

INVESTIGATION OF ICE MELTING CHEMICALS

UNION CARBIDE'S "UCAR" RUNWAY DEICER

Report 71-1

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VERMONT DEPARTMENT OF HIGHWAYS

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## INVESTIGATION OF ICE MELTING CHEMICALS

### OBJECTIVE:

The objective of this report is to compare the ice melting effectiveness of Union Carbide's liquid "UCAR" Runway Deicer PM 5197 to that of sodium chloride and calcium chloride over different time periods and at varying atmospheric temperatures.

It should be noted that the laboratory tests performed and stated in this report are somewhat limited and do not include information on:

- (a) effectiveness of the different deicers on hard packed snow;
- (b) possible increase in slipperiness of an icy pavement when "UCAR" liquid is first applied;
- (c) possible increase in vehicle traction when chloride crystals are first applied;
- (d) possible increase in vehicle traction due to initial pitting of icy surface by chloride crystals;
- (e) effectiveness of the different deicers in breaking the ice-pavement bond thereby allowing plows to clear the pavement surface.

The aforementioned information could only be attained with extensive field tests which would go beyond the scope of the investigation request.

### TEST PROCEDURE:

Four inch diameter metal pans containing 100 grams of water were placed in a freezer for 24 hours. On the day testing was to proceed, sufficient ice samples and cans containing the specified 18 or 21 grams of deicer were placed out of doors so that a sample of each deicer and ice combination could be weighed at the end of each specified time period.

After approximately an hour wait in which the ice samples and deicers could attain atmospheric temperature, each of the ice samples were covered with one of the specific deicers. At the completion of a prescribed time period, the temperature was recorded and one of each of the deicer and ice combinations was weighed by pouring the deicer and melted ice into a beaker. The weight of the deicer was then subtracted to obtain the weight of ice melted. The remaining ice sample was then discarded and at the next specified time period new samples were weighed with the same procedure continuing through the remainder of the testing period.

The deicer quantities (18 and 21 grams) were selected for covering the ice samples when visual observation and preliminary testing showed that this amount would cover approximately 85% of the sample surface but would not melt all of the ice within the test period. This volume of deicer would amount to approximately 58,000 pounds per lane mile (24' width) for the 18 gram sample and 67,000 pounds per lane mile for the 21 gram sample.

#### CONCLUSION

As the attached data sheets and graphs indicate, calcium chloride ( $\text{CaCl}_2$ ) is superior in ice melting effectiveness to sodium chloride ( $\text{NaCl}$ ) and Union Carbide's "UCAR".

The information also indicates that sodium chloride is more effective than Union Carbide's "UCAR" at all time intervals when the temperature is in the 15°F to 30°F range and is more effective over the longer time intervals when the temperature is in the 5°F to 15°F range. When temperatures range between -7°F to 10°F, Union Carbide's "UCAR" does take effect quicker than sodium chloride but it should be noted that the melting effectiveness of both products at these temperatures is so low that the actual value would probably be considered negligible.

# DEICER TEST DATA RESULTS

<u>Deicer Quantity</u>	<u>Elapsed Time</u>	<u>Temperature</u>	<u>Grams Ice Melted "UCAR"</u>	<u>Grams Ice Melted NaCl</u>	<u>Grams Ice Melted CaCl<sub>2</sub></u>
21 grams	½ hr	-7°	4	0	8
	1	-4°	4	0	34
	2	no reading	-	-	-
	3	6°	12	4	46
	4	6°	13	12	54
	5	6°	19	19	60
21 grams	½ hr	8°	8	6	38
	1	8°	8	11	44
	2	8°	16	26	54
	3	4°	21	26	56
	4	4°	13	45	61
	5	2°	22	29	63
21 grams	½ hr	4°	6	0	34
	1	7°	10	6	45
	2	8°	8	14	48
	3	5°	18	21	49
	4	6°	21	23	59
	5	7°	17	34	60
18 grams	1 hr	15°	13	13	
	2	14°	19	23	
	3	no reading	--	--	
	4	16°	32	52	
	5	18°	34	64	
18 grams	1 hr	23°	19	24	
	2	26°	23	48	
	3	no reading	--	--	
	4	27°	28	77	
	5	24°	33	94	
21 grams	½ hr	27°	19	16	36
	1	27°	29	26	44
	2	28°	45	48	57
	3	27°	50	61	78

