

COMMON CHEMICALS AND SUPPLIES IN AND AROUND YOUR HOME

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Many schools share the problem of insufficient budgets for purchasing chemicals necessary for laboratory experiments and demonstrations. Fortunately “chemicals” are everywhere (after all, what isn’t a chemical?) and cheap supplies of many useful chemicals can be found at local stores. This compilation lists sources as grocery store, drug store, hardware store, garden supply, and photo store. Much of these classifications have changed and now include supermarkets, natural food markets, hyperstores, pharmacy superstores, and home centers. Not every store carries all these items and some may have to be special ordered.

Most of these chemicals are not reagent grade chemicals, but are C.P., U.S.P., or technical grade suitable for most laboratory applications (See Grades of Purity for Chemicals, page 18). Using household chemicals not only can save money and the trouble of ordering from multiple catalogs, but it is effective in encouraging students to read the labels on products they use and thus become more “chemically literate”. In some cases, it may be necessary to determine the percent purity of the compound from the label and adjust your “recipes” accordingly. In most cases, the other ingredients will not significantly affect results. As always, pretesting your activities with proper precautions (especially eye protection) is essential for pedagogical and safety implications.

Name of Chemical	Common Name	Formula	Source
acetic acid	vinegar (5% solution) acetic acid, glacial stop bath (28%)	CH_3COOH	grocery store photo store photo store
acetone	nail polish remover epoxy and fiberglass cleaner acetone	CH_3COCH_3	drug store paint store paint store
acetylsalicylic acid	aspirin	$\text{C}_9\text{H}_8\text{O}_4$	drug store
aluminum	aluminum foil aluminum wire and sheet	Al	grocery store hardware store building supply
aluminum ammonium sulfate	ammonium alum	$\text{AlNH}_4(\text{SO}_4)_2$	drug store
aluminum potassium sulfate	alum	$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	drug store
aluminum sulfate	sulfate of aluminum flocculating powder	$\text{Al}_2(\text{SO}_4)_3$	garden supply pool store
ammonia	ammonia	$\text{NH}_3 \text{ (aq)}$	grocery store
ammonium carbonate	smelling salt	$(\text{NH}_4)_2\text{CO}_3$	drug store
ammonium chloride	sal ammoniac	NH_4Cl	hardware store
ammonium nitrate	nitrate of ammonia	NH_4NO_3	garden supply
amylum	corn starch	$[\text{C}_6\text{H}_{10}\text{O}_5]_n$	grocery store
ascorbic acid	vitamin C fruit fresh	$\text{C}_6\text{H}_8\text{O}_6$	drug store grocery store natural food store
boric acid	boric acid eyewash solution roach killer (solid)	H_3BO_3	drug store drug store hardware store
butane	lighter fuel	C_4H_{10}	grocery store
caffeine	No-Doz tablets	$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$	drug store
calcium carbonate	chalk limestone marble chips some antacids	CaCO_3	variety store garden supply drug store
calcium chloride	ice melter road salt/deicer	CaCl_2	hardware store pool store

Name of Chemical	Common Name	Formula	Source
calcium hydroxide	slaked lime some antacids	Ca(OH)_2	hardware store drug store
calcium hypochlorite	bleaching powder chlorinating powder some mildew removers	Ca(ClO)_2	grocery store pool supply hardware store
calcium oxide	quicklime	CaO	hardware store
calcium phosphate	superphosphate	$\text{Ca(H}_2\text{PO}_4)_2$	garden supply
calcium sulfate	gypsum Plaster of Paris	CaSO_4	building supply hardware store school supply
carbon	charcoal activated charcoal graphite (powder) graphite (rod): pencil lead graphite (rod): carbon battery ¹	C	hardware store pet store hardware store stationery store toy/electronic store
carbon dioxide, solid	dry ice	CO_2	refrigeration supply ice cream company
carbonic acid	soda water (seltzer)	H_2CO_3	grocery store
citric acid	sour salt (limes, lemons, etc ²)	$\text{C}_6\text{H}_8\text{O}_7$	grocery store drug store
copper	BB's ³ , sheet, pipe, or wire	Cu	hardware store building supply
copper sulfate copper(II) sulfate pentahydrate	Bluestone algicide Root Eater	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	pool supply hardware store
dichlorodifluoromethane	Freon-12 (may need permit)	Cl_2CF_2	auto supply
ethanol	ethyl alcohol, absolute ethyl alcohol, 95% denatured alcohol ethyl rubbing alcohol, 70% to 95%	$\text{CH}_3\text{CH}_2\text{OH}$	liquor store liquor store paint store drug store
ethylene glycol	antifreeze	$\text{HOCH}_2\text{CH}_2\text{OH}$	auto supply hardware store

¹See section on Making Materials for Experiments.

