Determination of Obscuration.

~~Rum~~ Whiskey.

First take Present Gravity of 50 c.c. ~~grammes~~ at 60° F. in spirit S.G. bottle.

Secondly evaporate 100 cc & about 25 cc washings & collect spirit distillate, making up with dist. Med H_2O at 60° to 100 cc

Thirdly Find Gravity of spirit.

Fourthly Wash out residue & fill up to 100 cc at 60° F ~~with~~ distilled water, & find gravity.

Find the proof spirit equivalent (in Table) to the present gravity & ~~subt~~ subtract one from the other which will give obscuration.

e.g. Pres Grav. = 47.498 × 19.9 (factor of bottle) = 945.21 = 77.21 proof spirit (by Table)

Spirit = 47.376 × 19.9 = 942.78 = 79 89

Residue = 50.346 × 19.9 = 1001.88 = 2.68 obscuration.

Check. 945.21
942.78
2.43

residue = 1.88.

check. The difference between Present Gravity & Spirit Gravity should be a little higher than the residue.

Determination of Original Gravity.

1. First toss the beer backwards & forwards into large beakers to remove gas. Then weigh in S.G bottle to find S.G. at 60°F.
2. Take 100 cc of beer in flask ~~at 60°F~~ at 60°F & wash out into distilling flask with not less than 25 cc water. Distil into 100 cc flask till almost full. Then make it up to 60°F & fill up to 100 cc mark with water at 60°F. Find S.G. of spirit
3. Pour out ~~100~~ residue & wash out with water. ~~at 60°F~~ bring temp to 60°, & add water at 60° to bring up to 100 cc mark, & shake well. Find S.G of ~~spirit~~ residue.

e.g.

Pres Grav = 50.7855 × 20.005. (factor of bottle) = 1015.9639

Spirit = 49.5881 × 20.005 = 992.0099 = 8.0 spirit indication

Residue = 51.1690 × 20.005 = 1023.6358

8.0 = 33.7 degrees of gravity lost. (by Table page 64)

33.7 + 2.5 allowance = 36.2.

36.2 + 23.6 (grav of residue) = 59.8

(by Table) = 21.5 (Brewers lbs.) O.G.

To check results.

The sum of Pres. Grav. & Spirit Indication should ~~be~~ not be more than .4 less ~~than~~ above gravity of Residue.

e.g. as above:-

P.G + Spirit = 23.96

Residue = 23.63

.33

Colouring of Beers.

Match tint of beers in tintometer with various tints of glass till the exact shade is obtained.
Subtract tint of beer from standard tint required
Multiply difference by number of barrels ~~to be~~ brewed & divide by constant divisor for 2% solution of caramel.

e.g.

	Barrels	Tint	Tint required
Mon F.P.A$_{(9)}$ (460)	193	14	19

$193 \times (19-14) = 193 \times 5 = 975 \div 41$ standard divisor

$= 23\frac{1}{2}$ pints = 2 gallons $7\frac{1}{2}$ pints

The Standard divisor is obtained thus:-
Take 3 separate flasks containing 100 cc H_2O. & add to each 0.2 cc of caramel. Mix well & take the tints. The average tint will be used for determining the amount of caramel required to raise 1 brl through 1 Tint, according to Table.

Determination of (α) j.

Measure out 50 c.c. of both coppers into a bottle-beaker: add 100 c.c of water. Pour in a few drops of Alumina & shake well. Filter twice till brilliant, & take Polariscope reading at 60° F. Then fill S.G bottle with brilliant wort (at a temp of 60°) & find Specific Gravity From S.G & Polariscope reading deduce as follows:-

1. { 50 c.c. 1 Copper } wort
   { 50 c.c. 2 Copper } L.D.a.
   { 100 cc H_2O

Polariscope = 14.9 = 2208.5 (by Table)

S.G = 10,1835 (50.905 × 2.0005)

1835) 22085 (120.3.
1835
3735
3670
6500
5505

α(j) = 120.3.

