

# APPENDIX

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## **COMMODITY CLASSIFICATIONS LIST**

### **1.10 Confection, Flavorings & Seasonings**

- 1.01 - Penny Goods
  - 1.02 - Bar Goods
  - 1.03 - Confectionery-Type Chocolate
  - 1.04 - Chocolate Coatings & Syrups
  - 1.05 - Other Flavoring Agents
  - 1.06 - Packaged Goods
  - 1.07 - Bulk Goods
  - 1.08 - Nutmeats & Seeds
  - 1.09 - Sweetening Syrups & Molasses
  - 1.10 - Flavoring Extracts, Emulsions & Other Flavorings
  - 1.11 - Salt
  - 1.12 - Pepper
  - 1.13 - Sugar & Sweeteners
  - 1.14 - Herbs, Spices & Seasoning Mixes
  - 1.15 - Baking Powder & Yeast
  - 1.16 - Tenderizers
  - 1.40 - Confections & Flavorings, N.E.C.
  - 1.50 - Confections, Flavorings & Seasonings, Audits
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### **2.00 Dairy-Type Products**

- 2.01 - Eggs, including Liquid, Dried, & Frozen
- 2.02 - Butter
- 2.03 - Margarine & Butter Substitutes
- 2.04 - Natural Cheeses Except Cottage Cheese
- 2.05 - Processed Cheeses & Related Products
- 2.06 - Cottage Cheese
- 2.07 - Sour Cream & Yogurts including Imitations
- 2.08 - Ice Creams & Ices

- 2.09 - Mix, Ice Cream & Ice Milk
  - 2.10 - Bars; Popsicle, Ice Cream, Ices, Fruit
  - 2.11 - Canned & Evaporated Milk
  - 2.12 - Dry Milk Products & Nondairy Creams
  - 2.13 - Milk & Cream
  - 2.14 - Buttermilk, Chocolate & Other Milk Drinks
  - 2.15 - Other Dairy Drinks
  - 2.16 - Puddings, Toppings, & Instant Breakfasts
  - 2.17 - Dips & Salads
  - 2.40 - Dairy-Type Products, N.E.C.
  - 2.50 - Dairy-Type Products, Audits
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### **3.0 Bakery Goods-Canned, Fresh, or Frozen**

- 3.01 - Breads & Bread-Type Rolls
- 3.02 - Breading, Croutons, Crumbs, & Dressings
- 3.03 - Cakes
- 3.04 - Pies, nonmeat
- 3.05 - Doughnuts
- 3.06 - Pastries & Cookies
- 3.07 - Sweet Rolls & Coffee Cakes
- 3.08 - Biscuits, Crackers, & Pretzels
- 3.09 - Other Dry Bakery Products
- 3.10 - Chips: Potato, Corn, etc.
- 3.11 - Tortillas & Allied Products
- 3.12 - Sandwiches
- 3.13 - Meat, Fish, Poultry Pies
- 3.40 - Bakery Goods, N.E.C.
- 3.50 - Bakery Goods, Audits

### **4.00 Meat, Fish, Poultry**

- 4.01 - Fish & Seafood, Canned
  - 4.02 - Fish & Seafood, Frozen
  - 4.03 - Fish & Seafood, Fresh
  - 4.04 - Canned Meats
  - 4.05 - Beef, Fresh or Frozen
  - 4.06 - Veal, Fresh or Frozen
  - 4.07 - Pork, Fresh or Frozen
  - 4.08 - Lamb & Mutton, Fresh or Frozen
  - 4.09 - Processed Pork: Ham, Bacon, etc.
  - 4.10 - Sausages, Luncheon & Other Processed Meats
  - 4.11 - Canned Poultry
  - 4.12 - Chicken, Fresh or Frozen
  - 4.13 - Turkey, Fresh or Frozen
  - 4.14 - Other Poultry & Small Game
  - 4.40 - Meat, Fish, Poultry N.E.C.
  - 4.50 - Meat, Seafood, Poultry, Audits
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### **5.00 Cooking Oils, Salad Dressings, Condiments**

- 5.01 - Soy & Teriyaki Sauces
- 5.02 - Olive Oil
- 5.03 - Peanut Oil
- 5.04 - Other Vegetable Oils
- 5.06 - Animal or Marine Oil Products
- 5.07 - Shortening, Cooking Oils
- 5.08 - Salad Dressings, Sandwich Spreads, Mayonnaise
- 5.09 - Meat Sauces, Hot Sauces
- 5.10 - Vinegars & Ciders
- 5.40 - Cooking Oils, Salad Dressings, Condiments N.E.C.
- 5.50 - Cooking Oils, Salad Dressings, Condiments, Audits

**6.00 Milling Products**

- 6.01 - Cereals, Breakfast Foods
  - 6.02 - Brans, Wheat Germ
  - 6.03 - Corn Meal
  - 6.04 - Wet Corn Meal Mush
  - 6.05 - Milled Rice & Rice By-Products
  - 6.06 - Prepared Flour & Flour Mixes
  - 6.07 - Grain Mill Products N.E.C.
  - 6.08 - Macaroni & Allied Foods
  - 6.09 - Popcorn
  - 6.40 - Milling Products, N.E.C.
  - 6.50 - Milling Products, Audits
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**7.00 Produce**

- 7.01 - Dried & Dehydrated Fruits & Vegetables
  - 7.02 - Canned Fruits & Vegetables, N.E.C.
  - 7.03 - Frozen Fruits & Vegetables
  - 7.04 - Fresh Fruits & Vegetables
  - 7.05 - Nuts in Shells
  - 7.06 - Mushrooms, All Forms
  - 7.40 - Produce, N.E.C.
  - 7.50 - Fruits & Vegetables, Audits
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**8.0 Other Food Preparations**

- 8.01 - Jams, Jellies, Preserves
- 8.02 - Peanut Butter & Peanut Butter Mixes
- 8.03 - Honey & Honey Mixes
- 8.04 - Pickles & Other Pickle Products
- 8.05 - Soup Mixes
- 8.06 - Soups, Canned
- 8.07 - Soups, Frozen
- 8.08 - Dinners, Frozen

8.09 - Catsup & Other Tomato Based Sauces

- 8.10 - Baby Food, Canned (Nonmeat, Fish, Poultry)
  - 8.11 - Other Canned Specialties
  - 8.12 - Desserts, Ready-to-Mix
  - 8.13 - Health Foods
  - 8.40 - Other Food Preparations, N.E.C.
  - 8.50 - Other Food Preparations, Audits
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**9.00 Beverages**

- 9.01 - Beers, Malt Liquors, & Brewing By-Products
- 9.02 - Wine, Brandy & Cordials
- 9.03 - Other Liquors, Distilled
- 9.04 - Ready-to-Serve Mixed Drinks
- 9.05 - Soft Drinks
- 9.06 - Flavoring Syrups
- 9.07 - Beverage Bases & Concentrated Juices
- 9.08 - Fruit Juices, Ades; Frozen
- 9.09 - Fruit Juices, Ades; Canned or Bottled
- 9.10 - Coffee, Whole Bean & Ground
- 9.11 - Coffee, Concentrated & Instant
- 9.12 - Coffee Substitutes
- 9.13 - Tea, Loose Leaf & Bag
- 9.14 - Tea, Instant or Concentrated
- 9.15 - Vegetable Juices
- 9.16 - Water & Flavored Waters
- 9.17 - Chocolate or Cocoa Based, Nondairy
- 9.18 - Ice
- 9.40 - Beverages, N.E.C.
- 9.50 - Beverages, Audits

**10.00 Pharmacy Products**

- 10.01 - Prescription Drugs
  - 10.02 - Medications, N.E.C.
  - 10.03 - Internal Analgesics (a remedy that lessens or removes pain)
  - 10.04 - External Analgesics & Antiseptics
  - 10.05 - Cough & Cold Items
  - 10.06 - Laxatives
  - 10.07 - Vitamins & Food Supplements
  - 10.08 - Dentifrices, inc. Rinses & Mouthwashes
  - 10.09 - Shaving Preparations
  - 10.10 - Razor Blades & Razors nonelectric)
  - 10.11 - Fragrances; Perfumes, Colognes, Toilet Water
  - 10.12 - Other Cosmetic & Toilet Preparations
  - 10.13 - Hair Products, inc. Shampoos
  - 10.14 - Body Powder & Related Products
  - 10.15 - Oils & Lotions
  - 10.16 - Tapes: Adhesive & other Medical Types
  - 10.17 - Bandages: Adhesive & Compresses
  - 10.18 - Cotton, Medical
  - 10.19 - Devices, Medical
  - 10.40 - Pharmacy Products, N.E.C.
  - 10.50 - Pharmacy Products, Audits
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Classifications Continue  
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**11.00 Garden, Farm, & Pet Supplies**

- 11.01 - Charcoal
  - 11.02 - Hickory & Other Wood Flavoring Chips
  - 11.03 - Fire Starters & Matches
  - 11.04 - Firewood, Kindling & Manufactured Logs
  - 11.05 - Household Insecticides & Repellents
  - 11.06 - Economic Poisons, N.E.C.
  - 11.07 - Phosphatic & Superphosphate Fertilizers
  - 11.08 - Organic Fertilizers & Mixed Fertilizers
  - 11.09 - Peat Moss, Mulch, Bark, & Soil Conditioners
  - 11.10 - Poultry Feeds
  - 11.11 - Livestock Feeds; inc. Salt Licks
  - 11.12 - Dog & Cat Foods
  - 11.13 - Other Prepared Animal Feeds
  - 11.14 - Pet & Livestock Supplies N.E.C.
  - 11.15 - Vegetable & Agricultural Seeds
  - 11.16 - Flower & Grass Seeds, Bulbs, Plants
  - 11.17 - Rock, Sand, & Gravel
  - 11.18 - Garden Tools & Related Products
  - 11.19 - Herbicides
  - 11.40 - Garden, Farm, & Pet Supplies, N.E.C.
  - 11.50 - Garden, Farm, & Pet Supplies, Audits
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**12.00 Hardware & Building Materials**

