





# The Chemical Formulary

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

VOLUME XVII

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# **The Chemical Formulary, Volume XVII**

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## PREFACE TO VOLUME XVII

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, so that 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 XVII (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.

Formulas for which patent numbers are listed can be manufactured only after obtaining a license from the patentees.



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## 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 formulae 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 formulae given in this volume will save chemists and allied workers much time and effort.

Manufacturers and sellers of chemicals will find, in these formulae, 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 formulae 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. Formulae are useful as starting points from which to work out one's own ideas. Also, formulae 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

## CONTENTS

1. Introduction	13
2. Adhesives	45
3. Coatings	75
4. Cosmetics	112
5. Detergents	156
6. Drugs	180
7. Emulsions and Dispersions	191
8. Foods, Beverages, and Flavors	202
9. Metals and Their Treatment	211
10. Polish	220
11. Rubbers, Plastics, and Waxes	229
12. Textiles and Their Treatment	268
13. Miscellaneous	275
<b>Appendix</b>	
Federal Regulations	284
Incompatible Chemicals	287
Tables	291
Chemical First Aid	296
Trademark Chemicals Suppliers	298
Trademark Chemicals	304
Index	309



## ABBREVIATIONS

amp	ampere
amp/dm <sup>2</sup>	amperes per square decimeter
amp/sq ft	amperes per square foot
anhydr	anhydrous
avoir	avoirdupois
bbi	barrel
Bé	Baumé
B.P.	boiling point
°C	degrees Centigrade
cc	cubic centimeter
cd	current density
cm	centimeter
cm <sup>3</sup>	cubic centimeter
conc	concentrated
c.p.	chemically pure
cp	centipoise
cu ft	cubic foot
cu in.	cubic inch
cwt	hundredweight
d	density
dil	dilute
dm	decimeter
dm <sup>2</sup>	square decimeter
dr	dram
E	Engler
°F	degrees Fahrenheit
ffc	free from chlorine
ffpa	free from prussic acid
fl dr	fluid dram
fl oz	fluid ounce
ft pt	flash point
F.P.	freezing point
ft	foot
ft <sup>2</sup>	square foot
g	gram

## ABBREVIATIONS

gal	gallon
gr	grain
hl	hectoliter
hr	hour
in.	inch
kg	kilogram
l	liter
lb	pound
liq	liquid
m	meter
min	minim, minute
ml	milliliter (cubic centimeter)
mm	millimeter
M.P.	melting point
N	Normal
N.F.	National Formulary
oz	ounce
pH	hydrogen-ion concentration
p.p.m	parts per million
pt	pint
pwt	pennyweight
q.s.	a quantity sufficient to make
qt	quart
r.p.m.	revolutions per minute
sec	second
sp	spirits
Sp. Gr.	specific gravity
sq. dm.	square decimeter
tech	technical
tinc	tincture
tr	tincture
Tw	Twaddell
U.S.P.	United States Pharmacopeia
v	volt
visc	viscosity
vol	volume
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 wellstudied procedures, any departure from which will inevitably result in failure. The steps for successful compounding are given with the formulae. 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.

And 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 minutes in cold water, steeping for 1 hour 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 minutes fails to produce it, steep them longer until you get the right kind of mucilage.



lage. 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 mouth washes, 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, tooth pastes, lubricating greases, wax polishes, etc., whose formulation requires relatively elaborate procedure 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 divers formulae 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 part		

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 or 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		

We can divide each amount by ten and then the finished bulk will be only one tenth of the original formula. Thus it becomes:

Acetic Acid (80%)	2	Alcohol	44
Glycerin	2	Water	50
Perfume	2		

### *Apparatus*

For most preparations, pots, pans, china, and glassware, which are used in every household, will be satisfactory. For making fine mixtures and emulsions, a malted-milk mixer or egg beater is necessary. For weighing, a small, low-priced scale should be purchased from a laboratory-supply house. For measuring fluids, glass graduates or measuring glasses may be purchased from your local druggist. Where a thermometer is necessary, a chemical thermometer should be obtained from a druggist or chemical-supply firm.

### *Methods*

To understand better the products which you intend to make, it is advisable that you read the complete section covering such products. You may learn different methods that may be used and also to avoid errors which many beginners are prone to make.

