Incompatible Chemicals

A wide variety of chemicals react dangerously when mixed with certain other materials. Some of the more widely-used incompatible chemicals are given below, but the absence of a chemical from this list should not be taken to indicate that it is safe to mix it with any other chemical!

Chemical	Incompatible chemicals
acetic acid	chromic acid, ethylene glycol, nitric acid, hydroxyl compounds, perchloric acid, peroxides, permanganates
acetone	concentrated sulphuric and nitric acid mixtures
acetylene	chlorine, bromine, copper, fluorine, silver, mercury
alkali and alkaline earth metals	water, chlorinated hydrocarbons, carbon dioxide, halogens, alcohols, aldehydes, ketones, acids
aluminium (powdered)	chlorinated hydrocarbons, halogens, carbon dioxide, organic acids.
anhydrous ammonia	mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
ammonium nitrate	acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided organic combustible materials
aniline	nitric acid, hydrogen peroxide
arsenic compounds	reducing agents
azides	acids
bromine	ammonia, acetylene, butadiene, hydrocarbons, hydrogen, sodium, finely-divided metals, turpentine, other hydrocarbons
calcium carbide	water, ethanol
calcium oxide	water
carbon, activated	calcium hypochlorite, oxidizing agents
chlorates	ammonium salts, acids, metal powders, sulphur, finely divided organic or combustible materials
chromic acid	acetic acid, naphthalene, camphor, glycerin, turpentine, alcohols, flammable liquids in general

chlorine	see bromine
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	aqueous or anhydrous ammonia
hydrogen peroxide	copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
hydrogen sulphide	fuming nitric acid, oxidizing gases
hypochlorites	acids, activated carbon
iodine	acetylene, ammonia (aqueous or anhydrous), hydrogen
mercury	acetylene, fulminic acid, ammonia
mercuric oxide	sulphur
nitrates	sulphuric acid
nitric acid (conc.)	acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulphide, flammable liquids, flammable gases
oxalic acid	silver, mercury
perchloric acid	acetic anhydride, bismuth and its alloys, ethanol, paper, wood
peroxides (organic)	acids, avoid friction or shock
phosphorus (white) potassium	air, alkalies, reducing agents, oxygen carbon tetrachloride, carbon dioxide, water, alcohols, acids
potassium chlorate	acids
potassium perchlorate	acids
potassium permanganate	glycerin, ethylene glycol, benzaldehyde, sulphuric acid

selenides	reducing agents
silver	acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
sodium	carbon tetrachloride, carbon dioxide, water
sodium nitrate	ammonium salts
sodium nitrite	ammonium salts
sodium peroxide	ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
sulphides	acids
sulphuric acid	potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)
tellurides	reducing agents
zinc powder	sulphur

Appendix A

Potentially Explosive Chemical and Reagent Combinations

Some chemical and reagent combinations have potential for producing a viol ent explosion when subject to shock or friction.

The following tables list some common laboratory reagents that can produce explosions when they are brought together or that give reaction products that can explode without apparent external initiating action.
This list is not all inclusive, but includes the most common incompatible combinations.

Shock Sensitive Compounds

Acetylenic compounds, especially polyacetylenes, haloacetylenes, and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive).

Acyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerine Alkyl an acyl nitrites

Alkyl perchlorates

Amminemetal oxosalts metal compounds with coordinated ammonia, hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing group.

Azides, including metal, nonmetal, and organic azides. Chlorite salts of metals such as AgClO2 and Hg (ClO2)2 Diazo compounds such as CH2N2

Diazonium salts, when dry

Fulminates (silver fulminate, AgCNO, can form in the reaction mixture from the Tolens' test for aldehydes if it is allowed to stand for some time; this can be prevented by adding dilute nitric acid to the test mixture as soon as the test has been completed).

N-Nitro compounds such as N-nitromethalymine, nitrourea, nitroguanidine, and nitric amide Hydrogen peroxide becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals.

N-Halogen compounds such as difluoroamino compounds and halogen azide

Oxo salts of nitrogenous bases perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.

Perchlorate salts. Most metal, non-metal, and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials.