---

2. Polariscope = 18.4 = 2727248

S.G. = 10,2135,27.

2135) 2727248 (127.7
2135
5922
4270
16524
14945
15798

127.7 = α(j)

---

3. Polariscope = 19.3 = 2860646

S.G. = 51.128 (× 2.0005) : 1022.815640

1281) 2860646 (1254
2281
5796
4562
12344
11405
9396

α(j) = 125.4

Analysis of Malts

I. Skinner's English. 1°

Determination of Diastatic Capacity

Weigh out 25 grms of malt free from screenings: add 3 or 4 corns for loss in mill. Grind in mill & pour grist into large beaker: add 500 c.c. of distilled water & leave to stand for 4 hours covering with plate & stirring occasionally.

Make a 2% solution of Lintner's Starch as follows:-

Weigh out 2 grms Starch, make into paste with a little cold water & pour in about 80 c.c of almost boiling water. Stir well & wash out into 100 c.c. flask, filling up to mark with water.

Take ten test-tubes, scrupulously clean, & put in each in succession from 1.1 to 1.0 c.c. of filtered & brilliant wort & to each add 10 cc of starch solution. Stand for 1 hour at 70° in water; then add 10 cc to each of Fehling's Solution & boil for 1 minutes in tube & stand overnight in water at ordinary temperature.

Some test-tubes will be found to have been entirely reduced, the blue coloration having disappeared, & giving place to the red coloration of copper oxide. The tube which is intermediate in coloration gives the diastatic capacity: e.g. if the 4th tube (containing .4 of wort) is almost decolorised, the diastatic capacity is said to be $\frac{.4 \times 10 \cdot 1.4 \times 100}{.4} = 25.$

A correction must be made for the other sugars which may be present. This is taken as 1.43.

Determination of Acidity in Malt.

Mash 25 grms of malt in 200 cc of cold water & stand for ½ hour, stirring at intervals. Add $\frac{n}{20}$ solution sodium carbonate drop by drop from burette until solution is neutral, & read off number of degrees of Na_2CO_3 used.

Determination of Moisture.

Dry a very small beaker perfectly in oven: weigh & fill $\frac{3}{4}$ full with grist. Weigh again & put in oven for several hours & weigh again, & again at intervals until the weight is constant. The difference between wt of beaker + grist after drying, & before drying = moisture.

e.g. Beaker = 9·5980 grms
" + grist = 14·4258 1st weighing
" " = 14·2704 after drying
" " = 14·2404 (2)
" " = 14·2370 (3)

moisture = ·033 grms
in 4·827 grms
= ·68%.

Preparation of the cold water mash.

Weigh out 25 gms of malt & grind. Place in a beaker & add 250 cc of distilled water at 60°F: stand for 3 hrs. Filter bright: & take 100 cc & wash into a beaker. Boil to half bulk. Then wash back into the same measuring flask, cooled & made up to the mark at that temperature at which it was before boiling.

Filter & with the bright filtrate determine:-

(1) The S.G. at 60° F. = 10,0 6·01

(2) The Opticity at 60°F = 0·6

(3) The ~~Albuminoids~~ Ash.
Evaporate 25 c.c. to dryness in a platinum dish previously weighed & then igniting till the ash is white: cool & weigh.

(4) The Cupric Reducing Power.

(5) The Albuminoids.
Kjeldahl's Method.
Evaporate 10 cc of cold mash in bottle beaker till almost dry. Digest residue with 10 cc of a mixture of equal quantities H_2SO_4 & Nordhausen do. over a small flame for a few hours until the liquid has a clear light brown appearance. While still hot add solid K_2MnO_4 in small quantities until the mixture turns green. When cold dilute with water & wash into a distilling flask with about 50 to 100 cc of water: Add 20 grms caustic soda previously dilutes in 100 – 150 cc of water & cooled.
Distil over about $\frac{2}{3}$rds of the liquid into a flask containing 20.25 cc $\frac{n}{20}$ H_2SO_4. After distillation add a few drops of methyl orange & run in from a burette $\frac{n}{20}$ Na_2CO_3 solution until the ~~straw~~ colour has just turned straw yellow, & note the no of cc used. It is necessary to make a correction for the N present in the reagents by means of a blank experiment.