### *Containers for Compounding*

Where discoloration or contamination is to be avoided, as in lightcolored, or food and drug products, it is best to use enameled or earthenware vessels. Aluminum is also highly desirable in such cases, but it should not be used with alkalies as these dissolve and corrode aluminum.

### *Heating*

To avoid overheating, it is advisable to use a double boiler when temperatures below 212°F (temperature of boiling water) will suffice. If a double boiler is not at hand, any pot may be filled with water and the vessel containing the ingredients to be heated placed in the water. The pot may then be heated by any flame without fear of overheating. The water in the pot, however, should be replenished from time to time; it must not be

## INDEX

- Adhesive, 45-73. *Also see* Caulk,  
Cement, Glue, Mastic Seal,  
Sealant.  
Bandage, 71  
Carton, 49  
Case Seal, 49  
Contact, 53  
Curtain Coating, 49  
Fabric Laminating, 69  
Fiberglass, 61  
Flame Retardant, 61  
Flock, 54  
    Printing, 67  
Heat Resistant, 58  
High Strength, 53  
Hot Melt, 47-51  
Metal, 61, 63, 67  
Plastics, 61, 67  
    for Polystyrene foam, 67  
    for PVC, 67  
Pressure Sensitive, 50-53  
    for Rubber, 67  
Silk Screen, 70  
Strapping Tape, 52  
Temporary, 50  
Transparent Film, 51  
Advice, 22  
Aluminum Etch, 217  
Anesthetic, Local, 188  
Anodized Finish, Removing, 217  
Antacid, 184  
Antiperspirant, 112-114  
Antiseptic, 190  
    Ointment, 16  
Ant Poison, 29  
Apparatus, 18  
    Where to Buy, 22  
Aquarium Cement, 37, 57  
Architectural Sealant, 56  
Asphalt Gel, 197  
Aspirin, Sustained Release, 189  
Athletic Padding, 250  
Atomic Weights, 293  
Auto wash, 167  
Baby Oil, 140  
Bakers' Topping, 204  
Baking Powder, 30  
Bath Cosmetics, 142-144  
Bedbug Exterminator, 29  
Bedsore Ointment, 181  
Beer Pipe Cleaner, 23  
Belt Dressing, 277  
Biological Samples, Preserving, 283  
Bleach, Laundry, 40, 165  
    Textile, 273  
    Wood Floor, 38  
Body Dusting Powder, 146 147  
Boiler Cleaning, In-Service, 214  
    Compound, 44  
Callous Softener, 184  
Canary Food, 31  
Candles, 36

- Candy, 209, 210  
Carpet Backing, 270  
Casting Mold, Precision, 218, 264  
Catalyst, Polymer, 265  
Caulk, 72-74  
Cement, Aquarium, 37  
    Auto Headliner, 64  
    Brake Liner, 64  
    Coating, 71  
    Dipping, 71  
    Elastomer, 45  
    Floor Hardener, 37  
    Gasket, 63  
    Heat Cure, 46  
    High Cure, 46  
    Neoprene, 69  
    Nitrile Rubber, 69  
    Shoe Sole, 62  
    Splice, 68  
    Tire Tread, 66  
    Undertread, 67  
    Waterproofing, 42  
Chemical Injuries, First Aid, 296  
Chemicals, Incompatible, 290  
    Suppliers of Trademark, 298  
    Where to Buy, 22, 298  
Chest Rub, 28  
Chewing Gum Remover, 176  
Chocolate Drink Mix, Instant, 207  
    Milk, 208  
Clarification, 20  
Cleaner. *Also see* Detergent, Soap.  
    Automobile, 167  
    Beer Pipe, 23  
    China, 172  
    Floor, 166, 171  
    Glass, 172  
    Grease, 40  
    Hard Surface, 170  
    Household, 39  
    Metal, 176, 211-213, 226  
    Milk Pipe, 23  
    Motor, 164  
    Oil Tank, 175  
    Oven, 164  
    Paint Brush, 40  
    Pipe Stem, 281  
    Bowl, 176  
    Plastic, 172, 174, 175  
    Pot and Pan, 164, 172  
    Printing Roll, 176  
    Refrigerator, 164  
    Silver Coin, 217  
    Silverware, 173  
    Spot, 40  
    Stainless Steel, 174  
    Straw Hat, 40  
    Tile, 171  
    Toilet Bowl, 172  
    Vinyl, 174  
    Wall, 171  
    Wallpaper, 39  
    Waterless Hand, 140  
    Window, 39, 173  
    Windshield, 173  
Coating. *Also see* Organosol, Paint, Varnish.  
    Acid and Alkali Resistant, 93  
    Appliance, 103  
    Butyl, 261  
    Coil, 94, 103  
    Dip, 263  
    Epoxy, 95  
    Flameproof, 233-235  
    Food Can, 106  
    Frying Pan, 278  
    Heat-Resistant, 218  
    Hi-Build, 94  
    Marine Antifouling, 104  
    Metal, 101  
    Non-Stick, 278  
    Plastisol, 106, 262  
    Roller, 101  
    Roof, 245  
    Strippable, 99  
    Textile, 262  
    Vinyl Fabric, 98, 99, 100  
    Window Shade, 98  
Cocoa-Malt Powder, 30  
    Sweet, 30  
Coffee Whitener, 202  
Cold Syrup, 186  
Coloring Copper, 32  
    Steel, 32

