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CHARCOAL FROM GROUNDNUT SHELLS

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Introduction

In this part I would like to present the general facts and problems with regard to energy situations in Sudan.

I would like to discuss the present situation of production, consumption patterns and issues of national policies in order to save energy and secure the future demand by making use of agricultural waste and crop residue.

Sudan derives most of its energy from fuel wood and charcoal which constitute about 20% of total energy consumed. The forests are already being depleted in certain areas. All of the conventional energy such as conventional fuel is imported.

Agriculture is the dominant economic sector in Sudan. Crops production and animal herding employ the majority of the nation's population and contribute to the largest share of G.D.P. which amounted to 31.5% in 1979/80.

So far, the modernization in agriculture is limited and traditional agriculture prevails.

The following table shows forests and agricultural residues in Sudan.

Table 1. The forest area and allowable cuts in Sudan (1979).

Item	Amount	Unit
Productive forests	414361	Km^2
Growing stalks	447	10^6 ton
Total allowed cut	21.04	10^6 ton
Allowable cut for fuelwood	17.330	10^6 ton

Table 2. Estimates of the available crop residue in the Sudan (1979).

	Residue crop ratio	Crop production (kilotons)	Residue production (kilotons)	Available residue
Cotton stalks	1:1	454.8	454.8	454.8
Cotton trash	0.3:1	454.8	136.44	136.44
Millet	1:1	467.9	467.9	292.438
Wheat	1:1.4	309.000	432.6	270.375
Sorghum	1:1	1.714.8	1714.8	1.071.75
Rice	1:1.4	665.541	931.757	282.348
Sugar cane	1:5	1.409.000	281.800	281.800

Table 3. Energy potential of available crop residues (direct consumption and alcohol production 1979).

Item	Available crop residue (1000 tons)	Energy potential 10^{12} BTU	Alcohol million gallons
Cotton stalks	454.8	7.77	17.74
Cotton trash	136.44	2.18	5.32
Millet	292.44	4.68	11.41
Wheat	270.38	4.33	10.54
Sorghum	1.071.75	17.15	41.8
Rice	582.35	9.32	22.71
Surgar cane	281.80	4.51	10.99

The annual bagasse and molasses production in 1979/80 and 1980/81 in ('000' mT)

	1979/80	1980/81
Bagasse	699.3	1133.0
Molasses	64.4	105.2

Objective

People in Sudan use charcoal as a main energy source especially in household purposes. The use of charcoal in Sudan causes a great depletion in forest resources by unrationed cutting which causes problems of desertification in so many areas. Because of that and because of the available resources I tried to make charcoal from the available crop residues as a substitute of wood charcoal using molasses which is available in large unused quantities as a combiner of peanut shell charcoal.

Description of the Experiment

The experiment has been done in four different groups of peanut shells.

