





# The Chemical Formulary

*Collection of Commercial Formulas  
for Making Thousands of Products  
in Many Fields*

**VOLUME XXIX**

*Editor-in-Chief*

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## CONTENTS

I	Introduction .....	1
II	Adhesives .....	41
III	Beverages and Foods .....	49
IV	Cosmetics .....	69
V	Coatings .....	199
VI	Detergents .....	240
VII	Drugs .....	259
VIII	Polishes .....	273
IX	Elastomers, Polymers and Resins .....	286
X	Miscellaneous .....	306
	Appendix .....	316
	Trademark Chemicals .....	328
	Trademark Chemicals Suppliers .....	336
	Index .....	341

## PREFACE

Chemistry, as taught in our schools and colleges, concerns chiefly synthesis, analysis, and engineering—and properly so. It is part of the right foundation for the education of the chemist.

Many a chemist entering an industry soon finds that most of the products manufactured by his concern are not synthetic or definite chemical compounds, but are mixtures, blends, or highly complex compounds of which he knows little or nothing. The literature in this field, if any, may be meager, scattered, or obsolete.

Even chemists with years of experience in one or more industries spend considerable time and effort in acquainting themselves with any new field which they may enter. Consulting chemists similarly have to solve problems brought to them from industries foreign to them. There was a definite need for an up-to-date compilation of formulas for chemical compounding and treatment. Since the fields to be covered are many and varied, an editorial board of chemists and engineers engaged in many industries was formed.

Many publications, laboratories, manufacturing firms, and individuals have been consulted to obtain the latest and best information. It is felt that the formulas given in this volume will save chemists and allied workers much time and effort.

Manufacturers and sellers of chemicals will find, in these formulas, new uses for their products. Nonchemical executives, professional men, and interested laymen will make through this volume a “speaking acquaintance” with products which they may be using, trying, or selling.

It often happens that two individuals using the same ingredients in the same formula get different results. This may be due to slight deviations in the raw materials or unfamiliarity with the intricacies of a new technique. Accordingly, repeated experiments may be necessary to get the best results. Although many of the formulas given are being used commercially, many have been taken from the literature and may be subject to various errors and omissions. This should be taken into consideration. Wherever possible, it

is advisable to consult with other chemists or technical workers regarding commercial production. This will save time and money and help avoid trouble.

A formula will seldom give exactly the results which one requires. Formulas are useful as starting points from which to work out one's ideas. Also, formulas very often give us ideas which may help us in our specific problems. In a compilation of this kind, errors of omission, commission, and printing may occur. I shall be glad to receive any constructive criticism.

**H. BENNETT**

## PREFACE TO VOLUME XXIX

This new volume of the CHEMICAL FORMULARY series is a collection of new, up-to-date formulas. The only repetitious material is the introduction (Chapter I) which is used in every volume for the benefit of those who may have bought only one volume and who have no educational background or experience in chemical compounding. The simple basic formulas and compounding methods given in the introduction will serve as a guide for beginners and students. It is suggested that they read the introduction carefully and even make a few preparations described there before compounding the more intricate formulas included in the later chapters.

The list of chemicals and their suppliers has been enlarged with new trademark chemicals. All tradename chemicals appear in the formulas in boldface and these tradenames are listed alphabetically in the appendix followed by a list of corresponding manufacturers. Thus buying the required ingredients will present no problem.

Grateful acknowledgement is made to the Contributors for their valuable suggestions and contributions.

H. BENNETT

NOTE: All the formulas in Volumes I through XXIX (except in the Introduction) are different. Thus, if you do not find what you want in this volume, you may find it in one of the others.

NOTE: This book is the result of cooperation of many chemists and engineers who have given freely of their time and knowledge. It is their business to act as consultants and to give advice on technical matters for a fee. As publishers, we do not maintain a laboratory or consulting service to compete with them. Therefore, please do not ask us for advice or opinions, but consult a chemist.

**BOOKS BY H. BENNETT**

The Chemical Formulary Vols. I—XXVIII  
The Cumulative Index Vols. I—XXV—The Chemical Formulary  
Concise Chemical & Technical Dictionary  
New Cosmetic Formulary  
Chemical Specialties  
Industrial Waxes, Vols. I, II  
Practical Emulsions, Vols. I, II  
More For Your Money  
Encyclopedia of Chemical Trademarks and Synonyms, Vols. I—III

