QUANTITATIVE ANALYSIS.

(PART 4.)

(1) Using formula **10**,

$$C = \frac{100\,p - 1{,}350}{86.5},$$

and substituting the known values, we obtain

$$C = \frac{100 \times 15 - 1{,}350}{86.5} = 1.734\% \text{ ceresin in sample.} \quad \text{Ans.}$$

(2) By "potential ammonia" is meant the nitrogen contained in the fertilizer, that, by the progress of decomposition of the organic matter of the fertilizer, will be transformed into ammonia.

(3) $$\frac{11.2 \times 273 \times 771}{(273 + 22) \times 760} = 10.52+ \text{ liters.} \quad \text{Ans.}$$

(4) See Art. **238.**

(5) As 1 cubic centimeter of the arsenious solution is equivalent to .0033 gram of chlorine, 47.4 cubic centimeters are equivalent to $47.4 \times .0033 = .15642$ gram in 50 cubic centimeters of the solution; but 50 cubic centimeters contain .575 gram of bleaching powder, hence the substance contains

$$\frac{.15642 \times 100}{.575} = 27.2\% \text{ of available chlorine.} \quad \text{Ans.}$$

(6) See Art. **29.**

(7) See Art. **206.**

(8) $C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6$. Cane sugar is transformed by inversion into glucose and fructose, as is seen by above equation.

(9) Subacetate of lead, prepared as described in Art. **169**, is most generally used.

(10) See Art. **120**.

(11) See Art. **16**.

(12) See Art. **36** *et seq.*

(13) See Art. **2**.

(14) Using formula **9**,

$$P = 100 - \frac{100\,S}{92.8},$$

and substituting the known values, we obtain

$$P = 100 - \frac{100 \times 87.6}{92.8} = 5.6+,$$

which is the amount of paraffin present in the sample.

(15) The percentage of iodine absorbed equals

$$\frac{26.1 \times .0122 \times 100}{1.0214} = 31.17+,$$

which would be the iodine number of the fat under examination.

(16) See Art. **218**.

(17) Using formula **7**,

$$R = \frac{100\,S}{142.66 - 13.5},$$

and substituting the known values, we obtain

$$R = \frac{100 \times (86 + 19)}{142.66 - 13.5} = 81.29\% \text{ of cane sugar.} \quad \text{Ans.}$$

(18) Soluble or water-soluble phosphoric acid; citrate-soluble phosphoric acid; citrate-insoluble phosphoric acid.

(19) No. See Art. **81**.

(20) See Art. **29**.

(21) See Art. **9.**

(22) See Arts. **230** and **231.**

(23) The iodine number in fat determination represents the quantity of iodine that a fat is able to absorb, and thus serves as a measure of the unsaturated acids present in the fat.

(24) Using formula **7,**

$$R = \frac{100\,S}{142.66 - \frac{1}{2}t^{\circ}},$$

and substituting the known values, we obtain

$$R = \frac{100 \times (93 + 21)}{142.66 - 10.5} = 86.259\% \text{ of cane sugar.} \quad \text{Ans.}$$

(25) 123.979 milligrams K_2O.

(26) Specific gravity, total solids, ash, total proteids, casein, albumin, and sugar.

(27) Using formula **5,**

$$W = \frac{100\,v(P - p)}{760 \times 354.33\,a \times (1 + .00366\,t)},$$

and substituting the known values, we obtain

$$\frac{100 \times 12 \times (767 - 11.2)}{760 \times (354.33 \times 2) \times (1 + .00366 \times 13)} = 1.607 \text{ grams;}$$

and as the specific gravity of the sample is 1.021, 100 cubic centimeters weigh 102.1 grams and the percentage of urea is

$$\frac{1.607 \times 100}{102.1} = 1.573. \quad \text{Ans.}$$

(28) Using formula **4,**

$$V_0 = \frac{V(P - p) \times 273}{760(273 + t)},$$

and substituting the known values, we obtain

$$V_0 = \frac{97(765 - 10.5) \times 273}{760 \times (273 + 12)} = 92.24+ \text{ cubic centimeters.} \quad \text{Ans.}$$

(29) See Arts. **204, 205,** and **206.**

(30) The saponification number indicates the number of milligrams of potassium hydrates required to saponify 1 gram of the fatty substance, and, therefore, represents the capacity of saturation of the fatty acids contained in the sample.

(31) See Art. **179.**

(32)

Sugar	95.00%
Water	2.20%
Ashes	1.32%
Foreign organic substance	1.48%
Total	100.00%

(33) See Art. **122.**

(34) The specific gravity of pure milk varies from 1.208 to 1.035; its average is about 1.0319—.

(35) See Art. **58.**

(36) $\frac{40.72 \times 273 \times 730}{(273+12) \times 760} = 37.466$ cubic centimeters. .1 liter of nitrogen at normal temperature and pressure weighs 1.257 grams, hence, 37.466 cubic centimeters weigh 470.95 milligrams, which equals 4.639 per cent. Ans.