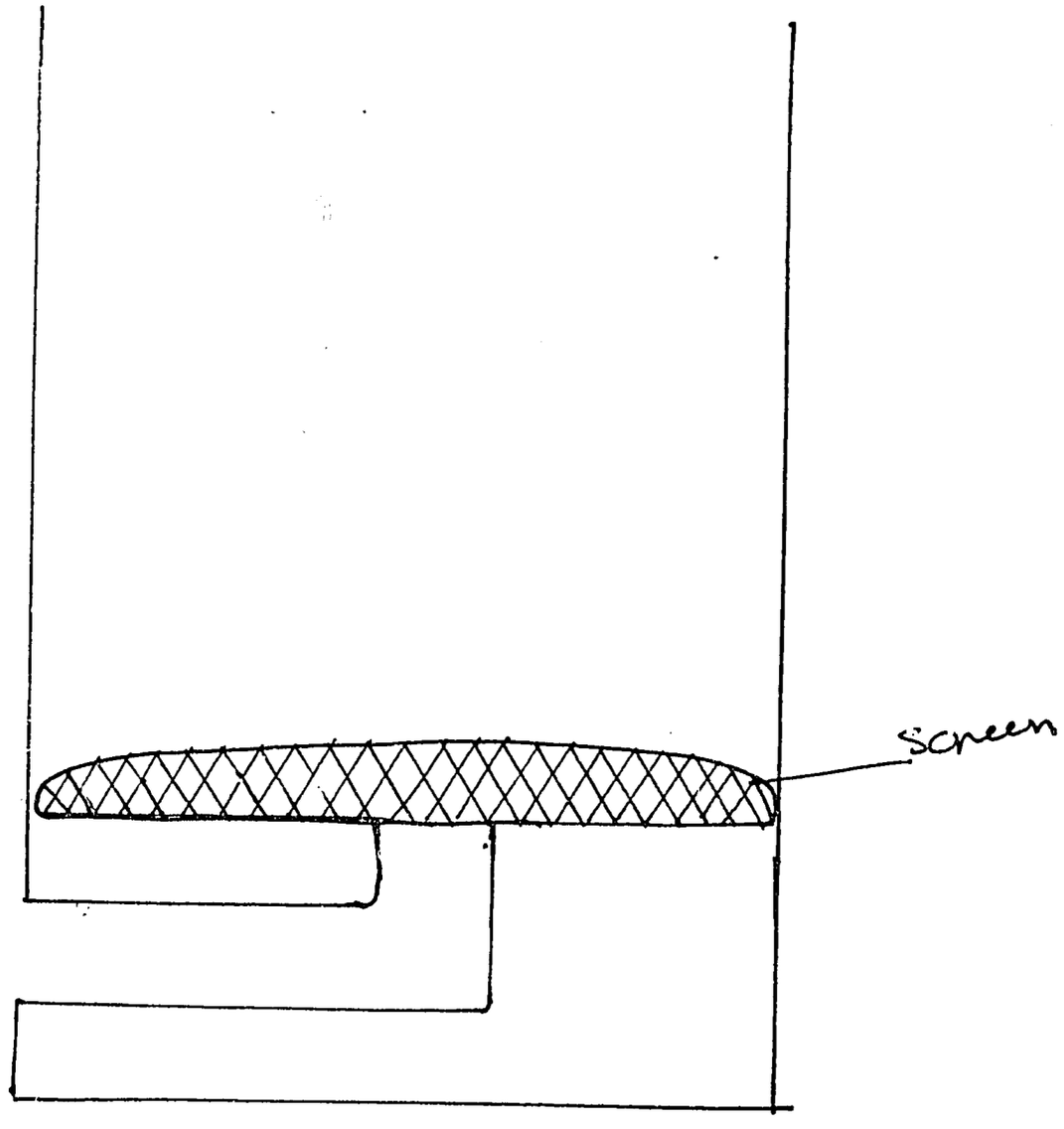
a. The most efficient way of using peanut shells for charcoal production.

b. The maximum heat which can be produced.

The Method Followed

(General)

