

SCOTTISH SCHOOLS SCIENCE

EQUIPMENT RESEARCH

CENTRE

Bulletin No. 123.

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Introduction

The whole of this bulletin is given over to the article on 'Restricted Chemicals', issued in the April issue of 'Education in Science' (No. 37). It is the work of the Materials and Processes Group, and our Mr Cochrane has been particularly closely involved in the preparatory work for this article, so that he is well qualified to answer any questions which may arise from its application.

Chemistry News

Many Education Authorities have their own lists of prohibited and restricted chemicals. Differences in these have already led to some difficulties, e.g. in practical examinations, and could in the event of an accident be used to weaken the defence or question the competence of the Authority involved to prepare or implement an adequate safety policy. In drawing up the following list of recommendations the Working Party convened by the Association for Science Education to examine safety in schools has sought the views of many science advisers, teachers and chemical suppliers. The 'distillation' of their experience has been used to prepare what is intended as a guide to good practice rather than as a set of hard and fast rules. It must be emphasised that these matters are only recommendations. Each Education Authority should prepare its own advice and guidance, and it is hoped that these recommendations will assist with this task.

The categories of restriction suggested below are based on the likely experience of pupils at a particular stage in their school career. However it must be remembered that teachers know best the capabilities of their pupils, and also that the science teacher must be allowed to exercise a certain amount of professional judgement in choice and use of materials. Thus a teacher with sufficient expertise who is working in a school with adequate facilities for safely handling certain hazardous chemicals, possibly even some of those listed below as being 'not recommended' for school use, should perhaps be permitted to use them for special cases, e.g. sixth form project work. Clearly in such a case, his employer will have to be satisfied that such substances can be safely handled. It must be further pointed out that teachers have a duty under the Health and Safety at Work Act to comply with any safety instructions given them by their employer and there may be science teachers in some areas who find that their Authority has banned a certain chemical which may have been shown as suitable for restricted use on the list below. In such cases, the teachers have a legal duty to follow their employer's instructions: having complied with such instructions, they may then find out why the chemical is banned, and if they consider the reason inadequate, they may ask to have the ban lifted.

The Working Party has endeavoured to balance the educational value obtained by using a particular chemical against the risk presented. One course of action is to recommend the exclusion from school of only a relatively small number of the more hazardous substances hitherto found in schools to provide teachers with information relating to the hazards of the remaining materials thus enabling them to handle those materials in a professional manner. Unless the use of each chemical is visualised it is impossible for anyone to place on it a user

restriction or a use restriction which is valid rather than one which is administratively convenient.

In some cases it has been possible to suggest alternatives for particular uses of certain chemicals, e.g. methylbenzene can be used as a suitable alternative to benzene as a solvent. Similarly benzene (liquid at room temperature) and naphthalene (solid) can be replaced respectively in change of state experiments by cyclohexane and the higher alcohols and acids. However to show the properties of a particular substance there is often no alternative to using the substance itself and if unfortunately that substance is judged to be too hazardous then the educational objectives will clearly have to be sought by other means.

The absence of a chemical from this list cannot be used to imply anything about it. The list simply covers those chemicals which have been found in schools, and which present sufficient risk to have been noted by the Education Authorities and by members of the Working Party. As new information relating to hazards comes available it will be necessary to add or subtract from the restrictions. For example, a few years ago it was common to see pupils preparing N-nitrosamines in open test-tubes. Syllabuses do change and this often results in new materials being used and often in some hitherto well used chemicals being left unused on shelves.

The labels on the containers of most chemicals recently purchased will probably carry limited information as to the hazards and the precautions for handling. Suppliers and manufacturers are willing to provide information but teachers may wish to have at hand a reference book. A number of these have been included in the Safety Bibliography published in September 1979 issue of Education in Science.

