

Lake County, Ohio USA

A Practical Guide to Weights and Measures

Christopher A. Galloway

Lake County Auditor

Introduction

Weights and Measures plays a vital role in our everyday lives. Our economy is intrinsically based on the monetary value placed on goods and services bought, sold and traded daily. That monetary value is ultimately determined by an accurate system, our orderly world would turn into chaos.

The Ohio Department of Agriculture is the custodian of the Ohio Primary Standards of Weights and Measures, which are traceable to U.S. Standards of the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. The official standards of Mass, length and volume are defined in systems of measurement which include U.S. customary, metric, apothecary and troy.

In Ohio, the Director of Agriculture is the state Sealer of Weights and Measures. In this capacity, the Director promulgates rules and regulations necessary for the prompt and effective enforcement of Weights and Measures laws. A Deputy State Sealer, Chief of the division of Weights & Measures, is appointed by the Director and is responsible for the Administration and enforcement of all the laws.

The State Weights and Measures Laboratory, Which houses the Primary Standards, is located at the Department's laboratory complex in Reynoldsburg. The laboratory provides testing and calibration services for local weights and measures jurisdictions, government agencies (federal, state and local), industry, education and research.

All 88 Ohio counties have established weights and measures programs included as one of the responsibilities of the County Auditor's Office. Several Ohio cities have also implemented weights and measures programs as part of their city services. The State Weights and Measures Office is obligated to advise, assist and train county and city officials.

While local jurisdictions are responsible for testing and inspecting all commercial weighing and measuring devices such as scales, gasoline pumps, taxi meters etc., the state assists them in the testing and inspection of vehicle and livestock scales, fuel meters (fuel oil, gasoline and L.P. gas) and packaged consumer goods.

Throughout the year, the State conducts ongoing schools and seminars for local

officials providing them with pertinent information on all facets of this ever changing technical field.

Other programs under the direction of the State Weights and Measures Office include the National Type Evaluation Program (NTEP) and the Voluntary Registration of Service Persons and Agencies Program (VRSPA).

As a participating NTEP laboratory certified by the National Institute of Standards and Technology (NIST), Ohio evaluates weighing devices to be used for commercial use prior to their final approval by NIST.

Agencies and individuals who install, recondition and repair weighing and measuring devices may apply for registration through the state's VRSPA Program. Participants must meet prescribed requirements and successfully complete a state examination before being registered.

The delicate system of weights and measures keeps us all in balance, protecting us in all phases of the economy. From the purveyor of raw materials to the manufacturer, and from the distributor and retailer to the consumer, accurate weights and measures carefully regulate each link in our complex economic chain. Let's all do our share to be informed consumers and work to maintain and support an accurate system of Weights and Measures.

A Lesson in Metrics

Measurements within the metric system are based on units of 10 known as the decimal system.

Basic units of the metric system are:

Meter - measurement of length and area

length

1 meter = 39.37 in. or 1.09 yd.

area

1 sq. meter = 1550 sq. in or 10.76 sq. ft.

Liter - measurement of capacity

liquid

1 liter = 33.81 oz. or 1.05 qt.

dry

1 liter = 61.02 cu. in. or .908 dry qt.

Gram - measurement of weight

1 gram = .035 oz. or .002 lb.

To these basic units are added prefixes representing different powers of 10. Some of the prefixes are:

kilo = 1000
hecto = 100
deka = 10
deci = 1/10
centi = 1/100
milli = 1/1000

By combining the prefixes and the basic units, we can understand the following:

kilogram = 1000 grams
hectoliter = 100 liters
dekameter = 10 meters
decigram = .1 gram
centiliter = .01 gram
millimeter = .001 meter

Measures of Weight

Avoirdupois

16 drams = 437.5 grains ; 1 oz.
16 oz. = 7000 grains; 1 lb.
100 lbs. = 1 hundredweight
2000 lbs. = 1 short or net ton

British Standards

14 pounds = 1 stone
2 stones = 1 quarter; 28 lb.
4 quarters = 112 lb.; 1 hundredweight
20 hundredweight = 2,240 lb.; 1 long or gross ton

Troy

24 grains = 1 pennyweight

20 penny weights = 480 grains; 1 troy oz.
12 troy oz. = 5760 grains; 1 troy lb.

Precious Stones & Metals

100 point stone = 1 carat
Pure Gold = 24 carat
75% Gold = 18 carat
50% Gold = 12 carat

Apothecary

20 grains = 1 scruple
3 scruples = 1 dram
8 drams = 1 oz.
12 oz. = 5760 grains; 1 lb.

