YEAST

and

FERMENTATION

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L G E

Growth of yeast in ethyl alcohol cultures under non-aerated condition using formula variety of yeast :—

Seeded on the 4th Dec. 1948 ; analysed on the 25th Feb '49. 18°c to 28°c.

	% of absolute added alcohol w.c.c. culti beginning.	gm. of ethyl alcohol added in the beginning.	gm. of ethyl alcohol left in the end.	gm. of ethyl alcohol used up.	gm. mol. of total acid produced.	gm. mol. of volatile acid produced	gm. mol of non-volatile acid produced.	% of acid formation.	gm. of yeast formed.	yield of yeast in pr. cent.	
	1	0·789	0·150	0·639	0·5250 ~~0·8700~~	0·0024	0·5226 ~~0·8676~~	66·54	0·3300	53·20.	
2.	2	1·578	0·150	1·428	0·9300	0·0012	0·9288	58·09	0·5418	37·94.	58·09.
3	3	2·367	0·100	2·267	1·0500	0·0010	1·0490	44·36	0·7490	31·64	44·36.
4	4	3·156	0·100	3·056	1·1300	0·0020	1·1280	35·74	0·9694	30·71	35·74.
5.	5	3·945	0·000	3·945	1·1637 ~~1·0300~~	0·0024	1·1613 ~~1·0276~~	26·10.	0·9098	23·66.	~~[illegible]~~ 29·50.

Int.

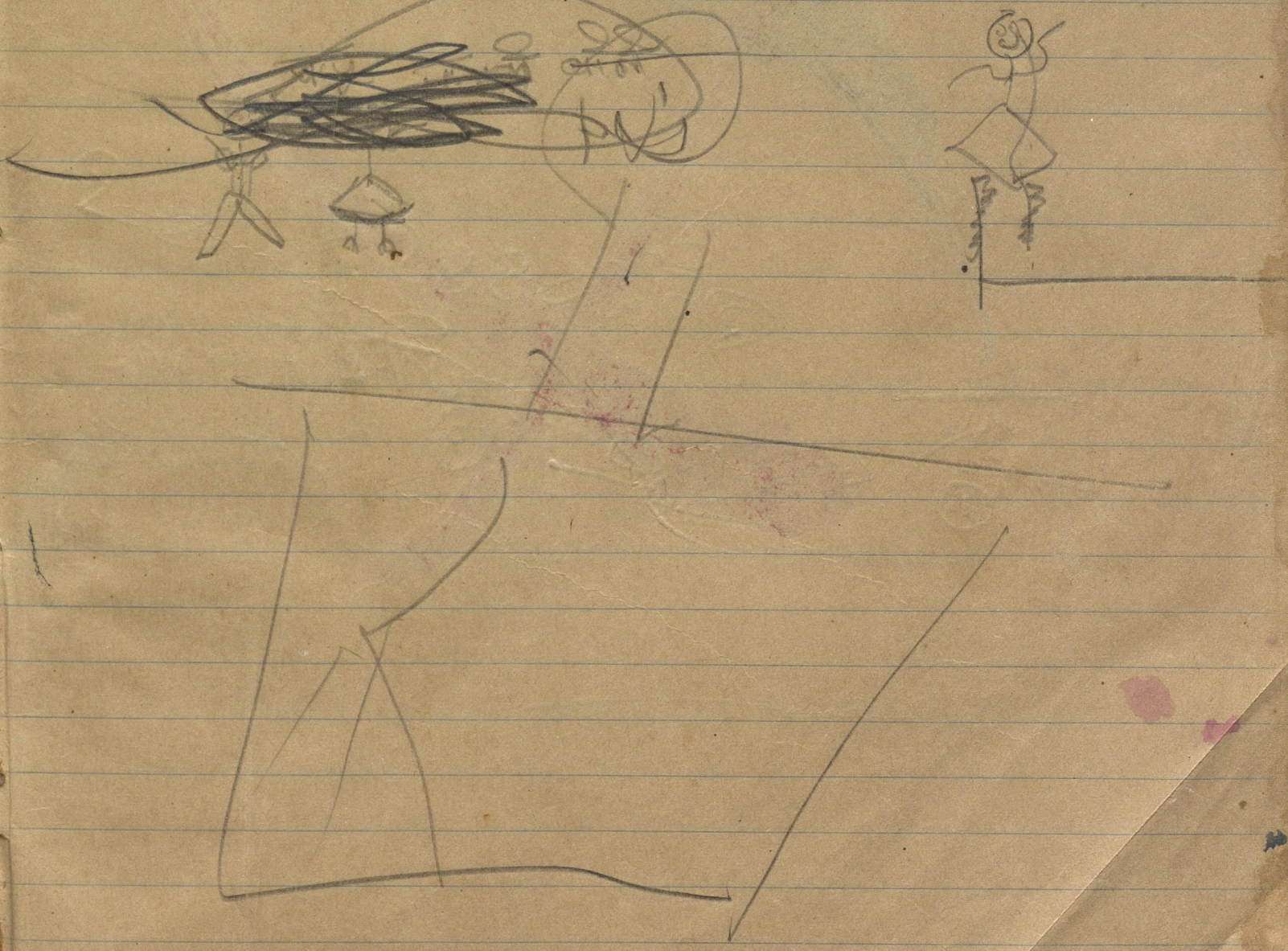
~~Chart No. 1.~~

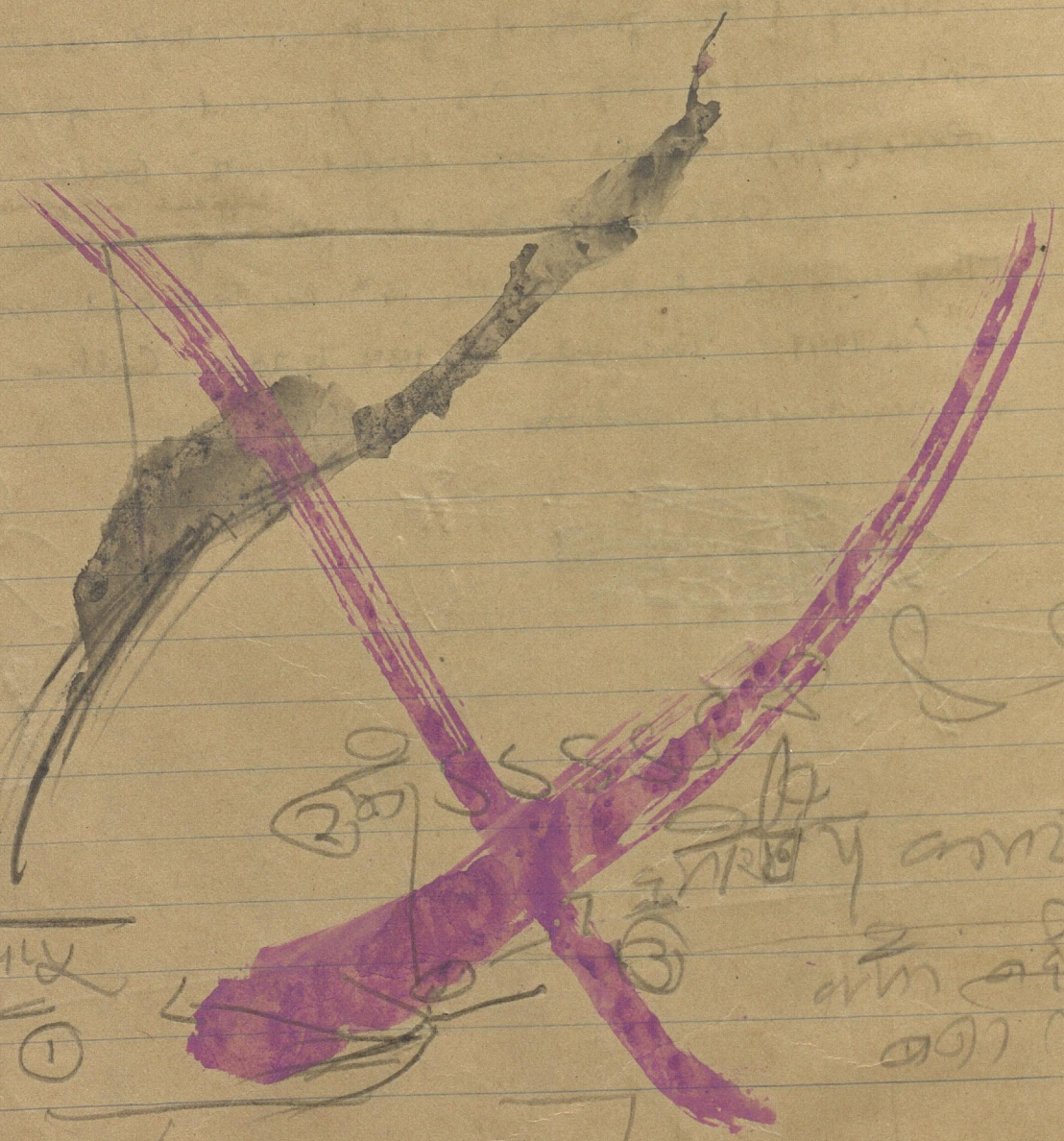
Table - No. 1.

Study of the growth of yeast in ethyl alcohol cultures containing 1%, 2%, 3%, 4% and 5% ethyl alcohol by volume (v/v). Cultures were seeded with Torula variety of yeast.

Culture contained ~~following~~ sufficient inorganic substances in each

They were seeded on the 4th Dec. 1948 and analysed on the 25th Feb 1949. Temperature 18°C to 28°C. Culture were subjected to non-aerated conditions.





Study of the effect of potassium hydrogen tartrate on the growth of Saccharomyces carlsbergensis variety of yeast in 10% sucrose culture under non-aerated condition.

Each culture contained the following inorganic salts.

Ammonium phosphate	–	3·5000 gm.
$MgCO_3$	–	0·0440 gm.
$CaCO_3$	–	0·0241 gm.
K_2SO_4	–	0·1008 gm.
NaCl.	–	0·0061 gm.
Zn. SO_4	–	0·025 gm.

Above substances were digested with hydrochloric acid till the ppt. just dissolved. The volume was finally made up to 100 c.c.

In 1st. flask. 2 gm. of potassium hydrogen tartrate was added.

" 2nd " 1·5 " " " " " " " "

" 3rd " 1·0 " " " " " " " "

" 4th " 0·5 " " " " " " " "

" 5th " 0·1 " " " " " " " "

" 6th " no " " " " " " " "

The culture were seeded on the 22nd. Feb '49 and analysed on the 9th. March '49.

Temperature – 26·5° to 30 °C

Effect of potassium hydrogen ~~phosphate~~ tartrate on the culture of under non-aerated condition.

Seeded on the 22nd Feb. 1949.

Experiment no.	gms. of potassium hydrogen tartrate per 100 c.c.	gms. of sugar fermented in 100 c.c.	gm. of sugar left unfermented in 100 c.c.	gm. of reducing sugar in 100 c.c.	gm. of non-reducing sugar in 100 c.c.	per centage of the sugar used up in fermentation	gm. mol. of total acid produced in 100 c.c. of culture.	gm. of volatile acid
1.	Control	6·1535	3·8461	3·6232	0·2229	61·53	0·52	0·04
2.	0·10	5·8520	4·1480	2·8571	1·2909	58·52	0·56	0·04
3.	0·50	5·1457	4·8543	2·4271	2·4272	51·46	0·84	0·01
4.	1·00	6·5750	3·4246	1·0000	2·4246	65·75	0·92	0·05
5.	1·50	6·9513	3·0487	0·2000	2·8487	69·51	0·94	0·04
6.	2·00	7·1429	2·8571	0·1000	2·7571	71·43	0·96	0·04

Conclusion -

(1) In the presence of potassium hydrogen tartrate ~~left~~ sugar in yeast cultures is mostly present in the culture in non-reducable form, while in culture containing no potassium hydrogen tartrate most of the non-reducing sugar, sucrose, previously added in the culture as yeast food is hydrolysed to reducing sugars.

(2) The fermentation decreases as the percentage of potassium hydrogen tartrate in sucrose cultures increases in the culture up to 0·5 % i. It is 51·46 per cent when 0·5 per cent. of the above salt is present in the culture as compared to 61·53 in the control experiment. But as the concentration of this salt in the culture increases the fermentation of sugar also increases and

Table No. 2.

Saccaromyces Carlsbergensis variety of yeast in 10 per. cent. sucrose solution.

Analysed on the 9th ~~Feb~~ March '49. Tempt. 28·5°c to 30°c.

(experiments carried at in 150 c.c. conical flasks)

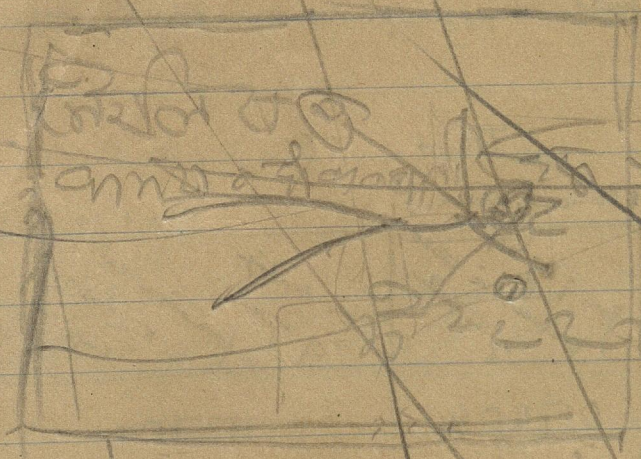
Chart no. 2.

in 100 c.c.	gm. of non-volatile acid in ~~100~~ 100 c.c.	per cent. of acid produced in the culture on sugar formed	gm. of alcohol formed	per cent. of alcohol formed on sugar formed	gm. of yeast produced in 100 c.c. of the culture	per centage of yeast formation cal. on the basis of sugar used up in fermentation
	0·48	8·45	1·87	30·38	0·7204	11·70
	0·52	9·39	1·72	29·39	0·7800	13·33
	0·83	16·32	1·07	20·79	0·9294	18·06
	0·87	13·99	1·65	25·09	1·0770	16·38
	0·90	13·51	1·76	25·32	0·9580	13·79
	0·92	13·58	2·39	33·46	0·9270	12·97

it becomes 71·43 per cent. if 2·0 per. cent. of the salt is present in the culture.

(3) Increasing the per centage of potassium hydrogen tartrate in sucrose the cultures increased per centage of acid formation is observed. It is 8·45% in control as compared to 16·32 per cent if 0·5 per cent of salt is present in the culture. But further increase of the salts does not have any substantial influence in acid formation in alcohol formation.

(4) Remarkable decrease is observed if a small amount of potassium hydrogen tartrate is present in sucrose cultures. e.g. it is 20·79 per cent if 0·5 per. cent. of salt is present in the culture as calculated on the basis of sugar consumed compared to 30·38 in the control experiment. But further increase of the salt in the culture increases alcohol formation and it bec



33·46% if 2·0 pr cent. of the salt is added in the culture.

(5) Small dozes of potassium hydrogen tartrate has beneficial effect on the yeast growth. If such is used as source of carbon it is 18·06 pr cent if 0·5 % pr cent of the above salt is present in the culture as compared to 11·70 in the case of control experiment. But as the pr centage of the salt in the culture increases so as growth of yeast decreases and it is only 12·97 if 2·0 pr centage of the salt is present in the culture.

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Growth of Torula and Saccaromyces carlsbergensis varieties of yeast in 0·5, 1·0, 2·0, and 3·0 % v/v of ethyl alcohol cultures under non aerated conditions.

Seeded on the 3rd. March 1949.

Analysed on the 16th/17th. March 1949.

Table No. 3.

Temperature – 25·5°C to 28·5°C.

Experiments carried out in 100 c.c. flat bottom flasks.

Chart. No 3.

Concentration of ethyl alcohol v/v	Name of the yeast.	gm. of ethyl alcohol present in the 100 c.c. of the culture in the beginning.	gm. of ethyl alcohol lost only due to the evaporation during the process of formation in 100 c.c.	gms of alcohol left unused up in 100 c.c. of the culture	gms alcohol consumed by the yeast and in oxidation	gm. wt. of Total Acid gms during the growth in 100 c.c.	gm. wt of volatile acid gms in the 100 c.c. of culture.	gms. of yeast formed in 100 c.c. of the culture.	percentage of acid production. (Calculation on the basis of alcohol consumed)	percentage of yeast formation. (Calculation on the basis of alcohol consumed)
0·5	Torula	0·399	~~0·25~~ 0·249	0·075	0·073	~~0·0875~~ 0·0675	0·010	0·0740	~~118·00~~ 90·00	~~98·66~~
	Saccaromyces carlsbergensis.	0·399	0·249	0·010	0·140	0·0175	0·005	0·0760	12·50	~~94·44~~
1·0	Torula	0·798	0·268	0·36	0·17	0·0550	0·030	0·0820	32·35	48·23
	S. Carlsbergensis.	0·798	0·268	~~0·41~~ 0·31	~~0·12~~ 0·22	0·0350	0·005	0·0998	29·16	~~93·16~~ 45·32
2·0	Torula.	1·596	0·316	0·56 ~~0·56~~ 0·72	0·56 0·72	0·1100	0·020	0·1920	19·64	~~34·44~~ 28·05
	S. Carlsbergensis.	1·596	0·316	~~0·38~~ 0·90	0·38	0·0500	0·005	0·1606	13·16	~~42·26~~ 17·75
3·0	Torula.	2·394	1·934	0·79	0·67	0·2750	0·075	0·2628	41·34	~~29·22~~ 39·20
	S. carlsbergensis.	2·394	1·934	0·73	0·73	0·2450	0·130	0·2586	33·56	35·42

Repeat
another
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Table No 4.

Study of the growth of ~~a~~ ~~torula~~ torula and Saccaromyces calsberengesis in 4%, 5% and 6% ethyl alcohol cultures containing all other necessary inorganic materials ~~and~~ under non-aerated conditions.

Seeded on the 3rd March 1949.

Analysed on the 18th March 1949.

Temperature – 25·5°c to 29·2°c.

(Experiments carried out in 100c.c. ~~flat~~ bottom flasks) Chart no. 4.

Concentration of ethyl alcohol in the culture w/v in the begining.	Name of the varity of yeast grown	gm. of ethyl alcohol originally present in 100c.c. of the culture.	gm. of alcohol lost by the culture only due to evaporation per 100c.c. of culture.	gm. of alcohol left unused at the end of the experiment.	gms. of ethyl alcohol consumed by the yeast.	gm. mol. of total acid generated during the process.	gm. mol. of the volatile acid produced in the culture.	percentage of acid formation.	gms. of yeast grown in 100c.c. of the culture.	percentage of yeast yield in the culture.
4·0	Torula	3·184	2·054	0·53	0·60	0·2200	0·030	36·66	0·3364	56·00
	Saccaromyces Calsberengesis	3·184	2·054	0·42	0·71	0·2700	0·035	38·02	0·2990	42·11
5·0	Torula	3·980	1·250	1·39	1·34	0·1850	0·055	13·80	0·3310	24·70
	S. Carlsberengesis.	3·980	1·250	1·24	1·49	0·2750	0·090	18·45	0·2830	19·00
6·0	Torula	4·776	2·526	1·50	1·70	0·1900	0·030	11·21	0·3056	17·90
	S. carlsberengesis.	4·776	2·526	1·13	1·12	0·3300	0·145	29·46	0·3300	29·68

RANGANA

Ranyana is a very bad girl

Study of the effect of $ZnSO_4$ on yeast growth, alcohol formation, acid production and sugar fermentation if Saccaromyces carlsberengensis and Torula varities of yeast are grown in it at 5 per cent concentration of sucrose solution under non-aerated condition.

Seeded on the 7th March '49.

Analysed on the 24th March '49.

Temperature - 29·1°C — 24·8°C.

(experiment carried out in 150 c.c. flat bottom flasks.)

Table No 5.

Chart No. 5.

S.N.	Name of the yeast.	Amount of $ZnSO_4$ in gm. % 100 c.c. of the culture.	gm. of total sugar left unfermented in 100 c.c. of the culture	gm. of reducing sugar present in 100 c.c. of the culture.	gm. of non-reducing sugar in the 100 c.c. of culture	% of fermented sugar.	gm. mol. of total acid generated in the culture.	gm. mol of volatile acids produced in the culture.	% of acid.	gm. of alcohol formed in the 100 c.c. of culture.	% of alcohol.	gm. of yeast in 100 c.c.	yield of yeast in per cent.
1.	Torula	nil	3·44	3·44	0·00	31·20	0·34	0·020	21·7%	0·16	10·25.	0·5217	33·46
2.	S. Carlsberengensis	nil	0·63	0·63	0·00		0·31	0·025		1·04		0·4220	9·26
1.	Torula.	0·025	3·66	3·64	0·02	27·20	0·54	0·120	39%	0·09	6·39.	0·4871	35·81
2.	S. carlsberengensis	0·025	1·30	0·97	0·33	9·80	0·40	0·070		0·44		0·4334	11·71.
1	Torula.	0·460	4·51	4·17	0·34	3·04.	0·42	0·010	83·7%	0·02	4·08.	0·3762	77·85.
2	S. carlsberengensis	0·460.	4·11	3·56.	0·55		0·53	0·08.		0·23.		0·4141	46·52

Conclusion:—

(1) Presence of zinc sulphate in the yeast culture checks sugar fermentation in the culture.

(2) Excess amount of zinc sulphate in the culture of yeast increases yeast yield.

Table No 6.

Growth of Saccaromyces carlsberengensis and torula in a 5 % v/v of ethyl alcohol culture under non-aerated condition:—

Seeded on the 7th March '49.

Analysed on the 24th March '49

Temperature variations 25·4°C 29·1°C.

(experiments carried out in 150 c.c. pyrex flat bottom flasks.)

Chart no 5.

S.N.	Variety of yeast under experiment.	gm. of $ZnSO_4$ in the culture	c.c. of ethyl alcohol per c.c.	gm. of ethyl alcohol in the beginning.	gm. of ethyl alcohol left in the culture	gm. of ethyl alcohol lost by evaporation.	gm. of ethyl alcohol consumed in the yeast growth.	gm. mol. of total acid produced.	gm. mol. of volatile acid produced.	gm. of yeast formed.	Percentage of yeast formation.
1	Torula	nil	5·0	3·970	~~2·58~~ 2·98	0·25	~~0·14~~ ~~1·14~~ ·74	0·310	0·015	0·3600 ?	48·5 ~~31·88~~ ~~125·13~~ ~~257·13~~
2	Torula	0·025	5·0	3·97	~~2·45~~ ~~2·05~~ 2·48	0·25	~~0·27~~ ~~1·67~~ 1·24	0·430	0·070	0·3734 ?	30·35 ~~138·29~~
1	Saccaromyces Carlsberengensis.	nil	5·0	3·97	~~2·45~~ 1·91	0·25	~~0·27~~ 1·63	0·300	0·020	0·3298 ?	20·00 ~~122·14~~
2.	S. Carlsberengensis.	0·025	5·0	3·97	1·96.	0·25	~~0·55~~ 1·76	0·450	0·070	0·2560	14·20 ~~46·55~~

Conclusion:—

(1) Presence of zinc sulphate in the culture decreases yeast formation but increases acid generation. In the previous experiments we have seen that if sugar is used as yeast food yield of yeast increases if zinc sulphate is added in the culture. This increases in growth of ~~in~~ yeast is associated with the decrease in fermenting ~~to~~ power of yeast. It therefore appears that in the previous case also zinc sulphate does not help ~~in~~ directly in growth of yeast but in checking sugar fermentation. And as ~~one~~ sugar very little sugar is wasted in alcohol conversion the yield of yeast appears to have increased.

Repeat

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Table No. 7.

Study of Mr. Chauhan's alkaloid on the yeast culture using 10% sucrose solution as yeast food under non-aerated condition.

Temperature variation 25·5°C to 27·5°C.

Seeded on the 12th March 1949

Analysed on the 26th March 1949.

(Cultures prepared in 250 c.c. flat bottom pyrex flasks) 100 c.c.

S. carlsbergensis.

S.N.	gm. of alkaloid in 100 c.c. of the culture.	gm. of reducing sugar left in the 100 c.c. of culture.	gm. of reducing sugar present in the culture.	gm. of total sugar present in the culture.	gm. of sugar consumed in fermentation.	gm. equ. of Tolune acid in 100 c.c. of culture.	gm. of volatile acid in the culture in 100 c.c.	Percentage of acid produced on the basis of sugar used.	gm. of alcohol formed in fermentation in 100 c.c.	Percentage of alcohol produced on the basis of sugar consumed.	gm. of yeast in 100 c.c. of the culture	Percentage of acid produced on the basis of sugar consumed.
1.	Control	3·282	0·016	3·298	6·702	0·60	0·02	8·95	1·06	15·81	0·9626	14·36
2.	0·001	3·236	0·062	3·398	6·602	0·61	0·02	9·24	0·86	13·02	0·9574	14·25
3.	0·002	3·105	0·083	3·188	6·812	0·66	0·02	8·88	1·06	15·56	0·9624	14·13
4.	0·003	2·968	0·097	3·065	6·935	0·60	0·02	8·93	1·23	13·73	0·9514	13·71

Study of the effect of fuchsine dye on the non-aerated condition.

Seeded on 19th March '49.

Analysed on 29th March '49.

S.N.	gm. of fuchsin in 100 c.c. ×10⁻⁴	gms. Total sugar left in the 100 c.c. culture	gm. of Reducing sugar present in 100 c.c.	gm. of non-reducing sugar in 100 c.c.	gm. of sugar consumed in fermentation	Percentage of Fermentation of sugar	gm. eqv. of Total acid in 100 c.c.	gm. eqv. of volatile acid in 100 c.c.	Percentage of acid from cal. on the basis of sugar consumed	gm. of ethyl alcohol in 100 c.c. of culture	Percentage of alcohol produced cal. on the basis of sugar consumed	gm. of yeast in 100 c.c. of the culture	Percentage of yeast growth cal. on the basis of sugar consumed
1	0.00000	6.70	5.20	1.50	3.30	33.00	0.6666	0.0320	20.20	0.16	5.00	0.6820	20.45
1	0.000025 (decolourised by fermentation)	8.36	6.86	1.50	1.64	16.40	0.4324	0.0276	26.21	0.69	44.07	0.7356	44.85
2	0.000250	7.76	6.86	0.90	2.24	22.40	0.4232	0.0184	18.75	0.58	25.89	0.7440	33.21
3	0.000500	6.86	6.81	0.05	3.14	31.40	0.4232	0.0273	13.37	0.53	16.87	0.7694	24.50
4	0.001000	7.66	7.18	0.48	2.82	28.20	0.4324	0.0184	15.24	0.44	15.67	0.7862	24.36

(1) Presence of fuchsin dye in the culture increases the sugar consumption and fermentation of the yeast up to the concentration of 5×10^{-5} per cent after which it decreases.

(2) Fuchsin dye is reduced to leuco-rosaniline and the intensity of the color of the solution decreases as the fermentation proceeds in the culture. The culture containing 1.25×10^{-4} gm of fuchsin is completely decolourised in 10 days.

Table No-8.

Torula variety of yeast in 10 per cent sugar culture under

Temperature variations 26.4°c to 29.8°c.

(cultures prepared in 150 c.c. conical flasks)

(3) Although there is not much change in the actual production of acid and yeast in the cultures containing increasing amounts of fuchsin the percentage yield of them show a good rise because this value is calculated on the basis of sugar consumed in fermentation.

(4)

Table No. 9.

Study of the effect of Potassium hydrogen tartrate on the growth of ~~yea~~ Torula variety of yeast in cultures containing ethyl alcohol (5% v/v) as food material under non-aerated condition.

Seeded on the 14th March '49.

Analysed on the 31st March '49.

Temperature variation 26·8°C to 31·5°C.

(Cultures prepared in 150 c.c. conical flasks)

	gm. of potassium hydrogen tartrate in 100 c.c.	gm. of alcohol in the control experiment per 100 c.c.	gm. of alcohol in ~~the~~ 100 c.c. of the culture.	gm. of alcohol consumed in yeast growth.	gm. eq. of Total acid in 100 c.c. of the culture.	gm. eq. of volatile acid in 100 c.c. of the culture.	Percentage of acid production calculated on the basis of alcohol consumed.	gm. of ~~[illegible]~~ Yeast formed in 100 c.c.	Percentage of yeast formed cal. on the basis of alcohol consumed.
1	nil (control)	3·54	2·39	1·15	0·4277	0·0520	37·19	0·3596	31·27
2	0·50	3·54	2·39	1·15	0·5541 ~~[illegible]~~	0·0094	47·31	0·4750	41·30

and thus ~~[illegible]~~ greater oxidation of ethyl alcohol but by ~~the~~ some internal biochemical oxidations ~~of~~ the alcohol ~~to a greater degree~~, ~~as~~ This is ~~seen~~ confirmed by the fact as ~~greater~~ larger amount of organic acid is seen in ~~such~~ cultures containing potass. hydrogen tartrate.

Summary: ~~A~~ Presence of pot. hy. tart. in culture increases ~~[illegible]~~ acid formation and yeast ~~in yea~~ yield ~~to~~ up to ~~a~~ a combination of 0·5 g of the salt per 100 c.c. of the culture. This is followed with least consumption of carbon food. This shows that the respiration rate of ~~4~~ yeasts in such salted cultures decrease and ~~[illegible]~~ the energy ~~[illegible]~~ needed for the life activity of yeast is obtained by ~~[illegible]~~ the

Conclusions:

1. If ethyl alcohol is used as carbon food of Dhar yeast it does not ~~[illegible]~~ increase the alcohol consuming property of yeast but increases the acid formation ~~of the~~ and yeast ~~[illegible]~~ yield in the culture. ~~This~~ As this ~~yeast~~ increase in yeast ~~[illegible]~~ yield is not followed by greater consumption of ethyl alcohol it is ~~[illegible]~~ evident that ~~[illegible]~~ the respiration of rate of yeast is considerably lowered ~~and in presence of potassium hydrogen tartrate~~. ~~This~~ Thus ~~[illegible]~~ the energy needed for the ~~[illegible]~~ life activity of the cells is not obtained by the ~~[illegible]~~ oxidation of carbon to carbon dioxide

Some biochemical oxidation of the same molecules to greater degree with ~~[illegible]~~ long of carbon. This does not give ~~[illegible]~~ only greater yield of yeasts but also produces greater amount of organic acids in ~~the~~ culture.

Study of the changes in the properties of yeasts brought about by growing them on ethyl alcohol and methyl alcohol. The study was made in a 5 per cent culture of 5 varieties of yeasts.

Seeded on the 24th. March '49.
Analysed on the 30th. March '49.

Table No. 10.

W/V of sugar under non-aerated condition using Torula and S. Carlsbergensis

Temperature variation — 26·5°C to 30·5°C

(Culture were prepared in 100 c.c. conical pyrex flasks)

S.N.	variety of yeast.	energy material over which it has been grown	gr. of reducing sugar in 100 c.c. culture	gr. of total sugar present in 100 c.c.	gr. of non-reducing sugar in 100 c.c. culture	gr. of sugar consumed in fermentation	Percentage of sugar fermented	gr. of total acid present in 100 c.c.	gr. of volatile acid present in 100 c.c.	Percentage of acid produced calculated on the basis of sugar used up	gr. of alcohol found in 100 c.c.	Percentage of alcohol produced calculated on the basis of sugar used up	gr. of yeast in 100 c.c.	Percentage of yeast produced on the basis of sugar consumed
1.	Torula	Sugar	0·72	3·54	2·82	1·46	29·60	0·1485	0·0027	10·17	0·30	21·00	0·2296	15·72
							+16.72·0			+·14		- 4·14		-2·03
2.	Torula.	ethyl alcohol	0·82	3·36	2·54	1·64	32·80	0·1692	0·0027	10·31	0·27	16·86	0·2246	13·69.
							-19·6			+18·21		+ 21·00		+ 13·36
3	Torula	methyl alcohol	0·65	4·50	3·85	0·5	10·00	0·1425	0·0018	28·50	0·21	42·00	0·1954	39·08.
1	Saccaromyces Calsbergensis	Sugar.	0·93	3·44	2·51	2·49	45·80	0·2878	0·0080	11·55	0·27	10·88	0·2450	9·84
							-15·7			+6·26		+13·30		+ 7·85
2	S. Carlsbergensis	ethyl alcohol	1·10	3·47	2·37	1·53	30·60	0·2878	0·0094	18·81	0·37	24·18	0·2616	17·09
							+8·6			-09		+25·39		4·06
3	S. Carlsbergensis	methyl alcohol	0·59	3·63	3·04	1·96	39·20	0·2285	0·0135	11·64	0·71	36·27	0·2554	13·03.

Study of the effect of zinc sulphate on solution under non-aerated condition.

Seeded on the 14th March '49.

Analysed on the 2nd April 49.

S. N.	gm. of $ZnSO_4$ in 100 c.c. of the culture	gm. of alcohol found in the control culture after sterility	gm. of alcohol left in the culture	gm. of alcohol consumed
1	nil.	2·91	2·51	0·40
2	0·025	2·91	2·39	0·52
3	0·050	2·91	2·17	0·74
4	0·100	2·91	2·06	0·85
5	0·150	2·91	2·02	0·89

Thus zinc sulphate is not at all suitable for yeast growth. It increase yeast formation in sucrose solution which is due to the fact that it checks longer fermentation and not because it helps in yeast growth.

Table No. 11.

Torula variety of yeast growth in 5 % v/v of ethyl alcohol

Temperature 27·5°C to 31·6°C.

(Culture prepared in 100 c.c. pyrex conical flasks.)

gm. eq. of Total acid produced	gm. eq. of volatile acid found	Percentage of acid formed on the basis of alcohol consumed	gm. of yeast produced in 100 c.c. of the culture	Percentage of yeast formed
0·2636	0·0200	65·90	0·1946	48·65
0·3303	0·0888	63·77	0·2374	45·65
0·4573	0·0978	61·78	0·2276	30·76
0·4734	0·0247	55·69	0·2304	27·10
0·5111	0·0847	55·18	0·2398	26·94

Study of the effect of basic fuchsin dye on .5 % sugar solution using Saccaromyces Carlsbergensis

Seeded on the 23rd. March 1949.

Analysed on the 7th. April 1949.

Sl.	gm. of fuchsin in 100 c.c.	gm. of Reducing sugar in 10 c.c. culture.	gm. of Total sug. in 10 c.c. of the culture.	gm. of Sugar Consumed in fermentation.	Percentage of sugar fermentable Carb. on the basis of 1 sugar sugar
1	0·00025	2·13	2·25	2·75	55·00
2.	0·00050	1·85	1·99	3·01	60·20
3	0·00100	1·58	1·66	3·34	66·80
4	0·00200	1·31	1·33	3·67	73·40
5	0·00400.	0·00	0·00	5·00	100·00
	~~Control~~ Control.				
	Control	0·93	3·44	2·49	45·80

(b) Presence of little amt of Fuchsin increases the hydrolysis of sucrose. 2878 / 2·49 = 1155 (11·47)

to reding sugar but this gradually decreases as its concentration

2878 / 249 / 368 / 2·49 / 1190 / 996 / 1940

given in the culture becomes nil when 40 X 10^{-4} gm. of Fuchsin is present per 100 c.c. of the culture.