²Citric acid is the principal acid in these fruits, but cannot be obtained pure from this source.

³Some BB's are only copper coated.

Name of Chemical	Common Name	Formula	Source
glucose	Dextrose	$C_6H_{12}O_6$	drug store grocery store natural food store
glycerol	glycerin	$C_3H_8O_3$	drug store
gold	gold	Au	jewelry supply coin store
helium	helium	He	party shop welding supply
hydrochloric acid	muriatic acid masonry cleaner	HCl	hardware store
hydrogen		H_2	welding supply
hydrogen peroxide	hydrogen peroxide, 3% Clairoxide, 20 volume (6%) hydrogen peroxide, 40 volume (12%)	H_2O_2	drug store drug store beauty supply
hypochlorous acid	laundry bleach	HClO	grocery store
hydroquinone		$C_6H_6O_2$	photo store
iodine	Tincture of iodine (dissolved in ethanol)	I_2	drug store
iron	steel wool nails	Fe	hardware store hardware store
iron(III) chloride	ferric chloride	$FeCl_3$	drug store
iron (III) oxide	ferric oxide rust	Fe_2O_3	ceramic shop
kerosene	lamp oil	C_nH_{2n+2}	gas station home store
lactic acid	milk acid	$CH_3COHCOOH$	grocery store hardware store
latex	liquid rubber isoprene	C_5H_8	hobby shop craft shop
lead store	lead shot sinkers (fishing)	Pb	hardware store sporting goods

Name of Chemical	Common Name	Formula	Source
magnesium hydroxide	Milk of Magnesia some antacids	Mg(OH)_2	drug store drug store
magnesium silicate	Talc(um) powder	$\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$	drug store
magnesium sulfate	Epsom salt	MgSO_4	drug store
manganese dioxide	black powder in C batteries ⁴	MnO_2	toy/electronic store
mercury	quicksilver	Hg	dental supply
methane	natural gas	CH_4	home gas range
methanol	methyl alcohol wood alcohol duplicator fluid gas dryer and antifreeze	CH_3OH	paint store paint store office supply auto store
methylene blue	Methidote	$\text{C}_{16}\text{H}_{18}\text{ClN}_3\text{S}$	veterinarian
methyl salicylate	oil of wintergreen	$\text{C}_6\text{H}_4(\text{OH})\text{COOCH}_3$	grocery store drug store
mineral oil	Nujol		drug store
naphthalene	some Moth balls	C_{10}H_8	hardware store grocery store
nickel	nickel (Canadian, pre-1983) (Note: pure nickel is magnetic)	Ni	Canadian currency coin store
nitrogen (liquid)	liquid air	N_2	hospital welding/gas supply
oxygen	oxygen	O_2	drug store welding supply
oxalic acid	rust remover radiator cleaner	$\text{HO}_2\text{CCO}_2\text{H}$	hardware store auto supply
paradichlorobenzene	some moth balls	$\text{C}_6\text{H}_4\text{Cl}_2$	hardware store grocery store
paraffin	paraffin wax candles		grocery store hardware store
phenol red	$\text{C}_{19}\text{H}_{14}\text{O}_5\text{S}$		pool supply
polystyrene	casting resin		hobby shop

⁴See section on Making Materials for Experiments.

