

further, as Dr. Babcock says, after once heating, the milk is sterilized and the process of drying and extracting may be completed at any subsequent time.

4th. The total solids may be determined on the ignited asbestos without the further trouble of previously drying to a constant weight.

Some recent experiments on the necessary amount of drying and extracting will be given in another paper.



THE UNITED STATES GALLON.

“The gallon is a vessel containing 58372.2 grains (8.3389 pounds avoirdupois) of the standard pound of distilled water, at the temperature of maximum density of water, the vessel being weighed in air in which the barometer is 30. inches at 62° F.” —(See report on “Weights and Measures,” by Secretary of the Treasury, Senate Doc., 1857.)

This definition being somewhat obscure, occasion was taken to write the Treasury Department, from which letter the following is quoted:

“Does this wording mean that the ‘gallon’ is a *volume* equal to that occupied by the above quantity of water under the conditions named; or does it intend a ‘gallon’ to be understood as meaning the quantity of liquid capable of being held by such standard *vessel* as above referred to, even after said vessel has been expanded by elevation of temperature? I take it that the latter view, although certainly stated, can hardly be intended.”

The reply to this came from the office of the “Coast Survey.” and read as follows:

“The standard gallon is a measure of capacity or volume. Its capacity was derived from standard weights, and in verifying and standardizing capacity measures it is the practice to determine the volumes by weighings. It is, therefore, to be understood that the capacity of a gallon is measured by the weight of a volume of distilled water at maximum density, whose weight in air at 62° F. Bar. 30. inches, equals 58372.2 grains.

“ It follows, therefore, that a gallon is the measure of a constant volume, and that due allowance must be made for changes of temperature of a vessel used as a gallon measure.”

A letter recently coming from the Treasury Department reads: “The value adopted by this office for the weight of 231 cubic inches of distilled water at its maximum density is 8.3389 lbs. : or 8.3316 lbs. at 15° C. This reduced to 60° F. gives a value of 8.3312 lbs.”

Desiring to obtain a value in pounds for a U. S. Gallon of distilled water at 60° F., said value to be carried beyond four decimal places, a very surprising degree of confusion was discovered among the authorities.

For instance :

U. S. Pharmacopœia, 1870...	58328.8862 grains or	8.332698	lbs.
“ “ 1880...	58329.6	“ “ 8.3328	“
Miller’s Chemistry.....	58317.3	“ “ 8.3310	“
Am. Chemist, vol. 1, page 318.	58319.8	“ “ 8.3314	“
U. S. Treasury Depart.....	—————	“ “ 8.3312	“
“ Dispensary (last ed.)..	58328.886	“ “ 8.332698	“
Oldberg’s “ Weights and Measures,” page 167.....	58335.218	“ “ 8.333602571	“

From Barnard’s “ Metric System ” we have :

1. cubic inch pure water at 62° F., and under a pressure of 30. inches of mercury weighs *in vacuo*.....252.75965 grains.

Using Kopp’s tables (Watt’s Dict., vol. 3, p. 58, and interpolating by formula number one), we have :

1 cu. in. water at 22° F. becomes :

At 60° F.....1.000769074769 cu. in.

“ 62° “.....1.000942703386 “ “

Hence :

1 cu. in. at 62° F. becomes .9998265349101 cu. in. at 60° F.

Hence :

1 cu. in. of water at 60° F. weighs *in vacuo*...252.8035026 grains.

And 1. gallon (232 cu. in.) *in vacuo*---- { 58397.6091006 grains or
8.3425155858 lbs.

Referring again to Barnard's "Metric System," we find :

1 cu. in. water at 62° in air at 62° weighs...	252.48843	grains.
1 " " dry air at 62°	0.30908093	"
1 " " " " " 60°	0.3102675	"

Hence :

1 cu. in. water at 62° <i>in air at 60°</i> "	252.48724343	"
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Now 1 cu. in. of water at 62° becomes, as we have seen:

0.9998265349101 cu. in. at 60°; and the weight of this volume of water at 60° is equal to that of the entire cubic inch at 62°, plus the weight of a volume of air at 60°, equal to the difference between unity and said volume of water.

Hence: .9998265349101 cu. in. water at 60° and in air at 60° weighs 252.48729724 grains.

Hence: 1 cu. in. water at 60° weighed in air at 60° and under 30 inches mercury weighs 252.53110257 grains.

From these results we obtain for the weight of one U. S. Gallon (231 cu. in.) of pure water at 60° F., and weighed in dry air at 60° F. under a pressure of 30 inches of mercury:

58334.68469367 grains or 8.33352638481 lbs.

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