Guide

TO

FARMER'S SPIRIT-RULE

THE UNIVERSAL CALCULATOR

For the Wine and Spirit Trade

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Guide

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FARMAR'S SPIRIT-RULE:

THE UNIVERSAL CALCULATOR

For the Wine and Spirit Trade.

BY

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EXAMPLE (*c*).—What is the average *strength* of the following Blend of Spirits:—

154·4 gallons @ 9·2 o.p.
26·2 „ „ 2·5 o.p.
108·2 „ „ Proof.
74·6 „ „ 4·6 u.p.

Answer 3·1 o.p.

†† STRENGTHS:—

154·4	× 109·2	=	16860 ‡
26·2	× 102·5	=	2680
108·2	× 100·0	=	10820
74·6	× 95·4	=	7110
363·4			37470

Then 37470 ÷ 363·4 = 103·1, or 3·1 o.p.

SETTING ON RULE:—

A	103·1	1	A
B	3747	363·4	B

EXAMPLE (*d*).—What is the average *strength* of the following blend of wines:—

56 gallons @ 36 degrees.
110 „ „ 38 „
24 „ „ 33 „

Answer 37°

**STRENGTHS:—

56 × 36°	= 20·16	× 100	= 2016
110 × 38°	= 41·80	× 100	= 4180
24 × 33°	= 7·92	× 100	= 792
190			6988

Then 6988 ÷ 190 = 36·7, or 37 degrees.

SETTING ON RULE:—

A	36·7	1	A
B	6988	190	B

NOTES.

†† Express all strengths in the *percentage* form: thus, "proof" being 100, "overproof" is 100 plus the o.p.; "underproof" is 100 minus the u.p. For example, 10 o.p. would be expressed 110; 10 u.p. as 90; and so on.

‡ These results may be obtained by the *Rule* if desired—being merely the *proof quantities* multiplied by 100. (*See page 19.*)

** The expression "Degrees" literally means "Proof-per-Cent." Thus, "36 degrees" means that 36 proof-gallons are contained in every 100 gallons of the wine. (*See page 23*).

AVERAGING.

METHOD.—*Multiply each separate quantity by its own Price or Strength, and divide the sum of the results by the total quantity.*

EXAMPLE (*a*).—What is the average *value* of the following Blend :—

120 gallons at 3/6
40 „ 5/-
20 „ 7/6

Answer 4/3¼

PRICES :—

s.	d.				shillings.
3	6	×	120	=	420
5	0	×	40	=	200
7	6	×	20	=	150
			180		770

Then 770 ÷ 180 = 4/3¼

SETTING ON RULE :—

A 1		* 4·27	A
B 180		770	B

EXAMPLE (*b*).—What is the average *value* of the following Blend :—

120 gallons at 3/6
40 „ 5/-
20 „ 7/6
50 (Water) —

Answer 3/4

PRICES —

s.	d.				shillings.
3	6	×	120	=	420
5	0	×	40	=	200
7	6	×	20	=	150
(Water)			50	=	0
			**230		770

Then 770 ÷ 230 = 3/4

SETTING ON RULE :—

A 3·34†		1	A
B 770		230	B

NOTES.

* The Rule here expresses the Answer 4·27, meaning 4 shillings and 27 hundredths of a shilling. Any decimal of a shilling may be converted to *pence* by multiplying mentally by 12. Thus ·27 × 12 = 3·24 pence, or 3¼d. nearly.

† Similarly, 3·34 = 3/4.

** No notice is here taken of the *Contraction in Bulk* which necessarily arises. *Vide General Exercises, page* 17.

Preface.

"FARMAR'S SPIRIT-RULE" is a Calculating Slide-Rule specially designed to meet the UNIVERSAL requirements of the Wine and Spirit Trade.

Its manifold powers are described in the Index; and in the pages following are given the necessary directions, examples, and exercises in the clearest manner.

It is simple to work, and can be relied upon to render invaluable assistance in every branch of the business.

FRANK C. FARMAR.

15, HYDE ROAD,
WATERLOO,
LIVERPOOL.

February, 1902.

LIVERPOOL
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1902

EXAMPLE (*c*).—In what proportions should I blend four wines, worth respectively 4/-, 6/-, 8/- and 9/- a gallon, to produce a mixture worth 7/- a gallon?

Answer: In the proportions of 2, 1, 1, and 3 respectively.

PRICES STATED:—

4/-	6/-	8/-	9/-
7/-	7/-	7/-	7/-
3 :	1 :	1 :	2

KEY.—The proportions (reading from right to left) stand thus:—

To every 2 gallons of the 4/- wine
add 1 " 6/- "
1 " 8/- "
and 3 " 9/- "

EXAMPLE (*d*).—In what proportions should I blend six spirits, worth respectively 4/-, 3/-, 3/6, 4/6, 5/6 and 5/- a gallon, to produce a mixture worth 4/3 a gallon?

Answer: In the proportions of 9, 15, 3, 9, 15, and 3 respectively.

PRICES STATED:—

4/-	3/-	3/6	4/6	5/6	5/-
4/3	4/3	4/3	4/3	4/3	4/3
-/3 :	1/3 :	-/9 :	-/3 :	1/3 :	-/9

or, expressed in *pence*:—

3 : 15 : 9 : 3 : 15 : 9

KEY.—The proportions (reading from right to left) stand thus:—

To every 9 gallons of the 4/- spirit
add 15 " 3/- "
3 " 3/6 "
9 " 4/6 "
15 " 5/6 "
and 3 " 5/- "

NOTES.

