

Unobtrusive Determination of Hotspots as a Function of Spatial Area Inside a Microwave

by

Nathan J. Sleiter

A Research Paper
Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree
in

Food and Nutritional Sciences

Approved: 2 Semester Credits

Research Advisor

The Graduate School
University of Wisconsin-Stout

December 2003

The Graduate School
University of Wisconsin Stout
Menomonie, WI 54751

Abstract

Sleiter

Nathan

J.

Unobtrusive Determination of Hotspots as a Function of Spatial Area Inside a Microwave

Food Packaging

Dr. Claire Koelsch Sand

Dec. 2nd, 2003

198

American Psychological Association, 5th edition

Hotspots have always been a challenge with heating and cooking of food and microwaves are not immune from this problem. Microwaves have a unique problem because, at the cavity where the food is cooked, the temperature doesn't change. Microwaves rely on the oscillation of water molecules within food to cook and heat. Where there is a concentration of this resulting heat, elevated temperatures exist relative to surrounding area. This is the definition of a hotspot.

This project investigated if these hotspots occurred as a function of the spatial area inside a microwave cavity. Hotspots were identified via experimentation of 240

areas with a microwave. Statistics were performed to determine if one area was significantly hotter than another area.

This research suggests that hotspots do exist in this microwave ($P \leq 0.001$).

ACKNOWLEDGEMENTS

I wish to express my profound gratitude to Dr. Claire Koelsch Sand for the help in preparing this manuscript. My special thanks to Dr. Lou Milanesi for his tremendous input on the statistical phase of the manuscript. I would also like to thank Mr. John Lavelle for the help with the writing the syntax for SPSS. I would also like to thank Dr. Janice Coker for her valuable input during the manuscript preparation.

I would like to thank Cardinal fg from Menomonie, WI for their donation of the glass that became the grid on the bottom of the microwave.

Finally, I would like to thank all of those who in one way or another participated and contributed to the success of this project.

Table of Contents

	Page
Abstract.....	ii
List of Tables	vii
List of Figures.....	xiv
Chapter I.....	1
Introduction.....	1
Statement of the Problem.....	1
Objective.....	1
Chapter II	3
Review of Literature	3
History of Microwave Ovens.....	3
Conventional heating vs. Microwave heating.....	4
Microwaves heat food by two basic mechanisms.....	4
Dipole rotation	4
Ionic polarization	5
Temperature Measurements in a Microwave Oven	6
Temperature Profiling and “Hot Spots”.....	9
Chapter III.....	11
Methodology.....	11
Objectives	11
Sample and equipment preparation.....	12
Selection of type and size of beaker.....	12
Preparation of the glass grid	13

Preparation of water bath and beaker drier	15
Test procedure.....	16
Data Analysis	19
Chapter IV.....	21
Results and Discussion	21
Mean and standard deviation determination	21
Aggregating Data to Achieve Adequate Statistical Power	27
Topographical maps.....	33
Chapter V	45
Summary and Conclusion.....	45
Summary	45
Recommendations for future study.....	45
References.....	46
APPENDIX A.....	47
APPENDIX B	49
APPENDIX C	110
APPENDIX D.....	113
APPENDIX E	132
APPENDIX F.....	151
APPENDIX G.....	170
APPENDIX H.....	176
APPENDIX I	178

List of Tables

Table	Page
1 - Mean and standard deviations of grid squares level 1, time=30 seconds.....	23
2 - Mean and standard deviations of grid squares level 1, time= 45 seconds.....	24
3 - Mean and standard deviations of grid squares level 2, time= 45 seconds.....	25
4 - Mean and standard deviations of grid squares level 3, time= 45 seconds.....	26
5 - Mean and standard deviations of grid columns and rows level 1, time= 30 seconds..	29
6 - Mean and standard deviations of grid columns and rows level 1, time= 45 seconds..	30
7 - Mean and standard deviations of grid columns and rows level 2, time= 45 seconds..	31
8 - Mean and standard deviations of grid columns and rows level 3, time= 45 seconds..	32
9 - Regions selected for potential hotspots from Figure 16.....	38
10 - Analysis of the difference of regions on level 1 at 30 seconds	39
11 - Posthoc (LSD) tests for regions on level 1 at 30 seconds	39
12 - Regions selected for potential hotspots from Figure 17.....	40
13 - Analysis of the difference of regions on level 1 at 45 seconds	40
14 - Posthoc (Tamhane) tests for regions on level 1 at 45 seconds	41
15 - Regions selected for potential hotspots from Figure 18.....	41
16 - Analysis of the difference of regions on level 2 at 45 seconds	42
17 - Posthoc (Tamhane) tests for regions on level 2 at 45 seconds	42
18 - Regions selected for.....	43
19 - Analysis of the difference of regions on level 3 at 45 seconds	43
20 - Posthoc (Tamhane) tests for regions on level 3 at 45 seconds	44
B 1 - Raw data sheet for level 1 replication 1.....	50

B 2 - Raw data sheet for level 1 replication 1	51
B 3 - Raw data sheet for level 1 replication 1	52
B 4 - Raw data sheet for level 1 replication 1	53
B 5 - Raw data sheet for level 1 replication 1	54
B 6 - Raw data sheet for level 1 replication 2	55
B 7 - Raw data sheet for level 1 replication 2	56
B 8 - Raw data sheet for level 1 replication 2	57
B 9 - Raw data sheet for level 1 replication 2	58
B 10 - Raw data sheet for level 1 replication 2	59
B 11 - Raw data sheet for level 1 replication 3	60
B 12 - Raw data sheet for level 1 replication 3	61
B 13 - Raw data sheet for level 1 replication 3	62
B 14 - Raw data sheet for level 1 replication 3	63
B 15 - Raw data sheet for level 1 replication 3	64
B 16 - Raw data sheet for level 1 replication 4	65
B 17 - Raw data sheet for level 1 replication 4	66
B 18 - Raw data sheet for level 1 replication 4	67
B 19 - Raw data sheet for level 1 replication 4	68
B 20 - Raw data sheet for level 1 replication 4	69
B 21 - Raw data sheet for level 2 replication 1	70
B 22 - Raw data sheet for level 2 replication 1	71
B 23 - Raw data sheet for level 2 replication 1	72
B 24 - Raw data sheet for level 2 replication 1	73

B 25 - Raw data sheet for level 2 replication 1	74
B 26 - Raw data sheet for level 2 replication 2	75
B 27 - Raw data sheet for level 2 replication 2	76
B 28 - Raw data sheet for level 2 replication 2	77
B 29 - Raw data sheet for level 2 replication 2	78
B 30 - Raw data sheet for level 2 replication 2	79
B 31 - Raw data sheet for level 2 replication 3	80
B 32 - Raw data sheet for level 2 replication 3	81
B 33 - Raw data sheet for level 2 replication 3	82
B 34 - Raw data sheet for level 2 replication 3	83
B 35 - Raw data sheet for level 2 replication 3	84
B 36 - Raw data sheet for level 2 replication 4	85
B 37 - Raw data sheet for level 2 replication 4	86
B 38 - Raw data sheet for level 2 replication 4	87
B 39 - Raw data sheet for level 2 replication 4	88
B 40 - Raw data sheet for level 2 replication 4	89
B 41 - Raw data sheet for level 3 replication 1	90
B 42 - Raw data sheet for level 3 replication 1	91
B 43 - Raw data sheet for level 3 replication 1	92
B 44 - Raw data sheet for level 3 replication 1	93
B 45 - Raw data sheet for level 3 replication 1	94
B 46 - Raw data sheet for level 3 replication 2	95
B 47 - Raw data sheet for level 3 replication 2	96

B 48 - Raw data sheet for level 3 replication 2.....	97
B 49 - Raw data sheet for level 3 replication 2.....	98
B 50 - Raw data sheet for level 3 replication 2.....	99
B 51 - Raw data sheet for level 3 replication 3.....	100
B 52 - Raw data sheet for level 3 replication 3.....	101
B 53 - Raw data sheet for level 3 replication 3.....	102
B 54 - Raw data sheet for level 3 replication 3.....	103
B 55 - Raw data sheet for level 3 replication 3.....	104
B 56 - Raw data sheet for level 3 replication 4.....	105
B 57 - Raw data sheet for level 3 replication 4.....	106
B 58 - Raw data sheet for level 3 replication 4.....	107
B 59 - Raw data sheet for level 3 replication 4.....	108
B 60 - Raw data sheet for level 3 replication 4.....	109
C 1 - Descriptive Statistics 0-A1 Time=0 seconds.....	111
C 2 - Descriptive Statistics 0-A2 Time=0 seconds.....	111
C 3 - Descriptive Statistics 0-A3 Time=0 seconds.....	111
C 4 - Descriptive Statistics 0-A4 Time=0 seconds.....	111
C 5 - Descriptive Statistics 0-A5 Time=0 seconds.....	111
C 6 - Descriptive Statistics 0-A6 Time=0 seconds.....	112
C 7 - Descriptive Statistics 0-A7 Time=0 seconds.....	112
C 8 - Descriptive Statistics 0-A8 Time=0 seconds.....	112
C 9 - Descriptive Statistics 0-A9 Time=0 seconds.....	112
C 10 - Descriptive Statistics 0-A10 Time=0 seconds.....	112

D 1 - Mean and standard deviations of grid squares level 1, time= 0 seconds.....	114
D 2 - Mean and standard deviations of grid squares level 1, time= 15 seconds.....	115
D 3 - Mean and standard deviations of grid squares level 1, time= 30 seconds.....	116
D 4 - Mean and standard deviations of grid squares level 1, time= 45 seconds.....	117
D 5 - Mean and standard deviations of grid squares level 1, time= 60 seconds.....	118
D 6 - Mean and standard deviations of grid squares level 1, time= 75 seconds.....	119
D 7 - Mean and standard deviations of grid squares level 2, time= 0 seconds.....	120
D 8 - Mean and standard deviations of grid squares level 2, time= 15 seconds.....	121
D 9 - Mean and standard deviations of grid squares level 2, time= 30 seconds.....	122
D 10 - Mean and standard deviations of grid squares level 2, time= 45 seconds.....	123
D 11 - Mean and standard deviations of grid squares level 2, time= 60 seconds.....	124
D 12 - Mean and standard deviations of grid squares level 2, time= 75 seconds.....	125
D 13 - Mean and standard deviations of grid squares level 3, time= 0 seconds.....	126
D 14 - Mean and standard deviations of grid squares level 3, time= 15 seconds.....	127
D 15 - Mean and standard deviations of grid squares level 3, time= 30 seconds.....	128
D 16 - Mean and standard deviations of grid squares level 3, time= 45 seconds.....	129
D 17 - Mean and standard deviations of grid squares level 3, time= 60 seconds.....	130
D 18 - Mean and standard deviations of grid squares level 3, time= 75 seconds.....	131
F 1 - Mean and standard deviations of grid columns and rows level 1, time= 0 seconds	152
F 2 - Mean and standard deviations of grid columns and rows level 1, time= 15 seconds	153
F 3 - Mean and standard deviations of grid columns and rows level 1, time= 30 seconds	154

F 4 - Mean and standard deviations of grid columns and rows level 1, time= 45 seconds	155
F 5 - Mean and standard deviations of grid columns and rows level 1, time= 60 seconds	156
F 6 - Mean and standard deviations of grid columns and rows level 1, time= 75 seconds	157
F 7 - Mean and standard deviations of grid columns and rows level 2, time= 0 seconds	158
F 8 - Mean and standard deviations of grid columns and rows level 2, time= 15 seconds	159
F 9 - Mean and standard deviations of grid columns and rows level 2, time= 30 seconds	160
F 10 - Mean and standard deviations of grid columns and rows level 2, time= 45 seconds	161
F 11 - Mean and standard deviations of grid columns and rows level 2, time= 60 seconds	162
F 12 - Mean and standard deviations of grid columns and rows level 2, time= 75 seconds	163
F 13 - Mean and standard deviations of grid columns and rows level 3, time= 0 seconds	164
F 14 - Mean and standard deviations of grid columns and rows level 3, time= 15 seconds	165

F 15 - Mean and standard deviations of grid columns and rows level 3, time= 30 seconds	166
F 16 - Mean and standard deviations of grid columns and rows level 3, time= 45 seconds	167
F 17 - Mean and standard deviations of grid columns and rows level 3, time= 60 seconds	168
F 18 - Mean and standard deviations of grid columns and rows level 3, time= 75 seconds	169
G 1 - Descriptive statistics of rows at time = 0 seconds and level 1.....	171
G 2 - ANOVA of rows at time = 0 seconds and level 1	171
G 3 - Posthoc comparisons between rows at time = 0 seconds and level 1	171
G 4 - Descriptive statistics of columns at time = 0 seconds and level 1.....	173
G 5 - ANOVA of columns at time = 0 seconds and level 1.....	173
G 6 - Posthoc comparisons between columns at time = 0 seconds and level 1	174
H 1 - Test for homogeneity of variances on level 1 at 30 seconds	177
H 2 - Test for homogeneity of variances on level 1 at 45 seconds	177
H 3 - Test for homogeneity of variances on level 2 at 45 seconds	177
H 4 - Test for homogeneity of variances on level 3 at 45 seconds	177

List of Figures

Figure	Page
1 – Caliper with mean diameter shown.....	12
2 – Glass grid placed inside of microwave	13
3 – Labeled and respective sizes of grid sections	13
4 – Polycarbonate cover with thermocouple attached	14
5 – Thermocouple set-up attached to digital thermometer	14
6 – Refrigerated recirculating water bath.....	15
7 – Food Dehydrator with door open.....	15
8 – Microwave locked in cabinet.....	16
9 - Mass scale with filled beaker.....	16
10- Entire set-up of the process, note the data sheet.....	16
11 - Temperature reading being taken	17
12 - Test tube clamp attached to hot beaker	17
13 - Beaker being cooled with room temperature DI water.....	18
14 - Glass grid elevated to the second level.....	18
15 - Glass grid elevated to the third level	19
16 – 3 Dimensional map of level 1, time= 30 seconds	34
17 - 3 Dimensional map of level 1, time= 45 seconds.....	35
18 - 3 Dimensional map of level 2, time= 45 seconds.....	36
19 - 3 Dimensional map of level 3, time= 45 seconds.....	37
A 1 - Food dehydrator chart.....	48
E 1 - 3-D map of level 1, time= 0 seconds	133
E 2 - 3-D map of level 1, time= 15 seconds.....	134

E 3 - 3-D map of level 1, time= 30 seconds.....	135
E 4 - 3-D map of level 1, time= 45 seconds.....	136
E 5 - 3-D map of level 1, time= 60 seconds.....	137
E 6 - 3-D map of level 1, time= 75 seconds.....	138
E 7 - 3-D map of level 2, time= 0 seconds	139
E 8 - 3-D map of level 2, time= 15 seconds.....	140
E 9 - 3-D map of level 2, time= 30 seconds.....	141
E 10 - 3-D map of level 2, time= 45 seconds	142
E 11 - 3-D map of level 2, time= 60 seconds	143
E 12 - 3-D map of level 2, time= 75 seconds	144
E 13 - 3-D map of level 3, time= 0 seconds	145
E 14 - 3-D map of level 3, time= 15 seconds	146
E 15 - 3-D map of level 3, time= 30 seconds	147
E 16 - 3-D map of level 3, time= 45 seconds	148
E 17 - 3-D map of level 3, time= 60 seconds	149
E 18 - 3-D map of level 3, time= 75 seconds	150

Chapter I

Introduction

Statement of the Problem

Microwave ovens have become very common in many households in the United States, providing customers with a rapid means of heating and serving food (Adams, et al., 1999). Food manufacturers are increasingly looking toward microwave heating to maintain competitive advantage over competitors in the market place. Microwaves also are being employed to reduce operational expenses, allow greater product improvement, provide innovation by increasing the speed at which the food can be prepared, and increase the flexibility without the need for large capital investments (Bows, 2000).

With microwave heating comes a very different and difficult problem not really of concern in conventional heating, hotspots. Hotspots are places of elevated temperatures surrounded by regions of lower temperatures. Hotspots can exist in conventional ovens, but not to the extreme that they can exist in microwaves. In a microwave oven, frozen food can stay frozen, and thawed portions of food can overcook, only microns apart.

In this study hotspots were investigated in one microwave. The data collected was then analyzed using current statistical models to determine whether those regions of elevated temperatures were significantly hotter than the surrounding area.

Objective

1) Unobtrusive Determination of Hotspots as a Function of Spatial Area Inside a Microwave (Whirlpool 3000XM-0).

Limitations

In this study, only one microwave was used, the results from this study are specific to that one microwave. Research can serve as a guide to determining the existence of hotspots as a function of spatial area inside a microwave.

Chapter II

Review of Literature

History of Microwave Ovens

Microwave ovens have become very common in many households in the United States, providing customers with a rapid means of heating and serving food (Adams et al., 1999). It wasn't too long ago that only the more affluent consumers had microwave ovens. Around the mid 1970's microwave ovens were luxuries, not a necessity as people today view them. The first home model microwave ovens cost \$1,250 in 1952-1955, compared to the low prices today (Gallawa, 2003).

Food manufacturers are increasingly looking toward microwave heating to maintain competitive advantage over competitors in the market place. Microwaves also are being employed to reduce operational expenses, allow greater product improvement, provide innovation by increasing the speed at which food can be prepared, and increase the flexibility without the need for large capital investments (Bows, 2000).

Manufacturing food for preparation in the microwave is complicated. According to Bows (2000) it often appears that microwave heating behaviors observed in foodstuffs are often complex and apparently unpredictable. In order to understand the heating of foods in a microwave, how a microwave actually heats food, and the difference between a conventional oven, the science of microwaving needs to be understood.

Conventional heating vs. Microwave heating

Conventional heating is relatively static when compared to microwave heating. Conventional oven heating of food is when food is placed into a higher than ambient temperature cavity and the food is warmed using conductive and convective heating mechanisms. Moisture is normally flashed off the surface of the product causing a moisture deficiency on the surface. This results in a driving force of moisture to the surface due to a drier surface than the interior (Robertson, 1993). This causes a drier and crispier “shell” on the food.

Microwave heating of the food occurs when the product is placed into a cavity at ambient temperature, without any elevation of that ambient temperature during the entire cooking process. Due to the phenomenon of how microwave energy passes through the food, the interior temperature of the food may be higher than the exterior. This causes a higher internal vapor pressure which in effect pumps water as vapor to the surface. This results in a much higher rate of water movement and evaporation than in a conventional oven, and frequently the surface remains wet (Robertson, 1993).

Microwaves heat food by two basic mechanisms

Dipole rotation

Polar molecules (water is polar) are charged, asymmetric molecules which are randomly orientated under normal conditions. One end of the molecule is positively charged and the other end of the molecule is negatively charged, hence the name dipole. In the presence of an electrical field the molecules attempt to align themselves in a systematic fashion. When that electrical field is produced with a microwave, the rapidly alternating electrical fields cause the molecules to oscillate around their axes in attempt to

align themselves to the proper positive and negative poles. As the field decays to zero, this gained energy is released as kinetic energy or heat (Robertson, 1993). Then the electrical field is created in the opposite charge. Again, the molecules try to align themselves to the proper positive and negative poles. This process repeats itself very quickly in a microwave. Since a standard microwave operates at 2450 MHz that means this process is repeated 2,450,000,000 times per second.

Ionic polarization

Ionic polarization occurs when ions in solution move in response to an electric field. Ions carry an electrical charge and are accelerated by the electric field. Kinetic energy is given up by the field to the ions, which collide with other ions, converting the kinetic energy to heat (Robertson, 1993). The more concentrated a solution is means more collisions and more kinetic energy is released. At microwave frequencies, 2450 MHz, numerous collisions occur and heat is generated, although at a lower rate and less important than dipole rotation (Robertson, 1993).

However, this doesn't mean that solids heat up more quickly than liquids. In ice, the different bond angles and restricted movement, reduce absorption of microwaves compared to liquid water. Therefore liquid water will absorb microwaves more quickly. This usually results in frozen foods staying frozen and thawed foods cooking and becoming drier.

Temperature Measurements in a Microwave Oven

Unlike a conventional oven, where it is relatively easy to measure the temperature of a product, the electrical fields produced by microwave ovens render most types of temperature sensing devices useless. Many different researchers have attempted to solve that problem. According to Maheswari et. al. (1980), researchers have tried to tackle that problem with the most common type of temperature measuring device, the thermocouple. Their research was met with “spurious signals, electrical discharges, fused thermocouples and, finally, the destruction of the oven” (Mahheswari et al., 1980). Chakraborty and Brezovich, (1982) provided an explanation of the problem in the case of thermocouple wires in a microwave field, capacitative and inductive coupling occur, producing currents which interfere with the measuring circuit.

At this time, it was suggested that Olsen’s concept of the non-metallic thermocouple from the late 1970’s, be reconsidered. Olson et al. (1982) stated that the use of metallic thermocouples is unsuitable for many applications because of reflections and localized field enhancement caused by materials of high conductivity. In contrast, Chakraborty and Brezovich (1982) supported the use of thermocouples by noting that conventional thermocouples are rugged, inexpensive, and do not require repeated re-calibration like many of potential replacements that Olsen suggested one should use in a microwave field. Van de Voort et. al. (1987), citing Olsen’s work states, “The main advantage of the non-metallic thermocouple would be reduced cost, the use of temperature compensation and the ability to use standard voltmeters or data logging equipment generally associated with thermocouple work.”