- 12.01 - Nails, Tacks, Brads, & Rivets
- 12.02 - Bolts, Nuts, Washers, & Screws

- 12.03 - Furniture Hardware
  - 12.04 - Builders Hardware
  - 12.05 - Other Hardware
  - 12.06 - Electrical Equipment & Supplies
  - 12.07 - Plumbing Equipment & Supplies
  - 12.08 - Tile & Tile Supplies
  - 12.09 - Lime & Fireclay
  - 12.10 - Cement & Cement Color; Stucco, Plaster
  - 12.11 - Mortar & Concrete Mix
  - 12.12 - Flooring Products, except for Linoleum, Carpets, & Rugs
  - 12.13 - Linoleum & Similar Floor Coverings
  - 12.14 - Doors & Windows
  - 12.15 - Molding & Lumber
  - 12.16 - Paneling, Wallboard, & other Wall Sheeting
  - 12.17 - Building Paper, Felt, & Plastic Coverings
  - 12.18 - Composition Shingles, Rolled Roofing
  - 12.19 - Wood Shingles Shakes & Accessory Supplies
  - 12.20 - Metal Roofing Products
  - 12.21 - Fiberglass Roofing, Sheets & Rolls
  - 12.22 - Fencing, Flashings, Wire Products & Posts
  - 12.40 - Hardware & Building Materials, N.E.C.
  - 12.50 - Hardware & Building Materials, Audits
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**13.00 Paint & Allied Products**

- 13.01 - Interior & Exterior Oil-Base Paints, including Tint Bases
- 13.02 - Interior & Exterior Water-Base Paints, including Tint Bases
- 13.03 - Lacquers
- 13.04 - Varnishes & Varnish Stains

- 13.05 - Wood Stains
  - 13.06 - Rust Preventives & Solvents
  - 13.07 - Wood Preservatives
  - 13.08 - Putty, Fillers, Caulking Compounds, & Allied Products
  - 13.09 - Glues, Adhesives, Sizing
  - 13.10 - Tapes, Adhesive, N.E.C.
  - 13.11 - Linseed Oil
  - 13.12 - Turpentine & Softwood Distillation Products
  - 13.13 - Other Wood & Gum Chemicals
  - 13.14 - Wallpaper
  - 13.15 - Painter's Equipment & Supplies
  - 13.40 - Paint & Allied Products N.E.C.
  - 13.50 - Paint & Allied Products, Audits
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**14.00 Maintenance Supplies**

- 14.01 - Bleaches & Bluing
  - 14.02 - Starch
  - 14.03 - Soap
  - 14.04 - Synthetic or Organic Detergent
  - 14.05 - Alkaline Detergent & Acid-Type Cleaners
  - 14.06 - Specialty Cleaning & Sanitary Products
  - 14.07 - Polishing & Preparation Products
  - 14.08 - Glycerine
  - 14.09 - Dyes
  - 14.10 - Sawdust & Shavings
  - 14.11 - Oil, Grease Absorbents
  - 14.12 - Polishing Cloths, Rags, & Chamois
  - 14.13 - Swimming Pool & Spa Supplies & Equipment
  - 14.40 - Maintenance Supplies, N.E.C.
  - 14.50 - Maintenance Supplies, Audits
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Classifications Continue  
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**15.00 Paper & Plastic Products**

- 15.01 - Bags: Grocers, Variety, Paper
- 15.02 - Bags: Specialty and Liners
- 15.03 - Gift Wrap, Ribbon, & Wrapping Products
- 15.04 - Rope, Cordage, Twine
- 15.06 - Party Favors, Supplies, Novelties, Tooth-picks, & Decorations
- 15.07 - Paper Linens, Wearing Apparel, Table Cloths, Wash Cloths & Towels
- 15.08 - Food Containers & Picnic Supplies
- 15.09 - Sanitary Napkins & Tampons
- 15.10 - Paper Napkins, Tissue Products, & Towels
- 15.11 - Foil & Plastic Wrap
- 15.12 - Oiled, Waxed, & Wax Laminated Paper
- 15.13 - School & Office Supplies, Stationary, Envelopes, & Related Products
- 15.14 - Photographic Paper & Film
- 15.15 - Artist's Materials & Supplies
- 15.40 - Paper & Plastic Products N.E.C.
- 15.50 - Paper & Plastic Products, Audits

**16.00 Textile Products**

- 16.01 - Bedspreads, Blankets, Bed Sets, etc.
- 16.02 - Sheets & Pillow Cases
- 16.03 - Towels & Wash Cloths
- 16.04 - Table Covers & Linens
- 16.05 - Curtains & Draperies
- 16.06 - Carpets & Drapes
- 16.07 - Carpet & Rug Padding

- 16.08 - Wearing Apparel
- 16.09 - Yardage Goods; Bolt, Roll or Package
- 16.10 - Thread & Yarn; Sewing Embroidering, Knitting, Crocheting, etc.
- 16.11 - Needles, Fasteners, Pins, & Similar Products
- 16.12 - Buttons & Button Parts, (except for precious metals)
- 16.13 - Zippers, Velcro & Slide Fasteners
- 16.14 - Agriculture Bag Sewing Threads, Twines, Yarns
- 16.15 - Upholstery Supplies
- 16.16 - Sleeping Bags & Mattresses
- 16.17 - Tents & Tarps
- 16.40 - Textile Products, N.E.C.
- 16.50 - Textile Products, Audits

**17.00 Miscellaneous**

- 17.01 - Cigarettes
- 17.02 - Cigars
- 17.03 - Tobacco: Chewing, Smoking, & Snuff
- 17.04 - Other Smoking Supplies & Equipment
- 17.05 - Fishing Equipment, Tackle, & Supplies
- 17.06 - Firearms, Hunting Equipment & Supplies
- 17.07 - Other Sporting & Athletic Goods
- 17.08 - Explosives, Fireworks, & Supplies
- 17.09 - Toys & Children's Items
- 17.10 - Hobby or Handicraft Equipment & Supplies
- 17.11 - Soldering Equipment & Supplies
- 17.12 - Welding Equipment & Supplies

- 17.13 - Tools, Shop Equipment & Supplies
- 17.14 - Extinguishers, Safety Products & Supplies
- 17.15 - Chemicals, General N.E.C.
- 17.16 - Pressurized Gasses
- 17.17 - Motor Oil & Automatic Transmission Fluids
- 17.18 - Lubricating Oils N.E.C.
- 17.19 - Lubricating Greases
- 17.20 - Brake Fluid
- 17.21 - Antifreeze, Coolant
- 17.22 - Automotive Window Cleaners
- 17.23 - Transportation Equipment & Hardware
- 17.24 - Automotive Products, N.E.C.
- 17.40 - Miscellaneous, N.E.C.
- 17.50 - Miscellaneous, Audits

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N.E.C. - Not Elsewhere Classified

AUDITS - Used for packages inspected at the location where they are weighed or measured **AND** labeled.

## CONVERSION FACTORS UNITS OF MEASUREMENT

All **boldface** figures are exact; others are generally seven significant figures.

In using conversion factors, it is possible to perform division as well as the multiplication process shown here. Division may be particularly advantageous where more than the significant figures published here are required. Division may be performed in lieu of multiplication by using the reciprocal of any indicated multiplier as divisor. For example, to convert from centimeters to inches by division, refer to the table headed "To Convert From Inches" and use the factor listed at "centimeters" (2.54) as divisor.

### UNITS OF LENGTH

To Convert From <b>Centimeters</b>	
To	Multiply By
Inches	0.393 700 8
Feet	0.032 808 40
Yards	0.010 936 13
Meters	<b>0.01</b>

To Convert From <b>Meters</b>	
To	Multiply By
Inches	39.370 08
Feet	3.280 840
Yards	1.093 613
Miles	0.000 621 37
Millimeters	<b>1 000</b>
Centimeters	<b>100</b>
Kilometers	<b>0.001</b>

To Convert From <b>Inches</b>	
To	Multiply By
Feet	0.083 333 33
Yards	0.027 777 78
Centimeters	<b>2.54</b>
Meters	<b>0.025 4</b>

To Convert From <b>Feet</b>	
To	Multiply By
Inches	<b>12</b>
Yards	0.333 333 3
Miles	0.000 189 39
Centimeters	<b>30.48</b>
Meters	<b>0.304 8</b>
Kilometers	<b>0.000 304 8</b>

To Convert From <b>Yards</b>	
To	Multiply By
Inches	<b>36</b>
Feet	<b>3</b>
Miles	0.000 568 18
Centimeters	<b>91.44</b>
Meters	<b>0.914 4</b>

To Convert From <b>Miles</b>	
To	Multiply By
Inches	<b>63 360</b>
Feet	<b>5 280</b>
Yards	<b>1 760</b>
Centimeters	<b>160 934.4</b>
Meters	<b>1 609.344</b>
Kilometers	<b>1.609 344</b>

## UNITS OF MASS

To Convert From <b>GRAINS</b>	
To	Multiply By
Avoirdupois Drams	0.036 571 43
Avoirdupois Ounces	0.002 285 71
Avoirdupois Pounds	0.000 142 86
Troy Ounces	0.002 083 33
Troy Pounds	0.000 173 61
Milligrams	<b>64.798 91</b>
Grams	<b>0.064 798 91</b>
Kilograms	<b>0.000 064 798 91</b>

To Convert From <b>GRAMS</b>	
To	Multiply By
Grains	15.432 36
Avoirdupois Drams	0.564 383 4
Avoirdupois Ounces	0.035 273 96
Avoirdupois Pounds	0.002 204 62
Troy Ounces	0.032 150 75
Troy Pounds	0.002 679 23
Milligrams	<b>1 000</b>
Kilograms	<b>0.001</b>