HOW TO FIX THE AVERAGE PRICE.—Arrange the given prices, forming the mixture, in *progressive* order, and separate them into two equal groups. The limits will lie between the two *centre* prices. For instance, take Example (*d*) above. Here we have six spirits whose values are 3/-, 3/6, 4/-, 4/6, 5/-, 5/6. The average price lies between 4/- and 4/6. Any odd amount can be fixed upon within these limits.

These remarks similarly apply to strengths.

Observe that there must be an *even* number of strengths or prices, and that by varying their order *in stating the question*, different proportions can be obtained to suit particular exigencies.

BLENDING.

METHOD:—*Arrange the given Strengths or Prices in any stated order. Insert under each the average required, and take the lesser from the greater in each pair. The proportions of the mixture will then appear in* REVERSE *order.*

EXAMPLE (*a*).—In what proportions should I blend two spirits, at 14 o.p. and 4 o.p. respectively, to make-up 20 gallons at 8 o.p.?

Answer 8 and 12 gallons respectively.

STRENGTHS STATED:—

114	104
108	108
6 +	4 = 10

Then (reading from right to left):—

	GALLONS.		
$\frac{4}{10}$ of 20 gallons	= 8	@	14 o.p.
$\frac{6}{10}$ of 20 "	= 12	@	4 o.p.

SETTING ON RULE:—

1st result

A 4	8 A
B 10	20 B

2nd result

A 6	12 A
B 10	20 B

EXAMPLE (*b*).—In what proportions should I blend four spirits, at 2 o.p., Proof, 10 o.p. and 6 o.p. respectively, to make-up 28 gallons at 4 o.p.?

Answer 4, 12, 8, & 4 gallons respectively.

STRENGTHS STATED:—

102	100	110	106
104	104	104	104
2 +	4 +	6 +	2 = 14

Then (reading from right to left):—

	GALLONS.		
$\frac{2}{14}$ of 28 gallons	= 4	@	2 o.p.
$\frac{6}{14}$ of 28 "	= 12	@	Proof
$\frac{4}{14}$ of 28 "	= 8	@	10 o.p.
$\frac{2}{14}$ of 28 "	= 4	@	6 o.p.

SETTING ON RULE:—

1st result

A 2	4 A
B 14	28 B

(The other results are found in like manner.)

INDEX.

PRELIMINARY DIRECTIONS.

THE various lines on this Rule are distinguished by *letters*.

A and **B** are logarithmic scales which mutually calculate any ordinary question in simple proportion, multiplication, or division.

AA and **BB** are subsidiary lines which (whenever required) mutually co-operate with the main lines, **A** and **B**.

C is a line representing the Bung and Wet-inches of Lying Casks, or the Length and Wet-inches of Standing Casks.

D is a line of segments for Lying Casks.

E is a line of segments for Standing Casks.

F indicates the number of pounds per gallon that spirits weigh at the different strengths—*adjusted at the standard temperature.*

G and **H** are special lines which mutually calculate the *exact* quantity of water required to reduce spirits—*contraction of bulk* being allowed for automatically.

I is a double line of money values, ranging from 1/- to 40/-.

J is a line of strengths varying from 35 u.p. to 70 o.p.

K is a line of percentages extending from 15 % Discount to 80 % Profit.

L (on the edge of the Rule) is a scale of equivalents, converting tenths of a gallon to pints.

FORTIFYING.

[SIMPLE PROPORTION: *Use the lines* A *and* B *on the rule.*]

The strength of the fortifying Spirit. * The required strength of the Wine.	:	The required strength of the Wine. * The present strength of the Wine.	: :	The quantity of Wine to be fortified.	:	The quantity of Spirit required.

EXAMPLE (*a*).—How much spirit at 64·2 o.p. is required to fortify 108 gallons of wine, from 34 to 40 degrees?

Answer 5·2 gallons.

TERMS STATED:—

164·2		40				
40		34				
124·2	:	6	: :	108	:	5·2

SETTING ON RULE:—

A	5·2	6	A
B	108	124·2	B

KEY.—We set the 1st term to the 2nd; then over the 3rd term we find the Answer.

EXAMPLE (*b*).—How much spirit at 64 2 o.p. is required to fortify 108 gallons of wine, from 25 to 30 degrees?

Answer 4 gallons.

TERMS STATED:—

164·2		30				
30		25				
134·2	:	5	: :	108	:	4

SETTING ON RULE:—

A	4	5	A
B	108	134·2	B

KEY.—We set the 1st term to the 2nd; then over the 3rd term we find the Answer.

* Subtract the one from the other.

NOTE—The expression "Degrees" literally means "Proof-per-cent." Thus, "34 degrees" means that 34 proof-gallons are contained in every 100 gallons of the wine.

CONTENTING.

METHOD:—*Ascertain from line* F *the number of lbs. per gallon corresponding to the hydrometer strength. Set this result to* 10 *on line* A; *then over the total net pounds will be found the quantity in the Cask.*

EXAMPLE (*a*).—Find the content of a cask of spirits from the following particulars:—

Net Weight. Cwt.	Qrs.	Lbs.	Pounds.		Hydrometer Strength.
2 :	3 :	5	or 313	@	Proof.