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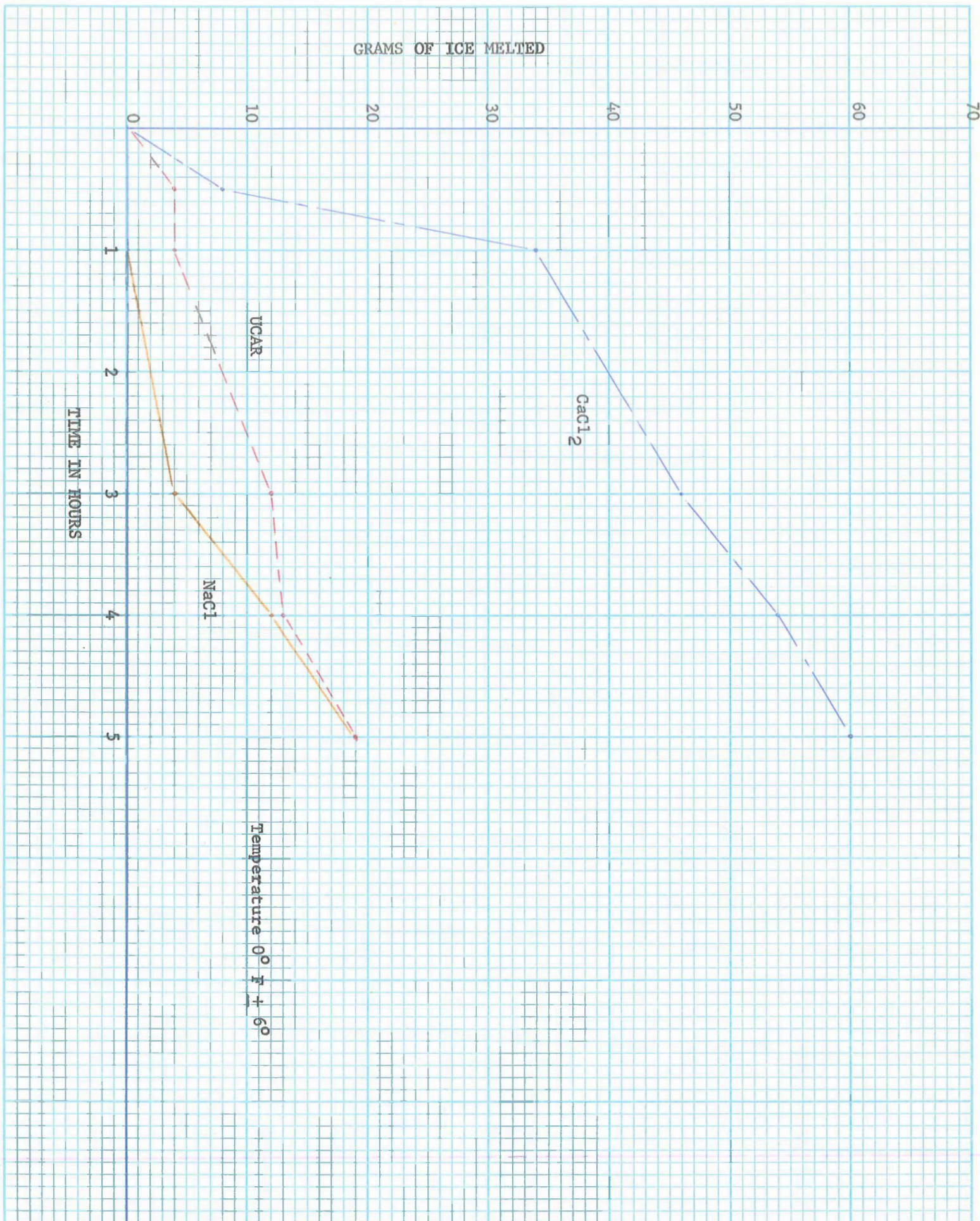


Deicer Quantity	Elapsed Time	Temperature	Grams Ice Melted "UCAR"	Grams Ice Melted NaCl	Grams Ice Melted CaCl <sub>2</sub>
18 grams	$\frac{1}{2}$ hr	28 <sup>0</sup> + 2	18	18	
	1	28 <sup>0</sup> + 2	26	31	
	2	28 <sup>0</sup> + 2	34	45	
	3	28 <sup>0</sup> + 2	36	61	
	4	28 <sup>0</sup> + 2	38	66	
18 grams	$\frac{1}{2}$ hr	28 <sup>0</sup> + 2	15	18	
	1	28 <sup>0</sup> + 2	23	26	
	2	28 <sup>0</sup> + 2	32	47	
	3	28 <sup>0</sup> + 2	35	60	
	4	28 <sup>0</sup> + 2	37	65	
21 grams	$\frac{1}{2}$ hr	21 <sup>0</sup>	18	18	46
	1	22 <sup>0</sup>	23	25	55
	2	21 <sup>0</sup>	24	53	69
	3	36 <sup>0</sup>	38	90	96
	4	30 <sup>0</sup>	61	98	--