Name of Chemical	Common Name	Formula	Source
polyurethane foam	Craft Cast Mountains in Minutes Insulating foam spray		hobby shop building supply
potassium aluminum sulfate	potassium alum alum	$KAl(SO_4)_2 \cdot 12H_2O$	photo store grocery store
potassium bitartrate	cream of tartar	$KHC_4H_4O_6$	grocery store
potassium bromide		KBr	photo store
potassium chloride	lite salt	KCl	grocery store
potassium chrome alum		$KCr(SO_4)_2 \cdot 12H_2O$	photo store
potassium dichromate		$K_2Cr_2O_7$	photo store
potassium ferricyanide		$K_3Fe(CN)_6$	photo store
potassium hydroxide	lye caustic potash	KOH	grocery store hardware store
potassium nitrate	saltpeter	KNO_3	drug store
potassium permanganate	“Clearwater” ⁵ (0.53% solution)	$KMnO_4$	tropical fish store
propane	gas barbecue fuel blow torch fuel	C_3H_8	gas station hardware store
2-propanol	isopropyl alcohol rubbing alcohol (70% and 99%)	$CH_3CHOHCH_3$	drug store
quinine	quinine water ⁶	$C_{20}H_{24}N_2O_2 \cdot 3H_2O$	grocery store
red cabbage juice	red cabbage		grocery store
silicon dioxide	sand	SiO_2	hardware store garden supply washed beach sand
silver	silver	Ag	coin store
sodium acetate	heating pad (supersaturated solution)	$NaC_2H_3O_2$	drug store sporting goods
sodium borate	borax	$Na_2B_4O_7$	grocery store

⁵Use to remove odors and cloudiness in aquariums.

⁶Quinine fluoresces in ultra violet light (UV).

Name of Chemical	Common Name	Formula	Source
sodium carbonate	washing soda	Na_2CO_3	grocery store
sodium chloride	table salt kosher salt pickling salt	NaCl	grocery store
sodium hydrogen carbonate (sodium bicarbonate)	baking soda	NaHCO_3	grocery store
sodium hydrogen phosphate (sodium biphosphate)	pH Down	Na_2HPO_4	tropical fish store
sodium hydrogen sulfate (sodium bisulfate)	pH Down	NaHSO_4	pool supply
sodium hydroxide	lye caustic soda many drain cleaners	NaOH	grocery store hardware store
sodium hypochlorite	bleach (5% solution) mildew remover	NaClO	grocery store paint store
sodium nitrate	nitrate of soda	NaNO_3	garden supply
sodium phosphate	trisodium phosphate	Na_3PO_4	paint store garden supply
sodium silicate	water glass egg preserver (40% solution) Magic Rocks	Na_2SiO_3 $\text{Na}_2\text{Si}_3\text{O}_7$	hardware store drug store toy store
sodium sulfite		Na_2SO_3	photo store
sodium sulfate		Na_2SO_4	photo store
sodium thiosulfate	hypo	$\text{Na}_2\text{S}_2\text{O}_3$	photo store
stearic acid	candle hardener	$\text{C}_{17}\text{H}_{35}\text{CO}_2\text{H}$	hobby shop
sucrose	table sugar	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	grocery store
sulfur	flowers of sulfur	S	drug store hardware store
sulfuric acid	battery acid some drain cleaners	H_2SO_4	auto store gas station hardware store
tannic acid	tannin	$\text{C}_{76}\text{H}_{52}\text{O}_{46}$	drug store dye/fabric store photo store

Name of Chemical	Common Name	Formula	Source
thymolphthalein	disappearing ink	$C_{28}H_{30}O_4$	toy/novelty store
1,1,1-trichloroethane	cleaning fluid	CCl_3CH_3	hardware store
tungsten (wolfram)	light bulb filament	W	grocery store hardware store
urea	ice melter fertilizer	H_2NCONH_2	hardware store garden supply
xylene	xylene	C_8H_{10}	paint store
zinc	canister of carbon batteries galvanizing coating	Zn	toy store hardware store

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Acid-Base Indicators and Their Color Changes

Acid-Base Indicator	pH of color changes	Source
bromothymol blue	6.0/yellow-green - 7.6/blue	pH test kit tropical fish store
litmus paper	5.5/red-pink - 8.0/blue	science supply co.
malachite green	0.2/yellow - 1.8/bluegreen	Ich cure/tropical fish store
methyl orange	3.2/red-orange - 4.4/yellow	pool pH test kit
phenolphthalein	8.2/colorless - 10.0/pink	Ex-Lax
phenol red	6.6/yellow-orange - 8.0/red	pool pH test kit
red cabbage (juice) ⁷	1-3/red 4-5/rose 6-8/purple 8-11/blue 12-13/green 14/yellow	grocery store
thymolphthalein	9.4/colorless - 10.6/blue	disappearing ink/ toy store

⁷See section on Making Materials for Experiments.