To Convert From <b>AVOIRDUPOIS OUNCES</b>	
To	Multiply By
Grains	<b>437.5</b>
Avoirdupois Drams	<b>16</b>
Avoirdupois Pounds	<b>0.062 5</b>
Troy Ounces	0.911 458 3
Troy Pounds	0.075 954 86
Grams	<b>28.349 523 12</b>
Kilograms	<b>0.028 349 523 125</b>

To Convert From <b>KILOGRAMS</b>	
To	Multiply By
Grains	15 432.36
Avoirdupois Drams	564.383 4
Avoirdupois Ounces	35.273 96
Avoirdupois Pounds	2.204 623
Short Hundredweights	0.022 046 23
Short Tons	0.001 102 31
Long Tons	0.000 984 2
Troy Ounces	32.150 75
Troy Pounds	2.679 229
Grams	<b>1 000</b>
Metric Tons	<b>0.001</b>

To Convert From <b>AVOIRDUPOIS POUNDS</b>	
To	Multiply By
Grains	<b>7 000</b>
Avoirdupois Drams	<b>256</b>
Avoirdupois Ounces	<b>16</b>
Short Hundredweight	<b>0.01</b>
Short Tons	<b>0.000 5</b>
Long Tons	0.000 446 428 6
Troy Ounces	14.583 33
Troy Pounds	1.215 278
Grams	<b>453.592 37</b>
Kilograms	<b>0.453 592 37</b>
Metric Tons	<b>0.000 453 592 37</b>

To Convert From <b>METRIC TONS</b>	
To	Multiply By
Avoirdupois Pounds	2 204.623
Short Hundredweights	22.046 23
Short Tons	1.102 311 3
Long Tons	0.984 206 5
Kilograms	<b>1 000</b>

To Convert From <b>SHORT HUNDREDWEIGHTS</b>	
To	Multiply By
Avoirdupois Pounds	<b>100</b>
Short Tons	<b>0.05</b>
Long Tons	0.044 642 86
Kilograms	<b>45.359 237</b>
Metric Tons	<b>0.045 359 237</b>



To Convert From <b>SHORT TONS</b>	
To	Multiply By
Avoirdupois Pounds	<b>2 000</b>
Short Hundredweights	<b>20</b>
Long Tons	0.892 857 1
Kilograms	<b>907.184 74</b>
Metric Tons	<b>0.907 184 74</b>

To Convert From <b>LONG TONS</b>	
To	Multiply By
Avoirdupois Ounces	<b>35 840</b>
Avoirdupois Pounds	<b>2 240</b>
Short Hundredweights	<b>22.4</b>
Short Tons	<b>1 016.046 908 8</b>
Kilograms	<b>1.016 046 908 8</b>
Metric Tons	

To Convert From <b>TROY OUNCES</b>	
To	Multiply By
Grains	<b>480</b>
Avoirdupois Drams	17.554 29
Avoirdupois Ounces	1.097 143
Avoirdupois Pounds	0.068 571 43
Troy Pounds	0.083 333 3
Grams	<b>31.103 476 8</b>

To Convert From <b>TROY POUNDS</b>	
To	Multiply By
Grains	<b>5 760</b>
Avoirdupois Drams	210.651 4
Avoirdupois Ounces	13.165 71
Avoirdupois Pounds	0.822 857 1
Troy Ounces	<b>12</b>
Grams	<b>373.241 721 6</b>

**UNITS OF CAPACITY, OR VOLUME, LIQUID MEASURE**

To Convert From <b>MILLILITERS</b>	
To	Multiply By
Minims	16.230 73
Liquid Ounces	0.033 814 02
Gills	0.008 453 5
Liquid Pints	0.002 113 4
Liquid Quarts	0.001 056 7
Gallons	0.000 264 17
Cubic Inches	0.061 023 74
Liters	<b>0.001</b>

To Convert From <b>LITERS</b>	
To	Multiply By
Liquid Ounces	33.814 02
Gills	8.453 506
Liquid Pints	2.113 376
Liquid Quarts	1.056 688
Gallons	0.264 172 05
Cubic Inches	61.023 74
Cubic Feet	0.035 314 67
Cubic Yards	0.001 307 95
Milliliters	<b>1 000</b>
Cubic Meters	<b>0.001</b>

To Convert From <b>CUBIC METERS</b>	
To	Multiply By
Gallons	264.172 05
Cubic Inches	61 023.74
Cubic Feet	35.314 67
Cubic Yards	1.307 950 6
Liters	<b>1 000</b>

To Convert From <b>MINIMS</b>	
To	Multiply By
Liquid Ounces	0.002 083 33
Gills	0.000 520 83
Cubic Inches	0.003 759 77
Milliliters	0.061 611 52

To Convert From <b>GILLS</b>	
To	Multiply By
Minims	<b>1 920</b>
Liquid Ounces	<b>4</b>
Liquid Pints	<b>0.25</b>
Liquid Quarts	<b>0.125</b>
Gallons	<b>0.031 25</b>
Cubic Inches	<b>7.218 75</b>
Cubic Feet	0.004 177 517
Milliliters	<b>118.294 118 25</b>
Liters	<b>0.118 294 118 25</b>

To Convert From <b>LIQUID OUNCES</b>	
To	Multiply By
Minims	<b>480</b>
Gills	<b>0.25</b>
Liquid Pints	<b>0.062 5</b>
Liquid Quarts	<b>0.031 25</b>
Gallons	<b>0.007 812 5</b>
Cubic Inches	1.804 687 5
Cubic Feet	0.001 044 38
Milliliters	29.573 53
Liters	0.029 573 53

To Convert From <b>LIQUID PINTS</b>	
To	Multiply By
Minims	<b>7 680</b>
Liquid Ounces	<b>16</b>
Gills	<b>4</b>
Liquid Quarts	<b>0.5</b>
Gallons	<b>0.125</b>
Cubic Inches	<b>28.875</b>
Cubic Feet	0.016 710 07
Milliliters	<b>473.176 473</b>
Liters	<b>0.473 176 473</b>

To Convert From <b>LIQUID QUARTS</b>	
To	Multiply By
Minims	<b>15 360</b>
Liquid Ounces	<b>32</b>
Gills	<b>8</b>
Liquid Pints	<b>2</b>
Gallons	<b>0.25</b>
Cubic Inches	<b>57.75</b>
Cubic Feet	0.033 420 14
Milliliters	<b>946.352 946</b>
Liters	<b>0.946 352 946</b>

To Convert From <b>GALLONS</b>	
To	Multiply By
Minims	<b>61 440</b>
Liquid Ounces	<b>128</b>
Gills	<b>32</b>
Liquid Pints	<b>8</b>
Liquid Quarts	<b>4</b>
Cubic Inches	<b>231</b>
Cubic Feet	0.133 680 6
Cubic Yards	0.004 951 13
Milliliters	<b>3 785.411 784</b>
Liters	<b>3.785 411 784</b>
Cubic Meters	<b>0.003 785 411 784</b>

To Convert From <b>CUBIC INCHES</b>	
To	Multiply By
Minims	265.974 0
Liquid Ounces	0.554 112 6
Gills	0.138 528 1
Liquid Pints	0.034 632 03
Liquid Quarts	0.017 316 02
Gallons	0.004 329 0
Cubic Feet	0.000 578 7
Cubic Yards	0.000 021 43
Milliliters	<b>16.387 064</b>
Liters	<b>0.016 387 064</b>
Cubic Meters	<b>0.000 016 387 064</b>

To Convert From <b>CUBIC FEET</b>	
To	Multiply By
Liquid Ounces	957.506 5
Gills	239.376 6
Liquid Pints	59.844 16
Liquid Quarts	29.922 08
Gallons	7.480 519
Cubic Inches	<b>1 728</b>
Cubic Yards	0.037 037 04
Liters	<b>28.316 846 592</b>
Cubic Meters	<b>0.028 316 846 592</b>

To Convert From <b>CUBIC YARDS</b>	
To	Multiply By
Gallons	201.974 0
Cubic Inches	<b>46 656</b>
Cubic Feet	<b>27</b>
Liters	<b>764.554 857 984</b>
Cubic Meters	<b>0.764 554 857 984</b>

### UNITS OF CAPACITY, OR VOLUME, DRY MEASURE

To Convert From <b>LITERS</b>	
To	Multiply By
Dry Pints	1.816 166
Dry Quarts	0.908 082 98
Pecks	0.113 510 4
Bushels	0.028 377 59
Dekaliters	<b>0.1</b>

To Convert From <b>CUBIC INCHES</b>	
To	Multiply By
Dry Pints	0.029 761 6
Dry Quarts	0.014 880 8
Pecks	0.001 860 10
Bushels	0.000 465 025

To Convert From <b>DEKALITERS</b>	
To	Multiply By
Dry Pints	18.161 66
Dry Quarts	9.080 829 8
Pecks	1.135 104
Bushels	0.283 775 9
Cubic Inches	610.237 4
Cubic Feet	0.353 146 7
Liters	<b>10</b>

To Convert From <b>CUBIC FEET</b>	
To	Multiply By
Dry Pints	51.428 09
Dry Quarts	25.714 05
Pecks	3.214 256
Bushels	0.803 563 95

To Convert From <b>CUBIC METERS</b>	
To	Multiply By
Pecks	113.510 4
Bushels	28.377 59

To Convert From <b>CUBIC YARDS</b>	
To	Multiply By
Pecks	86.784 91
Bushels	21.696 227

To Convert From <b>DRY PINTS</b>	
To	Multiply By
Dry Quarts	<b>0.5</b>
Pecks	<b>0.062 5</b>
Bushels	<b>0.015 625</b>
Cubic Inches	<b>33.600 312 5</b>
Cubic Feet	0.019 444 63
Liters	0.550 610 47
Dekaliters	0.055 061 05