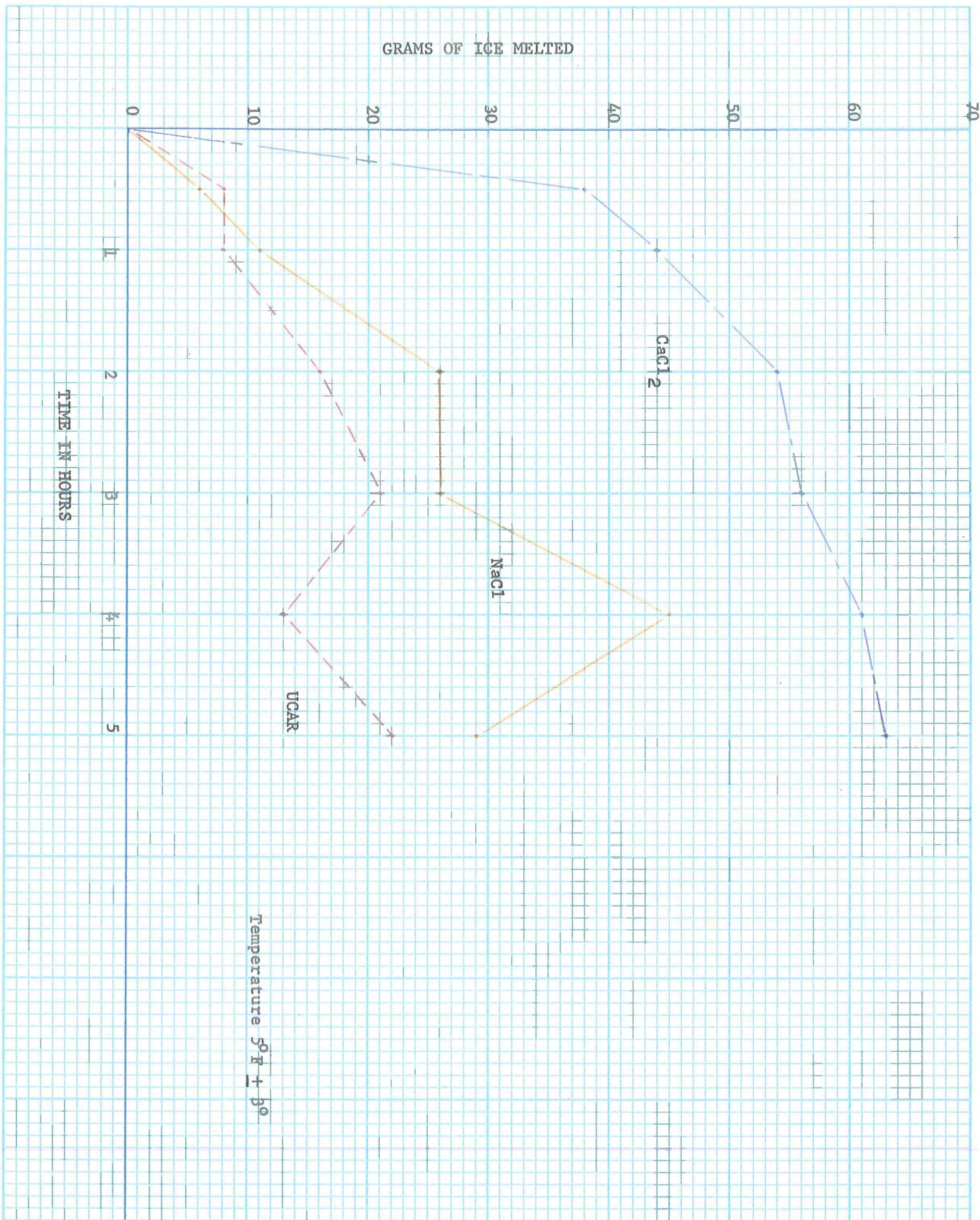
GRAMS OF ICE MELTED

VS

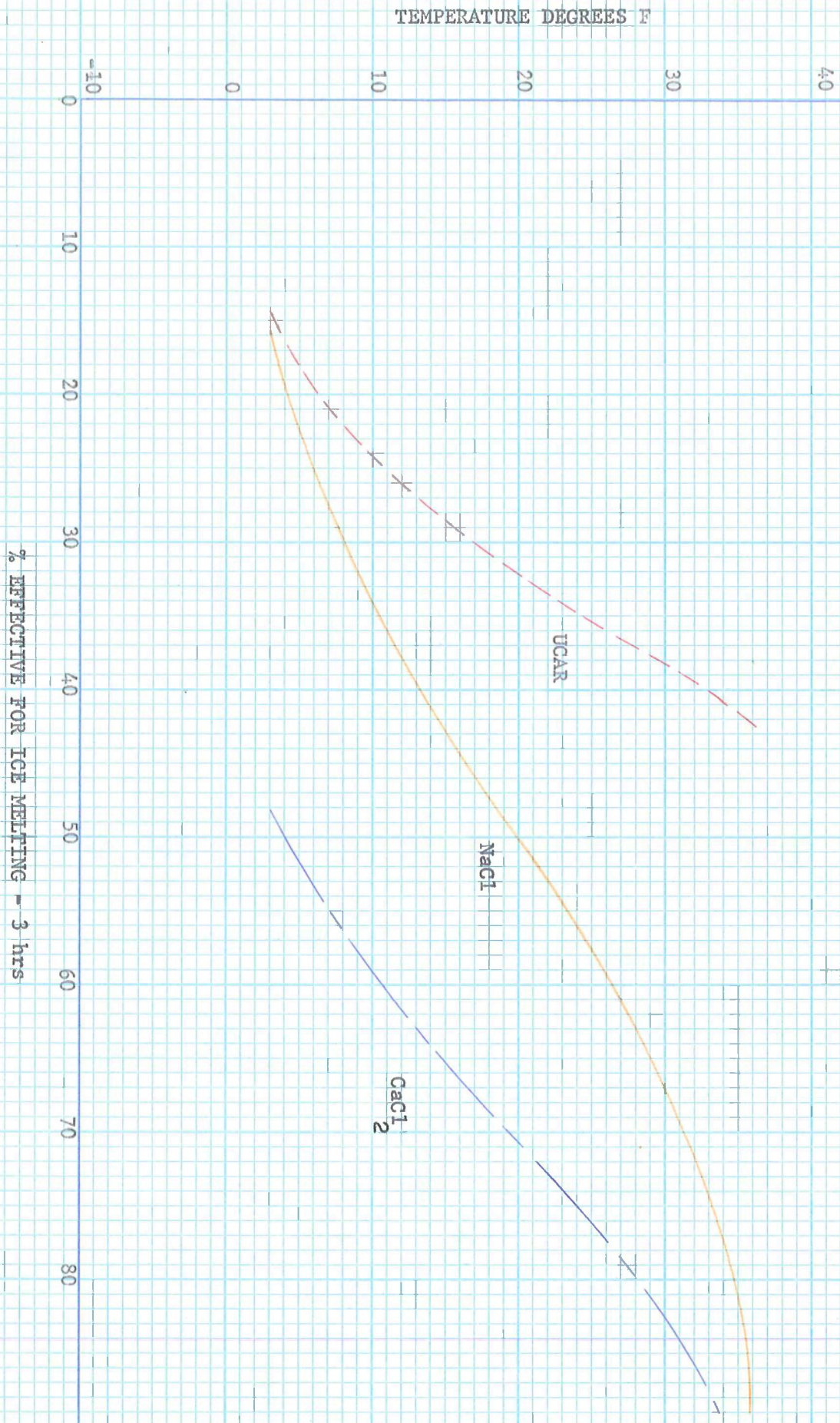