## ABBREVIATIONS

act .....	active, activity
AM .....	active matter
amp .....	ampere(s)
anhyd .....	anhydrous
approx. ....	approximately
aq. ....	aqueous
ASTM .....	American Society for Testing and Materials
avoir .....	avoirdupois
Bé .....	Baumé
B.P. ....	boiling point
°C .....	degrees Centigrade
cc .....	cubic centimeter(s)
cm .....	centimeter(s)
cm <sup>3</sup> .....	cubic centimeter(s)
conc .....	concentrated, concentration
c.p. ....	chemically pure
cp, cP, cps .....	centipoise(s)
cs .....	centistoke(s)
cu ft .....	cubic foot
cu in. ....	cubic inch
cwt .....	hundredweight
dil .....	dilute
dm .....	decimeter(s)
dr .....	dram(s)
°F .....	degrees Fahrenheit
fl .....	fluid
fl dr .....	fluid dram(s)
fl oz .....	fluid ounce(s)
F.P. ....	freezing point
ft .....	foot
ft <sup>2</sup> .....	square foot
ft <sup>3</sup> .....	cubic foot
g .....	gram(s)
gal .....	gallon(s)
gr .....	grain(s)
h .....	hour(s)
hl .....	hectoliter(s)
in. ....	inch(es)
in. <sup>3</sup> .....	cubic inch(es)
K.U. ....	Krebs units
kg .....	kilogram(s)
l .....	liter(s)
lb .....	pound(s)
liq .....	liquid

## ABBREVIATIONS

m	.....	milli or meter(s)
MIL	.....	Military specifications
min	.....	minimum, minute
ml	.....	milliliter(s)
mm	.....	millimeter(s)
M.P.	.....	melting point
MPa	.....	mega pascal
N	.....	newton or Normal
N.F.	.....	National Formulary
NV	.....	nonvolatiles
o/w	.....	oil-in-water
oz	.....	ounce(s)
P/B	.....	pigment/binder
Pa	.....	pascal
pH	.....	hydrogen-ion concentration
phr	.....	parts per hundred rubber
pkg.	.....	package
ppm	.....	parts per million
psi	.....	pounds per square inch
psig	.....	pounds per square inch gauge
pt	.....	pint(s)
PVC	.....	pigment volume concentration
pwt	.....	pennyweight
q.s.	.....	a quantity sufficient to make
qt	.....	quart
®	.....	registered trademark
R.T.	.....	room temperature
rpm	.....	revolutions per minute
s	.....	second(s)
sol'n.	.....	solution
Sp. Gr.	.....	specific gravity
T.P.	.....	triple pressed
tbsp.	.....	tablespoon(s)
tech	.....	technical
tinc	.....	tincture
™	.....	trademark
tsp	.....	teaspoon(s)
USP	.....	United States Pharmacopeia
UV	.....	ultraviolet
V	.....	volt(s)
visc	.....	viscosity
vol	.....	volume
w/o	.....	water-in-oil
wt	.....	weight





# Chapter I

## INTRODUCTION

The following introductory matter has been included at the suggestion of teachers of chemistry and home economics.

This section will enable anyone, with or without technical education or experience, to start making simple products without any complicated or expensive machinery. For commercial production, however, suitable equipment is necessary

Chemical specialties are composed of pigments, gums, resins, solvents, oils, greases, fats, waxes, emulsifying agents, dyestuffs, perfumes, water, and chemicals of great diversity. To compound certain of these with some of the others requires definite and well studied procedures, any departure from which will inevitably result in failure. The steps for successful compounding are given with the formulas. Follow them rigorously. If the directions require that (*a*) is added to (*b*), carry this out literally, and do not reverse the order. The preparation of an emulsion is often quite as tricky as the making of mayonnaise. In making mayonnaise, you add the oil to the egg, slowly, with constant and even stirring. If you do it correctly, you get mayonnaise. If you depart from any of these details: if you add the egg to the oil, or pour the oil in too quickly, or fail to stir regularly, the result is a complete disappointment. The same disappointment may be expected if the prescribed procedure of any other formulation is violated.

The point next in importance is the scrupulous use of the proper ingredients. Substitutions are sure to result in inferior quality, if not in complete failure. Use what the formula calls for. If a cheaper product is desired, do not prepare it by substituting a cheaper ingredient for the one prescribed: use a different formula. Not infrequently, a formula will call for an ingredient which is difficult to obtain. In such cases, either reject the formula or substitute a similar substance only after a preliminary experiment demonstrates its usability. There is a limit to which this rule may reasonably be extended. In some cases, substitution of an equivalent ingredient may be

made legitimately. For example, when the formula calls for white wax (beeswax), yellow wax can be used, if the color of the finished product is a matter of secondary importance. Yellow beeswax can often replace white beeswax making due allowance for color, but paraffin wax will not replace beeswax, even though its light color seems to place it above yellow beeswax.