To Convert From <b>DRY QUARTS</b>	
To	Multiply By
Dry Pints	<b>2</b>
Pecks	<b>0.125</b>
Bushels	<b>0.031 25</b>
Cubic Inches	<b>67.200 625</b>
Cubic Feet	0.038 889 25
Liters	1.101 221
Dekaliters	0.110 122 1

To Convert From <b>PECKS</b>	
To	Multiply By
Dry Pints	<b>16</b>
Dry Quarts	<b>8</b>
Bushels	<b>0.25</b>
Cubic Inches	<b>537.605</b>
Cubic Feet	0.311 114
Cubic Yards	0.011 522 74
Liters	8.809 767 5
Dekaliters	0.880 976 75
Cubic Meters	0.008 809 77

To Convert From <b>BUSHELS</b>	
To	Multiply By
Dry Pints	<b>64</b>
Dry Quarts	<b>32</b>
Pecks	<b>4</b>
Cubic Inches	<b>2 150.42</b>
Cubic Feet	1.244 456
Cubic Yards	0.046 090 96
Liters	35.239 07
Dekaliters	3.523 907
Cubic Meters	0.035 239 07

## UNITS OF AREA

To Convert From <b>SQUARE CENTIMETERS</b>	
To	Multiply By
Square Inches	0.155 000 3
Square Feet	0.001 076 39
Square Yards	0.000 119 599
Square Meters	<b>0.000 1</b>

To Convert From <b>SQUARE METERS</b>	
To	Multiply By
Square Inches	1 550.003
Square Feet	10.763 91
Square Yards	1.195 990
Acres	0.000 247 105
Square Centimeters	<b>10 000</b>
Hectares	<b>0.000 1</b>

To Convert From <b>SQUARE INCHES</b>	
To	Multiply By
Square Feet	0.006 944 44
Square Yards	0.000 771 605
Square Centimeters	<b>6.451 6</b>
Square Meters	<b>0.000 645 16</b>

To Convert From <b>ACRES</b>	
To	Multiply By
Square Feet	<b>43 560</b>
Square Yards	<b>4 840</b>
Square Miles	<b>0.001 562 5</b>
Square Meters	<b>4 046.856 422 4</b>
Hectares	<b>0.404 685 642 24</b>

To Convert From <b>SQUARE FEET</b>	
To	Multiply By
Square Inches	<b>144</b>
Square Yards	0.111 111 1
Acres	0.000 022 957
Square Centimeters	<b>929.030 4</b>
Square Meters	<b>0.092 903 04</b>

To Convert From <b>HECTARES</b>	
To	Multiply By
Square Feet	107 639.1
Square Yards	11 959.90
Acres	2.471 054
Square Miles	0.003 861 02
Square Meters	<b>10 000</b>

To Convert From <b>SQUARE YARDS</b>	
To	Multiply By
Square Inches	<b>1 296</b>
Square Feet	<b>9</b>
Acres	0.000 206 611 6
Square Miles	0.000 000 322 830 6
Square Centimeters	<b>8 361.273 6</b>
Square Meters	<b>0.836 127 36</b>
Hectares	<b>0.000 083 612 736</b>

To Convert From <b>SQUARE MILES</b>	
To	Multiply By
Square Feet	<b>27 878 400</b>
Square Yards	<b>3 097 600</b>
Acres	<b>640</b>
Square Meters	<b>2 589 988.110 336</b>
Hectares	<b>258.998 811 033 6</b>

**Reference:** Copied from units of measures, NBS Misc. Publication 286

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SECTION PROPERTIES –  
PLANE AREAS

Figure	General Properties
<p>Square</p>	<p>Area = <math>S^2</math></p> <p>Centroids = <math>\bar{x} = \bar{y} = \frac{S}{2}</math></p>
<p>Rectangle</p>	<p>Area = <math>BH</math></p> <p>Centroids = <math>\bar{x} = \frac{B}{2}</math> <math>\bar{y} = \frac{H}{2}</math></p>
<p>Hollow Square</p>	<p>Area = <math>S^2 - s^2</math></p> <p>Centroids = <math>\bar{x} = \bar{y} = \frac{S}{2}</math></p>
<p>Hollow Rectangle</p>	<p>Area = <math>BH - bh</math></p> <p>Centroid = <math>\bar{x} = \frac{B}{2}</math> <math>\bar{y} = \frac{H}{2}</math></p>
<p>Oblique Triangle</p>	<p>Area = <math>\frac{1}{2} BH</math></p> <p>Centroid = <math>\bar{x} = \frac{B+C}{3}</math> <math>\bar{y} = \frac{H}{3}</math></p>
<p>Isosceles Trapezoid</p>	<p>Area = <math>\frac{H(A+B)}{2}</math></p> <p>Centroid = <math>\bar{y}_a = \frac{H(B+2A)}{3(B+A)}</math> <math>\bar{y}_b = \frac{H(A+2B)}{3(A+B)}</math></p>
<p>Right Angled Trapezoid</p>	<p>Area = <math>\frac{H}{2}(2A+B)</math></p> <p>Centroid = <math>\bar{x} = \frac{3A^2 + 3AB + B^2}{3(2A+B)}</math> <math>\bar{y} = \frac{H}{3} \frac{(3A+B)}{(2A+B)}</math></p>
<p>Oblique Trapezoid</p>	<p>Area = <math>\frac{1}{2} H(A+B)</math></p> <p>Centroid = <math>x</math> is on a line connecting mid-points of sides A and B <math>\bar{y}_a = \frac{H(B+2A)}{3(B+A)}</math> <math>\bar{y}_b = \frac{H(A+2B)}{3(A+B)}</math></p>
<p>Parallelogram</p>	<p>Area = <math>BH</math></p> <p>Centroid = <math>\bar{x} = \frac{A+B}{2}</math> <math>\bar{y} = \frac{H}{2}</math></p>
<p>Regular Polygon</p> <p><math>n = \text{number of sides}</math> <math>\theta = \frac{180^\circ}{n}</math>    <math>B = 2\sqrt{R^2 - r^2}</math></p>	<p>Area = <math>\frac{nB^2 \cot \theta}{4}</math> <math>= \frac{nR^2 \sin 2\theta}{2}</math> <math>= nR^2 \tan \theta</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = 0</math></p>
<p>Regular Hexagon</p>	<p>Area = <math>0.866H^2</math></p> <p>Centroid = <math>\bar{x} = \frac{B}{2} = A</math> <math>\bar{y} = \frac{H}{2}</math></p>

SECTION PROPERTIES –  
PLANE AREAS

Figure	General Properties
<p>Regular Octagon</p>	<p>Area = <math>2.8284 R^2</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = R</math></p>
<p>Circle</p>	<p>Area = <math>0.7854 D^2</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = R</math></p>
<p>Hollow Circle</p>	<p>Area = <math>\pi(R^2 - r^2)</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = R</math></p>

<p>Semi-Circle</p>	<p>Area = <math>0.3927 D^2 = 1.571R^2</math></p> <p>Centroid = <math>\bar{x} = R</math> <math>\bar{y} = 0.2122D = 0.4244R</math></p>
<p>Hollow Semi-Circle</p>	<p>Area = <math>\frac{\pi(R^2 - r^2)}{2}</math></p> <p>Centroid = <math>\bar{x} = R</math> <math>\bar{y} = 0.4244\left(R + \frac{r^2}{R+r}\right)</math></p>
<p>Ellipse</p>	<p>Area = <math>\pi AB</math></p> <p>Centroid = <math>\bar{x} = A</math> <math>\bar{y} = B</math></p>

Figure	General Properties
<p>Hollow Ellipse</p>	<p>Area = <math>\pi(AB - CD)</math></p> <p>Centroid = <math>\bar{x} = A</math> <math>\bar{y} = B</math></p>
<p>Semi-Ellipse</p>	<p>Area = <math>\frac{\pi AB}{2}</math></p> <p>Centroid = <math>\bar{x} = A</math> <math>\bar{y} = 0.424B</math></p>
<p>Hollow Semi-Ellipse</p>	<p>Area = <math>\frac{\pi(AB - CD)}{2}</math></p> <p>Centroid = <math>\bar{x} = A</math> <math>\bar{y} = \frac{4}{3\pi} \frac{AB^2 - CD^2}{AB - CD}</math></p>

<p>Circular Sector</p>	<p>Area = <math>R^2 a</math></p> <p>Centroid = <math>\bar{x} = \frac{2}{3} \left[ \frac{R \sin a}{a} \right]</math> <math>\bar{y} = R \sin a</math></p>
<p>Hollow Circular Sector</p>	<p>Area = <math>(R^2 - r^2) a</math></p> <p>Centroid = <math>\bar{x} = \frac{2 \sin a (R^3 - r^3)}{3 a (R^2 - r^2)}</math> <math>\bar{y} = r \sin a</math></p>
<p>Circular Segment</p>	<p>Area = <math>\frac{R^2}{2} (2a - \sin 2a)</math></p> <p>Centroid = <math>\bar{x} = \frac{4 R \sin^3 a}{3 (2a - \sin 2a)}</math> <math>\bar{y} = r \sin a</math></p>



SECTION PROPERTIES –  
PLANE AREAS

Figure	General Properties
<p>Circular Complement</p>	<p>Area = <math>0.2146 R^2</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = 0.2234R</math></p>
<p>Elliptic Complement</p>	<p>Area = <math>0.2146 BC</math></p> <p>Centroid = <math>\bar{y} = \frac{B}{1.288} = 0.7766B</math> <math>\bar{x} = \frac{C}{1.288} = 0.7766C</math></p>
<p>Complement of Half Parabola</p>	<p>Area = <math>\frac{1}{3} BC</math></p> <p>Centroid = <math>\bar{x} = \frac{3}{4} C</math> <math>\bar{y} = \frac{7}{10} B</math></p>