Linear Measure

12 inches = 1 foot
4 inches = .333 (4/12) foot; 1 hand
3 feet = 1 yard
5.5 yards = 16.5 feet; 1 rod, pole or perch
40 poles = 220 yards; 1 furlong
8 furlongs = 1,760 yards; 5,280 feet; 1 mile
3 miles = 1 league
69.125 miles = 1 degree
320 rods = 1 mile

Volumetric Measure

Cubic Measure

1,728 cubic inches = 1 cubic foot
27 cubic feet = 1 cubic yard
1 cord of wood = 128 cubic feet
1 board foot (144 cubic in.) = .0833 cubic feet

Liquid Measure

4 fl. oz. = 1 gill
2 gills = 1 cup
2 cups = 1 pint

2 pints = 1 quart
4 quarts = 1 gallon
31 1/2 gallons = 1 barrel

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel

Metric Equivalents

Linear

1 millimeter = .0394 in.
1 centimeter = .3937 in.
1 decimeter = 3.937 in.
1 meter = 39.37 in.; 1.1 yard
1 dekameter = 393.7 in.; 10.936 yd.; 32.808 ft.
1 hectometer = 328 ft. 1 in

Square

1 square millimeter = .00155 sq.in.
1 square centimeter = .155 sq. in.
1 square meter = 10.764 sq. ft.; 1.196 sq. yd.
1 square kilometer = .3861 sq. mile
1 acre = 4,046 sq. meters; 4,840 sq. yd.

Cubic

1 cubic millimeter = .000061 cubic in.
1 cubic centimeter = .061 cubic in.
1 cubic meter = 35.314 cubic ft.; 1.3079 cubic yards

Weight

1 milligram = .015 grain
1000 milligrams = 1 gram; .035 oz.
1000 grams = 1 kilogram; 2.205 lb.
1000 kilograms = 1 metric ton

Fluid

1 centiliter = dry .6102 cu. in. or liquid .338 fl. oz.
1 deciliter = dry 6.102 cu. in. or liquid .845 gill.
1 liter = dry .908 qt. or liquid 1.0567 qt.
1 dekaliter = dry 9.08 qt. or liquid 2.64 gal

Common Conversions

1 bushel = 2150.42 cubic in.; 1.244 cubic ft.
1 gallon = 231 cubic in.
1 cubic ft. = 7.48 gallons
1 gallon of water = 8.33 lbs.

Arcs & Angles

60 seconds = 1 minute
60 minutes = 1 degree
90 degrees = 1 right angle
360 degrees of arc (circle) = 1 circumference
360 degrees of angle = 1 complete rotation

Square or Area Measure

144 square inches = 1 square foot
9 square feet = 1 square yard
30.25 square yards = 1 square rod. pole or perch
160 square rods = 1 acre
640 acres = 1 square mile, or 1 "section" of U.S. Government surveyed land

Sports Standards

Baseball(Big League)

Home plate to pitcher's box = 60 ft. 6 in.
Home plate to second base = 127 ft. 3 3/8 in.
Distance from base to base (home plate included) = 90 ft.
Batter's box = 6 ft. by 4 ft.
Weight of ball = Not less than 5 oz. and not more than 5 1/4 oz.
Bat = Must be round and made of hardwood in one piece or laminated. The diameter will not exceed 2 3/4 inches at thickest part, and length will not exceed 42 inches.

Football

Length of field = 120 yards (Includes 10 yards of end zone on either side)

Width of field = $53 \frac{1}{3}$ yards (160 ft.)

Height of goal posts = 20 ft.

Width of goal posts = (inside to inside) 18 ft. 6 in. (outside to outside) no more than 19 ft. 2 in.

Men's Volleyball

Court length = 60 ft.

Court width = 30 ft.

Height of net from ground = 7 ft. $11 \frac{5}{8}$ in.

Bottom of net from ground = 4 ft. $11 \frac{5}{8}$ in.

Women's Volleyball

Court length = 60 ft.

Court width = 30 ft.

Height of net from ground = 7 ft. $4 \frac{1}{8}$ in.

Bottom of net from ground = 4 ft. $4 \frac{1}{8}$ in.

Single Handball Court

Length = 34 ft.

Width = 20 ft.

Service line = 16 ft. from front wall

Tennis

Size of court = Rectangle 78 feet long and 27 feet wide (singles). Rectangle 78 feet long and 36 feet wide (doubles).

Service line = 21 feet from net.