Answer 34 gallons.

SETTING ON RULE.—

Line F: Proof. / 9·185 lbs.

A 34 gallons	10	A
B 313 lbs.	9·185	B

KEY.—Line F tells us that spirit @ Proof weighs 9·185 lbs. per gallon. Setting this 9·185 to 10 on line A, we find that 313 lbs = 34 gallons.

EXAMPLE (*b*).—Find the content of a cask of spirits from the following particulars:—

Net Weight. Cwt.	Qrs.	Lbs.	Pounds.		Hydrometer Strength.
4 :	2 :	7	or 511	@	21·0 o.p.

Answer 57¼ gallons.

SETTING ON RULE:—

Line F: 21 o.p. / 8·911 lbs.

A 57¼ gallons	10	A
B 511 lbs.	8·911	B

KEY.—Line F tells us that spirit @ 21 o.p. weighs 8·911 lbs. per gallon. Setting this 8·911 to 10 on line A, we find that 511 lbs. = 57¼ gallons.

EXERCISES.

Gross. cwt. qrs. lbs.	Tare. cwt. qrs. lbs.	Net Weight. cwt. qrs. lbs. Pounds	Hyd Strength.	Lbs. per gall.	Gallons.
1 : 3 : 1	0 : 1 : 26	1 : 1 : 3 = 143	15·0 u.p.	9·36	15¼
3 : 2 : 19	0 : 2 : 27	2 : 3 : 20 = 328	38·5 o.p.	8·653	37¾
11 : 0 : 22	1 : 2 : 10	9 : 2 : 12 = 1076	23·4 o.p.	8·878	121

A operates with **B.**
AA with **BB.**
C with **D** or **E.**
F with **A** and **B.**
G with **H.**
I with **J** or **K.**

NOTES.

THOSE familiar with logarithmic slide-rules of *any* description, will not need to be told that Numbers represented on the calculating lines AB or GH may be read either *literally*, or as though they were supplemented by Noughts (0), or by Decimal Points (·), according to the necessity of each case as it arises.

Take the following, for instance—

As marked on Rule.	May be taken to read.	Or,	Or,	Or,	Or,
1	1	10	100	·1	·01
2	2	20	200	·2	·02
3	3	30	300	·3	·03

Similarly—

Number.	May be read as	Or,	Or,
10	10	100	1·0
11	11	110	1·1
12	12	120	1·2
13	13	130	1·3

And so on.

VALUING.

METHOD:—Set any Price on I to any strength on J; then over any other strength will appear its corresponding value.

EXAMPLE (*a*).—A spirit is worth 14/- a gallon at Proof; how much is it worth at 15 o.p.?

Answer 16/1.

SETTING ON RULE:—

I	14/	16/1	I
J	Proof	15 o.p.	J

KEY.—We set 14/- to proof; then over 15 o.p. we find 16/1.

EXAMPLE (*b*).—A spirit is worth 17/9 a gallon at 10 o.p.; how much is it worth at 15 u.p.?

Answer 13/8½.

SETTING ON RULE:—

I	13/8½	17/9	I
J	15 u.p.	10 o.p.	J

KEY.—We set 17/9 to 10 o.p.; then over 15 u.p. we find 13/8½.

EXAMPLE (*c*).—A spirit is worth 3/- a gallon at proof; how much is it worth at 17 u.p.?

Answer 2/5¾.

SETTING ON RULE:—

I	2/5¾	3/-	I
J	17 u.p.	Proof	J

KEY.—We set 3/- to Proof; then over 17 u.p. we find 2/5¾.

EXAMPLE (*d*).—A spirit is worth 4/9 a gallon at 10 o.p.; how much is it worth at 15 u.p.?

Answer 3/8.

SETTING ON RULE:—

I	3/8	4/9	I
J	15 u.p.	10 o.p.	J

KEY.—We set 4/9 to 10 o.p.; then over 15 u.p. we find 3/8.

LOWERING.

[SIMPLE PROPORTION: *Use the lines* A *and* B *on the rule.*]

The required strength. * The strength of the spirit proposed to be added.	:	The present strength. * The required strength.	: :	The present quantity of spirit.	:	The quantity of the weaker spirit required.

EXAMPLE:—What quantity of spirit @ 12 u.p. is required to lower the strength of 54·4 gallons of another spirit from 15 o.p. to 5 o.p.?

Answer 32 gallons.

† TERMS STATED:—

105		115				
88		105				
17	:	10	: :	54·4	:	32

SETTING ON RULE:—

A	10	32	A
B	17	54·4	B

KEY.—We set the 1st term to the 2nd; then over the 3rd term we find the Answer.

* Subtract the one from the other.

† See footnote, page 20.

RAISING.

[SIMPLE PROPORTION: *Use the lines* A *and* B *on the rule.*]

The strength of the spirit proposed to be added. * The required strength.	:	The required strength. * The present strength.	: :	The present quantity of spirit.	:	The quantity of the stronger spirit required.

EXAMPLE.—What quantity of spirit @ 62 o.p. is required to raise the strength of 108 gallons of another spirit from 30 o.p. to 35 o.p.?

Answer 20 gallons.