Many chemicals present an intrinsic hazard in being toxic, highly flammable, explosive or corrosive. Others are unstable in storage e.g. potassium which forms unstable peroxides on prolonged storage or react unfavourably with ubiquitous materials such as air, moisture, wood etc. e.g. chloric(VII) acid. For some substances it is the experimental method employed and/or their incompatibility with other chemicals which give rise to the hazard e.g. propane-1,2,3.-triol (glycerol) is not regarded as an intrinsically hazardous substance but it will react vigorously if mixed with potassium manganate(VII).

The categories of restriction are listed below as 1-7.

1. Chemicals to be excluded from Schools X

These should not be stored nor should they be isolated in preparation. These are:

 - (i) a small number which have been prohibited by statutory instrument including naphthalene-2-amine (2-or beta-naphthylamine), biphenyl-4,4'-diamine (benzidine), 4-aminobiphenyl, 4-nitrobiphenyl and their salts.
 - (ii) others which in the opinion of the Working Party give rise to such a degree of hazard that their use in schools cannot be justified.
2. Chemicals not recommended to be normally held or stored N

These pose a high degree of risk and most syllabuses will not require them, but they may be needed for sixth year projects and options. E.g. analytical procedures likely to be used

in environmental studies need the use of small amounts of potassium cyanide as a masking agent. It is felt that exceptions can be made in such special cases provided that -

- (i) schools have adequate facilities to handle such materials i.e. secure storage, fume cupboards, ventilation etc. and are equipped for A level or Sixth Year Studies Work.
- (ii) teachers and pupils have the appropriate information and experience.

Employers may insist that teachers seek advice from them before making such decisions. In cases of doubt teachers should seek advice from their employers.

3. Chemicals restricted to small quantity for observation or exhibition only. E

Many wish to store small samples of materials for observation purposes only. These should be kept securely and it should be borne in mind that the forbidden status of such chemicals makes them more attractive to some pupils.

4. Chemicals restricted to small quantities - in storage R

It is difficult to give a recommended maximum value for the amount to be stored owing to the differences in syllabuses and the courses followed and in the local geography of the school. Some schools are on more than one site and others have laboratories which are widely separated within the one building. The dangers involved in transporting commonly used chemicals would be greater than those involved in storing twice the amount divided between the two sites.

However if it is found that most of the stock is consumed in the course of a year or of a term then that amount should not be exceeded.

5. Chemicals restricted to certain users.

- (a) Teachers only T
- (b) Senior pupils i.e. post 'O' Grade and post 'O' level S
- (c) 'O' Grade, 'O' Level or CSE and above (meaning the last two/three years of these and similar courses). O
- (d) Years 1 and 2 of secondary schools (11/12 years upwards) with close teacher supervision. t

All practical work to be carried out by pupils should in the first instance be supervised, in the sense that experimental details in texts and investigation sheets be checked and if necessary modified to suit the experience of the pupils and the facilities available. (During the use of some chemicals by certain users closer supervision is required, to these the suffix t has been added. For example see bromine element).

A number of chemicals which are not required by the syllabuses of some Examination Boards until after 'O' Grade or 'O' Level are required by others at an earlier stage. The designation of user category made on this list (i.e. O or Ot or S) has been decided on the basis of the hazards involved and on the likely experience and ability of pupils at a particular stage rather than on the demands of individual syllabuses.

6. Chemicals restricted to use in special circumstances only. F

E.g. for use in fume cupboards.

Again it will be necessary to exercise discretion e.g. it would

be no less safe to use lead(II) bromide or its solution outside of a fume cupboard than inside one, but if the salt were molten in order to electrolyse it then a fume cupboard is required. Though not ideal many substances can be safely handled in a well ventilated open laboratory, provided that the scale of operation is small e.g. up to 5cm³ of propanone. If a larger scale is used with open vessels then the use of a fume cupboard is recommended.

(F)

7. Chemicals with a short safe shelf-life.

L

These should only be purchased in small quantities and replaced by new stock at regular intervals, preferably not more than a year in most cases. Date stamping of new stock is recommended. Many chemicals are available in several portions of small quantities e.g. phosphorus(V) oxide can be purchased in 4 x 25g sealed containers and each upon opening can be used up within a short period of time. Purchased in this way the cost per gram is usually high, but on the other hand any initial saving, resulting from the purchase of one single large amount, is lost if disposal proves necessary. A visual check should be kept on such materials, and those in unopened sealed containers may be kept for longer periods. Such substances have been marked with an L.