* Put the peanut shells in a drum made especially for an anerobic carbonization until all of the shells carbonize.
* Grind the carbonized shells into powder.
* Add the molasses in certain quantities to powder to make the particles combined together.
* Use a compressor to compress the material after mixed with molasses.
* Cut the compressed material into small pieces (briquettes) for use.
* Let the briquettes dry either by air or by sun drying.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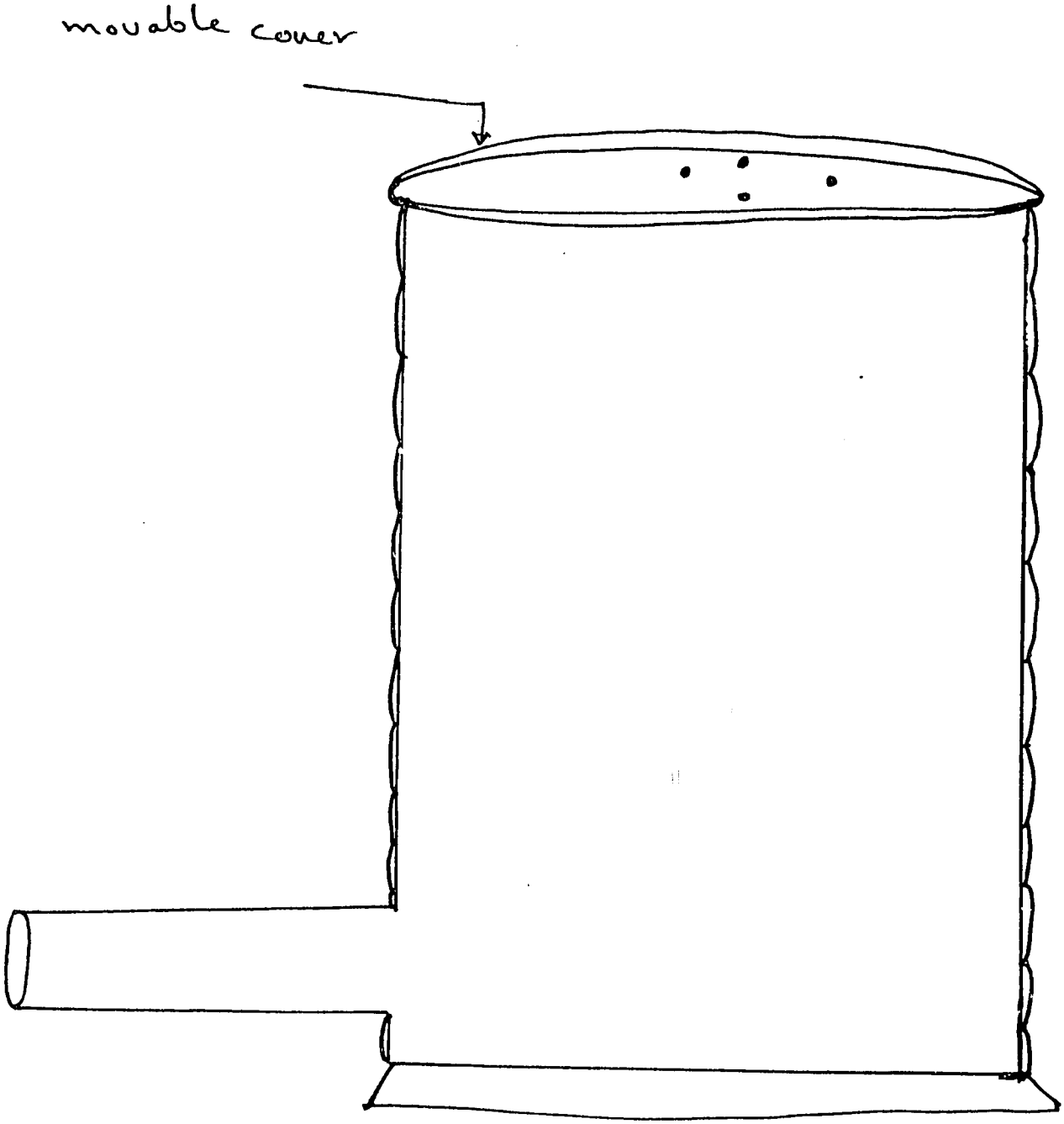
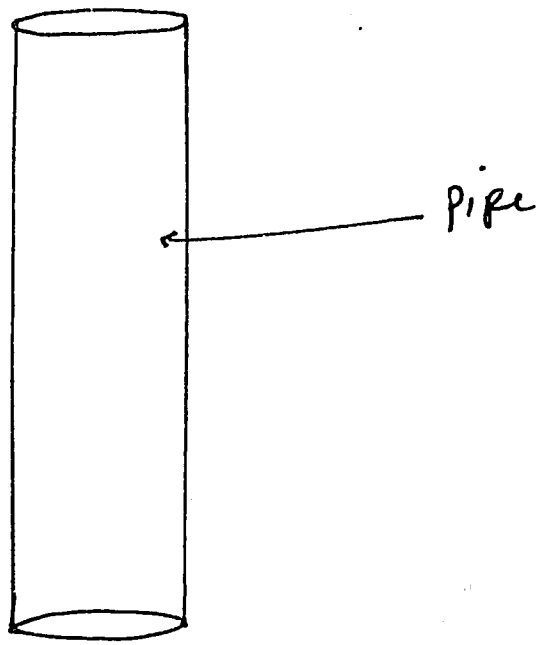
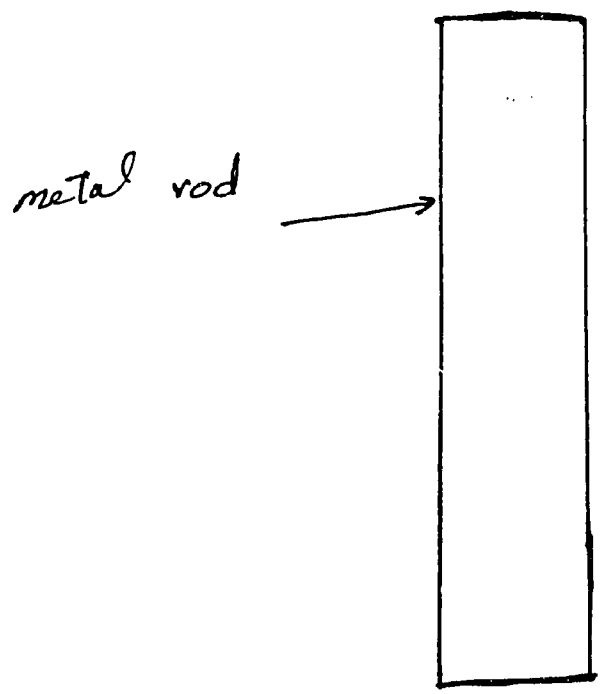