Preparation of the hot-water mash.

Heat 350 cc of water to 155°F. & add 50 grms of ground malt. The whole is placed in a water-bath & kept at 150 F for one hour. During the last five minutes the temperature is raised to 158°F. The mash is then poured into a 500 cc flask (graduated to 515 cc). It is cooled to 60°F, & made up with water at that temperature to 515 cc mark.

Filter & measure off 200 cc of the filtrate, wash into a beaker, boil down to half bulk, & then pour back into the same flask making up to the same temperature that it was when first measured.

Filter right & determine :-

1. Opticity @ 60°F.
2. Specific Gravity "
3. Cupric Reducing power.

Boil for 10 mins in bath, 50 cc of Fehling's solution + 50 cc of H_2O. Then add 5 cc of h-water mash & boil a further ten minutes. Filter through 2 specially prepared & weighed papers, & wash carefully so as to lose no reduced Copper oxide present (this should be done with hot water). Dry papers in oven for 40 mins & weigh.

4 The Matto-Dextrins

(α) The maltose in Matto-dextrins.

Two flasks are taken each containing 50 cc of hot mash. To one add a few drops of cold water extract. Pitch both with a little fresh yeast & place on forcing tray for 3 days. After fermentation wash out into 100 cc flasks, add alumina & from the bright filtrate take 10 cc & find the reducing power with 50 cc of Fehling.

(β) Dextrin in Matto-Dextrins.

25 cc of the hot mash are placed in a 100 cc flask & 2.5 cc of cold extract added. It is kept for 1 hour in a bath at 130°F. 10 cc of malt extract are similarly treated. Both are then made up to 100 cc at 60°F & the cupric reducing power found.

Full Theoretic yield of a Malt.

Mash 50 grms of malt & 5 grms of finely ground oats in about 350 cc of water in a weighed beaker so as to give a ~~mashing~~ striking of about 106° F. Add 10 c.c. 15% solution Potassium Bisulphite & keep at this temp^re ~~for one hour~~ all night. In the morning raise the heat to 150° F & keep at this temp^re for one hour. Proceed as with hot mash, but instead of making up to 515 cc Cool in the beaker & add water to make up to 500 grms of water. (50 grms malt + 5 grms oats + 500 grms water + wt of beaker)
Corrections must be made for the gravity due to the oats & the gravity due to the bisulphite.
Take 5 grms of oats with 10 cc of bisulphite & 350 cc of water & mash at 106 F with the malt mash side by side.
Next morning mash in 50 grms of malt of known extract & weigh in water as above.

A. Gravity due to Malt & Oat Soak x 3.36
B " " " Oat Soak with Malt Mash x 3.36
minus gravity due to Malt Mash x 3.36.

$$\frac{A \times 100}{B} = \text{Coef M.}$$

Theoretic yield of a malt.

Mash 50 gms of malt in 350 c.c. of water, & stand all night in a water bath at about 100°F. Then get heat up as in hot mash & stand for an hour, raising heat to 158° during the last 5 minutes. - 10 c.c. of potassium bisulphite must be added as a preservative overnight. Proceed as with a hot mash & find Specific Gravity of the wort.

Calculation of Malt Analysis.

Diastatic Capacity.

Example. .42 cc of M.E. converted the Fehlings Solution

∴ the D.C is $\frac{.1 \times 100}{.42} = 23.81$

Deduct 1.43 for correction 22.38. D.C.

Cold Water Mash Results.