This leads to the third point: the use of good-quality ingredients, and ingredients of the correct quality. Ordinary lanolin is not the same thing as anhydrous lanolin. The replacement of one with the other, weight for weight, will give discouragingly different results. Use exactly what the formula calls for: if you are not acquainted with the substance and you are in doubt as to just what is meant, discard the formula and use one you understand. Buy your chemicals from reliable sources. Many ingredients are obtainable in a number of different grades: if the formula does not designate the grade, it is understood that the best grade is to be used. Remember that a formula and the directions can tell you only part of the story. Some skill is often required to attain success. Practice with a small batch in such cases until you are sure of your technique. Many examples can be cited. If the formula calls for steeping quince seed for 30 min in cold water, steeping for 1 h may yield a mucilage of too thin a consistency. The originator of the formula may have used a fresher grade of seed, or his conception of what "cold" water means may be different from yours. You should have a feeling for the right degree of mucilaginousness, and if steeping the seed for 30 min fails to produce it, steep them longer until you get the right kind of mucilage. If you do not know what the right kind is, you will have to experiment until you find out. This is the reason for the recommendation to make small experimental batches until successful results are obtained. Another case is the use of dyestuffs for coloring lotions and the like. Dyes vary in strength; they are all very powerful in tinting value; it is not always easy to state in quantitative terms how much to use. You must establish the quantity by carefully adding minute quantities until you have the desired tint. Gum tragacanth is one of those products which can give much trouble. It varies widely in solubility and bodying power; the quantity listed in the formula may be entirely unsuitable for your grade of tragacanth. Therefore, correction is necessary, which can be made only after experiments with the available gum.

In short, if you are completely inexperienced, you can profit greatly by experimenting. Such products as mouthwashes, hair tonics, and astringent lotions need little or no experience, because they are, as a rule, merely mixtures of simple liquid and solid ingredients, which dissolve without difficulty and the end product is a clear solution that is ready for use when

mixed. However, face creams, toothpastes, lubricating greases, wax polishes, etc., whose formulation requires relatively elaborate procedures and which must have a definite final viscosity, need some skill and not infrequently some experience.

## FIGURING

Some prefer proportions expressed by weight or volume, others use percentages. In different industries and foreign countries different systems of weights and measures are used. For this reason, no one set of units could be satisfactory for everyone. Thus diverse formulas appear with different units, in accordance with their sources of origin. In some cases, parts are given instead of percentage or weight or volume. On the pages preceding the index, conversion tables of weights and measures are listed. These are used for changing from one system to another. The following examples illustrate typical units.

### Example No. 1

#### Ink for Marking Glass

Glycerin	40	Ammonium Sulfate	10
Barium Sulfate	15	Oxalic Acid	8
Ammonium Bifluoride	15	Water	12

Here no units are mentioned. In this case, it is standard practice to use parts by weight throughout. Thus here we may use ounces, grams, pounds, or kilograms as desired. But if ounces are used for one item, the ounce must be the unit for all the other items in the formula.

### Example No. 2

#### Flexible Glue

Powdered Glue	30.90%	Glycerin	5.15%
Sorbitol (85%)	15.45%	Water	48.50%

Where no units of weight or volume, but percentages are given, forget the percentages and use the same method as given in Example No. 1.

## Example No. 3

**Antiseptic Ointment**

Petrolatum	16 parts	Benzoic Acid	1 part
Coconut Oil	12 parts	Chlorothymol	1 part
Salicylic Acid	1 parts		

The instructions given for Example No. 1 also apply to Example No. 3. In many cases, it is not wise to make up too large a quantity of a product before making a number of small batches to first master the necessary technique and also to see whether the product is suitable for the particular purpose for which it is intended. Since, in many cases, a formula may be given in proportions as made up on a factory scale, it is advisable to reduce the quantities proportionately.

## Example No. 4

**Neutral Cleansing Cream**

Mineral Oil	80 lb	Water	90 lb
Spermaceti	30 lb	Glycerin	10 lb
Glyceryl Monostearate	24 lb	Perfume	To suit

Here, instead of pounds, ounces or even grams may be used. This formula would then read:

Mineral Oil	80 g	Water	90 g
Spermaceti	30 g	Glycerin	10 g
Glyceryl Monostearate	24 g	Perfume	To suit

Reduction in bulk may also be obtained by taking the same fractional part of portion of each ingredient in a formula. Thus in the following formula:

## Example No. 5

**Vinegar Face Lotion**

Acetic Acid (80%)	20	Alcohol	440
Glycerin	20	Water	500
Perfume	20		

## INDEX

### A

Acetaminophen  
  childrens chewable tablets, 270  
  syrup, 263  
Acrylic  
  finish, black, isocyanate-cured, 214  
  -melamine, high-solids, 288  
  -styrene paint latex for wet adhesion,  
  214  
Adhesives, 28, 41–48. *See also Cement,  
  Glue*  
  carpet-backing, 44  
  epoxy, for pavement markers, 47  
  hot-melt pressure-sensitive, 43  
  LDPE hot-melt, 43  
  metal-to-metal, 42  
  polychloroprene, 41  
Aftershave lotion, 84  
Alloy, thermoplastic elastomer, 286–287  
Almond pasta, 68  
Analgesic  
  micro-emulsion, clear gel, 263  
  stick, clear, 262  
Angel food cake, 56  
Ant poison, 18  
Anti-chap stick, 135  
Antihistamine elixir, 265  
Antiperspirant, 69–70  
  cream, 72–73  
  lotion, 70–71  
  stick, 73–75  
Antiseptic ointment, 4  
Apparatus, where to buy, 8  
Aquarium cement, 29

Astringent lotion, pearly, 115  
Athlete's foot remedy, 262  
Atomic weights, 323–325  
Atrazine, flowable, 309  
Auto  
  cleaner/polish, 254, 276–279  
  polish, 25, 279–280  
  wash concentrate, 254

### B

Baby  
  cream, 109  
  lotion, 110  
Baking powder, 19  
Barrier  
  lotion, 116  
  midcoat  
  medium to high PVC, high solids  
  epoxy, 210  
Bath  
  bubble, 192–194  
  emollient foam, 194  
  essence, dispersible emollient, 196  
  oil, aerosol, 195  
  oil, bloom type, 195  
  oil, soluble, 195  
  oil, three-layer with protein, 196  
Batter  
  adhesion, 64  
  eggless, 65  
  for deep-fried foods, 64  
  for seafood and fish, 65  
  pancake, 63  
  tempura, 64

- Bedbug exterminator, 18  
 Belting, rubber transmission, 298  
 Bleach  
   cleanser, 243–244  
   laundry, 35  
 Blemish or makeup stick, 121  
 Block filler, 230–233  
   PVA latex masonry, 232  
 Blush  
   emollient, 122  
   gelee, 123  
   stick, 122  
 Boat polish/restorer, fiberglass, 280–281  
 Body  
   and hand cleanser, 191  
   and hand lotion, 106–108  
   and sport shampoo, 191  
   silk, 100  
 Boiler compound, 39  
 Boots, safety, injection molding compound, 304  
 Bran nuggets, 66  
 Brilliantine cream, 172  
   protein, 173  
 Brownie, 55–56  
 Bubble  
   bath, 192–194  
   bath, clear, high foaming, 193  
   bath, conventional, 193  
   bath, powdered, 194  
 Bust cream, 99  
**C**  
 Cake  
   angel food, 56  
   lemon chiffon, 58  
   white layer, 57  
 Canary food, 20  
 Candles, 28  
 Canvas  
   fireproofing, 38  
   waterproofing, 36  
 Car. *See* *Auto*  
 Carpet-backing adhesive, 44  
 Caulking  
   and sealing compound, elastomeric, 46  
   clear, 45  
 Caustic gel, flowable, 315  
 Cement  
   aquarium, 29  
   cleaner, 252–258  
   floor hardener, 29  
   joint, tape, 47  
   roof, acrylic latex, 237  
   roof, black asphalt cutback, 236  
   roof, elastomeric, 236  
   roof, mastic asphalt, 235  
   waterproofing, 37  
 Chap stick, 135  
 Chemicals  
   incompatible, 318  
   where to buy, 8  
 Chest rub, 16  
 Childrens acetaminophen chewable tablets, 270  
 Chlorinated PVC compounds, 289  
 Chlorthalonil wettable powder, 310  
 Citric acid cleaning solution for membranes, 310  
 Citric/persulfate desmutter, 311–312  
 Cleaner, 31. *See also* *Cleanser, Detergent, Soap*  
   alkaline, low foam, 251  
   all-purpose, 251  
   cement, 252  
   disinfectant, liquid, 258  
   dry, 245  
   glass, 244–245  
   hand, waterless, 188–189  
   hard surface, 252  
   heavy duty, 247–249  
   heavy duty, all purpose alkaline, 247  
   heavy duty, all purpose concentrate, 247  
   household, 33  
   light duty, 250  
   d-limonene, 251  
   medium duty, 249–250  
   membrane, citric acid, 310  
   metal, acid, 255  
   microemulsion, 311  
   mildew, 258  
   paint brush, 34