THE CHEMICAL LOCATER

A Cross Reference of Chemicals by Common Name

Common Name

acetic acid, glacial
activated charcoal
alum
aluminum foil
aluminum wire
ammonia (household)
ammonium alum
antacid

antifreeze
aspirin
baking soda
battery acid
bleach

bleaching powder
blow torch
Bluestone algicide
borax
boric acid
candle hardener
candles
casting resin
caustic potash
caustic soda
chalk
charcoal
chlorinating powder
Clairoside
cleaning fluid
Clearwater
corn starch
Craft Cast
cream of tartar
denatured alcohol
Dextrose
disappearing ink
dry ice
duplicator fluid
egg preserver
epoxy cleaner
Epsom salts
ethyl alcohol
eyewash solution
ferric chloride
ferric oxide
fertilizer
fiberglass cleaner

Chemical Name

acetic acid
carbon
aluminum potassium sulfate
aluminum
aluminum
ammonia
aluminum ammonium sulfate
calcium carbonate, calcium hydroxide, or
magnesium hydroxide (check label)
ethylene glycol
acetylsalicylic acid
sodium hydrogen carbonate
sulfuric acid
sodium hypochlorite, (may also be
hypochlorous acid)
calcium hypochlorite
propane
copper sulfate
sodium borate
boric acid
stearic acid
paraffin
polystyrene
potassium hydroxide
sodium hydroxide
calcium carbonate
carbon
calcium hypochlorite
hydrogen peroxide (6%)
1,1,1-trichloroethane
potassium permanganate
amylum
polyurethane foam
potassium bitartrate
ethanol
glucose
thymolphthalein
carbon dioxide, solid
methanol
sodium silicate
acetone
magnesium sulfate
ethanol
boric acid
iron(III) chloride
iron(III) oxide
urea
acetone

Common Name**Chemical Name**

flocculating powder
flowers of sulfur
Freon-12
gas barbecue fuel
gas dryer
glycerin
graphite (powder)
graphite (rod)
gypsum
heating pad
hypo
ice melter
ice melter
isoprene
isopropyl alcohol
kosher salt
lamp oil
laundry bleach
lead shot
light bulb filament
lighter fuel
limestone
liquid rubber
lite salt
lye
lye
Magic Rocks
marble chips
masonry cleaner
Methidote
methyl alcohol
mildew remover
milk acid
Milk of Magnesia
Moth balls
moth balls
Mountains in Minutes
muriatic acid
nail polish remover
nails
natural gas
nitrate of ammonia
nitrate of soda
No-Doz tablets
Nujol
oil of wintergreen
paraffin wax
pH Down

pickling salt
potassium alum
potassium alum

aluminum sulfate
sulfur
dichlorodifluoromethane
propane
methanol
glycerol
carbon
carbon
calcium sulfate
sodium acetate
sodium thiosulfate
calcium chloride
urea
latex
2-propanol
sodium chloride
kerosene
hypochlorous acid
lead
tungsten (wolfram)
butane
calcium carbonate
latex
potassium chloride
potassium hydroxide
sodium hydroxide
sodium silicate
calcium carbonate
hydrochloric acid
methylene blue
methanol
sodium hypochlorite
lactic acid
magnesium hydroxide
naphthalene
paradichlorobenzene
polyurethane foam
hydrochloric acid
acetone
iron
methane
ammonium nitrate
sodium nitrate
caffeine
mineral oil
methyl salicylate
paraffin
sodium hydrogen phosphate or sodium
hydrogen sulfate
sodium chloride
aluminum potassium sulfate
potassium aluminum sulfate

Common Name**Chemical Name**

quicklime
quicksilver
quinine water
radiator cleaner
red cabbage
roach killer
road salt
Root Eater
rubbing alcohol
rubbing alcohol
rubbing alcohol
rust
rust remover
sal ammoniac
saltpeter
sand
seltzer
silver
sinkers (fishing)
slaked lime
smelling salt
soda water
sour salt
steel wool
stop bath
sulfate of aluminum
superphosphate
table salt
table sugar
Talc(um) powder
tannin
Tincture of iodine
trisodium phosphate
vinegar
vitamin C
washing soda
water glass
wood alcohol

calcium oxide
mercury
quinine
oxalic acid
red cabbage juice
boric acid
calcium chloride
copper sulfate
isopropyl alcohol (70%)
2-propanol
ethanol (70%)
iron(III) oxide
oxalic acid
ammonium chloride
potassium nitrate
silicon dioxide
carbonic acid
silver
lead
calcium hydroxide
ammonium carbonate
carbonic acid
citric acid
iron
acetic acid (28%)
aluminum sulfate
calcium phosphate
sodium chloride
sucrose
magnesium silicate
tannic acid
iodine (in alcohol)
sodium phosphate
acetic acid (5% solution)
ascorbic acid
sodium carbonate
sodium silicate
methanol

MEASUREMENT EQUIVALENTS FOR SCIENCE ACTIVITIES

Teachers, particularly in elementary and middle school, do not always have access to laboratory measuring devices such as graduated cylinders, volumetric glassware, balances, and thermometers. Common household devices are more readily available. Although most household measuring devices are graduated in English system units, a few will also contain metric equivalents.