† TERMS STATED:—

162		135				
135		130				
27	:	5	: :	108	:	20

SETTING ON RULE:—

A 5	20 A
B 27	108 B

KEY.—We set the 1st term to the 2nd; then over the 3rd term we find the Answer.

* Subtract the one from the other.

† Express all strengths in the *percentage* form: thus, "proof" being 100, "overproof" is 100 plus the o.p.; "underproof" is 100 minus the u.p. For example, 10 o.p. would be expressed 110; 10 u.p. as 90; and so on.

EXAMPLES.—(*Continued*):—

EXAMPLE (*e*).—A spirit is worth 14/2 a gallon at 20 o.p; how much is it worth at Proof?

Answer 11/9½.

SETTING ON RULE:—

I 11/9½	14/2 I
J Proof	20 o.p. J

KEY.—We set 14/2 to 20 o.p.; then over "Proof" we find 11/9½.

EXAMPLE (*f*).—A spirit is worth 5/6 a gallon at 30 o.p.; how much is it worth at Proof?

Answer 4/2¾.

SETTING ON RULE:—

I 4/2¾	5/6 I
J Proof	30 o.p. J

KEY.—We set 5/6 to 30 o.p.; then over "Proof" we find 4/2¾.

EXERCISES.

A Spirit that is Worth	Is Worth
3/8 a gallon @ 35 o.p.	2/0½ @ 25 u.p.
3/7 " " 15 u.p.	4/2½ " Proof
15/- " " 22 o.p.	10/2½ " 17 u.p.
18/6 " " 5 o.p.	15/6 " 12 u.p.

PRICING.

(SIMPLE PROPORTION: *Use the lines* A *and* B *on the Rule.*)

Gauge or Yield	:	1	: :	Total Cost (in Shillings)	:	Price (in Shillings)

EXAMPLE.—A Pipe of Port ne 42° costs £85 in Bond.

[Reckoning the standard gauge of 115 gallons, the average yield of 56 dozens, and the Duty, say £17 6s. 0d.]

WHAT IS THE PRICE

PER GALLON IN BOND P
(*Answer* 6/1)

Gallons. Gallon. Shillings. s. d.
115 : 1 :: 700 : 6/1

SETTING ON RULE:—

A 6·09	1 A
B 700	115 B

NOTE—·09 of a shilling=1d., found by multiplying mentally by 12.

PER GALLON DUTY PAID P
(*Answer* 9/1)

Gallons. Gallon. Shillings. s. d.
115 : 1 :: 1046 : 9/1

SETTING ON RULE:—

A 9·09	1 A
B 1046	115 B

NOTE—·09 of a shilling=1d., found by multiplying mentally by 12.

PER DOZEN IN BOND P
(*Answer* 12/6)

Dozens. Dozen. Shillings. s. d.
56 : 1 :: 700 : 12/6

SETTING ON RULE:—

A 1	12·5 A
B 56	700 B

NOTE—·5 of a shilling=6d., found by multiplying mentally by 12.

PER DOZEN DUTY PAID P
(*Answer* 18/8)

Dozens. Dozen. Shillings. s. d.
56 : 1 :: 1046 : 18/8

SETTING ON RULE:—

A 1	18·7 A
B 56	1046 B

NOTE—·7 of a shilling=8d., found by multiplying mentally by 12.

KEY.—We set the 1st term to the 2nd, then over the 3rd term we find the Answer.

PROOFING.

DIRECT METHOD.—*Set the Strength on* BB *to "Proof" on* AA; *then under the ullage on* A *will appear the Proof-quantity on* B.

Gallons. o.p. Proof.
EXAMPLE (*a*). 38·0 @ 5·0 = 39·9

SETTING ON RULE:—

AA Proof	38 A
BB 5 o.p.	39·9 B

KEY.—We set 5 o.p. to "Proof"; then under 38 we find 39·9, the proof-quantity.

Gallons. u.p. Proof.
EXAMPLE (*b*). 56·2 @ 12·0=49·4

SETTING ON RULE:—

AA Proof	56·2 A
BB 12 u.p.	49·4 B

KEY.—We set 12 u.p. to "Proof"; then under 56·2 we find 49·4, the proof-quantity.

INDIRECT METHOD.—*Set the strength on* B *to 10 on line* A; *then under the ullage will appear the quantity to add or deduct, according as the spirit is o.p. or u.p.*

Gallons. o.p. Proof.
EXAMPLE (*a*) 38·0 @ 5·0 = 39·9

SETTING ON RULE:—

A 38	10 A
B 1·9	5 B

KEY.—We set 5 to 10; then under 38 we find 1·9, the required *addition* to the ullage to make the Proof.

Gallons. u.p. Proof.
EXAMPLE (*b*) 56·2 @ 12·0 = 49·4

SETTING ON RULE:—

A 56·2	10 A
B 6·8	12 B

KEY.—We set 12 to 10; then under 56·2 we find 6·8, the required *deduction* from the ullage to make the Proof.

EXERCISES.

Ullage.	Strength.	Proof.
28·6	14·5 o.p.	32·7
34·8	9·4 u.p.	31·5
59·6	17·2 o.p.	69·8
59·6	17·2 u.p.	49·3
108·5	5·6 o.p.	114·5

NOTE.—The *direct* method is recommended for Stocktaking purposes; the *indirect* for Duty purposes.

STOCKTAKING.