- pipe, 9
- polish, auto, 276–279
- polish for plastic windows, 245
- straw-hat, 33
- toilet bowl, liquid, 256
- tub and tile, 256
- wallpaper, 32
- window, 33
- Cleanser
  - bleach, 243–244
  - hand and body, 191
  - skin, makeup remover, 185
- Cleansing cream, 4, 10, 186
- Coating. *See also Lacquer, Latex, Paint*
  - general purpose clear, 227
  - intermediate, 210
  - marine, 226
  - mineral surface, 234
  - pipe, general purpose, 228
  - pipe, urethane, 228
  - solventless, 227
  - solventless tile, 233
  - weapons, rule 66 exempt, 228
- Cocoa
  - malt powder, 19
  - powder, sweet, 19
- Cold cream, 10–13, 113, 186–187
- Color rinse, temporary, 183
- Concrete seal latex, 234
- Conditioner, hair, 167–171
- Conditioning
  - face cream, 111
  - rolling lotion for permanent waved hair, 184
  - shampoo, 164–166
- Copper
  - antique coloring for, 21
  - citrate, 312–313
- Corn bran muffins, 67
- Cortisone cream, 261
- Cosmetics, 69–198, 317
- Cost calculation, 9
- Cough
  - cold syrup, 264
  - syrup, antitussive-expectorant, 265
- Crayon, marking, green, 21
- Cream
  - cortisone, 261
  - hydrogen peroxide, 260
  - hydroquinone, 260
  - therapeutic humectant, 259
- Cream rinse, 171
- Cresol, 17
- Curing component, 308
- Curl activator, mousse, with sunscreen, 179
- Cutting fluid, synthetic, 309
- D**
- Degreaser spray, 255
- Deodorant
  - germicidal, detergent, 257
  - spray, 17
  - stick, 75–76
- Depilatory, 86–87
- Desmutter, citric acid/persulfate, 311–312
- Dessert, frozen, 61–62
- Detergent
  - auto cleaner/polish, 254
  - car wash concentrate, 254
  - germicidal, deodorant, 257
  - heavy-duty truck, 254
  - laundry, 246–247
  - soap bar, 192
- Developing solution, 40
- Dipping formulation, heat-sensitive, 304–305
- Dishwash, 242–243
  - bottle, concentrate, 242
- Disinfectant, 17
  - cleaner, liquid, 258
- Dispersion of water-soluble material in oil, 198
- Drain opener, 257
- Dry cleaning, 245
  - fluid, 32
- E**
- Egg nog, 51
- Elastomer, thermoplastic alloy, 286–287
- Elastomeric caulking and sealing compound, 46

- Electrical potting compound, 229
- Emollient
  - bath essence, dispersible, 196
  - foam bath, 194
- Emulsion
  - economical, clear micro, 197
  - o/w, 197
  - system, 287–288
  - system, styrene, 287
  - system, vinyl/acrylic, 288
- Enamel
  - clear, 221
  - gloss retentive white, 221
  - high gloss, black interior/exterior, 219
  - high gloss, green, 218
  - high gloss, white, 220
  - semigloss, 217–218
  - semigloss, white, 217–218
  - white high solids, 222
- Epoxy
  - adhesive for pavement markers, 47
  - hand lay-up, fiberglass-reinforced, 229
  - hardener, 308
- Eye
  - and throat lotion, 112
  - liner, liquid, 127
  - shadow, 124–126
  - shadow, pressed, 126
  - shadow, stick, 125
- F**
- Fabric fireproofing, 38
- Face
  - and hand lotion, 108
  - cream, 111
  - cream, conditioning, 111
  - lotion, 4
  - scrub lotion, abrasive, 187
- Federal laws, 316
- Fiberglass boat polish/restorer, 280–281
- Filtering and clarification, 7
- Finish, acrylic, black, isocyanate-cured, 214
- Fire
  - extinguisher, dry, 38
  - extinguishing liquid, 38
  - kindler, 39
- Fireproof paper, 37
- Fireproofing
  - canvas, 38
  - light fabrics, 38
- First aid, 326–327
- Fixing bath, acid-hardening, 40
- Flattening paste, 238
- Floor
  - oil, 26
  - patching compound, heavy-duty, 309
  - polish, 273–276
  - wax, 25
- Flooring, self-leveling thin-set, 230
- Flux, soldering, 39
- Fly
  - paper, 18
  - spray, 16, 17
- Foam
  - bath, emollient, 194
  - quick-breaking, hydrocarbon-propelled, 307
- Foot
  - powder, 15
  - remedy, athlete's, 262
- Foundation, liquid, 117–118
- Fragrance mousse, aerosol, 139
- French fries, frozen, 66
- Frozen dessert, 61–62
- Fruit glaze mix, 59
- Furniture polish, 25, 282–283
- G**
- Gasoline, solidified, 39
- Germicidal detergent and deodorant, 257
- Glass
  - cleaner, 244–245
  - etching fluid, 23
- Glassine paper, 35
- Glaze mix, fruit, 59
- Glue, 3
- Grafting wax, 28
- Graphite grease, 27
- Grease
  - proofing paper and fiberboard, 37