<p>Parabolic Segment</p>	<p>Area = <math>\frac{4}{3} AB</math></p> <p>Centroid = <math>\bar{x} = 0.6A</math> <math>\bar{y} = B</math></p>
<p>Parabolic Half-Segment</p>	<p>Area = <math>\frac{2AB}{3}</math></p> <p>Centroid = <math>\bar{x} = 0.6A</math> <math>\bar{y} = 0.375B</math></p>
<p>Nose Rib</p> <p>based on Parabolic Segment</p>	<p>Area = <math>\frac{2}{3} A(B + C)</math></p> <p>Centroid = <math>\bar{x} = 0.6A</math> <math>\bar{y} = 0.375(B - C)</math></p>

SECTION PROPERTIES -  
SOLIDS

Figure	General Properties
<p>Equilateral Triangle</p>	<p>Area = <math>\frac{BH}{2}</math></p> <p>Centroid = <math>\bar{x} = \frac{B}{2}</math> <math>\bar{y} = \frac{H}{3}</math></p>
<p>Rhombus</p>	<p>Area = <math>BH</math></p> <p>Centroid = <math>\bar{y} = \frac{H}{2}</math> <math>\bar{x} = \frac{A+B}{2}</math></p>
<p>Obtuse Angled Triangle</p>	<p>Area = <math>\frac{BH}{2}</math></p> <p>Centroid = <math>\bar{x} = \frac{B+2C}{3}</math> <math>\bar{y} = \frac{H}{3}</math></p>

Figure	General Properties
<p>Cube</p>	<p>Volume = <math>A^3</math></p> <p>Centroid = <math>\bar{x} = \bar{y} = \bar{z} = \frac{A}{2}</math></p>
<p>Rectangular Prism</p>	<p>Volume = <math>ABH</math></p> <p>Centroid = <math>\bar{x} = \frac{A}{2}</math> <math>\bar{y} = \frac{B}{2}</math> <math>\bar{z} = \frac{H}{2}</math></p>

SECTION PROPERTIES –  
SOLIDS

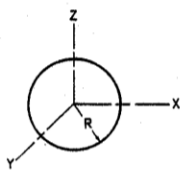
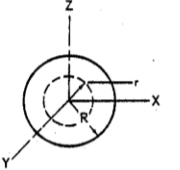
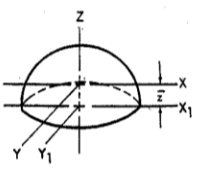
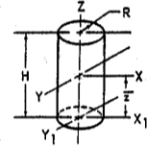
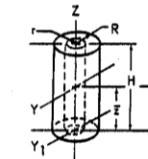
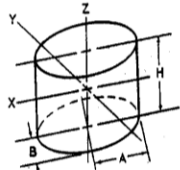
<p style="text-align: center;">Sphere</p> 	<p>Volume = <math>\frac{4}{3} \pi R^3</math></p> <p>Area = <math>4\pi R^2</math></p>
<p style="text-align: center;">Hollow Sphere</p> 	<p>Volume = <math>\frac{4}{3} \pi (R^3 - r^3)</math></p>
<p style="text-align: center;">Hemisphere</p> 	<p>Volume = <math>\frac{2}{3} \pi R^3</math></p> <p>Centroid = <math>\bar{z} = \frac{3}{8} R</math></p>

Figure	General Properties
<p style="text-align: center;">Right Circular Cylinder</p> 	<p>Volume = <math>\pi R^2 H</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{2}</math></p>
<p style="text-align: center;">Hollow Right Circular Cylinder</p> 	<p>Volume = <math>\pi H (R^2 - r^2)</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{2}</math></p>
<p style="text-align: center;">Elliptical Cylinder</p> 	<p>Volume = <math>\pi ABH</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{2}</math></p>

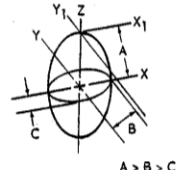
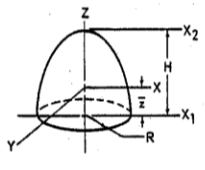
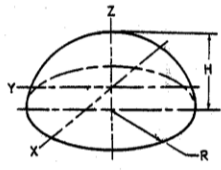
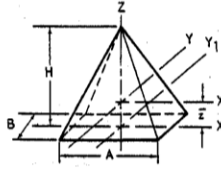
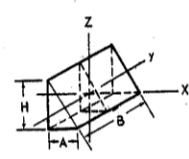
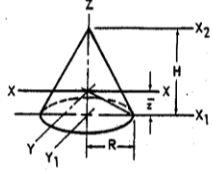
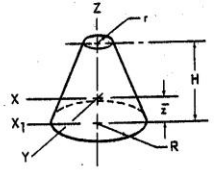
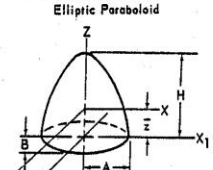
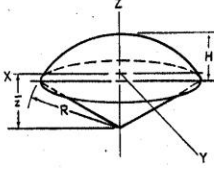
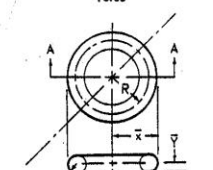
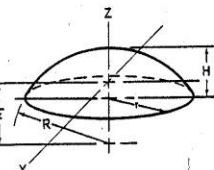
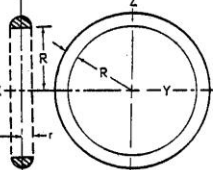
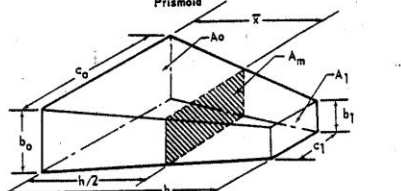
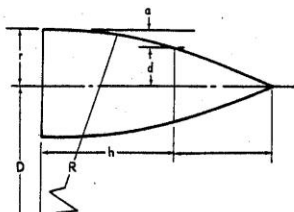
<p style="text-align: center;">Ellipsoid</p>  <p style="text-align: right;"><math>A &gt; B &gt; C</math></p>	<p>Volume = <math>\frac{4}{3} \pi ABC</math></p>
<p style="text-align: center;">Paraboloid of Revolution</p> 	<p>Volume = <math>\frac{\pi R^2 H}{2}</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{3}</math></p>
<p style="text-align: center;">Solid Elliptical Hemispheroid</p> 	<p>Volume = <math>\frac{2}{3} \pi R^2 H</math></p> <p>Centroid = <math>\bar{z} = \frac{3}{8} H</math></p>

Figure	General Properties
<p style="text-align: center;">Right Rectangular Pyramid</p> 	<p>Volume = <math>\frac{ABH}{3}</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{4}</math></p>
<p style="text-align: center;">Right Angled Wedge</p> 	<p>Volume = <math>\frac{ABH}{2}</math></p> <p>Centroid = <math>\bar{x} = \frac{A}{3}</math> <math>\bar{y} = \frac{B}{2}</math> <math>\bar{z} = \frac{H}{3}</math></p>
<p style="text-align: center;">Right Circular Cone</p> 	<p>Volume = <math>\frac{\pi R^2 H}{3}</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{4}</math></p>

SECTION PROPERTIES –  
SOLIDS

<p>Frustum of a Cone</p> 	<p>Volume =</p> $\frac{\pi H}{3} (R^2 + Rr + r^2)$ <p>Centroid =</p> $\bar{z} = \frac{H}{4} \left[ \frac{R^2 + 2Rr + 3r^2}{R^2 + Rr + r^2} \right]$	<p>Figure</p> <p>Elliptic Paraboloid</p> 	<p>General Properties</p> <p>Volume =</p> $\frac{\pi ABH}{2}$ <p>Centroid =</p> $\bar{z} = \frac{H}{3}$
<p>Spherical Sector</p> 	<p>Volume =</p> $\frac{2}{3} \pi R^2 H$ <p>Centroid =</p> $\bar{z} = \frac{3}{8} (2R - H)$	<p>Torus</p> 	<p>Volume =</p> $2\pi^2 r^2 R$ <p>Centroid =</p> $\bar{x} = \bar{z} = R + r$ $\bar{y} = r$
<p>Spherical Segment</p> 	<p>Volume =</p> $\frac{\pi H}{6} (3r^2 + H^2) = \frac{\pi H^2}{3} (3R - H)$ <p>Centroid =</p> $\bar{z} = \frac{3}{4} \frac{(2R - H)^2}{(3R - H)}$ <p>Area = 2πRH</p>	<p>Outer Half of Solid Torus</p> 	<p>Length =</p> $2\pi R$ <p>Volume =</p> $\frac{4}{3} \pi r^3 + \pi^2 r^2 R$

<p>Prismoid</p>  <p>Volume <math>V = \frac{h}{6} (A_0 + A_1 + 4A_m)</math></p> <p>Centroid <math>\bar{x} = \frac{h(A_1 + 2A_m)}{(A_0 + A_1 + 4A_m)}</math></p> <p><math>A_0</math> = Area of Base  <math>A_1</math> = Area of Top  <math>A_m</math> = Area @ <math>h/2</math></p> <p>Note:  <math>A_0</math>, <math>A_1</math> and <math>A_m</math>  must be parallel</p>	<p>Solid Ogive</p>  <p><math>R</math> = Ogive Radius  <math>d</math> = Radius of Truncated Nose  (<math>d = 0</math> for a complete ogive)</p> <p><math>D = R - r</math>  <math>a = r - d</math></p> <p><math>V = \frac{\pi h}{9} \left[ (3r - a)^2 + 2a^2 - \frac{1.2 a^2 (R - r)}{R} \right]</math></p>
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SECTION PROPERTIES –  
SHELLS

Figure	General Properties
<p>Lateral Cylindrical Shell</p>	<p>Surface Area = <math>2\pi RH</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{2}</math></p>
<p>Total Cylindrical Shell</p>	<p>Surface Area = <math>2\pi R(R + H)</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{2}</math></p>
<p>Total Elliptical Shell</p>	<p>Surface Area = <math>\frac{\pi H(3A^2 + B^2)}{2A}</math></p>