Van de Voort et al. (1987) developed an aluminum shielded thermocouple which could function in a microwave cavity. This thermocouple used Copper constantan, shielded with a nickel plated copper braid and using aluminum tubing to form the probe portion of the sensor. A standard brass Swagelock fitting was used to provide a microwave leak-free seal for the holes drilled through the microwave cavity wall and provide a ground for the shielding. This thermocouple could measure temperature within 1°C without electrical discharges, signal perturbations or extensive shield heating (Van de Voort et al., 1987). This would work well if one could make modifications to the microwave. However in the case of this research, an unobtrusive measuring device was needed (Sand, 2003).

The commercial probes which often accompany more sophisticated domestic microwave ovens are unobtrusive, but they do not have an advantage thermocouples have, the ability to log data. Those commercial probes are actually thermistors housed in stainless steel sleeves shielded with copper braid (Ramaswamy et al., 1991). Thermistors are thermally sensitive resistors and have, according to type, a negative (NTC), or positive (PTC) resistance/temperature coefficient (Thermetics. (1999). According to manufacturer's suggestion these probes should not be used above 95°C and cannot be used in a microwave cavity by themselves. It is supposed that additional shielding, provided by the food or beverage, into which they must be placed to function, prevents arcing (Ramaswamy at al., 1991). Using similar protection for thermocouples may allow them to function inside a microwave, but not in a cavity without a load.

Thermocouples, the most common means of temperature measurement have the ability to be used with most data acquisition systems that are designed to process voltage

data obtained from them. Relative to fluoroptics and infrared temperature measuring systems such as the Luxtron, thermocouples have a number of advantages, including sturdiness, price and convenience in terms of interfacing with data logging and control equipment (Ramswamy et al., 1991).

Temperature Profiling and “Hot Spots”

As early as 1978 researchers noted that one of the major problems in microwave processing of foods is the non-uniform temperature distribution. Ohlsson and Risman in 1978 studied the non-uniform temperature distribution inside cylindrical and spherical meat and potato samples. Local hotspots at the sample center were investigated. Pulsed (intermittent) microwave application has been reported to result in lower energy requirements and improved temperature uniformity inside food materials compared to continuous microwave application (Ohlsson and Risman, 1978). Successful applications of microwave heating in food processing must demonstrate that the interaction of the microwave field with the material and the process is understood and controllable (Bows, 2000).

Microwave energy created by a magnetron is funneled through a set of wave guides, normally made of aluminum towards a cavity or oven, which is where we place our food to be heated. In an attempt to provide an even distribution of waves throughout the cavity a metal fan and/or turntable are usually utilized. Even with turntables and fans, there could be areas that receive more waves of energy than other areas.

As both a turntable and a fan ramp up to their final velocity, the randomization of the waves would be pretty advantageous. As soon as both items reach their maximum velocity, their will be harmonic consistency. A true randomization of these waves could only occur if both the turntable and the fan varied in velocity throughout the cycle of the microwave.

As a result areas that receive more energy than other areas are termed hotspots. Since microwave energy absorption is a function of the product constituents, the more

microwave energy that is focused on one area as opposed to another of the same constituents, more microwave energy would be absorbed by the food creating a spot that is warmer than the surrounding area.

Chapter III

Methodology

Objectives

Unobtrusive determination of hotspots as a function of spatial area inside a microwave (Whirlpool 3000XM-0).

Methodology

1. Sample and equipment preparation
2. Test procedure
3. Data Analysis

The methodology is illustrated by digital photos depicting the exact equipment.

Sample and equipment preparation

Selection of type and size of beaker

The size of the beaker was chosen to maximize the number of grid squares available, and allow the de-ionized (DI) water to reach 100°C within approximately 1 minute of microwaving energy contact. Through preliminary trials, a 20 mL beaker with 15 grams of DI water was selected. The amount of water was chosen to be sufficiently small in order to minimize temperature gradients throughout the beaker. The water in the beaker was not to boil over if it reached 100°C. The 20 mL beaker chosen was measured with a caliper to the 0.001”.



Figure 1 – Caliper with mean diameter shown

The mean outside diameter of the seven beakers used was $1.302'' \pm 0.012''$ (Figure 1).

Preparation of the glass grid

The inside of the microwave (MW) was measured and determined to be 14.375" x 11.875". Glass (Cardinal fg, Menomonie, WI) at 14.375" x 11.875" x 0.100" was used. It was sufficiently thin

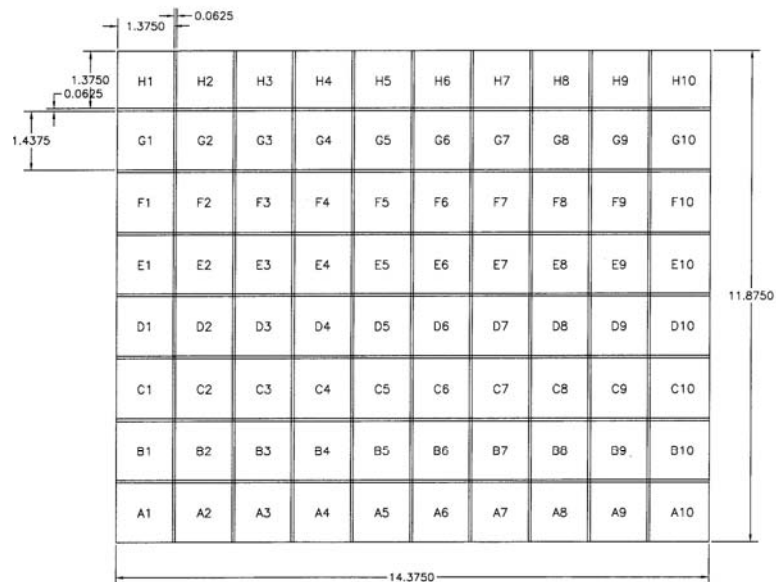


Figure 2 – Labeled and respective sizes of grid sections

so as to not raise the samples up off the bottom of the MW excessively. The glass piece was divided into grid sections identified by all rows being numbered and all columns being lettered at exactly 1.375" wide and 1.4375" long with the row labeled H1 through H10 (Figure 2) at 1.375" wide and 1.375" long. An allowance for the division line between each grid rectangle was accounted for at 0.0625". Once the grid was placed inside the MW, the MW was ready for testing. Grids were delineated and labeled to ensure experimental accuracy. Figure 3 shows the labeling and the corresponding location in the MW.



Figure 3 – Glass grid placed inside of microwave

Preparation of temperature measuring device

The temperature measuring device was prepared in such a way to minimize error that could be induced by measuring different regions of the water in the beaker. The measuring device was a thin plastic square made from polycarbonate. The polycarbonate piece was heated and the beaker was inverted on top of it to make a ring so the beaker rim would always fit into the same place. A hole was drilled into the geometric center of the ring to pass the

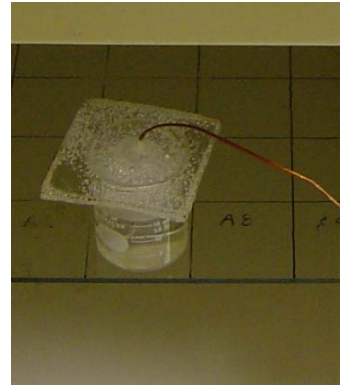


Figure 2 – Polycarbonate cover with thermocouple attached

thermocouple probe (Cole-Palmer, 5-foot type K, product number 08505-86) through.

The thermocouple was held in place by hot melt glue. Figure 4 shows the polycarbonate square on top of the beaker with the thermocouple probe through it.

The sub-miniature connector, on the other end, was attached to a Handheld Digital Thermometer (Omega product number: HH509R). Figure 5 shows the entire temperature measuring system in action.



Figure 3 – Thermocouple set-up attached to digital thermometer

Preparation of water bath and beaker drier

To ensure constant initial water temperature, a refrigerated, circulating water bath (VWR international model number 1186D) was utilized. This is shown in Figure 6.

The water bath was set sufficiently low so that when the squeeze bottle was removed from the cooled water, it remained $23.0^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$ for four to five minutes or about 3 experimental replications.

To ensure that each and every beaker was dry and at the same temperature, a food dehydrator (Harvest Maid) was used. This food dehydrator was set at 85°F (30°C). During some of the replications, a data-logger (Hobo H8) was placed inside the dehydrator to ensure that the temperature and humidity remained unchanged (Appendix A). Figure 7 shows the inverted beakers inside the food dehydrator.



Figure 4 – Refrigerated recirculating water bath



Figure 5 – Food Dehydrator with door open

Test procedure

A (MW) oven (Whirlpool 3000XM-0) operating at 500-W continuous power output at 2450 MHz was the microwave heating source. The MW was kept locked in order to prevent tampering during the entire length of the experiment. This is shown in Figure 8. The glass grid was placed on the bottom of the microwave to divide the heating surface into numerous squares. The empty and dry 20 mL glass beaker was placed on the mass scale (Mettler Toledo PG5002-S Delta Range) and then the scale was zeroed. The beaker was then filled with 15.00 g DI water with the cooled DI water from the squeeze bottle utilizing the mass scale to the hundredth of a gram. This is shown in Figure 10. The beaker was placed into the MW in a specified grid location and the MW turned on. The timer on the MW was a dial type and very inaccurate on short heating times. A digital timer was used to time the MW. The digital timer and the



Figure 6 – Locked cabinet holding the MW



Figure 9 - Mass scale with filled beaker

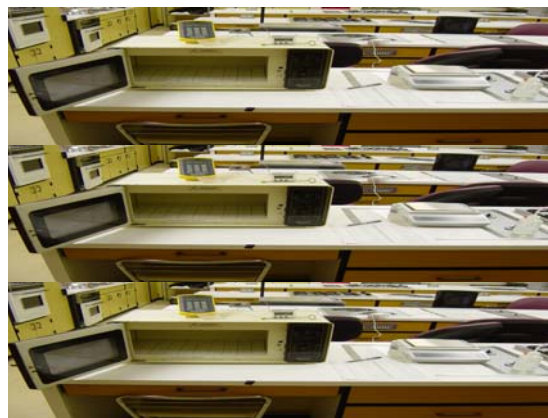


Figure 70- Entire set-up of the process and the data collection

MW were started at the same time. This is shown in Figure 10.

At 15 seconds, the MW was shutoff and a temperature was taken. The thermocouple was placed into the polycarbonate cover to ensure that the temperature was measured each time at the same spot in the beaker. The ring on the



Figure 11 - Temperature reading being taken

polycarbonate ensured that it was placed on the beaker pointing the same direction during temperature measurement. This is shown in Figure 11. The temperature registered

within 5 seconds. The temperature was then recorded onto the correct spot on the raw data sheet (Appendix B). The beaker was outside the MW for less than 5 seconds for each measurement. The beaker was placed in the MW in the same grid location as



Figure 12 – Placement of the beaker in the MW

before. This is shown in Figure 12. The

MW was then turned on again for 15

seconds. Then another measurement was taken. This process was repeated as many

times as required to get the sample to 100°C. Measurements at each grid section were

performed four times due to manual data collection. The beaker was removed from the

MW by the test tube clamp and emptied into a nearby sink. To cool the beaker before

placing it back into the dehydrator, a basin of room temperature DI water was used. This

is shown in Figure 13. The beaker was immersed in the DI water for about 15 seconds and dried using a clean cloth. The beaker was then placed into the dehydrator. A new clean and dry beaker was removed from the dehydrator and the cycle was repeated.

MW hotspots may vary as a function of height in the MW so beakers containing water at three levels of increasing height were evaluated. This was accomplished by inverting glass beakers. Glass was chosen due to its inability to absorb energy from microwaves.

It was assumed that the raw operation of heat generation was constant throughout the 24 hours of MW operation for data collection. This assumption is valid primarily due to the age of the MW and the knowledge of microwaves addressed in the literature review (p. 3-11)



Figure 13 - Beaker being cooled with room temperature DI water



Figure 14 - Glass grid elevated to the second level

Data Analysis

The hand-written temperatures were first recorded on data tables as shown in Appendix B. The data was later entered into the Microsoft Excel[®] spreadsheet (Appendix B).

The data was then manipulated to allow SPSS statistical software to interpret and separate all the data. The data was

organized into columns and four more columns were added to allow SPSS to easily recognize what level the temperatures were taken (loclev), the location from front to rear in the MW (locifr), the location from left to right in the MW (locir), and the replication number (rep). The data was then imported into SPSS and all the files were merged together to make one large file containing all the data. Using the split file command in SPSS, the data was split by loclev, locir, locifr, and time. Mean and standard deviation were determined (Appendix C). Outliers were not removed, because an outlier could be hotter than the mean temperature for that level at a specific time. An outlier could be a potential hotspot.

Numerous color images were created. The mean and standard deviations in Appendix D were color coded by their mean temperature. The data in Microsoft Excel[®] was then manipulated to be able to perform 3-D graphing. The 3-D graphs are in Appendix E.



Figure 15 - Glass grid elevated to the third level

Using the color-coded graphs, it was determined where potential hotspots occurred, at the regions of elevated temperature. The SPSS file was then coded to recognize each of the hotspot regions as separate entities and everything not in a hotspot region as another entity.

One-way analysis of variance (ANOVA) was performed on this data.

Chapter IV

Results and Discussion

The raw data are presented in Appendix B for reference.

Mean and standard deviation determination

When looking at the raw data the number in front of the hyphen describes the height of the glass plate, so the measurement taken at grid square G7 on the second level in the z-direction (up and down) was given an identifier as 2-G7 (Appendix B)

The data tables that follow (Table 1–4) are a sample of the temperature data collected. All the tables are very similar in format, however they represent different times and levels in the MW. The rest of the tables can be found in Appendix D.

The mean and the standard deviation were calculated using SPSS for a few reasons. One reason was to catch any possible data entry errors, the standard deviation would be very large if any occurred. The other reason was to be able to color-code the grid squares to show the temperature range that the particular grid square was in.

Outliers were not removed, because an outlier would be hotter than the mean temperature for that level at a specific time. An outlier could be a potential hotspot. Note the very low standard deviation (std. dev < 0.6000 °C) in all the grid squares. This suggests that the temperatures measured were very close to one another in all replications.

In all grid squares, if the water boiled at a particular time in one replication, it always boiled in the all the other replications, any grid square color-coded red has a standard deviation of 0.000.

In Table 1, note that most of the area is magenta (mean temperature 70.000-79.999°C), but there were a few spots, location C4 and B6, that were color coded orange (mean temperature (90.000-99.999°C). The areas immediately around those two hotter spots were mostly yellow, suggesting a potential hotspot area.

Table 2 was the same level as Table 1, just 15 seconds later. The spots that were before color-coded orange and yellow were red after 15 more seconds elapsed. The potential hotspot in Table 1 has become larger.

Table 3 was level 2 at 45 seconds, the same time as Table 2, but elevated one level in the microwave. There were less areas of red in this Table than Table 2 and the location of the hotter areas is different. In Table 1, the hotter areas were near the front of the MW and in Table 3, the hotter areas were near the middle and back of the MW and not as many red squares as in Table 2.

Table 4 was level 3 at 45 seconds. There were less areas of red on this Table than on Table 3. The locations of the hotspots were different on Table 4. On Table 4, the hotter areas were located in the front left hand corner, the front right hand corner and the back of the MW.

Table 1 - Mean and standard deviations of grid squares level 1, time=30 seconds

Location: H1 Mean: 73.050 Std Dev: 0.3873 n= 4	Location: H2 Mean: 72.475 Std Dev: 0.2986 n= 4	Location: H3 Mean: 66.025 Std Dev: 0.2217 n= 4	Location: H4 Mean: 70.550 Std Dev: 0.3416 n= 4	Location: H5 Mean: 76.800 Std Dev: 0.3162 n= 4	Location: H6 Mean: 72.400 Std Dev: 0.2582 n= 4	Location: H7 Mean: 78.700 Std Dev: 0.3266 n= 4	Location: H8 Mean: 66.375 Std Dev: 0.3304 n= 4	Location: H9 Mean: 78.775 Std Dev: 0.2062 n= 4	Location: H10 Mean: 69.225 Std Dev: 0.2217 n= 4
Location: G1 Mean: 72.625 Std Dev: 0.4113 n= 4	Location: G2 Mean: 69.600 Std Dev: 0.3367 n= 4	Location: G3 Mean: 71.725 Std Dev: 0.2363 n= 4	Location: G4 Mean: 76.600 Std Dev: 0.4163 n= 4	Location: G5 Mean: 76.450 Std Dev: 0.4203 n= 4	Location: G6 Mean: 73.475 Std Dev: 0.4113 n= 4	Location: G7 Mean: 78.475 Std Dev: 0.3304 n= 4	Location: G8 Mean: 75.575 Std Dev: 0.2217 n= 4	Location: G9 Mean: 71.800 Std Dev: 0.2160 n= 4	Location: G10 Mean: 68.500 Std Dev: 0.3559 n= 4
Location: F1 Mean: 83.575 Std Dev: 0.2217 n= 4	Location: F2 Mean: 78.800 Std Dev: 0.2582 n= 4	Location: F3 Mean: 78.350 Std Dev: 0.1915 n= 4	Location: F4 Mean: 78.025 Std Dev: 0.3304 n= 4	Location: F5 Mean: 75.600 Std Dev: 0.3651 n= 4	Location: F6 Mean: 64.725 Std Dev: 0.1708 n= 4	Location: F7 Mean: 81.575 Std Dev: 0.4031 n= 4	Location: F8 Mean: 75.875 Std Dev: 0.4031 n= 4	Location: F9 Mean: 79.800 Std Dev: 0.4082 n= 4	Location: F10 Mean: 78.425 Std Dev: 0.3096 n= 4
Location: E1 Mean: 69.650 Std Dev: 0.3317 n= 4	Location: E2 Mean: 77.925 Std Dev: 0.3304 n= 4	Location: E3 Mean: 67.175 Std Dev: 0.2630 n= 4	Location: E4 Mean: 81.175 Std Dev: 0.2500 n= 4	Location: E5 Mean: 77.250 Std Dev: 0.3416 n= 4	Location: E6 Mean: 67.050 Std Dev: 0.3317 n= 4	Location: E7 Mean: 78.725 Std Dev: 0.4113 n= 4	Location: E8 Mean: 71.000 Std Dev: 0.2944 n= 4	Location: E9 Mean: 74.075 Std Dev: 0.1708 n= 4	Location: E10 Mean: 68.675 Std Dev: 0.2500 n= 4
Location: D1 Mean: 64.375 Std Dev: 0.3304 n= 4	Location: D2 Mean: 71.975 Std Dev: 0.2986 n= 4	Location: D3 Mean: 77.950 Std Dev: 0.2887 n= 4	Location: D4 Mean: 83.600 Std Dev: 0.3367 n= 4	Location: D5 Mean: 71.100 Std Dev: 0.3464 n= 4	Location: D6 Mean: 71.800 Std Dev: 0.1414 n= 4	Location: D7 Mean: 80.575 Std Dev: 0.2217 n= 4	Location: D8 Mean: 68.450 Std Dev: 0.4123 n= 4	Location: D9 Mean: 72.725 Std Dev: 0.2986 n= 4	Location: D10 Mean: 68.475 Std Dev: 0.3304 n= 4
Location: C1 Mean: 79.550 Std Dev: 0.3109 n= 4	Location: C2 Mean: 74.175 Std Dev: 0.3594 n= 4	Location: C3 Mean: 77.700 Std Dev: 0.2944 n= 4	Location: C4 Mean: 91.650 Std Dev: 0.2082 n= 4	Location: C5 Mean: 73.975 Std Dev: 0.2630 n= 4	Location: C6 Mean: 75.000 Std Dev: 0.2160 n= 4	Location: C7 Mean: 81.125 Std Dev: 0.3775 n= 4	Location: C8 Mean: 70.025 Std Dev: 0.2986 n= 4	Location: C9 Mean: 79.600 Std Dev: 0.4243 n= 4	Location: C10 Mean: 77.600 Std Dev: 0.2449 n= 4
Location: B1 Mean: 67.125 Std Dev: 0.2986 n= 4	Location: B2 Mean: 67.375 Std Dev: 0.3862 n= 4	Location: B3 Mean: 74.000 Std Dev: 0.2582 n= 4	Location: B4 Mean: 85.975 Std Dev: 0.2872 n= 4	Location: B5 Mean: 82.700 Std Dev: 0.3367 n= 4	Location: B6 Mean: 91.250 Std Dev: 0.3109 n= 4	Location: B7 Mean: 78.950 Std Dev: 0.2887 n= 4	Location: B8 Mean: 73.375 Std Dev: 0.2500 n= 4	Location: B9 Mean: 72.450 Std Dev: 0.3000 n= 4	Location: B10 Mean: 70.450 Std Dev: 0.3416 n= 4
Location: A1 Mean: 62.425 Std Dev: 0.2754 n= 4	Location: A2 Mean: 65.400 Std Dev: 0.3916 n= 4	Location: A3 Mean: 73.675 Std Dev: 0.2986 n= 4	Location: A4 Mean: 78.675 Std Dev: 0.2630 n= 4	Location: A5 Mean: 81.450 Std Dev: 0.3416 n= 4	Location: A6 Mean: 87.800 Std Dev: 0.3162 n= 4	Location: A7 Mean: 75.550 Std Dev: 0.3109 n= 4	Location: A8 Mean: 70.400 Std Dev: 0.4243 n= 4	Location: A9 Mean: 68.350 Std Dev: 0.2646 n= 4	Location: A10 Mean: 60.675 Std Dev: 0.2363 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table 2 - Mean and standard deviations of grid squares level 1, time= 45 seconds