The drum from out side

hand compresser used:





The four groups used for the experiment are as follows:

Group 1. G_1 - using wet peanut shells.

Group 2. G_2 - using dry shells by direct sun drying for one day.

Group 3. G_3 - using peanut shells with molasses mixed before carbonization by a certain percentage.

Group 4. G_4 - Using dry peanut shells using solar dryers for complete drying.

The following table shows the whole experiment.

Item	G_1	G_2	G_3	G_4
Total weight of material before drying (07)	160	160	80	160
Hours for drying	-	7	6	7 (days)
Hours for carbonization	5	31/2	1	1
Total weight of material after carbonization (07)	3.75	15.25	8.25	-
Weight of dry carbonized material used for briquette (07)	3.75	16	6	6
Amount of molasses used (07)	3.75	12	4.5	4.5

G_1. I put ten pounds of wet peanut shells in the drum for carbonization. It took 5 hours for complete carbonization.

Observations.

* A lot of smoke appears during carbonization.

* The shells lose their shape after carbonization.

* A large drop in the weight of the original material.

G_2. I put ten pounds of peanut shells for direct sun drying by spreading the shells on the ground for one day (about 9 hours), then I put this amount in the drum for carbonization and it took 3-1/2 hours for full carbonization.

Observations.

* There is not as much smoke.

* The shells kept their shape.

* There was a small drop in material weight.

G_3. I put five pounds of peanut shells mixed with 500 ml of water to make the shells wet with 500 ml of molasses.

In this group I tried first to make shell cakes just by mixing the shells with the molasses and compress it to make small cakes, but I failed to do so because I didn't have a mechanical compressor. So I just carbonized the whole material.

Observations.

* A lot of smoke appears during carbonization.

* The shells lost their shape almost completely after carbonization.

* The charcoal material contains a lot of ashes.

G_4. I put about ten pounds of peanut shells in a solar dryer for about one week so they would become dry. It took only one hour for carbonization.

Observations.

* It took a shorter time for carbonization.

* The peanut shells kept their shape.

The following table shows the temperature produced by the total groups together by using a sample from each group of the same weight.