(37) The calculation is similar to that explained in Art. **189.** The values for $Cu = .385$, $W = 4.250$, and the percentage of cane sugar, 89 per cent., are known. Before using formula **8,** we must calculate the value for Z and the proportion of $R : I$, in order to be able to find the value for F in the formula.

$$\frac{Cu}{2} = \frac{.385}{2} = .1925 = Z.$$

$$Z \times \frac{100}{W} = .1925 \times \frac{100}{4.25} = 4.529 = y.$$

$$\frac{100\,P}{P+y} = \frac{8{,}900}{89+4.529} = 95.15 = R.$$

$$100 - R = 100 - 95.15 = 4.85 = I.$$

Then, $$R : I = 95.15 : 4.85.$$

By consulting Table 5, we find that the vertical column $I = 200$ is nearest to Z (.1925), the horizontal column headed 95 : 5, is nearest to the ratio $R : I = 95.15 : 4.85$. Where these two columns meet, we find the factor 52.6, and we can now make the final calculation by substituting the known values in formula **8.**

$\frac{Cu\,F}{W} = \frac{.385 \times 52.6}{4.250} = 4.764\%$ of invert sugar in sample under examination. Ans.

(38) See Art. **183.**

(39) 26.048 grams pure cane sugar.

(40) See Art. **129.**

(41) See Art. **116.**

(42) See Art. **50.**

(43) See Art. **11.**

(44) See Art. **227.**

(45) See Art. **181.**

(46) See Arts. **176, 177,** and **178.**

(47) 96.029 milligrams *PCl*.

(48) See Art. **93.**

(49) For the preparation of Fehling's solution, see Art. **78,** *Qualitative Analysis*, Part 2; 1 cubic centimeter of this solution is equivalent to .005 milligram of sugar.

(50) As 50 cubic centimeters of gas are taken, and this, on average, contains 20 per cent. CO_2, the amount of CO_2 in each determination weighs 19.77 milligrams. The absorption of CO_2 by a potassium-hydrate solution is expressed by the equation: $2KOH + CO_2 = K_2CO_3 + H_2O$ and 43.89 parts of CO_2 are absorbed by 112 parts KOH. Then, $43.89 : 112 = 19.77 : x$, when $x = 50.45$ milligrams KOH, and as 600 determinations are made, 50.45 milligrams $\times$ 600 = 30.27 grams, or 30.27 grams of KOH would be consumed.

(51) The first step to be taken is to calculate the percentage of cane sugar; we employ formula **7**,

$$R = \frac{100\,S}{142.66 - \frac{1}{2}t^{\circ}},$$

and substitute the known values,

$$R = \frac{100 \times (69 + 24)}{142.66 - 11} = 70.636\% \text{ cane sugar.} \quad \text{Ans.}$$

For the calculation of the invert sugar, we have to calculate the proportion $R : I$, and the value for Z, in order to obtain the value F, which is needed for formula **8**.

The known values are $Cu = .315$, $W = 3.5$, and the percentage of cane sugar $P = 70.636$ per cent.

$$\frac{Cu}{2} = \frac{.315}{2} = .1575 = Z.$$

$$Z \times \frac{100}{W} = .1575 \times \frac{100}{3.5} = 4.5 = y.$$

$$\frac{100\,P}{P+y} = \frac{7,063.6}{70.636 + 4.5} = 94.01 = R.$$

$$100 - R = 100 - 94.01 = 5.99 = I.$$

$$R : I = 94.01 : 5.99.$$

By consulting Table 5, we find that the vertical column headed "$I = 150$" is nearest to Z ($= .1575$), and the vertical column 94 : 6 is nearest to the ratio $R : I$ (94.01 : 5.99). Where these two columns meet, we find the factor 51.6, and can now apply formula **8**,

$$\frac{Cu\,F}{W} = \frac{.315 \times 51.6}{3.5} = 4.644\% \text{ invert sugar.}$$

Hence, the sample contains $\left.\begin{array}{l} 70.636\% \text{ cane sugar.} \\ 4.644\% \text{ invert sugar.} \end{array}\right\}$ Ans.

(52) Since 1 cubic centimeter of standard potassium permanganate corresponds to .004 gram of iron, and 24.6 cubic centimeters correspond to .0984 gram, then, .323 gram of iron taken, less .0984 gram of iron not oxidized by the bleaching powder, equals .2246 gram of iron oxidized by the sample.

Since 56 parts of *Fe* correspond to 35.5 parts of *Cl*, we obtain the proportion:

$$56 : 35.5 = .2246 : x,$$

when $x = .1424$ gram available *Cl*. .4 gram bleaching powder contains .1424 available chlorine. 1 gram contains .356 gram, or 35.6 per cent. Ans.

(53) 58.647 milligrams K_2SO_4.

(54) Using formula **6**,

$$t = \left(\frac{100\,S - FS}{100 - 1.0753\,FS} - 1\right)(250 - 2.5\,F),$$

and substituting the known values, we obtain

$$t = \left[\frac{100 \times 1.0328 - (2.56 \times 1.0328)}{100 - 1.0753(2.56 \times 1.0328)} - 1\right][250 - (2.5 \times 2.56)],$$

when $t = 8.720$.

Then, total solids not fat $= 8.720\%$, and fat $= 2.56\%$; hence, total solids $= 8.720 + 2.56 = 11.28\%$. Ans.

(55) See Arts. **59** and **60.**

(56) As 210 milligrams of cupric oxide equal 168 milligrams *Cu*, referring to Table 3, we find

165 milligrams *Cu*	= 1820	
3 milligrams *Cu* × .75	= 2.25	
168 milligrams *Cu*	= 1822.45	milligrams $C_{12}H_{22}, H_2O$.

Ans.

(57) See Art. **64** *et seq.*

(58) See Art. **114** *et seq.*

(59) See Art. **224.** $33.5 - 25 = 8.5$; $.000176 \times 8.5 = .0015$. Then, $1.4652 + .0015 = 1.4667$ refractive index at standard temperature. Ans.