Since most laboratory recipes for demonstrations and activities are written using metric measurements, it is useful to have a table of common equivalents to determine amounts needed for individual or class activities. The following tables give English-English and English-metric equivalents for common kitchen measures and for temperature.

Equivalents of Common Kitchen Measures

	Teaspoons	Table- spoons	Fluid ounces	Cups	Liquid pints	Liquid quarts	Milli- liters	Liters
1 teaspoon	1	1/3	1/6	-	-	-	5	-
1 tablespoon	3	1	1/2	1/16	1/32	-	15	-
1 fluid ounce	6	2	1	1/8	1/16	1/32	30	.03
1 cup	48	16	8	1	1/2	1/4	237	.24
1 liquid pint	96	32	16	2	1	1/2	473	.47
1 quart	-	-	32	4	2	1	946	.95
1 milliliter	1/5	1/15	1/30	-	-	-	1	1/1000
1 Liter	-	-	34	4.2	2.1	1.06	1000	1

MASS-VOLUME EQUIVALENTS OF COMMON CHEMICAL SOLIDS

Volume and temperature measurements can easily be used for many materials, but when using weight measurements of solid materials there are no universal measurements. The masses of solids vary widely and a balance is needed for accurate measurements. Since accurate balances can be expensive, a cheaper alternative is knowing the approximate weight equivalents of various substances using common kitchen measuring devices. The following table lists the approximate weights of some common materials.

Measuring devices vary greatly from manufacturer to manufacturer. A cup measure can vary as much as 10% between two manufacturers. There are also differences in capacities between glass, plastic, and metal measuring devices. In addition, relationships between measuring devices within a set show variations from standards. For example, in a set of measuring spoons used by the author, one tablespoon was slightly more than 3 teaspoons.

Finding accurate measuring devices is not practical. Instead, when purchasing measuring devices for class use, purchase several sets from a single manufacturer to reduce variations in the class. Test all procedures and make adjustments in recipes, as needed, to allow for variations in the measuring devices.

All volume measurements were made by overfilling the measuring device and leveling with a spatula. No effort was made to pack material into the measuring device.

All weights were measured in grams. Ounces can be calculated using an equivalent of 453.6 grams per pound.