Finally the Working Party would welcome suggestions from science teachers as to other chemicals which might be included in this list, and for safer alternatives to any of the restricted chemicals.

Summary of Key

X	excluded from school laboratories	(1)
N	not recommended	(2)
E	exhibition sample only	(3)
R	restrict inventory	(4)
T	teacher use only	(5)
S	also used by senior pupils	(5)
O	also used by pupils on 'O' Grade, 'O' Level or CSE and similar courses.	(5)
t	can with close teacher supervision be used by years one and two of secondary school. (The suffix t following on a user restriction implies that more direct supervision may be advisable).	(5)
F	to be used in fume cupboard	(6)
(F)	to be used in fume cupboard if in open vessels on a scale other than small	(6)
L	short safe shelf life	(7)

Numbers in brackets refer to categories in the Introduction.

Name	Restriction
acetone nitrile (methyl cyanide)	R, S, F
aerosol sprays	R, Ot, F
alcohols other than ethanol	R, O, (F)
aldehydes other than methanal	R, O, (F)
alkyl halides	R, Ot, (F)
all unlabelled bottles which contain substances of unknown composition	X
aluminium powder	Rt
aluminium bromide, anhydrous	R, S, L
aluminium carbide	R, T, L
aluminium chloride, anhydrous	R, S, L
4-aminobiphenyl	X
ammonia '880'	Ot, (F)
ammonical silver nitrate (Tollens reagent)	X Prepare as required and immediately dispose of excess.
ammonium chlorate(VII) (perchlorate)	X
ammonium dichromate(VI)	S
ammonium nitrate	R, St
ammonium peroxydisulphate(VI) (persulphate)	St avoid raising dust
ammonium sulphide anhydrous	Ot, (F)
anthracene	N, L alternatives are calcium sulphate, calcium chloride (both anhydrous) and molecular sieves.
antimony	E
antimony compounds	E
aromatic amines (except aminobiphenyls or naphthalenamines)	S
	R, St, F

Name	Restriction
arsenic	E
arsenic compounds	N If Marsh's Test needs to be shown use impure zinc.
asbestos, soft forms	X ceramic wool forms of paper, wool and platinised wool available. Calcium silicate matrix heat resistant mats and ceramic centred or stainless steel gauzes available.
paper fibre mats	Use heat resistant leather.
platinised centred gauzes	R, Ot See article on Carcinogens in Bulletin 117.
gloves	
azo dyes	
barium, metal	F
barium compounds, solid	S
barium compounds, dilute solution	t
barium chromate(VI)	N should not be isolated from any preparation.
barium peroxide	R, T, L
barium sulphate	O
Benedict's solution	O
benzamide	S
benzene, use as a solvent	N use methylbenzene as alternative solvent. Use cyclohexane for change of state experiment.
benzene, use as reagent	R, St, F (small scale preparative work).
benzenecarbaldehyde (benzaldehyde)	R, S, (F)
benzenecarbonyl chloride	R, S, F
(benzoyl chloride)	R, S, F
benzene-1,3-diamine (m-phenylenediamine)	R, S, F
benzene-1,4-diamine (p-phenylenediamine)	R, S, F
benzene-1,2-diol (catechol)	S