- remover, 34
- Gum lubricant, 26
- H**
- Hair
  - conditioner, 167–171
  - conditioner, baby, 170
  - conditioner, balsam, 169
  - conditioner, opaque concentrate, 169
  - conditioner, pump spray, 170
  - dressing, 177–178
  - dressing, clear gel, 177
  - food, 174
  - glosser, 174
  - groom, cream, 176
  - groom, stick, 176
  - pomade, 175
  - shaping gloss, 178
  - straightener, 185
  - styling glaze, 178
  - treatment cream, 173
- Hairspray, 180–182
  - aerosol, 182
  - detangling spritz, 182
  - nonaerosol with sunscreen, 180
  - pump, 180
- Hand
  - and body cleanser, 191
  - and body lotion, 106–108
  - and face lotion, 108
  - cleaner, waterless, 188–189
  - cream, 102–104
  - lotion, 12, 13, 104–106
  - soap, liquid, 189–191
- Hard surface cleaner, 252
- Heating, 5
- Hose
  - cover, EPDM rubber, 299
  - radiator, black rubber, 295
- Hot-melt
  - adhesive, LDPE, 43
  - adhesive, pressure-sensitive, 43
- Household cleaner, 33
- Humectant, therapeutic cream, 259
- Hydrogen peroxide cream, 260
- Hydroquinone cream, 260
- I**
- Icing, 58
  - buttercream, 59
- Injection
  - molding compound, 303–304
  - molding compound, safety boots, 304
- Ink
  - blue-black writing, 20
  - for glass, 3
  - laundry marking, indelible, 21
  - remover, 34
- Insect
  - killer, household, 307
  - repellent, 16, 306
- Insecticide, 18
- J**
- Jam, imitation, reduced-calorie, 60
- Javelle water, 35
- Jelly, imitation, reduced-calorie, 60
- Joint cement, tape, 47
- K**
- Kaolin-pectin suspension, 266
- L**
- Lacquer
  - aqueous clear, 224
  - full gloss topcoat for forced air dry, 225
  - semigloss urethane-alkyd, 224
  - spot remover, 34
- Laryngitis (sore throat) remedy, 271
- Latex
  - acrylic-styrene, for wet adhesion, 214
  - concrete seal, 234
  - PVA acrylic flat white, 212
  - vinylacetate-Veova, for wet adhesion, 213
- Laundry
  - bleach, 35
  - blue, liquid, 35
  - detergent, 246–247
  - detergent, cold water, 246
  - detergent, hand wash, 246

Leather preservative, 24  
Lemon  
  chiffon cake, 58  
  extract, pure, 20  
Limestone acidizing, 311  
Liniment, sore muscle, 15  
Lip  
  balm, 133–135  
  balm, stick, 134  
  balm, sunscreen, 135  
  gloss, 132–133  
Lipstick, 129–131  
Lubricant, 26  
  gum, 26

## M

Makeup, 119–121  
  cream, 119  
  remover/skin cleanser, 185  
  stick, blemish, 121  
  waterproof, 120  
Malted-milk powder, 19  
Marine coating, 226  
Mascara, 127–129  
Massage skin cream, 99  
Meat replacement, 67  
Mechanics' hand soap, 32  
Medicated  
  cream, 116  
  greaseless skin preparation, 261  
Membrane, citric acid cleaning solution  
  for, 310  
Metal  
  cleaner, acid, 255  
  paint stripper for, 223  
  polish, 22  
  to-metal adhesive, 42  
Microemulsion cleaner, 311  
Midcoat, medium to high PVC, high  
  solids epoxy barrier, 210  
Mildew cleaner, 258  
Milk  
  calcium-fortified, 49  
  chocolate, 49  
Mineral surface coating, 234  
Moisture balm, 100

Moisturizing  
  cream, 114–115  
  lotion, 92–94  
Molding  
  compound, 27  
  compound, injection, 303  
  compound, injection, safety boots, 304  
  natural rubber, 296  
Mothproofing, 18  
Mouthwash, 14, 77–78  
Muffins, corn bran, 67  
Multivitamin and iron chewable tablets,  
  269

## N

Nail polish remover, 139  
Neatsfoot, cold-pressed, 24  
Neoprene, roll cover/gasket, 297  
Night cream, 112

## O

O-ring rubber, 297  
Oil  
  bath, 195–196  
  spot remover, 34  
Ointment  
  antiseptic, 4  
  base, 259  
Omelette, frozen, 68  
Oven and hood areas, protective film  
  for, 238  
Overnight cream, 113