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
aluminum potassium sulfate	$\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	powder	3.6	10.8	173	
aluminum sulfate	$\text{Al}_2(\text{SO}_4)_3$	powder	3.8	11.4	182	
ammonium carbonate	$(\text{NH}_4)_2\text{CO}_3$	powder	3.0	9.0	144	
ammonium nitrate	NH_4NO_3	crystal	3.8	11.2	180	
ascorbic acid	$\text{C}_6\text{H}_8\text{O}_6$	crystal	2.8	8.4	134	
boric acid	H_3BO_3	powder	4.0	12	192	
calcium acetate	$\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$	crystal	1.9	5.7	91.2	
calcium carbonate	CaCO_3	powder	1.5	4.5	72	
		chips	6.3	19	302	
calcium chloride	CaCl_2	round mesh	4.5	13.5	216	
calcium hydroxide	$\text{Ca}(\text{OH})_2$	powder	2.2	6	96	
calcium oxide	CaO	powder	1.5	4.5	72	
calcium phosphate	$\text{Ca}(\text{H}_2\text{PO}_4)_2$	crystal	3.9	9.0	144	
calcium sulfate	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	powder	1.4	4.2	67	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
carbon (activated)	C	granular	2.1	6.3	131	
citric acid	C ₆ H ₈ O ₇ •H ₂ O	crystal	3.6	10.8	-	
cobalt chloride	CoCl ₂ •6H ₂ O	powder	4.5	13.2	211	
copper(II) chloride	CuCl ₂ •2H ₂ O	crystal	4.7	14.1	226	
copper(II) sulfate	CuSO ₄ •5H ₂ O	large crystals	6.4	19.2	307	
flour (all purpose)		powder	2.5	7	118	
glucose	C ₆ H ₁₂ O ₆	crystals	3.5	10.5	168	
iron(III) chloride	FeCl ₃ •6H ₂ O	powder	5.1	15.3	245	
iron(III) nitrate	Fe(NO ₃) ₃ •9H ₂ O	crystals	4.6	13.7	219	
lithium chloride	LiCl	fine crystal	4.0	1267		
luminol		powder		6.4		1/8 tsp = 0.8 g
magnesium chloride	MgCl ₂ •6H ₂ O	wet crystals	3.2	9.7	155	
magnesium hydroxide	Mg(OH) ₂	fine granular	2.4	7.2	115	
magnesium sulfate	MgSO ₄ •7H ₂ O	fine crystals	3.3	9.9	158	
magnesium sulfate (anhy.)	MgSO ₄	crystals	3.6	10.8	173	
manganese dioxide	MnO ₂	powder	9.25	27.8	-	1/8 tsp = 1.35 g
methylene blue	C ₁₆ H ₁₈ ClN ₃ S	powder	3.3	9.9	-	1/8 tsp = 0.4 g
naphthalene	C ₁₀ H ₈	crystal	2.6	7.8	125	
oxalic acid	HO ₂ CCO ₂ H	crystal	3.5	10.5	168	
paradichlorobenzene	C ₆ H ₄ Cl ₂	crystal	3.4	10.1	163	
phenolphthalein	C ₂₀ H ₁₄ O ₄	powder	1.84	-	-	1/8 tsp = 0.23 g
potassium aluminum sulfate	KAl(SO ₄) ₂ •12H ₂ O	powder	3.6	10.8	173	
potassium bitartrate	KHC ₄ H ₄ O ₆	powder	2.7	8	130	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
potassium bromide	KBr	granular	6.2	18.6	298	
potassium chloride	KCl	crystal	4.5	13.5	216	
potassium chrome alum	KCr(SO ₄) ₂ •12H ₂ O	crystal	3.9	11.6	186	
potassium dichromate	K ₂ Cr ₂ O ₇	crystal	5.4	16.3	260	
potassium ferricyanide	K ₃ Fe(CN) ₆	fine crystal	4.0	12	192	
potassium ferrocyanide	K ₄ Fe(CN) ₆ •3H ₂ O	lump, flakes	4.6	13.6	218	
potassium hydroxide	KOH	pellets	4.5	13.5	216	
potassium iodate	KIO ₃	powder	3.3	9.8	157	
potassium nitrate	KNO ₃	crystal	5.7	17	274	
potassium oxalate	K ₂ C ₂ O ₄	crystal	4.2	12.6	202	
potassium permanganate	KMnO ₄	fine crystal	5.7	17.1	274	1/8 tsp = 0.95 g
potassium sodium tartrate	KNaC ₄ H ₄ O ₆ •4H ₂ O	crystal	4.0	12	192	
potassium thiocyanate	KSCN	crystal	3.5	10.5	168	
sodium acetate (anhy.)	NaC ₂ H ₃ O ₂	crystal	2.6	7.8	125	
sodium acetate	NaC ₂ H ₃ O ₂ •3H ₂ O	crystal	3.8	11.4	182	
sodium bicarbonate sodium hydrogen carbonate	NaHCO ₃	powder	4.7	14.5	240	
sodium bisulfite	NaHSO ₃	crystal	5.5	16.5	264	
sodium borate	Na ₂ B ₄ O ₇	crystal	3.3	9.9	158	
sodium carbonate	Na ₂ CO ₃ •H ₂ O	powder	4.6	13.8	221	
sodium carbonate (anhy.)	Na ₂ CO ₃	powder	4.7	14	225	
sodium chloride	NaCl	crystal	6.0	18	290	
sodium hydroxide	NaOH	pellets	4.6	13.8	221	
sodium nitrate	NaNO ₃	crystal	4.6	13.8	221	
sodium phosphate	Na ₃ PO ₄ •12H ₂ O	crystal	3.6	10.8	173	