LYING CASKS.—*Set the Bung on* C *to* 100 *on* D; *then under the Wet-Inches will appear the Segment. Set this Segment to* 10 *on line* A; *then under the Content will appear the ullage quantity in the Cask.*

EXAMPLE.—Find the ullage of a Lying Cask from the following particulars:—

Bung	Wet	Content
26·4	17·5	55

Answer 39·5 galls.

SETTINGS ON RULE:—

1st

C	17·5	26·4	C
D	72	100	D

2nd

A	55	10	A
B	39·5	72	B

KEY.—We set the Bung 26·4 to 100 on D, and find that Wet 17·5 shows 72 Segment. Setting this Segment to 10 on line A, we find that 55 Content gives 39·5 ullage.

STANDING CASKS.—*Set the Length on* C *to 100 on* E; *then under the Wet-Inches will appear the Segment. Set this Segment to 10 on line* A; *then under the Content will appear the ullage quantity in the Cask.*

EXAMPLE.—Find the ullage of a Standing Cask from the following particulars:—

Length	Wet	Content
25·0	18·0	28

Answer 20·7 galls.

SETTINGS ON RULE:—

1st

C	18	25	C
E	74	100	E

2nd

A	28	10	A
B	20·7	74	B

KEY.—We set the Length 25 to 100 on E, and find that Wet 18 shows 74 Segment. Setting this Segment to 10 on line A, we find that 28 Content gives 20·7 ullage.

EXERCISES.

Bung.	Wet.	Content.	Ullage.
17·1	13·6	14	12·2
21·0	18·1	28½	26·7
26·4	17·5	55	39·5
34·1	30·9	110	106·3

EXERCISES.

Length.	Wet	Content	Ullage
23·8	17·0	18¼	13·3
25·0	18·0	28	20·7
27·8	18·4	30½	20·4
32·5	25·0	56	44·2

NOTE.—When reading Contents or Ullages over 100 gallons, observe the directions given on page 3.

REFERENCE TABLE.

WINE.		* Standard Gauge.	* Average Yield.	DUTY. † n.e. 30° @ 1/3	DUTY. † n.e. 42° @ 2/-
		GALLONS.	DOZENS.	£ s. d.	£ s. d.
Lisbon	PIPE	117	57	7 6 7	17 11 10
Bucellas	,,	117	57	7 6 7	17 11 10
Calcavellos ..	,,	117	57	7 6 7	17 11 10
Port	,,	115	56	7 4 1	17 5 10
Tarragona ..	,,	115	56	7 4 1	17 5 10
Sherry	BUTT	108	52	6 15 3	16 4 9
Tent	,,	108	52	6 15 3	16 4 9
Teneriffe	PIPE	100	48	6 5 3	15 0 9
Marsala	,,	93	45	5 16 6	13 19 8
Madeira	,,	92	44	5 15 3	13 16 8
Cape	,,	92	44	5 15 3	13 16 8
Claret	HHD	47	23	2 18 11	—
Burgundy....	,,	47	23	2 18 11	—
Rhenish	AUM	30	14½	1 17 7	—
Hock.....	,,	30	14½	1 17 7	—
Moselle.....	,,	30	14½	1 17 7	—

NOTES.

* These are the standards and averages *commonly recognised by the* Trade, but do not necessarily indicate the *actual output.* The Rule, however, calculates independently from *any* gauge or yield.

† The amounts in these two columns are calculated at *present* Duty-rates (1902), and include the Customs Charges of 5/- per cent.

SELLING.

PROFIT.

~~Set the cost-price on~~ I to "Par" on K; then over the desired gain per cent will appear the selling-price.

EXAMPLE (*a*).—Bought at 13/8 a gallon, and desire to make 35 °/₀ profit. What must be the selling-price?

Answer 18/5½

SETTING ON RULE:—

I	13/8	18/5½	I
K	Par	Profit 35 °/₀	K

KEY.—We set 13/8 to "Par," then over 35°/₀ profit is found 18/5½, the selling-price.

EXAMPLE (*b*).—I buy at 13/8 a gallon, and sell at 18/5½. What do I gain per cent?

Answer 35 °/₀

SETTING ON RULE:—

I	13/8	18/5½	I
K	Par	Profit 35°/₀	K

KEY.—We set 13/8 to "Par"; then under 18/5½ is found 35 °/₀ Profit.

EXERCISES.

Cost Price.	Desired Profit.	Selling Price.
4/6	25°/₀	5/7½
17/2	15°/₀	19/9
16/6	40°/₀	23/1

DISCOUNT.

Set the nominal selling price on I to "Par" on K; then over the stipulated rate of discount will appear the net selling price.

EXAMPLE (*a*).—I sell at 18/5 a gallon, subject to 5°/₀ discount. What do I *net*?

Answer 17/6.

SETTING ON RULE:—

I	17/6	18/5	I
K	5°/₀ Discount.	Par.	K

KEY.—We set 18/5 to "Par"; then over 5°/₀ Discount is found 17/6, the net price.

EXAMPLE (*b*).—I sell nominally at 18/5 a gallon, but net only 17/6. What rate of discount is that?

Answer 5°/₀.

SETTING ON RULE:—

I	17/6	18/5	I
K	5°/₀ Discount.	Par.	K

KEY.—We set 18/5 to "Par"; then under 17/6 is found 5°/₀ Discount.