Location: H1 Mean: 95.675 Std Dev: 0.4031 n= 4	Location: H2 Mean: 89.875 Std Dev: 0.3403 n= 4	Location: H3 Mean: 77.500 Std Dev: 0.3830 n= 4	Location: H4 Mean: 86.950 Std Dev: 0.2887 n= 4	Location: H5 Mean: 96.850 Std Dev: 0.4203 n= 4	Location: H6 Mean: 93.850 Std Dev: 0.3109 n= 4	Location: H7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: H8 Mean: 79.800 Std Dev: 0.2944 n= 4	Location: H9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: H10 Mean: 82.925 Std Dev: 0.0957 n= 4
Location: G1 Mean: 93.375 Std Dev: 0.2630 n= 4	Location: G2 Mean: 82.975 Std Dev: 0.3775 n= 4	Location: G3 Mean: 88.025 Std Dev: 0.2630 n= 4	Location: G4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: G5 Mean: 94.525 Std Dev: 0.2754 n= 4	Location: G6 Mean: 91.925 Std Dev: 0.4031 n= 4	Location: G7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: G8 Mean: 93.825 Std Dev: 0.2217 n= 4	Location: G9 Mean: 88.075 Std Dev: 0.2217 n= 4	Location: G10 Mean: 86.875 Std Dev: 0.2217 n= 4
Location: F1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F5 Mean: 93.500 Std Dev: 0.4243 n= 4	Location: F6 Mean: 78.650 Std Dev: 0.3416 n= 4	Location: F7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: E1 Mean: 83.925 Std Dev: 0.3304 n= 4	Location: E2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E3 Mean: 80.950 Std Dev: 0.2887 n= 4	Location: E4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E6 Mean: 81.150 Std Dev: 0.3109 n= 4	Location: E7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E8 Mean: 93.425 Std Dev: 0.2363 n= 4	Location: E9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E10 Mean: 83.675 Std Dev: 0.2363 n= 4
Location: D1 Mean: 77.975 Std Dev: 0.3775 n= 4	Location: D2 Mean: 90.400 Std Dev: 0.4546 n= 4	Location: D3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D5 Mean: 88.625 Std Dev: 0.3304 n= 4	Location: D6 Mean: 89.025 Std Dev: 0.3403 n= 4	Location: D7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D8 Mean: 88.375 Std Dev: 0.2630 n= 4	Location: D9 Mean: 88.500 Std Dev: 0.3559 n= 4	Location: D10 Mean: 83.525 Std Dev: 0.3500 n= 4
Location: C1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C2 Mean: 90.600 Std Dev: 0.3916 n= 4	Location: C3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C5 Mean: 93.450 Std Dev: 0.3109 n= 4	Location: C6 Mean: 91.000 Std Dev: 0.2944 n= 4	Location: C7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C8 Mean: 86.575 Std Dev: 0.3775 n= 4	Location: C9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C10 Mean: 95.425 Std Dev: 0.4193 n= 4
Location: B1 Mean: 81.300 Std Dev: 0.3916 n= 4	Location: B2 Mean: 78.500 Std Dev: 0.4320 n= 4	Location: B3 Mean: 90.675 Std Dev: 0.4924 n= 4	Location: B4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B8 Mean: 89.975 Std Dev: 0.3304 n= 4	Location: B9 Mean: 90.850 Std Dev: 0.2380 n= 4	Location: B10 Mean: 92.000 Std Dev: 0.0816 n= 4
Location: A1 Mean: 74.650 Std Dev: 0.3416 n= 4	Location: A2 Mean: 77.750 Std Dev: 0.3697 n= 4	Location: A3 Mean: 91.500 Std Dev: 0.4243 n= 4	Location: A4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A8 Mean: 88.725 Std Dev: 0.3304 n= 4	Location: A9 Mean: 88.375 Std Dev: 0.3096 n= 4	Location: A10 Mean: 72.750 Std Dev: 0.2646 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table 3 - Mean and standard deviations of grid squares level 2, time= 45 seconds

Location: H1 Mean: 87.025 Std Dev: 0.4031 n= 4	Location: H2 Mean: 82.025 Std Dev: 0.2630 n= 4	Location: H3 Mean: 91.625 Std Dev: 0.2986 n= 4	Location: H4 Mean: 90.600 Std Dev: 0.3367 n= 4	Location: H5 Mean: 80.550 Std Dev: 0.2646 n= 4	Location: H6 Mean: 91.500 Std Dev: 0.3559 n= 4	Location: H7 Mean: 93.625 Std Dev: 0.1708 n= 4	Location: H8 Mean: 79.400 Std Dev: 0.2944 n= 4	Location: H9 Mean: 85.475 Std Dev: 0.3862 n= 4	Location: H10 Mean: 81.375 Std Dev: 0.0957 n= 4
Location: G1 Mean: 76.225 Std Dev: 0.2062 n= 4	Location: G2 Mean: 76.750 Std Dev: 0.2380 n= 4	Location: G3 Mean: 80.700 Std Dev: 0.2449 n= 4	Location: G4 Mean: 86.450 Std Dev: 0.1732 n= 4	Location: G5 Mean: 87.750 Std Dev: 0.1732 n= 4	Location: G6 Mean: 88.675 Std Dev: 0.3403 n= 4	Location: G7 Mean: 84.050 Std Dev: 0.4203 n= 4	Location: G8 Mean: 80.100 Std Dev: 0.2582 n= 4	Location: G9 Mean: 80.250 Std Dev: 0.2380 n= 4	Location: G10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: F1 Mean: 95.200 Std Dev: 0.1633 n= 4	Location: F2 Mean: 86.650 Std Dev: 0.2887 n= 4	Location: F3 Mean: 72.650 Std Dev: 0.2517 n= 4	Location: F4 Mean: 88.400 Std Dev: 0.4082 n= 4	Location: F5 Mean: 91.975 Std Dev: 0.3096 n= 4	Location: F6 Mean: 96.225 Std Dev: 0.2754 n= 4	Location: F7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F9 Mean: 90.150 Std Dev: 0.1291 n= 4	Location: F10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: E1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E3 Mean: 81.450 Std Dev: 0.3697 n= 4	Location: E4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E7 Mean: 93.575 Std Dev: 0.1708 n= 4	Location: E8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: D1 Mean: 95.925 Std Dev: 0.2872 n= 4	Location: D2 Mean: 93.025 Std Dev: 0.4193 n= 4	Location: D3 Mean: 88.575 Std Dev: 0.2062 n= 4	Location: D4 Mean: 97.400 Std Dev: 0.3162 n= 4	Location: D5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D6 Mean: 79.975 Std Dev: 0.3304 n= 4	Location: D7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D8 Mean: 72.775 Std Dev: 0.1500 n= 4	Location: D9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D10 Mean: 97.150 Std Dev: 0.1291 n= 4
Location: C1 Mean: 83.908 Std Dev: 0.2256 n= 4	Location: C2 Mean: 85.575 Std Dev: 0.3500 n= 4	Location: C3 Mean: 79.725 Std Dev: 0.2754 n= 4	Location: C4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C5 Mean: 88.650 Std Dev: 0.2517 n= 4	Location: C6 Mean: 86.275 Std Dev: 0.1500 n= 4	Location: C7 Mean: 83.000 Std Dev: 0.2944 n= 4	Location: C8 Mean: 85.200 Std Dev: 0.3651 n= 4	Location: C9 Mean: 90.350 Std Dev: 0.1291 n= 4	Location: C10 Mean: 89.875 Std Dev: 0.2217 n= 4
Location: B1 Mean: 79.375 Std Dev: 0.2062 n= 4	Location: B2 Mean: 97.125 Std Dev: 0.2754 n= 4	Location: B3 Mean: 75.650 Std Dev: 0.4041 n= 4	Location: B4 Mean: 93.475 Std Dev: 0.3775 n= 4	Location: B5 Mean: 81.625 Std Dev: 0.2872 n= 4	Location: B6 Mean: 82.025 Std Dev: 0.2986 n= 4	Location: B7 Mean: 96.525 Std Dev: 0.2630 n= 4	Location: B8 Mean: 73.600 Std Dev: 0.1155 n= 4	Location: B9 Mean: 77.350 Std Dev: 0.2082 n= 4	Location: B10 Mean: 78.825 Std Dev: 0.2217 n= 4
Location: A1 Mean: 80.075 Std Dev: 0.2217 n= 4	Location: A2 Mean: 84.425 Std Dev: 0.3096 n= 4	Location: A3 Mean: 72.750 Std Dev: 0.2082 n= 4	Location: A4 Mean: 87.975 Std Dev: 0.2986 n= 4	Location: A5 Mean: 96.275 Std Dev: 0.3096 n= 4	Location: A6 Mean: 93.175 Std Dev: 0.5123 n= 4	Location: A7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A8 Mean: 75.475 Std Dev: 0.0957 n= 4	Location: A9 Mean: 81.500 Std Dev: 0.1826 n= 4	Location: A10 Mean: 87.275 Std Dev: 0.1258 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table 4 - Mean and standard deviations of grid squares level 3, time= 45 seconds

Location: H1 Mean: 94.150 Std Dev: 0.1291 n= 4	Location: H2 Mean: 91.475 Std Dev: 0.1708 n= 4	Location: H3 Mean: 79.750 Std Dev: 0.2517 n= 4	Location: H4 Mean: 95.725 Std Dev: 0.2062 n= 4	Location: H5 Mean: 85.725 Std Dev: 0.2500 n= 4	Location: H6 Mean: 92.425 Std Dev: 0.2754 n= 4	Location: H7 Mean: 92.900 Std Dev: 0.1826 n= 4	Location: H8 Mean: 92.725 Std Dev: 0.2630 n= 4	Location: H9 Mean: 82.875 Std Dev: 0.2754 n= 4	Location: H10 Mean: 92.550 Std Dev: 0.2380 n= 4
Location: G1 Mean: 82.350 Std Dev: 0.3512 n= 4	Location: G2 Mean: 86.300 Std Dev: 0.2160 n= 4	Location: G3 Mean: 77.650 Std Dev: 0.1291 n= 4	Location: G4 Mean: 84.650 Std Dev: 0.0577 n= 4	Location: G5 Mean: 89.375 Std Dev: 0.1708 n= 4	Location: G6 Mean: 77.700 Std Dev: 0.0816 n= 4	Location: G7 Mean: 76.150 Std Dev: 0.0577 n= 4	Location: G8 Mean: 80.150 Std Dev: 0.2082 n= 4	Location: G9 Mean: 78.650 Std Dev: 0.0577 n= 4	Location: G10 Mean: 92.825 Std Dev: 0.2754 n= 4
Location: F1 Mean: 83.300 Std Dev: 0.3162 n= 4	Location: F2 Mean: 70.150 Std Dev: 0.2380 n= 4	Location: F3 Mean: 74.850 Std Dev: 0.2380 n= 4	Location: F4 Mean: 81.900 Std Dev: 0.1633 n= 4	Location: F5 Mean: 74.200 Std Dev: 0.1826 n= 4	Location: F6 Mean: 79.250 Std Dev: 0.1291 n= 4	Location: F7 Mean: 75.300 Std Dev: 0.2449 n= 4	Location: F8 Mean: 74.175 Std Dev: 0.3500 n= 4	Location: F9 Mean: 70.375 Std Dev: 0.2217 n= 4	Location: F10 Mean: 80.550 Std Dev: 0.1915 n= 4
Location: E1 Mean: 94.550 Std Dev: 0.1291 n= 4	Location: E2 Mean: 76.725 Std Dev: 0.1708 n= 4	Location: E3 Mean: 76.575 Std Dev: 0.1500 n= 4	Location: E4 Mean: 77.500 Std Dev: 0.1826 n= 4	Location: E5 Mean: 89.675 Std Dev: 0.2500 n= 4	Location: E6 Mean: 78.950 Std Dev: 0.1291 n= 4	Location: E7 Mean: 78.225 Std Dev: 0.1708 n= 4	Location: E8 Mean: 82.500 Std Dev: 0.2944 n= 4	Location: E9 Mean: 73.800 Std Dev: 0.1826 n= 4	Location: E10 Mean: 91.875 Std Dev: 0.2630 n= 4
Location: D1 Mean: 91.375 Std Dev: 0.1708 n= 4	Location: D2 Mean: 79.500 Std Dev: 0.1155 n= 4	Location: D3 Mean: 77.975 Std Dev: 0.3304 n= 4	Location: D4 Mean: 76.875 Std Dev: 0.2630 n= 4	Location: D5 Mean: 83.400 Std Dev: 0.1155 n= 4	Location: D6 Mean: 78.825 Std Dev: 0.2217 n= 4	Location: D7 Mean: 80.925 Std Dev: 0.1708 n= 4	Location: D8 Mean: 88.125 Std Dev: 0.2217 n= 4	Location: D9 Mean: 74.500 Std Dev: 0.2708 n= 4	Location: D10 Mean: 88.375 Std Dev: 0.2986 n= 4
Location: C1 Mean: 79.400 Std Dev: 0.2944 n= 4	Location: C2 Mean: 77.850 Std Dev: 0.1291 n= 4	Location: C3 Mean: 75.575 Std Dev: 0.1500 n= 4	Location: C4 Mean: 85.000 Std Dev: 0.2160 n= 4	Location: C5 Mean: 93.075 Std Dev: 0.2500 n= 4	Location: C6 Mean: 80.050 Std Dev: 0.1291 n= 4	Location: C7 Mean: 81.350 Std Dev: 0.0577 n= 4	Location: C8 Mean: 80.675 Std Dev: 0.2500 n= 4	Location: C9 Mean: 75.400 Std Dev: 0.3559 n= 4	Location: C10 Mean: 81.300 Std Dev: 0.2160 n= 4
Location: B1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B3 Mean: 79.200 Std Dev: 0.1826 n= 4	Location: B4 Mean: 80.850 Std Dev: 0.1915 n= 4	Location: B5 Mean: 80.275 Std Dev: 0.1258 n= 4	Location: B6 Mean: 76.675 Std Dev: 0.3775 n= 4	Location: B7 Mean: 84.950 Std Dev: 0.2380 n= 4	Location: B8 Mean: 83.175 Std Dev: 0.2217 n= 4	Location: B9 Mean: 89.125 Std Dev: 0.2754 n= 4	Location: B10 Mean: 91.450 Std Dev: 0.2646 n= 4
Location: A1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A2 Mean: 75.925 Std Dev: 0.1708 n= 4	Location: A3 Mean: 71.400 Std Dev: 0.0816 n= 4	Location: A4 Mean: 90.800 Std Dev: 0.1414 n= 4	Location: A5 Mean: 81.650 Std Dev: 0.1291 n= 4	Location: A6 Mean: 82.775 Std Dev: 0.1708 n= 4	Location: A7 Mean: 94.400 Std Dev: 0.1155 n= 4	Location: A8 Mean: 81.200 Std Dev: 0.1826 n= 4	Location: A9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A10 Mean: 91.100 Std Dev: 0.2582 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

It was difficult to select regions from these Tables (1-4) that could be potential hotspot regions due to way the color-coding abruptly stops at the grid boundary.

Aggregating Data to Achieve Adequate Statistical Power

In that only four replications were performed for each grid square, there was insufficient statistical power to perform reliable statistical tests at this level of analyses. Therefore, a hierarchical process was developed to aggregate data into empirically defined units that were (1) spatially proximal and (2) contained a minimum of twenty data points (Milanesi, 2003).

The first grouping divided the grid into rows and columns. In each row, (A-H) there was 40 data points per time and level. In each column (1-10) there was 32 data points per time and level

The data tables that follow (Table 5-8) are samples of the regions by rows and columns temperature data collected. All the tables are very similar in format, as they represent different times and levels in the MW. The rest of the tables can be found in Appendix G.

This grouping of the data produced distinct rows and columns that were statistically hotter than all other rows:

- Level 1-time 15 seconds, column 4, Appendix F Table F2
- Level 2-time 30 seconds, column 7, Appendix F Table F3
- Level 2-time 45 seconds, row E, Appendix F Table F9
- Level 3-time 15 seconds, row H, Appendix F Table F14
- Level 3-time 30 seconds, row H, Appendix F Table F15
- Level 3-time 45 seconds, row H, Appendix F Table F16

This grouping of the data produced distinct rows and columns that were statistically hotter than other rows except for one other row or column:

- Level 1-time 15 seconds, row C and column 4, Appendix F Table F2
- Level 1-time 30 seconds, rows B, C, and F, and column 4, Appendix F Table F3
- Level 1-time 45 seconds, rows C and F, column 7, Appendix F Table F4
- Level 2-time 15 seconds, columns 1 and 2, Appendix F Table F8
- Level 2-time 45 seconds, rows D and F, Appendix F Table F10
- Level 3-time 15 seconds, column 1, Appendix F Table F14
- Level 3-time 30 seconds, columns 1 and 10, Appendix F Table F15
- Level 3-time 45 seconds, rows A and B, column 1 and 10, Appendix F Table F16
- Level 3-time 60 seconds, row H, Appendix F Table F17

This segregation of the data produced distinct rows and columns that were statistically hotter than other rows except for two other rows or two other columns:

- Level 1-time 15 seconds row F, Appendix F Table F2
- Level 1-time 30 seconds column 7, Appendix F Table F3
- Level 1-time 45 seconds columns 4, 5, and 9, Appendix F Table F4
- Level 3-time 15 seconds, column 10, Appendix F Table F14
- Level 3-time 60 seconds columns 1, 4, 5, 8, and 10, Appendix F Table F17

Table 5 - Mean and standard deviations of grid columns and rows level 1, time= 30 seconds

		Level = 1				Time = 30 seconds					
		Mean: 71.453 Std Dev: 6.8210 n= 32	Mean: 72.216 Std Dev: 4.5050 n= 32	Mean: 73.325 Std Dev: 4.5500 n= 32	Mean: 80.812 Std Dev: 6.0870 n= 32	Mean: 76.916 Std Dev: 3.5790 n= 32	Mean: 75.456 Std Dev: 8.8910 n= 32	Mean: 79.209 Std Dev: 1.8430 n= 32	Mean: 71.416 Std Dev: 3.2180 n= 32	Mean: 74.697 Std Dev: 4.0200 n= 32	Mean: 70.253 Std Dev: 5.3620 n= 32
Mean: 72.438 Std Dev: 4.4280 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 73.483 Std Dev: 3.1260 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 77.475 Std Dev: 4.8840 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 73.285 Std Dev: 5.0090 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 73.102 Std Dev: 5.6980 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 77.965 Std Dev: 5.5940 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 76.390 Std Dev: 7.7870 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 72.465 Std Dev: 8.3540 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table 6 - Mean and standard deviations of grid columns and rows level 1, time= 45 seconds

		Level = 1					Time = 45 seconds				
		Mean: 88.363 Std Dev: 9.6090 n= 32	Mean: 88.747 Std Dev: 8.2190 n= 32	Mean: 91.081 Std Dev: 8.3160 n= 32	Mean: 98.369 Std Dev: 4.3860 n= 32	Mean: 95.869 Std Dev: 3.9080 n= 32	Mean: 90.700 Std Dev: 7.3980 n= 32	Mean: 100.000 Std Dev: 0.0000 n= 32	Mean: 90.087 Std Dev: 5.6430 n= 32	Mean: 94.475 Std Dev: 5.6720 n= 32	Mean: 87.147 Std Dev: 8.0960 n= 32
Mean: 90.343 Std Dev: 7.9300 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 91.960 Std Dev: 5.3490 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 97.215 Std Dev: 6.5690 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 92.313 Std Dev: 8.4470 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 90.643 Std Dev: 7.0960 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 95.705 Std Dev: 4.8510 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 92.330 Std Dev: 7.5750 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 89.362 Std Dev: 10.5700 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table 7 - Mean and standard deviations of grid columns and rows level 2, time= 45 seconds

	Level = 2					Time = 45 seconds				
	Mean: 87.217 Std Dev: 8.4060 n= 32	Mean: 88.197 Std Dev: 7.4960 n= 32	Mean: 80.391 Std Dev: 6.5860 n= 32	Mean: 93.037 Std Dev: 5.2440 n= 32	Mean: 90.853 Std Dev: 7.2210 n= 32	Mean: 89.575 Std Dev: 6.6740 n= 32	Mean: 93.847 Std Dev: 6.5730 n= 32	Mean: 83.319 Std Dev: 10.4920 n= 32	Mean: 88.134 Std Dev: 8.1940 n= 32	Mean: 91.813 Std Dev: 8.2830 n= 32
	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=	Mean: Std Dev: n=
Mean: 86.320 Std Dev: 5.0900 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 84.095 Std Dev: 6.8050 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 92.125 Std Dev: 8.1000 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 97.503 Std Dev: 5.7570 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 92.482 Std Dev: 8.9910 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 87.131 Std Dev: 5.3930 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 83.558 Std Dev: 8.4570 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 85.893 Std Dev: 8.4920 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table 8 - Mean and standard deviations of grid columns and rows level 3, time= 45 seconds