- Zinc, 215, 216
- Concrete Block Filler, 275
  - Curing Coating, 92
  - Floor Sealer, 92
- Construction Sealant, 56
- Containers for Compounding, 18
- Copper, Antiquing, 32
  - Coloring, 32
- Corn and Callous Remover, 183
- Costs, Calculating, 23
- Cough Syrup, 185
- Crayon, 31
- Cream Base, Cosmetic, 180
  - Cleansing, 17, 23, 24, 117
  - Cold, 24, 25
  - Diaper Rash, 181
  - Hand, 116
    - Protective, 117
  - Insect Bite, 183
    - Repellent, 182
  - Medicated, 181
  - Moisturizing, 117
  - Prickly Heat, 182
  - Sachet, 118
  - Shaving, 26
  - Substitute, Dairy, 202
  - Vanishing, 25, 118
- Curing Agents, Polymer, 166, 167
- Decolorizing, 20
- Degreaser, 175
- Dentifrice, 27. *Also see* Tooth Powder.
- Denture Cleaner, 153
- Deodorant, 29
  - Cosmetic, 114, 115
- Depilatory, 115
- Detergent, 156-164. *Also see* Cleaner, Soap.
- Diaper Rash Cream, 181
- Disinfectant, 29
  - Perfumed, 179
- Dispersion, Powder, 199, 200, 271, 278, 282
- Dissolving, 20
- Drycleaning Fluid, 39
- Dust Mop Treatment, 176
- Dyeing Plastic, 265
- Effervescent Powder, 153
- Egg Albumen Replacement, 210
- Elastomer Coating, 93
  - Oil Resistant, 238
- Emollient, Cosmetic, 141
- Emulsion, Dichlorobenzene, 195
  - Ester, 193
  - Foam, Aerosol, 197
  - Homopolymer, 260
  - Hydrocarbon, 191
  - Plasticizer, 193, 194, 195
  - Resin, 191, 192, 200, 255
  - Synthetic Wax, 195, 196
- Enamel, Aerosol, 85
  - Fume Resistant, 83
  - High Gloss, 84
  - Wrinkle, 83
- Encapsulation Compound, 62
- Etch, Glass, 33
- Ethyl Acrylate, 267
- Eye Shadow, 118, 119
- Face Powder, 145
- Feces Softener, 184
- Federal Laws and Regulations, 284-286
- Fiberboard, Waterproofing, 41
- Figuring, 13
- Filtering, 20
- Fire Extinguisher, 43
  - Kindler, 43
- Fireproofing Canvas, 43
  - Paper, 42
  - PVC, 263
  - Textiles, 42
- Flameproof Coating, 233-235. *Also see* Fireproof.
- Flavor, Anise, 209
  - Licorice, 209
  - Vanilla Imitation, 31
- Floor Bleach, Wood, 38
  - Oil, 35
  - Polish, 34
- Fly Paper, 30
  - Spray, 29
- Foam, Aerosol Emulsion, 197, 198
  - Elastomer, 246-253
- Foot Powder, 27, 28, 183