Repeat

9/4/49

Table No. 12.

The growth of yeast, alcohol formation and acid production in variety of yeast under non aerated condition.

Temperature variation - 29·4°C to 32·4°C

(Experiment carried out in 100 c.c. flat bottom flasks)

Sample.	gm. of eq. of total acid in 100 c.c.	Acidity	gm. of alcohol in 100 c.c. culture.	Percentage of alcohol formation c.c. on the basis of sugar consumed.	gm. of yeast produced	Percentage of yeast growth cal. on the basis of sugar consumed.
	0·0238	0·66	0·64	23·27	0·4284	15·57
	0·0524	1·74	0·71	23·65	0·4148	13·76
	0·0619	1·85	0·96	28·74	0·3938	11·79
	0·0762	2·57	1·39	37·87	0·3888	10·59
	0·2142	4·48	2·01	40·20	0·3288	6·57
	~~0·1448~~					
	0·2878		0·37	11·46	0·2616	17·09

(2) Sugar consumption of the yeast gradually increases with the increase of Fuchsin in the culture. This increased sugar consumption is to involve increased alcohol and decreased Yeast products.

(3) The acid production suddenly falls if conc. exceeds 2·5 X 10^{-4} gm Fuchsin per 100 c.c. in the culture but then it gradually increases with the rise of the dye in the culture reaching to 4·28 with 40 X 10^{-4} gm of Fuchsin per 100 c.c. of culture.

Study of the difference of properties brought about by the growing yeast in sugar, ethyl alcohol and methyl alcohol. Sucrose solution of 3 % concentration was used in the culture and experiments were performed with Saccaromyces Calsbergensis and Torula varies of yeast.

Seeded on the 26-3-49.

Analysed on the 4-4-49.

Temperature variation 27°C to 31.2°C.

Table No. 13.

S.No.	Variety of yeast in experiment.	Culture in which it was formly grown.	gm. of reducing sugar per 100 c.c.	gm. of non-red. sugar per 100 c.c.	gm. of total sugar in 100 c.c.	gm. of sugar consumed per 100 c.c.	Percentage of formaldehyde cal. on the basis of sugar consumed.	gm. eq. of total acid in 100 c.c.	gm. eq. of volatile acid in 100 c.c.	Percentage of acid produced. Cal. on the basis of sugar consumed.	gm. of alcohol formed	Percentage of alcohol formed Cal. on the basis of sugar consumed.	gm. of yeast produced.	Percentage of yeast yield cal. on the basis of sugar consumed.
1	Torula.	Sugar	2.28	1.67	3.95	1.05	21.00	0.1883	0.0026	17.93	0.21	21.00	0.2884	27.46
							+2.00			-0.61		-4.05		-4.48
2	Torula.	Ethyl alcohol	2.23	1.59	3.82	1.18	23.00	0.2044	0.0080	17.32	0.21	16.95	0.2712	22.98
							-0.4			+0.35		+23.82		+3.31
3	Torula.	Methyl alcohol	2.50	1.47	3.97	1.03	20.60	0.1883	0.0040	18.28	0.42	40.77	0.3108	30.17
													0.4928.	15.06gm.
4	Saccaromyces Calsbergensis.	Sugar	1.47	0.21	1.68	3.32	66.40	0.2528	0.0134	7.51	0.85	25.60		-4.92
										+7.11		+ 4.4		10.14
5	S. Cals.	Ethyl alcohol	2.33	1.12	1.55	3.45	31.00	0.2367	0.0200	14.62	0.47	30.00	0.3530	-5.52
							-2			+0.3		+ 9.52		
6	S. Cals.	Methyl alcohol	0.92	0.77	1.69	3.31	66.20	0.2582	0.0080	7.80	1.15	35.12	0.3160	9.54

Table No. 14.

Study of the differences bright about in the Saccaromyces Calsbrengensis and Torula varities of yeast by growing them in 5% sugar, ethyl alcohol and methyl alcohol. 5% sucrose culture was used in the experiments under non-aerated conditions.

Seeded on the 26-3-49.

Analysed on the 26-4-49.

Temperature variations — 27°C to 33°C.

S.N.	Variety of yeast in experiment	Culture in which it was previously grown.	gm. of Reducing Sugar left per 100 c.c. of culture.	gm. of total Sugar left per 100 c.c. of the culture.	gm. of non-reducing Sugar in 100 cc.	gm. of Sugar consumed per 100 c.c.	Percentage of Fermentation cal. on the basis of sugar finally present.	gm. eq. of total acid in 100 c.c.	gm. eq. of volatile acid in 100 c.c.	Percentage of acid formed cal. on the basis of Sugar consumed.	gm. of alcohol formed.	Percentage of alcohol form.	gm. of yeast produced	Percentage of Yield of yeast cal. on the basis of sugar consumed.
1	Torula.	Sugar	3·13	3·13	0·00	1·87	38·40	0·2641	0·0333	14·12	0·16	8·55	0·4966	26·49
							+ 11·50			− 1·60		+ 1·46		− 7·84
2	Torula.	Ethyl alcohol	2·53	2·53	0·00	2·47	49·90	0·3094	0·0452	12·52	0·21	10·01	0·4608	18·65
							− 1·80			+ 1·340		+ 6·20		− 0·90
3	Torula.	Methyl alcohol	3·17	3·17	0·00	1·83	36·60	0·2821	0·0418	15·42	0·27	14·75	0·5008	27·39
4	Saccaromyces Calsbrengensis.	Sugar.	1·72	1·72	0·00	2·28	45·60	0·1671	0·0284	7·40	0·59	25·89	0·4970	19·95
							+ 12·00			+ 3·01		+ 3·79		− 3·67
5	S. Calsbrengensis	Ethyl alcohol	2·07	2·07	0·00	2·93	58·60	0·3046	0·0402	10·39	0·85	29·01	0·4478	15·28
							+ 39·01			+ 0·47 − 2·52		+ 4·60		− 10·09
6	S. Calsbrengensis	Methyl alcohol	0·77	0·77	0·00	4·23	84·60	0·3332	0·0226	7·87	1·29	30·49	0·4200	9·92

Repeat with potato & wheat & check para air

19/7/49

Study of the growth of Saccharomyces cerevisiae Torula, on Saccharomyces cals calsberengesis (30 gms. in 500 c.c.) under non-aerated conditions.

Seeded on the 15th May '49.

Analysed on the 29th July '49

Table No. 15.

(y8), Saccharomyces turbidans (46), Torulopsis utitis (y19), and Torulopsis utitis (y42) in 6 % sucrose solution

Temperature variation - 30.8°C to 33.5°C.

ph. — 4.3.

name of the yeasts.	gms. of sugar left unfermented as reducing sugar.	gms. of sugar assumed in fermentation.	gm. Equ. of total acid produced in the culture.	gm. equ. of volatile acid generated in the culture.	Percentage of acid formation	gms. of alcohol in 100 c.c. of the culture.	total gms. of alcohol in the culture.	Percentage of alcohol formation calculated on the basis of sugar used.	gms. of yeasts grown in 500 c.c. of the culture.	Percentage of yield calculated on the basis of sugar consumed.
Dhar Yeast (Torula)	15.00	15.00	2.736	0.056	18.20	0.14	0.70	4.66	3.2184	21.46
S. Calsberengensis	12.00	18.00	2.928	0.144	16.22	0.27	1.35	7.50	2.8520	15.83
Torulopsis utitis (y42)	0.44	29.56	1.456	0.156	4.90	1.82	9.10	30.79	0.6480	2.19
Saccharomyces turbidans	14.29	15.71	1.567	0.052	8.06	1.26	6.30	40.10	0.3312	2.18
Torulopsis utitis (y19)	nil	30.00	1.408	0.096	4.69	1.95	9.75	32.50	0.4118	1.37
Saccharomyces cerevisiae (y8)	8.57	21.41	1.880	0.024	8.78	1.39	6.95	32.54	0.2288	1.06

Study of the effect of mutation on the change grown in cultures containing sugar, ethyl alcohol or methyl under non-aerated condition.

Seeded on 2rd. May '49

Table No. 16; 17; 18;
of the properties of yeasts when Saccaromyces calosberengesis is grown once alcohol as source of carbon, then grown in 5% sucrose culture.

Analysed on 8th. May '49. Temperature variation 29·5°C - 32·3°C
19th. May '49. pH - 4·5
2nd. Aug. '49.

S.N.	Substance used for mutation.	Date of Analysis	gm. of sugar left after fermentation.	gm. of sugar used up in the process of fermentation	gm. Equv. of total acid produced in 100 c.c. culture.	gm. Eq. of non volatile acid generated in 100 c.c.	Percentage of acid produced Cal. on the basis of sugar consumed?	gm. of ethyl alcohol in 100 c.c. of the culture.	gm. of Percentage of alcohol formed Cal. on the basis of sugar used	gm. of yeast grown in 100 c.c. of the culture.	Percentage of yield of yeast calculated on the basis of sugar consumed
(16)											
1	Sucrose.	8th May '49.	4·10	0·90	0·0052	0·0013	0·57	0·00	0·09	0·2196	24·40
2	Ethyl alcohol	8th May '49	3·78	1·22	0·2418	0·0013	19·80	0·07	5·73	0·2060	16·87
3	Methyl alcohol.	8th May '49.	4·14	0·86	0·0062	0·0013	6·18	0·01	1·16	0·1225	18·25
(17)											
1	Sucrose	19th May '49	2·40	2·60	0·2480	0·0024	9·53	0·01	0·38	0·5814	20·15
2	Ethyl alcohol	19th May '49	2·36	2·64	0·2400	0·0096	9·09	0·14	5·30	0·5246	19·87
3	Methyl alcohol	19th May '49	2·30	2·70	0·2720	0·0054	10·74	0·07	2·59	0·4743	17·56
(18)											
1	Sucrose	2nd Aug. '49	0·00	5·00	0·5928	0·0104	11·84	0·01	0·20	0·8732	17·46
2	Ethyl alcohol	2nd Aug. '49	0·00	5·00	0·5928	0·0184	11·84	0·14	2·80	0·8057	16·11
3	Methyl alcohol.	2nd Aug '49.	0·00	5·00	0·5928	0·0134	11·84.	0·07	1·40	0·7790	15·58

78 – 0 – 0 — Samuel Das Ketaram
100 – 0 – 0 — Gajadhar Pd.
35 – 0 – 0 — Jewellers
64 – 6 – 0 — Madan Sahib.

277 – 0 – 0
40 – 0 – 0

237 – 0 – 0 — Less for cheddars.
89 – 0 – 0

228 – 0 – 0

5·0 gms. Sugar. (sucrose.)

1·75 ~~17·50~~ Ammonium ~~sulphate~~. hydrogen ~~tetra~~ Phosphate.

0·075 gm. Calcium carbonate.

0·220 gm. Magnesium carbonate.

0·5 gm. Potassium sulphate.

0·3 gm. NaCl.

0·125 gm. ZnSO4.

5·0 gm. & $(NH_4)_2SO_4$.

These substances were added in 500 c.c. of water in the cultures prepared for the study of the competitive growth of yeast and alcohol production of the following yeasts.

S. Cerevisiae – Y1; Y8; ~~Y5~~.

S. turbidans – Y4,

S. ellipsoides.

Torula,

Torulopsis utilis Y19, 42,

seeded on the 25·7·49. temp. 30·8°C.

K Bahadur.

13/8/49.

Table 19.

Study of the growth of 8 Dhar yeast, Saccharomyces cerevisiae (41) (y42) Saccharomyces cerivisiae (y 8) and Saccharomyces ellipsoides, S. turbidans, Torulopsis utilis (y19), & Torulopsis utilis 10% sucrose solution (50 grs in 500 c.c.) under non aerated condition

Temperature 29.8°C 30.8°C.

pH. 4.3.

Seeded on the 26th July '49.
Analysed on the 9th Aug '49.

S.N.	name of the yeast.	grm. of reducing sugar left in the whole culture.	grm. of Total sugar left unfermented in the whole culture.	grm. of non-reducing sugar in the 500 c.c. of the culture.	grm. of sugar consumed in the Culture.	Percentage of the sugar fermented. Cal. on the basis of sugar first added.	...eq. of total ...id formed in ...e culture.	grm. eqv. of volatile acid found in the whole culture.	Percentage of acid produced in the culture.	grms. of alcohol formed in 100 c.c. of the Culture.	Cgms. of total alcohol generated in the whole culture.	Percentage of alcohol formed in Cal. on the basis of sugar added.	grm. of yeast produced during fermentation.	Percentage of yeast yield cal. on the basis of Sugar Consumed.
1.	~~T~~ Dhar Yeast (Torula)	34.88	41.66	6.78	8.34	16.68	3.391	0.380	40.66	~~0.39~~ 0.14	~~1.95~~ 0.70	~~23.40~~ 8.45	1.6224	19.46
2.	Saccharomyces turbidans.	15.00	15.10	0.10	34.90	69.80	2.400	0.320	7.01	3.49	17.45	50.00	0.4654	1.33.
3.	S. ellipsoides.	0.71	4.00	3.29	46.00	92.00	2.160	0.164	4.65	4.21	21.05	45.54	0.4070	0.88
4.	Torulopsis Utilis (y19)	3.26	3.26	0.00.	46.74	93.48	2.383	0.264	5.09	4.08	20.40	43.64	0.3862	0.80
5.	T. Utilis (y42)	0.60	0.60	0.00.	49.40	98.80	2.432	0.280	4.92	3.54	17.70	35.80	0.3828	0.77
6.	Saccaromyces Cerevisiae (y1)	17.60	17.60	0.00	32.56	65.12	2.032	0.060	6.24	3.01	15.05	46.22	0.2432	0.75
7.	S. Cerevisiae (y8)	15.46	15.46	0.00.	34.54	69.08	1.632	0.108	472	3.24	16.20	46.90	0.2264	0.65

Study of the effect of ~~S. Calster~~ fucsin red dye on S. Calsberengesis in ~~[illegible]~~ ethyl alcohol solution of 5 per cent v/v concentration.

Temperature variation. Seeded on the 8th April '49.

32·5°C to 30·4°C. Analysed on the 16th August '49

S.N.

1.

2.

3.

4.

5.

6.

7.

Study of the effect of fucsin red dye on yeast culture containg Saccharomyces Calsbergensis variety of yeast in culture of ethyl alcohol of 5% concentration v/v in under non-aerated condition.

Seeded on the 8th April '49
Analyzed on the 16th August '49. 100 days

Temperature variation.
32.5°C - 30.4°C
pH - 4.5 Approx.

S.N.	Amount of Fucsin red in the Culture in the beginning in gm.	Color of the Culture on the day of the analysis.	gm. of ethyl alcohol of the culture lost by evaporation.	gm. of ethyl alcohol left in the culture unused.	gm. of ethyl alcohol utilized for yeast production	gm. eqv. of Total acid produced in the culture.	gm. eq. of the volatile acid formed in the Culture.	Percentage of the Total acid produced in the Culture calculated on the basis of alcohol consumed.	gm. of yeast produced by fermentation.	Yield of Yeast Calculated on the basis of ethyl alcohol consumed
1.	Control (no color)	Colorless	2.21	0.21	2.00	0.400	0.0019	20.00	0.4070	20.35
2.	0.00025	Colorless	2.21	0.21	2.20	0.371	0.0056	16.86	0.3920	17.82
3.	0.0005	Colorless	2.21	0.00	2.21	0.3640	0.0008	16.48	0.3380	15.26
4	0.0020	yeast cells stained	2.21	0.00	2.21	0.326	0.0006	14.75	0.2964	13.41
5.	0.0040	Culture cells deeply stained	2.21	0.00	2.21	0.289	0.0004	13.92	0.2560	11.62

Table no. 20.

2.00
.21
2.21
4.42

Study of the effect of zinc sulphate and potassium hydrogen tartrate on separately and combined on the yeast culture of Torula. The cultures contained 5% sugar and experiments were performed under non-aerated conditions :-

Seeded on the 25th March 1949.
Analysed on the 29th Aug. 1949. } 200 days

Temperature - 29·8°C to 33·2°C.
pH - 4·5.

Table No 21

Serial Number	gm. of zinc sulphate added per 100 c.c. of the culture.	gm. of potassium hydrogen tartrate added per 100 c.c. of the culture.	gms. of sugar left unconsumed per 100 c.c.	gm. of sugar consumed per 100 c.c.	Percentage of sugar fermented during the whole process.	gm. equ. of total acid generated in 100 c.c. culture.	gm. equ. of non-volatile acid formed during the process of fermentation.	gm. equ. of non-volatile acid produced by fermented.	Percentage of acid produced calculated on the basis of sugar consumed.	gms. of ethyl alcohol formed in 100 c.c. of the culture by fermentation.	Percentage of ethyl alcohol produced calculated on the basis of sugar consumed.	gms. of yeast produced per 100 c.c. of the culture.	Yield of yeast calculated on the basis of sugar consumed.
1	0·015	nil	3·00	2·00	40·00	0·4000	0·0024	0·3976	20·00	0·14	7·00	0·5376	27·00
2	0·015	0·25	0·90	4·10	82·00	0·5777	0·0036	0·5741	14·63	0·01	0·24	0·4780	11·70
3	0·015	0·75	nil	5·00	100·00	0·6613	0·0040	0·6573	13·22	0·07	1·40	0·6603	13·20
4	nil	0·50	nil	5·00	100·00	0·8133	0·0040	0·8093	16·20	0·00	0·00	0·6342	12·60
5	0·03	0·50	0·24	4·76	95·20	0·9001	0·0047	0·8954	18·88	0·01	0·21	0·6756	14·29

Presence of zinc sulphate in the culture decreases sugar fermentation to a degree than only 40% of the original sugar is fermented even after 200 days. Whereas as if only potassium hydrogen tartrate does not interfere with the fermentation of the sugars and whole of it is consumed during that period.

Acid production is all most double in the culture containing only potass. hydro. tartrate than what it is in cultures containing only zinc sulphate.

~~Table No.~~

Study of the effect of Ginger, lime juice and other ~~so~~ necessary salts on the Ginger Yeast drink. The culture contained 15 % w/v of sugar (60 gms in 400 cc). It was seeded on the 19th March '49 and analysed on the 25th Aug '49. The temperature variation during this period was between 29.8°C & 32.7°C. The pH of the culture before seeding was 4.50.

Serial Number	gm adt
1	Gm. Equ. of Total Acid produced in the whole culture 9.8240
2	Gm. Equ. of volatile acid formed in the whole culture 0.0416 Gm. Equ. of non-volatile acid formed - 9.1824 Percentage of total acid produced 16.86
3.	Gms. of Reducing Sugar left in the whole culture - 6.00. Gms. of non-Reducing Sugar in the culture - nil
4.	Gms. of Sugar consumed in fermentation - 54.00 g Gms. of ethyl alcohol formed nil.
5.	~~Gms~~ Percentage of ethyl alcohol formation - nil Gms. of Yeast produced in the culture - 8.5150. Percentage of yeast yield - 15.74.

Note - The culture contained the following substances.

(1) 60 gms. Sucrose in 400 c.c. of water
(2) 2 gms. Potassium hydrogen tartrate
(3) 10 c.c. Lime juice
(4) 25 gms. Ginger
(5) Enough necessary inorganic salts.

Growth of yeast on potatoes :—

Table No. 22

½ lb. of potatoes were boiled and after seeding ~~were~~ they were pastefied and boiled with 25 c.c. of con. hydrochloric acid for 24 hours. The solution was filtered and neutralised with caustic soda solution till a precipitates just appeared. The glucose of the solution thus obtained was estimated. ~~by Fehling~~ Total amount of glucose obtained by ~~the~~ hydrolysis of ½ lb of potatoes was nearly 40g. This solution was used as the glucose ~~and~~ source of the yeast cultures.

Each culture contained 7·66 gms. of glucose 165 c.c. of the culture. Inorganic salts necessary for the growth of 7 gms. of yeast were also added in the cultures. Experiments were carried out under non-aerated conditions.

Date of seeding 24th. Aug '49.
Analysed on the 5th. Sept '49.

pH. 3·8.
Temperature variations. 29·8°C to 30·9°C.

Serial Number	S. No.	Name of the yeast	gms. of Total glucose present in the culture before fermentation.	gms. of sugar left unused in the whole culture.	gms. of sugar consumed in fermentation.	Percentage of the sugar consumed during yeast growth.	gm. Eqv. of the total acid generated in the culture.	gm. Eqv. of the volatile acid produced in the culture.	gm. of the non-volatile acid produced in the culture.	Percentage of total produced in the culture Calculated on the basis of sugar consumed.	gms. of alcohol produced per 100 c.c. of the culture.	Percentage of the alcohol formation Calculated on the basis of sugar consumed.	gms. of yeast grown in the whole culture.	Yield of yeast Cal. on the basis of sugar consumed in fermentation.
1	1.	Dhar Yeast (Torula)	7·66	6·48	1·18	14·26	0·1350	0·0127	·1223	12·38	0·008	0·56	0·6092 ~~0·8750~~	84·00
2	2.	Saccharomyces Carlsbergensis	7·66	4·95	2·71	35·38	0·1286	0·0432	·0834	4·87	0·53	18·45	0·3750	13·84
3.	3.	Saccharomyces cerevisiae (y5.)	7·66	0·39	7·27	94·90	0·7688	0·0044	·7644	10·51	2·06	28·33	0·3006	4·13
4.	4.	Torulopsis utilis (y19)	7·66	0·48	7·18	93·73	0·3564	0·0316	·3248	5·01	2·06	28·67	0·2266	3·18
5.	5.	Saccharomyces cerevisiae. (y8)	7·66	0·73	6·93	90·38	0·8425	0·0978	0·7447	12·25	2·01	29·00	0·1132	1·63
6.	6.	Saccharomyces ellipsoides (y4.)	7·66	0·35	7·31	95·43	0·7656	0·0118	0·7538	10·53	2·17	29·68	0·0961	1·31
7.	7.	Torulopsis utilis (y12.)	7·66	0·66	7·00	92·69	1·0690	0·0672	1·0018	15·28	2·01	28·71	0·0863	1·23
8.	8.	Saccharomyces cerevisiae (y.1.)	7·66	0·84	6·82	89·03	1·1220	0·0432	1·0788	16·44	2·01	29·47	0·0428	0·63.

Sug Data

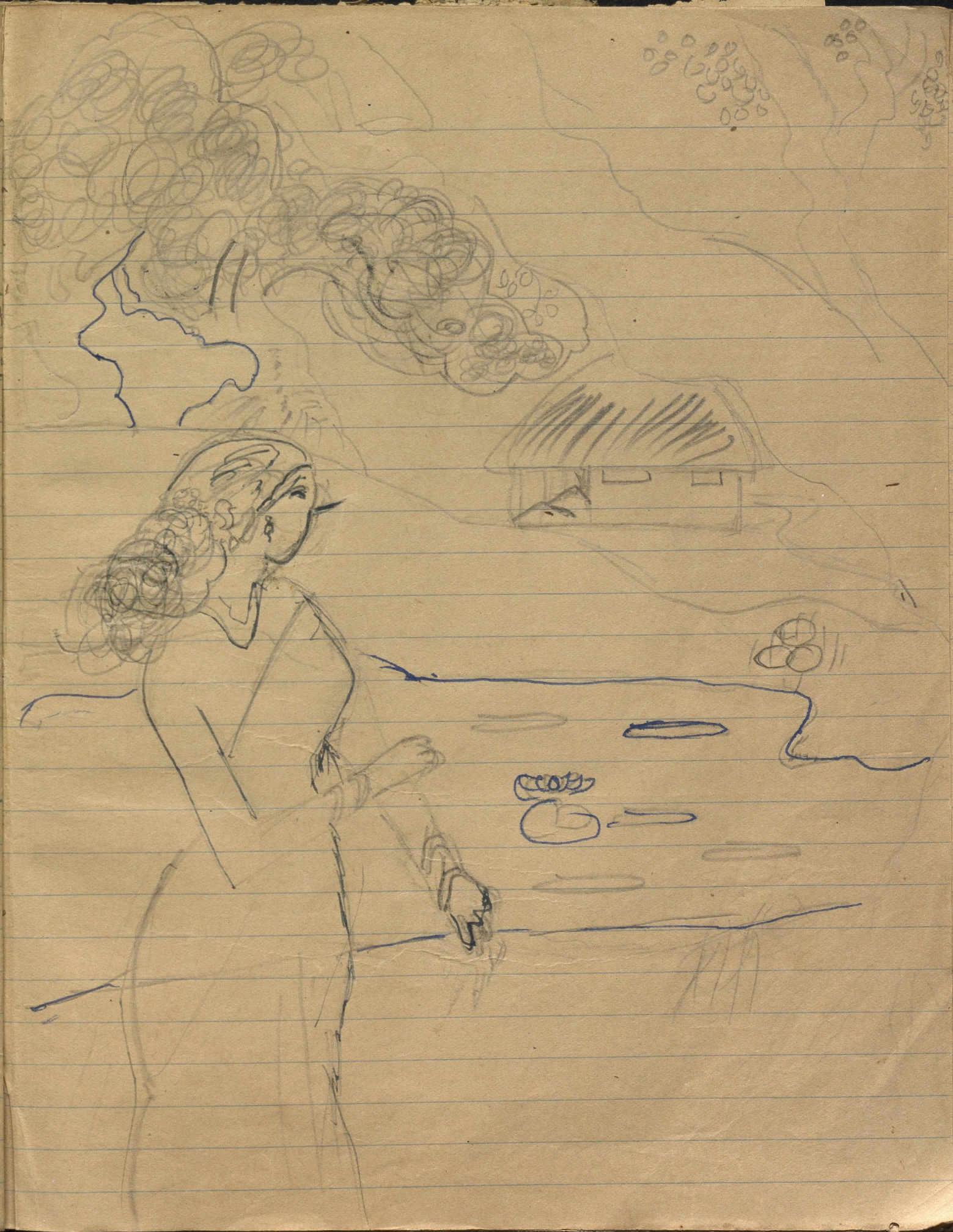
Study of the growth of yeast, alcohol formation
cent of total sugars and other salts under non.

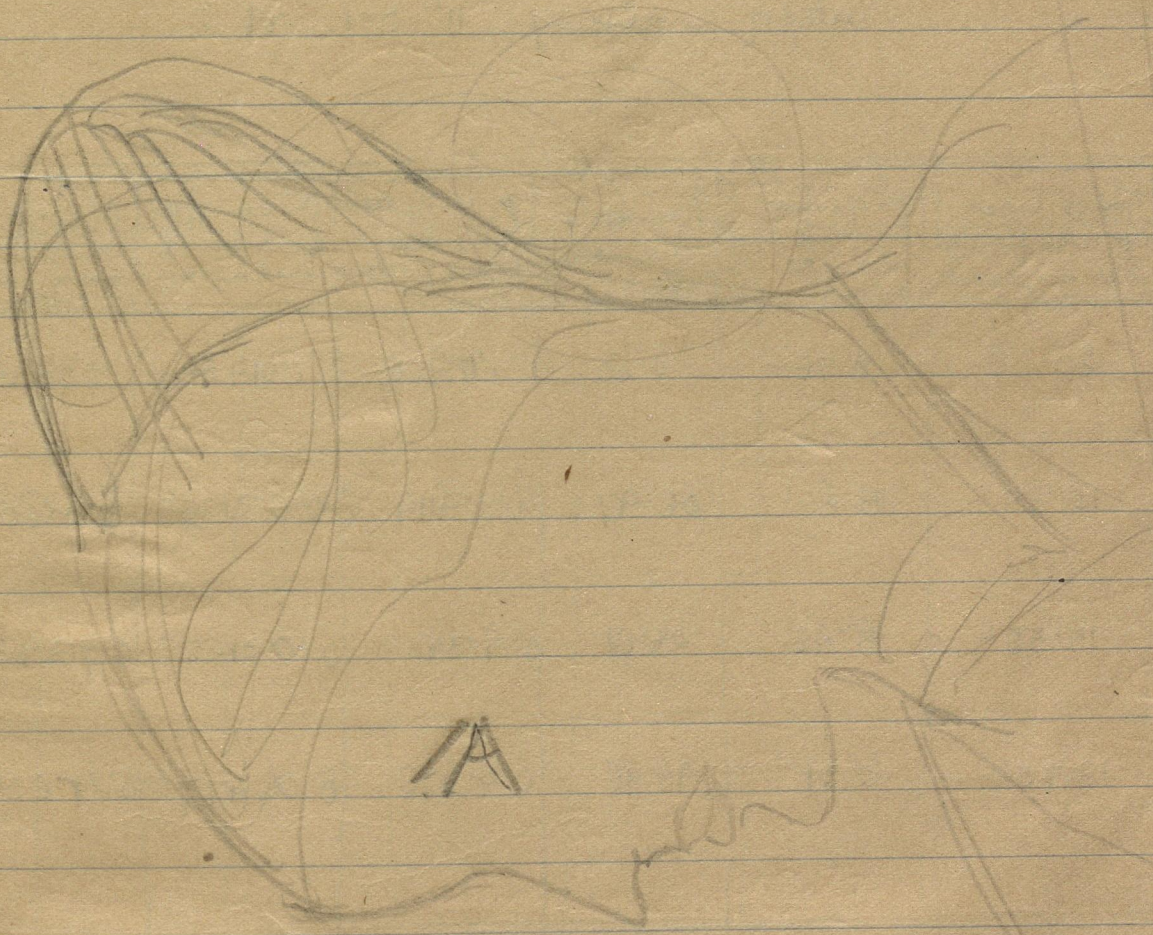
Seeded on the 24* Sept. '49

Analysed on the 11th Oct. '49.

Serial Number.	S.N.	gms. of salts with their name present in 200 c.c.	gms. of sugar left after fermentation.	gms. of sugar consumed in fermentation.	gms. of equi. of total acid produced per 100 c.c.	gm. eqv. of volatile acid produced per 100 c.c.	gm. eqv. of Non-volatile acid formed in 100 c.c.	per centage of acid formed calculated on the basis of sugar
1	1.	Nil	20·30	0·76	0·9900	0·1431	0·8469	130·26
2	2.	4·00 Ammonium nitrate	15·38	5·68	3·9114	0·3100	3·6014	68·83
3.	3.	2·00 Ammonium nitrate	15·58	5·48	7·3458	0·3100	7·0358	134·90
4.	4.	4 gm. NH_4NO_3. 0·3590 K_3PO_4 0·224 K_2SO_4 0·200 $MgCO_3$ 0·124 $CaCO_3$	18·75	2·31	4·1176	0·0477	4·1499	181·81
5.								

99





Study of the growth of yeast, alcohol formation and acid production containing 21·06 gms. of total sugar (~~from ypipe juice~~ ~~[illegible]~~ from Gur.) per 100cc. under non-aerated condition.

Date of Seeding 24th Sept. '49.

Date of analysing 11th Oct. '49.

Tempt. 30·2°C to 31·9°C.

pH. 4·5

S.N.	Name and gms. of salts added in 200c.c. of the culture.	gms. of sugar left after fermentation in 100c.c. of the culture	gms. of sugar consumed in 100c.c. of the culture.	Percentage of Fermentation	gm. equ. of the Total Acid formed in 100c.c.	gm. equ. of the volatile acid formed in 100c.c.	gm. equ. of the non-volatile acid formed in the 100c.c. culture.	Percentage of Acid formation cal. on the basis of sugar used up.	Percentage of Acid formation calculated on the basis of sugar original present.	gms. of alcohol per 100c.c. of the culture.	Percentage of the alcohol cal. on the basis of sugar consumed.	Percentage of alcohol cal. on the basis of sugar original present.	gms. of Yeast formed in 100c.c. of the culture.	Percentage of the yeast formation calculated on the basis of sugar used up.	Remark.
1	Nil	20·30	0·76	3·60	0·09900	0·01451	0·08469	13·026	4·70	0·27	35·52	1·25	0·0953	8·35	Sour in taste, Not much change in color.
2.	4·00 Ammonium nitrate.	15·38	5·68	26·97	0·39114	0·03100	0·36014	~~[illegible]~~ ~~134~~ 6883	18·56	0·75	13·20	3·75	1·5740	18·47	bad in taste, milky appearence.
3.	2·00 Ammonium nitrate.	15·58	5·48	26·01	0·73458	0·03125	0·73433	13·490	34·90	0·63	11·59	3·15	1·6850	24·98	very good taste, milky in appearance.
4	NH_4NO_3 – 4·000 K_3PO_4 – 0·359 K_2SO_4 – 0·224 $MgCO_3$ – 0·200 $CaCO_3$ – 0·124.	18·75	2·31	10·96	0·41176	0·00477	0·40699	181·81	19·94	0·05	2·16	0·25	1·0959	31·96	Good in taste, but not as good as the second.

Table 23.

Study of the growth of yeast in gur solution containing 10.06 per cent of total sugars w/v under non-aerated conditions.

Date of seeding of 24th Sept. '49.
Date of analysis 13th Oct '49.

Tempt. 30.2°C to 31.9°C.
ph. 4.5.

S.N.	Names and qus. of the salts added in 200 c.c of the culture.	qus. of sugar left in 100 c.c after the fermentation.	qus. of sugar consumed per 100 c.c. of the culture.	Percentage of Fermentation.	qm. equ. of the Total Acid added per 100 c.c. of the culture.	qm. equ. of the Volatile Acid produced per 100 c.c.	qm. equ. of the non-volatile acid in 100 c.c. of the culture.	Percentage of acid produced calculated on the basis of sugar used.	Percentage of acid produced cal. on the basis of sugar originally present.	qus. of alcohol produced per 100 c.c. of the culture.	Percentage of the alcohol formed calculated on the basis of sugar used.	Percentage of the alcohol formed calculated on the basis of sugar originally present.	qus. of Yeast in 150 c.c. of the culture.	Percentage of Yeast Yield on the basis of sugar consumed.	Remark.
1.	Nil	9.45	0.61	6.06	008586	000954	007632	141.65	0.854	0.15	24.26	1.50	0.0499	5.54	Sour in taste, color of the culture persists. slow filteration.
2.	2.00 Ammonium nitrate.	7.53	3.53	35.08	0.27166	000477	0.27189	78.47	2.753	0.37	10.50	3.70	1.0860	20.60	Not bad in taste but less sweet.
3.	1.00 Ammonium nitrate.	6.09	3.97	39.55	0.31482	002385	0.29097	79.34	3131	0.33	8.29	3.30	1.4736	24.70	Ordinarily good in taste, less sweet and milky,
4.	NH_4NO_3 2.000 $CaCO_3$ 0.060 $MgCO_3$ 0.1000 K_3PO_4 0.178.	7.46	2.60	25.88	0.30528	000715	029813	8448	3032	0.06	1.75	0.60	1.7076	28.70	Quickest filteration. milky, not good in taste.

Table 24.

Study of the growth of yeast in gur culture containing 5·00 gms. of total sugar per 100 c.c. of it, Experiments carried out under non-aerated [illegible]

Date of seeding [illegible] 49.
Date of analysing 15th [illegible] 49.

Tempt. 30·2°C to 31·9°C.
[illegible] pH. 4·5.