CONCLUSION

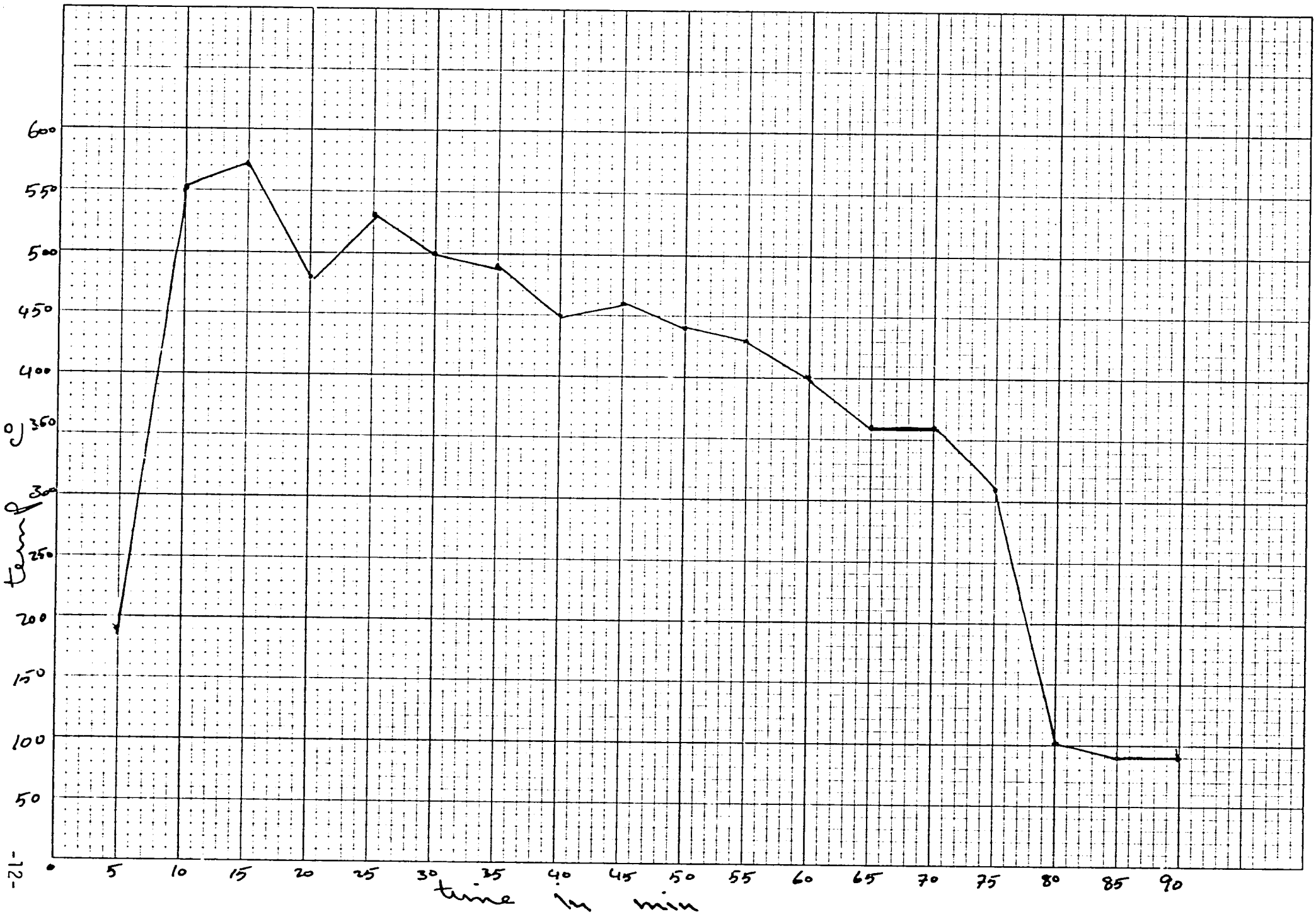
I think the charcoal produced from peanut shells is good and desirable and produce an average temperature.