TIME IN HOURS



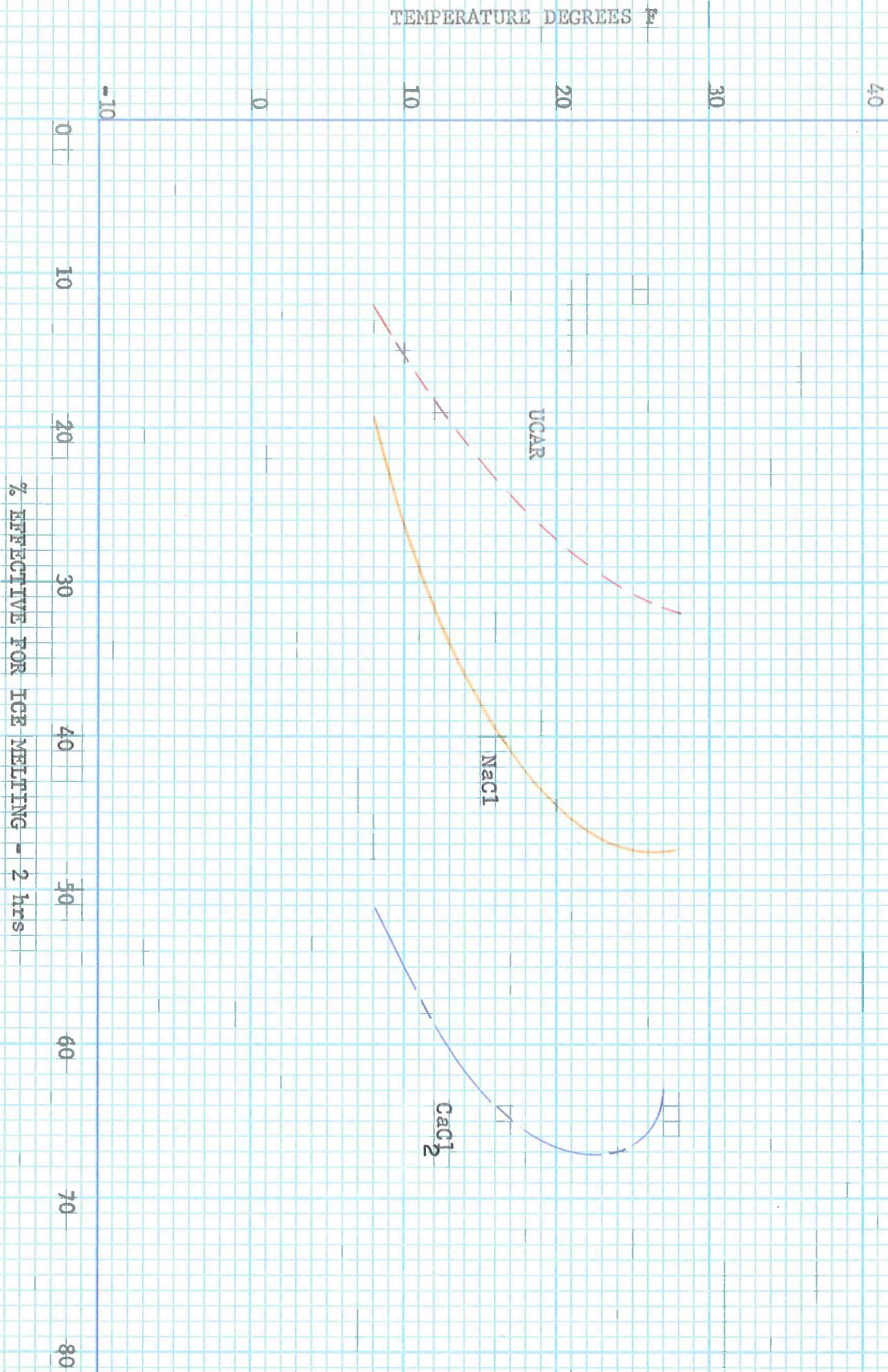




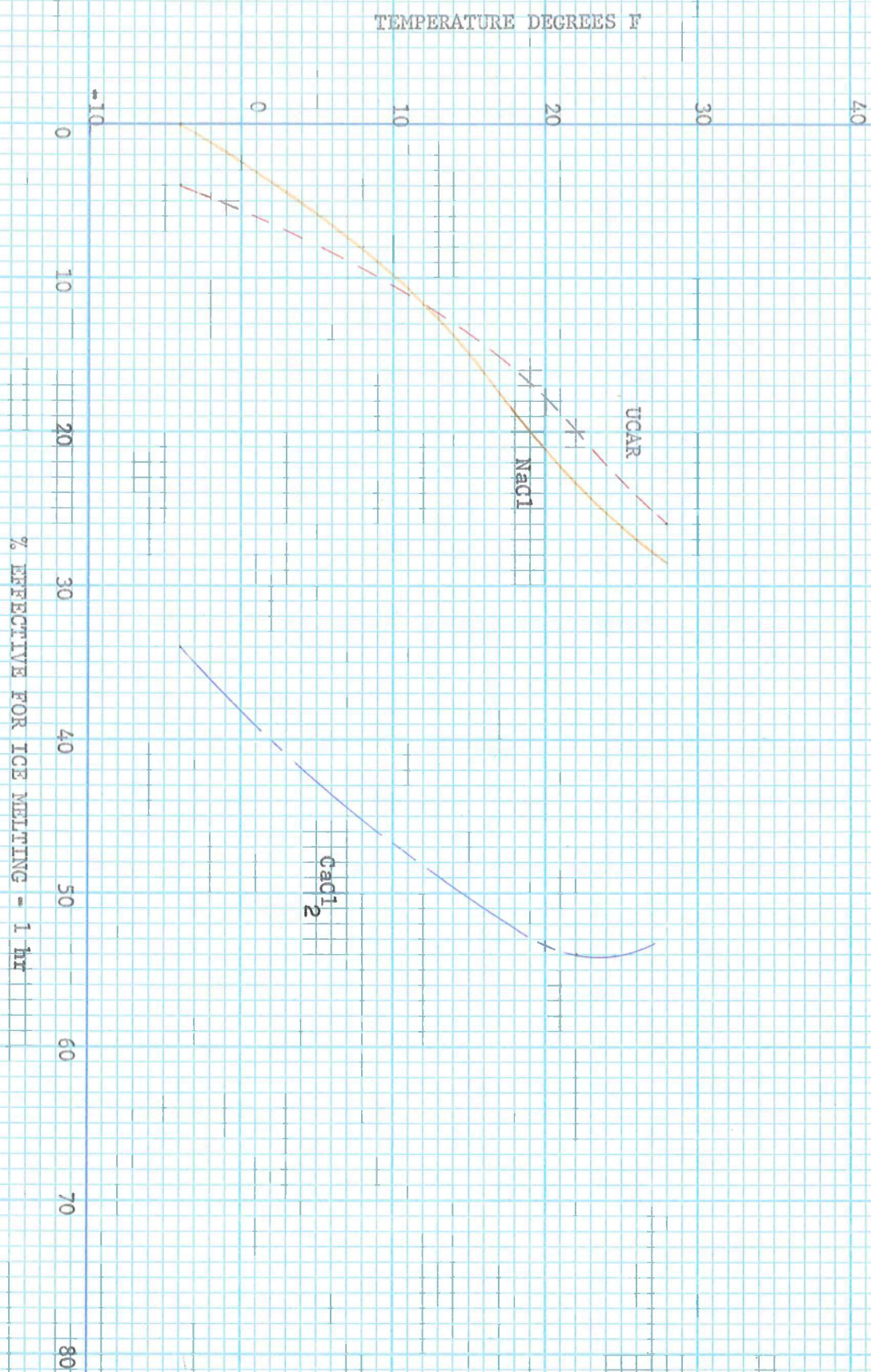