S.N.	Name of the salts and gms. of them added in 200 c.c. of the culture.	gms. of sugar left in 100 c.c. cultures after fermentation	gms. of sugar consumed in 100 c.c. culture during fermentation	Percentage of Fermentation.	gm. eqn. of the Total Acid formed in the 100 c.c. of the culture.	gm. eqn. of the volatile acid per 100 c.c. of the culture.	gm. eqn. of the non-volatile acid per 100 c.c. of the culture.	Percentage of the total acid formed Calculated on the basis of sugar used	Percentage of the Total acid cal. on the basis of original [illegible]	gms. of alcohol in 100 c.c. [illegible] culture.	[illegible] formation cal. on the basis of sugar used.	Percentage of the alcohol formation cal. on the basis of sugar original used.	gms. of yeast in 150 c.c. of the cultn.	Percentage of the Yeast yield cal. on the basis of sugar used	Remark.
1.	Nil.	4·10	0·90	18·00	0·03816	0·00477	0·03339	1·22	1·60	0·05	5·54	0·50	0·0314	2·33	Sour, Not at all tasts full.
2.	1·00 Ammonium nitrate.	2·63	2·37	47·40	0·22496	0·00238	0·22253	9·049	4·500	0·14	5·86	1·40	0·7309	21·11	Toddy like smell, Less sweet.
3.	0·50 Ammonium nitrate.	2·72	2·28	45·60	0·29420	0·00954	0·28466	12·894	5·800	0·10	4·02	1·00	0·6716	29·88	Toddy like taste, good smell.
4.	NH_4NO_3 - 1·000 $CaCO_3$ - 0·030 $MgCO_3$ - 0·050 K_3PO_4 - 0·089	3·37	1·63	32·60	0·20988	0·00954	0·20034	12·944	4·200	0·01	0·85	0·10	0·6626	37·05	Toddy like smell.

Table 25.

1) Fuchsin ~~increase~~ dye in culture decreases ~~for~~ sugar consumption of the culture in general.

Study of the effect of fuchsin dye in the culture of Torulopsis utilis Y42 and Torulopsis y19 using ~~in~~ 5% sucrose culture (20 gms. sugar in 400 c.c.) under non aerated condition.

Seeded on the 25th Aug. '49

Analysed on the 4th Oct. '49

Tempt. 33.5°C to 31.6°C.

pH. 4.5.

S.N.	Name of the yeast	amount of fuchsin added in the whole culture	gms. of sugar previously present in the culture	gms of sugar left in the culture	gms. of sugar consumed in fermentation	Percentage of fermentation	gm. eqn. of total acid present in the culture	gm. mol. of volatile acid in the culture	gm. eq. of non-volatile acid in the culture	Percentage of acid produced	gms. of alcohol in 100 c.c.	Total weight of alcohol in the culture in gms.	Percentage of alcohol production in the culture	gms. of yeast in the culture	Percentage of the Yield of yeast calculated on the basis of sugar used up.
1.	Torulopsis utilis Y42.	nil	20.00	0.00	20.00	100	0.14400	0.02204	0.12196	0.720	2.10	8.40	42.00	0.1308	0.65.
2.	Torulopsis utilis Y42.	0.03	20.00	5.45	14.55	72.75	0.17280	0.00896	0.16384	11.89	1.77	7.08	48.66	0.0590	0.40.
1.	Torulopsis utilis ~~Saccharomyces ellipsoides~~ Y19	nil	20.00	0.00	20.00	100	0.13760	0.01632	0.12028	0.688	2.10	8.40	42.00	0.1082	0.54
2.	Torulopsis utilis ~~Saccharomyces ellipsoides~~ Y19.	0.03	20.00	4.14	15.86	79.30	0.17600	0.00800	0.16800	11.97	1.72	6.88	43.88	0.0986	0.62

Table 26

(1) Presence of fuchsin in the yeast cultures causes increase of the percentage of yeast yield calculated on the basis of total sugar consumed during fermentation. This is not because in all the cultures net weight of dry yeast is ~~to~~ produced is less but because sugar consumption is ~~to~~ lowered. Thus in the case of S. ~~Cerevisiae Y8~~ T.U Y19 and S. Cere Y5, ~~S. ellipsoides~~, ~~and Phar yeast~~ ~~the~~ yeast ~~all~~ although greater amount of dry yeast is produced when they are grown in cultures containing fuchsin dye ~~and~~ ~~to~~ and 5% sucrose ~~cult~~ as carbon food. But this increase ~~is~~ ~~follo~~ involves still greated consumption of ~~carbon~~ sugar and thus the ~~a~~ percentage yield calculated on the basis of sugar consumed ~~a~~ comes ~~more~~ less. T.U. Y42 does not follow this rule ~~a~~ and shows decreased production of dry yeast and percentage yeast yield.

(2) ~~Acid~~ Fuchsin ~~dye~~ shows increase alcohol production in ~~the~~ studied yeasts can be divided into ~~two~~ two groups, one which shows the core of increase alcohol formation in presence of fuchsin dye ~~a~~ to this group belongs T.U. 42, T.U. y19, S. Cere 8, S. Cere y5, and S. Cal and ~~the another group in of two~~ decreased alcohol formation in S. ellip and other, which show decreased alcohol formation in presence of the dye.

Study of the effect of fucsin dye on the cultures of Saccaromyces cerevisieae Y8 and Saccaromyces ellipsoides Y4. using 5% sucrose solution ~~as~~ ~~en~~ (20 gms in 400 c.c.) under non-aerated condition.

Seeded on the 25th Aug '49.

Analysed on the 6th Oct '49.

Tempt. 33·5°C to 31·6°C.

pH. 4·5.

S.N.	Name of the variety of yeast in the culture.	gms. of fucsin in the culture.	gms. of total sucrose previously added in the culture.	gms. of sugar left unused in the culture	gms. of sugar consumed in the culture.	Percentage of fermentation.	gm. eqn. of total acid produced	gm. eqn. of volatile acid growth	gm. eqn. of non-volatile acid formed.	Percentage of acid produced in the culture	gms. of alcohol in 100 c.c. of culture.	Total weight of alcohol formed in the culture.	Percentage of alcohol formation.	gms. of yeast grown in the culture.	Yield of ~~yield~~ yeast in per cent. calculated on the basis of sugar used up.
1.	Saccaromyces cerevisiae Y8	nil	20·00	0·00	20·00	100	0·12480	0·00768	0·11712	0·624	1·95	7·80	39·00	0·1634	0·81
2.	S. cerevisiae Y8.	0·03	20·00	7·29	12·73	63·65	0·07020	0·00672	0·06348	0·549	1·29	5·16	40·53	0·1926	1·52
3.	Saccaromyces ellipsoides Y4.	nil	20·00	0·00	20·00	100	0·24320	0·00768	0·23552	1·215	1·83	7·32	36·60	0·1432	0·71.
4	S. ellipsoides Y4.	0·03.	20·00	2·59	17·41	87·05	0·09600	0·00543	0·09057	0·551	1·39	5·56	31·87	0·2958	1·72.

(3) the effect on Acid formation is also irregular. In case of T.U.1-92, T.U.19 Dhar, S. Cere Y5 and S. cal increase out of acid production is noted where as S. Cere 8 and S. ellips show a dimin ~~ed~~ acid production if fucsin is put in the culture.

that the color of the ~~8~~ culture decreases as the fermentation proceeded. In very ~~the~~ great dilution ~~the~~ Dhar yeast completely decolourised it. This is perhaps due to the reduction ~~of the~~ of rosaniline to leucorosaniline due to ~~the~~ reducing, ~~the~~ a reducing enzyme put in the yeast cells.

Table 27

Summary: Fucsin dye when put in the yeast cultures affects different varieties of yeast in different way. Acid formation, alcohol production or sugar consumption and yeast growth none follow the same rule. ~~This is in accordance to and the~~ It affect on the yeast is specific ~~as and different~~ dependent on the variety ~~was~~ of yeast used in the culture.

In ~~cult~~ all the yeast cultures it was noted

Study of the effect of fucsin dye on yeast culture of Torula and Saccaromyces Cerevisiae y 5 varities of yeast using 5% sucrose solution as source of energy (20 gms in 400 c.c.) under non aerated condition.

Torula { Date of seeding ~~21st Aug 49~~. 5th Oct 49.
Analysed on the 31st Oct 49.
(Tempt variation 32.5°c to 30.6°c.

S. Cerevisiae y 5 { 5th Oct '49. date of seeding. Tempt. 32.5°c to 30.6°c.
11th ~~Oct~~ Nov. 49. date of analysing. pH. 4.5
(Tempt. variation 32.5°c to 25.8°c).

S.N.	Name of the variety of yeast	gms. of fucsin in the culture.	gms. of sucrose in the culture originally added.	gms. of sugar left in the culture after fermentation.	gm. of sugar consumed in fermentation.	Percentage of fermentation.	gm. equ. of Total acid produced.	gm. equ. of volatile acid formed.	gm. equ. of non-volatile acid produced.	Percentage of acid production.	gm. of alcohol in 100 c.c. of the culture.	gms of Total ethyl alcohol formed.	Percentage of alcohol formed.	gms. of yeast in the culture.	Percentage of yeast Yield calculated on the basis of sugar used.
1.	Torula.	nil	20.00	2.73	17.27	86.35	17.7200	0.3816	17.3384	100.00	0.31	1.24	7.18	3.4412	19.34
2.	Torula.	0.03	20.00	6.32	13.68	68.40	17.1720	0.2862	16.8858	132.08	0.06	0.24	1.75	3.5650	26.09.
3	Saccaromyces cerevisiae. y 5.	nil	20.00	0.00	20.00	100.00	09.5400	0.0.6698	0.8.8802	4770	1.44	5.76	28.80	0.2266	0.73
4	Saccaromyces cerevisiae y 5.	0.03.	20.00	0.00	20.00	100.00	11.0664	0.0.3816	10.6848	5531	1.95	9.75	48.75	0.2190	1.10.

Table 28

Study of the growth of yeast in 15% sucrose solution containing all the necessary inorganic salts and 0·1 gms. of $ZnSO_4$.

60 gms of sucrose.

2 gms. ~~KH~~ potassium hydrogen tartrate.

10 c.c. lime juice

0·10 gm $ZnSO_4$

water 400 c.c.

All the above substances were taken in a 700 c.c. flat bottom flask and after sterilisation seeded with pure culture of Torula yeast.

Date of seeding – 10th March '49.

Date of analysing – 2nd Nov. '49.

variation of temp. 34·5°c to 26·4°c.

pH. 4·5.

Results.

1. Gms. of total sugar in the culture before fermentation — 60.00

2. Gms. of sugar left in the culture after fermentation — 25.96

3. Gms. of sugar consumed in fermentation or between 10th March '49 & 2nd Nov. '49. — 34.04

4. Percentage of fermentation — 56.78

5. Gm. equ. of total acid present in the culture. — 89.4000

6. Gm. equ. of the volatile acid in the culture — 0.05724

7. Gm. equ. of the non volatile acid in the culture. — 88.8276

8. Percentage of acid production calculated on the basis of sugar used. — 26.26

9. Gms. of ethyl alcohol in the culture. — 0.52

10. Gms. of ethyl alcohol calculated on the basis of sugar used. — 1.53

11. Gms of total yeast produced — 7.4109

12. Percentage of yeast yield calculated on the basis of sugar used — 21.73.

Study of the effect of fucsin dye in the culture of Saccaromyces calsterengensis (mutated at present) using 5 % of sucrose ~~and~~ under non aerated condition.

Seeded on 25th ~~Aug~~ Sept. '49.

Analysed on 27th Oct '49.

Tempt. 31·4 °C to 27·5 °C.

pH. 4·5

S.N.	Name of the variety of yeast	gm. of fucsin in the culture	gms. of total sugar present in the culture	gms. of sugar left after fermentation	gm. of sugar consumed in fermentation	Percentage of fermentation	gm. eq. of total acid in the culture	gm. eq. of volatile acid in the culture	gm. eq. of non-volatile acid	Percentage of acid formation	gms. of ethyl alcohol in the 100 c.c. culture	gm. of total alcohol in the culture	Percentage of alcohol formation	gms. of yeast in the culture	Percentage of yeast yield cal. on the basis of sugar used
1.	Saccaromyces calsterengensis	nil	20·00	1·54	18·46	92·30	17·7200	0·00954	17·6246	9·699	0·31	1·24	6·71	3·0066	16·29
2.	S. calsterengensis	0·03	20·00	2·73	17·27	86·35	17·72	0·03816	17·3384	10·00	0·31	1·24	7·18	3·4412	19·34

Table 29.

Make more experiments with this yeast and investigate the influence of air and the growth in presence of alcohol

Study of the changes in ~~pro~~ properties of the Saccharomyces calsberengesis, Saccharomyces turbidans and Torula varities of yeast when they are once grown in a sugar culture containing 0·03 gms of fucsin in 400 c.c. These dried yeasts of the above cultures were red in color. A little yeast was taken out from each culture and grown in ~~separate~~ different sugar cultures. This yeast ~~was~~, from the sugar culture, was taken for ~~x sm~~ seeding in the following experiments [First on the 25th Aug '49 several sugar cultures were prepared which contained 0·03 gms of fucsin in 400 c.c. of culture. These cultures were ~~grown~~ seeded with the yeasts and allowed to grow up to 26th Oct '49, when a sample of the yeast was taken and was used for impregnating new sugar cultures. After the yeasts were reactivated this sample was used for seeding in the following experiments ~~cultures~~]

Each culture contains 10 gms of sucrose in 200 c.c. of volume.

Torula (non-mutated) – seeded on the 7th Nov. '49. and analysed on 17th Nov. '49

Saccharomyces calsberengesis (non-mutated) – seeded on the 4th Nov. '49. analysed on 17th Nov '49

Saccharomyces turbidans (mutated) – Seeded on the 2nd Nov '49 analysed on 17th Nov '49.

Saccharomyces Calsberengesis (mutated) seeded on 2nd Nov. '49. analysed on 17th Nov '49.

Torula m (mutated) seeded on 2nd Nov '49. analysed on 17th Nov. '49.

Temp – 25·2°C to 23·0°C.

pH. 4·5

S.N.	Name of the varity of yeast in experiment.	nature.	gms. of total sugar in the culture.	gms. of Reducing sugar left in the culture.	gms. of total sugar left after fermentation in the culture.	gms. of non-reducing sugar in the culture after fermentation.	gms. of total sugar consumed in the process of fermentation.	Percentage of fermentation.	Total gms of sugar hydrolysed into reducing sugar.	Percentage of sugar hydrolysed Cal. on the basis of total sugar previously present.	gm. Equ. of Total acid formed in the whole culture.	gm. Equ. of volatile acid formed in the culture.	gm. Equ. of non-volatile acid formed in the culture.	gm. Equ. of Percentage of acid produced Cal. on the basis of ~~sugar~~ sugar consumed.	gms. of alcohol in 100 c.c. of the culture	gms. of total alcohol formed in the culture.	Percentage of alcohol produced Calculated on the basis of sugar consumed	gms. of yeast produced in the culture.	Yield % of yeast Cal. on the basis of sugar consumed.
1	Torula	non-mutated	10·00	5·00	7·19	2·19	2·81	28·10	7·81	78·10	0·7708	0·0141	0·7561	27·40	0·11	0·22	7·82	0·9372	33·45
2.	Torula	mutated	10·00	5·26	7·69	2·43	2·31	23·10	7·57	75·70	0·8648	0·0141	0·8507	37·23	0·00	0·00	0·00	1·5656	67·95
3.	Saccharomyces calsberengesis	non-mutated	10·00	5·15	6·58	1·43	3·42	34·20	8·58	85·80	0·7896	0·0094	0·7802	23·09	0·17 ~~0·03~~	0·34 ~~0·06~~	10·02 ~~1·75~~	0·9680	28·39.
4	S. Calsberengesis	mutated	10·00	5·58	6·66	1·08	3·34	33·40	8·92	89·20	0·7520	0·0005	0·7515	22·45	0·00	0·00	0·00	1·4037	43·71
5.	S. turbidans	mutated	10·00	4·74	5·19	0·45	4·81	48·10	9·55	95·50	0·7896	0·0188	0·7708	16·42	0·00	0·00	0·00	1·3172	27·44.

Table No 30.

25.11-49.
6-12-49.

Study of the effect of $ZnSO_4$ on the yeast growth and alcohol formation. The cultures were examined after 8 months. Sucrose solution of 5% concentration was used as the source of energy and experiments were carried on under anaerobic condition.

Date of Seeding 28th March '49.
Date of analyses 25th Nov. '49.

temp - 33°C to 24°C.
pH - 4.5.

S.No.	gms. of Zinc sulphate in the culture.	gms. of Sugar originally present in the culture.	gms. of Total sugar left in the culture.	gms. of Reducing Sugar left in the culture.	gms. of non-reducing sugar left in the culture.	gms. of sugar Consumed in fermentation.	gm. equ. of Total acid formed in the culture.	gm. equ. of volatile acid in the culture.	gm. equ. of non-volatile acid in the culture.	Percentage of acid produced calculated on basis of sugar used up.	Relative Density of the distillate	gms. of alcohol in the culture.	Percentage of alcohol formation calculated on the basis of sugar used.	gms. of Yeast gram in the culture.	Yield of Yeast calculated on the basis of sugar used.
1	nil	12·30	0·00	0·00	0·00	12·30	1·3180	0·0058	1·3132	10·72	1·0001	0·00	0·00	1·9800	16·07
2	0·10	12·80	0·00	0·00	0·00	12·80	1·3180	0·0232	1·2946	10·31	1·0002	0·00	0·00	1·4904	11·61
3.	0·20	12·60	1·26	1·14	0·12	10·34	1·5745	0·0174	1·5571	15·18	1·0003	0·00	0·00	1·8502	17·91
4.	0·40	12·75	2·88	2·83	0·05	9·93	1·9184	0·0174	1·9010	19·23	1·0001	0·00	0·00	1·9141	19·23.
5.															

Table 31.

7 12-49
10-12-49.

Study of the growth of yeast, alcohol formation and g acid production in 10 % glucose solution obtained by hydrolysing "Banda" under normal anaerobic condition. (20 gms of sugar in 200 c.c. culture)

Seeded on 3rd. Nov. '49. tempt 24·4°C 20·7°C.

Analysed on 7th Dec. '49. pH - 4·3.

S.No	Names and quantities in gms of salts added in 200 c.c. of the culture.	gms. of total sugar in the culture in the beginning.	gms. of sugar left after fermentation.	gms. of sugar used in yeast growth	Percentage of sugar fermented.	gm. equi. of total acid formed.	gm. equi. of volatile acid formed.	gm. equi. of non-volatile acid formed.	Percentage of acid production cal. on the basis of sugar used.	Relative Density of the distillate.	gms. of alcohol produced.	Percentage of alcohol formed cal. on the basis of sugar used.	gms. of yeast grown in the culture.	Yield of Yeast cal. on the basis of sugar consumed.
1	nil	20·00	19·60	0·40	2·00	0·3620	0·0931	0·2689	90·50	1·00030	0·00	0·00	0·0376	9·40
2.	1·00 Ammonium Nitrate	20·00	19·23	0·77	3·85	0·5520	0·0565	0·4955	71·66	0·99988	0·03	3·89	0·0840	10·92
3.	Ammonium nitrate 2·00	20·00	18·87	1·13	5·65	0·7870	0·0565	0·7305	69·65	1·00020	0·00	0·00	0·1746	15·45

Table No 32.

6.12.49
11.12.49.

Study of the growth of yeast, alcohol formation and acid production in 5.00% glucose solution obtained by hydrolysing "Banda," under anaerobic condition. (10.00 gms of glucose in 200 c.c. culture)

Seeded on the 3rd. Nov. '49.
Analysed on the 7th Dec. '49.

temp. 24.4°C – 20.7°C.
pH – 4.5.

S.N.	Names and gms. of the salts added in 200 c.c. of the culture.	gms. of Sugar present in the culture in the begining.	gms. of sugar left after fermentation.	gms. of sugar consumed in fermentation.	Percentage of sugar fermented.	gm. equ. of Total acid in the culture.	gm. equ. of volatile acid found.	gm. equ. of non volatile acid formed.	Percentage of acid formed calc. on the basis of sugar used.	Relative Density of the distillate.	gms. of alcohol produced in the whole culture.	Percentage of alcohol formation calc. on the basis of sugar consumed.	gms. of yeast grown in the culture.	Yield of Yeast Calculated on the basis of sugar consumed.
1	nil	10.00	9.61	0.39	3.90	0.2410	0.0382	0.2028	61.70	0.99989	0.02	5.13	0.0196	5.02
2	Ammonium Nitrate 0.50	10.00	9.52	0.48	4.80	0.2600	0.0287	0.2313	54.12	1.00010	0.00	0.00	0.0634	13.20
3.	Ammonium nitrate 1.00	10.00	9.43	0.57	5.70	0.2980	0.0382	0.2518	52.28	1.00090	0.00	0.00	0.0608	10.66
4.	Ammoniumnitrate – 1.000 Na_3PO_4 – 0.089 $CaCO_3$ – 0.030 $MgCO_3$ – 0.050 K_2SO_4 – 0.056	10.00	9.09	0.91	9.10	0.3380	0.0191	0.3189	37.14	0.99980	0.06	6.59.	0.1070	11.74

Table No 33.

6·12·49.
11·12·49.

Study of the growth of yeast, alcohol formation and acid production in 2·50 % glucose solution obtained by hydrolysing "Banda", under anaerobic condition. (5·00 gms. sugar in 200 c.c. culture).

Seeded on 3rd Nov. '49.
Analysed on 7th Dec. '49.

Temp - 24·4°C - 20·7°C.
pH - 4·5.

S.N.	Name and gms. of the Salts added in 200 c.c. of the culture	gms. of sugar originally present in the Culture.	gms. of Sugar left unused in the Culture.	gms. of sugar consumed in fermentation	Percentage of Fermentation	gm. equn. of Total Acid found in the culture.	gm. equn. of Volatile acid in the culture.	gm. equn. of non-volatile acid in culture.	Percentage of acid formation calculated on the basis sugar consumed.	Relative Density of the distillate.	gms. of alcohol in the culture	Percentage of alcohol formation.	gms. of yeast grown in the culture.	Yield of yeast cal. on the basis of sugar consumed.
1.	nil.	5·00	2·88	2·12	42·40	0·1014	0·0191	0·0823	5·00	0·99980	~~0·06~~ 0·12	5·65	0·4110	19·38
2	0·25	5·00	2·72	2·28	45·60	0·2522	0·0095	0·2427	11·06	0·99980	0·12	5·26	0·5392	23·65
3	0·50	5·00	1·79	3·21	64·20	0·3930	0·0191	0·3739	12·23	0·99980	0·12	3·73	0·8196	25·53
4	Ammonium nitrate 0·50 $CaCO_3$ - 0·015 $MgCO_3$ - 0·025 K_3PO_4 - 0·0445 K_2SO_4 - 0·028	5·00	1·91	3·09	61·80	0·3976	0·0382	0·3694	12·86	0·9994	0·48	15·53	0·8776	28·40

Table No 04.

Study of the growth of yeast (Toula) in grape juice containing 22·22 grs of total sugar in 100 c.c. of it. Cultures were kept under anaerobic conditions.

Seeded on the 12th Nov. '49.

Analysed on the 19th ~~Nov~~ Dec. '49.

Tempt. variations - 24·5°c - 20·2°c.

ph. 4·3.

S.N.	Name and qnts. of the Salt added in 100 c.c. of the culture.	grs. of total Sugar originally present in the culture.	grs. of total Sugar left in the culture.	grs. of Reducing Sugar left in the culture.	grs. of Non-Reducing sugar in the culture.	grs. of Sugar consumed in fermentation.	Percentage of Sugar fermented during the process.	grs. eqr. of Total Acid produced in the culture.	grs. eqr. of volatile acid generated in the culture.	grs. eqr. of non-volatile acid generated in the culture.	Percentage of Acid formed in calculated on the basis of Sugar used.	Percentage of alcohol formed in the culture (v/w).	Yield of alcohol calculated on the basis of sugar consumed.	grs. of yeast in 100 c.c. of the culture.	Yield of Yeast Calculated on the basis of sugar used.
1.	Nil.	22·22	21·74	20·83	0·91	1·39	6·25	0·3290	0·0118	0·3172	23·68	0·53	38·12	1·0734	77·22
2.	Ammonium nitrate 1·00	22·22	18·51	18·51	0·00	3·71	16·69	0·6110	0·0094	0·6016	16·47	0·36	9·70	2·0200	54·45
3.	Ammonium nitrate - 1·000 $CaCO_3$ — : 0·030 $MgCO_3$ — 0·050 K_2PO_4 — 0·089	22·22	17·24	17·24	0·00	4·98	22·41	0·7614	0·0024	0·7591	15·26	0·36	7·21	2·4680	47·51

Table No 35.

Study of the growth of yeast (Torula) in grape juice containg 80 pr cent v/v water (11·11 grs of total sugar in 100 c.c. of juice). Experiments were performed in anaerobic condition.

Seeded on 12th Nov '49.

Analysed on 19th Dec '49.

Temperature variations –

pH. 4·5

S.N.	Names and grs. of the salts added in 100 c.c. of the culture.	grs. of Total sugar in 100 c.c. of the culture.	grs. of Total sugar left in the culture.	grs. of Reducing sugar left in the culture.	grs. of Non-reducing sugar left in the culture.	grs. of sugar consumed in fermentation	Percentage of sugar fermented in the process.	grm. equ. of Total Acid in the culture.	grm. equ. of volatile acid in the culture.	gr. equ. of non-volatile acid in the culture.	Percentage of acid produced calculated on the basis of sugar consumed.	Percentage of alcohol in the culture (v/v)	Yield of alcohol calculated on the basis of sugar consumed.	grs. of yeast formed in 100 c.c. of the culture.	Yield of yeast calculated on the basis of sugar consumed.
1.	Nil	11·11	8·93	8·93	0·00	2·18	19·62	0·2256	0·0070	0·2186	10·32	0·82	37·80	0·3686	16·90
2.	NH_4NO_3 – 0·500	11·11	7·24	7·24	0·00	3·87	34·84	0·3572	0·0047	0·3525	9·04	0·10	2·58	0·9206	23·79
3	NH_4NO_3 – 0·500 $CaCO_3$ — 0·0150 $MgCO_3$ — 0·0250 K_3PO_4 — 0·0490	11·11	6·41	6·41	0·00	4·70	42·30	0·4982	0·0023	0·4959	10·59	0·10	2·13	1·4407	30·65

Table No 36

Study of the growth of yeast (Torula) in grape juice containg 75 per cent v/v water; (5.55 gms of Total sugar per 100 c.c. of the culture.) Experiments were performed under anaerobic conditions.

Seeded on 12th Nov '49

Analysed on 19th Dec. '49

Temp. variation –

pH 4.5

S.N.	Names and gms. of salts added in 100 c.c. of the culture.	gms. of Total Sugar added in the culture.	gms. of Total Sugar left in the culture.	gm. of Reducing Sugar left in the culture.	gms. of Non-reducing Sugar in the Culture.	gms. of Sugar consumed in fermentation.	Percentage of Sugar fermented during the process.	gm. Eqv. of acid in the culture.	gm eqv. of volatile acid in the culture.	gm. eqv. of Non-volatile acid in the culture.	Percentage of acid produced calculated on the basis of Sug used.	Percentage of alcohol v/w in the culture.	Yield of alcohol in the culture calculated on the basis of Sug used.	gms. of Yeast in 100 c.c. of the culture.	Yield of Yeast calculated on the basis of Sug used.
1	Nil	5.55	3.84	3.84	0.00	1.71	30.08	0.1222	0.0047	0.1175	7.01	0.64	37.42	0.3432	20.07
2.	NH_4NO_3 – 0.250	5.55	3.44	3.44	0.00	2.11	39.82	0.1880	0.0047	0.1833	8.91	0.05	1.42	0.4620	21.90
3.	NH_4NO_3 – 0.2500 $CaCO_3$ – 0.0075 $MgCO_3$ – 0.0125 K_2PO_4 – 0.0245	5.55	2.37	2.37	0.00	3.20	57.65	0.3008	0.0023	0.2985	9.37	0.05	1.56	0.7576	23.67

Table No 37.

Study of the rudimentary effect of mutation in yeasts by growing them in cultures containing fucsin dye. These yeasts were grown in a sucrose cultures after mutation and the results are given on table no 30.. After one having grown on sugar these varieties were again grown in separate sucrose cultures to see if the change of properties are still manifested. Torula, Saccharomyces calsberengesis and S. turbidans were used in the study. 10 gms sugar was added in 200 c.c. of water containing other requisite salts for each culture. All the experiments were performed under perfectly nonaerobic conditions.

Seeded on 23rd Nov. '49

Analysed on 21st Dec. '49

Tempt variation - 20°2° to 22°4° C.

pH. 4.5.

S.N.	Name of the variety of yeast in the culture.	variety.	gms. of Total sugar in the culture in beginning.	gms. of Total sugar left in the culture.	gms. of reducing sugar left in the culture.	gms of Non-reducing sugar left in the culture.	gms. of sugar consumed in the fermentation.	Percentage of sucrose hydrolysed during fermentation.	Percentage of sugar fermented in the process.	gm. eqn. of Total acid in the culture	gm. eqn. of volatile acid in the culture.	gm. eqn. of non-volatile acid in the culture.	Percentage of Acid formation calculated on the basis of sugar used.	Percentage of alcohol (v/w) in the culture.	gms. of alcohol produced in the whole culture.	Yield of alcohol calculated on the basis of sugar consumed.	gms. of Yeast in 200 c.c. of the culture.	Yield of Yeast calculated on the basis of sugar consumed.
1.	Saccharomyces ~~Torula~~ calsberengesis	Non-mutated	10.00	3.87	3.76	0.11	6.13	98.90	~~61.30~~	0.8836	0.0328	0.8508	14.34	0.42	0.84	13.70	1.5490	25.46
2.	S. calsberengesis	Mutated	10.00	4.16	3.61	0.55	5.84	94.50	58.40	0.8460	0.0282	0.8178	14.55	0.05	0.10	1.71	1.2538	20.79
3.	Torula	Non-Mutated	10.00	5.03	4.58	0.45	4.97	95.50	49.70	0.8270	0.0094	0.8178	16.50	0.30	0.64	16.90	1.1941	24.02
4.	Torula	Mutated	10.00	2.91	2.35	0.56	7.09	94.40	70.90	1.2220	0.0094	1.2126	10.60	0.10	0.20	2.82	1.8364	25.90
5.	Saccharomyces tubidans	Mutated	10.00	4.06	3.76	0.30	5.94	87.00	59.40	0.8836	0.0141	0.8695	14.98	0.21	0.42	7.07	1.6430	27.65

Table No 38.

Study of the loss of nitrogen in yeast cultures, when varying amounts of Ammonium sulphate is used as source of nitrogen and 8 per cent cane sugar solution as carbon food under non-aerated conditions. (20 gms sugar in 240 c.c. culture)

Date of seeding 16th Nov. '49.

Temp variations - 18.4°C to 20.0°C.

pH - 4.5.

Date of analyses. Culture No. 1. 11th Jan. 1950. Culture No 2. 12th Jan. '50. Culture no. 3. 12th Jan. '50.

S.N.	gms. of Ammonium sulphate in the whole culture	Sugar. Total gms. of sugar present in the culture before fermentation.	gms. of Total sugar left after the fermentation	gms. of sugar consumed in the fermentation	Percentage of sugar fermented Cal. on the basis of original sugar.	gms. of Reducing sugar left in the culture	gms. of non-reducing sugar in the culture after fermentation	Acid. gm. equ. of Total acid formed during fermentation.	gm. equ. of volatile acid formed in the culture.	gm. equ. of non-volatile acid in the culture.	Percentage of Acid formation Calculated on the basis of sugar used.	Alcohol. gms. of ethyl alcohol formed in the culture.	Yeast. Percentage of ethyl alcohol formed in the culture Cal. on the basis of sugar used.	gms. of Yeast grown in the culture.	Percentage of Yeast yield Cal. on the basis sugar consumed	Nitrogen. C/N ratio of the culture.	Percentage of ammonium nitrogen in the culture.	gms. of Nitrogen originally present in the culture before fermentation	gms. of nitrogen left in the culture after fermentation	gms. of nitrogen consumed during fermentation	gms. of nitrogen in the yeast cells.	gms. gm nitrogen lost during fermentation.	Loss of Nitrogen calculated on the basis of nitrogen consumed in fermentation
1.	1.25	20.00	12.42	7.58	38.00	9.70	2.72	0.9400	0.0282	0.9118	12.40	0.52	6.02	2.3380	30.84	29.09	0.0662	0.2651	0.1656	0.0995	~~0.0704~~ 0.08425	0.0153	29.53 ~~15.37~~
2.	2.50	20.00	12.59	7.41	37.05	8.21	4.38	0.8907	0.0376	0.8531	12.02	0.77	10.50	2.0790	28.02	14.54	0.1324	0.5302	0.4020	0.1248	~~0.1663~~ ~~0.0748~~	0.0499	~~1770~~ 40.05
3.	5.00	20.00	12.73	7.27	36.35	7.86	4.87	1.0152	0.0094	1.0058	13.96	1.24	17.10	1.9567	26.95	7.27	0.2648	1.0604	0.7488	0.3116	0.0978 ~~0.0704~~	0.2412	77.46

Table no 39.

use of ethylalcohol as an energy material

urea, ammonium phosphate, nitrate, glycine as a nitrogen source

Question 27/1/50

1. 0.0935 g.
0.1639 g.
0.0978 g.

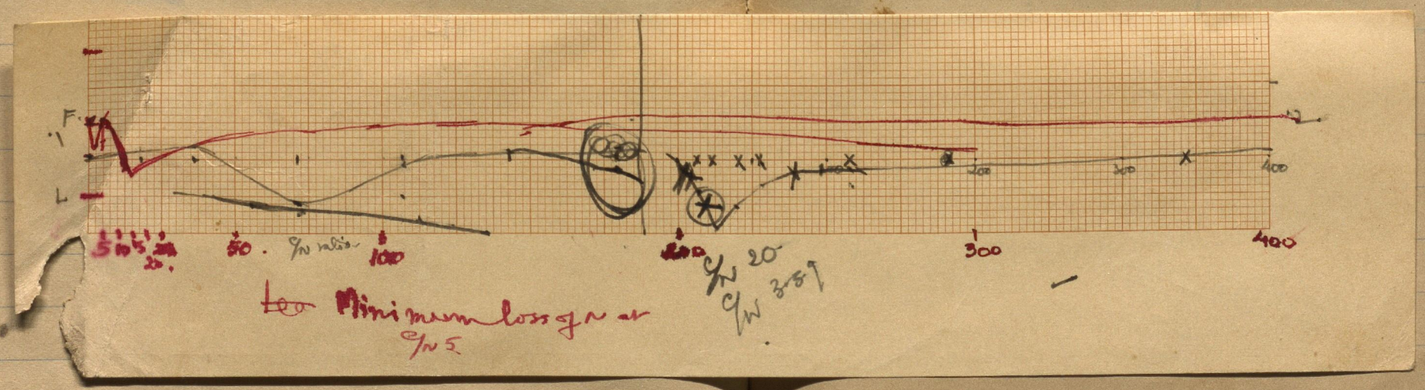
Study of the loss of nitrogen shown in yeast culture which contains 4·02 per cent w/v of ethyl alcohol as carbon food and urea as nitrogen food, under non aerated conditions. (8·4 gms of ethyl alcohol in 200 c.c.)