Name of Chemical	Formula	Form	Mass in grams			
			1 tsp	1 Tbsp	1 cup	other
sodium silicate	Na_2SiO_3	powder	4.0	12	192	
sodium sulfate	Na_2SO_4	powder	6	18	288	
sodium sulfite	Na_2SO_3	crystal	5.5	16.5	264	
sodium thiosulfate	$\text{Na}_2\text{S}_2\text{O}_3$	crystal	3.75	11.2	180	
starch		powder	2.4	7.3	117	
strontium chloride	$\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$	crystal	4.2	12.7	203	
sucrose	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	granular	4.0	12	192	
sulfur	S	powder	3.2	9.6	154	
tannic acid	$\text{C}_{76}\text{H}_{52}\text{O}_{46}$	powder	1.27	3.81	61	
thymolphthalein	$\text{C}_{28}\text{H}_{30}\text{O}_4$	powder	2.3	7	-	1/8 tsp = 0.2 g
urea	H_2NCONH_2	round pellets	3.4	10.2	163	
zinc	Zn	granular (20 mesh)	10	30	480	

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GRADES OF PURITY FOR CHEMICALS

The following is a partial listing of designations which have been generally adopted to indicate different degrees of quality and primary uses of laboratory chemicals. The grades are listed by decreasing degrees of purity.

Reagent. High purity for analytical use. Bottles are often labeled to show lot analysis and/or maximum limits of impurities.

ACS. Meets reagent specifications of the American Chemical Society.

Chemically Pure (CP). Suitable for routine use. Lot analysis not specified.

USP. Meets the specifications of the United States Pharmacopeia.

NF. Meets the specifications of the National Formulary.

Pharmaceutical Grade. Designates products listed in the USP and NF compendia.

Practical. Principally organic compounds of medium purity often purified from technical grade. Considered suitable for most syntheses.

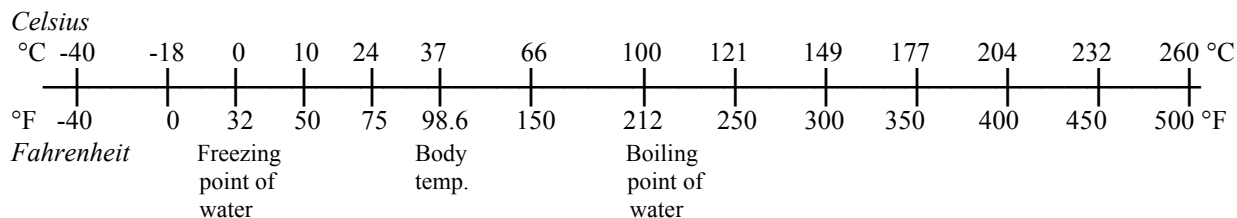
Purified. Superior to technical grade, being free from excessive foreign matter. Suitable for most purposes except analysis.

Technical, Commercial, or Industrial. Chemicals of ordinary commercial purity. Not refined for laboratory use.

Most household chemicals are purified grade or better. They can be used in most experiments and activities with no adverse effects on results. Always pretest any materials in the experiment/demonstration with proper precautions.

TEMPERATURE

In the metric system, degrees Celsius are used rather than degrees Fahrenheit. One degree Celsius is equivalent to 1.8 degrees Fahrenheit.



MAKING MATERIALS FOR EXPERIMENTS

graphite electrodes	Obtain heavy pencil leads from a stationery store. Shave the wood off a lead pencil exposing the lead. Use the center electrode from a dry cell (carbon) battery (any size).
iron filings	Rub two pieces of steel wool together over a piece of paper to catch the small pieces.
manganese dioxide	Break open a dry cell battery (carbon type). The black powder is a mixture of ammonium chloride and manganese dioxide. For many applications, the powder can be used directly. To purify the manganese dioxide: Mix the black powder with water. Filter the mixture through filter paper, wash with small portions of water, and let dry.
potassium hydroxide	Mix wood ashes with water. Let stand overnight. Filter the solution of caustic potash. (CAUTION: This is a highly caustic solution.) To make potassium hydroxide, add calcium oxide, stir, and filter the solution.
red cabbage juice	Place some pieces of red cabbage in a beaker or pot, cover with water, and heat to boiling. Save the red liquid. Refrigerate it to slow spoiling. Alternate method: Place red cabbage and water in a blender. Blend the mixture. Strain into a jar and refrigerate the liquid.
turmeric solution	Mix some turmeric with alcohol. Save the solution.
zinc	Use the metal casing from a dry cell (carbon type) battery. (Note: Some batteries have iron cases. Test with a magnet.)