Name	Restriction
benzene-1,3-diol (resorcinol)	Ot, F
benzene-1,4-diol (quinol or hydroquinone)	S
benzenesulphonic acid	St
benzene-1,2,3-triol (pyrogallol)	S
benzotrile	R, S, F
beryllium	E
beryllium compounds	X
biphenyl-4,4'-diamine (benzidine)	X
bis(4-isocyanatophenyl) methane (Caradate 30)	R, St, F
bismuth	S
bismuth compounds	O
bleaching powder	R, O, L
bromates	R, S
bromine, element	R, St, F
bromine, dilute solutions	O
bromobenzene (phenyl bromide)	S
1-bromobutane (n-butyl bromide)	R, S, (F)
2-bromobutane (sec-butyl bromide)	S, (F)
bromoethane (ethyl bromide)	R, S, (F)
bromomethane (methyl bromide)	R, T, F
2-bromo-2-methylpropane (t-butyl bromide)	R, S, (F)
bromopropane (propyl bromides)	R, S, (F)
3-bromoprop-1-ene (allyl bromide)	R, S, F
butanal	R, O, (F)
butane cylinder	N not recommended in lab.
butanoic acid	R, S
butan-1-ol (n-butanol)	O, (F)

Name	Restriction
butan-2-ol (sec-butanol)	O, (F)
butanone (methyl ethyl ketone)	O, (F)
cadmium	R, St
cadmium compounds	R, St
calcium, metal turnings	R, Ot
calcium dicarbide	R, St, L
calcium hydride	R, St, L
calcium oxide	R, Ot, L
calcium phosphide	N
calcium sulphide	R, S, F
carbon dioxide, solid	Ot
carbon monoxide	R, S, F
carbon disulphide	St, F small scale preparation.
camphor	St, F
chlorates(I) (Hypo-chlorites)	II use dimethylbenzene as solvent for preparing rhombic sulphur and ethyl cinnamate for prism experiment.
chlorates(III) (chlorites)	II
chlorates(V) (chlorates)	R, Ot, L purchase sodium salt as solution: ensure cap is vented.
chlorates(VII) (perchlorates)	II
chloric(VII) acid (perchloric acid)	II small quantities may be isolated as in fractional crystallisation of disportionation products of potassium chlorate(V) - not to be stored.
chlorine cylinder	II
chlorobenzene	II
chlorobutanes (butyl chlorides)	R, S, (F)
chloroethane (ethyl chloride)	R, S, (F)

Name	Restriction
chloroethene (vinyl chloride monomer)	X
(chloromethyl) benzene (benzyl chloride)	R, S, F
chloropropanes (propyl chlorides)	R, S, (F)
chlorosulphonic acid	R, St, F
chromates(VI) and dichromates(VI) solutions	O
solids	S
chromium(VI) oxide	R, S
(chromium trioxide)	
chromium(III) compounds	O
(chromic compounds)	
cleaning mixture	T Do not store.
(dichromate(VI)/conc sulphuric acid)	Decon 90 good alter-native.
crude oil	Ot, F
cyanates	R, T
cyanides	N
cyclohexane	O, (F)
cyclohexanol	S, (F)
cyclohexanone	S, (F)
cyclohexene	O, (F)
DDT	N
decanedioyl dichloride (sebacoyl chloride)	Ot, F
Devarda's alloy	O
N,N'-dialkylphenylamines (N,N'-dialkylanilines)	R, S, F
di(benzenecarbonyl) peroxide (benzoyl peroxide)	N di(dodecanyl) peroxide is alternative polymerisation catalyst.
1,2-dibromoethane (ethylene dibromide)	N may be formed as in test for unsaturation, but should not be isolated.
1,2-dibromopropane (propylene dibromide)	R, S, F

Name	Restriction
dichlorobenzenes	R, S, F 1,2-isomer most toxic of the three isomers.
dichlorobiphenyl-4,4'-diamines (chlorobezidines)	X
dichlorodimethylsilane	R, T, F
1,2-dichloroethane (ethylene dichloride)	R, T, F
dichloroethanoic acid (dichloroacetic acid)	R, S
2,4-dichlorophenols	R, S
di(dodecanoyl) peroxide (lauroyl peroxide)	R, Ot
diethylamine	R, Ot, F
diethylamine, dilute solution	O
diethyl sulphate	X
diiodine hexachloride (iodine trichloride)	R, St, F
3,3'-dimethoxybiphenyl-4,4'-diamines	X
dimethylamine	T, Ot, F
dimethylamine, dilute solutions	O
3,3'-dimethylbiphenyl-4,4'-diamine (o-tolidine)	X
dimethyl formamide	R, S, F
dimethyl sulphate	X
dinitrobenzenes	R, St
3,5-dinitrobenzoic acid	R, S
4,4'-dinitrobiphenyl	X
2,4'-dinitrobromobenzene	R, T
2,4-dinitrochlorobenzene	N
2,4-dinitrofluorobenzene	N
dinitrophenols	R, St
2,4-dinitrophenyl-hydrazine	R, S
dioxan	R, St, L
dipentene	R, O