Seeded on the 12-12-49. Temps variations - 18°C to 22·5°C.

Analysed on the 29th-1-49. (Culture No 1.) & 31-1-49 (Culture No 2) and 7-2-50 (Culture No. 3). pH - 4·5.

Culture No.	gms. of ethyl alcohol present in the culture before growth.	gms. of ethyl alcohol left after the growth of yeast.	gms. of ethyl alcohol consumed in yeast formation	gms. equ. of alkali produced in the culture.	Percentage of alkali produced as the acid	gms. of yeast grown in the culture.	gms. Percentage of yeast yield in the culture.	gms. of urea added in the culture.	gms. of urea Nitrogen in the culture in beginning.	gms. of nitrogen left in the culture after formation.	gms. of Nitrogen Consumed in fermentation.	gms of Nitrogen used up in yeast formation	C/N ratio of the culture in beginning.	gms. of Nitrogen Lost in the culture growth.	Percentage of Nitrogen loss in the culture.
1.	8·04	1·84	6·20	0·2620	4·22	2·6722	43·10	3·6732	1·7142	1·2372	0·2159	0·0913	2·5	0·1246	57·71
2	8·04	0·46	7·58	0·1692	2·23	3·5954	47·43	1·8366	0·8571	0·7001	0·1570	0·1229	5·0	0·0341	21·72
3	8·04	0·42	7·62	0·0554	0·73	3·8498	50·52	0·9183	0·4285	0·2967	0·1318	0·1295	10·0	0·0023	1·74

Table no. 40.



Study of the rudimentary effect of mutation by fuesin dye on the physiological properties of Saccharomyces Carlsbergensis and Torula variety of yeasts. These varities were first mutated by fuesin and then dried & grown in cultures containing sugar as source of carbon. Then In these sets of experiments 5 per cent sugar sucrose solution was used as source of energy (5 gms. sucrose in 200 c.c. culture) and experiments were performed under non-aerated conditions.

References – table no. 28, 29, 30, ~~35~~ and 38.

Seeded on the 7th Jan. 1950.
Analysed on the 3rd Feb. 1950.

Tempt – @ 18·90°c to 22·0°c.
pH – 4·5

S.N.	Name of the Yeast.	Variety.	gms. of sucrose in the culture before fermentation.	gm. of Reducing sugar left in the culture after fermentation.	gm. of total sugar left in the culture after fermentation.	gms. of non-reducing sugar left in the culture.	gms. of sugar consumed in the fermentation.	Percentage of fermentation calculated on the basis of sugar consumed.	gm. eqv. of Total Acid produced in the culture.	gm. eqv. of volatile acid formed in the culture.	gm. eqv. of non-volatile acid formed in the culture.	Percentage of acid formation calculated on the basis of sugar used	gms. of Ethyl alcohol generated in the culture.	Percentage of alcohol formation calculated on the basis of sugar used.	gms. of yeast grown in the culture.	Percentage of Yeast Yield calculated on the basis of sugar used.
1.	Dhar Yeast.	Pure (non-mutated)	10·00	5·81	6·06	0·25	3·94	39·40	0·4112	0·0705	0·3407	8·63	0·20	5·03	1·1762	29·84
2.	Dhar Yeast	Mutated.	10·00	6·89	6·89	0·00	3·11	31·10	0·4112	0·0235	0·3877	12·21	0·10	3·20	1·2202	39·23
1.	Saccharomyces Calsbergensis	Non-mutated (Pure)	10·00	5·92	5·92	0·00	4·08	40·80	0·4528	0·0705	0·3823	11·02	0·42	10·29	1·1864	29·07
2.	S. Calsbergensis	Mutated	10·00	5·55	6·02	0·47	3·98	39·80	0·4112	0·0235	0·3877	9·80	0·20	5·03	1·0452	26·26.

Table no. 41

Study of the Loss of Nitrogen in Dhar Yeast Cultures when 5 per cent sucrose solution (5 gms of sugar in 100 c.c) is used as carbon source and ammonium sulphate as nitrogen source, in C/N ratio 80·0, 40·0, 26·6 and 20·0 under non-aerated conditions.

Seeded on the 30-1-50. } 25 days
Analysed on the 25-2-50.

Tempt - 23·5° to 26·5 °C.
pH - 4·0.

	Culture contents		Sugar					Acid				Alcohol		Yeast		Nitrogen.					
S.N.	gms. of ammonium sulphate in the culture.	Carbon nitrogen ratio of the culture. C/N	gms. of Reducing sugar left in the culture unconsumed.	gms. of total sugar left unconsumed.	gm. of non-reducing sugar in the culture.	gms. of sugar consumed in fermentation	Percentage of sugar fermented.	gm. eqn. of total acid formed in the culture.	gm. eqn. of volatile acid produced.	gm. eqn. of non-volatile acid in culture.	Percentage of Acid production	gms. of ethyl alcohol in culture.	Percentage of alcohol formation cal. on the basis of sugar used.	gms. of yeast grown in the culture.	Percentage of Yeast Yield cal. on the basis of consumed sugar	gms of N 100 c.c. in the culture in beginning.	gms. of nitrogen left in the culture after fermentation.	gms of nitrogen consumed in process of fermentation	gms. of nitrogen used in yeast cells.	gms. of nitrogen lost during fermentation	Percentage of the loss of nitrogen cal. on the basis of nitrogen used in fermentation.
1	0·1178	80·00	3·78	3·78	0·00	1·22	24·40	0·1290	0·0050	0·1240	10·57	0·10	8·20	0·3930	31·96	0·0250	0·0031	0·0219	0·0198	0·0021	10·00
																		→ gms. of yeast produced by 1 gm of nitrogen = 17·92			
2.	0·2356	40·00	3·24	3·37	0·13	1·63	32·60	0·1560	0·0050	0·1510	9·57	0·15	9·20	0·5416	33·12	0·0500	0·0187	0·0313	0·0273	0·0040	13·00
																		→ gms of yeast produced by 1 gm of nitrogen = 17·28			
3.	0·3534	26·66	3·16	3·18	0·02	1·82	36·40	0·2475	0·0050	0·2425	13·32	0·48	26·33	0·5399	30·25	0·0750	0·0428	0·0322	0·0267	0·0055	17·38
																		→ gms. of yeast produced by 1 gm of nitrogen. = 16·73			
4.	0·4712	20·00	3·40	3·49	0·09	1·51	30·20	0·1594	0·0050	0·1544	10·55	0·48	31·78	0·4418	29·25	0·1000	0·0679	0·0321	0·0222	0·0099	30·84
																		→ gms of yeast produced by 1 gm of nitrogen = 13·73			

Table no. 42.

Study of the loss of nitrogen in yeast cultures containing different quantities of ammonium sulphate as nitrogen food and ethyl alcohol as carbon food under non-aerated conditions. (7·80 gms. of ethyl alcohol in 400 c.c.)

Seeded on the 7th Feb '50.

Analysed on the 6th March '50.

Temp. – 23·4°C to 27·5°C.

pH – 4·5

S.N	Contents.		Alcohol			Acids				Yeast	Nitrogen.									
	gms. of ammonium sulphate in the whole culture (400 c.c.)	C/N ratio of the culture before start.	gms. of ethyl alcohol left in the control flask after complete fermentation i.e. gms. of alcohol in beginning.	gms. of ethyl alcohol left in the culture after fermentation.	gms. ethyl alcohol consumed in the process of fermentation.	gm. eqv. of Total acid formed in the culture.	gm. eqv. of volatile acid formed in the culture.	gm. eqv. of non-volatile acid formed in the culture.	Percentage acid production Cal. on the basis of alcohol consumed	gm. of yeast grown in the culture.	Percentage of yield Cal. on the basis of alcohol used	Percentage of ammonium nitrogen in culture in beginning.	gms. of total ammonical nitrogen in culture in beginning.	gms. of nitrogen left in culture after fermentation.	gms. of nitrogen consumed during fermentation	gms. of Nitrogen used in yeast formation.	gms. of nitrogen lost during fermentation.	Percentage of loss of nitrogen Cal. on the basis of nitrogen consumed.	Percentage of nitrogen utilisation Cal. on the basis of N used.	gms. of yeast produced per gms. of nitrogen
1	0·9428	20·00	7·80	1·24	6·56	0·8552	0·0269	0·8283	13·11	2·6662	40·70	0·050	0·20000	0·00624	0·19376	0·14630	0·04746	23·70	76·30	13·75
2.	1·4142	13·33	7·80	1·04	6·76	1·0245	0·0034	1·0211	15·09	3·3146	49·02	0·075	0·30000	0·04375	0·25625	0·18283	0·06393	24·88	75·12	12·95
3.	1·8856	10·00	7·80	0·92	6·98	1·0514	0·0034	1·0480	15·04	3·3902	48·64	0·100	0·40000	0·14052	0·25948	0·18645	0·07303	28·14	71·86	13·09

Table – 43.

Study of the loss of nitrogen in yeast cultures containing varying different quantities of ammonium sulphate as source of nitrogen and 2·5 per cent sucrose solution (10 grs in 400 cc.) as source of carbon under non-aerated conditions.

Seeded on the 9th Feb '50.

Analysed on the 6th March '50.

Compt. 23·4°c to 27·5°c.

pH. 4·5.

S.N.	Contents.		Sugar.						Acid.				Alcohol		Yeast.		Nitrogen.							
	grs. of $(NH_4)_2SO_4$ in the culture.	C/N ratio of the culture in begining.	grs. of total sugar before fermentation.	grs. of total sugar left in culture after fermentation.	grs. of Reducing sugar in the culture.	grs. of non-reducing sugar in the culture.	grs. of Sugar used in fermentation.	Percentage of Fermentation cal. on the basis of total sugar in begin.	grs. eqv. of Total acid formed in the culture.	grs. eq. of volatile acid in the culture.	grs. eqv. of non-volatile acid in culture.	Percentage of acid production cal. on the basis of sugar used.	grs. of total alcohol formed in the culture.	Percentage of alcohol formation cal. on the basis of sugar used.	grs. of yeast grown in the culture.	Percentage of yield cal. on the basis of sugar used.	Percentage of nitrogen in the culture.	grs. of nitrogen in the culture before fermentation.	grs. of nitrogen left in the culture after fermentation	grs. of nitrogen consumed in fermentation.	grs. of nitrogen taken up by yeast in cells formation	grs. of nitrogen lost during fermentation.	Percentage of loss of nitrogen cal. on the basis of nitrogen consumed.	grs. of yeast formed for 1 gm of nitrogen.
1	0·4714	40·00	10·00	3·86	3·86	0·00	6·14	61·40	0·4718	0·0102	0·4616	7·81	0·40	0·61	1·3748	22·31	0·025	0·10000	0·00625	0·09375	0·07557	0·01818	19·40	14·65
2.	0·9428	20·00	10·00	0·69	0·69	0·00	9·31	93·10	0·7953	0·0134	0·7819	8·58	0·52	@ 5·50	2·2538	24·16	0·050	0·20000	0·02875	0·17125	0·12397	0·05728	33·48	13·17
3.	1·4142	13·33	10·00	0·29	0·29	0·00	9·71	97·10	0·8222	0·0182	0·8040	8·64	0·60	@ 6·10	2·2456	23·04	0·075	0·30000	0·11562	0·18438	0·12353	0·06085	32·99	12·18
4	1·8856	10·00	10·00	0·00	0·00	0·00	10·00	100·00	0·8880	0·0215	0·8665	8·88	0·84	8·40	2·3192	23·19	0·100	0·40000	0·22189	0·17811	0·12754	0·05057	28·48	13·02

Table - 44.

24.

Study of the loss of Nitrogen in yeast cultures containing ethyl alcohol as (5 c.c. absolute ethyl alcohol in 400 c.c.) as carbon food and urea as source of nitrogen food at various C/N ratios under non-aerated conditions.

Seeded on 2nd. March 1950.

Analysed on 20th March 1950.

Tempt. 26·0°C – 27·0°C.

pH. 4·5.

S.N.	gms. of urea in the culture.	Carbon/Nitrogen ratio of the culture.	gms. of ethyl alcohol originally present in the culture.	gms. of ethyl alcohol left in the culture unused.	gms. of ethyl alcohol consumed in fermentation.	Percentage of alcohol consumed cal. on the basis of alcohol in the begining.	gm. equ. of Alkali formed during yeast growth.	Percentage of alkali formation cal. on the basis of alcohol consumed.	gms. of yeast grown in the culture during fermentation.	Percentage of Yield cal. on the basis of alcohol consumed.	Percentage of urea nitrogen in the culture before fermentation.	gms. of Total nitrogen in the culture in begining.	gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen used in the process of fermentation.	gms. of nitrogen taken up by Yeasts for their growth.	gms. of nitrogen Lost during the process.	Percentage of loss of nitrogen in the culture cal. on the basis of nitrogen consumed in fermentation.	gms. of Yeasts produced by 1 gms. of urea nitrogen.
1.	0·2143	26·00	3·60	0·00	3·60	100·00	0·0539	1·49	1·4996	41·66	0·0250	0·1000	0·02912	0·07088	0·07008	0·00080	1·12	21·43
2.	0·4286	13·00	3·60	1·00	2·60	72·22	0·2561	9·85	1·9720	75·79	0·0500	0·2000	0·11104	0·08896	0·08696	0·00200	2·27	22·80
3.	0·6429	8·66	3·60	2·32	1·28	35·55	0·33708	26·32	0·9096	70·28	0·0750	0·3000	0·21092	0·08907	0·04450	0·04457	49·43	10·21
4.	0·8572	6·50	3·60	1·68	1·92	56·02	0·3639	18·97	0·7248	37·69	0·1000	0·4000	0·32116	0·06884	0·03600	0·03284	52·94	10·60

Table 45.

Study of the loss of nitrogen in yeast cultures which contain ~~so~~ 2·50 per cent sugar (10 gms in 400 c.c.) and different quantities of urea as source of nitrogen.

Seeded on the 2nd. March '50

Analysed on the 4th. April '50.

temperature – 25·2°C to 29·2°C.

pH. 4·5

S.N.	gms. of urea in 400 c.c. of the culture.	C/N ratio of the culture	gms. of sugar in the culture before fermentation	gms. of total sugar left in the culture after fermentation.	gms. of reducing sugar in the culture after fermentation.	gms. of non-reducing sugar left in the culture after fermentation	gms. of sugar consumed in the process of fermentation	Percentage of sugar consumed cal. on the basis of original sugar.	gm. eqn. of total acid produced in the culture.	gm. eqn. of volatile acid produced in the culture	gm. eqn. of non-volatile acid formed.	Percentage of acid produced cal. on the basis of sugar consumed
1.	0·2143.	40·0	10·00	3·69	3·63	0·06	6·31	63·10	0·0539	0·0067	0·0472	0·85
2	0·4286	20·0	10·00	4·82	4·08	0·74	5·18	51·80	0·0000	0·0088	0·0000	0·00
3.	0·6429	13·3	10·00	3·88	2·92	0·96	6·12	61·20	0·0000	0·0048	0·00000	0·00
4	0·8572	10·0	10·00	3·05	1·56	1·49	6·95	69·50	0·0000	0·0047	0·0000	0·00

S.N.	gm. eqn. of alkali formed in the culture.	Percentage of alkali formed in cal. on the basis of sugar consumed.	gms. of ethyl alcohol found in the culture.	Percentage of alcohol formed in.	gms. of yeast grown in the culture.	Percentage of yeast yield cal. on the basis of sugar used.	gms. of total nitrogen in culture before fermentation.	gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen consumed in the fermentation.	gms. of nitrogen in the yeast in making its body matter.	gms. of nitrogen lost during fermentation	Percentage of loss of N cal. on N consumed	gms. of yeast by 1 gm of Nitrogen
1.	0·00	0·00	0·04	0·64	0·9676	15·37	0·10000	0·03363	0·06636	0·04886	0·01750	26·35	14·57
2	0·0539	1·04	0·26	5·01	0·7590	14·67	0·20000	0·13830	0·06170	0·03832	0·02338	37·92	12·30
3.	0·0539	0·88	0·80	13·07	0·7728	12·58	0·30000	0·22954	0·07046	0·03874	0·03172	45·02	11·08
4	0·1078	1·49	0·40	5·75	0·6962	10·01	0·40000	0·32116	0·06884	0·03515	0·03369	48·98	10·12

Table 4b.

Study of the effect of diffused light of the room, zinc sulphate, and fucshine dye separately, on the loss of nitrogen in yeast cultures when ammonium sulphate is used as source of nitrogen and ~~ethyl~~ 1·25 per cent v/v of ethyl alcohol is used as the carbon food, under non-aerated conditions. (5c.c. absolute ethyl alcohol in 400c.c.)

Seeded on - 11th March '50.

Analysed on - 14th April '50.

Temp. - 27·0°C - 32·5°C

pH - 4·5

OH 43

S.N.	Condition of the culture.	gms of $(NH_4)_2SO_4$ in the whole culture.	C/N ratio of the culture.	gms. of ethyl alcohol added in the culture in beginning.	gms. of ethyl alcohol left in the culture after fermentation.	gms. of ethyl alcohol consumed during fermentation.	gm. eqn. of acid formed in culture in total.	gm. eqn. of volatile acid formed in the culture.	gm. eqn. of non-volatile acid formed in the culture.	Percentage of acid formed cal. on the basis of alcohol consumed.	gms. of yeast grown in the culture.	Percentage of yeast yield cal. on the basis of alcohol used.	gms of total nitrogen present in the culture before fermentation.	Percentage of nitrogen in the culture in beginning.	gms of nitrogen left in the culture after fermentation.	gms. of nitrogen in the cells of yeast.	gms. of nitrogen lost during fermentation.	Total gms of nitrogen consumed in fermentation.	Percentage of loss of nitrogen calculated on the basis of N consumed.	gms. of yeast produced by 1 gm of nitrogen.
1.	Light (diffused light of the room).	0·9428	10	3·84	1·64	2·20	0·5257	0·0052	0·5205	24·09	1·3576	61·82	0·20000	0·05	0·04218	0·06868	0·08914	0·15782	56·67	8·60
2.	Dark	0·9428	10	3·84	0·64	3·20	0·3774	0·0067	0·3707	11·84	1·4686	45·93	0·20000	0·05	0·04219	0·07424	0·08357	0·15781	52·53	9·29
3.	$ZnSO_4$	0·9428	10	3·84	2·76	1·08	0·5796	0·0238	0·5558	53·70	1·0363	95·37	0·20000	0·05	0·06875	0·05252	0·07873	0·13125	59·54	7·90
4.	Fucshine	0·9428	10	3·84	1·36	2·48	0·3238	0·0052	0·3181	23·53	1·3897	56·04	0·20000	0·05	0·06250	0·07019	0·06731	0·13750	48·55	10·07

Table. 47.

Study of the loss of nitrogen, yeast growth, alcohol formation and acid production in yeast-cultures containing sucrose as carbon and ammonium sulphate as nitrogen food at C/N ratio 40. The concentration of sucrose in the cultures varied from 0·5 to 2·0 per cent and ~~the~~ fermentation was carried under non-aerated conditions.

Seeded on 3rd. April '30.

Analysed on 23rd. April '30.

Temp. 28·4° - 31·5°

~~pH~~ pH - 4·5

C/N. 40

S.N.	Contents of the culture.		Contents of the culture in terms of C and N.		Sugar					Acids formed				Alcohol		Yeast		Nitrogen.					
	gms. of sucrose	gms. of $(NH_4)_2SO_4$.	gms. of carbon in the culture in begin.	gms. of N in the culture in begin.	gms. of reducing sugar left	gms. of Total Sugar left.	gms. of non-reducing sugar left.	gms. of sugar consumed in fermentation	Percentage of fermentable sugar.	gm. equ. of total acid formed.	gm. equ. of volatile acid formed.	gm. equ. of non-volatile acid formed.	Percentage of acid formation calculated on the sugar consumed	gms. of alcohol in the culture.	Percentage of alcohol formation calculated on the basis of sugar used.	gms. of yeast grown in the culture.	Percentage of yield of dry yeast calculated on the basis of sugar used.	gms. of nitrogen left in the culture after fermentation	gms. of nitrogen consumed during fermentation	gms. of nitrogen present in the yeast cells.	gms. of nitrogen lost during fermentation.	Percentage of nitrogen lost calculated on the basis of consumed nitrogen	1 gm. of N gives so many gms. of dry yeast.
1	1·00	0·0447 ~~0·0095~~	0·3800	0·0095	0·00	0·00	0·00	1·00	100·00	0·0741	0·0002	0·0739	7·41	0·15	15·00	0·1384	13·84	0·00000	0·00948	0·00698	0·00249	26·37	14·59
2.	2·00	0·0895	0·7600	0·0190	0·00	0·00	0·00	2·00	100·00	0·1685	0·0005	0·1680	8·42	0·24	12·00	0·2556	12·78	0·00022	0·01750	0·01291	0·00437	25·00	14·60
3.	3·00	0·1343	1·1400	0·0285	0·75	0·76	0·01	2·24	74·33	0·2426	0·0009	0·2417	10·83	0·21	9·22	0·4085	18·23	0·00182	0·02668	0·02062	0·00606	24·60	15·04
4.	4·00	0·1707	1·5800	0·0385	0·00	0·00	0·00	4·00	100·00	0·3774	0·0011	0·3763	9·43	0·24	6·05	0·5090	12·75	0·02291	0·03318	0·02570	0·00770	23·23	15·64

Table 48

Note - Each of the above cultures contains following salts:-

$Ca_3(PO_4)_2$ - 0·0500 gms.

$MgCO_3$ - 0·0250 gms.

Na_2CO_3 - 0·0200 gms.

K_2SO_4 - 0·0200 gm.

Study of the loss of nitrogen, yeast growth, alcohol formation and yeast production in cultures containing Sucrose as Carbon and ammonium sulphate as nitrogen food. The C/N ration of the cultures was 20 and sugar concentration in different cultures varied between 0·5 to 2·0 per cent. During fermentation cultures were kept under non-aerated conditions.

Seeded on the 3rd April '50

Analysed on the 27th April '50

Temp. 28·1° – 32·3°C.

pH. 4·5.

21

C/N 20

S.N.	Contents of the culture: gms. of Sucrose originally added in the Culture.	gms. of (NH4)2SO4 originally added in the culture.	Content of the cultures in C and N.: gms. of Carbon in the culture before fermentation.	gms. of nitrogen in culture before fermentation.	Sugar: gms. of reducing sugar in the culture.	gms. of total sugar left in the culture after fermentation.	gms. of non-reducing sugar present in the culture after fermentation.	gms. of sugar consumed during fermentation	Acids: gm. equ. of total acid formed during fermentation.	gm. equ. of volatile acids formed during fermentation.	Percentage of acid formation Cal. on the basis of sugar consumed.	Alcohol: gms. of alcohol produced in the culture	Percentage of alcohol formation Cal. on the basis of sugar consumed.	Yeast: gms. of dry yeast in the culture during fermentation.	Percentage of yeast yield cal. on the basis of sugar used.	Nitrogen: gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen consumed during fermentation.	gms. of nitrogen taken up by yeast cells.	gms. of nitrogen lost during yeast growth.	Percentage of nitrogen lost on the basis of nitrogen consumed.	1gm. of nitrogen yields so many gms. of dry yeast.
1	1·00	0·0895	0·3800	0·0190	0·00	0·00	0·00	1·00	0·1752	0·0006	17·52	0·12	12·00	0·1984	19·84	0·00156	0·01744	0·01001	0·00742	42·58	11·38
2	2·00	0·1603	0·7600	0·0340	0·00	0·00	0·00	2·00	0·2561	0·0008	12·80	0·18	9·00	0·4024	20·12	0·00056	0·03344	0·02032	0·01311	39·23	12·02
3	3·00	0·2689	1·1400	0·0570	0·00	0·00	0·00	3·00	0·3370	0·0012	11·13	0·18	6·12	0·6736	22·45	0·00156	0·05544	0·03401	0·01942	35·03	12·25
4	4·00	0·3725	1·5800	0·0790	0·00	0·00	0·00	4·00	0·3976	0·0015	10·04	0·16	4·04	0·6834	17·08	0·02340	0·05560	0·03451	0·01781	32·04	12·61

Table 49.

Each culture contains following salts:-

$Ca_3(PO_4)_2$ – 0·5000 gm.

$MgCO_3$ – 0·2500 gm.

Na_2CO_3 – 0·2000 gm.

K_2SO_4 – 0·2000 gm.

Study of the loss of nitrogen, yeast growth, alcohol formation and acid production in cultures containing Sucrose as Carbon and ammonium sulphate as nitrogen food. The concentration of Sucrose in the cultures varied between 0·5 to 2·0 per cent and fermentation was carried under non-aerobic conditions. The C/N ratio of the cultures was 15.

Seeded on the 3rd May '50

Analysed on the 22nd May '50

Temp:- 33·5° — 35° C.

ph. 4·5.

C/N 15

Serial No.	Contents		Contents of the culture in terms of C and N.		Sugar.				Acid			Alcohol		Yeast		Nitrogen.					
	gms. of Sucrose added in the culture before fermentation.	gms. of $(NH_4)_2SO_4$ in the culture before fermentation started.	gms. of Carbon present in the culture before fermentation.	gms. of nitrogen present in the culture before fermentation started.	gms of total sugar left in the culture after fermentation.	gms. of reducing sugar left in the culture after fermentation.	gms. of non-reducing sugar left in the culture after the fermentation.	gms. of sugar consumed during fermentation.	gm. equ. of total acid formed during fermentation.	gm. equ. of volatile acid formed during fermentation.	Percentage of yeast yield cal. on the basis of sugar consumed.	gms. of ethyl alcohol formed in the culture during fermentation.	Percentage of ~~yeast formed~~ alcohol formation cal. on the basis of sugar consumed.	gms. of yeast grown in the culture during fermentation.	Percentage of yeast yield cal. on the basis of Sugar Consumed.	gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen consumed during fermentation.	gms. of nitrogen in the yeasts formed during fermentation.	gms. of nitrogen lost during fermentation.	Percentage of nitrogen lost cal. on the basis of nitrogen consumed.	1 gm of N gives so many gms of dry yeast.
1	1·00	0·2389	0·3800	0·5067 0·1080	0·00	0·00	0·00	1·00	0·3100	0·0009	31·00	0·08	8·05	0·1916	19·16	0·03412	0·01649	0·00967	0·00811	49·20	11·00
2	2·00	0·4752	0·7600	~~0·0506~~	0·00	0·00	0·00	2·00	0·3707	0·0013	18·50	0·12	5·75	0·4094	20·45	0·06711	0·04089	0·02067	0·01881	46·02	11·42
3	3·00	0·7260	1·1400	0·1540 ~~0·0760~~	0·25	0·25	0·00	2·75	0·4313	0·0016	15·67	0·11	4·08	0·6764	24·59	0·09710	0·05690	0·03415	0·02460	43·25	11·74
4	4·00	0·9900	1·5800	0·2100 ~~0·1540~~ ~~0·1053~~	0·82	0·82	0·00	3·18	0·3946	0·0018	12·41	0·09	2·95	0·7550	23·74	0·14576	0·06434	0·03812	0·02621	40·75	11·89

Table 50.

Each culture contains:

$Ca_3(PO_4)_2$ - 0·5000 gm.

$MgCO_3$ - 0·2500 gm.

K_2SO_4 - 0·2000 gm.

Na_2CO_2 - 0·2000 gm.

Study of the loss of nitrogen, yeast growth, alcohol formation and acid production with sulphites of C/N ratio 10 and containing sucrose as carbon and ammonium sulphate as nitrogen between 0·5 to 2·0 per cent and fermentation was carried under different concentration of sucrose in the different cultures varied non-aerated conditions.

Seeded on the 3rd. May '50

analysed on the 22nd. May '50.

Temp — 33·5° — 35°C.

pH — 4·5

C/N 10

Sl.	Content		Content of the culture in terms of C and N.		Sugar				Acid			Alcohol		Dry yeast		Nitrogen.				Protein	
	gms. of sucrose added in the culture before fermentation.	gms. of $(NH_4)_2SO_4$ added in the culture before fermentation	gms. of carbon in the culture before fermentation	gms. of nitrogen in the culture in begining.	gms. of total sugar left unused in the culture.	gms. of reducing sugar left after fermentation.	gms. of non-reducing sugar left after fermentation	gms. of sugar consumed during fermentation.	gms. equ. of total acid found during fermentation.	gm. equ. of volatile acid found during yeast growth.	Percentage of acid formation cal. on the basis of sug. consumed.	gms. of ethyl alcohol formed in the culture by yeast growth.	Percentage of alcohol formation cal. on the basis of sugar consumed.	gms. of dry yeast grown in the culture during fermentation.	Percentage of yeast yield cal. on the basis of sugar consumed.	gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen consumed during yeast growth.	gms. of nitrogen present in the yeast grown in the culture.	gms. of nitrogen lost during the fermentation.	Percentage of N lost cal. on the basis of N consumed.	1 gm. of nitrogen produces so many gms. of dry yeast.
1	1·00	0·3300	0·3800	0·0380	0·00	0·00	0·00	1·00	0·3841	0·0014	38·00	0·04	4·06	0·2853	28·53	0·00798	0·03002	0·01441	0·01561	52·02	12·75
2	2·00	0·7260	0·7600	0·0760	0·00	0·00	0·00	2·00	0·4381	0·0017	21·90	0·07	3·56	0·2966	14·83	0·04052	0·03548	0·01498	0·02040	57·50	8·36
3.	3·00	1·0560	1·1400	0·1140	0·00	0·00	0·00	3·00	0·4815	0·0019	16·05	0·09	2·85	0·3766	12·55	0·06136	0·05264	0·01902	0·03318	63·05	7·15
4	4·00	1·4520	1·5800	0·1580	0·00	0·00	0·00	4·00	0·5594	0·0022	13·85	0·09	2·15	0·8934	22·33	0·01153	0·14647	0·04511	0·10124	69·02	8·12

Table 51.

Each culture contains:

$Ca_3(PO_4)_2$ — 0·5000 gm.

$MgCO_3$ — 0·2500 gm.

K_2SO_4 — 0·2000 gm.

Na_2CO_3 — 0·2000 gm.

Study of the loss of nitrogen in yeast cultures at different carbon nitrogen ratios eg. 5, 10, 20 and 40, using potassium nitrate as nitrogen and sucrose as carbon sources, under non-aerated conditions. 5 gms. of sucrose was present in 400 c.c. of the cultures.

Seeded on the 4th April 1950

Analysed on the 26th July 1950.

Tempt — 30°c - 36.0°c.

pH - 4.5.

Serial no.	Content		Sugar				Acid			Alcohol		Yeast		Nitrogen						
	Carbon nitrogen ratio of the culture.	gms. of KNO_3 present in the culture	gms. of Total sugar left in the culture after fermentation.	gms. of reducing sugar left in the culture after fermentation	gms. of non-reducing sugar left in the culture.	gms. of ~~nitrogen~~ sugar consumed during fermentation.	gm. equ. of total acid formed.	gm. equ. of volatile acid produced in the culture	gm. equ. Percentage of acid formation cal. on the basis of sugar consumed.	gms. of ethyl alcohol in the culture	Percentage of ethyl alcohol formed, cal. on the basis of sugar used.	gms. of yeast grown in the culture.	Percentage of yeast yield cal. on the basis of sugar used.	gms. of nitrogen originally present in the culture	gms. of nitrogen left in the culture after fermentation	gm. of nitrogen utilised in cell formation.	gms. of nitrogen consumed during fermentation.	gms. of nitrogen lost in fermentation.	Percentage of loss of nitrogen cal. on the basis of sugar nitrogen consumed	gms. of dry yeast formed by 1 gram of nitrate nitrogen.
1	5.0	2.7404	4.55	4.55	0.00	0.45	0.1884	0.0004	41.86	0.00	0.00	0.0092	2.04	0.38000	0.32608	0.00046	0.05392	0.05346	99.14	0.18
2	10	1.3707	4.00	3.96	0.04	1.00	0.1884	0.0006	18.84	0.02	2.00	0.0121	1.21	0.19000	0.15195	0.00061	0.03805	0.03744	98.39	0.31
3	20	0.6850	4.22	3.64	0.58	0.78	0.1884	0.0008	24.15	0.02	2.66	0.0226	2.89	0.09500	0.07499	0.00114	0.02001	0.01887	94.30	1.12
4	40	0.5222	4.04	3.60	0.44	0.96	0.1413	0.0009	14.61	0.03	3.12	0.0428	4.45	0.04750	0.04239	0.00216	0.00511	0.00285	55.77	8.37

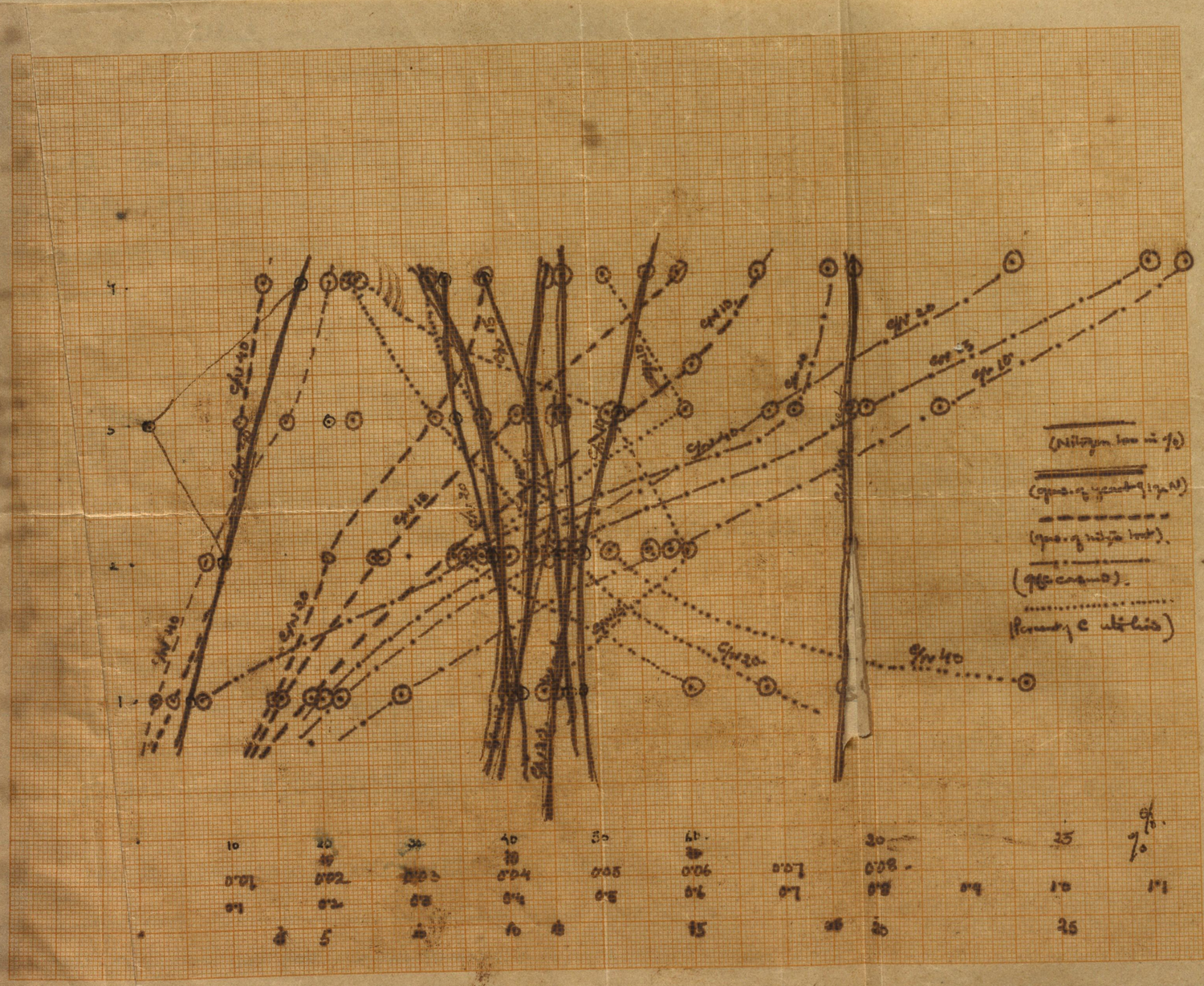
table no 52.