<p>Hollow Box</p>	<p>Surface Area = <math>2(AB + BC + AC)</math></p> <p>Surface Area = Hollow Box With Open Ends <math>2C(A + B)</math></p>
<p>Lateral Surface of a Circular Cone</p>	<p>Surface Area = <math>\pi R\sqrt{R^2 + H^2}</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{3}</math></p>
<p>Lateral Surface of Frustum of Circular Cone</p>	<p>Surface Area = <math>\pi(R + r)\sqrt{H^2 + (R - r)^2}</math></p> <p>Centroid = <math>\bar{z} = \frac{H}{3} \left( \frac{2r + R}{r + R} \right)</math></p>

Figure	General Properties
<p>Spherical Shell</p>	<p>Surface Area = <math>4\pi R^2</math></p>
<p>Hemispherical Shell</p>	<p>Surface Area = <math>2\pi R^2</math></p> <p>Centroid = <math>\bar{z} = \frac{R}{2}</math></p>
<p>Elliptical Hemispheroidal Shell</p>	<p>Surface Area = <math>\pi \left[ R^2 + \frac{H^2}{2E} \text{LOG}_e \frac{1+E}{1-E} \right]</math></p> <p>Centroid = <math>\bar{z} = \frac{2\pi H(R^3 - H^3)}{3E^2 R(\text{Surface Area})}</math></p> <p><math>E = \frac{\sqrt{R^2 - H^2}}{R}</math></p>

<p>Paraboloid of Revolution Shell</p>	<p>Surface Area = <math>\frac{\pi R}{6H^2} [P - R^3]</math></p> <p>Centroid = <math>\bar{z} = \frac{P(6H^2 - R^2) + R^5}{10H(P - R^3)}</math></p> <p><math>P = (4H^2 + R^2)^{3/2}</math></p>
<p>Sector of a Hollow Torus</p>	<p>Length <math>2\alpha R</math></p> <p>Centroid <math>\bar{x} = \frac{\sin \alpha}{\alpha} \left[ R + \frac{A}{4R} \right]</math></p> <p>Volume <math>2\pi R a (r_0^2 - r_i^2)</math></p>

## JULIAN CALENDAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	001	032	060	091	121	152	182	213	244	274	305	335
2	002	033	061	092	122	153	183	214	245	275	306	336
3	003	034	062	093	123	154	184	215	246	276	307	337
4	004	035	063	094	124	155	185	216	247	277	308	338
5	005	036	064	095	125	156	186	217	248	278	309	339
6	006	037	065	096	126	157	187	218	249	279	310	340
7	007	038	066	097	127	158	188	219	250	280	311	341
8	008	039	067	098	128	159	189	220	251	281	312	342
9	009	040	068	099	129	160	190	221	252	282	313	343
10	010	041	069	100	130	161	191	222	253	283	314	344
11	011	042	070	101	131	162	192	223	254	284	315	345
12	012	043	071	102	132	163	193	224	255	285	316	346
13	013	044	072	103	133	164	194	225	256	286	317	347
14	014	045	073	104	134	165	195	226	257	287	318	348
15	015	046	074	105	135	166	196	227	258	288	319	349
16	016	047	075	106	136	167	197	228	259	289	320	350
17	017	048	076	107	137	168	198	229	260	290	321	351
18	018	049	077	108	138	169	199	230	261	291	322	352
19	019	050	078	109	139	170	200	231	262	292	323	353
20	020	051	079	110	140	171	201	232	263	293	324	354
21	021	052	080	111	141	172	202	233	264	294	325	355
22	022	053	081	112	142	173	203	234	265	295	326	356
23	023	054	082	113	143	174	204	235	266	296	327	357
24	024	055	083	114	144	175	205	236	267	297	328	358
25	025	056	084	115	145	176	206	237	268	298	329	359
26	026	057	085	116	146	177	207	238	269	299	330	360
27	027	058	086	117	147	178	208	239	270	300	331	361
28	028	059	087	118	148	179	209	240	271	301	332	362
29	029		088	119	149	180	210	241	272	302	333	363
30	030		089	120	150	181	211	242	273	303	334	364
31	031		090		151		212	243		304		365

17-20  
Rev. 9/09

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## RANDOM NUMBERS

### USE OF TABLE

Random sampling numbers are helpful in random sampling when the items in the universe (lot) can be associated with a succession of numbers. In that instance, a selection of a group of numbers from the table will yield a random sample from the universe.

The use of tables of random numbers varies. Generally, to draw a random sample from a given universe, the members of the universe are associated with the set of random numbers. Then a sample is taken from the set of random numbers and the corresponding items of the universe are selected. This gives a random sample of the size desired.

**For example:** Suppose that there are 100 bottles on a rack and we wish to draw a random sample of 10. We note that the numbers in the Table of Random Numbers are grouped in clusters of 2 digits each. If we number the bottles from 00 to 99, we can select a random sample of ten bottles by simply picking any ten numbers from the Table of Random Numbers. Say we open to the Table of Random Numbers, Side 1, and let us pick the first ten two-figured numbers in the third column on that page. The random numbers will thus be 68, 27, 23, 76, 28, 53, 58, 35, 25, and 96. The bottles with these numbers will constitute our sample of bottles.

Possibly a better way of proceeding is to put our pencil down at random on a digit in the table. If it is even, we use Side II; if odd, use Side I. The first two-figured numbers to the right of this that is less than 26 may be used to indicate what column to start in and the next two-figured numbers to the right may be used to indicate the row. If some such method is employed, we will have greater assurance that our starting point will be random. When the starting point is once picked, movement in any direction will give a random sample of numbers.

If more numbers are needed than available in the Table of Random Numbers, reference should be made to one of the larger sets, such as Table XXXIII of R. A. Fisher and F. Yates; Statistical Tables for Biological, Agricultural and Medical Research; Interstate Commerce Commission, Bureau of Transport Economics and Statistics, Table of 105,000 Random Decimal Digits; and the Rand Corporation's A Million Random Digits, published by the Free Press (Glencoe, Ill.).

The general rules to be kept in mind in drawing a random sample are:

1. Adopt a method of selection that will give every member of the universe an equal chance of being drawn.
2. Avoid any method that associates the selection of an item with the classification of the item being selected.
3. Draw sample items from all parts of each subplot of the inspection lot.
4. Draw sample items blind.

### TABLE OF RANDOM NUMBERS

22 17 68 65 84	68 95 23 92 35	87 02 22 57 51	61 09 43 95 06	58 24 82 03 47
19 36 27 59 46	13 79 93 37 55	39 77 32 77 09	85 52 05 30 62	47 83 51 62 74
16 77 23 02 77	09 61 87 25 21	28 06 24 25 93	16 71 13 59 78	23 05 47 47 25
78 43 76 71 61	20 44 90 32 64	97 67 63 99 61	46 38 03 93 22	68 81 21 99 21
03 28 28 26 08	73 37 32 04 05	69 30 16 09 05	88 69 58 28 99	35 07 44 75 47
93 22 53 64 39	07 10 63 76 35	87 03 04 79 88	08 13 13 85 51	55 34 57 72 69
78 76 58 54 74	92 38 70 96 92	52 06 79 79 45	82 63 18 27 44	69 66 92 19 09
23 68 35 26 00	99 53 93 61 28	52 70 05 48 34	56 65 05 61 86	90 92 10 70 80
15 39 25 70 99	93 86 52 77 65	15 33 59 05 28	22 87 26 07 47	86 96 98 29 06
58 71 96 30 24	18 46 23 34 27	85 13 99 24 44	49 18 09 79 49	74 16 32 23 02
57 35 27 33 72	24 53 63 94 09	41 10 76 47 91	44 04 95 49 66	39 60 04 59 81
48 50 86 54 48	22 06 34 72 52	82 21 15 65 20	33 29 94 71 11	15 91 29 12 03
61 96 48 95 03	07 16 39 33 66	98 56 10 56 79	77 21 30 27 12	90 49 22 23 62
36 93 89 41 26	29 70 83 63 51	99 74 20 52 36	87 09 41 15 09	98 60 16 03 03
18 87 00 42 31	57 90 12 02 07	23 47 37 17 31	54 08 01 88 63	39 41 88 92 10
88 56 53 27 59	33 35 72 67 47	77 34 55 45 70	08 18 27 38 90	16 95 86 70 75
09 72 95 84 29	49 41 31 06 70	42 38 06 45 18	64 84 73 31 65	52 53 37 97 15
12 96 88 17 31	65 19 69 02 83	60 75 86 90 68	24 64 19 35 51	56 61 87 39 12
85 94 57 24 16	92 09 84 38 76	22 00 27 69 85	29 81 94 78 70	21 94 47 90 12
38 64 43 59 98	98 77 87 68 07	91 51 67 22 44	40 98 05 93 78	23 32 65 41 18
53 44 09 42 72	00 41 86 79 79	68 47 22 00 20	35 55 31 51 51	00 83 63 22 55
40 46 66 26 84	57 99 99 90 37	36 63 32 08 58	37 40 16 68 97	87 64 81 07 83
02 17 79 18 05	12 59 52 57 02	22 07 90 47 03	28 14 11 30 79	20 69 22 40 98
95 17 82 06 53	31 51 10 96 46	92 06 88 07 77	56 11 50 81 69	40 23 72 51 39
35 76 22 42 92	96 11 83 44 80	34 68 35 48 77	33 42 40 90 60	73 96 53 97 86
26 29 13 56 41	85 47 04 66 08	34 72 57 59 13	82 43 80 46 15	38 26 61 70 04
77 80 20 75 82	72 82 32 99 90	63 95 73 76 63	89 73 44 99 05	48 67 26 43 18
46 40 66 44 52	91 36 74 43 53	30 82 13 54 00	78 47 63 98 35	55 03 36 67 68
37 56 08 18 09	77 53 84 46 47	31 91 18 95 58	24 16 74 11 53	44 10 13 85 57
61 65 61 68 66	37 27 47 39 19	84 83 70 07 48	53 21 40 06 71	95 06 79 88 54
93 43 69 64 07	34 18 04 52 35	56 27 09 24 86	61 85 53 53 45	19 90 70 99 00
21 96 60 12 99	11 20 90 45 18	48 13 93 55 34	18 37 79 49 90	65 94 38 20 46
95 20 47 67 67	27 37 83 28 71	00 06 41 41 74	45 89 09 39 84	51 67 11 52 49
97 86 21 78 73	10 65 81 92 59	58 76 17 14 94	04 76 62 16 17	17 95 70 45 80
69 92 06 34 13	59 71 74 17 32	27 55 10 24 19	23 71 82 13 74	63 52 52 01 41
04 31 17 21 56	33 73 99 19 87	26 72 39 27 69	53 77 57 68 93	60 61 97 22 61
61 06 98 03 91	87 14 77 43 96	43 00 65 98 50	45 60 33 01 07	98 99 46 50 47
85 93 85 86 88	72 87 08 62 40	16 06 10 89 20	23 21 34 74 97	79 38 03 29 63
21 74 32 47 45	73 96 07 94 52	09 65 90 77 47	25 76 16 19 33	53 05 70 53 30
15 69 53 82 50	79 96 23 52 10	65 39 07 16 29	45 33 02 43 70	02 87 40 41 45
02 89 08 04 49	20 21 14 65 86	87 63 93 95 17	11 29 01 95 80	35 15 94 35 33
87 18 15 89 79	86 43 01 72 73	08 61 74 51 69	89 74 39 82 15	94 51 33 41 67
98 83 71 94 22	59 97 50 99 52	08 52 85 08 40	87 80 61 65 31	91 51 80 32 44
10 05 58 51 66	72 68 49 29 31	89 85 84 46 06	59 72 19 86 23	65 09 29 75 63
47 90 56 10 18	88 02 84 27 83	42 29 72 23 19	66 56 45 65 79	20 71 53 20 25
22 85 61 68 91	49 64 92 85 44	16 40 12 89 88	50 14 49 81 06	01 82 77 45 12
67 80 43 79 33	12 83 11 41 16	25 58 19 68 70	77 02 54 00 52	53 43 37 15 26
27 62 50 96 72	79 44 61 40 15	14 53 40 65 39	27 31 58 50 28	11 39 03 34 25
33 78 80 87 15	38 30 06 38 21	14 47 47 07 26	54 96 87 53 32	40 36 40 96 76
13 13 92 66 99	47 24 49 57 74	32 25 43 62 17	10 97 11 69 84	99 63 22 32 98