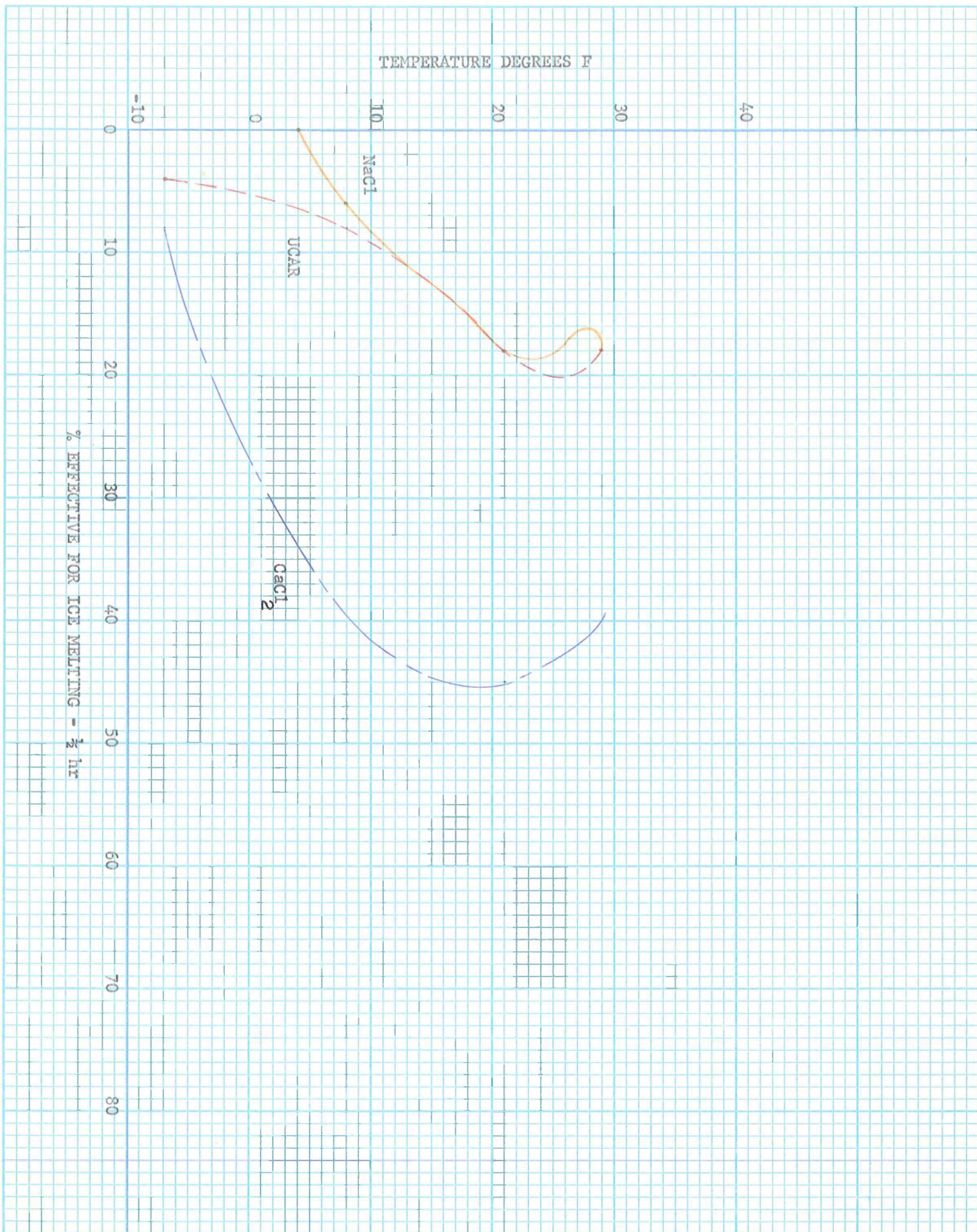






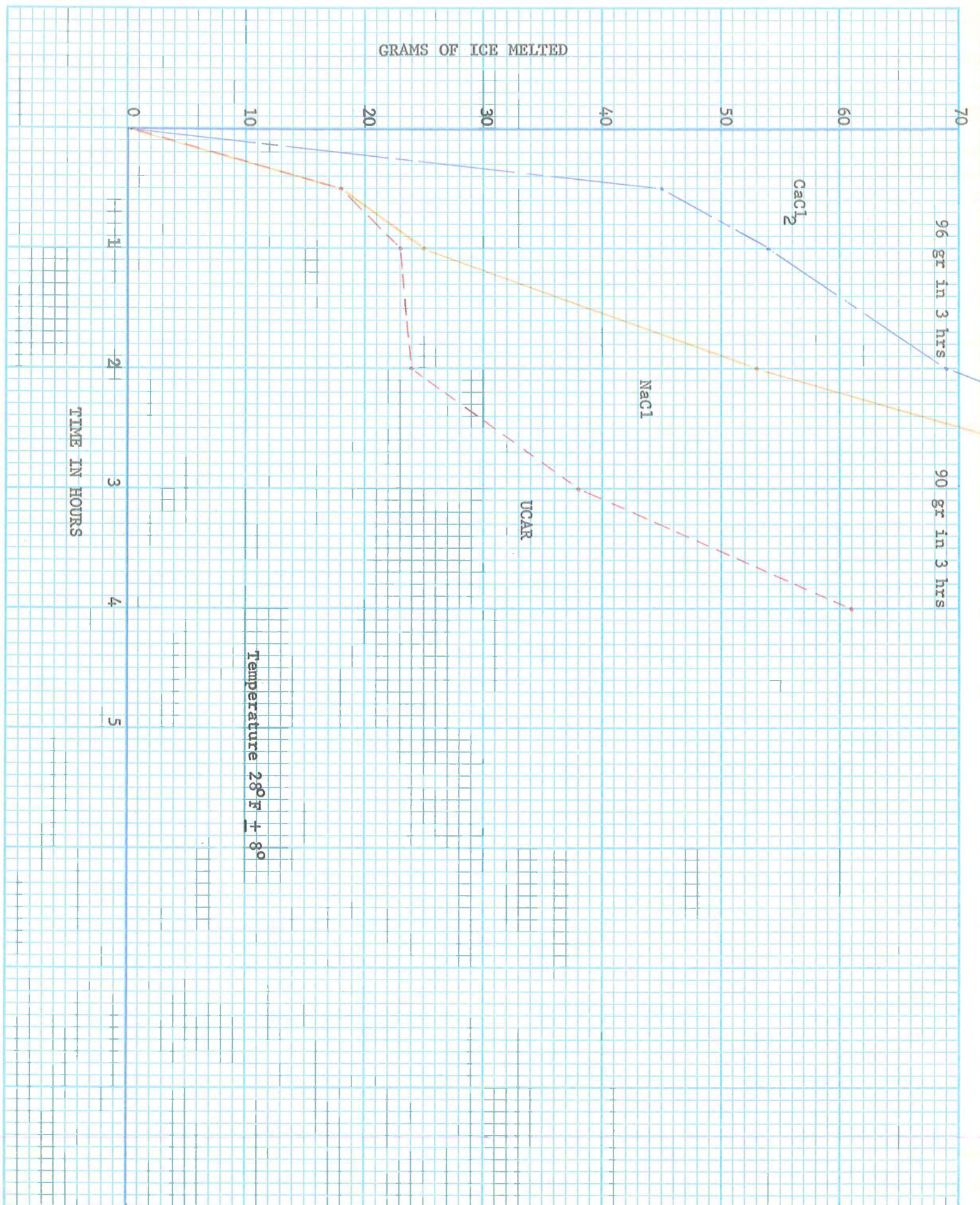