Study of the loss of nitrogen in yeast cultures using different ammonium salts as source of nitrogen and ethyl alcohol as source of carbon food under non-aerated conditions.

Seeded on the 18th. May 1950 Temp. 36°C to 29.6°C.
Analysed on the 2nd. Aug. 1950. pH. 4.5.

Serial No.	Contents				Alcohol		Acid			Yeast		Nitrogen.						
	Ammonium salts used in the culture as nitrogen food.	gms. of the ammonium salt used.	gms. of ethyl alcohol in the culture.	Carbon nitrogen ratio of the culture.	gms. of ethyl alcohol left in the culture.	gms. of ethyl alcohol used during yeast growth.	gm. eqv. of acid produced in culture.	gm. eqv. of volatile acid produced during fermentation.	Percentage of acid yield cal. on the basis of alcohol consumed.	gms. of dry yeast grown in the Culture.	Percentage of yield of dry yeast cal. on the basis of alcohol consumed	gms. of nitrogen present in the culture in begining.	gms. of nitrogen left in the culture after fermentation.	gms. of nitrogen present in yeast grown during fermentation.	gms. of nitrogen Consumed during fermentation.	gms. of nitrogen lost during fermentation	Percentage of the loss of N cal. on the basis of [illegible] consumed.	1gms. of nitrogen yields so many gms. of dry yeast.
1	ammonium sulphate	0.9428	2.32	7.12	0.20	2.12	0.2431	0.0132	11.31	0.9659	45.54	0.22848	0.11150	0.04878	0.11698	0.06820	58.30	8.25.
2	ammonium carbonate	0.6851	2.32	11.7	0.40	1.92	0.1157	0.0132	6.24	0.7568	39.41	0.14108	0.04201	0.03822	0.09907	0.05706	57.59	7.63
3	ammonium bitartrate	2.1571	2.32	7.80	0.64	1.68	0.2928	0.0033	17.42	1.1828	70.40	0.21184	0.05317	0.05973	0.15817	0.09844	62.23	7.47
4	Sodium ammonium hydrogen-phosphate	1.9571	2.32	11.00	0.00	2.32	0.1392	0.0000	0.00.	1.0528	45.38	0.15423	0.00000	0.05317	0.15423	0.10106	65.52	6.79
5	ammonium hydrogen phosphate	1.6428	2.32	4.31	0.40	1.92	−0.2674	0.0000	0.00	1.1112	57.86	0.37699	0.21331	0.05612	0.16368	0.10756	65.34	6.78.

Note – No yeast growth took place in cultures containing ammonium oxalate or ammonium chromate as source of nitrogen food.



(Nitrogen loss in %)
(gas. of yeast 1 gr N)
(gas. of nitrite test).
(gas casing).
(Percent of C utilised)
C/N 40
C/N 20
C/N 10
C/N 3
C/N 15
10
20
30
40
50
60
20
25
%
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
5
10
15
20
25

Study of the ~~[illegible]~~ residual effect ~~[illegible]~~ of mutation induced by fuchsin dye in the yeasts ~~left in yeasts~~ after ~~growing~~ they have been grown ~~[illegible]~~ for nearly 10 days (in ordinary sucrose cultures). ~~The yeast was mutated and the~~ traces of samples of yeast obtained from the cultures of the table no 2 before analysis were added in ~~a [illegible]~~ test-tubes containing sterilised cultures. After due activation ~~these~~ ~~[illegible]~~ ~~yeast~~ yeast cultures were used ~~to~~ as seed ~~yeast~~ in the following experiments.

2 Study of the ~~[illegible]~~ residual affect of the mutations induced by fuchsin dyes in the yeasts after they have been grown in ordinary sucrose cultures for nearly 2 months. ~~The cultures~~ A few drops of ~~the~~ each cultures of the table no 3 were taken out in separate test-tubes containing sterilised sucrose yeast cultures. After the proper activation of these samples these test-tube cultures were used for seeding in the following experiments. 10 g. of sucrose was put in 200 c.c. of each culture and the ~~experi~~ study was made under non-aerated conditions.

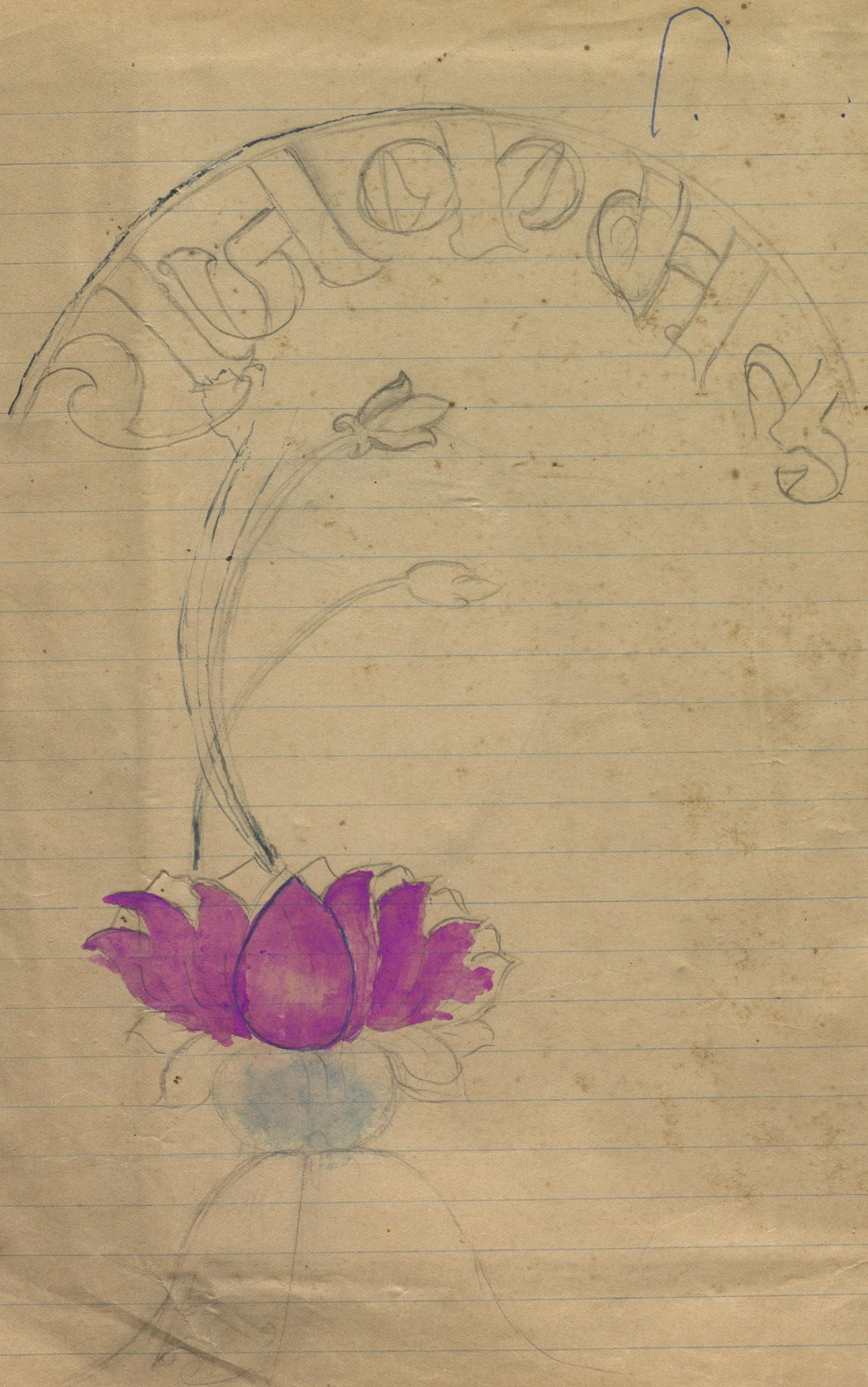
Study of the loss of nitrogen in yeast cultures containing ammonium nitrate as source of nitrogen and sucrose as source of carbon.
The C/N ratio of the culture was kept constant at 40 and sugar concentration varied from 0·5 to 2 per cent.

Seeded on the 22nd July '50
Analysed on the 18th Aug '50.

C/N 40

Condition — non aerated
temperature — 32·0 – 29·7°C.
pH — 4·5.

S.N.	Gms. of sucrose in the beginning of fermentation (in 200 c.c.)	Gms. of ammonium nitrate added in the culture in beginning	Carbon nitrogen ratio of the culture before the fermentation	Gms. of nitrogen originally present in the culture before fermentation	Gms. of ammonium nitrogen in the culture before the fermentation started	Gms. of nitric nitrogen in the culture before the fermentation	Gms. of total nitrogen left in the culture after the fermentation	Gms. of ammonium nitrogen left in the culture after fermentation	Gms. of nitric nitrogen left in the culture after yeast growth	Gms. of total nitrogen consumed during the yeast growth	Gms. of ammonium nitrogen consumed during the yeast growth	Gms. of nitric nitrogen consumed during the yeast growth	Percentage of ammonium nitrogen consumed calculated on the basis of total nitrogen consumed	Percentage of the nitric nitrogen consumed calculated on the basis of total nitrogen consumed	Gms. of nitrogen in the yeast cells formed during the ~~yeast~~ fermentation	Gms. of nitrogen wasted during the yeast growth	Percentage of the loss of nitrogen calculated on the basis of total nitrogen consumed during fermentation	Gms. of dry yeast produced by 1 gm. of nitrogen after its complete consumption	Gms. of ethyl alcohol formed during yeast growth	Percentage of alcohol formation calculated on the basis of sugar used	Gm. equ. of total acid formed during the fermentation	Gm. equ. of volatile acid formed during fermentation	Gm. eq. of non-volatile acid formed during the yeast growth	Percentage of acid formation calculated on the basis of sugar consumed	Gms. of total sugar left in the culture after fermentation	Gms. of Reducing sugar left in the culture after fermentation	Gms. of non-reducing sugar left in the culture after fermentation	Gms. of sugar consumed during the yeast growth	Percentage of the sugar consumed calculated on the basis of the original sugar left in the culture	Gms. of dry yeast produced during the fermentation	Percentage of yeast yield calculated on the basis of the sugar consumed	Gms. of carbon consumed during the yeast growth	Gms. of carbon in the yeast cells produced during the fermentation	Percentage of the carbon utilised calculated on the basis of the carbon consumed
1	1·00	0·0172	40	0·00650	0·00325	0·00325	0·00240	0·00000	0·00240	0·00410	0·00325	0·00085	79·26	20·73	0·00397	0·00013	3·17	18·71	0·00	0·00	0·1344	0·0005	0·1339	53·76	0·75	0·73	0·02	0·25	25·00	0·0786	31·44	0·6734	0·0179	24·33
2	2·00	0·0543	40	0·01900	0·00950	0·00950	0·00874	0·00000	0·00874	0·01026	0·00950	0·00076	92·57	7·40	0·00975	0·00051	4·96	18·80	0·00	0·00	0·1972	0·0005	0·1967	18·87	0·76	0·72	0·04	1·24	82·00	0·1930	15·56	0·3647	0·0441	12·92 ~~6·69~~ m.
3	3·00	0·0814	40	0·02860	0·01425	0·01425	0·01617	0·00244	0·01353	0·01243	0·01181	0·00062	95·84	5·02	0·01219	0·00024	1·94	19·42	0·00	0·00	0·1953	0·0009	0·1944	7·90	0·55	0·54	0·01	2·45	88·16	0·2414	9·05	0·7200	0·0553	6·69
4	4·00	0·1086	40.	0·03800	0·03800	0·03800	0·02293	0·02330	0·03763	0·01507	0·01470	0·00037	97·54	2·50	0·01560	0·00288	19·11	19·82	0·00	0·00	0·2028	0·0009	0·2018	8·11	1·50	0·92	0·58	2·50	62·50	0·3094	12·37	0·7347	0·0707	9·62



Study of the loss of nitrogen in yeast cultures containing ammonium ~~salt~~ nitrate as source of nitrogen and sucrose as carbon food. The C/N ration of the culture was kept constant at ~~9~~ 20 and the concentration of ~~sucrose~~ sucrose varied from 0·5 to 2·0 per cent. All the cultures were kept under non-aerated conditions.

Seeded on the 22nd July '50
Analysed on the 20th Aug. '50

C/N 20

Condition – non-aerated
temperature – 32 - 29·7 °C
pH – 4·5.

S.N.	Gms. of sucrose present in the culture in hyeing. (in 2000 c.c.)	Gms. of ammonium nitrate added in the culture.	Carbon nitrogen ratio of the culture before the fermentation started.	Gms. of total nitrogen in the culture before the fermentation.	Gms. of ammonical nitrogen before the yeast growth.	Gms. of nitric nitrogen before the fermentation.	Gms. of total nitrogen left after the fermentation.	Gms. of ammonical nitrogen left after the fermentation.	Gms. of nitric nitrogen left in the culture after fermentation.	Gms. of total nitrogen consumed during yeast growth.	Gms. of ammonical nitrogen consumed during yeast growth.	Gms. of nitric nitrogen consumed during yeast growth.	Gms. of nitrogen in the yeast produced during the fermentation.	Gms. of nitrogen lost during the fermentation.	Percentage of the loss of nitrogen cal. on the basis of nitrogen consumed.	Gms. of ethyl alcohol formed during the fermentation.	Percentage of alcohol formed calculated on the basis of sugar consumed.	Gm. eqn. of total acid formed during the fermentation.	Gm. eqn. of volatile acid produced during yeast growth.	Gm. eqn. of non-volatile acid formed during fermentation.	Percentage of ~~gm. eqn.~~ acid formed cal. on the basis of sugar consumed.	Gms. of total sugar left in the culture after fermentation.	Gms. of reducing sugar left in the culture after fermentation.	Gms. of non-reducing sugar left in the culture after fermentation.	Percentage of sugar consumed calculated on the basis of sugar consumed during the fermentation.	Percentage of ammonical nitrogen consumed calculated on the basis of total sugar ~~consumed~~ used up.	Percentage of the nitric nitrogen used cal. on the basis of total nitrogen consumed.	Gms. of dry yeast formed by the ~~the~~ consumption of 1 gm. of nitrogen.	Gms. of sugar used up during the fermentation.	Gms. of dry yeast grown during the fermentation.	Percentage of yeast yield calculated on the basis of the sugar consumed.	Gms. of carbon used up during the yeast growth.	Gms. of carbon present in the yeast cell grown during fermentation.	Percentage of carbon utilised during growth calculated on the basis of carbon consumed.
1	1·00	0·0543	20	0·01900	0·00150	0·00950	0·00331	0·00000	0·00331	0·01569	0·00950	0·00619	0·00913	0·00656	41·81	0·16	18·33	0·1572	0·0015	0·1557	19·65	0·20 ~~0·00339~~	0·20	0·00	80·00	60·54	39·46	11·52	0·80	0·1808	22·50 ~~22·89~~	0·2351	0·0413	17·56
2	2·00	0·1086	20	0·03800	0·01900	0·01900	0·01626	0·00000	0·01626	0·02174	0·01900	0·00274	0·01320	0·00854	39·28	0·26	15·60	0·2028	0·0015	0·2013	12·05	0·33 ~~0·01626~~	0·32	0·01	83·50	87·85	12·60	2·02	1·67	0·2614	15·56	0·4907	0·0597	12·16
3	3·00	0·1629	20	0·05700	0·02850	0·02850	0·02308	0·00000	0·02308	0·03392	0·02850	0·00542	0·02101	0·01291	35·40	0·26	11·98	0·2484	0·0030	0·2454	10·61	0·66 ~~0·02308~~	0·40	0·26	78·50	84·02	15·98	12·25	2·34	0·4160	17·77	0·6876	0·0950	13·80
4	4·00	0·2171	20	0·07600	0·03800	0·03800	0·03612	0·00336	0·03279	0·03985	0·03464	0·00521	0·02559	0·01426	35·76	0·26	6·50	0·2864	0·0030	0·2834	7·09	0·00 ~~0·03612~~	0·00	0·00	100·00	86·42	13·08	12·72	4·00	0·5068	12·67	1·7551	0·1158	6·67

Study of the loss of nitrogen in yeast cultures containing ammonium nitrate as source of nitrogen and sucrose as source of carbon under non-aerobic conditions. The C/N ratio of the culture was kept constant at 15 and sucrose concentration varied from 0.5 to 2.0 per cent.

Seeded on the 22nd July '50.
Analysed on the 26th Aug '50.

C/N 15

Condition — non-aerated
Temperature — 32-29.7°C
pH — 4.5

S.No.	Gms of sucrose present in the culture before fermentation (in 200 c.c.)	Gms of ammoniacal nitrogen added in the culture in beginning	Carbon nitrogen ratio of the culture before fermentation	Gms. of total nitrogen in the culture before fermentation	Gms. of ammoniacal nitrogen in the culture before fermentation	Gms. of nitrate nitrogen present in the beginning	Gms. of total nitrogen left in the culture after fermentation	Gms. of ammoniacal nitrogen left in the culture after fermentation	Gms. of nitrate nitrogen in the culture after fermentation	Gms. of total nitrogen consumed during the fermentation	Gms. of ammoniacal nitrogen used during yeast growth	Gms. of nitrate nitrogen consumed during fermentation	Percentage of ammoniacal nitrogen used up each on the basis of total nitrogen consumed	Percentage of nitrate nitrogen used up each on the basis of the total nitrogen consumed.	Gms. of nitrogen in the yeast cells grown during the fermentation	Gms. of nitrogen lost during the fermentation.	Percentage of the loss of nitrogen each on the basis of nitrogen present in the beginning	Gms. of dry yeast produced by the consumption of one gram of nitrogen.	Gms. of total ethyl alcohol produced during the fermentation	Percentage of alcohol yield calculated on the basis of sugar consumed	Gm. equ. of total acid produced during fermentation.	Gm. equ. of volatile acid produced during fermentation	Gm. equ. of non-volatile acid formed	Percentage of total acid formed each on the basis of sugar consumed	Gms. of total sugar left in the culture after the fermentation.	Gms. of reducing sugar left in the culture after fermentation	Gms. of non-reducing sugar left in the culture after fermentation	Gms. of sugar oxidised during yeast growth	Percentage of sugar consumed calculated on the basis of sugar supplied present in the culture before fermentation	Gms. of dry yeast grown in the culture	Percentage of yeast yield i.e. on the basis of sugar consumed during fermentation	Gms. of Carbon consumed during the fermentation.	Gms. of Carbon in the yeast grown during fermentation.	Percentage of the Carbon utilized assy calculated on the basis of carbon consumed during fermentation
1	1.00	0.0723	15	0.0253	0.01265	0.01265	0.01070	0.00000	0.01007	0.01523	0.01265	0.00258	83.02	16.90	0.00802	0.00721	47.34	10.57	0.10	13.15	0.1648	0.0015	0.1633	21.48	0.24	0.24	0.00	0.76	76.50	0.1588	20.89	0.2233	0.0363	11.33
2	2.00	0.1449	15	0.0507	0.02535	0.02535	0.02327	0.00000	0.02327	0.02743	0.02535	0.00208	92.34	7.57	0.01558	0.01185	43.20	11.25	0.10	6.13	0.2408	0.0045	0.2363	14.77	0.37	0.32	0.05	1.63	81.50	0.3086	18.31	0.4792	0.0705	14.71
3	3.00	0.2171	15	0.07600	0.03800	0.03800	0.03388	0.00703	0.02685	0.04212	0.03097	0.01115	73.52	26.71	0.02495	0.00893	21.20	11.75	0.10	3.59	0.2864	0.0015	0.2844	12.49	0.22	0.20	0.02	2.78	92.66	0.4940	17.72	0.8169	0.1129	13.82
4	4.00	0.2897	15	0.10130	0.05065	0.05065	0.04598	0.00954	0.03644	0.05532	0.0411	0.01421	74.31	25.68	0.03355	0.02177	39.54	12.01	0.10	2.50	0.3320	0.0015	0.3315	8.30	0.00	0.00	0.00	4.00	100.00	0.6644	16.61	1.1730	0.1517	12.84

Study of the loss of nitrogen in yeast cultures containing ammonium nitrate as source of nitrogen and sucrose as source of carbon under non-aerated conditions. The C/N ratio of the cultures was kept constant at 10 and sucrose concentration varied from 0·5-2·0 per cent.

Seeded on the 22nd July '50
Analysed on the 7th Sept. '50.

C/N 10

Condition — non-aerated
Temperature — 32 - 29·7°C
pH — 4·5.

S.N.	gms. of sucrose in the culture before fermentation. (in 200 c.c.).	gms. of NH_4NO_3 in the culture before fermentation.	Carbon nitrogen ratio of the culture in the beginning.	gms. of total nitrogen in the culture in beginning.	gms of ammoniacal nitrogen in the culture in beginning.	gms. of nitric nitrogen in the culture before fermentation	gm of total nitrogen left in the culture after fermentation	gms. of total nitrogen of ammonium left after the fermentation	gms. of nitric nitrogen left after the fermentation	gms. of total nitrogen consumed during the fermentation.	gms of ammoniacal nitrogen used up during yeast growth	gms. of nitric nitrogen consumed during fermentation.	Percentage of ammoniacal nitrogen used up as the basis of total nitrogen consumed in fermentation	Percentage of nitric nitrogen consumed during fermentation on the basis of total nitrogen consumed	gms of nitrogen in the yeast cells grown during the fermentation of the culture	gms. of nitrogen lost during the fermentation.	Percentage of the loss of nitrogen calculated on the basis of the total nitrogen consumed during fermentation	gms of dry yeast formed by 1 gm of consumed nitrogen.	gms. of total ethyl alcohol formed during yeast formation	Percentage of alcohol formation calculated on the basis of sugar consumed.	gms. of total acid formed during the yeast growth.	gm. equ. of volatile acid formed during fermentation.	gm. equ. of non-volatile acid formed during yeast growth.	Percentage of acid yield calculated on the basis of sugar consumed.	gms. of total sugar left in the culture after fermentation.	gms. of reducing sugar left in the culture after fermentation	gms of non-reducing sugar left in the culture after the fermentation	gms of sugar consumed the fermentation.	Percentage of sugar consumed during the yeast formation period. Calculated on the basis of original sugar in the culture.	gms. of dry yeast grown during the fermentation	Percentage of yeast yield calculated on the basis of sugar consumed during yeast growth.	gms. of carbon consumed during the fermentation	gms. of carbon in the yeast produced during formation	Percentage of carbon utilised in yeast formation calculated on the basis of total carbon consumed during fermentation
1	1·00	0·1086	10	0·03800	0·01900	0·01900	0·01843	0·00149	0·01694	0·019571	0·01751	0·00282	89·48	10·54	0·01013	0·00944	48·25	10·25	0·00	0·00	0·1800	0·0015	0·1785	18·00	0·00	0·00	0·00	1·00	100·00	0·2006	20·06	0·2938	0·0458	15·58
2	2·00	0·2171	10	0·07600	0·03800	0·03800	0·04988	0·01420	0·03578	0·02612	0·02380	0·00232	91·11	8·88	0·01318	0·01284	49·16	9·99	0·00	0·00	0·3244	0·0085	0·3159	16·22	0·00	0·00	0·00	2·00	100·00	0·2610	13·05	0·5876	0·0598	10·18
3	3·00	0·3257	10	0·11400	0·05700	0·05700	0·05219	0·00703	0·05478	0·06181	0·04997	0·00222	86·66	4·25	0·02900	0·03284	53·10	9·29	0·00	0·00	0·3320	0·0170	0·3150	11·06	0·00	0·00	0·00	3·00	100·00	0·5743	19·14	0·8814	0·1302	14·77
4	4·00	0·4343	10	0·15200	0·07600	0·07600	0·07353	0·04260	0·07482	0·07847	0·07729	0·00118	98·42	1·50	0·03385	0·04432	56·73	8·54	0·00	0·00	0·3472	0·0266	0·3206	8·01	0·00	0·00	0·00	4·00	100·00	0·6702	16·75	1·1730	0·1532	13·06

Now that E. Merck and co of U.S.A. is trying to manufacture Dhar Yeast for ~~Ed~~ ediable purposes it is certainly profitable to make comparative experiments with Dhar Yeast and other Ediable casts, ~~Reg~~ regarding their efficiency; ~~yield~~, in (a) alcohol as medium

(b) Cane sugar " "

(c) Glucose as "

(d) Sugar obtained by the hydrolysis of wheat.

(e) Sugar obtained by the hydrolysis of rice

(f) " " " — of any protein.

(g) Sweet potatoes,

(f) Barley,

(g) Oats.

(h) and in molasses.

In most of these experiments air should be passed to increase the yield of the yeast. Germany has always produced yeast at a very cheap prize. Prof Sodenberg told us in June last that ever in the last war

yeast was easily available in Germany and was used in scope. It will be certainly worth while to purchase some mark yeast from the market (German Edible Yeast).

These experiments must be pushed and [illegible] in the thesis.

favourably

Date 1.10.63

कक्षा कार्य

1.

	४२
४	१६४२५
+ ४	१६
८१	१४२
+३	८३
८४	४८५

	४१०.
४	१६४२५
४	१६
८१	१४२
१	८१
८२०	६१५०

	१३२
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	५२४
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	२४[illegible]२
२	५,८५,६४,
+२	४
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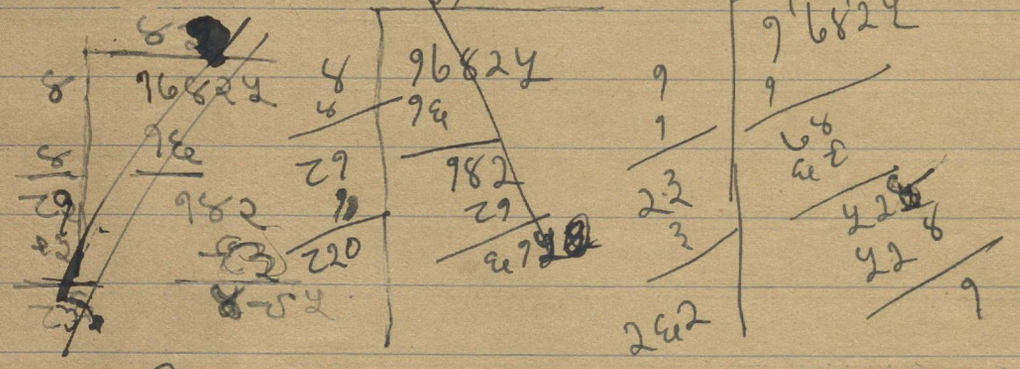

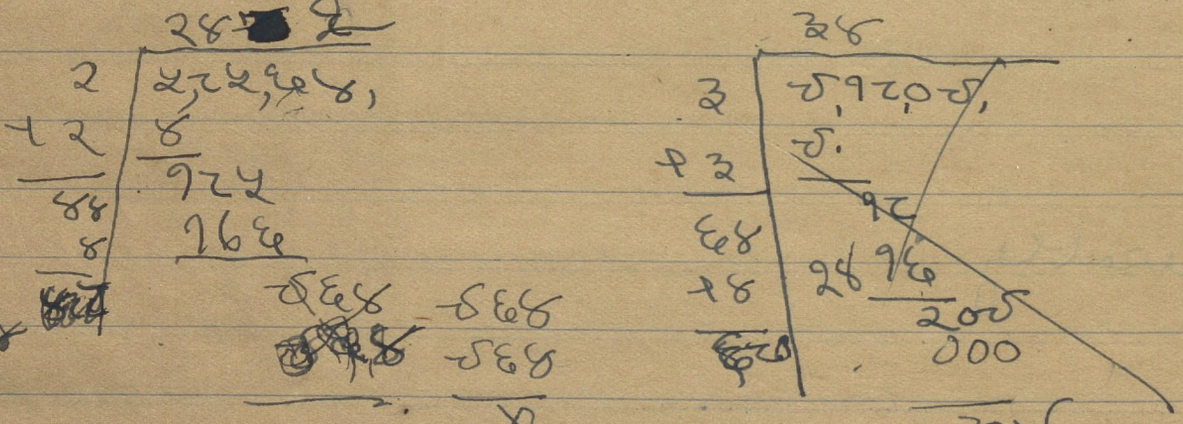

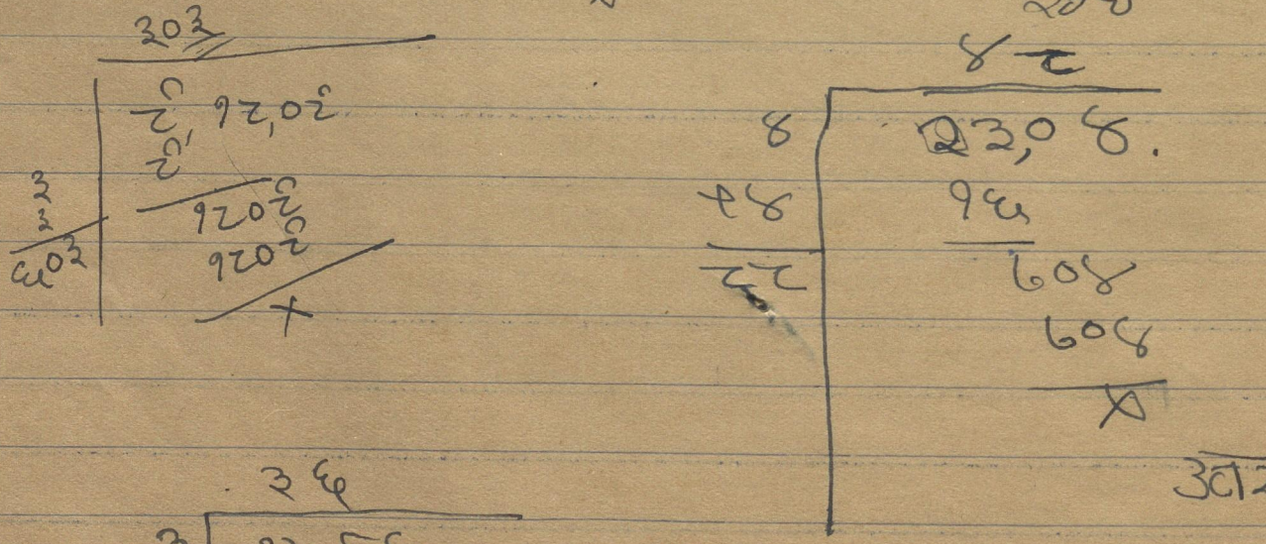

2. ४८४

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३	५,१८,०५,
+३	५.
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६८	२०५
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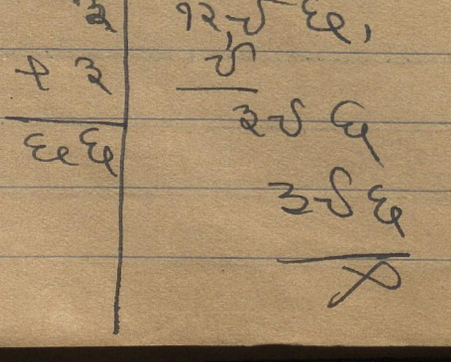

	४८
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उत्तर ४८

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३	१२,५६,
+३	५
६६	३५६
	३५६
	×

उत्तर ३६

४८

Date 11.10.63

कक्षा कार्य

3.

४६

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८६	५१६
	५१६

२४२

२	५,८५,६४,
+२	४
४४	१८५
+४	१६६
४८२	८६४
	८६४

१२

१	१,५२,२६,५६,
+१	१
२२	५२
+२	४४
२४	८२६

३१

३	८,१८,०८,
+३	८
६१	०१८

३०३

३	९१८०९
+३	९
६३	०१८०८
	१८०८

१२

१	१,५२,२६,५६,
+१	१
२२	५२
+२	४४
२४२	८२६

इतिहास

सर टामस से कौन था? उसने जहांगीर एवं उसके राज्य के विषय में क्या लिखा है।

भारत-यूरोप का व्यापार अकबर के समय पुर्तगालियों के हाथ में था। १६०० ई० में अंग्रेजों ने भी ईस्ट इंडिया कम्पनी बनाकर भारत से व्यापार करना प्रारम्भ किया। अंग्रेजों को व्यापार की सुविधाएं देने के लिए इंगलैंड के राजा ने दो बार अपने दूत जहांगीर के पास भेजे इनमें से दूसरे दूत सर टामस रो थे। पहले तो पुर्तगालियों ने इनके मार्ग में बहुत रोड़े अटकाए मगर अन्त में वे किसी तरह जहांगीर के पास पहुंच गये। सर टामस रो जहांगीर के राज्य में ३ वर्षों तक रहा उसने उसकी शानो-शौकत के बारे में लिखा है। उसने अपनी डायरी में सम्राट की विलासिता और नूरजहां के असीम प्रभाव के बारे में लिखा है। उसने जहांगीर को चित्रकला का प्रेमी बताया था। उसने लिखा है कि उसने शासन का सारा भार नूरजहां पर छोड़ रक्खा था। वह कहता था कि मुझे तो दो प्याले शराब के चाहिये उसने उसके शराब नोशी के बारे में यह लिखा है कि वह दिन में कभी शराब नहीं पीता था और न किसी को शराब पी कर दरबार में आने देने देता। सर टामस रो ने जहांगीर के राज्य में लोगों को बहुत दुखी देखा। प्रजा धनाभाव तथा अत्याचारों से दुखी थे। सरकारी कर्मचारी बड़ी बड़ी घूसें लेते थे। राज्य में डाकुओं का डाके बढ़ गया था इसलिए लोग अकबर को याद करते थे।

नूरजहां की कूटनीति क्या थी उसके कारण राजवंश और दरबारियों में क्यों असन्तोष फैला।

नूरजहां ने अपनी पति की सेवा सच्चे दिल से की इसमें तनिक भी संदेह नहीं है परन्तु उसकी कूटनीति से राजवंश और दरबारियों में बड़ा असन्तोष फैला नूरजहां ने अपने भाई को वजीर बनाया। अपने पिता को ऊँचा पद दिया। अपने रिश्तेदारों को मालामाल कर दिया। इस प्रकार के पक्षपात के कारण जहांगीर के शासन के अन्तिम दिनों में बड़ी उशान्ति मची। नूरजहां ने अपने पहले पति से उत्पन्न पुत्री का विवाह जहांगीर के सबसे छोटे पुत्र से कर दिया वह चाहती थी थी कि जहांगीर के बाद मेरा दामाद गद्दी पर बैठे इससे जहांगीर के दूसरे बेटे खुर्रम का जो पीछे शाह जहां बना नाराज होना स्वाभाविक ही था उसने विद्रोह कर दिया खैर जहांगीर के सेनापति महाबत खाँ ने उसे हरा दिया।

ग्रे.