Name	Restriction	Otherwise N
diphenylamine, solution for redox indicator	R, St	
esters (general)	R, O, (F)	
ethanal (acetaldehyde)	R, O, (F)	
ethanal tetramer (metaldehyde)	Ot	
ethanal trimer (paraldehyde)	R, S, F	
ethane cylinder	N	
ethane-1,2-diamine (ethylene diamine)	R, S, F	
ethanedioic acid and salts (oxalic acid and salts)	R, S	
solid	R, Ot	
dilute solution	Ot, (F)	
ethanoic acid, glacial (acetic acid, glacial)	R, S, (F)	
ethanoic anhydride	O, (F)	
ethanol (acetic anhydride)	S, F	
ethanoyl chloride (acetyl chloride)	N	
ethene cylinder (ethylene)	R, S, F	
ethers (general)	R, S, F, L	
ethoxyethane (diethyl ether)	S, F	
ethoxyethanol (cello- solve)	R, Ot, F	
ethylamine	O	
ethylamine, dilute solution	O, (F)	
ethylbenzene	O, (F)	
ethyl benzoate	N	
ethyl carbamate	O, (F)	
ethyl ethanoate (ethyl acetate)	O, (F)	
ethyl methanoate (ethyl formate)	O, (F)	

Name	Restriction
ethyne cylinder (acetylene)	X
Fehlings solution No 2	Ot Use water bath. Alternative is Benedict's or Barfoed's solution.
fluorene	N
fluorenone	N
fluorides, solid	R, T
fluorides, solution	Ot
germanium tetrachloride	R, S, F
heptane	R, O, (F)
hexacyanoferrates(II)	S
(ferrocyanides)	
hexacyanoferrates(III)	S
(ferricyanides)	
solutions of hexacyano- ferrates	Ot no heating, no addition of strong acids
hexamethylcosane (squalene)	O
hexamine	R, S, F
hexane	R, O, (F)
hexane-1,6-diamine (hexamethylenediamine)	Ct
hexanedioic acid (adipic acid)	O
hexanedioyl dichloride (adipoyl chloride)	Ot, F
hexenes	O, (F)
hydrazine	X
hydrazine chloride	R, St
hydrazine hydrate	R, T
hydrazine sulphate	R, St
hydrides, metal	R, St
hydriodic acid	R, S
hydrobromic acid	R, S
hydrocarbons, aliphatic	O small scale, (F)
hydrocarbons, aryl	S, (F)
hydrochloric acid, conc	Ot
hydrofluoric acid	T
hydrogenation catalysts	R, St
hydrogen cyanide	R, St
hydrogen cylinder	T