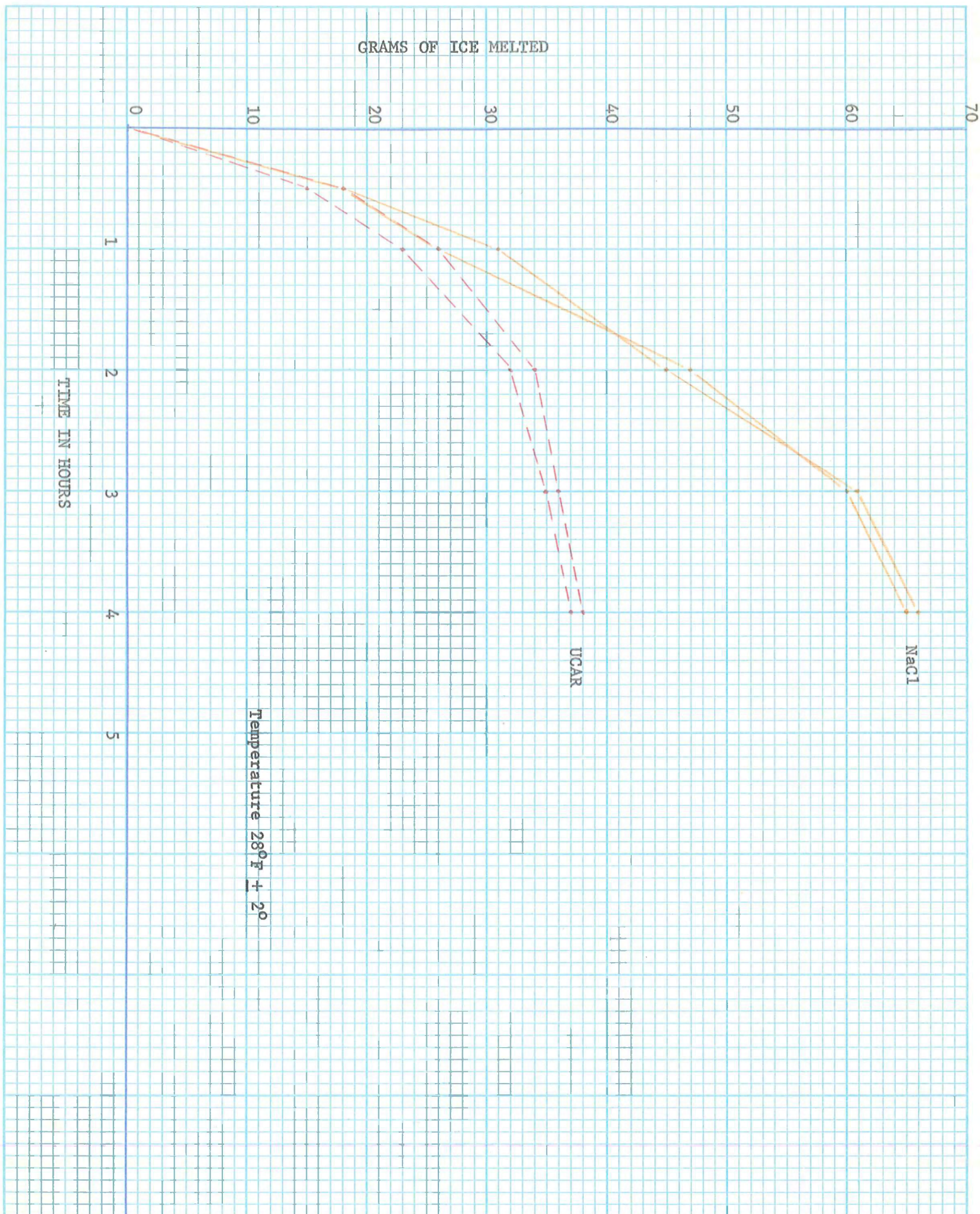




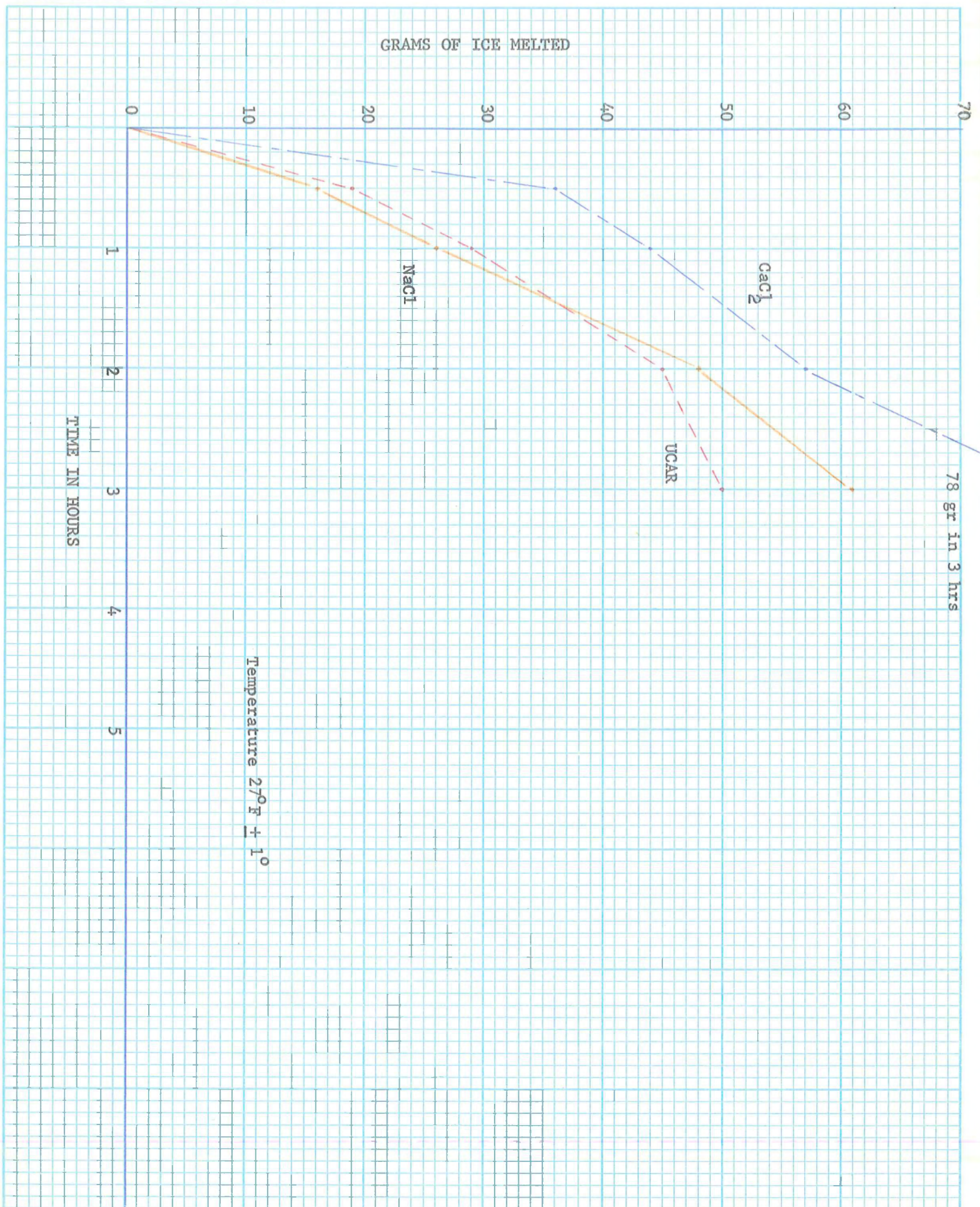