		Level = 3					Time = 45 seconds				
Mean: 90.641		Mean: 82.241	Mean: 76.559	Mean: 84.163	Mean: 84.672	Mean: 80.831	Mean: 83.025	Mean: 82.841	Mean: 80.591	Mean: 88.753	
Std Dev: 7.6420		Std Dev: 9.2320	Std Dev: 2.5110	Std Dev: 6.1430	Std Dev: 5.7790	Std Dev: 4.7680	Std Dev: 6.8910	Std Dev: 5.2790	Std Dev: 9.3210	Std Dev: 4.7770	
n= 32		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	
Mean: 89.980	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Std Dev: 5.2240											
n= 40											
Mean: 82.580	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Std Dev: 5.3630											
n= 40											
Mean: 76.405	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Std Dev: 4.4420											
n= 40											
Mean: 82.038	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Std Dev: 7.0370											
n= 40											
Mean: 81.988	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Std Dev: 5.4030											
n= 40											
Mean: 80.968	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Std Dev: 4.9270											
n= 40											
Mean: 86.570	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Std Dev: 8.0390											
n= 40											
Mean: 86.925	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	
Std Dev: 9.4480											
n= 40											

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

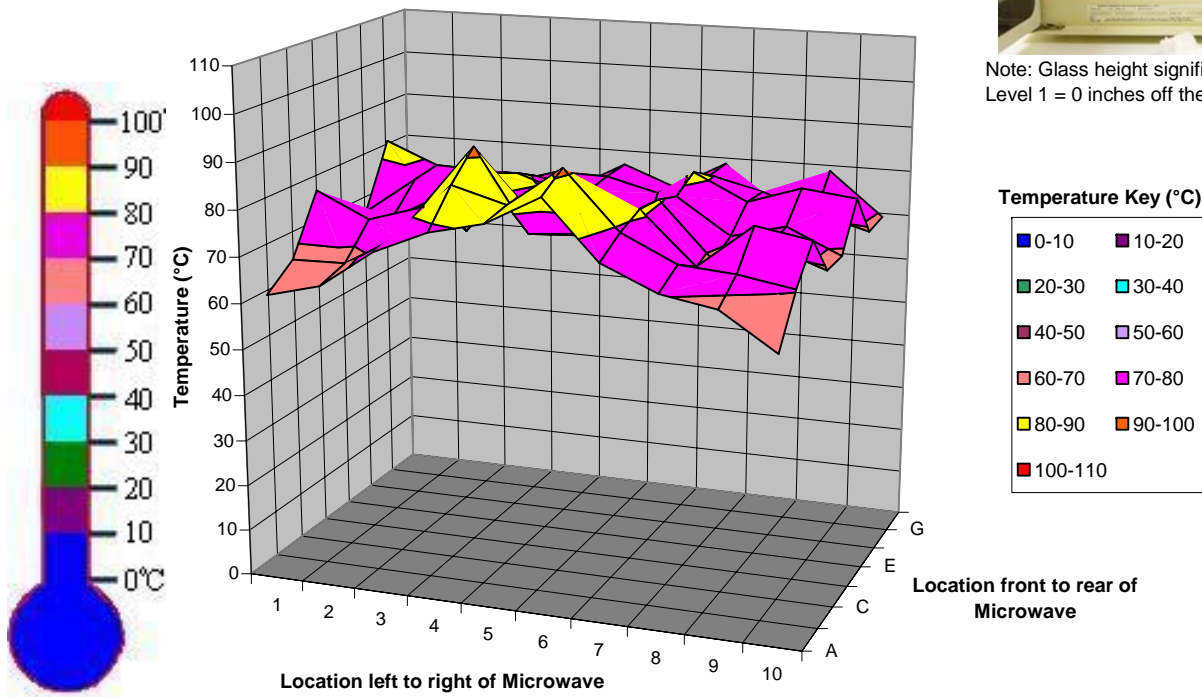
This first phase of the analysis process clearly demonstrated that statistically significant temperature gradients existed across both the width and depth of the microwave (see Tables 5-8), thus warranting further investigation. Therefore, the next phase of the analysis process was initiated to isolate the more localized hotspots within these gradients by combining data from the gradient tests (Tables 5-8) with the descriptive information for individual cells (Tables 1-4). This produced the empirically defined units of analysis to meet the criteria described previously (spatially proximal and containing a minimum of 20 data points), units that represented hotspots within larger background fields.

Topographical maps

Hotspots are regions of elevated temperature as compared to surrounding regions. Hotspots do not need to be regular in shape. It was determined that a 3-D map would be the best option. Appendix E contains all the 3-D maps. These maps would have color-coded temperature regions that could be irregularly shaped.

The following figures (Figure 17 – 20) depict the temperature data at each level at a specific time. It is important to note that the means are plotted on the lines not the actual grid squares, where horizontal line A and vertical line 1 cross is where location A1 is on the previous tables (Tables 1-8)

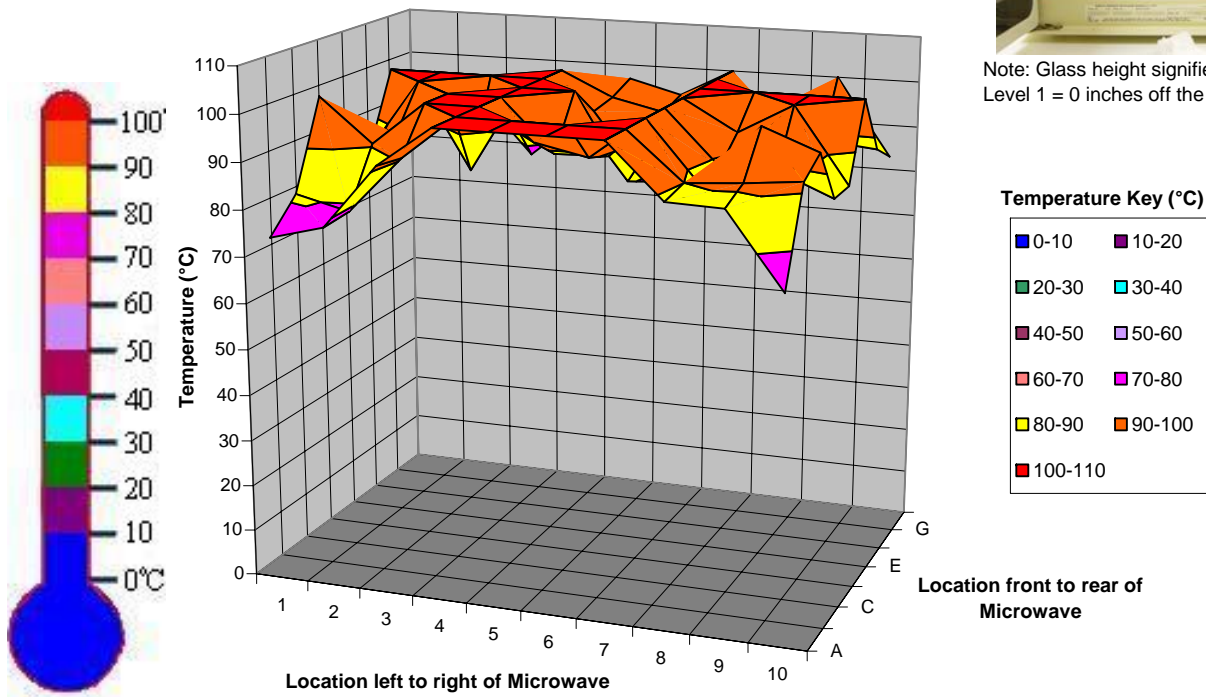
Temperature Profile Level 1 30 Seconds



Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Figure 16 – 3 Dimensional map of level 1, time= 30 seconds

Temperature Profile Level 1 45 Seconds



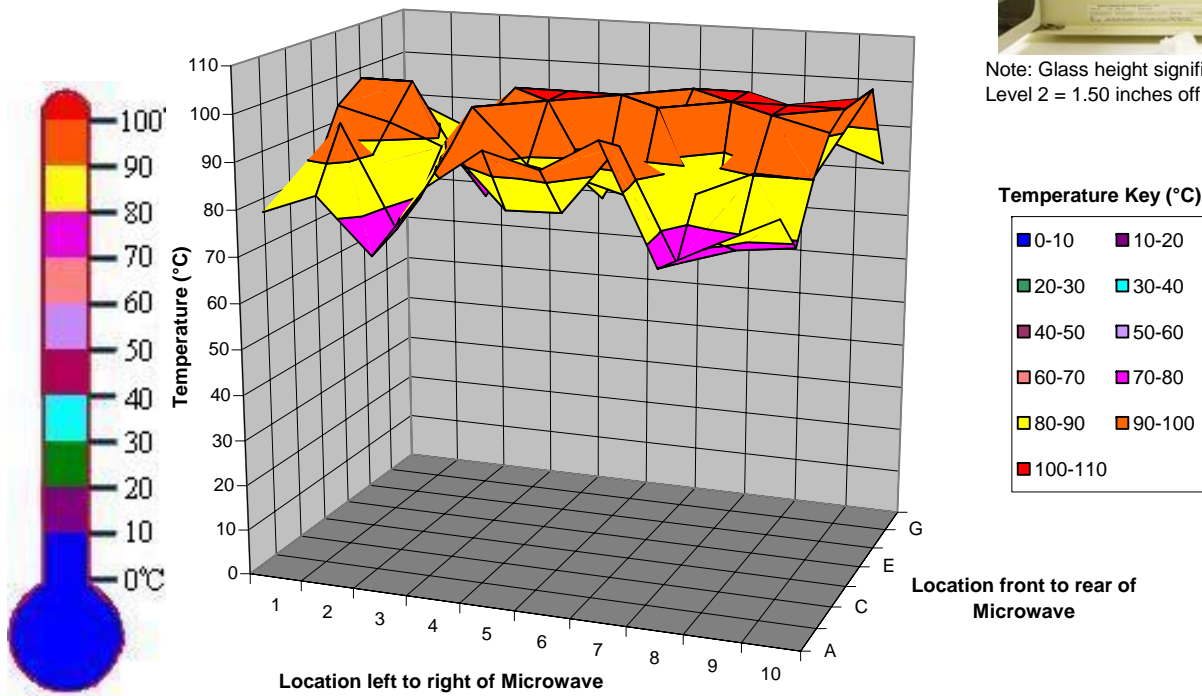
Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure 17 - 3 Dimensional map of level 1, time= 45 seconds

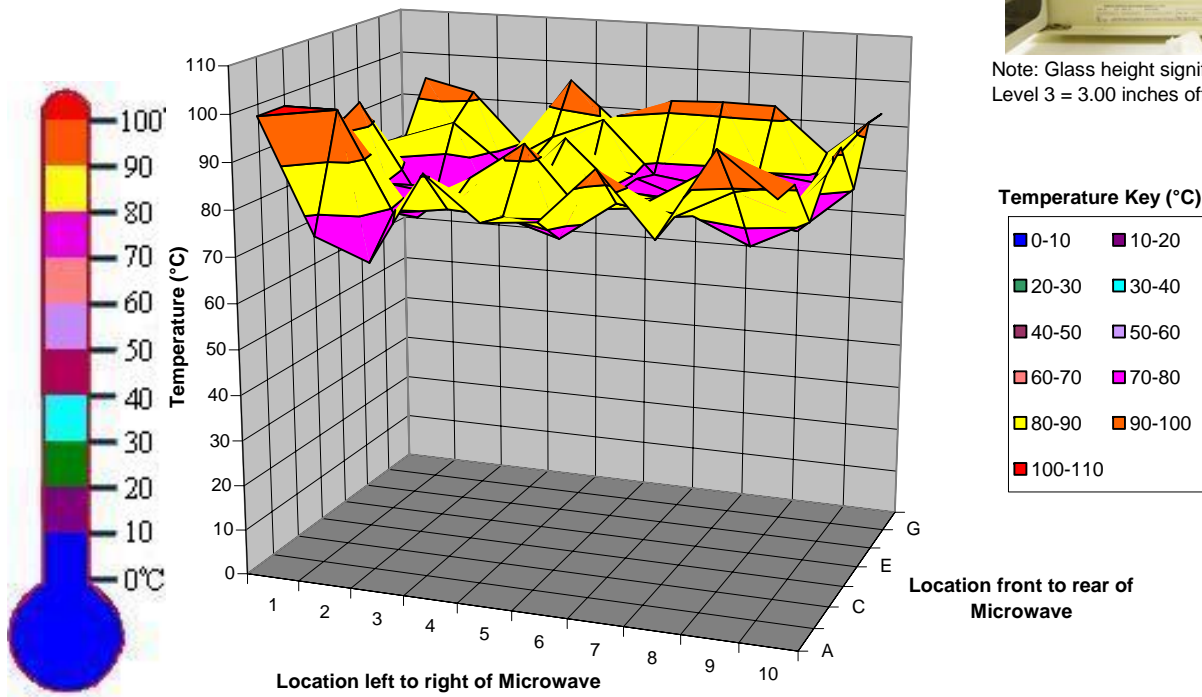
Temperature Profile Level 2 45 Seconds



Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Figure 18 - 3 Dimensional map of level 2, time= 45 seconds

Temperature Profile Level 3 45 Seconds



Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Figure 19 - 3 Dimensional map of level 3, time= 45 seconds

As Figures 16, 17, 18, and 19 and the rest of the Figures in Appendix E show, regions of elevated temperatures exist in close proximity to each other and hotspot regions grow larger as time increases. Since regions of elevated temperature grow larger with time, it was acceptable to pick one time on each level to perform ANOVA to determine if selected regions were statistically hotter than surrounding regions. The syntax used to recode the variables in SPSS is in Appendix I. It was determined to select one time and assess temperature as a function of the level at this time. Figure 17 was also selected to determine if hotspots may exist on level 1 previous to other levels.

Hotspot 1 (location B4, C3, C4, D4, and E4), hotspot 2 (location A5, A6, B5, B6, and B7), and all other locations as region 3 on level 1 at 30 seconds were selected

First the test for homogeneity was performed. Appendix H contains the tests for homogeneity. This test checks for a variance difference between

the regions as selected previously. Since this was not significant at the 0.05 level, the Least Significant Difference (LSD) test was valid. Table 10 was used to determine if there was a significant difference between the groups and Table 11 was used to determine which group if any was different.

Table 9 - Regions selected for potential hotspots from Figure 16

H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
	Hotspot 1								
	Hotspot 2								
	Region 3 (Surrounding Area)								

Table 10 - Analysis of the difference of regions on level 1 at 30 seconds

Dependent Variable: Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4257.331	2	2128.666	85.601	.000*
Within Groups	7882.963	317	24.867		
Total	12140.294	319			

Note: * indicates significance at .05 level.

Table 11 - Posthoc (LSD) tests for regions on level 1 at 30 seconds

Dependent Variable: Temperature (°C)

(I) Region at level 1 time 30	(J) Region at level 1 time 30	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-.410	1.5769	.795	-3.513	2.693
	3.00	10.822*	1.1542	.000	8.551	13.093
2.00	1.00	.410	1.5769	.795	-2.693	3.513
	3.00	11.232*	1.1542	.000	8.961	13.503
3.00	1.00	-10.822*	1.1542	.000	-13.093	-8.551
	2.00	-11.232*	1.1542	.000	-13.503	-8.961

Note: * indicates significance at .05 level.

Hotspot 1 and 2 are significantly hotter ($P \leq 0.001$) than region 3. However hotspot 1 and 2 are not significantly different ($P \leq 0.795$).

Hotspot 4 (location F1, F2, F3, F4, G4, E2, E4, and E5), hotspot 5 (location A4, A5, A6, A7, B4, B5, B6, B7, C3, C4, D3, and D4), hotspot 6 (location E7, E9, F7, F8, F9, F10, and G7), and all other locations as region 7 on level 1 at 45 seconds were selected.

The test for homogeneity found no significant difference between the variances ($P \leq 0.001$) therefore the LSD test was not valid and Tamhane was valid. Appendix H contains the tests for homogeneity.

Table 12 - Regions selected for potential hotspots from Figure 17

H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
	Hotspot 4								
	Hotspot 5								
	Hotspot 6								
	Region 7 (Surrounding Area)								

Table 13 - Analysis of the difference of regions on level 1 at 45 seconds

Dependent Variable: Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9205.762	3	3068.587	93.940	.000*
Within Groups	10322.239	316	32.665		
Total	19528.001	319			

Note: * indicates significance at .05 level.

Table 16 - Analysis of the difference of regions on level 2 at 45 seconds

Dependent Variable: Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7672.778	3	2557.593	52.066	.000*
Within Groups	15522.686	316	49.122		
Total	23195.463	319			

Note: * indicates significance at .05 level.

Table 17 - Posthoc (Tamhane) tests for regions on level 2 at 45 seconds

Dependent Variable: Temperature (°C)

(I) Region at level 2 at 45 seconds	(J) Region at level 2 at 45 seconds	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
8.00	9.00	-3.170	.6347	.000*	-5.032	-1.308
	10.00	-2.650	.6786	.004*	-4.593	-.707
	11.00	10.511	.7942	.000*	8.326	12.695
9.00	8.00	3.170	.6347	.000*	1.308	5.032
	10.00	.520	.2402	.234	-.185	1.225
	11.00	13.681	.4774	.000*	12.415	14.946
10.00	8.00	2.650	.6786	.004*	.707	4.593
	9.00	-.520	.2402	.234	-1.225	.185
	11.00	13.161	.5344	.000*	11.742	14.580
11.00	8.00	-10.511	.7942	.000*	-12.695	-8.326
	9.00	-13.681	.4774	.000*	-14.946	-12.415
	10.00	-13.161	.5344	.000*	-14.580	-11.742

Note: * indicates significance at .05 level.

Since the test for homogeneity was significant, the variance of each potential hotspot was assumed to be the same. Hotspots 8, 9, and 10 were significantly hotter than region 11 ($P \leq 0.001$).

Hotspot 12 (location A1, A2, B1, B2, and C1), hotspot 13 (location A8, A9, A10, B9, and B10), hotspot 14 (location H4, H5, H6, H7, and H8), and all other locations as region 15 on level 3 at 45 seconds were selected.

Table 18 - Regions selected for potential hotspot from Figure 19

H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
	Hotspot 12								
	Hotspot 13								
	Hotspot 14								
	Region 15 (Surrounding Area)								

The test for homogeneity found no significant difference between the variances ($P \leq 0.001$) therefore the LSD test was not valid and Tamhane was valid. Appendix H contains the tests for homogeneity.

Table 19 - Analysis of the difference of regions on level 3 at 45 seconds

Dependent Variable: Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4444.400	3	1481.467	34.637	.000*
Within Groups	13515.533	316	42.771		
Total	17959.932	319			

Note: * indicates significance at .05 level.

Table 20 - Posthoc (Tamhane) tests for regions on level 3 at 45 seconds

Dependent Variable: Temperature (°C)

(I) Region at level 3 at 45 seconds	(J) Region at level 3 at 45 seconds	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
12.00	13.00	.490	2.8744	1.000	-7.616	8.596
	14.00	-.835	2.6354	1.000	-8.435	6.765
	15.00	9.414	2.5530	.009*	1.961	16.866
13.00	12.00	-.490	2.8744	1.000	-8.596	7.616
	14.00	-1.325	1.5727	.956	-5.758	3.108
	15.00	8.924	1.4304	.000*	4.793	13.054
14.00	12.00	.835	2.6354	1.000	-6.765	8.435
	13.00	1.325	1.5727	.956	-3.108	5.758
	15.00	10.249	.8538	.000*	7.845	12.653
15.00	12.00	-9.414	2.5530	.009*	-16.866	-1.961
	13.00	-8.924	1.4304	.000*	-13.054	-4.793
	14.00	-10.249	.8538	.000*	-12.653	-7.845

Note: * indicates significance at .05 level.

Since the test for homogeneity was significant, the variance of each potential hotspot was assumed to be the same. Hotspots 12, 13, and 14 were significantly hotter than region 15 ($P \leq 0.001$).

Chapter V

Summary and Conclusion

Summary

In this project, it was determined, using an unobtrusive method that hotspots exist as a function of spatial area inside a microwave (Whirlpool 3000XM-0). The study showed significant temperature ($P < 0.001$) difference between all Hotspots (11) and their respective surrounding area. This is shown in Figures 9, 12, 15 and 18.

The data analyzed in this research shows that hotspots were a function of spatial area in the microwave (Whirlpool 3000XM-0). Eighty locations were measured at each of the three levels. On the lowest level, the hotspots were concentrated front and the right rear of the microwave. But at the third level, the hotspots were concentrated completely around the perimeter of the microwave.

Recommendations for future study

Microwave ovens and the foods they heat are complex. Numerous phenomenon are responsible for heating profiles in microwaves.

Recommendations for future study might include the following:

- 1) Examination of other microwaves to determine if they exhibit the same type of behavior
- 2) Examination of harmonic behavior in the location of hotspots in a microwave with a turntable.
- 3) Application of this research method to an actual food product.