EXERCISES.

Nominal Selling-price.	Rate of Discount.	Net Selling-price.
5/9	10°/₀	5/2¼
19/-	6½°/₀	17/9
21/6	5°/₀	20/5

EXAMPLE (*f*)—How much water is required to reduce 120 gallons of strong spirits from 62 o.p. to proof, *allowing for contraction in bulk*?

Answer, 79·8.

[or, 79 galls, 6½ pints.]

SETTING ON RULE:-

G	†	Spirit 120	G
H	62	Water 79·8	H

KEY. 62 + 0 = 62. We therefore set 62 to the "proof" mark at the left hand extremity of line G; then under 120 we find 79·8, the *true* water required.

[Line L tells us that 8 tenths = 6½ pints.]

Referring to EXAMPLE (*f*), *opposite*:—

120·0 Spirit.
79·8 Water.

The *apparent* bulk is 199·8; what is the *true* bulk?

Answer, 194·4

SETTING ON RULE:—

AA	62 o.p.	Bulk 194·4	A
BB	Proof.	Spirit 120	B

KEY.—We set Proof to 62 o.p.; then over 120 spirit we find 194·4, the *true* bulk measurement of the mixture.

[The contraction, therefore = 5·4 gallons, or, 5 galls, 3¼ pints.]

GENERAL EXERCISES.

STRENGTH.		QUANTITY.		BULK.		Extent of "Contraction"
Present Strength.	Required Strength.	Spirit.	Water.	Apparent Bulk.	True Bulk.	
O.P.	U.P.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.
23·0	17·0	68·0	34·1	102·1	100·9	1·2
22·4	12·0	56·5	23·0	79·5	78·8	0·7
5·3	18·5	21·6	6·5	28·1	27·9	0·2
35·7	Proof	230·4	87·1	317·5	313·5	4·0
68·0	Proof	50·0	36·5	86·5	84·0	2·5

[*See Page 14.*] **REDUCING.**—*Continued*

EXAMPLE (*d*).—How much water is required to reduce 40 gallons of Rum from 35 o.p. (actual) to 20 u.p. (actual)—*allowing for contraction in bulk?*

Answer 28·7

[or, 28 gallons 5¾ pints].

SETTING ON RULE:—

G 40 Spirit.	20 u.p.	G
H 28·7 Water.	55	H

KEY. 35 + 20 = 55. We therefore set 55 to 20 u.p. at the *right hand* position; then under 40 we find 28·7, the *true* water required.

[Line L tells us that 7 tenths = 5¾ pints].

Referring to EXAMPLE (*d*), *opposite*:—

40·0 Spirit.
28·7 Water.

The *apparent* bulk is 68·7; what is the *true* bulk?

Answer 67·5

SETTING ON RULE:—

AA 35 o.p.	Bulk 67·5	A
BB 20 u.p.	Spirit 40	B

KEY.—We set 20 u.p. to 35 o.p.; then over 40 spirit we find 67·5, the *true* bulk measurement of the mixture.

[The *contraction* therefore = 1·2 gallons; or, 1 gallon 1½ pints.]

EXAMPLE (*e*).—How much water is required to reduce 52 gallons of Whiskey from 5 u.p. to 17 u.p.—*allowing for contraction in bulk?*

Answer 7·8

[or, 7 gallons 6½ pints.]

SETTING ON RULE:—

G	17 u.p	Spirit 52 G
H	12	Water 7·8 H

KEY. 17—5 = 12. We therefore set 12 to 17 u.p. at the *middle* position; then under 52 we find 7·8, the *true* water required.

[Line L tells us that 8 tenths = 6½ pints.]

(*See footnote, page 14.*)

Referring to EXAMPLE (*e*), *opposite*:—

52·0 Spirit
7·8 Water.

The *apparent* bulk is 59·8; what is the *true* bulk?

Answer 59·6

SETTING ON RULE:—

A 59·6 Bulk.	95	A
B 52 Spirit.	83	B

KEY.—We make an exceptional setting for this case—*a reducing from U.P. to a further degree U.P.* We set the reduced strength °/₀ (83) to the original strength °/₀ (95); then over 52 spirit we find 59·6 the *true* bulk measurement.

[The *contraction* therefore = 0·2 gallons; or, 1½ pints.]

SELLING.

PROFIT AND DISCOUNT COMBINED.

Set the cost-price on I *to the rate of discount on* K; *then over the required gain per cent. will appear the nominal selling-price.*

EXAMPLE (*a*).—A spirit costs me 18/- a gallon. What price should I *ask* for it, so that I may be enabled to make 16 °/₀ Profit, and yet allow 5 °/₀ Discount? **Answer 22/-.**

SETTING ON RULE:—

I 18/-	22/-	I
K 5 °/₀ Discount	Profit 16 °/₀	K

KEY.—We set 18/- to 5 °/₀ Discount; then over 16 °/₀ Profit we find 22/-, the *asking* price.

EXAMPLE (*b*).—A spirit costs me 18/- a gallon, and I *ask* 22/- for it, subject to a discount of 5 °/₀. What profit do I make myself?

Answer 16 °/₀.

SETTING ON RULE:—

I 18/-	22/-	I
K 5 °/₀ Discount	Profit 16 °/₀	K

KEY.—We set 18/- to 5 °/₀ Discount; then under 22/- we find 16 °/₀ the net profit.