% EFFECTIVE FOR ICE MELTING



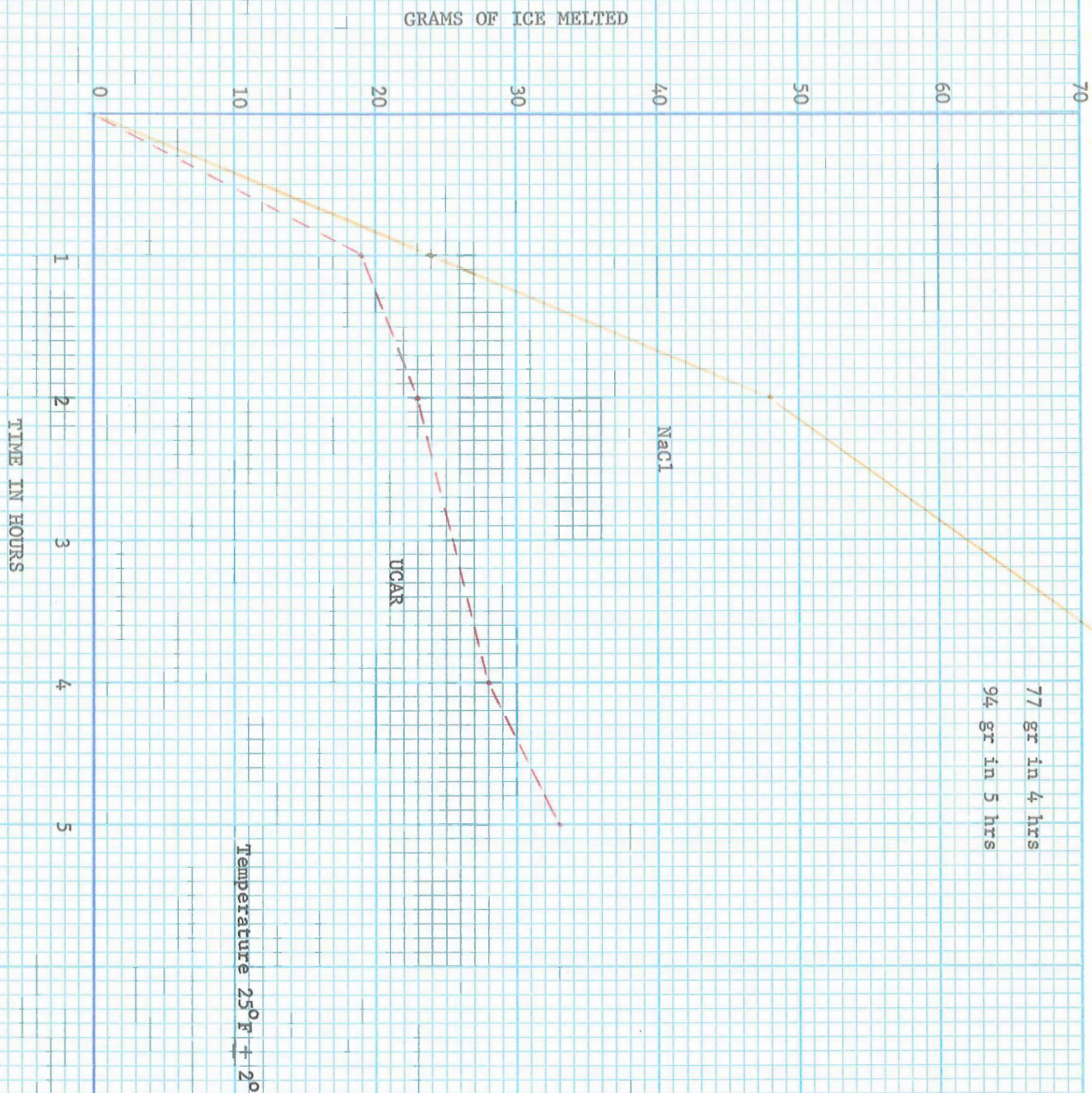