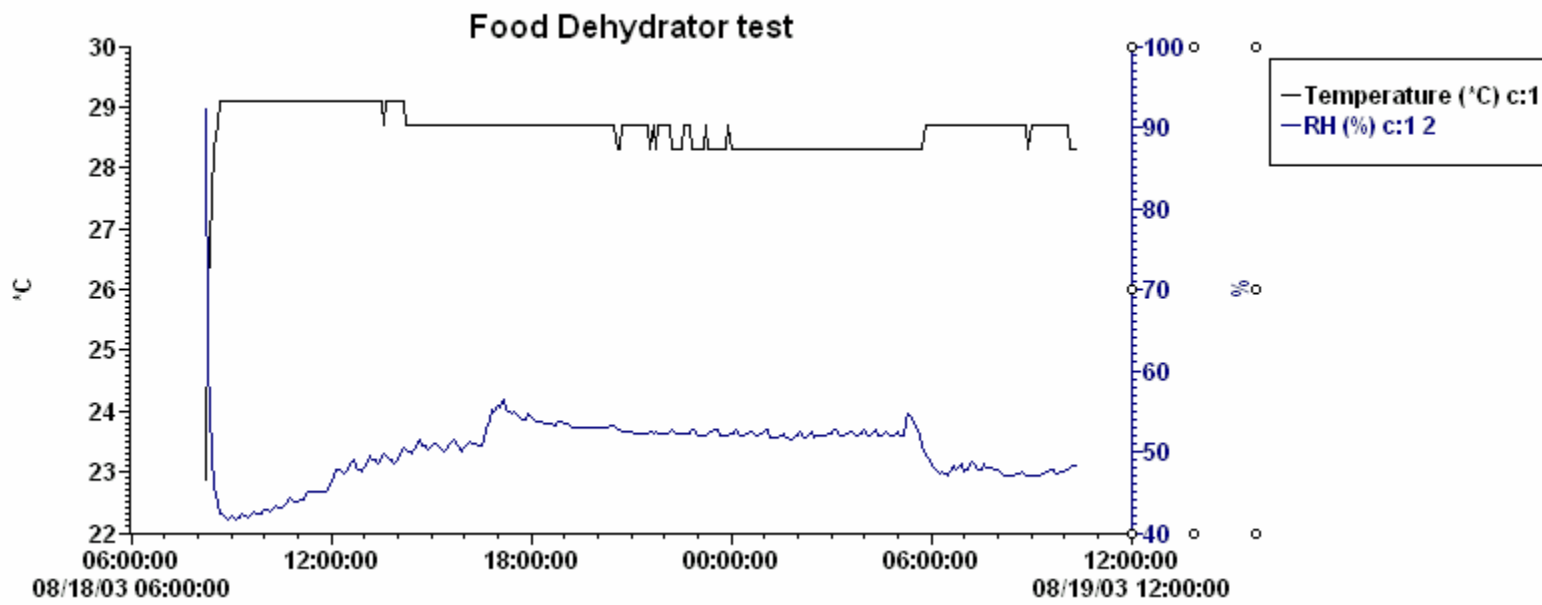
References

- Adams, A.M., Miller, K.S., Wekell, M.M., Dong, F.M. 1999. Survival of *Anisakis Simplex* in Microwave-Processed Arrowtooth Flounder (*Atheresthes stomias*). *Journal of Food Protection*. 62 (4) p.403-409.
- Bows, J.R. 2000. A Classification System for Microwave Heating of Food. *International Journal of Food Science and Technology*. 35 p.417-430.
- Chakraborty, D.P. and Brezovich, I.A. 1982 Error Sources Affecting Thermocouple Thermometry in RF Electromagnetic Fields. *Journal of Microwave Power*. 17 (1) 17.
- Gallawa, J.C. (2003) <http://www.gallawa.com/microtech/history.html> accessed July 17th, 2003.
- Thermetics. (1999) <http://www.thermometrics.com/htmldocs/whatis.htm> accessed July 17th, 2003
- Maheswari, P.N. Stanley, D.W., van de Voort, F.R. and Gray, J.I. 1980. The Heat Stability of Allyl Glucosinate (Singrin) in Aqueous and Model Systems. *Journal of Canadian Institute of Food Science and Technology*. 13 (1) 28.
- Ohlsson, T., Risman, P.O. 1978. Temperature Distribution of Microwave Heating Spheres and Cylinders. *Journal of Microwave Power and Electromagnetic Energy*. 13 (4) p.303-309.
- Olsen, R.G., Hammer, W.C., Taylor, J.C. 1982. Coaxial Non-Metallic Thermocouple with Electronic Ice Point for Dosimetric Use in Electromagnetic Environments. *Journal of Microwave Power and Electromagnetic Energy*. 17 (2) 137.
- Ramaswamy, H., van-de Voort, F.R., Raghavan, G.S.V., Lightfoot, D., Timbers, G. 1991. Feed-back Temperature Control System for Microwave Ovens using a Shielded Thermocouple. *Journal of Food Science*. 56 (2) p.550-552, 555.
- Robertson, G.L. 1993. *Food Packaging: Principles and Practice*. P.412-414.
- Van de Voort, F.R., Laureano, M., Smith, J.P. 1987. A Practical Thermocouple for Temperature Measurement in Microwave Ovens. *Canadian Institute of Food Science and Technology*. 20 (4) p.279-284.

APPENDIX A

Output chart from data logger placed in dehydrator

Figure A 1 - Food dehydrator chart



APPENDIX B

Raw data sheets

Table B 1 - Raw data sheet for level 1 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A1	14.99	0	23.1	0-A2	15.01	0	23.1
		15	46.6			15	48.2
		30	62.1			30	65.0
		45	74.8			45	77.5
		60	90.1			60	91.6
		75	100.0			75	100.0
0-B1	14.99	0	23.2	0-B2	15.00	0	23.2
		15	50.7			15	50.7
		30	67.5			30	67.6
		45	81.8			45	78.7
		60	100.0			60	91.1
		75				75	100.0
0-C1	15.01	0	23.1	0-C2	15.00	0	23.2
		15	58.1			15	56.0
		30	79.9			30	74.0
		45	100.0			45	90.5
		60				60	100.0
		75				75	
0-D1	14.98	0	23.0	0-D2	14.99	0	23.1
		15	48.8			15	54.1
		30	64.4			30	72.1
		45	78.1			45	90.4
		60	93.7			60	100.0
		75	100.0			75	
0-E1	15.00	0	23.2	0-E2	15.02	0	23.1
		15	53.1			15	57.1
		30	70.0			30	77.7
		45	84.0			45	100.0
		60	100.0			60	
		75				75	
0-F1	14.98	0	23.0	0-F2	15.01	0	23.1
		15	59.0			15	58.4
		30	83.8			30	78.9
		45	100.0			45	100.0
		60				60	
		75				75	
0-G1	15.01	0	23.1	0-G2	14.98	0	23.1
		15	53.8			15	53.1
		30	73.0			30	70.0
		45	93.5			45	83.4
		60	100.0			60	100.0
		75				75	
0-H1	15.01	0	23.0	0-H2	14.98	0	23.1
		15	53.7			15	54.5
		30	73.0			30	72.4
		45	96.1			45	90.0
		60	100.0			60	100.0
		75				75	

Table B 2 - Raw data sheet for level 1 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A3	15.00	0	23.1	0-A4	15.02	0	23.0
		15	54.6			15	55.5
		30	74.0			30	78.7
		45	91.1			45	100.0
		60	100.0			60	
		75				75	
0-B3	15.01	0	23.1	0-B4	14.99	0	22.9
		15	54.9			15	61.9
		30	73.7			30	85.8
		45	91.3			45	100.0
		60	100.0			60	
		75				75	
0-C3	15.02	0	23.0	0-C4	14.98	0	23.0
		15	58.0			15	62.0
		30	77.3			30	91.7
		45	100.0			45	100.0
		60				60	
		75				75	
0-D3	15.00	0	23.1	0-D4	14.99	0	23.1
		15	57.9			15	61.0
		30	78.0			30	83.7
		45	100.0			45	100.0
		60	100.0			60	
		75				75	
0-E3	15.02	0	22.9	0-E4	15.01	0	23.0
		15	51.4			15	60.4
		30	66.9			30	80.9
		45	81.0			45	100.0
		60	100.0			60	
		75				75	
0-F3	15.01	0	23.2	0-F4	15.00	0	23.1
		15	58.1			15	60.1
		30	78.5			30	78.4
		45	100.0			45	100.0
		60				60	
		75				75	
0-G3	14.98	0	22.8	0-G4	14.99	0	23.0
		15	55.1			15	57.1
		30	71.9			30	77.1
		45	88.4			45	100.0
		60	100.0			60	
		75				75	
0-H3	14.99	0	23.1	0-H4	15.01	0	22.9
		15	51.0			15	52.7
		30	66.3			30	70.7
		45	77.4			45	87.3
		60	89.3			60	100.0
		75	100.0			75	

Table B 3 - Raw data sheet for level 1 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)		Location	DI water (g)	Time (s)	Temperature (°C)
0-A5	15.01	0	23.0		0-A6	15.00	0	22.9
		15	57.7				15	58.3
		30	81.4				30	88.1
		45	100.0				45	100.0
		60					60	
		75					75	
0-B5	15.02	0	23.1		0-B6	15.01	0	22.8
		15	58.7				15	61.9
		30	83.1				30	91.6
		45	100.0				45	100.0
		60					60	
		75					75	
0-C5	14.99	0	23.0		0-C6	15.02	0	23.0
		15	54.2				15	56.4
		30	74.1				30	75.3
		45	93.0				45	90.7
		60	100.0				60	100.0
		75					75	
0-D5	14.98	0	23.1		0-D6	14.99	0	23.1
		15	52.4				15	53.1
		30	71.6				30	71.9
		45	88.3				45	88.6
		60	100.0				60	100.0
		75					75	
0-E5	15.00	0	23.2		0-E6	14.98	0	23.2
		15	57.4				15	51.3
		30	77.7				30	67.3
		45	100.0				45	81.3
		60					60	100.0
		75					75	
0-F5	15.00	0	23.1		0-F6	14.99	0	23.2
		15	55.4				15	48.9
		30	76.0				30	64.5
		45	93.7				45	78.3
		60	100.0				60	95.7
		75					75	100.0
0-G5	15.01	0	23.0		0-G6	15.02	0	22.5
		15	57.8				15	54.7
		30	76.5				30	73.5
		45	94.2				45	91.7
		60	100.0				60	100.0
		75					75	
0-H5	15.02	0	22.9		0-H6	15.00	0	22.8
		15	57.4				15	55.1
		30	77.0				30	72.1
		45	96.9				45	94.2
		60	100.0				60	100.0
		75					75	

Table B 4 - Raw data sheet for level 1 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A7	15.01	0	23.0	0-A8	15.01	0	22.9
		15	55.2			15	53.1
		30	75.1			30	70.6
		45	100.0			45	88.8
		60				60	100.0
		75				75	
0-B7	15.01	0	23.1	0-B8	15.01	0	22.8
		15	56.1			15	56.0
		30	78.6			30	74.3
		45	100.0			45	89.6
		60				60	100.0
		75				75	
0-C7	14.99	0	23.1	0-C8	14.99	0	22.9
		15	60.3			15	52.1
		30	80.7			30	70.4
		45	100.0			45	86.5
		60				60	100.0
		75				75	
0-D7	14.98	0	23.0	0-D8	14.98	0	23.1
		15	57.8			15	50.9
		30	80.8			30	69.0
		45	100.0			45	88.5
		60				60	100.0
		75				75	
0-E7	15.00	0	23.0	0-E8	14.99	0	23.1
		15	57.9			15	52.6
		30	78.6			30	70.9
		45	100.0			45	93.6
		60				60	100.0
		75				75	
0-F7	14.99	0	22.8	0-F8	15.00	0	22.9
		15	57.8			15	55.9
		30	81.8			30	75.4
		45	100.0			45	100.0
		60				60	
		75				75	
0-G7	15.01	0	22.9	0-G8	15.01	0	23.0
		15	58.0			15	55.9
		30	78.8			30	75.5
		45	100.0			45	94.1
		60				60	100.0
		75				75	
0-H7	15.00	0	23.2	0-H8	15.00	0	23.1
		15	57.9			15	52.1
		30	78.3			30	66.0
		45	100.0			45	80.1
		60				60	96.4
		75				75	100.0

Table B 5 - Raw data sheet for level 1 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A9	14.98	0	23.1	0-A10	14.99	0	23.0
		15	50.1			15	45.6
		30	68.2			30	60.7
		45	88.4			45	72.9
		60	100.0			60	88.0
		75				75	100.0
0-B9	15.00	0	23.1	0-B10	15.00	0	22.8
		15	54.6			15	51.9
		30	72.3			30	70.3
		45	91.0			45	92.0
		60	100.0			60	100.0
		75				75	
0-C9	15.01	0	23.1	0-C10	15.01	0	23.0
		15	60.0			15	60.0
		30	80.0			30	77.7
		45	100.0			45	95.4
		60				60	100.0
		75				75	
0-D9	15.02	0	22.8	0-D10	15.02	0	23.0
		15	55.4			15	50.8
		30	72.4			30	68.5
		45	88.8			45	83.9
		60	100.0			60	100.0
		75				75	
0-E9	15.00	0	22.9	0-E10	15.02	0	22.9
		15	56.4			15	51.5
		30	74.0			30	68.4
		45	100.0			45	83.5
		60				60	100.0
		75				75	
0-F9	15.02	0	23.1	0-F10	15.01	0	23.0
		15	59.0			15	53.7
		30	80.0			30	78.4
		45	100.0			45	100.0
		60				60	
		75				75	
0-G9	14.98	0	23.0	0-G10	15.00	0	22.9
		15	53.6			15	50.0
		30	71.9			30	68.7
		45	88.0			45	87.0
		60	100.0			60	100.0
		75				75	
0-H9	14.99	0	22.8	0-H10	14.99	0	23.0
		15	57.0			15	50.0
		30	78.9			30	69.0
		45	100.0			45	83.0
		60				60	96.4
		75				75	100.0

Table B 6 - Raw data sheet for level 1 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A1	15.00	0	22.9	0-A2	15.01	0	23.2
		15	46.2			15	48.1
		30	62.3			30	65.5
		45	74.6			45	77.9
		60	89.9			60	92.0
		75	100.0			75	100.0
0-B1	14.99	0	23.2	0-B2	15.02	0	323.1
		15	51.0			15	50.6
		30	67.2			30	67.8
		45	81.4			45	77.9
		60	100.0			60	90.7
		75				75	100.0
0-C1	15.01	0	23.2	0-C2	14.98	0	23.0
		15	57.7			15	56.3
		30	79.2			30	74.1
		45	100.0			45	91.0
		60				60	100.0
		75				75	
0-D1	14.99	0	23.2	0-D2	15.02	0	23.0
		15	48.6			15	53.9
		30	64.0			30	71.9
		45	77.5			45	90.9
		60	94.1			60	100.0
		75	100.0			75	
0-E1	15.01	0	23.1	0-E2	15.00	0	23.2
		15	52.5			15	57.0
		30	69.2			30	77.7
		45	83.5			45	100.0
		60	100.0			60	
		75				75	
0-F1	15.00	0	22.9	0-F2	14.99	0	23.0
		15	58.6			15	57.9
		30	83.5			30	78.7
		45	100.0			45	100.0
		60				60	
		75				75	
0-G1	14.99	0	23.1	0-G2	15.01	0	23.0
		15	53.6			15	53.0
		30	72.1			30	69.5
		45	93.4			45	82.9
		60	100.0			60	100.0
		75				75	
0-H1	14.99	0	23.0	0-H2	14.98	0	23.1
		15	53.0			15	54.9
		30	73.6			30	72.6
		45	95.5			45	89.9
		60	100.0			60	100.0
		75				75	

Table B 7 - Raw data sheet for level 1 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A3	14.99	0	23.1	0-A4	15.01	0	23.0
		15	55.2			15	55.7
		30	73.8			30	78.9
		45	92.0			45	100.0
		60	100.0			60	
		75				75	
0-B3	14.99	0	22.9	0-B4	15.02	0	22.8
		15	55.4			15	61.7
		30	73.9			30	85.9
		45	90.7			45	100.0
		60	100.0			60	
		75				75	
0-C3	15.00	0	23.0	0-C4	15.00	0	23.2
		15	59.0			15	61.9
		30	77.7			30	91.6
		45	100.0			45	100.0
		60				60	
		75				75	
0-D3	15.01	0	23.0	0-D4	14.98	0	22.9
		15	57.6			15	60.9
		30	77.9			30	83.5
		45	100.0			45	100.0
		60				60	
		75				75	
0-E3	15.00	0	22.8	0-E4	14.99	0	22.9
		15	51.0			15	61.0
		30	67.0			30	81.1
		45	80.6			45	100.0
		60	100.0			60	
		75				75	
0-F3	14.98	0	23.0	0-F4	15.01	0	23.2
		15	57.9			15	59.9
		30	78.3			30	78.1
		45	100.0			45	100.0
		60				60	
		75				75	
0-G3	14.99	0	23.1	0-G4	15.02	0	23.1
		15	55.4			15	56.8
		30	71.7			30	76.5
		45	88.0			45	100.0
		60	100.0			60	
		75				75	
0-H3	15.00	0	22.9	0-H4	14.99	0	22.8
		15	50.8			15	52.5
		30	66.1			30	70.9
		45	77.0			45	86.9
		60	89.0			60	100.0
		75	100.0			75	

Table B 8 - Raw data sheet for level 1 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)		Location	DI water (g)	Time (s)	Temperature (°C)
0-A5	15.02	0	23.1		0-A6	14.99	0	23.0
		15	57.8				15	59.1
		30	81.8				30	87.7
		45	100.0				45	100.0
		60					60	
75		75						
0-B5	15.00	0	22.8		0-B6	15.00	0	23.1
		15	58.4				15	61.8
		30	82.8				30	91.4
		45	100.0				45	100.0
		60					60	
75		75						
0-C5	14.99	0	22.9		0-C6	15.00	0	22.9
		15	55.0				15	55.9
		30	73.6				30	74.9
		45	93.6				45	91.4
		60	100.0				60	100.0
75		75						
0-D5	15.00	0	23.1		0-D6	14.99	0	23.0
		15	53.1				15	53.8
		30	70.8				30	71.6
		45	89.0				45	89.3
		60	100.0				60	100.0
75		75						
0-E5	14.99	0	22.8		0-E6	14.98	0	22.9
		15	57.1				15	50.7
		30	76.9				30	66.6
		45	100.0				45	81.4
		60					60	100.0
75		75						
0-F5	15.02	0	23.1		0-F6	15.01	0	23.0
		15	55.6				15	49.3
		30	75.8				30	64.9
		45	94.0				45	79.1
		60	100.0				60	96.7
75		75	100.0					
0-G5	15.01	0	23.1		0-G6	15.00	0	22.9
		15	57.6				15	55.0
		30	76.3				30	73.4
		45	94.7				45	91.6
		60	100.0				60	100.0
75		75						
0-H5	14.99	0	23.1		0-H6	15.01	0	22.8
		15	58.1				15	55.9
		30	76.4				30	72.3
		45	96.7				45	93.5
		60	100.0				60	100.0
75		75						

Table B 9 - Raw data sheet for level 1 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A7	15.00	0	23.1	0-A8	15.01	0	23.1
		15	55.1			15	52.1
		30	75.6			30	70.9
		45	100.0			45	88.7
		60				60	100.0
		75				75	
0-B7	14.99	0	22.9	0-B8	15.02	0	23.0
		15	56.7			15	55.2
		30	79.3			30	73.7
		45	100.0			45	90.4
		60				60	100.0
		75				75	
0-C7	15.00	0	22.9	0-C8	15.02	0	22.9
		15	59.9			15	52.4
		30	81.6			30	70.1
		45	100.0			45	86.7
		60				60	100.0
		75				75	
0-D7	15.00	0	22.8	0-D8	15.01	0	23.1
		15	57.3			15	50.7
		30	80.7			30	68.4
		45	100.0			45	88.4
		60				60	100.0
		75				75	
0-E7	14.98	0	23.0	0-E8	14.99	0	23.0
		15	57.8			15	52.4
		30	79.1			30	71.4
		45	100.0			45	93.4
		60				60	100.0
		75				75	
0-F7	15.00	0	23.1	0-F8	15.01	0	23.2
		15	57.1			15	55.4
		30	81.6			30	76.3
		45	100.0			45	100.0
		60				60	
		75				75	
0-G7	14.98	0	22.8	0-G8	14.99	0	22.9
		15	57.4			15	55.9
		30	78.7			30	75.9
		45	100.0			45	93.6
		60				60	100.0
		75				75	
0-H7	14.98	0	22.9	0-H8	15.01	0	23.0
		15	57.3			15	51.9
		30	79.1			30	66.3
		45	100.0			45	79.8
		60				60	97.0
		75				75	100.0