EXERCISES.

Cost Price.	Expected Profit.	Discount to Customer.	Asking Price.
5/-	30 °/₀	2½ °/₀	6/8
15/-	25 °/₀	6¼ °/₀	20/1
17/6	20 °/₀	5 °/₀	22/1

WHOLESALE TRANSACTIONS.

Arrange the terms of the given proportion, using the lines A *and* B *on the rule. Set the 1st term to the 2nd; then over the 3rd term will be found the Answer.*

EXAMPLE (*a*).—Bought goods for £175, and want to gain 20 °/₀ profit. What must be the selling price?

Answer £210.

TERMS STATED:—

£ 100 : £ 120 :: £ 175 : £ 210

SETTING ON RULE:—

A 120	210	A
B 100	175	B

EXAMPLE (*b*).—Bought goods for £175, and want to gain 20 °/₀ *after allowing 5 °/₀ discount.* What must be the selling price?

Answer £221.

TERMS STATED:

£ 95 : £ 120 :: £ 175 : £ 221

SETTING ON RULE:—

A 120	221	A
B 95	175	B

EXAMPLE (*c*).—Bought goods for £175, and sold for £210. What is the gain per cent?

Answer 20 °/₀

TERMS STATED:—

£ 175 : £ 100 :: £ 35 : £ 20

SETTING ON RULE:—

A 20	100	A
B 35	175	B

LESSENING.

[SIMPLE PROPORTION: *Use the lines* A *and* B *on the rule.*]

The required value of the mixture. * The value of the article proposed to be added.	:	The present value * The required value of the mixture.	: :	The quantity of stuff in hand.	:	The quantity of the cheaper stuff to be added.

EXAMPLE:—I have 60 gallons of spirit worth 16/3 a gallon. How much spirit worth 11/6 a gallon must I *add* to it to produce a mixture worth 14/- a gallon?

Answer 54 gallons

TERMS STATED:—

14/-	16/3
11/6	14/-
2/6	2/3
(or) pence	(or) pence

30 : 27 : : 60 : 54

SETTING ON RULE:—

A	27	54	A
B	30	60	B

KEY.—*We set the 1st term to the 2nd; then over the 3rd term we find the Answer.*

* *Subtract the one from the other.*

EXAMPLE (*b*).—How much water is required to reduce 36·2 gallons of Whiskey from 24 o.p. to Proof—*allowing for contraction in bulk?*

Answer 9·2
[or, 9 gallons 1½ pints].

SETTING ON RULE:—

G	Proof.	Spirit 36·2	G
H	24	Water 9·2	H

KEY. 24+0=24. We therefore set 24 to "Proof" at the *middle* position, then under 36·2 we find 9·2, the *true* water required.

[Line L tells us that 2 tenths = 1½ pints.]

Referring to EXAMPLE (*b*), *opposite*:—

36·2 Spirit.
9·2 Water.

The *apparent* bulk is 45·4; what is the *true* bulk?

Answer 44·9

SETTING ON RULE:—

AA	24 o.p.	Bulk 44·9	A
BB	Proof.	Spirit 36·2	B

KEY.—We set "Proof" to 24 o.p.; then over 36·2 spirit we find 44·9, the *true* bulk measurement of the mixture.

[The contraction, therefore = 0·5 gallon; or, ½ gallon.]

EXAMPLE (*c*).—How much water is required to reduce 26·5 gallons of Whiskey from Proof to 12 u.p.—*allowing for contraction in bulk?*

Answer 3·7
[or, 3 gallons 5¾ pints.]

SETTING ON RULE:—

G	12 u.p.	Spirit 26·5	G
H	12	Water 3·7	H

KEY. 0 + 12 = 12. We therefore set 12 to 12 u.p. at the *middle* position; then under 26·5, we find 3·7, the *true* water required.

[Line L tells us that 7 tenths = 5¾ pints.]

Referring to EXAMPLE (*c*), *opposite*:—

26·5 Spirit.
3·7 Water.

The *apparent* bulk is 30·2; what is the *true* bulk?

Answer 30·1

SETTING ON RULE:—

AA	Proof.	Bulk 30·1	A
BB	12 u.p.	Spirit 26·5	B

KEY.—We set 12 u.p. to Proof; then over 26·5 spirit we find 30·1, the *true* bulk measurement of the mixture.

[The contraction, therefore = 0·1 gallon; or, ¾ pint.]

REDUCING.

NOTE.—*It should always be remembered that a Contraction in Bulk takes place when spirits and water are mixed together. To meet this "Contraction," an increased quantity of water is required—the calculation of which must be based on the specific gravity system. This the Rule does automatically.*

TO FIND THE TRUE WATER.

Set the *sum* * of the two strengths on H, to the required strength on G, according to directions specified on the Rule. Then under the quantity of spirit will appear the *true* water required—*allowing for contraction in bulk.*

EXAMPLE (*a*).—How much water is required to reduce 28 gallons of Whiskey from 13 o.p. to 17 u.p.—*allowing for contraction in bulk?*

Answer 10·5

[or, 10 gallons 4 pints.]

SETTING ON RULE:—

G	17 u.p.	Spirit 28 G
H 30		Water 10·5 H

KEY. 13+17=30. We therefore set 30 to 17 u.p. at the *middle* position; then under 28 we find 10·5, the *true* water required.