## SIDE 2

10 27 53 96 23	71 51 54 36 23	54 31 04 82 98	04 14 12 15 09	26 78 25 47 47
28 41 50 61 88	64 85 27 20 18	83 36 36 05 56	39 71 65 09 62	94 76 62 11 89
34 21 42 57 02	59 19 18 97 48	80 30 03 30 98	05 24 67 70 07	84 97 50 87 46
61 81 77 23 23	82 82 11 54 08	53 28 70 58 96	44 07 39 55 43	42 34 43 39 28
61 15 18 13 54	16 86 20 26 88	90 74 80 55 09	14 53 90 51 17	52 01 63 01 59
91 76 21 64 64	44 91 13 32 97	75 31 62 66 54	84 80 32 75 77	56 08 25 70 29
00 97 79 08 06	37 30 28 59 85	53 56 68 53 40	01 74 39 59 73	30 19 99 85 48
36 46 18 34 94	65 95 79 42 94	78 91 69 16 00	08 43 18 73 68	67 69 61 34 25
88 98 99 60 50	65 95 79 42 94	93 62 40 89 96	43 56 47 71 66	46 76 29 67 02
04 37 59 87 21	05 02 03 24 17	47 97 81 56 51	92 34 86 01 82	55 51 33 12 91
63 62 06 34 41	94 21 78 55 09	72 76 45 16 94	29 05 81 83 83	79 88 01 97 30
78 47 23 53 90	34 41 92 45 71	09 23 70 70 07	12 38 92 79 43	14 85 11 47 23
87 68 62 15 43	53 14 36 59 25	54 47 33 70 15	59 24 48 40 35	50 03 42 99 36
47 60 92 10 77	88 59 53 11 52	66 25 69 07 04	48 68 64 71 06	61 65 70 22 12
56 88 87 59 41	65 28 04 67 53	95 79 88 37 31	50 41 06 94 76	81 83 17 16 33
02 57 45 86 67	73 43 07 34 48	44 26 87 93 29	77 09 61 67 84	06 69 44 77 75
31 54 14 13 17	48 62 11 90 60	68 12 93 64 28	46 24 79 16 76	14 60 25 51 01
28 50 16 43 36	28 97 85 58 99	67 22 52 76 23	24 70 36 54 54	59 28 61 71 96
69 39 62 66 50	02 63 45 52 38	67 63 47 54 75	83 24 78 73 20	92 63 13 47 48
45 65 58 26 51	76 96 59 38 72	86 57 45 71 46	44 67 76 14 55	44 88 01 62 12
39 65 36 63 70	74 45 85 50 51	74 13 39 35 22	30 53 36 02 95	49 34 88 73 61
73 71 98 16 04	29 18 94 51 23	76 51 94 54 86	79 93 96 38 63	08 58 25 58 94
72 20 56 20 11	72 65 71 08 86	79 57 95 13 91	97 78 72 66 48	09 71 17 24 89
75 17 26 99 76	89 37 20 70 01	77 31 61 95 46	26 97 05 73 51	53 33 18 72 87
37 48 60 82 29	81 30 15 39 14	48 38 75 93 29	06 87 37 78 48	45 56 00 84 47
68 08 02 80 72	83 71 46 30 49	89 17 95 88 29	02 39 56 03 46	97 74 06 56 17
14 23 98 61 67	70 52 85 01 50	01 84 02 78 43	10 62 98 19 41	18 83 99 47 99
49 08 96 21 44	25 27 99 41 28	07 41 08 34 66	10 42 74 69 91	41 96 53 78 72
78 37 06 08 43	63 61 62 42 29	69 98 95 10 96	09 24 23 00 62	56 12 80 73 16
37 21 34 17 68	68 96 83 23 56	32 84 61 15 31	44 73 69 34 77	91 15 79 74 58
14 29 09 64 04	87 83 07 55 07	76 58 30 83 64	87 29 25 58 84	86 50 60 00 25
58 43 28 06 36	49 52 83 51 14	47 56 91 29 34	05 57 31 06 95	12 45 57 09 09
10 43 67 29 70	80 62 80 03 42	10 80 21 38 84	90 56 35 03 09	43 12 74 49 14
44 38 88 39 54	86 94 37 44 22	00 95 01 31 76	17 16 29 56 63	38 78 94 49 81
90 69 59 19 51	85 39 52 85 13	07 28 37 07 61	11 16 36 27 03	78 68 72 04 95
41 47 10 25 62	97 05 31 03 61	20 26 36 31 62	68 69 86 95 44	84 95 48 46 45
91 94 14 63 19	75 89 11 47 11	31 56 34 19 09	79 57 92 36 59	14 93 87 81 40
80 06 54 18 66	09 18 94 06 19	98 40 07 17 81	22 45 44 84 11	24 62 20 42 31
67 72 77 63 48	84 08 31 55 58	24 33 45 77 58	80 45 44 84 11	24 62 20 42 61
59 41 24 13 27	79 26 88 86 30	01 31 60 10 39	53 58 47 71 93	85 81 56 39 38
05 90 35 89 95	01 61 16 96 94	51 78 13 69 36	37 68 53 37 31	71 26 35 03 71
44 43 81 69 98	46 68 15 14 82	90 78 50 05 62	77 79 13 57 44	59 60 10 39 66
61 81 61 96 82	00 27 25 61 59	46 72 60 18 77	55 66 12 62 11	08 99 55 64 57
42 88 07 10 05	24 98 65 63 21	47 21 61 88 32	49 99 57 94 82	96 88 57 17 91
78 83 19 76 16	94 11 68 84 26	23 54 20 86 85	23 86 66 99 07	36 37 34 92 09
87 76 59 61 81	43 63 64 61 61	65 76 36 95 90	18 48 27 45 68	27 23 65 30 72
91 43 05 96 47	55 78 99 95 24	37 55 85 78 78	01 48 41 19 10	35 19 57 07 73
84 97 77 72 73	09 62 06 65 72	87 12 49 03 60	41 15 20 76 27	50 47 02 29 16
87 47 60 76 83	44 88 96 07 81	83 05 83 38 96	73 70 66 81 90	30 56 10 48 59

## ROUNDING VALUES

### GENERAL

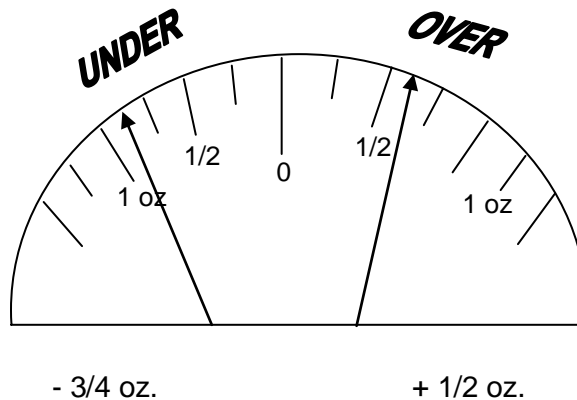
#### A. Recording Package Errors

Package errors can be recorded in whole units of measure. If the indicated or calculated value of a package error falls between whole units of measure, the error value is truncated not rounded.