Reducing power of 10 cc

Wt of Cu + Cu O	37.6696
Wt of Cu	37.5314
	.1382
Ash of F.P.	.003
Wt of Cu O	.1352

This is required to correct the H.M. figures.

Opticity 1.9 Scale Divisions. (required to correct the Opticity of the H.M).

Specific Gravity 50.3761 = 1008.0257

By subtracting 1000 & dividing by 3.86 we obtain the solids in solution per cent.

$\frac{8.0257}{3.86} = 2.079$. Total solids in solution (C.M.)

Albuminoids.

10 c.c. $\frac{N}{20} H_2SO_4$ require on distillation $\frac{5}{4}$ cc of $\frac{N}{20}$ Na_2CO_3 to neutralise it. ∴ $10 - \frac{5.1}{4} = \frac{4.9}{5}$ cc of $\frac{N}{20}$ H_2SO_4 have been neutralised by ammonia from the Albuminoids.

Each 1 cc of acid neutralised corresponds to 0.0007 gms nitrogen

∴ $\frac{4.9}{5}$ cc = 0.00343 gms nitrogen

or $6.3 \times .00343 = .0216$ gms albuminoids in 10 cc extract.

or .2.16 per cent.

The factor 6.3 has been found by experiment for calculating nitrogen into its containing all albuminoids; it is absolutely correct but near enough to ensure no great error.

Ash. 25 cc.

Wt of plat dish & ash 30.0636

Wt of dish 30.0371

Wt of ash .0265

4 (4 × 25 = 100)

1.060 mineral matter %

Acidity as Lactic. 25 grms of malt in 250 cc of water required 14 cc $\frac{n}{20}$ Na_2CO_3 to neutralise.

Lactic acid. $C_3H_6O_3$

Molecular Wt 90.

$\frac{n}{1}$ solution 90 grms per litre

$\frac{n}{20}$ 4.5 ———

or .0045 per cc.

14 × .0045 = .063 grm lactic acid in 25 grm malt

= .063 × 4 = .252 grm % lactic acid.

Ready formed sugars.

The total solid matter in the extract as determined by

S.G = $\frac{8025761}{3.86}$ = 2.079 = 20.79 %.

Subtract from this figure the sum of the albuminoids, ash & lactic acid & the result is the percentage of ready formed sugars.

Albuminoids	2.161	20.79
Ash	1.06	3.473
Lactic acid.	.252	17.317 sugars
	3.473	

Hot Mash Results.

S.G. 1028 152.

Brewer's Extract per quarter is the excess gravity in pounds over 360 (the weight of a barrel of water in pounds) of a wort made from one quarter (= 8 bushels of 42 lbs each) & one barrel of water. 58.33 grms of malt bear the same relation to 500 cc of water as one bushel of malt does to one barrel of water.
The excess gravity of ~~the~~ the hot mash was 28.15. This was obtained by mashing 50 grms malt & 500 cc of water.
If we multiply the 28.15 by 58.33 & divide by 50 we obtain the excess gravity of a mash corresponding to one bushel to the barrel. $\frac{28.15 \times 58.33}{50} = 32.84$

$32.84 \times 8 = 262.72$ excess gravity due to a quarter of malt in one barrel.
This gravity is excess over 1000. required the excess over 360.

$$\frac{262.72 \times 360}{1000} = 94.59.$$

To save labour in the above calculation use a factor obtained by multiplying together the various fractions necessary in the calculations.
This factor is 3.36.

1 grm Cu_2O is produced from .743 grm maltose

3.905 & 5.625 are the deviations in a one decimetre tube of solutions containing one grm pure maltose & dextrin respectively per 100 cc.

Reducing Power. Hot Mash. 5.c.c.

Wt of CuO + Cu	= 40.8916
Wt of Cu	− 40.5655
	.3261
ash of Pr	− .003
CuO =	.3231

Wt of CuO per 100 cc = .3231 × 20 = 6.462 grms

Deduct ~~ready formed sugars~~ CuO of C M 1.352 / 1.731 / 5.11 grms CuO due to maltose.