## P

Paint. *See also Coating, Lacquer, Latex*  
  brush cleaner, 34  
  remover, 30  
  semigloss, 215–216  
  semigloss, white tint base, rule 66  
    exempt, 216  
  spot remover, 34  
  stripper for metal, 223  
  tempera, 211  
Pancake batter, 63  
Paper  
  fireproof, 37

- glassine, 35
  - greaseproofing, 37
  - waterproofing, 35
  - Paperhanger's paste, 29
  - Pasta, almond, 68
  - Pavement marker, epoxy adhesive for, 47
  - Penetrating oil, 27
  - Perfume, 136–138
    - cream, 137
    - cream, emollient, 138
    - mousse, aerosol, 139
    - stick, 136
    - stick, emollient, 137
  - Permanent
    - waved hair, conditioning rolling lotion for, 184
    - waving solution, 184
  - Peroxide lotion, 182
  - Photographic solution, 40
  - Pina colada mix, 49–50
  - Pine wood stain, 226
  - Pipe
    - cleaner, 9
    - coating, general purpose, 228
    - coating, urethane, 228
    - compound, PVC, 291
    - fitting compounds, PVC, 290
  - Plaster wall patching, 28
  - Plastic window polishing cleaner, 245
  - Polish, 26, 273–285
    - auto, 279–280
    - auto cleaner/, 276–279
    - cleaner for plastic windows, 245
    - floor, 273–276
    - furniture, 25, 282–283
    - metal, 22
    - restorer, fiberglass boat, 280–281
    - shoe, 283–285
    - shoe, black, 24
    - silver, with antitampering agent, 313–315
  - Polychloroprene adhesive, 41
  - Polyethylene, low-density adhesive, hot-melt, 43
  - Potting compound, electrical, 229
  - Pre-electric shave lotion, 79–80
  - Prelipstick stick, 129
  - Pressure-sensitive adhesive, hot-melt, 43
  - Primer, 200–207
    - aqueous pigmented, 200
    - epoxy/polyamide, high m.w., 203
    - epoxy/polyamide, medium m.w., 203
    - epoxy urethane, 204
    - rule 66 exempt, 80% zinc dust, 201
    - rule 66 exempt, 93% zinc dust, 202
    - trade sales alkyd red, 205
  - Primer/topcoat, 199–200
    - green phenolic alkyd, 200
    - orange phenolic-modified alkyd, 199
  - Profiles
    - PVC, high impact, 291
    - rubber, black compact, 295
  - Protective film for oven and hood areas, 238
  - Pudding mix, 54
    - vanilla, 54
  - Pulverizing and grinding, 7
  - Putty, 30
  - PVA acrylic flat white latex, 212
  - PVC
    - compound, chlorinated, 289
    - compound, pipe, 291
    - compound, pipe fitting, 290
    - compound, profiles, high impact, 291
    - compound, semirigid, 290
    - compound, sheet, transparent, 291
  - Pyridoxine HCl tablets, 270
- ## R
- Radiator hose, black rubber, 295
  - Roll cover/gasket, neoprene rubber, 297
  - Roof
    - cement, acrylic latex, 237
    - cement, black asphalt cutback, 236
    - cement, elastomeric, 236
    - cement, mastic asphalt, 235
  - Rouge, liquid, 123
  - Rubber
    - brake diaphragm stock, 293
    - EPDM hose cover, 299
    - natural, low sulfur cured, 292
    - natural, molding, 296