**Example:** Using a scale with graduations of 0.001 lb, package errors for the first two packages inspected are + 0.019 lb. and + 0.011 lb. The unit of measure used for recording errors is 0.01 lb. Both of these errors would be recorded as +1. Minus errors are recorded in the same manner, - 0.019 lb and - 0.011 would both be recorded as -1. ( $0.019 \text{ lb} \div 0.01 \text{ lb} = 1.9$ , and  $0.011 \text{ lb.} \div 0.01 \text{ lb} = 1.1$ )

#### B. Scale Readings and Rounding

##### 1. Over-Under Balance.



2. Digital indications should be truncated to the lower whole unit of measure (Example: 0.122 to 12; 0.128 to 12 when using .01 as a unit of measure).

#### C. Calculations

When calculations are performed, it will frequently be necessary to round off the calculated number. Only the final result should be rounded. During the computations, the intermediate values should not be rounded.

**TABLE OF EQUIVALENT WEIGHTS, DECIMALS TO NEAREST 1/32 OUNCE**

<u>Pounds</u>	<u>Ounces</u>	<u>Pounds</u>	<u>Ounces</u>
.01	5/32	.51	8-5/32
.02	5/16	.52	8-5/16
.03	15/32	.53	8-15/32
.04	5/8	.54	8-5/8
.05	25/32	.55	8-25/32
.06	31/32	.56	8-15/16
.07	1-3/32	.57	9-3/32
.08	1-1/4	.58	9-1/4
.09	1-7/16	.59	9-7/16
.10	1-19/32	.60	9-19/32
.11	1-3/4	.61	9-3/4
.12	1-29/32	.62	9-29/32
.13	2-1/16	.63	10-1/16
.14	2-7/32	.64	10-7/32
.15	2-3/8	.65	10-3/8
.16	2-17/32	.66	10-17/32
.17	2-23/32	.67	10-23/32
.18	1-7/8	.68	10-7/8
.19	3-1/32	.69	11-1/32
.20	3-3/16	.70	11-3/16
.21	3-11/32	.71	11-11/32
.22	3-1/2	.72	11-1/2
.23	3-21/32	.73	11-21/32
.24	3-13/16	.74	11-13/16
.25	4-0	.75	12-0
.26	4-5/32	.76	12-5/32
.27	4-5/16	.77	12-5/16
.28	4-15/32	.78	12-15/32
.29	4-5/8	.79	12-5/8
.30	4-25/32	.80	12-25/32
.31	4-15/16	.81	12-15/16
.32	5-3/32	.82	13-3/32
.33	5-1/4	.83	13-1/4
.34	5-7/16	.84	13-7/16
.35	5-19/32	.85	13-19/32
.36	5-3/4	.86	13-3/4
.37	5-29/32	.87	13-29/32
.38	6-1/16	.88	14-1/32
.39	6-7/32	.89	14-7/32
.40	6-3/8	.90	14-3/8
.41	6-17/32	.91	14-17/32
.42	6-23/32	.92	14-23/32
.43	6-7/8	.93	14-7/8
.44	7-1/32	.94	15-1/32
.45	7-3/16	.95	15-3/16
.46	7-11/32	.96	15-11/32
.47	7-1/2	.97	15-1/2
.48	7-21/32	.98	15-21/32
.49	7-13/16	.99	15-13/16
.50	8-0	1.00	16-0

**TABLE OF WEIGHTS AND MEASURES**  
**ACCEPTED COMMON CONVERSIONS**

**Weight**

**Grain Weight Equivalents**

Note: The grain is the fundamental unit of the Avoirdupois, Troy, and Apothecaries Weight Systems. Useful equivalents are:

<u>1 grain</u>	=	<u>64.798918 milligrams</u>
1 apothecaries scruple	=	20 grains
1 apothecaries dram	=	60 grains
1 apothecaries / troy ounce	=	480 grains
1 apothecaries / troy pound	=	5,760 grains
1 avoirdupois dram	=	27-11/32 grains
1 avoirdupois ounce	=	437.5 grains
1 avoirdupois pound	=	7,000 grains
1 pennyweight	=	24 grains

**Avoirdupois (U. S. Customary**

1 dram (dr) = 27-11/32 grains

1 ounce (oz) = 16 drams

1 pound (lb) = 16 ounces

1 quarter = 25 pounds

1 hundredweight (cwt) = 100 pounds / 4 quarters

1 ton = 2,000 pounds / 20 hundredweight

1 long ton = 2,240 pounds

**Troy Weight**

1 pennyweight (dwt) =

24 grains

1 ounce troy (oz t) =

20 pennyweight

1 pound troy (lb t) =

12 ounces troy

**Apothecaries Weight**

1 scruple (ʒ or sc) =

20 grains

1 dram apothecaries (or dr ap) =

3 scruples

1 ounce apothecaries (ʒ or oz ap) =

8 drams apothecaries

1 pound apothecaries =

12 ounce apothecaries

**Carat Weight**

1 carat =

200 milligrams / 100 points

### U. S. Liquid Measure

1 fluid dram (fl dr)	=	60 minims (min)
1 fluid ounce (fl oz)	=	8 fluid drams / 1.8047 cubic inches
1 gill (gi)	=	4 fluid ounce / 32 fluid drams / 7.2188 cubic inches
1 cup	=	8 fluid ounce / 2 gills / 64 fluid drams / 14.4376 cubic inches
1 pint (pt)	=	16 fluid ounce / 2 cups / 128 fluid drams / 28.875 cubic inches
1 quart (qt)	=	2 pints / 32 fluid ounces / 256 fluid drams / 57.75 cubic inches
1 gallon (gal)	=	4 quarts / 128 fluid ounces / 1,024 fluid drams / 231 cubic inches
1 barrel	=	31-1/2 gallons
1 hogshead	=	2 barrels

### Dry Measure

1 dry pint	=	1/2 dry quart / 33.6 cubic inches
1 dry quart	=	2 dry pints / 67.2006 cubic inches
1 peck (pk)	=	8 dry quarts / 16 dry pints / 537.605 cubic inches
1 bushel (bu)	=	4 pecks / 32 dry quarts / 2,150.42 cubic inches
1 chaldron	=	36 bushels

### U. S. Linear Measure

1 foot (ft)	=	12 inches (in)
1 yard (yd)	=	3 feet
1 rod (rd)	=	5-1/2 yards / 1 pole / 16-1/2 feet
1 furlong	=	40 rods / 220 yards / 660 feet
1 statute or land mile (mi)	=	5,280 feet / 1,760 yards / 8 furlongs / 320 rods
1 league	=	3 miles / 5,280 yards / 15,840 feet

### **Mariner's Measure**

1 fathom	=	6 feet
1 cable length	=	120 fathoms
1 mile	=	7-1/2 cable lengths
1 statute mile	=	5,280 feet
1 nautical mile	=	6,076.11549 feet

### **Surveyor's Measure**

1 link	=	7.92 inches
1 rod	=	25 links
1 chain	=	100 links / 4 rods / 66 feet
1 square mile	=	640 acres
1 township	=	36 square miles / 6 miles square

### **Cloth Measure**

1 nail	=	2-1/4 inches
1 quarter	=	4 nails
1 yard	=	4 quarters

### **Miscellaneous Measures**

1 hand	=	4 inches
1 span	=	9 inches
1 cubit	=	18 inches
1 pace	=	30 inches

### Square Area Measure

1 square foot	=	144 square inches
1 square yard	=	9 square feet / 1,296 square inches
1 square rod	=	30-1/4 square yards / 272-1/4 square feet
1 rood	=	40 square rods / 1/4 acre
1 acre	=	160 square rods / 4,840 square yards / 43,560 square feet
1 square mile	=	640 acres
1 mile square	=	1 section (of land)
1 township	=	36 miles square / 36 sections / 36 square miles

### Cubic Measure

1 cubic foot	=	1,728 cubic inches / 7.480519 gallons
1 cubic yard	=	27 cubic feet
1 cord	=	128 cubic feet / a stack 4' x 4' x 8'
1 ton (shipping)	=	40 cubic feet

### Miscellaneous

To convert temperature:  $C^{\circ} = \frac{5}{9}(F^{\circ} - 32)$   
 $F^{\circ} = \frac{9}{5} \times C^{\circ} + 32$

### Approximate Weight per Gallon for Some Common Liquids

Water	=	8.337 lbs / gal (at 15 C°)
Gasoline (Reg. Unleaded)	=	6.2 lbs / gal
Diesel Fuel	=	7.2 lbs / gal
Propane	=	4.24 lbs / gal
Butane	=	4.81 lbs / gal



## SI (Systeme International d'Unites), METRIC SYSTEM

Originally the system was based on the units below. These original base values are not exact when measured with today's precise instruments, but are still used for common measurements.

The SI (Metric) system is based on a unit of length, the **meter**.

A cubic box 1/10 of a meter (10 cm) on the side is the unit of capacity which equals the **liter**. (1,000 cubic centimeters) The weight of the water contained in the liter is the **kilogram**.

The unit of weight, the **gram**, is the weight of water contained in a cubical box 1/100 of a meter on the side. (1 cubic centimeter)

The system is built up by multiplying or dividing the unit by 10, 100, or 1,000, always using the same prefix to indicate what the unit is multiplied or divided by.

milli means 1/1000 or divided by 1,000

centi means 1/100 or divided by 100

deci means 1/10 or divided by 10

deka means 10 or multiplied by 10

hecto means 100 or multiplied by 100

kilo means 1000 or multiplied by 1,000

### Common Weight to Volume Conversions

1 gram (g) = 1 cubic centimeter (cc) of water

1 kilogram (kg) = 1 liter (L) of water

1 liter (L) = 1 cubic decimeter (dc<sup>3</sup>) = 1,000 cubic centimeters

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