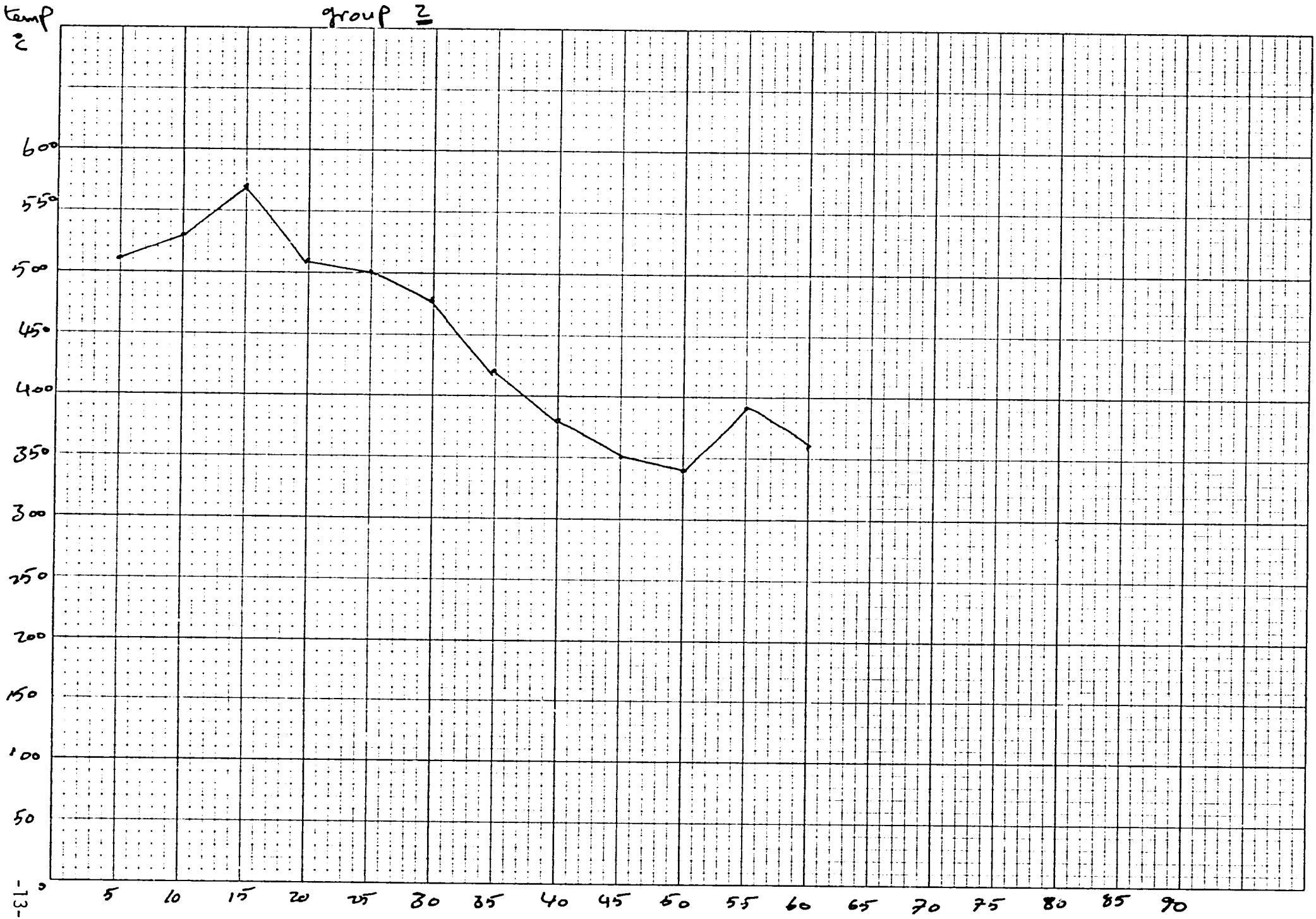
Through more study and research we can use it as a substitute for wood charcoal.

Time after each five minutes	Temperature in °C
5	190
10	550
15	570
20	480
25	480
30	530
35	500
40	490
45	450
50	440
55	430
60	400
65	360
20	360
75	310
80	100
85	90
90	90