- NBR, 299
- neoprene roll cover/gasket, 297
- o-ring, 297
- radiator hose and compact profiles, black, 295
- roll stock, nonconducting, 294
- sleeve stock, 293
- transmission belting, 298
- window weatherstripping, black, 295
- Rug shampoo, 253
- Rust
  - prevention compound, 22
  - remover, 34
- S**
- Sachet, cream, 138
- Saddle soap, 31
- Salad dressing
  - Italian, 51–52
  - spoonable, 53
- Scrub, abrasive facial lotion, 187
- Sealing and caulking compound, elastomeric, 46
- Shake mix, direct draw, 63
- Shampoo, 151–166
  - antidandruff, 158–159
  - baby, 162–164
  - baby, mousse with sunscreen, 163
  - balsam/herbal, 153
  - body and sport, 191
  - clear, 155
  - clear acid, 156
  - clear gel, 155
  - conditioning, 164–166
  - cream, 160
  - detangling, 158
  - ethnic mild cleansing, 164
  - gel, 160–161
  - gel, clear, 161
  - lotion, 162
  - low cost, 155, 156
  - nonalkaline, 156
  - normal hair, 155
  - pearly, 155
  - protein, 157
  - rug, 253
  - shower, 166
  - shower, pearlescent, 166
- Shave
  - after, lotion, 84–86
  - cream, 80–81
  - cream, brushless, 13
  - foam, 83–84
  - lotion, pre-electric, 79–80
- Sheet, PVC, transparent, 291
- Shoe
  - dressing, white, 23
  - polish, 283–285
  - polish, black, 24
  - sole compound, 303
  - waterproofing for, 23
- Shower gel, high-quality, 196
- Silver polish with antitarnishing agent, 313–315
- Skin
  - cleanser, 185
  - conditioner, 101
  - cream, 94–99
  - cream and lotion, medicated greaseless, 261
  - cream, massage, 99
  - cream, moisturizing, 97
  - lotion, 87–92
- Soap, 31
  - concentrated liquid, 31
  - detergent bar, 192
  - hand, liquid, 189–191
  - liquid, 240–242
  - liquid, emollient, 241
  - mechanics' hand, 32
  - saddle, 31
- Sodium fluoride chewable tablets, 269
- Softener
  - textile, 313
  - water, salt and citric acid, 312
- Soldering flux, 39
- Solventless
  - coating, 227
  - tile coating, 233
- Spoilage and loss, 8
- Sport and body shampoo, 191
- Spot remover, grease, oil, paint, and lacquer, 34

- Stain, pine wood, 226  
 Steel, blue-black finish on, 22  
 Straw-hat cleaner, 33  
 Styling lotion, 179  
 Styrene emulsion system, 287  
 Sun milk, 145  
 Sunblock, 145–146  
 Sunscreen  
   cream, 140–142  
   gel, 140  
   lip balm, 135  
   lotion, 142–143  
   oil, 139–140  
   water-in-oil, 143–144  
 Suntan  
   cream, natural, 146  
   lotion, 147–150  
   oil, 150  
   oil, mousse, 151  
 Suspension  
   kaolin-pectin, 266  
   tetracycline, 267  
 Syrup  
   acetaminophen, 263  
   cough, antitussive-expectorant, 265  
   cough-cold, 264
- T**
- Tablets  
   chewable, childrens acetaminophen, 270  
   chewable, multivitamin and iron, 269  
   chewable, sodium fluoride, 269  
   chewable, vitamin C, 268  
   chewable, vitamin E, 268  
   coating, multiple vitamin, 271  
   coating, stress vitamin with iron, 271  
   coating, therapeutic multivitamin, 271  
   pyridoxine HCl, 270–271  
 Tape joint cement, 47  
 Tempera paint, 211  
 Temperature measurement, 6  
 Tempura batter, 64  
 Tetracycline suspension, 267  
 Textile softener, 313  
 Therapeutic humectant cream, 259  
 Thermoplastic elastomer alloy (TPE), 286–287
- Throat  
   and eye lotion, 112  
   remedy, sore, 271  
 Tile  
   and tub cleaner, 256  
   coating, solventless, 233  
 Tire treads, logging, high-performance, 302  
 Toilet bowl cleaner, liquid, 256  
 Tooth powder, 14  
 Toothpaste, 76–77  
 Topcoat, 207–210  
   gloss, 208  
   hazy gray, 209  
   white, 208  
   white medium build, 207  
 Transmission belting, rubber, 298  
 Transparent gel, 198  
 Transportation detergent  
   auto cleaner/polish, 254  
   car wash, 254  
   heavy-duty truck, 254  
 Truck detergent, heavy-duty liquid, 254  
 Tub and tile cleaner, 256
- V**
- Vanilla flavor, artificial, 20  
 Vanishing cream, 12, 114  
 Vinyl  
   acetate-Veova latex for wet adhesion, 213  
   /acrylic emulsion system, 288  
 Vitamin  
   C chewable tablets, 268  
   E chewable tablets, 268  
   tablet coating, 271
- W**
- Wallpaper  
   cleaner, 32  
   remover, 253  
 Water softener salt and citric acid, 312  
 Waterless hand cleaner, 188–189  
 Waterproofing  
   canvas, 36  
   cement, 37

- for shoes, 23
- liquid, 36
- paper and fiberboard, 35
- Waving solution, permanent, 184
- Wax
  - auto, 25
  - floor, 25
  - grafting, 28
  - polishing, 26
- Weapons coating, 228
- Weatherstripping, window, black rubber, 295
- Weighing and measuring, 8
- Weights and measures, 321
- Window
  - cleaner, 33
  - plastic, polishing cleaner, 245
  - weatherstripping, black rubber, 295
- Wire and cable
  - flame-retardant EPDM, 301
  - flame-retardant, halogen-free, 300
  - low-smoke, 300
- Wood
  - dough plastic, 30
  - flour bleach, 30