- Foundry Core and Mold Wash, 217
- Gasket Compound, 243
- Gasoline, Solidified, 43
- Testing for Water in, 282
- Gel, Cosmetic, 119
- Ester, 198
- Hydrocarbon, 198, 199
- Rosin, 199
- Solvent, 198
- Thiokol, 199
- Trichloroethylene, 199
- Vegetable Oil, 198
- Glass Etching, 33
- Glassine Paper, 41
- Glass Sealant, 57
- Glue, Flexible, 16
- Grafting Wax, 36
- Graphite Grease, 35
- Grinding, 21
- Gum Drop Improver, 209
- Gun Lubricant, 35
- Hair Brilliantine, 131
- Conditioner, 125-127, 129, 130
- Negro, 131
- Pomade, 131
- Rinse, 124, 125
- Shampoo. *See Shampoo.*
- Spray, 128
- Straightener, Negro, 132
- Hand Lotion, 25, 26
- Hazards, Chemical, 22
- Headache Relief, 189
- Heating, 18
- Hectograph Carbon, 280
- Hose Compound, 244, 245
- Ice Stick, Fudge, 208
- Icing Base, Bakers', 204
- Incompatible Chemicals, 288-290
- Ink, Carbon Paper, 280
- Edible Indelible, 279
- Flexographic Printing, 280
- Glass Marking, 16
- Indelible, 31, 279
- Laundry Marking, 31
- Marking, 16
- Printing, 279, 280
- Remover, 40
- Textile Transfer, 280
- Thickener, 274
- Writing, 31
- Insecticidal Coating, Face, 283
- Insect Repellent, 28, 182
- Insulation, Electrical, 237, 238
- Javelle Water, 40
- Laundry Bleach, 40
- Blue, 41
- Marking Ink, 31
- Laws Regulating Foods, Drugs and  
    Cosmetics, 284-286
- Lemon Extract, 31
- Liniment, 28
- Lip Pomade, 134
- Lipstick, 134
- Lotion Base, Cosmetic, 180
- Hand, 25, 26, 137-139
- Lubricant. *Also see Mold Release.*
- Aerosol, 277
- Gun, 35
- Leather, 277
- Mandrel, 277
- Packing, 277
- Makeup, Cosmetic, 135
- Malted Milk Powder, 30
- Margarine, 206
- Marshmallow Economizer, 209
- Masonry Filler Coat, 90
- Surfacer, 91
- Waterproofing, 90, 276
- Mastic, 59, 60
- Wall Tile, 71
- Meat Substitute, 207
- Mercury, Removing Spilled, 276
- Metal Cleaners, 211
- Milk Pipe Cleaner, 23
- Mixing, 20
- Molding Compound, 36, 59, 239,  
    240
- Mold Release Agent, 265, 277



- Monosodium Glutamate Replacement, 209  
Mothproofing, 30  
Mousse Dry Mix, 204  
Mouth Wash, 27, 155
- Ointment, Antiseptic, 16  
  Base, 180  
  Chlorophyll, 180  
  Gentian Violet, 181  
Organosol, 232
- Pain Reliever, 189  
Paint. *Also see* Coating.  
  Aluminum, 100  
  Antifouling, 102, 104, 105  
  Camouflage, 283  
  Corrosion Proofing, 102  
  Defoamer, 110  
  Flat, 79, 80  
  Floor, 88  
  Improver, 110  
  Latex, 81, 86  
  Marine, 102, 104, 105  
  Masonry, 89  
  Polka-Dot, 95  
  Remover, 38, 176  
  Shingle, 88  
  Ship Bottom, 106  
  Skinning, Preventing, 110  
  Swimming Pool, 107  
  Texture Coating, 86, 87  
  Traffic, 96, 97  
  Water Base, 85  
Paper Coating, Clay Dispersion, 278  
  Hot Melt, 279  
Paper, Electrical Conductive, 277  
  Electrophotographic, 107  
  Fireproof, 42  
  Greaseproof, 42  
  Moisture Proof, 278  
  Oilproof, 42  
  Precoating, 279  
  Reproductive, 280  
  Transparent, 41  
  Waterproofing, 41  
Paperhangers' Paste, 37
- Pavement Sealer, 92  
Penetrating Oil, 36  
Perfume, Face Powder, 148, 149  
  Gel, 150  
  Roll-On, 150  
  Synthetic, 150, 151  
Photographic Developer, 44  
  Fixer, 44  
  Hardener, 44  
Pigment Dispersion, 199, 200, 271  
Pipe and Stem Sweetener, 282  
Plaster, Wall-Patching, 37  
Plastic, Dyeing, 265  
  Film, 263, 264  
  Wood Dough, 38  
Plastisol, 229, 230, 231  
Plating, Chromium, 214  
  Copper, 215  
  Gold, 214  
  Nickel, 215  
  Non-Electric, 215  
Polish, Auto, 34, 225  
  Floor, 34, 220  
  Furniture, 35, 222-224  
  Metal, 32, 226, 227  
  Pipe Bowl, 282  
  Shoe, 34, 228  
  Wax, 34  
Polishing, Electro-, 215  
Potting Compounds, 61, 240  
Powders, Free Flowing, 281  
  Suspending, 282. *Also see* Dispersions.  
Precautions, 22  
Primer, 75-79  
  Aluminum, 104  
  Metal, 262  
Printing Paste, Textile, 273  
Publications, Technical, 22  
Pulverizing, 21  
Putty, 38  
  Construction, 57
- Release Agent, Mold, 265  
Resin, Alkyd, 254  
  Epoxy, 257  
  Gel, 197