Table B 10 - Raw data sheet for level 1 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A9	15.00	0	23.0	0-A10	14.99	0	22.9
		15	50.0			15	45.9
		30	68.1			30	60.5
		45	88.8			45	73.0
		60	100.0			60	88.4
		75				75	100.0
0-B9	15.01	0	23.1	0-B10	14.98	0	23.0
		15	54.7			15	52.0
		30	72.7			30	70.9
		45	91.1			45	92.1
		60	100.0			60	100.0
		75				75	
0-C9	15.01	0	22.8	0-C10	15.01	0	22.9
		15	60.4			15	60.1
		30	79.9			30	77.4
		45	100.0			45	96.0
		60				60	100.0
		75				75	
0-D9	14.98	0	22.8	0-D10	15.02	0	22.9
		15	54.9			15	50.7
		30	72.6			30	68.7
		45	88.7			45	83.4
		60	100.0			60	100.0
		75				75	
0-E9	14.98	0	23.0	0-E10	14.99	0	23.0
		15	56.9			15	51.7
		30	74.1			30	69.0
		45	100.0			45	83.7
		60				60	100.0
		75				75	
0-F9	15.01	0	23.1	0-F10	14.99	0	23.1
		15	59.1			15	53.8
		30	80.1			30	78.0
		45	100.0			45	100.0
		60				60	
		75				75	
0-G9	15.01	0	23.2	0-G10	15.01	0	23.1
		15	53.7			15	49.6
		30	71.8			30	68.8
		45	88.0			45	87.1
		60	100.0			60	100.0
		75				75	
0-H9	15.02	0	23.2	0-H10	15.00	0	22.9
		15	57.1			15	50.6
		30	79.0			30	69.3
		45	100.0			45	83.0
		60				60	96.5
		75				75	100.0

Table B 11 - Raw data sheet for level 1 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A1	15.00	0	23.2	0-A2	15.00	0	23.1
		15	47.1			15	47.9
		30	62.7			30	65.2
		45	74.2			45	77.4
		60	89.6			60	91.3
		75	100.0			75	100.0
0-B1	14.98	0	23.0	0-B2	15.02	0	23.0
		15	50.5			15	50.2
		30	66.8			30	67.0
		45	81.1			45	78.9
		60	100.0			60	91.5
		75				75	100.0
0-C1	14.99	0	23.1	0-C2	15.01	0	23.1
		15	58.2			15	56.1
		30	76.7			30	73.9
		45	100.0			45	90.8
		60				60	100.0
		75				75	
0-D1	15.02	0	23.1	0-D2	15.01	0	23.1
		15	49.2			15	54.3
		30	64.3			30	72.3
		45	77.9			45	90.5
		60	94.1			60	100.0
		75	100.0			75	
0-E1	15.01	0	23.0	0-E2	15.00	0	23.2
		15	52.9			15	57.3
		30	69.7			30	77.9
		45	83.9			45	100.0
		60	100.0			60	
		75				75	
0-F1	15.00	0	23.0	0-F2	14.98	0	23.2
		15	58.9			15	58.9
		30	83.3			30	79.1
		45	100.0			45	100.0
		60				60	
		75				75	
0-G1	15.02	0	23.2	0-G2	15.01	0	23.2
		15	54.4			15	52.7
		30	72.9			30	69.7
		45	93.6			45	83.1
		60	100.0			60	100.0
		75				75	
0-H1	14.99	0	23.2	0-H2	15.02	0	23.0
		15	53.5			15	54.3
		30	72.9			30	72.1
		45	95.9			45	89.4
		60	100.0			60	100.0
		75				75	

Table B 12 - Raw data sheet for level 1 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A3	15.00	0	22.9	0-A4	14.99	0	23.0
		15	54.8			15	55.9
		30	73.6			30	78.8
		45	91.7			45	100.0
		60	100.0			60	
		75				75	
0-B3	15.02	0	23.0	0-B4	14.98	0	23.1
		15	55.7			15	62.2
		30	74.3			30	85.8
		45	90.6			45	100.0
		60	100.0			60	
		75				75	
0-C3	14.99	0	22.9	0-C4	14.98	0	22.8
		15	58.6			15	61.8
		30	78.0			30	91.9
		45	100.0			45	100.0
		60				60	
		75				75	
0-D3	15.01	0	23.1	0-D4	15.00	0	23.0
		15	58.0			15	61.3
		30	78.3			30	84.0
		45	100.0			45	100.0
		60				60	
		75				75	
0-E3	15.02	0	23.2	0-E4	14.98	0	23.0
		15	51.8			15	60.6
		30	67.4			30	81.5
		45	81.3			45	100.0
		60	100.0			60	
		75				75	
0-F3	14.99	0	22.9	0-F4	14.99	0	22.8
		15	58.1			15	59.7
		30	78.5			30	78.0
		45	100.0			45	100.0
		60				60	
		75				75	
0-G3	15.01	0	22.9	0-G4	15.02	0	23.2
		15	55.5			15	57.1
		30	71.9			30	76.7
		45	87.8			45	100.0
		60	100.0			60	
		75				75	
0-H3	15.02	0	23.1	0-H4	14.99	0	23.1
		15	51.2			15	52.6
		30	65.9			30	70.5
		45	77.8			45	87.0
		60	88.9			60	100.0
		75	100.0			75	

Table B 13 - Raw data sheet for level 1 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A5	15.02	0	23.1	0-A6	15.02	0	23.2
		15	57.3			15	58.5
		30	81.6			30	87.4
		45	100.0			45	100.0
		60				60	
		75				75	
0-B5	15.01	0	23.1	0-B6	15.01	0	23.0
		15	59.0			15	62.5
		30	82.6			30	91.1
		45	100.0			45	100.0
		60				60	
		75				75	
0-C5	15.01	0	23.0	0-C6	15.02	0	23.2
		15	54.8			15	56.3
		30	74.0			30	74.8
		45	93.7			45	91.0
		60	100.0			60	100.0
		75				75	
0-D5	15.01	0	23.2	0-D6	15.02	0	23.0
		15	52.9			15	53.4
		30	71.0			30	71.8
		45	88.4			45	893.1
		60	100.0			60	100.0
		75				75	
0-E5	15.02	0	23.0	0-E6	14.98	0	23.1
		15	57.5			15	50.6
		30	77.1			30	67.0
		45	100.0			45	81.2
		60				60	100.0
		75				75	
0-F5	14.99	0	23.2	0-F6	15.02	0	22.9
		15	54.9			15	49.1
		30	75.2			30	64.8
		45	93.2			45	78.7
		60	100.0			60	96.4
		75				75	100.0
0-G5	14.98	0	23.1	0-G6	15.02	0	23.1
		15	57.2			15	54.2
		30	76.0			30	73.0
		45	94.8			45	92.5
		60	100.0			60	100.0
		75				75	
0-H5	15.02	0	23.2	0-H6	15.01	0	23.0
		15	57.5			15	55.6
		30	76.7			30	72.7
		45	97.4			45	93.7
		60	100.0			60	100.0
		75				75	

Table B 14 - Raw data sheet for level 1 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A7	15.00	0	23.2	0-A8	15.00	0	23.2
		15	54.7			15	52.1
		30	75.8			30	70.1
		45	100.0			45	88.3
		60				60	100.0
		75				75	
0-B7	15.02	0	23.0	0-B8	15.02	0	23.0
		15	56.7			15	55.0
		30	78.9			30	73.1
		45	100.0			45	89.9
		60				60	100.0
		75				75	
0-C7	15.01	0	23.2	0-C8	15.01	0	23.1
		15	59.6			15	52.4
		30	81.2			30	69.9
		45	100.0			45	86.1
		60				60	100.0
		75				75	
0-D7	14.99	0	22.9	0-D8	15.02	0	23.2
		15	57.7			15	50.3
		30	80.5			30	68.4
		45	100.0			45	88.6
		60				60	100.0
		75				75	
0-E7	14.99	0	23.2	0-E8	14.98	0	22.9
		15	57.6			15	52.8
		30	78.2			30	70.7
		45	100.0			45	93.1
		60				60	100.0
		75				75	
0-F7	15.00	0	23.1	0-F8	15.01	0	22.9
		15	57.6			15	55.5
		30	81.9			30	75.7
		45	100.0			45	100.0
		60				60	
		75				75	
0-G7	15.02	0	23.1	0-G8	15.02	0	23.0
		15	57.7			15	56.3
		30	78.1			30	75.5
		45	100.0			45	93.9
		60				60	100.0
		75				75	
0-H7	14.99	0	23.0	0-H8	14.99	0	23.0
		15	57.5			15	51.8
		30	78.7			30	66.4
		45	100.0			45	79.9
		60				60	96.7
		75				75	100.0

Table B 15 - Raw data sheet for level 1 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A9	14.99	0	22.9	0-A10	14.98	0	23.0
		15	49.9			15	46.0
		30	68.7			30	61.0
		45	88.1			45	72.4
		60	100.0			60	87.9
		75				75	100.0
0-B9	15.01	0	22.9	0-B10	14.99	0	22.9
		15	54.9			15	51.5
		30	72.7			30	70.5
		45	90.6			45	92.0
		60	100.0			60	100.0
		75				75	
0-C9	15.00	0	23.1	0-C10	15.01	0	23.2
		15	59.7			15	59.5
		30	79.4			30	77.9
		45	100.0			45	95.0
		60				60	100.0
		75				75	
0-D9	15.01	0	22.9	0-D10	15.02	0	23.1
		15	55.2			15	50.4
		30	72.8			30	68.0
		45	88.0			45	83.7
		60	100.0			60	100.0
		75				75	
0-E9	14.99	0	22.9	0-E10	14.99	0	23.0
		15	56.7			15	51.9
		30	74.3			30	68.7
		45	100.0			45	84.0
		60				60	100.0
		75				75	
0-F9	15.01	0	23.1	0-F10	15.01	0	23.1
		15	59.2			15	53.2
		30	79.9			30	78.7
		45	100.0			45	100.0
		60				60	
		75				75	
0-G9	15.00	0	23.2	0-G10	15.02	0	23.2
		15	53.9			15	49.8
		30	72.0			30	68.0
		45	87.9			45	86.8
		60	100.0			60	100.0
		75				75	
0-H9	15.00	0	23.1	0-H10	15.02	0	23.0
		15	57.5			15	51.0
		30	78.6			30	69.5
		45	100.0			45	82.8
		60				60	96.7
		75				75	100.0

Table B 16 - Raw data sheet for level 1 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A1	15.00	0	23.0	0-A2	14.99	0	23.0
		15	46.7			15	48.6
		30	62.6			30	65.9
		45	75.0			45	78.2
		60	90.4			60	91.4
		75	100.0			75	100.0
0-B1	15.01	0	23.1	0-B2	15.00	0	23.1
		15	51.0			15	49.9
		30	67.0			30	67.1
		45	80.9			45	78.5
		60	100.0			60	91.9
		75				75	100.0
0-C1	15.01	0	23.1	0-C2	15.02	0	22.9
		15	57.9			15	56.9
		30	79.4			30	74.7
		45	100.0			45	90.1
		60				60	100.0
		75				75	
0-D1	14.99	0	23.1	0-D2	15.00	0	22.9
		15	49.0			15	54.7
		30	64.8			30	71.6
		45	78.4			45	89.8
		60	94.5			60	100.0
		75	100.0			75	
0-E1	15.01	0	23.0	0-E2	15.00	0	23.2
		15	53.3			15	57.7
		30	69.7			30	78.4
		45	84.3			45	100.0
		60	100.0			60	
		75				75	
0-F1	15.02	0	23.1	0-F2	15.01	0	23.1
		15	59.2			15	58.6
		30	83.7			30	78.5
		45	100.0			45	100.0
		60				60	
		75				75	
0-G1	14.99	0	22.9	0-G2	14.99	0	23.2
		15	54.1			15	53.2
		30	72.5			30	69.2
		45	93.0			45	82.5
		60	100.0			60	100.0
		75				75	
0-H1	15.00	0	22.9	0-H2	15.00	0	23.2
		15	53.1			15	55.1
		30	72.7			30	72.8
		45	95.2			45	90.2
		60	100.0			60	100.0
		75				75	

Table B 17 - Raw data sheet for level 1 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A3	15.00	0	23.2	0-A4	14.99	0	22.9
		15	55.0			15	56.1
		30	73.3			30	78.3
		45	91.2			45	100.0
		60	100.0			60	
		75				75	
0-B3	15.02	0	23.0	0-B4	15.02	0	23.2
		15	55.9			15	62.4
		30	74.1			30	86.4
		45	90.1			45	100.0
		60	100.0			60	
		75				75	
0-C3	15.01	0	23.2	0-C4	14.98	0	23.1
		15	58.4			15	62.2
		30	77.8			30	91.4
		45	100.0			45	100.0
		60				60	
		75				75	
0-D3	15.01	0	23.2	0-D4	15.00	0	23.1
		15	57.4			15	60.7
		30	77.6			30	83.2
		45	100.0			45	100.0
		60				60	
		75				75	
0-E3	15.02	0	22.9	0-E4	14.99	0	23.2
		15	51.6			15	60.2
		30	67.4			30	81.2
		45	80.9			45	100.0
		60	100.0			60	
		75				75	
0-F3	14.99	0	23.2	0-F4	14.98	0	22.9
		15	57.7			15	59.3
		30	78.1			30	77.6
		45	100.0			45	100.0
		60				60	
		75				75	
0-G3	15.02	0	22.9	0-G4	15.02	0	22.9
		15	55.2			15	56.7
		30	71.4			30	76.1
		45	87.9			45	100.0
		60	100.0			60	
		75				75	
0-H3	14.98	0	23.2	0-H4	14.98	0	23.1
		15	50.6			15	52.1
		30	65.8			30	70.1
		45	77.8			45	86.6
		60	88.4			60	100.0
		75	100.0			75	

Table B 18 - Raw data sheet for level 1 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A5	15.01	0	23.0	0-A6	15.00	0	22.8
		15	57.1			15	58.5
		30	81.0			30	88.0
		45	100.0			45	100.0
		60				60	
		75				75	
0-B5	14.99	0	22.9	0-B6	15.02	0	23.1
		15	59.1			15	61.5
		30	82.3			30	90.9
		45	100.0			45	100.0
		60				60	
		75				75	
0-C5	15.02	0	23.0	0-C6	14.99	0	23.2
		15	54.6			15	56.2
		30	74.2			30	75.0
		45	93.5			45	90.9
		60	100.0			60	100.0
		75				75	
0-D5	15.01	0	22.9	0-D6	14.98	0	23.1
		15	52.7			15	53.3
		30	71.0			30	71.9
		45	88.8			45	88.9
		60	100.0			60	100.0
		75				75	
0-E5	15.00	0	22.8	0-E6	15.00	0	22.9
		15	57.4			15	51.0
		30	77.3			30	67.3
		45	100.0			45	80.7
		60				60	100.0
		75				75	
0-F5	14.99	0	22.9	0-F6	15.01	0	22.8
		15	55.0			15	49.3
		30	75.4			30	64.7
		45	93.1			45	78.5
		60	100.0			60	96.5
		75				75	100.0
0-G5	14.98	0	23.1	0-G6	15.02	0	23.1
		15	57.0			15	54.3
		30	77.0			30	74.0
		45	94.4			45	91.9
		60	100.0			60	100.0
		75				75	
0-H5	14.98	0	23.2	0-H6	15.00	0	23.0
		15	57.0			15	55.7
		30	77.1			30	72.5
		45	96.4			45	94.0
		60	100.0			60	100.0
		75				75	

Table B 19 - Raw data sheet for level 1 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A7	15.01	0	23.1	0-A8	14.99	0	22.9
		15	54.8			15	52.3
		30	75.7			30	70.0
		45	100.0			45	89.1
		60				60	100.0
		75				75	
0-B7	15.02	0	22.8	0-B8	15.01	0	23.0
		15	56.8			15	55.4
		30	79.0			30	73.4
		45	100.0			45	90.0
		60				60	100.0
		75				75	
0-C7	15.00	0	23.2	0-C8	14.98	0	23.1
		15	59.4			15	52.0
		30	81.0			30	69.7
		45	100.0			45	87.0
		60				60	100.0
		75				75	
0-D7	14.98	0	22.9	0-D8	15.00	0	23.0
		15	57.4			15	50.5
		30	80.3			30	68.0
		45	100.0			45	88.0
		60				60	100.0
		75				75	
0-E7	14.99	0	22.9	0-E8	15.01	0	23.0
		15	57.4			15	51.9
		30	79.0			30	71.0
		45	100.0			45	93.6
		60				60	100.0
		75				75	
0-F7	15.00	0	22.8	0-F8	15.02	0	23.0
		15	57.3			15	55.4
		30	81.0			30	76.1
		45	100.0			45	100.0
		60				60	
		75				75	
0-G7	15.01	0	22.9	0-G8	15.01	0	22.8
		15	57.6			15	56.1
		30	78.3			30	75.4
		45	100.0			45	93.7
		60				60	100.0
		75				75	
0-H7	15.01	0	23.1	0-H8	15.01	0	23.1
		15	57.3			15	51.7
		30	78.7			30	66.8
		45	100.0			45	79.4
		60				60	96.9
		75				75	100.0

Table B 20 - Raw data sheet for level 1 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
0-A9	14.98	0	23.1	0-A10	15.01	0	23.2
		15	50.3			15	45.3
		30	68.4			30	60.5
		45	88.2			45	72.7
		60	100.0			60	88.2
		75				75	100.0
0-B9	15.02	0	23.0	0-B10	15.00	0	23.2
		15	54.4			15	51.5
		30	72.1			30	70.1
		45	90.7			45	91.9
		60	100.0			60	100.0
		75				75	
0-C9	15.01	0	23.1	0-C10	15.01	0	23.0
		15	59.7			15	59.3
		30	79.1			30	77.4
		45	100.0			45	95.3
		60				60	100.0
		75				75	
0-D9	15.02	0	23.0	0-D10	15.01	0	23.0
		15	55.0			15	50.2
		30	73.1			30	68.7
		45	88.5			45	83.1
		60	100.0			60	100.0
		75				75	
0-E9	15.00	0	23.2	0-E10	15.00	0	23.0
		15	56.2			15	51.3
		30	73.9			30	68.6
		45	100.0			45	83.5
		60				60	100.0
		75				75	
0-F9	14.99	0	23.0	0-F10	14.98	0	23.2
		15	58.9			15	53.5
		30	79.2			30	78.6
		45	100.0			45	100.0
		60				60	
		75				75	
0-G9	15.02	0	23.0	0-G10	14.99	0	23.2
		15	53.7			15	49.4
		30	71.5			30	68.5
		45	88.4			45	86.6
		60	100.0			60	100.0
		75				75	
0-H9	15.02	0	23.2	0-H10	14.99	0	23.2
		15	56.7			15	50.4
		30	78.6			30	69.1
		45	100.0			45	82.9
		60				60	96.9
		75				75	100.0

Table B 21 - Raw data sheet for level 2 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A1	15.01	0	23.1	1-A2	14.98	0	22.9
		15	52.4			15	52.7
		30	69.7			30	70.7
		45	80.4			45	84.6
		60	96.7			60	100.0
		75	100.0			75	
1-B1	14.99	0	23.2	1-B2	15.02	0	22.8
		15	51.6			15	58.3
		30	68.9			30	77.9
		45	79.4			45	96.8
		60	95.4			60	100.0
		75	100.0			75	
1-C1	14.98	0	23.1	1-C2	15.00	0	23.0
		15	55.4			15	54.6
		30	71.0			30	72.5
		45	84.1			45	85.4
		60	100.0			60	100.0
		75				75	
1-D1	15.00	0	22.9	1-D2	14.99	0	23.1
		15	57.3			15	55.5
		30	76.7			30	73.9
		45	96.3			45	92.9
		60	100.0			60	100.0
		75				75	
1-E1	15.01	0	22.9	1-E2	14.98	0	22.8
		15	56.9			15	57.6
		30	75.0			30	78.0
		45	100.0			45	100.0
		60				60	
		75				75	
1-F1	15.02	0	23.1	1-F2	15.00	0	23.2
		15	58.6			15	54.9
		30	76.7			30	73.9
		45	95.2			45	86.7
		60	100.0			60	100.0
		75				75	
1-G1	15.01	0	23.2	1-G2	14.99	0	23.1
		15	50.3			15	51.3
		30	64.7			30	66.8
		45	76.4			45	76.9
		60	87.9			60	88.4
		75	100.0			75	100.0
1-H1	15.02	0	23.1	1-H2	15.02	0	23.0
		15	54.7			15	49.7
		30	72.7			30	69.6
		45	86.8			45	82.4
		60	100.0			60	100.0
		75				75	

Table B 22 - Raw data sheet for level 2 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A3	14.99	0	23.2	1-A4	15.01	0	22.9
		15	46.1			15	50.4
		30	61.0			30	70.0
		45	72.5			45	88.3
		60	83.0			60	100.0
		75	100.0			75	
1-B3	15.02	0	23.1	1-B4	15.00	0	22.9
		15	49.0			15	53.4
		30	63.0			30	73.2
		45	75.6			45	93.6
		60	88.0			60	100.0
		75	100.0			75	
1-C3	15.01	0	22.9	1-C4	15.00	0	22.8
		15	50.0			15	55.7
		30	66.7			30	75.8
		45	79.4			45	100.0
		60	100.0			60	
		75				75	
1-D3	14.98	0	23.0	1-D4	14.99	0	23.0
		15	52.4			15	52.0
		30	70.6			30	75.6
		45	88.6			45	97.6
		60	100.0			60	100.0
		75				75	
1-E3	15.01	0	22.9	1-E4	15.02	0	23.1
		15	50.0			15	54.0
		30	66.4			30	76.0
		45	82.0			45	100.0
		60	100.0			60	
		75				75	
1-F3	14.99	0	23.2	1-F4	15.00	0	23.1
		15	46.7			15	49.0
		30	60.5			30	68.4
		45	73.0			45	89.0
		60	83.4			60	100.0
		75	100.0			75	
1-G3	15.02	0	22.8	1-G4	15.00	0	22.9
		15	50.0			15	51.0
		30	67.4			30	70.0
		45	81.0			45	86.4
		60	100.0			60	100.0
		75				75	
1-H3	15.01	0	22.9	1-H4	14.99	0	22.8
		15	52.4			15	51.5
		30	73.6			30	71.3
		45	91.5			45	91.0
		60	100.0			60	100.0
		75				75	

