, organic peroxides and easily ignitable materials.

Solvents (Flammable and Halogenated Solvents):

- Segregate from oxidizing acids and oxidizers.
- Keep away from any source of ignition (heat, sparks, or open flames).

Oxidizers:

- Store in a cool, dry place.
- Keep away from combustible and flammable materials.
- Keep away from reducing agents such as zinc, alkali metals, and formic acid.

Water Reactive Chemicals:

- Store in a cool, dry place away from any water source.
- Make certain that a Class D fire extinguisher is available in case of fire.

Pyrophoric Substance:

- (Materials which will react with the air to ignite when exposed, e.g., white phosphorus or tert-Butyl Lithium.)
- Store in a cool, dry place making provisions for an airtight seal.

Peroxide Forming Chemicals:

- Store in airtight containers in a dark, cool, and dry place.
- Label containers with receiving, opening, and disposal dates.
- Periodically test for the presence of peroxides.

Organic Peroxides:

- Store in area such as a refrigerator where the temperature will remain below the self accelerating decomposition temperature.

The table below shows combinations of some of the more commonly encountered chemicals that should be avoided. Before mixing any chemicals, refer to this partial list, the chemicals' MSDS, or call the Office of Environmental Health and Safety to verify compatibility.

Chemical	**Kept Out of Contact With:**
Acetic Acid	Chromic acid, nitric acid hydroxyl compounds, ethylene, glycol, perchloric acid, peroxides, permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, the halogens
Ammonia, anhydrous	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium Nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	Same as chlorine
Calcium Oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents.
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic Acid	Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals

Chlorine Dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene Hydroperoxide	Acids, organic or inorganic
Cyanides	Acids
Flammable Liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic Acid	Nitric acid, alkali
Hydrofluoric Acid	Ammonia, aqueous or anhydrous
Hydrogen Peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
Hydrogen Sulfide	Fuming nitric acid, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric Acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic Acid	Silver, mercury
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric Acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium Chlorate	Sulfuric and other acids
Potassium Permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium Peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric Acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)
Tellurides	Reducing agents

Reference**:**
From Manufacturing Chemists' Association, Guide for Safety in the Chemical Laboratory, pp. 215 – 217.