[Line L tells us that 5 tenths =4 pints.]

TO FIND THE TRUE BULK.

Set the reduced strength on BB to the original strength on AA; then *over* the original quantity of spirit on B will appear the *true* bulk measurement of the mixture.

Referring to EXAMPLE (*a*), *opposite*:—

28·0 Spirit.
10·5 Water.

The *apparent* bulk is 38·5; what is the *true* bulk?

Answer 38·1

SETTING ON RULE:—

AA 13 o.p.	Bulk 38·1	A
BB 17 u.p.	Spirit 28	B

KEY.—We set 17 u.p. to 13 o.p; then over 28 spirit we find 38·1, the *true* bulk measurement of the mixture.

[The "Contraction" therefore =0·4 gall., or, 3¼ pints.]

*Set the *difference* instead of the *sum* when reducing from u.p. to a further degree u.p. Vide example (*e*).

INCREASING.

[SIMPLE PROPORTION: *Use the lines* A *and* B *on the rule.*]

The value of the article proposed to be added. * The required value of the mixture.	:	The required value of the mixture. * The present value.	::	The quantity of stuff in hand.	:	The quantity of the *dearer stuff* to be added.

EXAMPLE.—I have 60 gallons of spirit worth 11/6 a gallon. How much spirit worth 16/3 a gallon must I *add* to it to produce a mixture worth 14/- a gallon?

Answer 66·6 gallons.

TERMS STATED:—

16/3	14/-
14/-	11/6
2/3	2/6
(or) pence	(or) pence
27	30

27 : 30 :: 60 : 66·6

SETTING ON RULE:—

A	30	66·6	A
B	27	60	B

KEY.—*We set the 1st term to the 2nd; then over the 3rd term we find the Answer.*

* *Subtract the one from the other.*

PROPORTIONING.

NOTE.—*It should be more generally known that a Contraction in Bulk takes place when spirits and water are mixed together. To meet this "Contraction," an increased quantity of water is required—the calculation of which must be based on the specific gravity system. This the Rule does automatically.*

TO PROPORTION THE SPIRIT.

Set the required strength on BB to the present strength on AA; then under the total required bulk on A will appear the quantity of spirit to be drawn off.

EXAMPLE (*a*).—How much spirit at 20 o.p. is required to make up 4 gallons at 15 u.p.?

Answer 2·9
[or, 2 galls. 7¼ pints.]

SETTING ON RULE:—

AA 20 o.p.	Bulk 4 A
BB 15 u.p.	Spirit 2·9 B

KEY.—We set 15 u.p. to 20 o.p.; then under 4 gallons we find 2·9, the quantity of spirit required to be drawn off.

[Line L tells us that 9 tenth=7¼ pts.]

TO PROPORTION THE WATER.

Set the *sum* of the two strengths on H to the required strength on G, according to directions specified on the Rule. Then under the quantity of spirit will appear the *true* water required—*allowing for contraction in bulk*

EXAMPLE (*a*).—Having drawn off 2·9 spirit @ 20 o.p, find the balance of *water* required to make up 4 gallons @ 15 u.p.—*allowing for contraction in bulk.*

Answer 1·2
[or, 1 gall. 1½ pints.]

SETTING ON RULE:—

G [15 u.p.]	Spirit 2·9 G
H 35	Water 1·2 H

KEY. 20+15=35. We therefore set 35 to 15 u.p. at the *middle* position; then under 2·9 we find 1·2, the *true* water required.

[The "Contraction" therefore =0·1 gal., or ¾ pint.]

EXAMPLE (*b*).—How much spirit @ 22 o.p. is required to make up 12 gallons @ 17 u.p.?

Answer 8·2 [or, 8 gals. 1½ pts.]

SETTING ON RULE:—

AA 22 o.p.	Bulk 12 A
BB 17 u.p.	Spirit 8·2 B

KEY.—We set 17 u.p. to 22 o.p; then under 12 gallons we find 8·2, the quantity of spirit required to be drawn off.

(Line L tells us that 2 tenths=1½ pints.)

EXAMPLE (*b*).—Having drawn off 8·2 spirit @ 22 o.p., find the balance of water required to make up 12 gallons @ 17 u.p., *allowing for contraction in bulk.*

Answer 4 gallons
[or 4 gals. 0 pts.]

SETTING ON RULE:—

G [17 u.p.]	Spirit 8·2 G
H 39	Water 4·0 H

KEY. 22+17=39. We therefore set 39 to 17 u.p. at the middle position; then under 8·2 we find 4·0, the *true* water required.

(The "Contraction" therefore= 0·2 gal., or 1½ pints.

GENERAL EXERCISES.

Strength of the Spirit Used.	Required Strength.	Quantity to be Made Up.	True Proportions.				Extent of Contraction.	
			Spirit.		Water.			
		Gallons.	Gallons.	Pints.	Gallons.	Pints.	Gallons.	Pints.
21 o.p.	18 u.p.	25	17	0	8	2½	0	2½
34 o.p.	10 u.p.	50	33	5¾	17	1½	0	7¼
2 o.p.	17 u.p.	5	4	0¾	0	7¼	0	0½
24 2 o.p.	Proof	60	48	2½	12	2½	0	5
60 o.p.	Proof	50	31	2¼	20	1½	1	4