Table B 23 - Raw data sheet for level 2 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A5	15.01	0	23.0	1-A6	15.02	0	23.2
		15	53.5			15	54.5
		30	75.4			30	73.8
		45	96.0			45	92.5
		60	100.0			60	100.0
		75				75	
1-B5	15.02	0	23.0	1-B6	15.02	0	23.0
		15	51.3			15	50.5
		30	68.4			30	67.5
		45	81.4			45	81.9
		60	100.0			60	100.0
		75				75	
1-C5	15.02	0	23.2	1-C6	14.99	0	22.8
		15	53.9			15	51.0
		30	71.7			30	68.7
		45	88.4			45	86.1
		60	100.0			60	100.0
		75				75	
1-D5	15.02	0	22.9	1-D6	15.02	0	23.2
		15	50.1			15	46.7
		30	72.9			30	63.7
		45	100.0			45	79.9
		60				60	100.0
		75				75	
1-E5	15.02	0	23.2	1-E6	15.02	0	23.0
		15	50.5			15	52.3
		30	73.6			30	74.8
		45	100.0			45	100.0
		60				60	
		75				75	
1-F5	14.99	0	23.1	1-F6	15.02	0	23.0
		15	53.0			15	52.7
		30	71.6			30	72.1
		45	91.7			45	96.1
		60	100.0			60	100.0
		75				75	
1-G5	14.99	0	22.9	1-G6	15.01	0	22.8
		15	48.9			15	51.6
		30	69.0			30	70.2
		45	87.8			45	88.2
		60	100.0			60	100.0
		75				75	
1-H5	15.02	0	22.8	1-H6	15.00	0	23.0
		15	47.8			15	50.8
		30	67.0			30	70.9
		45	80.3			45	91.0
		60	100.0			60	100.0
		75				75	

Table B 24 - Raw data sheet for level 2 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A7	15.02	0	23.0	1-A8	15.00	0	23.1
		15	61.5			15	49.0
		30	89.6			30	63.7
		45	100.0			45	75.5
		60				60	87.9
		75				75	100.0
1-B7	14.98	0	22.8	1-B8	15.01	0	22.9
		15	53.5			15	46.2
		30	76.0			30	62.8
		45	96.5			45	73.7
		60	100.0			60	83.9
		75				75	100.0
1-C7	14.98	0	23.1	1-C8	15.01	0	23.2
		15	50.0			15	51.7
		30	67.6			30	68.7
		45	83.3			45	85.6
		60	100.0			60	100.0
		75				75	
1-D7	15.00	0	22.9	1-D8	15.01	0	23.2
		15	49.4			15	42.4
		30	71.5			30	59.0
		45	100.0			45	72.7
		60				60	100.0
		75				75	
1-E7	14.99	0	23.1	1-E8	14.99	0	23.1
		15	48.7			15	50.0
		30	71.5			30	71.8
		45	93.6			45	100.0
		60	100.0			60	
		75				75	
1-F7	14.98	0	22.9	1-F8	14.99	0	23.2
		15	57.6			15	52.6
		30	80.8			30	73.6
		45	100.0			45	100.0
		60				60	
		75				75	
1-G7	14.98	0	23.0	1-G8	14.98	0	23.1
		15	49.4			15	48.9
		30	68.9			30	66.3
		45	83.9			45	80.2
		60	100.0			60	100.0
		75				75	
1-H7	15.01	0	22.8	1-H8	15.00	0	22.9
		15	52.8			15	47.9
		30	78.1			30	65.1
		45	93.4			45	79.7
		60	100.0			60	92.6
		75				75	100.0

Table B 25 - Raw data sheet for level 2 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)		Location	DI water (g)	Time (s)	Temperature (°C)
1-A9	14.98	0	23.1		1-A10	14.99	0	23.0
		15	48.9				15	53.4
		30	66.1				30	70.0
		45	81.4				45	87.4
		60	100.0				60	100.0
		75					75	
1-B9	14.98	0	23.0		1-B10	14.98	0	23.0
		15	48.0				15	50.8
		30	64.3				30	66.4
		45	77.1				45	78.7
		60	89.0				60	97.1
		75	100.0				75	100.0
1-C9	14.99	0	23.1		1-C10	14.98	0	22.9
		15	56.0				15	51.0
		30	73.7				30	71.9
		45	90.4				45	89.6
		60	100.0				60	100.0
		75					75	
1-D9	14.98	0	22.9		1-D10	15.00	0	22.8
		15	49.0				15	51.0
		30	80.8				30	70.7
		45	100.0				45	97.1
		60					60	100.0
		75					75	
1-E9	15.02	0	22.9		1-E10	15.00	0	22.9
		15	51.3				15	51.6
		30	71.6				30	72.3
		45	100.0				45	100.0
		60					60	
		75					75	
1-F9	15.00	0	23.1		1-F10	14.98	0	23.0
		15	51.0				15	50.0
		30	69.1				30	69.0
		45	90.1				45	100.0
		60	100.0				60	
		75					75	
1-G9	15.02	0	23.2		1-G10	14.98	0	23.1
		15	48.1				15	50.8
		30	67.6				30	74.1
		45	80.4				45	100.0
		60	100.0				60	
		75					75	
1-H9	14.99	0	23.1		1-H10	15.00	0	23.2
		15	49.4				15	46.0
		30	68.0				30	63.1
		45	84.9				45	81.4
		60	100.0				60	100.0
		75					75	

Table B 26 - Raw data sheet for level 2 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A1	15.02	0	23.0	1-A2	14.98	0	23.2
		15	52.7			15	52.5
		30	69.1			30	70.0
		45	79.9			45	84.4
		60	96.9			60	100.0
		75	100.0			75	
1-B1	15.01	0	22.9	1-B2	15.00	0	23.2
		15	51.1			15	57.8
		30	68.7			30	77.6
		45	79.1			45	97.3
		60	95.3			60	100.0
		75	100.0			75	
1-C1	15.00	0	23.1	1-C2	14.98	0	22.9
		15	55.1			15	53.9
		30	70.1			30	72.0
		45	83.6			45	85.2
		60	100.0			60	100.0
		75				75	
1-D1	15.00	0	23.1	1-D2	15.02	0	23.1
		15	56.7			15	55.1
		30	76.1			30	73.8
		45	95.7			45	92.6
		60	100.0			60	100.0
		75				75	
1-E1	14.98	0	23.2	1-E2	15.02	0	23.1
		15	56.9			15	58.0
		30	74.4			30	77.5
		45	100.0			45	100.0
		60				60	
		75				75	
1-F1	15.02	0	23.0	1-F2	15.02	0	22.9
		15	58.3			15	55.1
		30	76.1			30	73.0
		45	95.2			45	86.3
		60	100.0			60	100.0
		75				75	
1-G1	14.98	0	23.1	1-G2	15.01	0	23.2
		15	50.1			15	51.2
		30	64.5			30	66.2
		45	76.4			45	76.8
		60	87.5			60	88.6
		75	100.0			75	100.0
1-H1	15.00	0	22.9	1-H2	14.98	0	23.2
		15	54.5			15	49.5
		30	73.2			30	69.1
		45	87.0			45	81.8
		60	100.0			60	100.0
		75				75	

Table B 27 - Raw data sheet for level 2 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A3	15.02	0	23.0	1-A4	15.01	0	23.1
		15	46.2			15	49.5
		30	60.8			30	69.9
		45	72.7			45	87.9
		60	82.9			60	100.0
		75	100.0			75	
1-B3	15.01	0	23.2	1-B4	15.02	0	22.9
		15	48.6			15	53.7
		30	63.3			30	73.1
		45	75.1			45	93.4
		60	87.1			60	100.0
		75	100.0			75	
1-C3	14.98	0	22.9	1-C4	14.98	0	23.2
		15	49.2			15	55.4
		30	66.4			30	75.1
		45	79.6			45	100.0
		60	100.0			60	
		75				75	
1-D3	14.99	0	23.1	1-D4	14.99	0	23.2
		15	52.7			15	51.7
		30	70.0			30	75.1
		45	88.8			45	97.7
		60	100.0			60	100.0
		75				75	
1-E3	15.00	0	22.8	1-E4	15.00	0	23.0
		15	49.9			15	54.1
		30	66.3			30	75.5
		45	81.3			45	100.0
		60	100.0			60	
		75				75	
1-F3	15.02	0	23.1	1-F4	14.99	0	22.9
		15	46.2			15	48.6
		30	60.5			30	68.7
		45	72.6			45	88.3
		60	82.8			60	100.0
		75	100.0			75	
1-G3	15.00	0	22.8	1-G4	15.00	0	23.1
		15	50.4			15	50.6
		30	67.0			30	69.4
		45	80.7			45	86.3
		60	100.0			60	100.0
		75				75	
1-H3	15.00	0	23.2	1-H4	14.98	0	23.2
		15	52.3			15	51.7
		30	72.6			30	71.0
		45	91.7			45	90.7
		60	100.0			60	100.0
		75				75	

Table B 28 - Raw data sheet for level 2 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A5	15.00	0	22.9	1-A6	15.00	0	22.9
		15	53.5			15	55.0
		30	75.3			30	74.0
		45	96.3			45	93.1
		60	100.0			60	100.0
		75				75	
1-B5	14.99	0	23.0	1-B6	14.98	0	22.8
		15	51.4			15	50.7
		30	67.8			30	68.4
		45	82.0			45	82.4
		60	100.0			60	100.0
		75				75	
1-C5	15.01	0	22.9	1-C6	14.98	0	23.0
		15	54.0			15	51.5
		30	71.9			30	68.5
		45	89.0			45	86.2
		60	100.0			60	100.0
		75				75	
1-D5	15.00	0	23.0	1-D6	14.99	0	23.1
		15	50.0			15	47.0
		30	73.0			30	64.7
		45	100.0			45	80.0
		60				60	100.0
		75				75	
1-E5	15.01	0	22.9	1-E6	14.98	0	23.2
		15	51.0			15	52.6
		30	74.2			30	74.9
		45	100.0			45	100.0
		60				60	
		75				75	
1-F5	15.00	0	23.0	1-F6	14.99	0	23.1
		15	53.4			15	53.6
		30	72.0			30	73.0
		45	91.8			45	96.5
		60	100.0			60	100.0
		75				75	
1-G5	15.02	0	23.1	1-G6	15.01	0	23.0
		15	49.0			15	52.0
		30	69.4			30	70.4
		45	87.5			45	89.0
		60	100.0			60	100.0
		75				75	
1-H5	15.02	0	23.2	1-H6	14.98	0	23.0
		15	47.1			15	51.4
		30	67.4			30	70.8
		45	80.4			45	91.5
		60	100.0			60	100.0
		75				75	

Table B 29 - Raw data sheet for level 2 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A7	15.01	0	22.9	1-A8	14.98	0	22.8
		15	61.4			15	48.6
		30	89.4			30	63.9
		45	100.0			45	75.4
		60				60	87.4
		75		75	100.0		
1-B7	15.01	0	23.1	1-B8	14.99	0	23.0
		15	53.6			15	46.1
		30	75.0			30	62.4
		45	96.4			45	73.5
		60	100.0			60	83.7
		75		75	100.0		
1-C7	14.99	0	22.8	1-C8	15.01	0	22.9
		15	49.6			15	51.3
		30	67.9			30	68.6
		45	83.1			45	85.4
		60	100.0			60	100.0
		75		75			
1-D7	15.00	0	23.0	1-D8	15.02	0	22.9
		15	49.0			15	42.8
		30	72.0			30	58.9
		45	100.0			45	72.7
		60				60	100.0
		75		75			
1-E7	14.98	0	23.1	1-E8	15.02	0	23.2
		15	48.8			15	49.7
		30	71.6			30	71.7
		45	93.4			45	100.0
		60	100.0			60	
		75		75			
1-F7	14.98	0	23.0	1-F8	15.01	0	23.0
		15	57.5			15	52.3
		30	80.4			30	73.1
		45	100.0			45	100.0
		60				60	
		75		75			
1-G7	15.01	0	22.9	1-G8	14.99	0	22.9
		15	49.3			15	48.7
		30	68.9			30	66.7
		45	84.6			45	80.4
		60	100.0			60	100.0
		75		75			
1-H7	15.02	0	23.0	1-H8	14.99	0	23.0
		15	52.6			15	48.4
		30	78.1			30	65.3
		45	93.7			45	79.6
		60	100.0			60	92.6
		75		75	100.0		

Table B 30 - Raw data sheet for level 2 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A9	15.00	0	22.9	1-A10	14.99	0	22.8
		15	48.4			15	53.6
		30	66.8			30	69.8
		45	81.6			45	87.1
		60	100.0			60	100.0
		75				75	
1-B9	15.02	0	23.0	1-B10	15.01	0	23.1
		15	48.3			15	50.7
		30	64.0			30	66.0
		45	77.6			45	79.1
		60	88.8			60	96.9
		75	100.0			75	100.0
1-C9	15.01	0	23.0	1-C10	15.00	0	23.0
		15	55.8			15	51.2
		30	73.9			30	72.1
		45	90.2			45	90.1
		60	100.0			60	100.0
		75				75	
1-D9	14.98	0	23.0	1-D10	14.99	0	23.1
		15	49.4			15	51.0
		30	80.9			30	70.7
		45	100.0			45	97.0
		60				60	100.0
		75				75	
1-E9	14.98	0	22.9	1-E10	15.00	0	22.9
		15	51.3			15	51.9
		30	71.4			30	72.4
		45	100.0			45	100.0
		60				60	
		75				75	
1-F9	15.00	0	22.8	1-F10	15.01	0	22.8
		15	50.9			15	49.8
		30	69.3			30	68.7
		45	90.2			45	100.0
		60	100.0			60	
		75				75	
1-G9	14.99	0	22.9	1-G10	15.01	0	23.0
		15	47.9			15	51.0
		30	68.0			30	74.2
		45	80.0			45	100.0
		60	100.0			60	
		75				75	
1-H9	14.99	0	23.2	1-H10	15.02	0	23.1
		15	49.5			15	45.8
		30	67.9			30	62.7
		45	85.7			45	81.5
		60	100.0			60	100.0
		75				75	

Table B 31 - Raw data sheet for level 2 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A1	14.99	0	23.1	1-A2	14.98	0	23.0
		15	52.6			15	53.0
		30	69.0			30	70.4
		45	80.0			45	84.7
		60	97.0			60	100.0
		75	100.0			75	
1-B1	15.02	0	22.9	1-B2	15.01	0	22.9
		15	51.0			15	58.0
		30	69.0			30	77.0
		45	79.4			45	97.0
		60	95.4			60	100.0
		75	100.0			75	
1-C1	14.99	0	22.8	1-C2	15.00	0	22.9
		15	55.3			15	54.0
		30	70.1			30	72.7
		45	84.0			45	86.0
		60	100.0			60	100.0
		75				75	
1-D1	14.98	0	23.1	1-D2	15.00	0	23.0
		15	57.0			15	55.7
		30	76.1			30	74.0
		45	96.0			45	93.0
		60	100.0			60	100.0
		75				75	
1-E1	15.00	0	23.2	1-E2	15.01	0	23.2
		15	57.3			15	58.4
		30	74.9			30	77.9
		45	100.0			45	100.0
		60				60	
		75				75	
1-F1	14.98	0	23.0	1-F2	14.99	0	22.9
		15	59.0			15	55.4
		30	76.9			30	73.7
		45	95.0			45	87.0
		60	100.0			60	100.0
		75				75	
1-G1	15.00	0	22.9	1-G2	15.01	0	22.9
		15	50.7			15	51.0
		30	64.7			30	66.4
		45	76.0			45	76.4
		60	88.0			60	89.0
		75	100.0			75	100.0
1-H1	15.01	0	22.9	1-H2	14.99	0	23.0
		15	55.0			15	49.3
		30	73.0			30	69.7
		45	87.6			45	81.9
		60	100.0			60	100.0
		75				75	

Table B 32 - Raw data sheet for level 2 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A3	14.98	0	23.0	1-A4	14.98	0	23.0
		15	46.3			15	49.9
		30	60.4			30	70.4
		45	72.8			45	88.1
		60	82.7			60	100.0
		75	100.0			75	
1-B3	15.01	0	22.9	1-B4	15.00	0	22.9
		15	48.4			15	53.8
		30	63.4			30	73.0
		45	75.9			45	93.0
		60	87.6			60	100.0
		75	100.0			75	
1-C3	15.02	0	22.9	1-C4	15.00	0	23.0
		15	49.4			15	55.6
		30	66.6			30	75.7
		45	79.9			45	100.0
		60	100.0			60	
		75				75	
1-D3	15.02	0	23.1	1-D4	15.01	0	23.1
		15	52.5			15	51.9
		30	70.4			30	75.4
		45	88.3			45	97.0
		60	100.0			60	100.0
		75				75	
1-E3	14.99	0	23.2	1-E4	14.99	0	23.0
		15	50.1			15	54.7
		30	65.9			30	76.2
		45	81.2			45	100.0
		60	100.0			60	
		75				75	
1-F3	15.02	0	22.9	1-F4	15.00	0	23.0
		15	46.0			15	49.3
		30	60.4			30	68.3
		45	72.4			45	88.1
		60	82.7			60	100.0
		75	100.0			75	
1-G3	15.01	0	22.9	1-G4	15.01	0	22.9
		15	51.0			15	51.3
		30	67.3			30	69.4
		45	80.4			45	86.7
		60	100.0			60	100.0
		75				75	
1-H3	14.99	0	23.0	1-H4	14.98	0	23.1
		15	52.6			15	51.6
		30	72.8			30	71.7
		45	91.3			45	90.2
		60	100.0			60	100.0
		75				75	

Table B 33 - Raw data sheet for level 2 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A5	14.99	0	23.0	1-A6	14.98	0	23.2
		15	53.4			15	55.2
		30	75.9			30	74.2
		45	96.1			45	93.7
		60	100.0			60	100.0
		75				75	
1-B5	15.00	0	23.1	1-B6	14.98	0	23.1
		15	51.0			15	50.8
		30	67.9			30	68.1
		45	81.4			45	82.1
		60	100.0			60	100.0
		75				75	
1-C5	14.98	0	22.9	1-C6	15.01	0	23.2
		15	53.7			15	51.3
		30	71.6			30	68.7
		45	88.6			45	86.4
		60	100.0			60	100.0
		75				75	
1-D5	14.98	0	22.8	1-D6	14.98	0	22.9
		15	50.6			15	47.4
		30	72.9			30	63.9
		45	100.0			45	80.4
		60				60	100.0
		75				75	
1-E5	14.98	0	22.8	1-E6	14.98	0	22.9
		15	50.4			15	52.5
		30	73.7			30	73.9
		45	100.0			45	100.0
		60				60	
		75				75	
1-F5	15.01	0	22.8	1-F6	14.98	0	23.1
		15	53.6			15	52.9
		30	71.8			30	73.1
		45	92.0			45	96.4
		60	100.0			60	100.0
		75				75	
1-G5	15.01	0	23.0	1-G6	14.99	0	23.1
		15	48.6			15	52.4
		30	69.6			30	70.6
		45	87.8			45	88.7
		60	100.0			60	100.0
		75				75	
1-H5	14.98	0	23.1	1-H6	15.00	0	23.1
		15	47.4			15	51.2
		30	67.8			30	70.6
		45	80.6			45	91.7
		60	100.0			60	100.0
		75				75	

Table B 34 - Raw data sheet for level 2 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A7	15.01	0	23.1	1-A8	15.02	0	23.1
		15	61.0			15	48.4
		30	90.0			30	64.1
		45	100.0			45	75.6
		60				60	88.0
		75				75	100.0
1-B7	14.98	0	23.1	1-B8	14.99	0	23.2
		15	53.4			15	46.4
		30	75.4			30	62.1
		45	96.9			45	73.5
		60	100.0			60	83.5
		75				75	100.0
1-C7	15.00	0	23.0	1-C8	15.01	0	23.0
		15	49.4			15	51.0
		30	68.0			30	68.8
		45	83.0			45	85.0
		60	100.0			60	100.0
		75				75	
1-D7	15.02	0	22.9	1-D8	15.02	0	22.8
		15	48.9			15	42.4
		30	72.1			30	58.7
		45	100.0			45	73.0
		60				60	100.0
		75				75	
1-E7	14.99	0	22.8	1-E8	15.01	0	22.9
		15	49.0			15	49.6
		30	72.0			30	71.6
		45	93.5			45	100.0
		60	100.0			60	
		75				75	
1-F7	14.98	0	23.0	1-F8	15.02	0	23.0
		15	57.4			15	52.1
		30	80.7			30	73.2
		45	100.0			45	100.0
		60				60	
		75				75	
1-G7	14.99	0	23.1	1-G8	15.01	0	23.2
		15	49.6			15	49.0
		30	69.6			30	66.0
		45	84.1			45	80.0
		60	100.0			60	100.0
		75				75	
1-H7	15.01	0	23.2	1-H8	14.99	0	23.2
		15	52.4			15	48.1
		30	78.6			30	65.5
		45	93.8			45	79.2
		60	100.0			60	92.7
		75				75	100.0