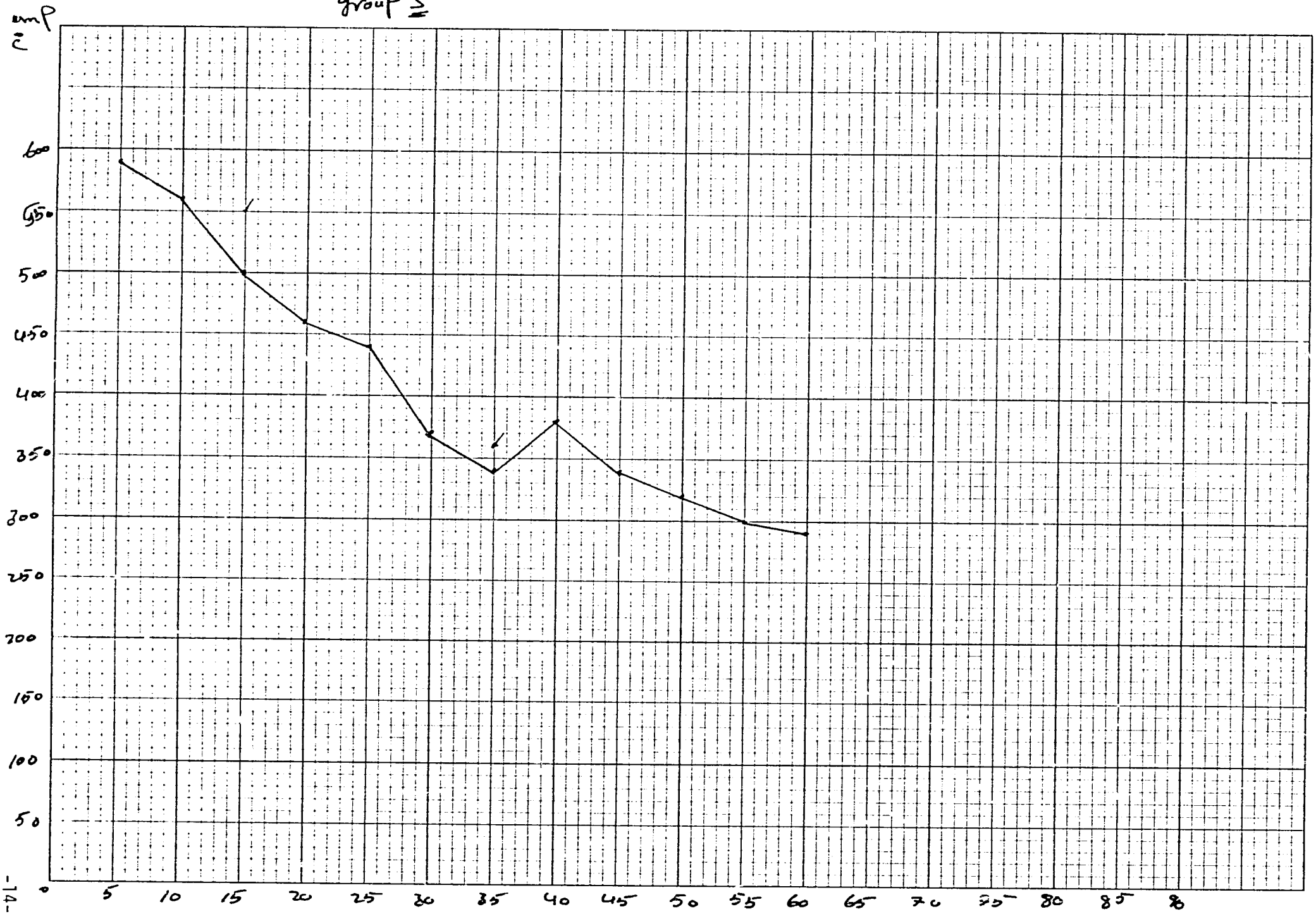
The following table represents the temperature produced by each group after each five minutes.