8/10

RB
14.11.13

I was learning composition yesterday

मैं कल निबन्ध सीख रहा था

Hari riding on a elephant

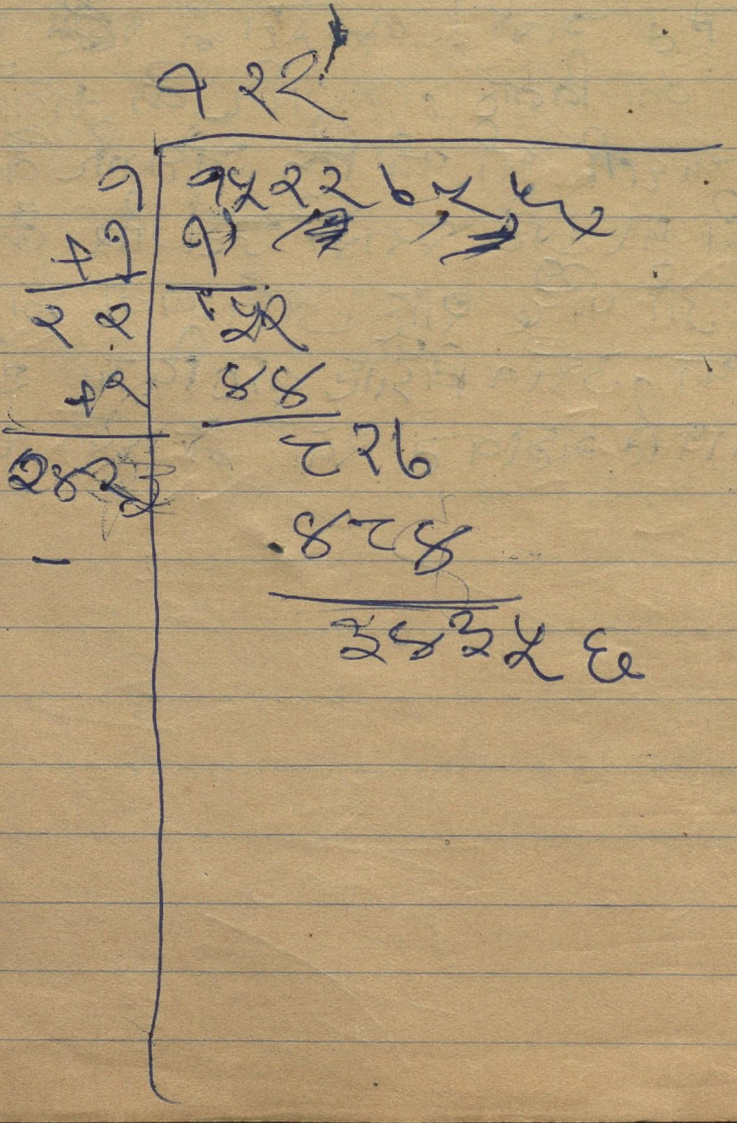
क्या हरी हाथी के ऊपर सवारी कर रहा था

a kind god will give him a loaf

एक दयालु लड़का उसे रोटी देगा

Ramesh will go by tomorrow morning

रमेश कल सवेरे की गाड़ी से जाएगा



(१)

कलाकार्य

प्रतिबन्ध
स्वाभाविक
औद्योगिक
जनश्रुति
स्पन्न
समाज

रोकथाम
आदत
कारखाने संबंधित
मराहुवा

My school

My ~~college is~~ schools named is Dyogi colleg
~~They~~ There are 112000 girls in ~~my~~ my school
There are 80 Teachers ~~also~~ in my ~~class~~ school.
There is a big garden and ~~there are many~~
~~hand~~ in my school There are many kinds
of flowers in It There are 7 ox cart in my school
and There are ~~4~~ 8 busses in my school.
There are ~~40~~ 50 girls in my class room
my class tacher is ~~Mrs~~ Mrs. Singh.
She teaches me english also. my school
is very big It opens at 10.0 clock. we
come back ~~&~~ at 4 3½ o clock.

[illegible]

[illegible]

stocking Laugh ~~Mahat~~ Mat'hama stoching

$अ^2 + ब^2$

५ $अ - ब \;\big|\; अ^3 - अ^2ब + अब^2 - ब^3$

$अ^3 - अ^2ब$

$+ अब^2 - ब^3$

$- अब^2 - ब^3$

$\times$

$अ^2 + ब^2$

$अ^3 - ब^3$ ६

$अ^3 + ब^3 \;\big|\; अ^6 - ब^6$

$अ^6 + अ^3ब^3$

$- अ^3ब^3 - ब^6$

६ $- अ^3ब^3 - ब^6$ $\quad अ^3 - ब^3$

$अ^2 + 1$

६ $अ^2 - अ + 1 \;\big|\; अ^4 + अ^2 + 1 \rightarrow अ^2 \quad + 1$

$अ^4 - अ^3 + अ^2$

$- अ^3 + अ^2 + अ^2$

$अ + 1$

$अ^2 + अ + 1$

$अ^2 - अ + 1 \;\big|\; अ^3 \quad + अ^2 \quad + 1$

$अ^3 - अ^2 \pm अ^2$

$अ^3 - अ^2 + अ^2$

$अ^3 - अ^2 + अ$

$- अ^2 - अ + 1$

$अ^2 - अ + 1$

$\times$

great Africa kasturba

africa kasturba

स्वसृ (बहन) नेतृ (नेता)

तव भ्राता किम करोति

रामस्य भ्रातरः किं कुर्वन्ति

पंडित जवाहरलाल नेहरुः कः अस्ति

पण्डित जवाहरलाल नेहरुः भारत नेता अस्ति

~~स्वसा~~ नेतारः किं कुर्वन्ति

तव स्वसा कुत्र गच्छति ?

मोहनस्य स्वसारौ किं पचतः ?

नेतारः देश-सेवां कुर्वन्ति।

मम स्वसा मन्दिरं गच्छति

मोहनस्य स्वसारौ पक्वान्नं पचतः

राजा शत्रुं जयति।

हस्ती किं करोति ?

अयं कः पुरुषः ?

सः किं करोति ?

एकः पक्षी वृक्षे कूजति।

राजानः प्रासादेषु निवसन्ति।

हस्ती सरोवरे विहरति।

अयम् एकः महात्मा।

सः सर्वेषां सेवां करोति।

$4अ^2$

$2अ + ब$ | $2अ^3 + 12अ^2ब + अब^2 + ब^3$

$2अ^3 + 4अ^2ब$

$8अ^2ब + 12अब^2$

$अ^2 - अब + ब^2$

$अ + ब + स$ | $अ^3 + ब^3 + स^3 - 3अबस$

$अ^3 + अ^2ब + अस^2$

$-अ^2ब - अब^2 + ब^3$

$-अ^2ब - ब^2अ - अबस$

$-अब^2 + ब^2अ + अबस + ब^3$

$-अ$

$अ^2 - अब + ब^2 - अस + स^2 - बस$

$अ + ब + स$ | $अ^3 + ब^3 + स^3 - 3अबस$

$अ^3 + अ^2ब + अ^2स$

$-अ^2ब - अ^2स + ब^3$

$-अ^2ब - अब^2 - अबस$

$अब^2 - अ^2स + अबस + ब^3$

$अब^2$

$+ ब^3 + ब^2स$

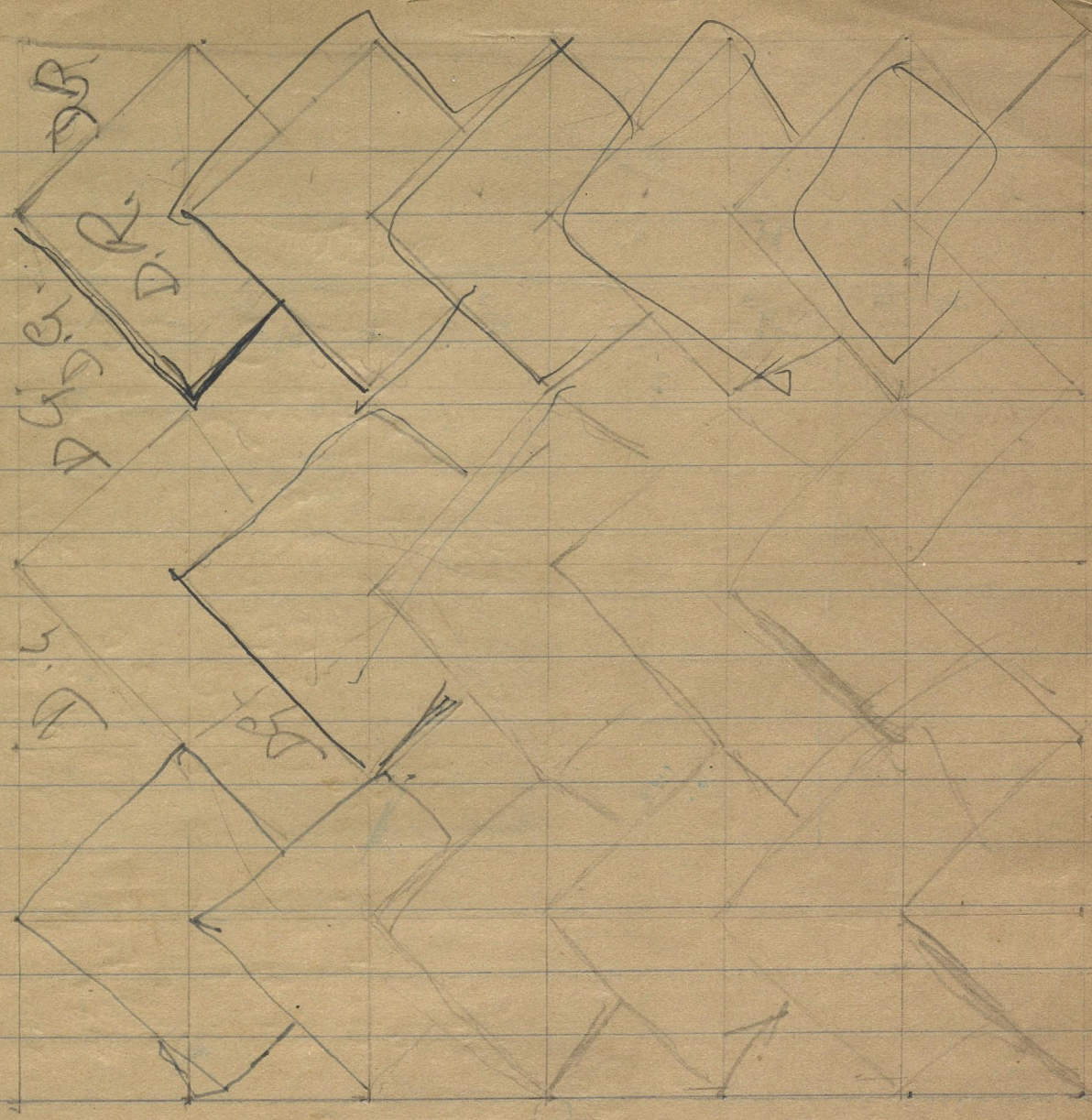
$-अ^2स + अबस - ब^2स$

$-अ^2स - अबस - अस^2$

$2अबस + अस^2 - ब^2स + स^3$

$+ अस^2 + बस^2 + स^3$

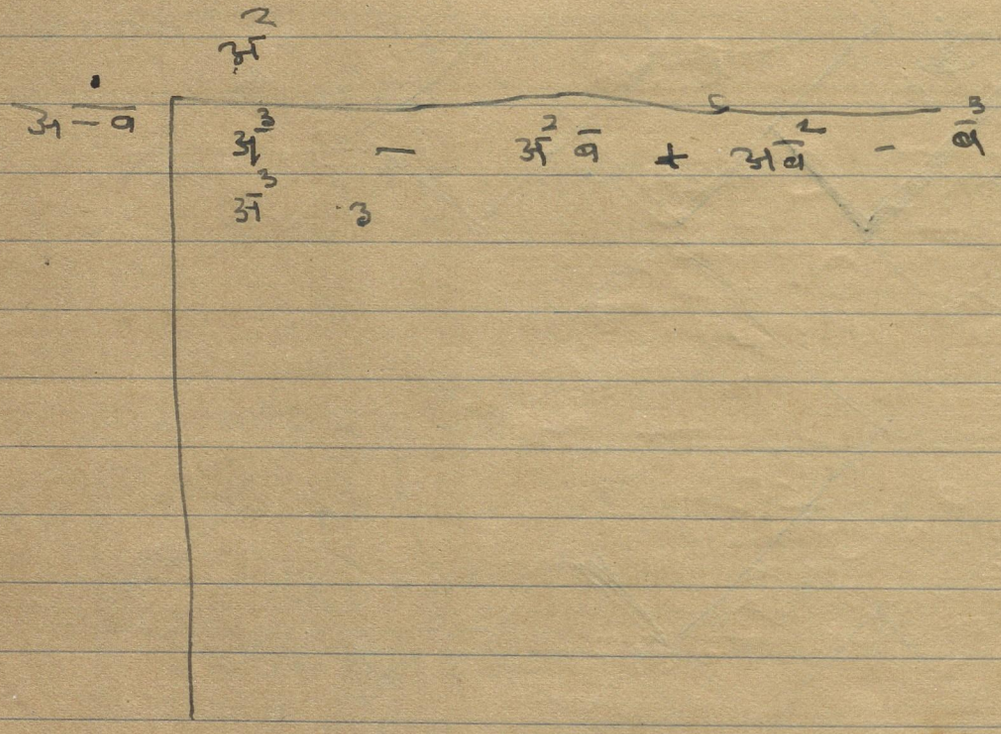
$2अबस - ब^2स - बस$

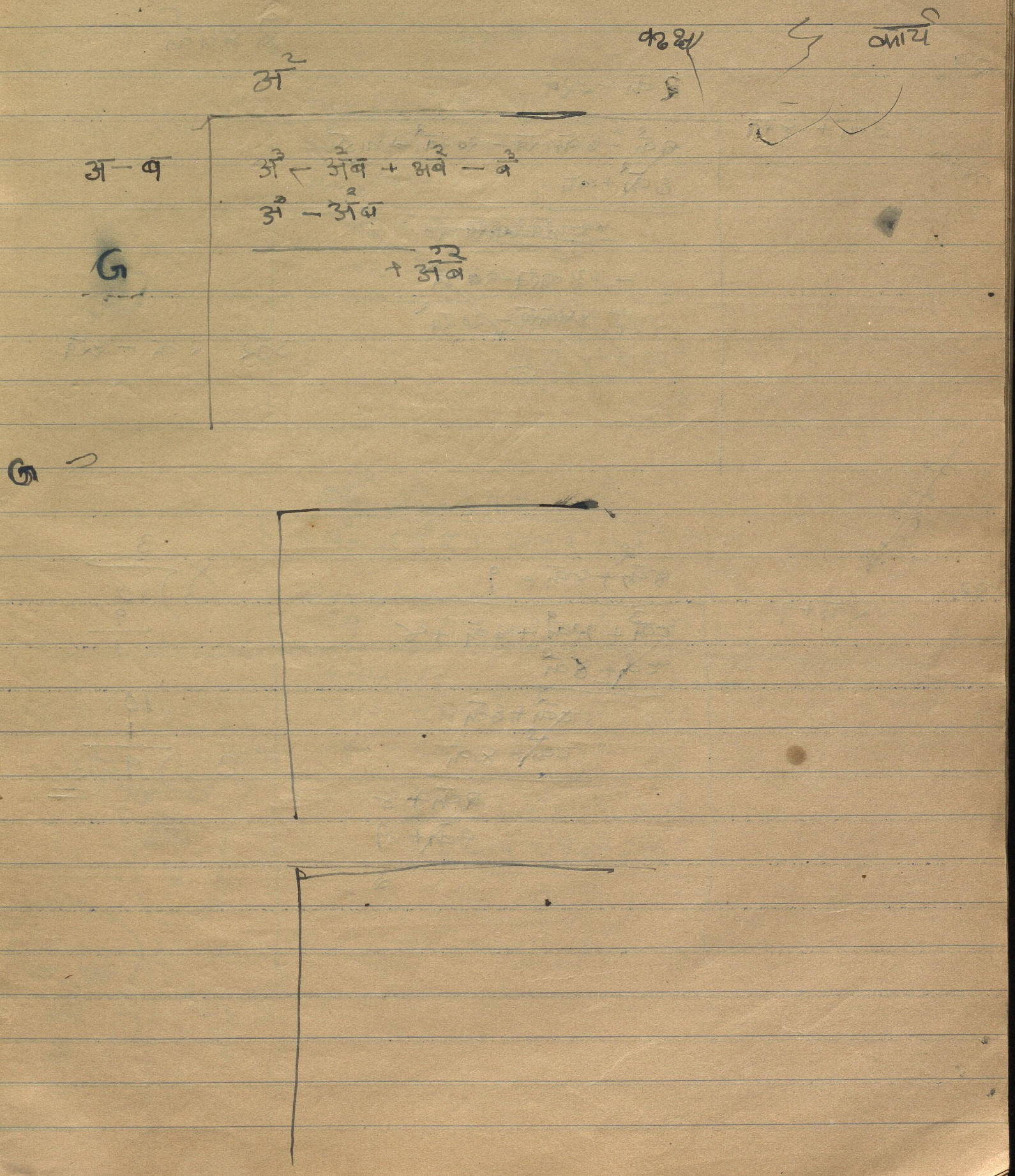


$2अबस = - ब^2स - बस^2 - 3अबस$

$- ब^2स - बस^2 - अबस$

X


$\vec{a}^2$
$\vec{a}-\vec{b}$
$\vec{a}^3$
$\vec{a}^3$
$-$
$\vec{a}^2\vec{b}$
$+$
$\vec{a}\vec{b}^2$
$-$
$\vec{b}^3$
3


अ²
अ - ब
अ³ - अ²ब + अब² - ब³
अ³ - अ²ब
+ अ²ब

२०.

हो मवर्क

२१.

२क − ५ख

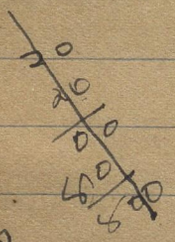
भाजक → ३क + ४ख

$$\begin{array}{l} \cancel{६क^2} - ७क\,ख - २०\,ख^2 \rightarrow \text{भाज्य} \\ \cancel{६क^2} + ८क\,ख \\ \hline \cancel{-१५क\,ख - २०} \\ -१५क\,ख - २०\,ख^2 \\ \mp १५क\,ख \mp २०\,ख^2 \\ \hline \times \end{array}$$

उत्तर २क − ५ख

२२.

२क + १



$$\begin{array}{l} ४क^2 + ४क + १ \\ \hline ८क^3 + १२क^2 + ६क + ४ \\ \cancel{८क^3} \pm ४क^2 \\ \hline \cancel{८क^2} + ६क \\ \cancel{८क^3} + ४क \\ \hline \cancel{२क} + ४ \\ \cancel{२क} + १ \\ \hline ३ \end{array}$$

$$\begin{array}{r} 3 \\ \times\ 3\,\overline{)\,10} \\ 9 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 10 \\ 1 \\ \hline 3\,\overline{)\,9\,(\,3} \end{array}$$

कक्षाकार्य

२३.

$$\text{क}^2 + २\text{क}\text{ख} - \text{ख}^2$$

क − ३ख

$$\text{क}^3 - \text{क}^2\text{ख} - ७\text{क}\text{ख}^2 + ५\text{ख}^3$$

$$\text{क}^3 \mp ३\text{क}^2\text{ख}$$

$$+२\text{क}^2\text{ख} - ७\text{क}\text{ख}^2$$

$$+२\text{क}\text{ख} \mp ६\text{क}\text{ख}^2$$

$$-\text{क}\text{ख}^2 + ५\text{ख}^3$$

$$-\text{क}\text{ख}^2 + ३\text{ख}^3$$

$$२\text{ख}^3$$

२४.

$$\cancel{२\text{य}^3}\ \text{य}^2 - ३\text{य}\text{र} + २\text{र}^2$$

$$२\text{य}^3 - ९\text{य}^2\text{र} + १३\text{य}\text{र}^2 - ७\text{र}^3 \quad \text{भाज्य}$$

$$-\text{र}^3 \quad \text{शेष}$$

$$२\text{य}^3 - ९\text{य}^2\text{र} + १३\text{य}\text{र}^2 - ६\text{र}^3$$

$$२\text{य} - ३\text{र} \quad \text{भाजक}$$

भजनफल $\text{य}^2 - ३\text{य}\text{र} + २\text{र}^2$

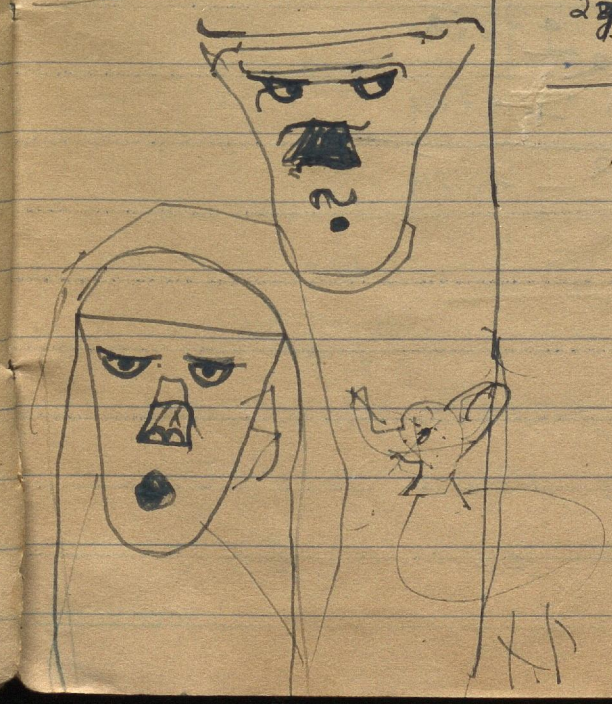
$$२\text{य}^3 - ९\text{य}^2\text{र} + १३\text{य}\text{र}^2 - ६\text{र}^3$$

$$२\text{य}^3 - ६\text{य}^2\text{र} + ४\text{य}\text{र}^2$$

$$-३\text{य}^2\text{र} + ९\text{य}\text{र}^2 - ६\text{र}^3$$

$$-३\text{य}^2\text{र} + ९\text{य}\text{र}^2 - ६\text{र}^3$$

×



भाजक × भागफल + शेष = भाज्य.

भाजक 3) 4 भाज्य
3
1
भाजक × भागफल + शेष = भाज्य.

$क^2 + 2ख^2 - कख$ | $क^2 + 2ख^2 - कख$

$2क - ख$ | $2क - ख$

$-क^2ख - 2ख^3 + कख^2$ | $-क^2ख - 2ख^3 + कख^2$

$-2क^2ख + 2क^3 + 4कख^2 - 2$

$-2क^2ख + 2क^3 - 2ख^3 + 5कख^2$

$क^2 + क - 2$

$= 2क^3 - 2ख^3 - 3क^2ख + 5कख^2 + क - 2$

$\boxed{2६}$

$4क^2 - 2ख^2 - 24ख - 20$

$4 +$

$4क^2 - 6ख^2 - 24ख - 96$

$2क + 3ख + 8$

$2क + 3ख$

$4क^2 - 6ख^2 - 24ख - 96$

$4क^2 + 6कख + 8क$

$+6कख + 8क - 6ख^2 - 24ख$

$\pm 6कख + 8 + 6ख^2 + 12ख$

$+8क + ख^2 - 12ख$

8. 1, 1.

२क − ३ख − ४

२क + ३ख + ४ | ४क² − ९ख² − २४ख − १६

४क² + ६कख + ८क

− ६कख − ८क − ९ख² − २४ख

− ६कख − ९ख² − १२ख

− ८क − १२ख − १६

− ८क − १२ख − १६

×

22.

९क² + ९क

३क + ४ | २६क³ + १०८क² + १४४क + ८०

२६क³ + ३६क²

+ ६२क² + १४४क

+ २६क² + ३६क

४५क² + १०८ + ८०

१०८
३६
६२

९क² + २४क + १६

३क + ४ | २६क³ + १०८क² + १४४क + ८०

२६क³ + ३६क²

+ ६२क² + १४४क

६२क² + ९६क

+ ४८क + ८०

४८क + ६४

१६

१४४
९६
४८

९ × ५ × ५ + २४ × ५ + १६

९ × २५ + १२० + १६

२२५ + १२० + १६

८०
६४
१६

३क + ४ | ९क² + २४क + १६

२२५ + १२० + १६

१२०
१६
100 | ३६९

900 | ३६९
300
६७

$$\text{क}^3 - 3\text{क}^2 - 3\text{क} - 5$$

$$\text{क} - 3 \;\Big|\; \text{क}^4 \qquad - 20$$

$$\text{क}^4 - 3\text{क}^3$$

$$-3\text{क}^3 \qquad - 20$$

$$-3\text{क}^3 + 5\text{क}^2$$

$$5\text{क}^2 \qquad - 20$$

$$5\text{क}^2 + 5\text{क}$$

$$+5\text{क} \qquad - 20$$

$$-5\text{क} + 26$$

$$+26 \qquad - 20$$

$$\text{क}^2 + \text{क}\text{ख} + \text{ख}^2$$





$$2\text{क} - \text{ख} \;\Big|\; 2\text{क}^3 + 3\text{क}^2\text{ख} + 4\text{क}\text{ख}^2 - 2\text{ख}^3$$

$$2\text{क}^3 - \text{क}^2\text{ख}$$

$$+4\text{क}^2\text{ख} + 4\text{ख}^2$$

$$4\text{क}^2\text{ख} - 2\text{क}\text{ख}^2$$

$$4\text{ख}^2 + 2\text{क}\text{ख}^2 - 2\text{ख}^3$$

$$+2\text{क}\text{ख}^2 - \text{ख}^3$$

$$4\text{ख}^2 - \text{ख}^3$$

(२९)

$$\text{क}^2 + 2\text{क}\,\text{ख} + 3\text{ख}^2$$

$$2\text{क} - \text{ख} \;\big)\; 2\text{क}^3 + 3\text{क}^2\text{ख} + 4\text{क}\,\text{ख}^2 - 2\text{ख}^3$$

$$2\text{क}^3 - \text{क}^2\text{ख}$$

$$4\text{क}^2\text{ख} + 4\text{क}\,\text{ख}^2$$

$$4\text{क}^2\text{ख} - 2\text{क}\,\text{ख}^2$$

$$6\text{क}\,\text{ख}^2 - 2\text{ख}^3$$

$$6\text{क}\,\text{ख}^2 - 3\text{ख}^3$$

$$\text{ख}^3$$

$8 \times 1 \times 1$

$2 \times 1 \times 1$

$2\text{क} - \text{ख} = 2 \times 2 - 1$

$= 3.$

$2\text{क}^3 - 3\text{क}\,\text{ख} + 4\text{क}\,\text{ख}^2 - 2\text{ख}^2$

$16 - 12 + 8 - 2$

$= 10$

ख^3

$= 1 \times 1 \times 1$

$= 1$

$$3 \overline{)10}^{\,3}$$

$$9$$

$$1$$

(३०)

$$\text{क}^2 + \text{क} + 2$$

$$\text{ई}\text{क} - 11 \;\big)\; \text{ई}\text{क}^3 + 16\text{क}^2 - 15\text{क} - 24$$

$$\pm \text{ई}\text{क}^2 - 11\text{क}^2$$

$$+ 5\text{क}^2 - 15\text{क}$$

$$+ \text{ई}\text{क}^2 - 11\text{क}$$

$$- \quad +$$

$$- 4\text{क}^2 - 4\text{क} - 24$$

$$+ 12\text{क} - 22$$

$\text{ई} - 24$

33
15

$x^2 + 3x + 2$

$x - 11$) $2x^3 + 19x^2 - 42x - 24$

$2x^3 - 11x^2$

$30x^2 - 42x$

$30x^2 - 33x$

$-9x - 24$

$-9x + 22$

2

2 जोड़ा जायगा.

$x^3 + 3x^2 + 9x + 27$

$x - 3$) $x^4 - 80$

$x^4 - 3x^3$

$3x^3$

$3x^3 - 9x^2$

$9x^2$

$9x^2 - 27x$

$27x - 80$

$27x - 81$

1

36
6
216
6
1296
80
1216

$x = 6$

$x - 3 = 6 - 3 = 3$

$x^4 - 80 = 6 \times 6 \times 6 \times 1 - 80$

$= 1216$

3) 1216 (405
12
016
15
1

अंक गोपाल [illegible]

१६३२०

१	३
+१	१
२६	२००
+६	१२५
३४३	११००
+३	१०२६
३४६२	६१००
+२	६५२४
३४६४	१६६००

१.६३२

२

१०२६

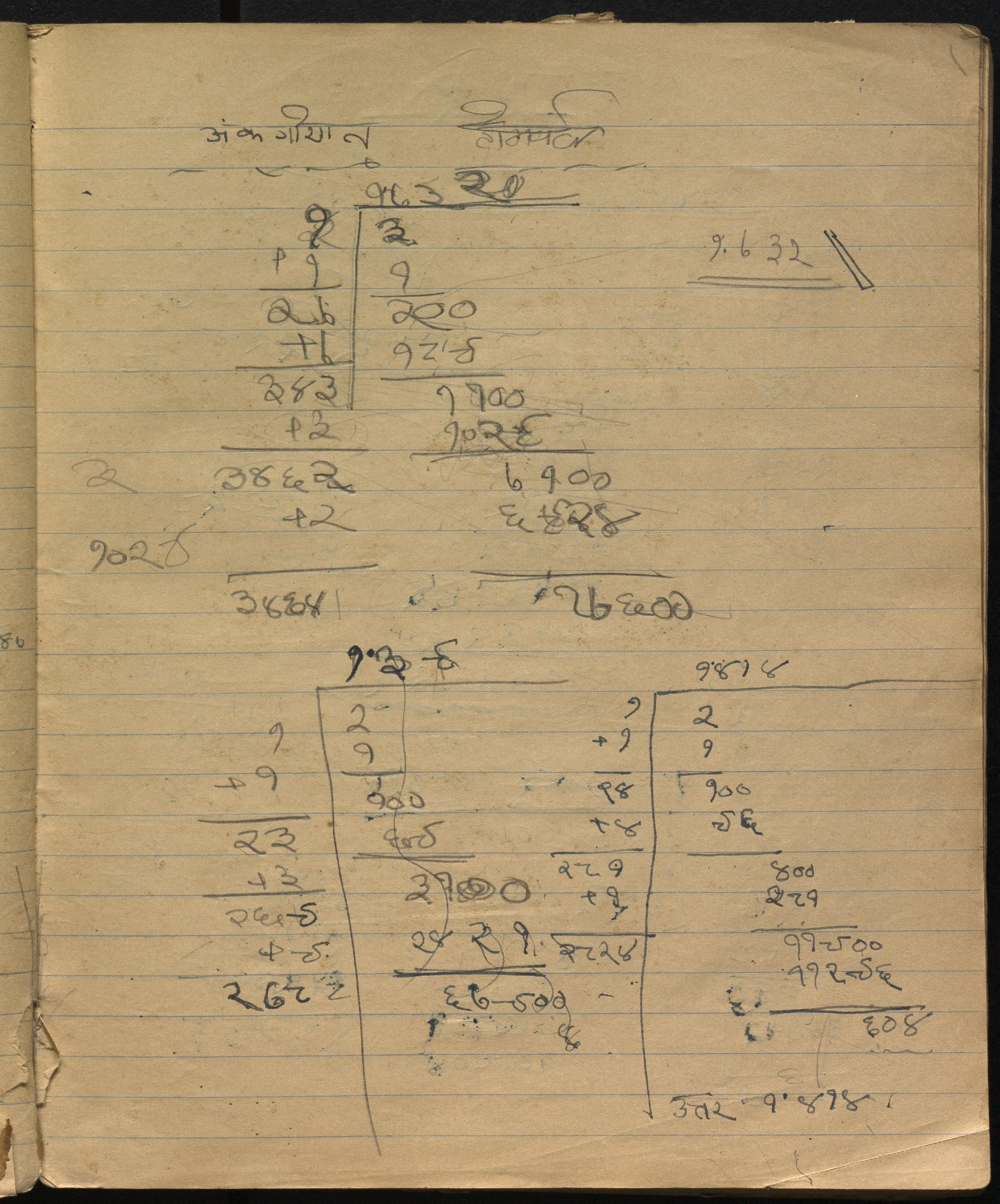
१.३६

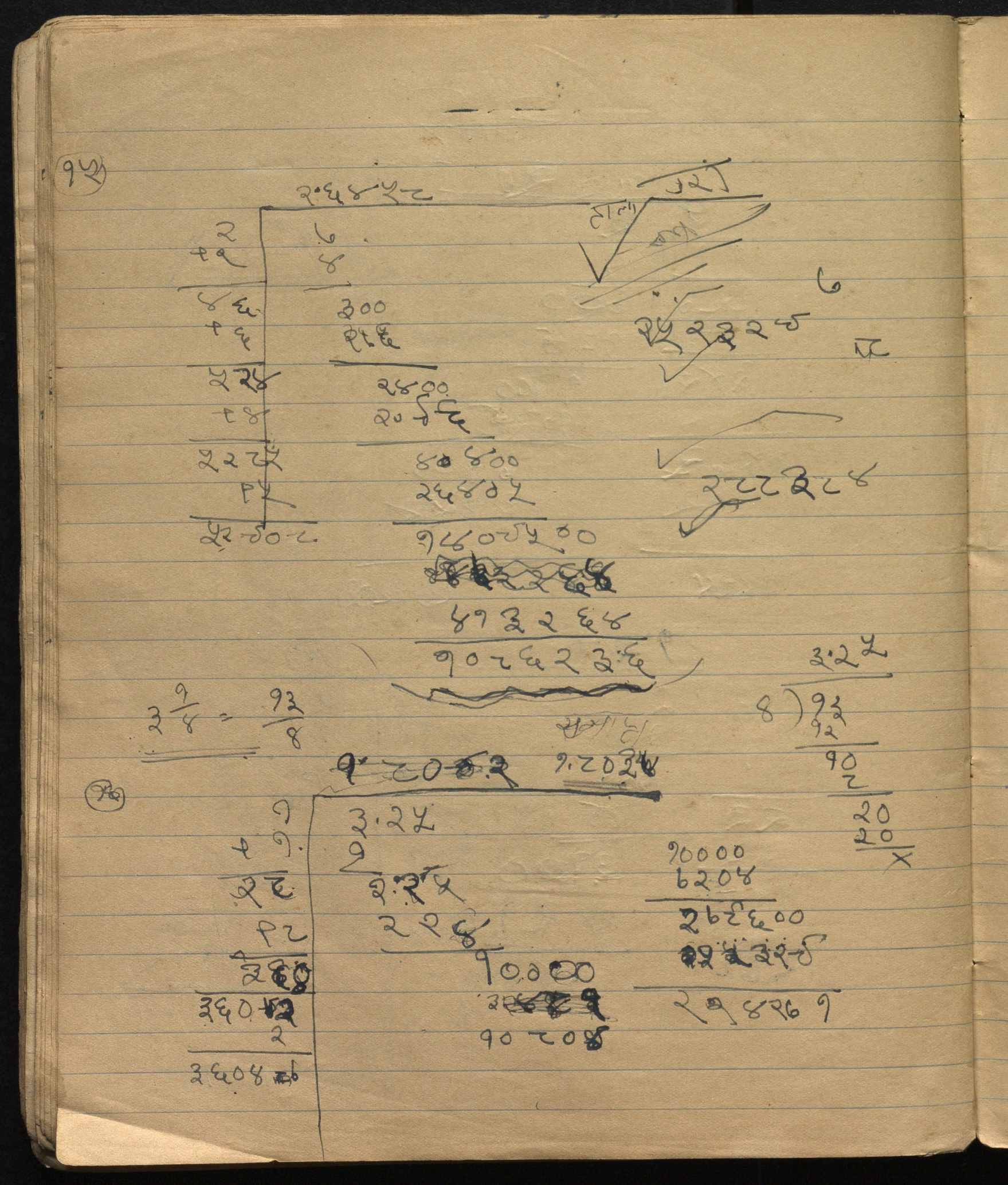
१	२
+१	१
२३	१००
+३	६५
२६५	३१००
+५	२४२१
२६८२	६६५००