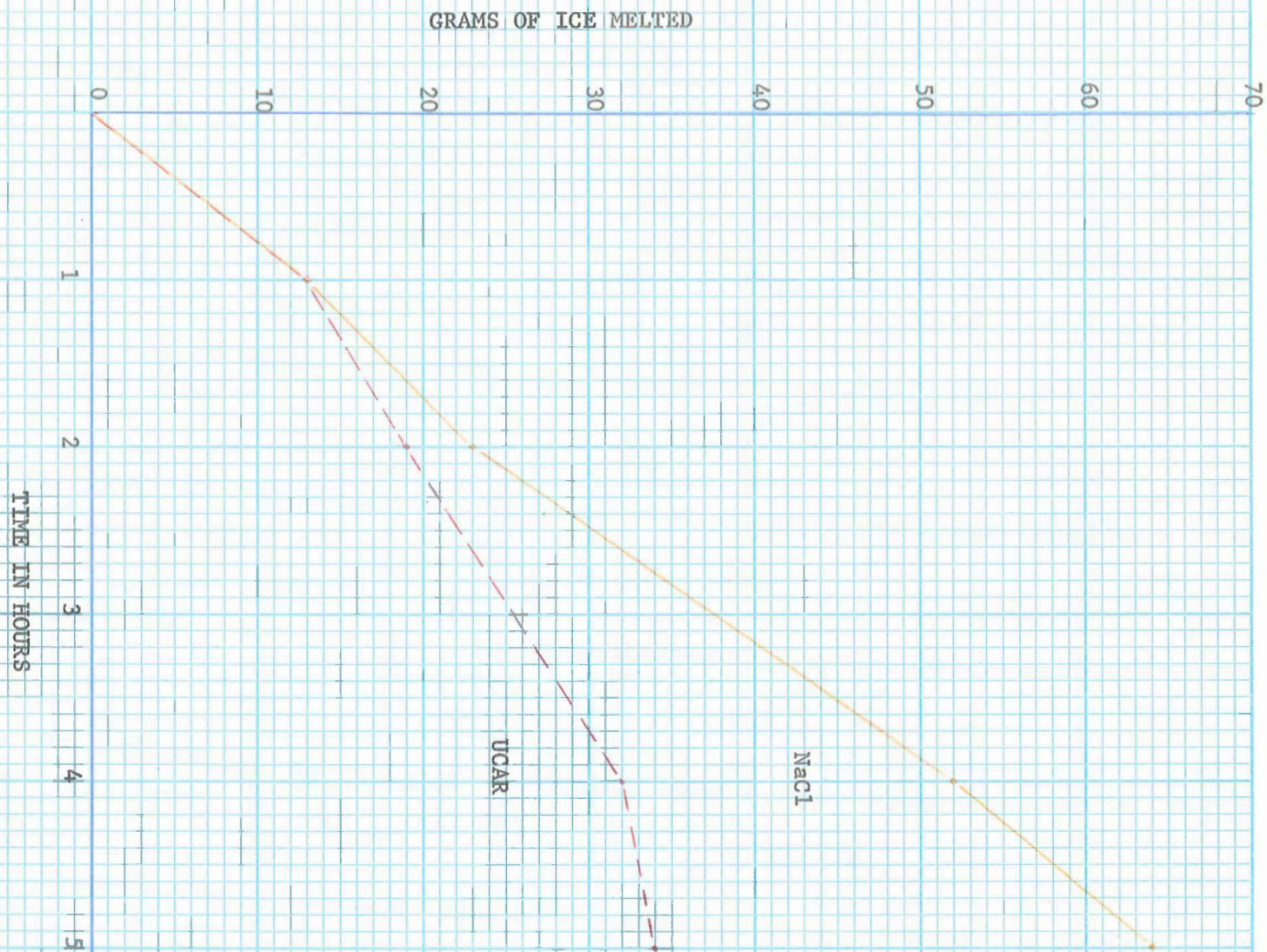












Temperature  $16^{\circ}\text{F} \pm 2^{\circ}$