- Polyester, 255
- Polysulfide, 258
- Terpolymer, 259
- Water Soluble, 258
- Rocket Propellant Binder, 70
- Rodenticide Bait, 276
- Rubber. *See* Elastomer.
  - Bands, 245
- Rug Backing, Flame Retardant, 272
- Rust Penetrating Oil, 36
  - Preventative, 32
  - Remover, 40
- Sachet Powder, 146, 148
- Sanitizer, Dairy, 179
  - Effervescing, 178
- Sealant, Aircraft, 65
  - Asphalt, 68
  - Auto Seam, 64, 65, 242
  - Elastomer, 236
  - Wood, 55
- Sealing, Black Top, 92
  - Tape, Windshield, 65
- Sebum Simulated, 280
- Shampoo, Hair, 119-124
- Shaving Cream, Aerosol, 132
  - Brushless, 26, 132
- Shaving Lotion, After, 133
- Shoe Sole Compound, 243
- Silver, Anti-Tarnish, 217, 227
- Sintering, Iron Powder, 217
- Skin Cleaner, Germicidal, 182
  - Freshener, 139
  - Nourishing Oil, 146
- Soap, Enzyme, 170
  - Liquid, 38
  - Mechanics' Hand, 39
  - Saddle, 39
  - Soft, 177
  - Transparent, 170, 176, 177
- Soldering Flux Non-Corrosive, 44
- Solvent, Gel, 198
- Sponge Rubber, 253
- Spot Remover, 40, 166
- Stabilizer, PVC, 267
- Stain Remover, Hard Surface, 171, 174
- Starch, Non-Thickening, 177
- Steel, Bluing, 32
- Sterilizing Solution, 190
- Stool Softener, 184
- Straw Cleaner, 40
- Sun Tan Preparations, 141
- Syrup, Chocolate, 207
- Tarnish, Silver, Anti-, 217
- Temperature Measurement, 19
- Textile Bleach, 273
  - Finish, 269
  - Flame Retardant, 272
  - Printing Paste, 273
  - Proofing, 270
  - Size, 268
  - Softener, 270
  - Soil and Static Proofing, 271
  - Waterproofing, 272
  - Water Repellent, 272
- Thickening Liquids, 282
- Thread, Elastomeric, 245
- Tile Adhesive, 71
  - Compound, 243, 244
  - Cord Dip, 262
- Toothpaste, 152
- Tooth Powder, 27
- Urethane Foam, 246-250
- Vanilla Flavor, Artificial, 131
- Varnish, Cold Cut, 107
  - Pro-Preg, 108
  - Remover, 38
  - Rosin Ester, 109
  - Soy Oil, 109
  - Tung Oil, 109
- Vitamin Drop, Pediatric, 184
- Volume, Measuring, 21
- Wallpaper Cleaner, 39
- Water in Gasoline Test, 282
  - Tank Sealant, 63
  - Treatment, Boiler, 44
- Waterproofing Cement, 42
  - Cloth, 41
  - Fiberboard, 41

- Masonry, 276
- Paper, 41
- Textiles, 272
- Wax Emulsion, 195, 196
  - Grafting, 36
  - Investment Casting, 264
  - Laminating, 71
  - Liquid, 35
  - Paste, 35
  - Polish, 34
- Stripper, 166
- Weatherstrip, Automotive, 242
- Weighing, 21
- Weight-Measure Tables, 291
- Window Cleaner, 39, 173
- Wood Dough, Plastic, 38
  - Sealant, 55
  - Stain, 89
- Yogurt, 208