Time each five minutes	Temperature °C		
	G_2	G_3	G_4
5	510	590	520
10	530	560	510
15	570	500	500
20	510	460	510
25	500	440	490
30	480	370	480
35	420	340	340
40	380	380	320
45	350	340	310
50	340	320	300
55	390	300	300
60	360	290	290


600
550
500
450
400
350
300
250
200
150
100
50
temp °C
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
time in min


temp
°C
group 2
600
550
500
450
400
350
300
250
200
150
100
50
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

group 3


mP
600
550
500
450
400
350
300
250
200
150
100
50
0
5
10
15
20
25
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40
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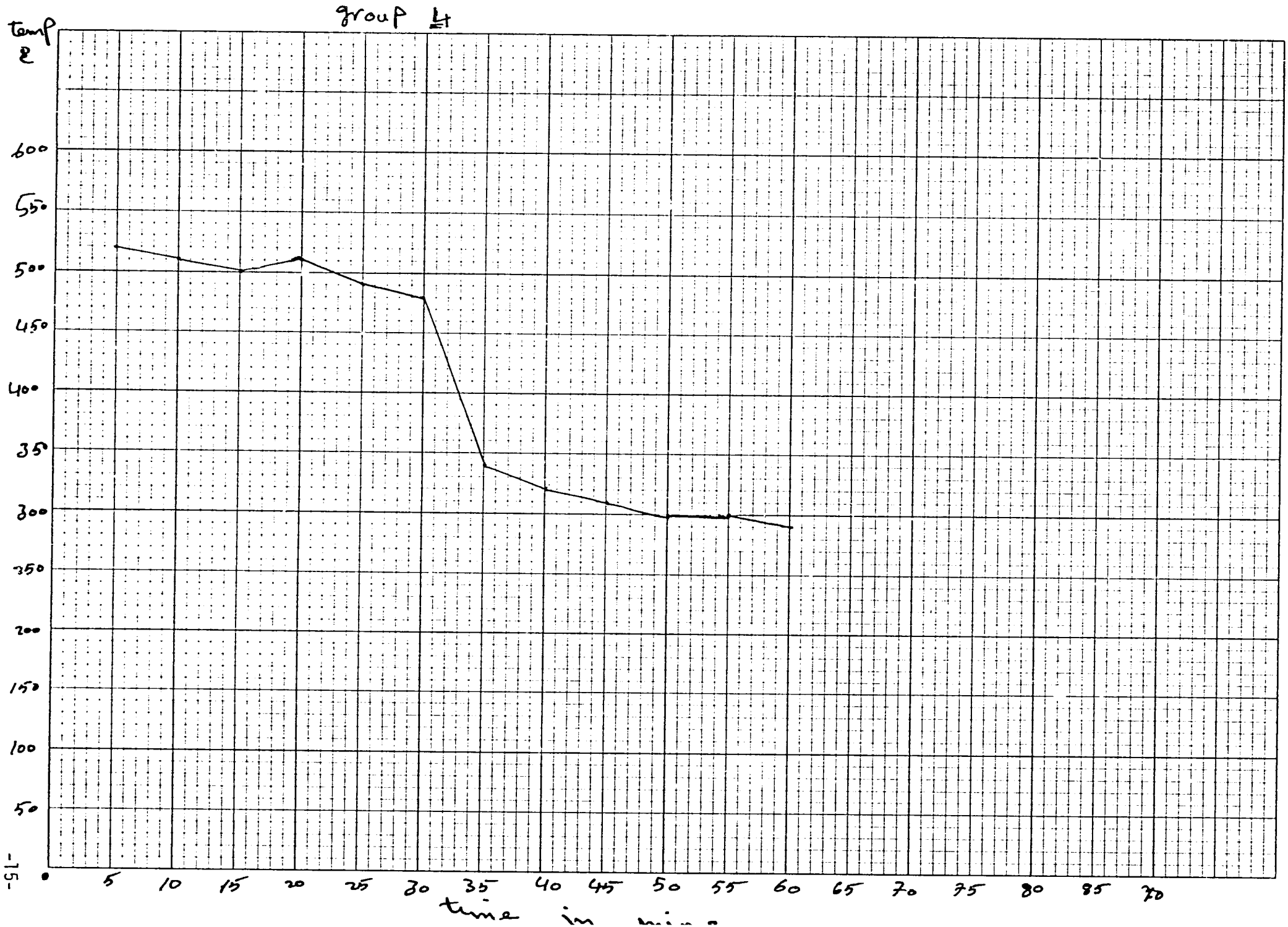
60
65
70
75
80
85
90


group 4
Temp
°F
600
550
500
450
400
350
300
250
200
150
100
50
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
time in min.