Name	Restriction	Name	Restriction
hydrogen peroxide 20 vol	t, L	magnesium powder	Ot
hydrogen peroxide 100 vol	R, T, L	magnesium ribbon	t
hydrogen sulphide gas	S, F aqueous solutions may be used outside fume cupboard.	mercury	R, St in well ventilated room on spillage tray
2-hydroxybenzoic acid (salicylic acid)	0	mercury alkyls	X
indicator powders	T	mercury salts, solid	St
indium compounds	S	mercury salts, solution	Ot
iodates(V)	S	methanal (formaldehyde, formalin)	R, Ot in F unless very dilute. Do not use in presence of hydrogen chloride.
iodic(V) acid	R, T	methanoic acid (formic acid)	Ot, (F)
iodine, solid	O, lower levels t, if heated t, (F)	methanol	Ot, (F)
iodine(V) oxide (iodine pentoxide)	N	2-methoxyphenylamine (o-anisidine)	R, S, F
iodoethane (ethyl iodide)	R, T, F	4-methoxyphenylamine (p-anisidine)	R, S, F
iron(III) chloride, solid	0	methylamine	S, F
iron(II) sulphide	0	methylamine, dilute solution	0
isocyanates	R, T, F	methylbenzene (toluene)	Ot, (F)
lead alkyls	N	3-methylbutanol (iso-amyl alcohol)	0
lead(II) bromide	Ot if used for electrolysis F	3-methylbutyl ethanoate (iso-amyl acetate)	S, (F)
lead(II) chloride	Ot	methyl ethanoate (methyl acetate)	O, (F)
lead(II) chromate(VI)	N	methyl ethyl ketone peroxide	Ot
lead(II) ethanoate (lead acetate)	Ot	methyl methanoate (methyl formate)	O, (F)
lead(II) methanoate (lead formate)	Ot	methyl 2-methylpropionate (methyl methacrylate)	R, S, F, L
lead oxides	all levels t	methylphenols (cresols)	R, S
lithium	R, Ot if heated T	N-methylphenylamine (N-methylaniline)	R, St, F
lithium compounds	R, S	Millon's reagent	R, S alternatives are Albusstix, Cole's modification of Millon's reagent or Sakaguchi Test.
lithium aluminium hydride	R, St, F, L		
lithium hydride	R, T, F, L		
lithium hydroxide	R, S		

Name Restriction

molybdenum R,S liquid paraffin is
naphtha R,T,F preferred for storing
alkali metals

naphthalen-1-amine X
(1-naphthylamine)
naphthalen-2-amine X
(2-naphthylamine)
naphthalene 0 For cooling curves use
hexadecan-1-ol, octadecan-
1-ol, hexadecanoic or
octadecanoic acid
R,St

N-naphthylethane-1,2-
diamine as solution
(N.E.D. or N-naphthy-
lethylenediamine)
naphthylthiourea (AMTU)
Messler's reagent R,T
nickel, dust R,S
nickel salts, solid R,St
nickel salts, solution S avoid raising dust
ninhydrin, solid 0
ninhydrin, aerosol R,T
spray R,St,F

nitric acid conc 0t
nitric acid, fuming R,St,F
nitrobenzene R,S,F
4-nitrobiphenyl X
nitrocellulose X
nitrogen dioxide X
nitrogen triiodide O,F
nitromethylbenzenes N
(nitrotoluenes)
nitronaphthalenes X
nitrophenols X
0 R,St
+((4-nitrophenyl)azo)
benzene-1,3-diol 0
solution (Magneson I)
+((4-nitrophenyl)azo) 0
naphthalen-1-ol
solution (Magneson II)

Name Restriction

nitrosamines X
nitrosophenols, 2-and X
3-isomers
4-nitrosophenol R,St
octane R,O,(F)
oct-1-ene R,S,(F)
oleum N
orthophosphoric acid S
orthophosphoric acid, 0
dilute
osmic acid N alternative strains for
microscope work are the
Sudan dyes

oxygen mixture N alternative preparation
(potassium chlorate(V))/
manganese(IV) oxide is decomposition of 20 vol
hydrogen peroxide catalysed
by manganese(IV) oxide
0
paraffin oil R,T
paraquat R,T
pentane 0,(F)
pentan-1-ol and 2-ol 0,(F)
(n- and sec-amyl
alcohol)
pentan-3-one (diethyl 0,(F)
ketone)
pentyl ethanoate (amyl R,O,(F)
acetate)

peroxides, inorganic S
(excluding H₂O) St
peroxodisulphates(VI)
(persulphates)
petroleum ether, BP S,(F)
below 80°C
petroleum ether, BP 0t,(F)
above 80°C
phenols St
phenols, dilute solutions 0
e.g. indicators
phenylamine (aniline) R,St,F
phenylammonium salts R,S,(F)
(anilinium salts)