MOLARITY OF MURIATIC ACID SOLUTIONS

Muriatic acid, the commercial form of hydrochloric acid available in hardware stores, is sold with its concentration listed in percent hydrochloric acid and degrees Baume (a method of expressing specific gravity). The following table lists equivalents in Molarity (moles/liter) for use in chemical experiments.

<u>°Baume</u>	<u>% HCl</u>	<u>Molarity</u>
10°	14.8	4.4
11°	16.4	4.9
12°	18.0	5.4
13°	19.6	5.9
14°	21.3	6.5
15°	22.9	7.0
16°	24.6	7.6
17°	26.2	8.1
18°	27.9	8.7
19°	29.7	9.3
20°	31.5	10.0

DILUTING SOLUTIONS

To dilute a concentrated solution to a lower concentration (such as a muriatic acid solution), the formulas to use are:

$$V_i = \frac{M_f V_f}{M_i}$$

and

$$V_w = V_f - V_i$$

where M_i = molarity of the initial or concentrated solution
 V_i = volume of initial or concentrated solution needed
 M_f = molarity of diluted or final solution
 V_f = volume of diluted or final solution
 V_w = volume of water needed

Example: To make 100 mL of a 1.0 M solution of hydrochloric acid from 8.7 M hydrochloric acid

$$V_i = \frac{(1.0 \text{ M}) \times (100 \text{ mL})}{(8.7 \text{ M})} = 11.5 \text{ mL hydrochloric acid solution needed}$$

$$V_w = 100 \text{ mL} - 11.5 \text{ mL} = 88.5 \text{ mL water needed}$$

To make the solution, measure 88.5 mL of water into an appropriate container and add 11.5 mL of the hydrochloric acid solution. **Safety note:** Always add acid to water to prevent splattering from occurring.

REFERENCES FOR USING AND/OR FORMULATING HOUSEHOLD PRODUCTS

The following is a brief list of some books that utilize household products for a wide range of activities from simple experiments to formulating household products.⁸

Cosmetics

Cobb, Vicki, **The Secret Life of Cosmetics**, J. B. Lippincott, 1985.

Information and experiments on soap and toothpaste, lotions and creams, fragrances, hair, and makeup.

Crafts

Hobson, Phyllis, **Making Homemade Soaps and Candles**, Garden Way Publishing 1974.

⁸A comprehensive list of demonstration and activity books, many of which use common chemicals, can be found in Katz, D. A., "Science Demonstrations, Experiments, and Resources", *J. Chem. Educ.*, **68**, 235 (March, 1991).

Dyeing:

Brooklyn Botanical Garden, **Natural Plant Dyeing**, A Handbook

Kramer, Jack, **Natural Dyes: Plants and Processes**, Charles Scribner's Sons, 1972.

Foods

Cobb, Vicki, **Science Experiments You Can Eat**, and **More Science Experiments You Can Eat**, J. B. Lippincott, Harper and Row, New York, 1972 and 1979.

A collection of experiments with food covering everything from acids and bases through popping popcorn to yeast.

Hobson, Phyllis, **Making Homemade Cheeses & Butter**, Garden Way Publishing, 1973.

Formula Books and Experiment Books

Cobb, Vicki, **The Secret Life of Hardware**, J. B. Lippincott, 1982.

Science experiments with cleaners, polishes, waxes, paints, rope, glue, tools, and electricity. Each section explains how things were invented and why things work.

Cobb, Vicki, **Chemically Active**, J. B. Lippincott, New York, 1985

A collection of chemical experiments using materials found at home combined with explanations of chemical principles.

Herbert, Don, **Mr. Wizard's Supermarket Science**, Random House, 1980.

Over 100 experiments and projects using and making household materials.

Hiscox, Gardner D. (Ed), **Henley's Formulas for Home and Workshop**, Crown, 1979.

Originally published in 1907, and revised in 1927 and 1979, this volume contains over 10,000 scientific formulas, trade secrets, food and chemical recipes, and money saving ideas. It does contain a disclaimer about the lack of a thorough safety review, but with wise use, is a valuable reference book.

Stark, Norman, **The Formula Book**, Volumes 1, 2, & 3, Sheed and Ward, Inc., 1975, 1976, & 1978.

Recipes for making a variety of personal care and household products.

Tocci, Salvatore, **Chemistry Around You**, Arco Publishing, Inc., 1985.

Experiments and projects with everyday chemicals. Divided by sections of the house: kitchen, bathroom, laundry room, garage, and backyard.