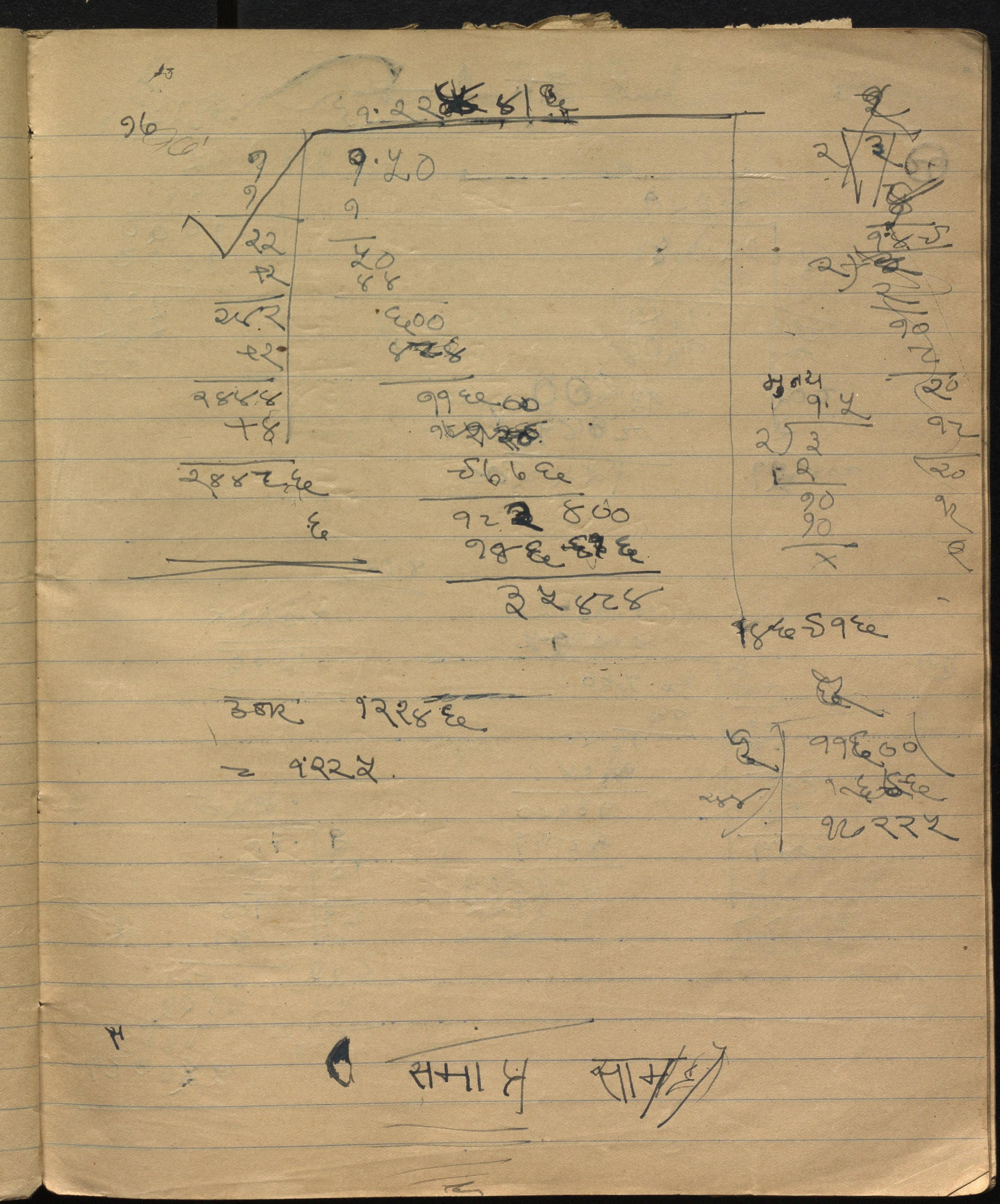
१.४१४

१	२
+१	१
२४	१००
+४	५६
२८१	४००
+१	२८१
२८२४	११५००
	११२५६
	६०४

उत्तर १.४१४









(17)

~~४.०२१~~

~~१६.१६४०~~
~~१६~~
~~.१६४०~~
~~१६०४~~
~~१३६००~~
~~२०४१~~
~~२५५२५००~~

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४
२०
+०
२०२
२
२०४२१

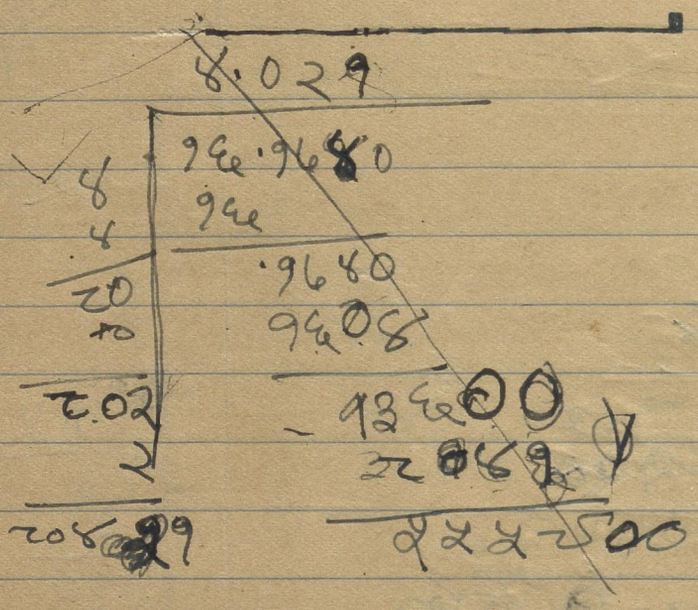
१६ १४४) २५०
१४४
१०६०
१००२
५२०
४३२
२२०

.१६३५

४.०२१

४.०२१५
~~४.०२१५~~

(18)



४
+४
२०
+०
२०२
+२
२०४१
१
२०४२५

१६.१६४०
१६
.१६४०
१६०४
१३६००
२०४१
५५५२५००
४०२१२५

४.०२२ ×
.३१६

.३१५२

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+३
६१
+१
६२५
+५
६३०२

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३१२५
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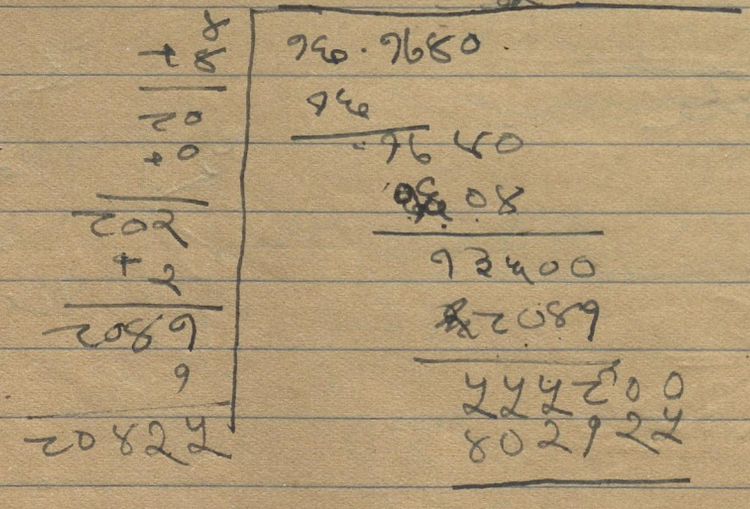
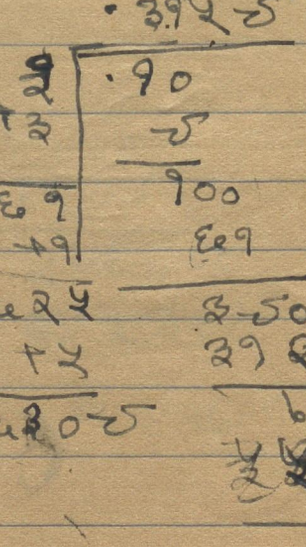
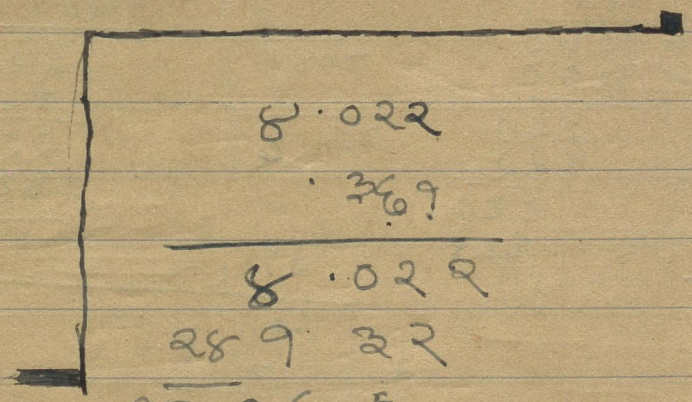
५५६०२१

२





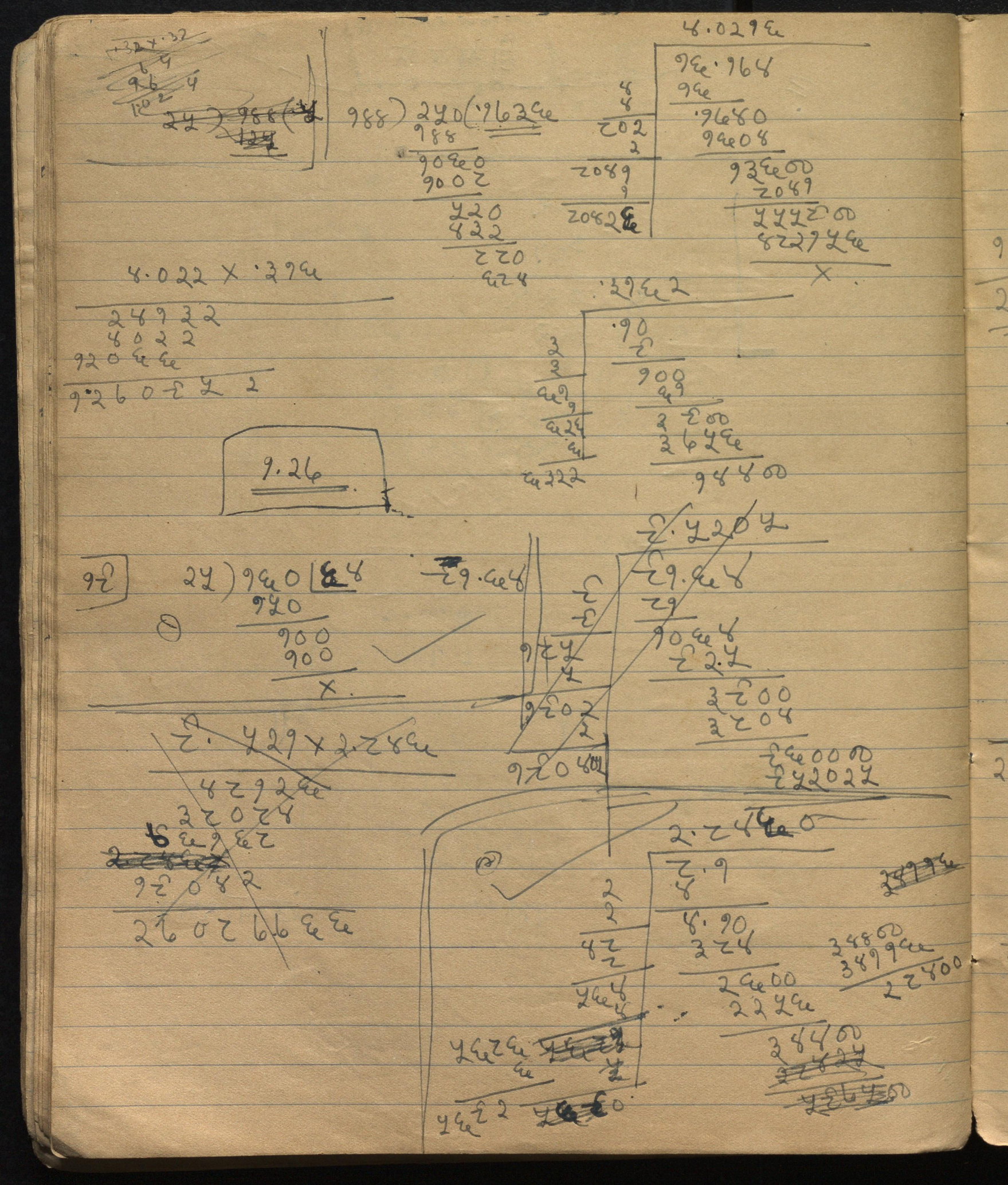
होमवर्क



४·०२२
·३६१
४·०२२
२४१ ३२
१२०६६
१४५१५४२

२१

रंजना चोर



९.०३५ × २.८४६

५४२१०
३६१४०
६२२६०
१२०६०

२५.६१२६१०

२५.६१३

९.०३५

(३)

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९
१२०३
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१२०६५
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१२०६०४

२१.६४
२१
× ६४००
५४१५
९८५००
९०३२५
२१६५००

20

.०२१) ५.०४

२४०
२१) ५०४०
४२
८४
८४
००

१५.४९५

५.०४० / .०२१ = ५०४० / ०२१

१५.४९५१

(४)

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३०४
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३०८९
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३०९८५
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३०९९०१

२,४०
१
१४०
१२५
१५००
१२०६
२९४००
२६६०१
१५९९००
१५४६२५
५१६५००
३०९९०१

२१

५६६

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११४६

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२५
८२९
६४९
८०३०
८०२९
१

~~१ घटाने~~ १ घटाने से पूर्णवर्ग हो जायेगा

११४६ ३
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६८६६

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८०२९ ४
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४.८२२४

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९६८
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९७६२
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२२५००
१८५२४
३९७६००
३९०५७५

९७६४४
४
३९०५७६

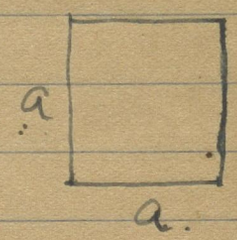
४.८२२

२३

२.५५ बीघा

= २.५५ × ३०२५ वर्गगज

= ७७१३.७५ वर्गगज



वर्ग ल = चौ.
ल × चौ = क्षेत्रफल

∴ लम्बाई = $\sqrt{७७१३.७५}$ गज

३०२५
२.५५
१५१२५
१५१२५
६०५०
७७१३.७५

८७.८२२२

८
८
१६७
७
१७४८
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१७५६२
२
१७५६४२
२
१७५६४४

७७१३.७५
६४
१३१३
११६९
~~२४४७५~~
१४४७५
१३९८४
४९१००
३५१२४
३९७६००
३५१२८४

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४६३१६००

१६८८
१३४४
१७४८
९
१५७४१
१७५६४४२

८६.८२२ गज़
×४
३५१.२८८

१ गज़ का ३ आना.

∴ ३५१.२८८ गज़ का

३५१.२८८×३
१०५३.८६४

६५ रु १३ आना

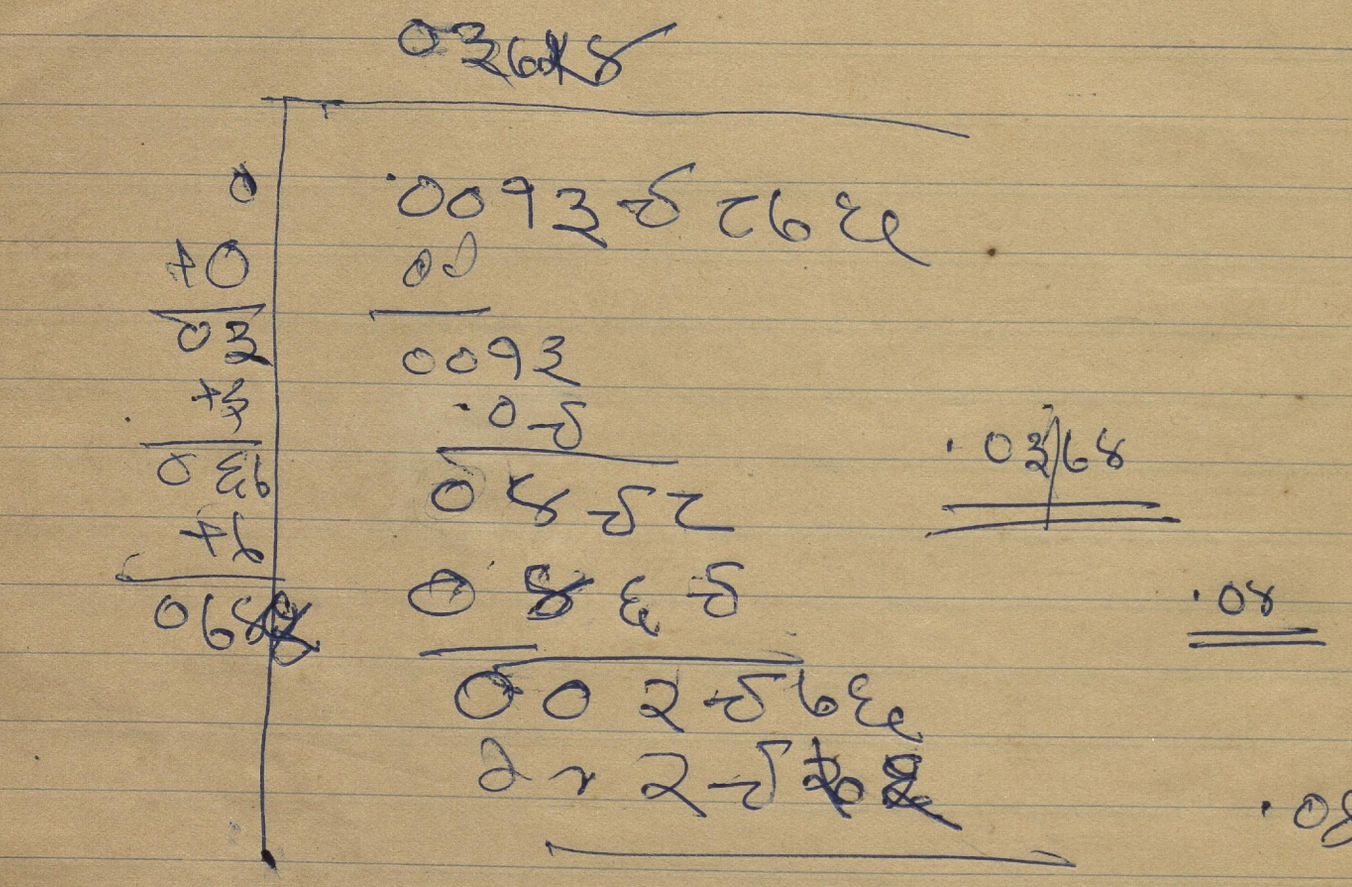
६५
१६ | १०५३.८६४
९६
९३
८०
१३.१

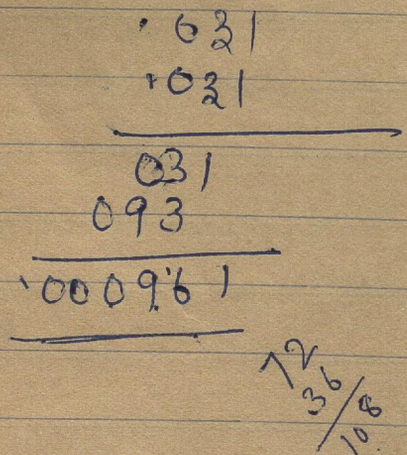
(२४)

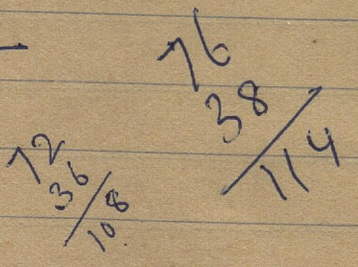
कपास

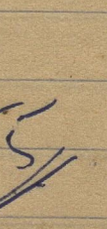
चाय

भारत अधिक तर सब देशों को चाय भेजता है। हमारे सभ्य समाज में चाय का प्रयोग धीरे २ बढ़ता जा रहा है आसाम की पहाड़ी ढालों पर लगाये गये चाय के बागों के बारे में हम पढ़ चुके हैं। वास्तव में चाय का प्रयोग पहले भारत के पड़ोसी राज्य में [illegible] होता था पर धीरे २ सब देशों ने चाय पीने की आदत डाली चाय का पौधा झाड़ी के समान होता है। उसकी पत्तियों को उबाल कर चाय बनाई जाती है।









0३६४

0
+0
03
+३
0६६
+६
0६४

.0093 ८ ८६ ६
00
0093
.0 ८
0 ४ ८ ८
0 ४ ६ ८
0 0 २ ८ ६ ६
0 0 २ ८ ६ ६

.03/64

.08

.08

.031
.031
031
093
.000961

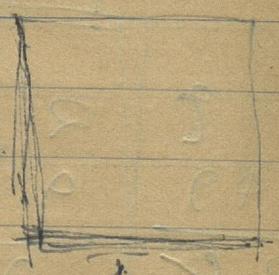
72
36
108

76
38
114

114
29
.85

My favorit flower

area.

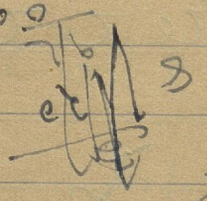


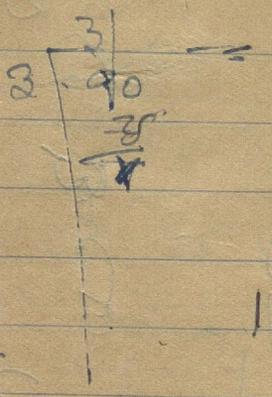
ल × चौ = क्षेत्रफल

ल = चौ. वर्ग.

क्षे. = ल × ल ← वर्ग

चौ × चौ





120 — 4.

ल × ल = 10 रुकड़

ल

6 × 6 = 36 वर्ग.

20.

? = 4240 वर्ग गज़

[illegible]

44

3.1

	90
3	९
3	900
61	61
1	3900
62	

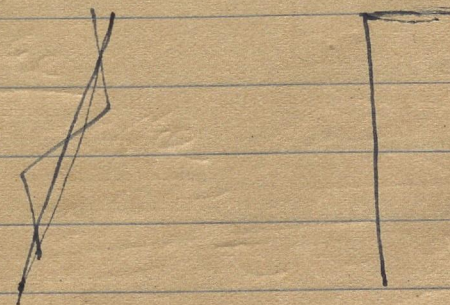
एक एकड़ बराबर है 4840 वर्ग गज

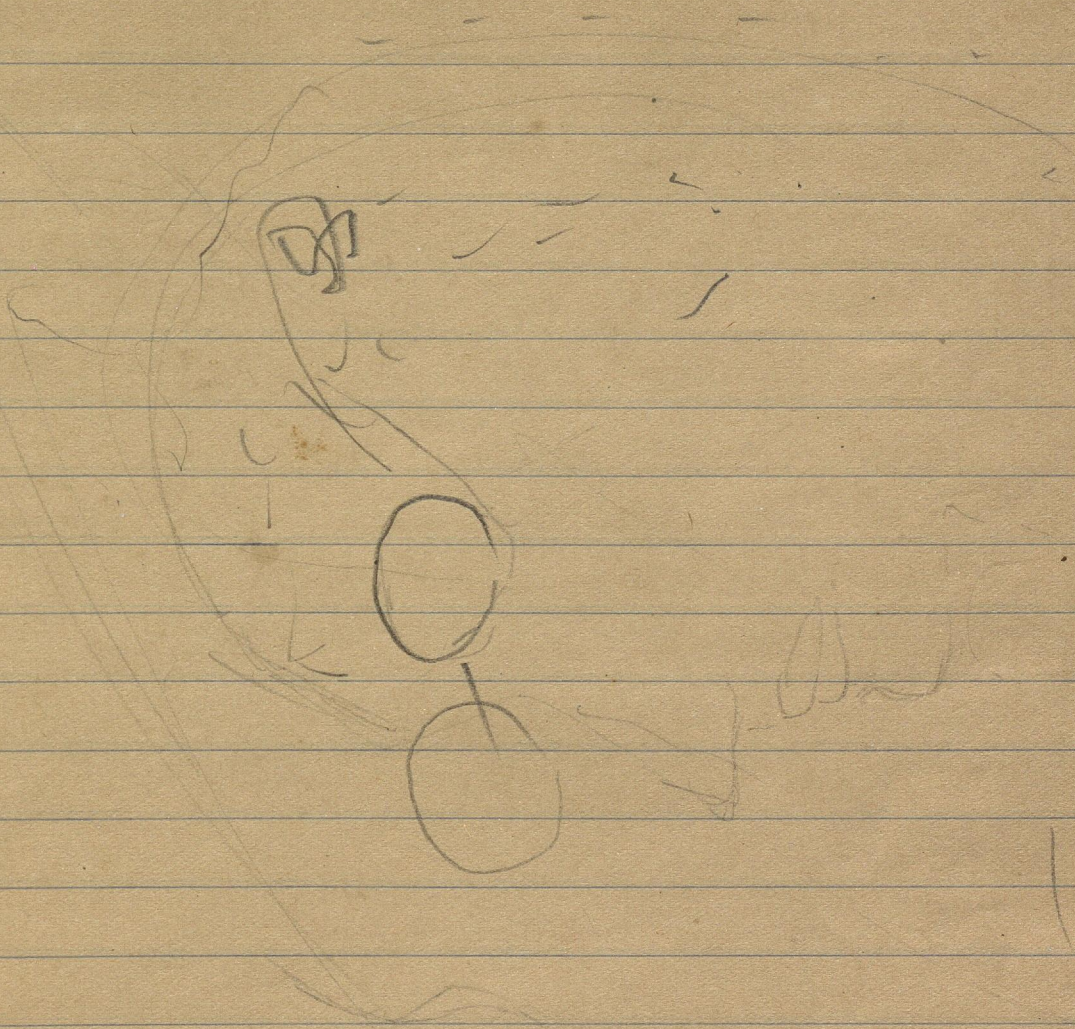
४८४०
90
0000
४८४०
४८४००

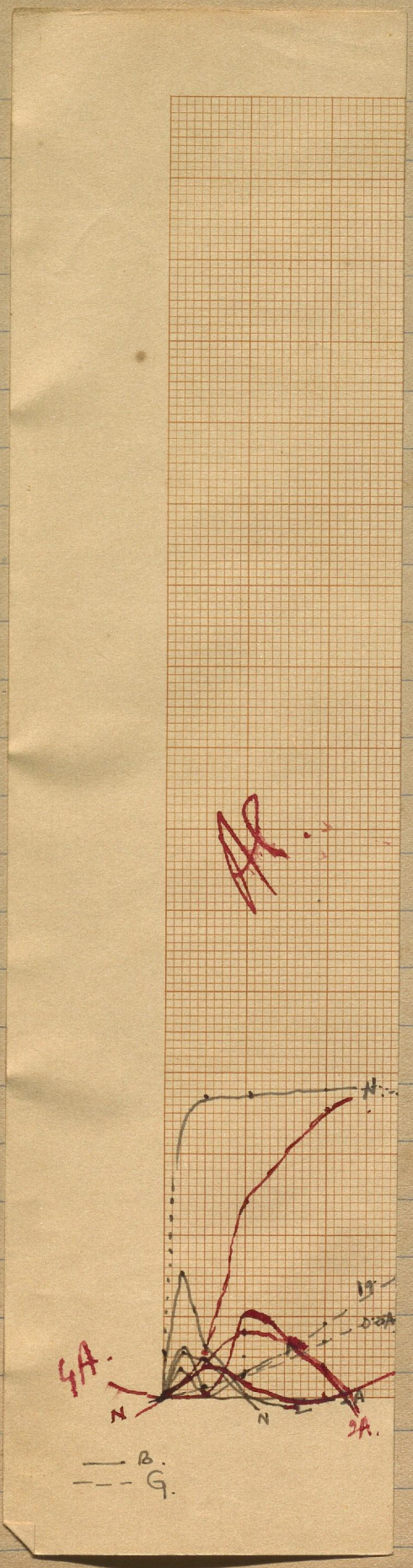
[illegible] 1४८४००

	220
2	४८४००
+2	४
४२	८४
+2	८४
४४	[illegible]

[illegible]







4A.
N
N
2A.
B.
G.

$$
\begin{array}{r|l}
 & 4\text{अ}^2 + 4\text{अब} + \text{ब} \\
\hline
8.\ 2\text{अ} + \text{ब} & 8\text{अ}^3 + 12\text{अ}^2\text{ब} + 6\text{अब}^2 \\
 & 8\text{अ}^3 + 4\text{अ}^2\text{ब} \\
\hline
 & 8\text{अ}^2\text{ब} + 6\text{अब}^2 \\
 & 8\text{अ}^2 + 4\text{अब}^2 \\
\hline
 & 2\text{अब}^2 + \text{ब}^2 \\
 & 2\text{अब}^3 + \text{ब}^2 \\
\hline
 & \times
\end{array}
$$

$$
\begin{array}{r|l}
 & 3\text{ब} \\
\hline
9.\ 1 + 3\text{ब} & 1 - 9\text{ब}^2 \\
 & 1 + 9\text{ब}^2 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
 & 1 - 3 \\
\hline
9.\ 1 + 3\text{ब} & 1 - 9\text{ब}^2 \\
 & 1 \\
\hline
 & -9\text{ब}^2 \\
 & -9\text{ब}^2 \\
\hline
 & \times
\end{array}
$$

$$
\begin{array}{r|l}
 & 100 + \text{ब}^2 \\
\hline
10.\ 10 + \text{ब} & 1000 + \text{ब}^3 \\
 & +1000 \\
\hline
 & +\text{ब}^3 \\
 & +\text{ब}^3 \\
\hline
 & \times
\end{array}
$$

96

$$
\begin{array}{r|l}
 & 4\text{क} + 5\text{ख} \\
\hline
4\text{क} - 5\text{ख} & 16\text{क}^2 - 25\text{ख}^2 + 5 \\
 & 16\text{क}^2 - 20\text{खक} \\
\hline
 & 20\text{कख} - 25\text{ख}^2 \\
 & 20\text{कख} - 25\text{ख}^2 \\
\hline
 & \times \quad 5.
\end{array}
$$

कक्षा प्रार्थ

(१६)

२क + ३ख

२क + ५ख | ४क² + १६कख + १५ख²
२क² + १०कख + ४

६कख + १५ख²
± ६कख ± १५ख²

× उत्तर

२क + ३ख

(१८)

४ कख + ५

४क - ५ख | १६क² - २५ख² + ५
१६क² - २०ख²
- ५ख² + ५

४क + ५ख

४क - ५ख | १६क² - २५ख² + ५
१६क²
- २५ख²
२५ख²
× + ५

३क - ४ख | ९क² - १५कख + ४ख²
९क² - १२कख
- ३कख + ४ख²
- ३कख + ४ख²
×

17,

२क + ३

१५ — २क + ३) ४क² + १२क + १५

४क² + ६क

+ ६क + १५

+ ६क + ५

— ६

२० — अ + बस) अ² — अ³ + ब³ + स³ — ३ अबस

अ³ + ब³ + स³

— ३ अबस

(20)