Name	Restriction
phenylethene (styrene)	R, S, F
phenylhydrazine and salts	R, S
phenylthiourea (P.T.U.) also phenylthiocarbamide (P.T.C.)	Ot see Bulletin 117.
phosphides, metal	N
phosphorus, red	R, Ot, F
phosphorus, white	R, T, F, L
phosphorus(V) oxide	R, St, F, L
phosphorus pentabromide	R, St, F, L
phosphorus tribromide	R, St, F, L
phosphorus trichloride	R, St, F, L
phosphorus trichloride oxide	R, St, F, L
photographic developer	t
potassium	R, T, L
potassium amide (potassamide)	N, L
potassium hydrogensulphate (potassium bisulphate)	0
potassium hydroxide, solution <2 molar	Ot
potassium hydroxide, solid, melt or concentrated solution	St
potassium manganate(VII) (potassium permanganate)	t
potassium nitrate	t
potassium nitrite	R, S
potassium sulphide	R, Ot
propanol (propionaldehyde)	0, (F)
propanoic acid (propionic acid)	0, (F)
propan-1-ol and -2-ol (n-propyl and iso-propyl alcohols)	0, (F)

Name	Restriction
propanone (acetone)	0, below 0 if t, (F)
propylamine	S, F
propylamine, dilute solution	0
propyl ethanoate (propyl acetate)	0, (F)
pyridine	R, St, F
quinine	R, T cold tea is alternative for taste buds experiment
selenium and compounds	R, S, F
silicon tetrachloride	R, St, F, L
silver nitrate	R, S
silver nitrate solution	Ot
sodamide (sodium amide)	N, L
sodium	R, St
sodium amalgam	R, S
sodium azide	R, S
sodium chlorate(I)	R, S
sodium solution (hypochlorite)	Ot Ensure container is vented
sodium hydroxide, solution <2 molar	Ot
sodium hydroxide, solid, melt or concentrated solution	St
sodium hydrogen sulphate (bisulphate)	0
sodium nitrate	t
sodium nitrite	R, S
sodium pentacyanonitrosylferrate(II) (sodium nitroprusside)	S
sodium peroxide	R, St, L
sodium sulphide	R, Ot
strontium	K, T
sulphides, heavy metal	Ot
sulphur chlorides	R, St, F
sulphur dioxide canister	St, F
sulphuric acid, conc	Ot
sulphuric acid, dilute	t
tellurium metal and compounds	F

Name	Restriction
tellurium compounds	X
tetrachloromethane (carbon tetrachloride)	R,St,F 1,1,1-trichloroethane is less harmful substitute for solvent applications.
thallium and compounds	X
Thermit mixture	T Do not store
thiocyanates, solid	S Do not heat to decomposition or add strong acids
thiourea (also thiocarbamide)	R,S See Bulletin 117.
tin(II) chloride (stannous chloride)	O
tin(IV) chloride (stannic chloride)	R,S,F,L
titanium(IV) chloride (titanium tetrachloride)	R,T,F
1,1,1-trichloroethane as solvent	t,(F)
2,2,2-trichloroethanediol (chloral hydrate)	R,S,F
trichloroethanoic acid (trichloroacetic acid)	S
trichloroethene (trichloroethylene) as solvent	N 1,1,1-trichloroethane is a less harmful substitute for solvent applications.
trichloromethane (chloroform)	R,St,F 1,1,1-trichloroethane is a less harmful substitute for solvent applications.
3,4,5-trinitrobenzoic acid (gallic acid)	R,S
2,4,6-trinitrophenol (picric acid)	R,S
turpentine	R,t,F
uranium compounds, solid	R,T
uranium compounds, solution	S
vanadium(V) oxide (vanadium pentoxide)	T
vanadates(V)	S
xylene cyanol solid	R,S
zinc powder	R,t
zinc chloride	S
zinc chromate(VI)	X

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