Height of net = 3 feet in center, gradually rising to reach 3 ft. 6 in. posts at each side of court.

Basketball

Playing court = 94 feet long by 50 feet wide (maximum dimensions) 74 feet long by 42 feet wide (minimum dimensions)

Baskets = Rings 18 inches inside diameter, with white cord nets measuring 15 to 18 inches in length. Each ring is made of metal and is not more than $\frac{5}{8}$ of an inch in diameter.

Basket ring height = 10 feet.

Free-throw line = 15 feet from the face of the backboard.

Baseball(Little League)

Home plate to pitcher's box = 46 feet

Home plate to second base = 84 feet 10 inches

Distance from base to base (home plate included) = 60 feet

Batter's box = 5 ft. 6 in. by 3 ft.

Weight of ball = not less than 5 oz. and not more than 5 1/4 oz.

Bat = Must be round, made of wood, and not more than 33 inches in length. The diameter at thickest part will not be more than 2 1/4 inches, and not less than 1 1/16 inches at its smallest part. Bats may be taped for a distance not exceeding 16 inches from the smallest end.

Horseshoe Court

Length Between pegs = 40 feet

Boxes = 6 ft. by 6 ft.

Length = Over all 50 feet

Decimals & Fractions

To convert common fractions to decimals, simply divide the fraction's numerator by the denominator.

For example:

$$1/2 = 1 \text{ divided by } 2 = .50$$

$$5/12 = 5 \text{ divided by } 12 = .4167$$

Thermometers

Comparative Scales Centigrade to Fahrenheit

100 = 212 Water Boils at Sea Level

75 = 167 Alcohol Boils

52.8 = 127 Tallow Melts

36.7 = 98 Blood Temperature

15.5 = 60 Temperate

0 = 32 Water Freezes

-40 = -40 Scales Reach Equilibrium

Wind Force

Designation to Miles per hour

Calm = Less than 1

Very Light = 1 to 3

Light = 4 to 7
Gentle = 8 to 12
Moderate = 13 to 18
Fresh = 19 to 24
Strong = 25 to 38
Gale = 39 to 54
Whole Gale = 55 to 72
Hurricane = Above 72

Weight of Water

1 cubic inches = .0360 pound
12 cubic inches = .433 pound
1 cubic foot = 62.3 pounds
1 cubic foot = 7.48052 U.S. gallons
1.8 cubic feet = 112.0 pounds
35.96 cubic feet = 2240.0 pounds
1 imperial gallon = 10.0 pounds
11.2 imperial gallons = 112.0 pounds
224 imperial gallons = 2240.0 pounds
1 U.S. gallon = 8.33 pounds
13.45 U.S. gallon = 112.0 pounds
269.0 U.S. gallons = 2240.0 pounds

Nautical Measure

6,028 feet = 1 nautical mile
6 feet = 1 fathom
120 fathoms = 1 cable length
1 nautical mile per hour = 1 knot of speed

Paper Measurements

24 sheets = 1 quire
500 sheets = 1 ream
10 reams = 1 bale

Kitchen Measurements

Standard to Equivalent

Note: All measurements quoted are level.

One pinch or dash = 1/16 tsp.
3 teaspoons = 1 tbl.; 1/2 oz. liquid
4 tablespoons = 1/4 cup; 2 oz. liquid
1/3 cup = 5 tbs. plus 1 tsp.
1/2 cup = 8 tbs.; 4 oz. liquid
1 gill = 1/2 cup; 4 oz. liquid
1 cup = 2 gills; 16 tbs.; 8 oz. liquid
2 cups = 1 pint; 16 oz. liquid
2 pints = 1 quart; 32 oz. liquid
4 quarts = 1 gallon
8 quarts = 1 peck
4 pecks = 1 bushel
31 1/2 gallons = 1 barrel
16 ounces = 1 lb. - dry measure
1 pound of butter = 2 cups

Any information regarding the Weights and Measures program may be obtained from the Lake County Auditor's Office by mail, by phone or in person.

WandM@lakecountyohio.gov

By Mail:

Christopher A. Galloway
County Auditor
105 E. Main Street
Painesville, OH 44077-3414

Attn:

Division of Weights and Measures

By Telephone:

Western Lake County
918-2829 Ext. 2535
Painesville 350-2535
Madison 428-4348 Ext. 2535

In person:

County Administration Building
105 Main Street
Painesville, OH 44077-3414
Hours: 8:00 a.m. - 4:30 p.m.
Monday thru Friday