अ² — ब² + स² — ३

अ + बस) अ³ + ब³ + स³ — ३ अबस

अ³ + ब³ + स³

— ३ अबस

अ² — अब + ब² + बस — अस + स²

अ + ब + स) अ³ + ब³ + स³ — ३ अबस

अ³ + अ²ब + अ²स

— अ²ब — अ²स + ब³

— अ²ब — अब² — अबस

अब² + अबस — अ²स + ब³

अब² + ब³ + ब²स

अबस — अ²स + ब²स + स³

अबस + + ब²स + बस²

— अ²स + बस² + स³ — ३ अबस

— अ²स — अबस — अस²

बस² + स³ — २ अबस + अस²

बस² + स³ + अस²

— २ अबस

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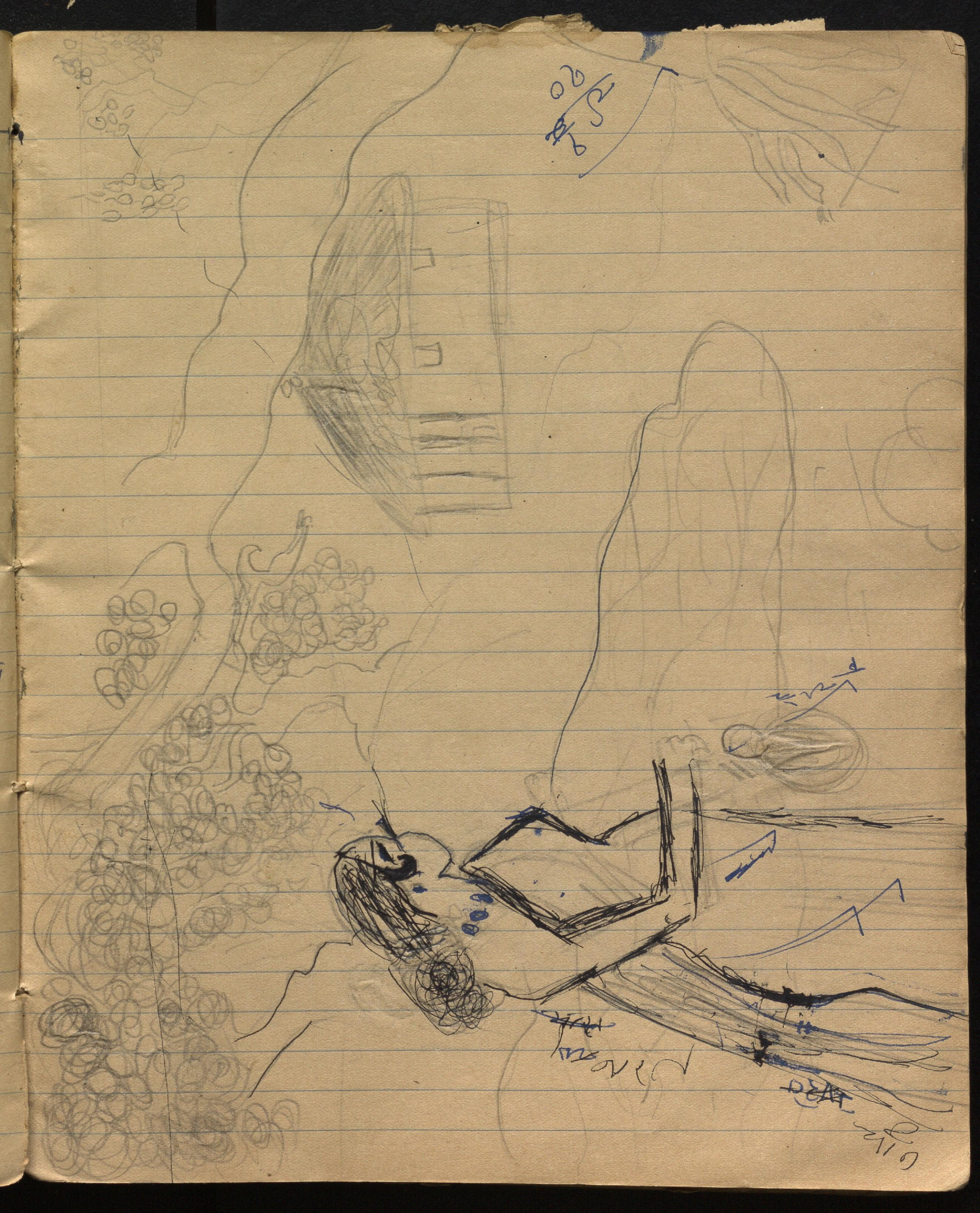
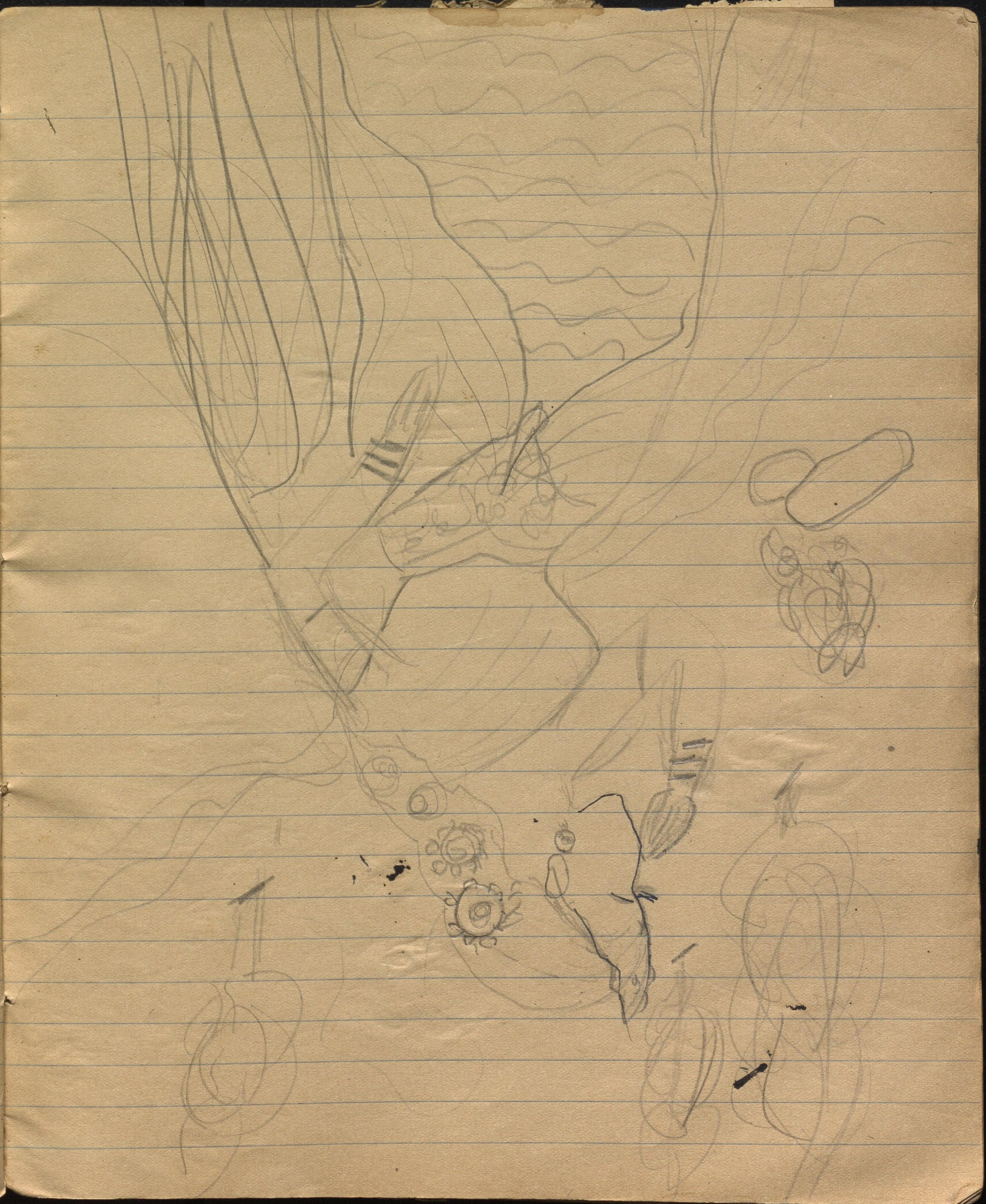
अ² — अब + ब² + बस — अस + स²





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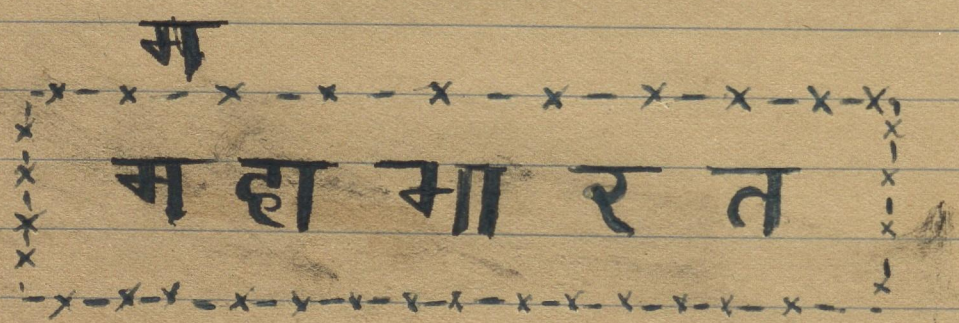

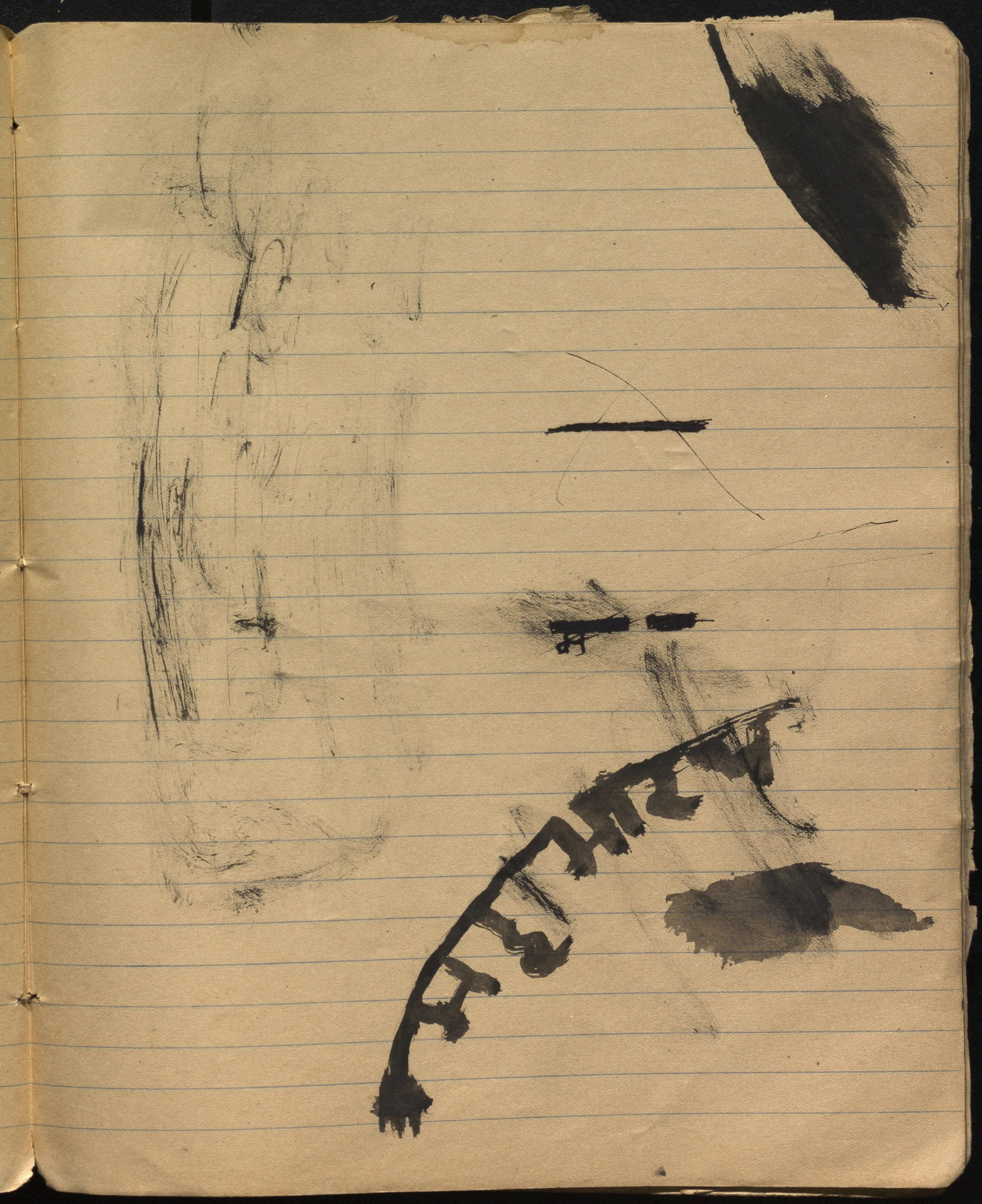

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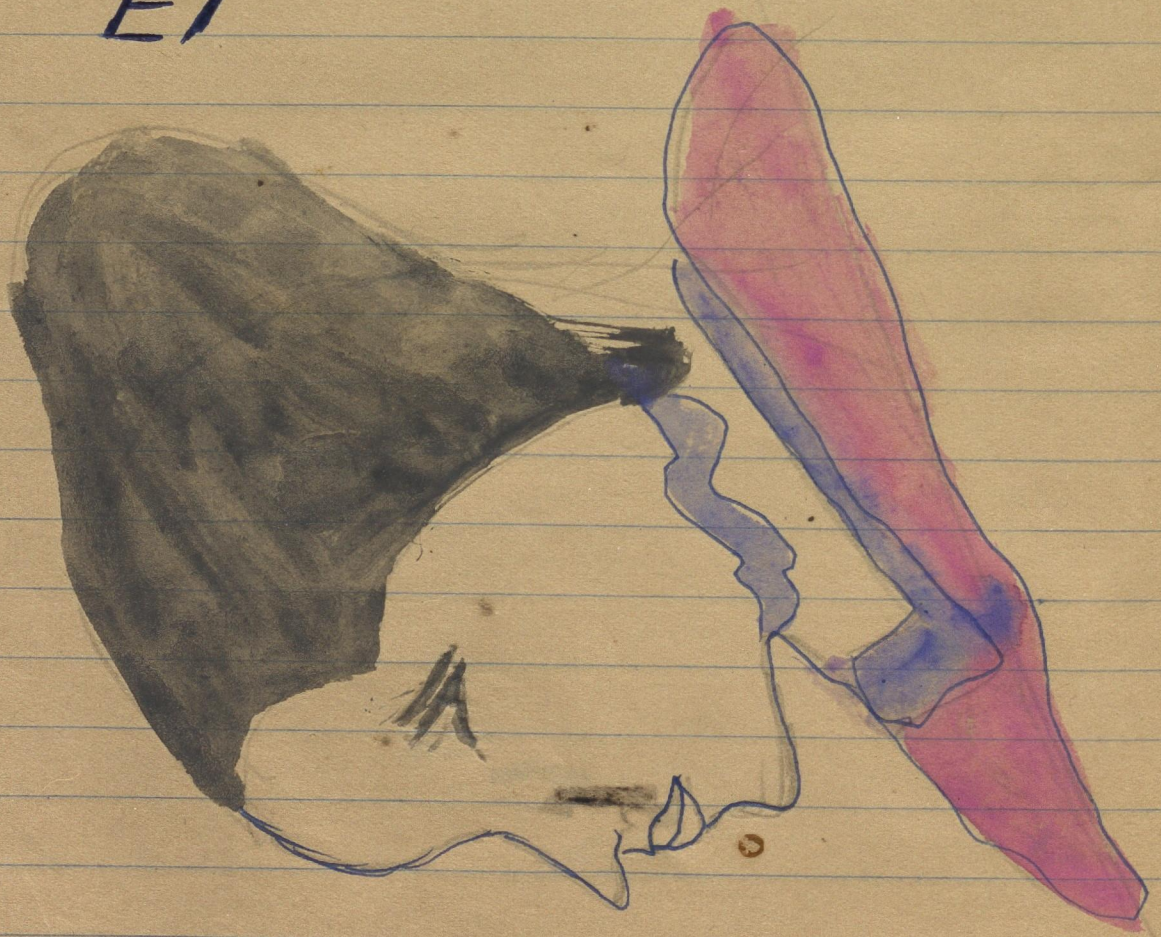

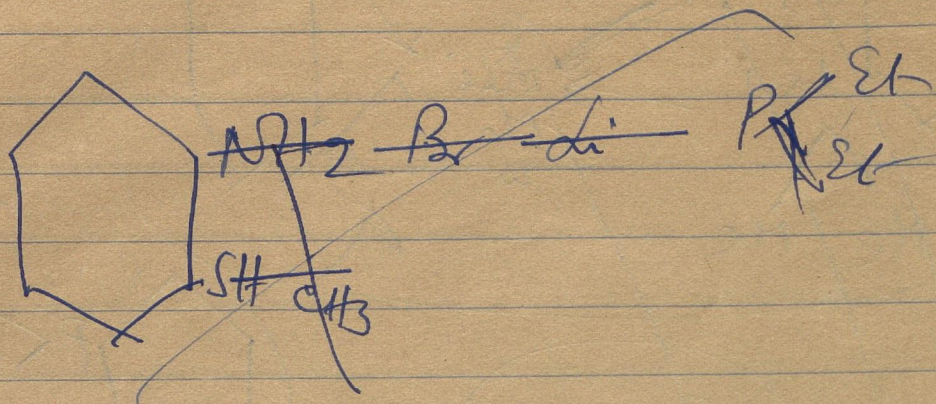

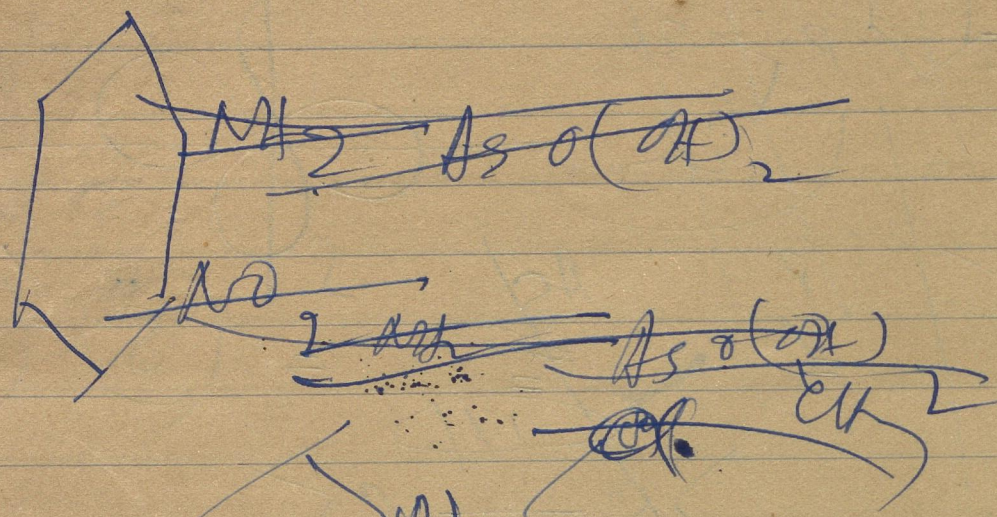

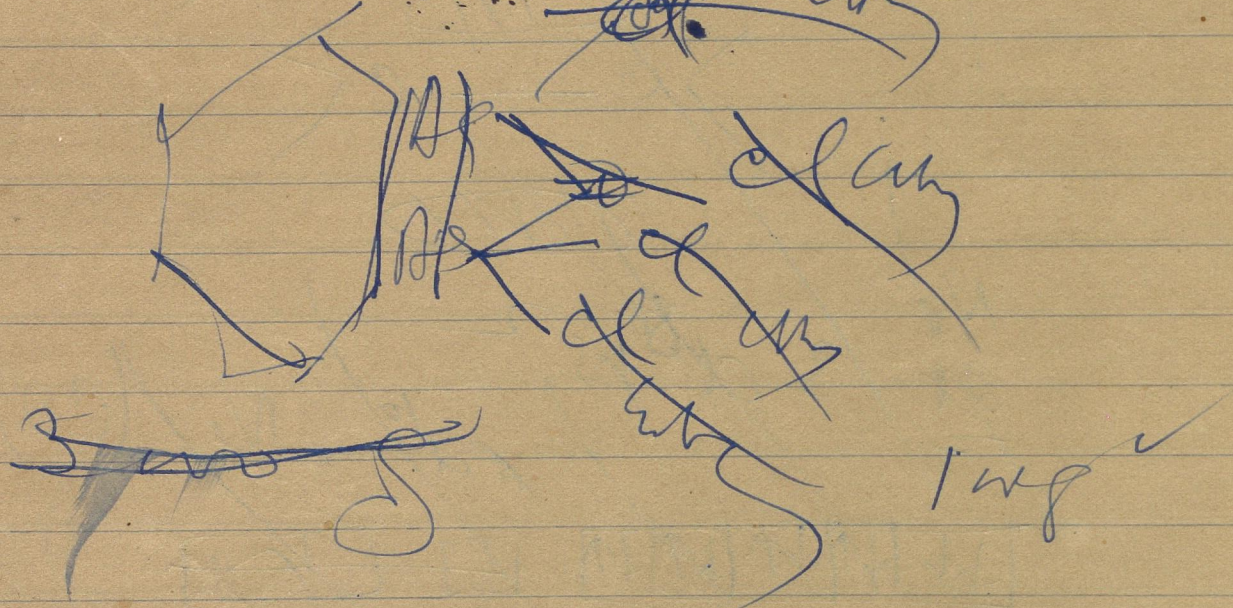

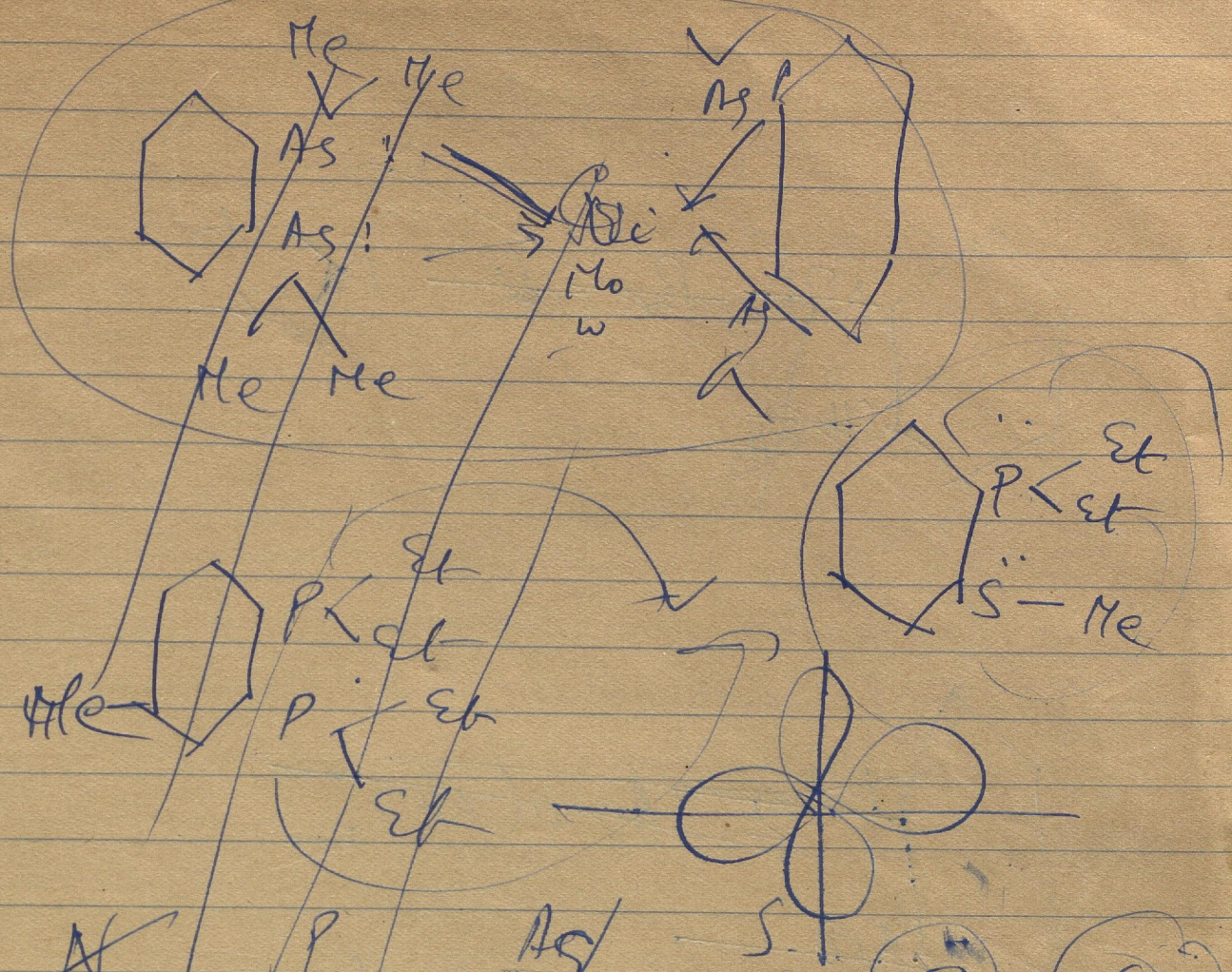

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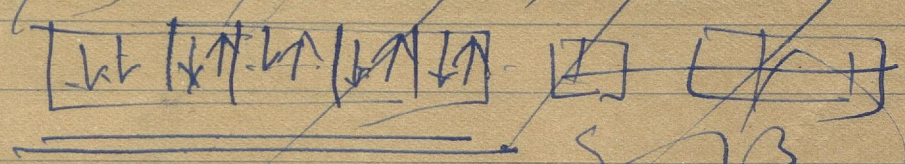
3 d^{8} $4s^{2}$

$3d^{10}$ Ni (CO) 4



आरती

पहर तोहे क्या समझावे पावता की झनकार

क्या रे तोहे बिन साजन लागे न जीया हमार तेरे बिन साजन लागे न जीया हमार

क्या रे दुख के करता है इसी रेखन्या सौ बार आ तोहे सजनी ले चलूँ न दिया के पार — — — — — — — —

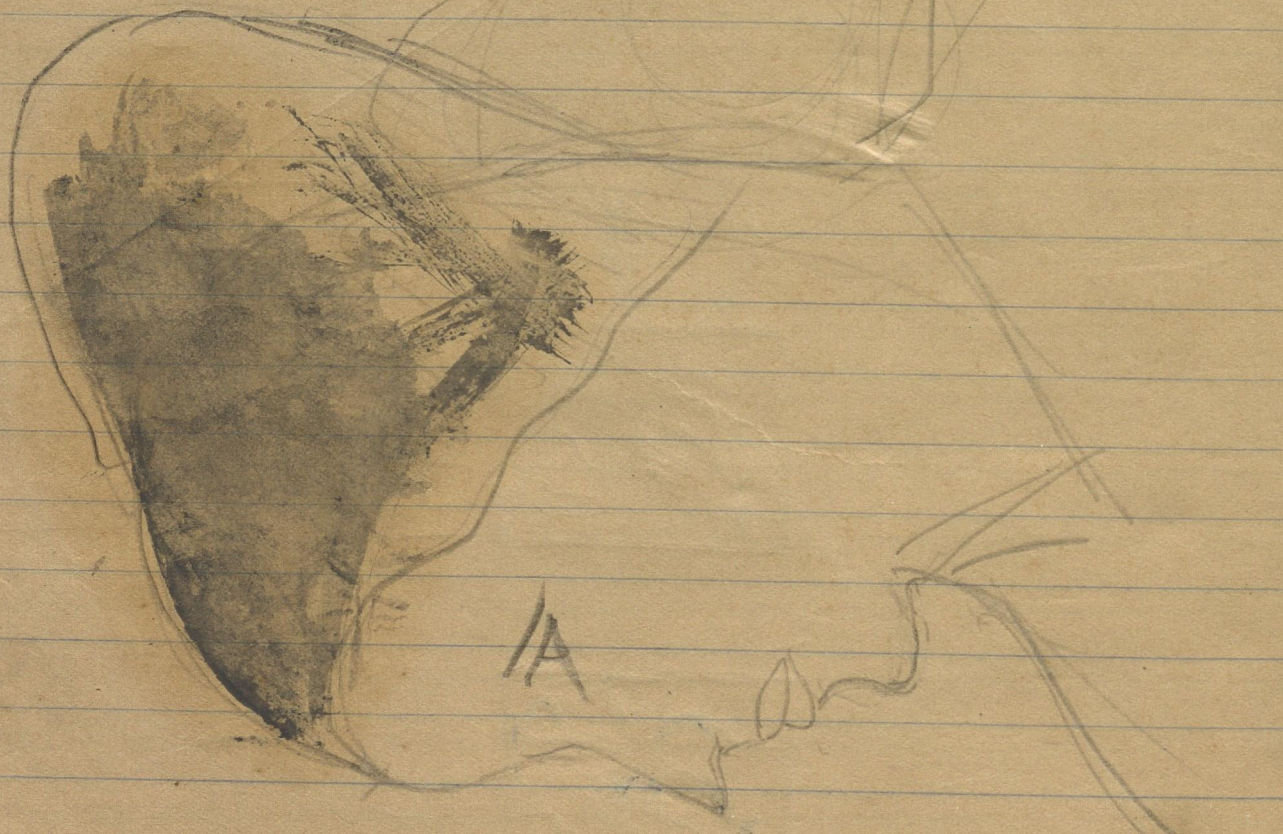
दीरघा अपर चांद नी आई सम्हले

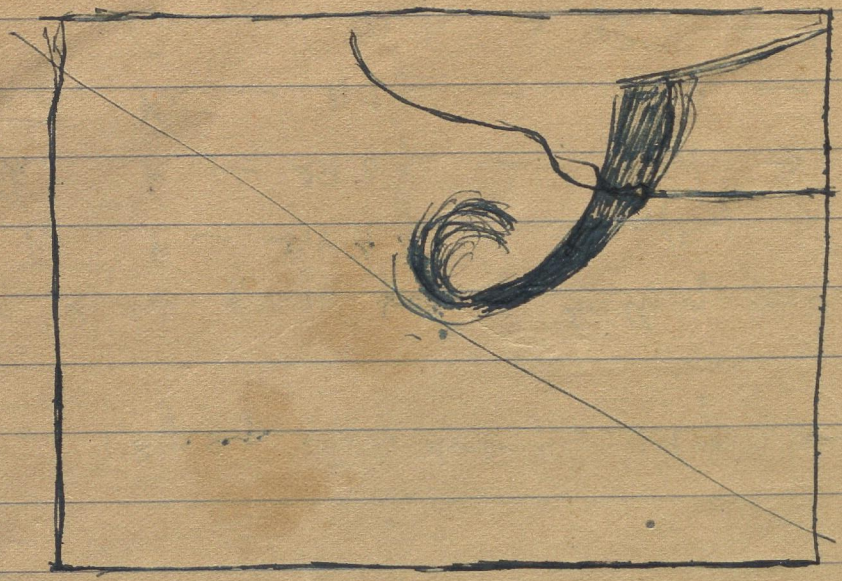
महाभारत











Dr. Krishna Bahadur M.Sc; D.Phil.

Dr.

Team Dr.

Perplexed

Dr. Krishna Bahadur

Prakash

Content of mineral in max. min. on the basis of ash which is 3 to 4 %.

	Max. Min.	Max	In 1770 gm yeast
P_2O_5	51·0	59·0	P → 24·44
SO_2	0·6	6·0	S → 0·30
Si	0·0	1·6	
K_2O	2·8	4·00	→ 2·90
Na_2O	·5	1·9	→ 1·12
MgO	4·0	8·1	→ 3·90
Calcium	1·0	4·5	→ 3 gs.
FeO_2	·1	7·3	
Cl	·3	1·0	

7·8 gs sugar which should give 1·9 gs of yeast will take

For 2 mds. of sugar produce 40 lbs of yeast. 160 lbs

P	244·4 gs	$Na_3(PO_4)_2$ →	$2\frac{1}{2}$ lbs. 1100 gs.
K	29·0 gs	K_2SO_4 →	60 gms.
Na	11·2 gs	NaCl →	30 gs.
Ca	30 gs	~~CaO~~ →	~~42 gs~~
Mg	39 gs	$MgCO_3$ →	126 gs.

$(NH_4)_2SO_4$ — 3 lbs.

1350 gs.

All the above salts should be digested with Con. HCl.

Magnesium Carbonate, Calcium Phosphate, Potassium Sulphate, Sodium Chloride.

for 1 Rs.

$(NH_4)_2SO_4$		12 gms.
$Ca_3(PO_4)_2$	–	10 gms.
K_2SO_4	—	0·6 gms.
NaCl	–	·3 gms.
$MgCO_3$	—	1·2 gms.

28/12/

1. Torulopsis Utitis

I (Henenberg Lodder var. Major Thyssea et. Morris on P.D.A. 30/3 Y 42)

2. Torulopsis Utitis.

III (Henenberg Lodder Y. 19. on P.D.A. 30/3).

3. Saccaromyces Cerevisiae (Hensen var. ellipsoidens Dekker

IV Y 8. on P.D.A 30/3).

IX

4. Saccaromyces Cerevisiae (Hensen Y 1)

5. VIII S. ellipsoidens. (Hensen Y 4)

6. II Saccaromyces turbidans (Hensen Y 6)

7. VII Saccaromyces Calsbergensis.

8. Torula

9. VI Saccaromyces cerevisiae Hans. var. cretericus (Linder) Lodder Y. 5. 29/4/49 on P.D.A. fm. Agriculture Research Institute, New Delhi;

10. Ashbya gossypii (Ashby et Nowell) Guiu. 12/4/49 on P.D.A. Agr. Rec. Ins. Delhi

Magnesium [illegible] Calcium [illegible] Nos phate, Potassium, Sulphate, Sodium chloride.

Cm. H[illegible]

In N loss experiments of sets started on the 7-2-50.
each culture contained following salts

$Ca_3(PO_4)_2$ — 0.50 gms.
$MgCO_3$ — 0.25 gms.
K_2SO_4 — 0.20 gm.
Na_2CO_3 — 0.2 gm
Dissolved in HCl acid.

with 5 c.c. absolute alcohol in 400 or 10 gms of sugar in the same vol.
K Bahadur
2 9/3/50

कुमार
वेरसरन
रोहा
गुरादावाद
d before
gms. of yeast

-28-12-49

200gm. needs the following minerals — 1/4 of [illegible] [illegible] for 50 gm

7.5 gm Na_2HPO_4.
0.5 $CaCO_3$
0.8 gm $MgCO_3$
2 K_2SO_4 — g

5/11/50 [illegible]

[illegible]

Industrial

$(NH_4)_3PO_4$ — 6 gms.
$CaCO_3$ — 0.4 gm.
$MgCO_3$ — 0.7 gms.
K_2SO_4 — 1.5 gm.
all above for 2gm. of [illegible]

[illegible]

[illegible] in [illegible] of N loss [illegible] in ethyl alcohol of 27-1-50

Na_2HPO_4 — ~~28 gm.~~ 30 gms
$CaCO_3$ — 2 gm.
$MgCO_3$ — 3.2 gm.
K_2SO_4 — 4 gms
in 500 c.c. — 40 c.c. of this in each cell.
[illegible] cell. kept.

Potassium, Sulphate, Sodium Chloride.

महेन्द्र कुमार
C/o
लाखुवीरसरन
कटरा
प्रभरोहा
जि. मुरादाबाद

1. For 10 gm of sugar following salts in the quantities mentioned before them are to be added. They will supply enough material for 10 gms. of yeast

$(NH_4)_2HPO_4$ — 0.35 gm.
$CaCO_3$ — 0.025 gm.
$MgCO_3$ — 0.044 gm.
K_2SO_4 — 0.100 gm.
NaCl — 0.06 gm.
$ZnSO_4$ — 0.025 gm. $(NH_4)_2SO_4$ — 1 gm.

2. For 20 gms of yeast following substances to be added

$(NH_4)_2HPO_4$ — 0.736
$(NH_4)_2SO_4$ — 3.0 gm.
$CaCO_3$ — .05 gm.
$MgCO_3$ — .088 gm.
NaCl — .12 gm.
K_2SO_4 — .2 gm.
$ZnSO_4$ — .05 gm.
K+I Tart — 0.5%

3. 500 gms ~~flask~~ yeast should have the following — Culture – No 1 — 28-12-49

$(NH_4)_2HPO_4$ — 17.5 gms.
$(NH_4)_2SO_4$ — 75.00 gms.
$CaCO_3$ — 2.5 gms.
$MgCO_3$ — 4.40 gms.
NaCl — 7.2 gms.
K_2SO_4 — 10 gms.
$ZnSO_4$ — 2.5 gms.

Kshahadev
28/12/49