Peroxides and hydroperoxides, organic Peroxides, transition-metal salts

Picrates, especially salts of transition and heavy metals such as Ni, Pb, Hg, Cu, and Zn; picric acid is explosive but is less sensitive to shock or friction that its metal salts and is relatively safe as a water-wet paste.

Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile Polynitroaromatic compounds, especially polynitro hydrocarbons, phenols, and amines

Potentially Explosive Combinations of Common Reagents

Acetone + chloroform in the presence of base

Acetylene + copper, silver, mercury or their salts

Ammonia (including aquaeous solutions) + Cl2, Br2, or I2

Carbon disulfide + sodium azide

Chlorine + an alcohol

Chloroform or carbon tetrachloride + powdered Al or Mg

Decolorizing carbon + an oxidizing agent

Diethyl ether + chlorine (including a chlorine atmosphere)

Dimethyl sulfoxide + CrO_3

Ethanol + calcium hypochlorite

Ethanol + silver nitrate

Nitric acid + acetic anhydride or acetic acid

Picric acid + a heavy metal salt such as Pb, Hg, or Ag Silver oxide + Ammonia + ethanol

Sodium + a chlorinated hydrocarbon

Sodium hypochlorite + an amine

Apendix B

Basic Chemical Segregation

CLASS OF CHEMICALS	RECOMMENDED STORAGE METHOD	EXAMPLES	INCOMPATIBILITIES SEE MSDS IN ALL CASES
Compressed Gases-Flammable	Store in a cool, dry area, away from oxidizing gases. Securely strap or chain cylinders to a wall or bench top.	Methane, acetylene, propane	Oxidizing and toxic compressed gases, oxidizing solids.
Compressed Gases-Oxidizing	Store in a cool, dry area, away from flammable gases and liquids. Securely strap or chain cylinders to a wall or bench.	Oxygen, chlorine, bromine	Flammable gases.
Compressed Gases-Poisonous	Store in a cool, dry area, away from flammable gases and liquids. Securely strap or chain cylinders to a wall or bench.	Carbon monoxide, hydrogen sulphide (H_2S)	Flammable and/or oxidizing gases.

Corrosives - Acids	Store in separate acid storage cabinet.	Mineral acids - Hydrochloric acid, sulfuric acid, nitric acid, perchloric acid, chromic acid, chromerge	Flammable liquids, flammable solids, bases, oxidizers.
Corrosives - Bases	Store in separate storage cabinet.	Ammonium hydroxide, sodium hydroxide	Flammable liquids, oxidizers, poisons, and acids.
Shock Sensitive Materials	Store in secure location away from all other chemicals.	Ammonium nitrate, Nitro Urea, Picric Acid (in dry state), Trinitroaniline, Trinitroanisole, Trinitrobenzene, Trinitrobenzenesulfonic acid, Trinitrobenzoic acid, Trinitrochlorobenzene,	Flammable liquids, oxidizers, poisons, acids, and bases.
Flammable Liquids	In grounded flammable storage cabinet.	Acetone, benzene, diethyl ether, methanol, ethanol, toluene, glacial acetic acid	Acids, bases, oxidizers, and poisons.
Flammable Solids	Store in a separate dry, cool area away from oxidizers, corrosives, flammable liquids.	Phoshorus	Acids, bases, oxidizers, and poisons.
General Chemicals Non-reactive	Store on general laboratory benches or shelving preferably behind glass doors, or	Agar, sodium chloride, sodium bicarbonate, and most non-reactive salts	See MSDS

	below eye level.		
Oxidizers	Store in a spill tray inside a noncombustible cabinet, separate from flammable and combustible materials.	Sodium hypochlorite, benzoyl peroxide, potassium permanganate, potassium chlorate, potassium dichromate. The following are generally considered oxidizing substances peroxides, perchlorates, chlorates, nitrates, bromates, superoxides	Separate from reducing agents, flammables and combustibles.
Poisons	Store separately in vented, cool, dry, area, in unbreakable chemically resistant secondary containers.	Cyanides, cadmium, mercury, osmiumpounds, i.e. cadmium, mercury, osmium	Flammable liquids, acids, bases, and oxidizers.
Water Reactive Chemicals	Store in dry, cool, location, protect from water fire sprinkler.	Sodium metal, potassium metal, lithium metal lithium aluminum hydride	Separate from all aqueous solutions, and oxidizers.