5.11 × .743 = 3.7967 3 = the amount amount of maltose due to the starch transformation in 100 cc of wort, i.e. on 10 grms of wort.

∴ on 100 grms of malt maltose = ~~41.40~~ 37.96 grms

Opticity

P. 24.0 sc dis.

The Dextrin due to the starch transformation is obtained from the opticity as follows

P. H. m. 24.0

P. C. m 1.9 / 22.1

Deviation due to maltose + dextrin produced from transformation of starch.

We know that the Maltose per 100 c c = 5.11. = ~~41~~ 37.96 grms.

3.796 × 3.905 = 14.823 deviation due to the maltose per 100 cc

22.1 − 14.82 = 7.276 deviation due to the dextrin per 100 c.

7.276 / 5.625 = 12.936 grms dextrin per 100 grms malt.

Moisture

Wt of beaker + malt 13.1815
beaker 8.1181
5.0634 wt of malt taken.

After drying wt of beaker + malt = 13.0928
13.1815 − 13.0928 = .0887

$\frac{.0887 \times 100}{5.0634}$ = 1.75% moisture

Grains

The grains are obtained by adding up the whole of the constituents as above obtained & subtracting the total from 100 cc

The maltose existed in the malt as starch & to obtain the amount of starch corresponding to it we must subtract $\frac{1}{20}$th.

Maltose (less $\frac{1}{20}$th)	36.07
Dextrin	12.93
Ash	1.06
Ready formed sugars	17.32
Moisture	1.75
Albuminoids	2.16
Acidity	0.25
	71.54
from 100	
	28.46 'grains'

Tint This is determined direct from the hot mash removed in 1 inch cell.

Tint 7.

Check on results.

The sum of the maltose + dextrin should nearly equal the difference of the totals of the hot water + cold water mashes.

3.86) 281.522 (72.93 = H.M. solids.

3.86) 80.25761 (20.79 = C.M. solids.

72.93	Maltose	37.967
20.79	Dextrin	12.936
52.14	Total	50.903
50.90		
1.24 check.		

The Malto Dextrins

Combined Maltose

The difference in the reducing power determined on the wort after fermentation + fermentation with diastase will be due to the combined maltose.

F. $\frac{50}{25}$ cc to 100 × 25

Wt of Cu O + Cu	24.8942
Wt of Cu	24.8588
	~~.646~~
	.0354
ash of pp	.003
	.0324 total Cu O.

F.D. $\frac{50}{25}$ cc to 100 × 25.

	17.5324
	17.5246
	.0078
	.003
	.0048

.0324
.0048
.0276 reduction due to combined maltose
8
.2208
.743
1.64 combined maltose %

(N.B these figures are incorrect)

1 grm of Dextrin per 100 cc is equivalent to .706 grm Cu0

Combined Dextrin.

The difference in the reducing power between that of the ~~grand~~ original work & that which has been digested with diastase solution will be due to the combined dextrin, making correction for the sugars contained in the diastase solution.

m D. 25 / 50 cc + 2.5 cc D to 100 x 10. D. 10 cc to 100 x 10.

	m D.	D.
Wt of CuO + Cu	22.0426	20.5742
Wt of Cu	21.8639	20.5415
	.1787	.0327
ash of ff.	.003	.003
	.1757 CuO	.0297 CuO

Wt of m D. CuO	.1757
¼ D. solution	.0074
	.1683 per 5 cc
	~~20~~
	~~3.36~~60
	40
	6.732
Wt of original CuO	6.462
Wt of CuO due to	.270
Combined dextrin	.706 combined
	1.91 dextrin per 100 cc.

Coefficient of Modification

The difference between the extracts obtained by the simple hot mash & the mash digested with oats expressed as a percentage upon the simple hot mash extract is termed the coefficient of modification.

Oat Mash.

Sp. Gr.