Table B 35 - Raw data sheet for level 2 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A9	15.02	0	23.2	1-A10	15.01	0	23.2
		15	48.6			15	53.3
		30	66.5			30	69.6
		45	81.3			45	87.3
		60	100.0			60	100.0
		75				75	
1-B9	15.02	0	22.9	1-B10	15.02	0	23.1
		15	48.2			15	50.7
		30	64.1			30	66.1
		45	77.3			45	78.6
		60	88.7			60	97.0
		75	100.0			75	100.0
1-C9	15.01	0	23.2	1-C10	15.02	0	23.2
		15	55.9			15	51.1
		30	73.5			30	71.8
		45	90.3			45	89.8
		60	100.0			60	100.0
		75				75	
1-D9	15.02	0	22.9	1-D10	15.00	0	23.0
		15	49.4			15	51.3
		30	81.0			30	70.5
		45	100.0			45	97.2
		60				60	100.0
		75				75	
1-E9	14.98	0	23.0	1-E10	15.00	0	23.2
		15	51.2			15	51.5
		30	71.3			30	72.2
		45	100.0			45	100.0
		60				60	
		75				75	
1-F9	15.00	0	23.0	1-F10	15.02	0	22.9
		15	50.7			15	49.7
		30	69.0			30	68.8
		45	90.0			45	100.0
		60	100.0			60	
		75				75	
1-G9	14.98	0	23.0	1-G10	15.02	0	23.2
		15	47.9			15	51.0
		30	67.5			30	74.2
		45	80.1			45	100.0
		60	100.0			60	
		75				75	
1-H9	15.01	0	23.2	1-H10	15.00	0	22.9
		15	49.3			15	45.9
		30	68.1			30	63.2
		45	85.6			45	81.3
		60	100.0			60	100.0
		75				75	

Table B 36 - Raw data sheet for level 2 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A1	15.01	0	23.0	1-A2	15.00	0	23.0
		15	51.9			15	53.4
		30	68.6			30	70.6
		45	80.0			45	84.0
		60	96.7			60	100.0
		75	100.0			75	
1-B1	15.00	0	22.9	1-B2	14.98	0	22.9
		15	51.4			15	57.4
		30	69.4			30	77.6
		45	79.6			45	97.4
		60	95.7			60	100.0
		75	100.0			75	
1-C1	14.99	0	23.2	1-C2	15.01	0	23.1
		15	55.7			15	54.5
		30	71.0			30	72.1
		45	83.9			45	85.7
		60	100.0			60	100.0
		75				75	
1-D1	14.98	0	22.8	1-D2	15.00	0	23.2
		15	56.4			15	55.6
		30	76.5			30	73.7
		45	95.7			45	93.6
		60	100.0			60	100.0
		75				75	
1-E1	15.01	0	23.1	1-E2	14.98	0	22.9
		15	56.8			15	57.9
		30	74.7			30	77.6
		45	100.0			45	100.0
		60				60	
		75				75	
1-F1	14.99	0	23.1	1-F2	14.99	0	22.8
		15	58.7			15	55.6
		30	76.4			30	73.5
		45	95.4			45	86.6
		60	100.0			60	100.0
		75				75	
1-G1	15.00	0	23.1	1-G2	14.99	0	22.9
		15	50.7			15	51.4
		30	65.0			30	66.9
		45	76.1			45	76.9
		60	87.6			60	88.3
		75	100.0			75	100.0
1-H1	14.99	0	23.1	1-H2	15.01	0	23.1
		15	55.1			15	49.9
		30	72.8			30	69.4
		45	86.7			45	82.0
		60	100.0			60	100.0
		75				75	

Table B 37 - Raw data sheet for level 2 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A3	14.98	0	23.1	1-A4	14.99	0	23.0
		15	46.7			15	49.7
		30	60.6			30	69.4
		45	73.0			45	87.6
		60	82.6			60	100.0
		75	100.0			75	
1-B3	14.99	0	22.9	1-B4	14.98	0	23.0
		15	48.6			15	53.6
		30	63.3			30	72.9
		45	76.0			45	93.9
		60	87.4			60	100.0
		75	100.0			75	
1-C3	15.01	0	22.9	1-C4	15.02	0	22.8
		15	49.5			15	55.5
		30	66.9			30	75.5
		45	80.0			45	100.0
		60	100.0			60	
		75				75	
1-D3	15.01	0	23.1	1-D4	15.01	0	23.0
		15	52.6			15	51.6
		30	69.8			30	75.3
		45	88.6			45	97.3
		60	100.0			60	100.0
		75				75	
1-E3	15.00	0	22.9	1-E4	15.00	0	23.1
		15	49.7			15	54.4
		30	66.7			30	75.8
		45	81.3			45	100.0
		60	100.0			60	
		75				75	
1-F3	14.98	0	23.0	1-F4	15.01	0	23.0
		15	46.4			15	48.4
		30	60.0			30	69.0
		45	72.6			45	88.2
		60	82.9			60	100.0
		75	100.0			75	
1-G3	15.00	0	22.9	1-G4	15.00	0	22.9
		15	50.8			15	51.0
		30	67.7			30	69.8
		45	80.7			45	86.4
		60	100.0			60	100.0
		75				75	
1-H3	15.00	0	23.0	1-H4	15.02	0	23.1
		15	52.8			15	51.7
		30	73.0			30	71.3
		45	92.0			45	90.5
		60	100.0			60	100.0
		75				75	

Table B 38 - Raw data sheet for level 2 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A5	14.99	0	23.1	1-A6	15.01	0	23.2
		15	53.4			15	55.0
		30	75.7			30	74.6
		45	96.7			45	93.4
		60	100.0			60	100.0
		75				75	
1-B5	15.00	0	22.9	1-B6	15.02	0	22.9
		15	50.9			15	51.0
		30	68.3			30	67.9
		45	81.7			45	81.7
		60	100.0			60	100.0
		75				75	
1-C5	14.98	0	23.1	1-C6	15.01	0	23.0
		15	54.1			15	51.1
		30	71.7			30	68.7
		45	88.6			45	86.4
		60	100.0			60	100.0
		75				75	
1-D5	14.98	0	22.9	1-D6	15.02	0	23.0
		15	49.8			15	47.6
		30	72.6			30	63.8
		45	100.0			45	79.6
		60				60	100.0
		75				75	
1-E5	15.01	0	22.8	1-E6	14.98	0	23.1
		15	50.6			15	52.1
		30	73.9			30	74.0
		45	100.0			45	100.0
		60				60	
		75				75	
1-F5	15.02	0	22.8	1-F6	14.99	0	23.2
		15	54.0			15	52.8
		30	71.9			30	72.6
		45	92.4			45	95.9
		60	100.0			60	100.0
		75				75	
1-G5	14.98	0	22.9	1-G6	15.01	0	23.1
		15	48.7			15	51.7
		30	69.9			30	70.7
		45	87.9			45	88.8
		60	100.0			60	100.0
		75				75	
1-H5	14.99	0	23.1	1-H6	15.00	0	23.2
		15	47.6			15	51.0
		30	67.5			30	70.5
		45	80.9			45	91.8
		60	100.0			60	100.0
		75				75	

Table B 39 - Raw data sheet for level 2 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A7	14.98	0	23.1	1-A8	15.01	0	23.2
		15	61.1			15	48.3
		30	89.3			30	63.2
		45	100.0			45	75.4
		60				60	87.2
		75				75	100.0
1-B7	15.02	0	22.8	1-B8	15.02	0	23.2
		15	53.3			15	46.4
		30	75.3			30	62.0
		45	96.3			45	73.7
		60	100.0			60	83.9
		75				75	100.0
1-C7	15.02	0	23.2	1-C8	14.99	0	22.8
		15	49.3			15	51.2
		30	67.8			30	68.7
		45	82.6			45	84.8
		60	100.0			60	100.0
		75				75	
1-D7	15.00	0	22.8	1-D8	14.99	0	23.2
		15	48.6			15	42.4
		30	72.0			30	58.9
		45	100.0			45	72.7
		60				60	100.0
		75				75	
1-E7	14.99	0	23.0	1-E8	15.00	0	23.2
		15	48.6			15	49.4
		30	71.8			30	71.4
		45	93.8			45	100.0
		60	100.0			60	
		75				75	
1-F7	15.02	0	23.2	1-F8	15.01	0	23.2
		15	57.2			15	52.1
		30	80.9			30	73.1
		45	100.0			45	100.0
		60				60	
		75				75	
1-G7	15.02	0	23.1	1-G8	15.00	0	22.9
		15	49.2			15	48.5
		30	69.2			30	66.1
		45	83.6			45	79.8
		60	100.0			60	100.0
		75				75	
1-H7	14.99	0	23.2	1-H8	15.01	0	22.9
		15	52.3			15	47.5
		30	77.4			30	65.7
		45	93.6			45	79.1
		60	100.0			60	92.3
		75				75	100.0

Table B 40 - Raw data sheet for level 2 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
1-A9	15.01	0	23.0	1-A10	15.02	0	23.1
		15	49.0			15	53.7
		30	66.4			30	69.7
		45	81.7			45	87.3
		60	100.0			60	100.0
		75				75	
1-B9	14.98	0	22.8	1-B10	15.00	0	22.9
		15	48.4			15	50.6
		30	64.1			30	66.3
		45	77.4			45	78.9
		60	89.1			60	96.8
		75	100.0			75	100.0
1-C9	14.99	0	23.0	1-C10	15.01	0	23.1
		15	56.1			15	51.4
		30	73.6			30	71.6
		45	90.5			45	90.0
		60	100.0			60	100.0
		75				75	
1-D9	15.00	0	23.0	1-D10	15.00	0	23.1
		15	49.6			15	51.4
		30	81.1			30	70.6
		45	100.0			45	97.3
		60				60	100.0
		75				75	
1-E9	14.99	0	23.0	1-E10	15.01	0	23.2
		15	51.6			15	51.7
		30	71.5			30	72.4
		45	100.0			45	100.0
		60				60	
		75				75	
1-F9	15.00	0	23.1	1-F10	15.02	0	22.9
		15	50.8			15	50.2
		30	68.7			30	69.3
		45	90.3			45	100.0
		60	100.0			60	
		75				75	
1-G9	14.98	0	22.9	1-G10	14.99	0	22.8
		15	48.3			15	51.2
		30	67.7			30	74.6
		45	80.5			45	100.0
		60	100.0			60	
		75				75	
1-H9	15.00	0	23.0	1-H10	14.99	0	23.0
		15	49.7			15	46.3
		30	68.3			30	62.9
		45	85.7			45	81.3
		60	100.0			60	100.0
		75				75	

Table B 41 - Raw data sheet for level 3 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A1	14.99	0	23.1	2-A2	15.01	0	23.1
		15	57.9			15	50.6
		30	78.9			30	65.5
		45	100.0			45	76.1
		60				60	86.7
		75				75	100.0
2-B1	15.01	0	22.9	2-B2	14.98	0	22.8
		15	54.4			15	56.9
		30	75.7			30	75.9
		45	100.0			45	100.0
		60				60	
		75				75	
2-C1	15.00	0	22.9	2-C2	14.98	0	22.9
		15	50.7			15	49.3
		30	67.9			30	65.3
		45	79.3			45	77.7
		60	90.0			60	95.4
		75	100.0			75	100.0
2-D1	15.00	0	23.1	2-D2	15.02	0	23.2
		15	50.9			15	47.8
		30	70.4			30	65.1
		45	91.4			45	79.4
		60	100.0			60	97.7
		75				75	100.0
2-E1	15.00	0	23.0	2-E2	14.98	0	23.1
		15	52.7			15	49.1
		30	73.4			30	64.3
		45	4.7			45	76.8
		60	100.0			60	91.5
		75				75	100.0
2-F1	14.99	0	23.1	2-F2	14.98	0	23.1
		15	50.6			15	46.0
		30	68.4			30	60.7
		45	83.7			45	70.3
		60	100.0			60	79.0
		75				75	90.9
2-G1	14.99	0	23.1	2-G2	14.99	0	23.2
		15	50.8			15	52.6
		30	68.3			30	70.9
		45	82.7			45	86.3
		60	97.6			60	100.0
		75	100.0			75	
2-H1	14.98	0	23.0	2-H2	15.00	0	23.0
		15	55.7			15	55.9
		30	75.7			30	73.4
		45	94.2			45	91.7
		60	100.0			60	100.0
		75				75	

Table B 42 - Raw data sheet for level 3 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A3	15.01	0	22.9	2-A4	15.02	0	22.9
		15	45.1			15	52.8
		30	60.2			30	72.4
		45	71.4			45	90.8
		60	81.6			60	100.0
		75	97.2			75	
2-B3	15.00	0	23.1	2-B4	15.01	0	23.1
		15	49.7			15	49.8
		30	65.7			30	66.6
		45	79.3			45	81.0
		60	97.1			60	96.4
		75	100.0			75	100.0
2-C3	14.99	0	22.9	2-C4	14.98	0	22.8
		15	46.1			15	50.8
		30	62.4			30	70.9
		45	75.7			45	84.8
		60	94.7			60	100.0
		75	100.0			75	
2-D3	15.01	0	23.1	2-D4	14.98	0	22.9
		15	48.3			15	52.1
		30	65.7			30	64.9
		45	77.6			45	76.9
		60	94.2			60	88.8
		75	100.0			75	100.0
2-E3	15.02	0	22.9	2-E4	15.00	0	22.9
		15	47.6			15	49.7
		30	63.2			30	64.3
		45	76.4			45	77.7
		60	94.2			60	95.7
		75	100.0			75	100.0
2-F3	15.01	0	23.0	2-F4	15.01	0	23.1
		15	47.9			15	51.4
		30	63.1			30	68.1
		45	75.1			45	81.7
		60	87.6			60	100.0
		75	100.0			75	
2-G3	15.01	0	23.0	2-G4	15.00	0	23.2
		15	50.3			15	50.4
		30	64.7			30	70.6
		45	77.7			45	84.6
		60	96.3			60	100.0
		75	100.0			75	
2-H3	15.01	0	22.9	2-H4	14.99	0	23.1
		15	47.9			15	55.1
		30	66.6			30	75.1
		45	79.4			45	95.7
		60	100.0			60	100.0
		75				75	

Table B 43 - Raw data sheet for level 3 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A5	14.99	0	23.1	2-A6	14.98	0	23.0
		15	50.2			15	50.9
		30	68.4			30	67.4
		45	81.7			45	82.6
		60	100.0			60	100.0
		75				75	
2-B5	15.00	0	22.9	2-B6	14.99	0	23.1
		15	50.1			15	48.1
		30	65.7			30	64.1
		45	80.4			45	76.8
		60	100.0			60	89.4
		75				75	100.0
2-C5	15.00	0	22.8	2-C6	14.99	0	22.9
		15	53.3			15	50.4
		30	71.7			30	65.4
		45	93.4			45	80.1
		60	100.0			60	100.0
		75				75	
2-D5	15.01	0	22.9	2-D6	14.98	0	22.8
		15	51.6			15	48.7
		30	67.8			30	65.9
		45	83.5			45	78.7
		60	100.0			60	94.7
		75				75	100.0
2-E5	15.02	0	23.1	2-E6	15.00	0	23.1
		15	51.7			15	50.1
		30	71.4			30	67.6
		45	90.0			45	79.1
		60	100.0			60	91.9
		75				75	100.0
2-F5	15.01	0	23.0	2-F6	15.00	0	23.1
		15	47.3			15	51.0
		30	62.4			30	66.1
		45	74.4			45	79.4
		60	88.0			60	94.1
		75	100.0			75	100.0
2-G5	14.99	0	23.0	2-G6	14.98	0	23.1
		15	52.9			15	49.7
		30	71.5			30	65.7
		45	89.6			45	77.7
		60	100.0			60	92.7
		75				75	100.0
2-H5	15.01	0	22.8	2-H6	15.01	0	22.9
		15	56.2			15	56.4
		30	71.8			30	74.6
		45	85.4			45	92.6
		60	100.0			60	100.0
		75				75	

Table B 44 - Raw data sheet for level 3 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A7	15.00	0	22.9	2-A8	14.98	0	23.0
		15	54.8			15	48.6
		30	74.9			30	65.4
		45	94.5			45	81.1
		60	100.0			60	98.6
		75				75	100.0
2-B7	14.98	0	22.8	2-B8	15.00	0	23.1
		15	50.3			15	50.9
		30	68.9			30	67.6
		45	85.1			45	83.0
		60	100.0			60	100.0
		75				75	
2-C7	15.00	0	22.9	2-C8	14.98	0	23.1
		15	48.2			15	47.4
		30	64.6			30	65.1
		45	81.3			45	80.6
		60	100.0			60	100.0
		75				75	
2-D7	14.99	0	23.1	2-D8	14.99	0	23.0
		15	49.1			15	51.9
		30	67.4			30	71.2
		45	80.9			45	87.9
		60	94.5			60	100.0
		75	100.0			75	
2-E7	14.99	0	22.9	2-E8	15.02	0	22.9
		15	50.3			15	49.8
		30	66.9			30	68.6
		45	78.0			45	82.5
		60	91.1			60	100.0
		75	100.0			75	
2-F7	15.02	0	23.1	2-F8	15.02	0	23.0
		15	48.6			15	48.8
		30	64.7			30	62.7
		45	75.1			45	74.6
		60	88.7			60	88.6
		75	100.0			75	100.0
2-G7	14.98	0	23.0	2-G8	15.02	0	23.0
		15	49.1			15	49.2
		30	64.7			30	66.3
		45	76.2			45	80.1
		60	89.9			60	100.0
		75	100.0			75	
2-H7	15.01	0	23.0	2-H8	14.98	0	23.1
		15	54.1			15	52.6
		30	75.1			30	70.9
		45	92.7			45	92.6
		60	100.0			60	100.0
		75				75	

Table B 45 - Raw data sheet for level 3 replication 1

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A9	14.98	0	23.0	2-A10	14.98	0	23.1
		15	53.9			15	50.8
		30	75.7			30	71.4
		45	100.0			45	91.2
		60				60	100.0
		75				75	
2-B9	14.98	0	22.9	2-B10	14.98	0	23.0
		15	52.6			15	53.4
		30	70.9			30	73.6
		45	88.8			45	91.4
		60	100.0			60	100.0
		75				75	
2-C9	14.99	0	23.0	2-C10	15.02	0	23.0
		15	47.4			15	51.3
		30	64.4			30	68.1
		45	74.9			45	81.0
		60	90.7			60	100.0
		75	100.0			75	
2-D9	14.98	0	23.0	2-D10	14.99	0	22.9
		15	48.9			15	52.6
		30	65.7			30	71.6
		45	74.1			45	88.3
		60	88.3			60	100.0
		75	100.0			75	
2-E9	14.98	0	22.9	2-E10	14.98	0	22.9
		15	48.3			15	52.4
		30	62.5			30	70.4
		45	73.7			45	91.9
		60	85.7			60	100.0
		75	100.0			75	
2-F9	14.98	0	23.0	2-F10	15.00	0	22.9
		15	45.7			15	52.6
		30	60.0			30	67.5
		45	70.5			45	80.6
		60	80.9			60	100.0
		75	94.2			75	
2-G9	14.98	0	23.0	2-G10	15.02	0	22.9
		15	48.6			15	54.3
		30	65.6			30	73.6
		45	78.6			45	92.5
		60	95.2			60	100.0
		75	100.0			75	
2-H9	14.99	0	23.0	2-H10	15.00	0	22.9
		15	50.1			15	53.1
		30	69.1			30	74.1
		45	83.2			45	92.8
		60	100.0			60	100.0
		75				75	

Table B 46 - Raw data sheet for level 3 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A1	14.99	0	23.1	2-A2	14.99	0	23.1
		15	58.0			15	50.7
		30	78.6			30	65.7
		45	100.0			45	75.7
		60				60	86.8
		75				75	100.0
2-B1	15.00	0	22.9	2-B2	15.00	0	23.2
		15	54.5			15	57.1
		30	75.4			30	76.1
		45	100.0			45	100.0
		60				60	
		75				75	
2-C1	15.01	0	22.8	2-C2	15.02	0	22.8
		15	50.4			15	49.5
		30	67.4			30	65.1
		45	79.8			45	77.9
		60	90.3			60	95.8
		75	100.0			75	100.0
2-D1	15.01	0	23.1	2-D2	15.01	0	22.9
		15	50.8			15	47.6
		30	70.6			30	65.6
		45	91.6			45	79.6
		60	100.0			60	97.8
		75				75	100.0
2-E1	15.01	0	23.0	2-E2	15.00	0	23.1
		15	52.6			15	48.7
		30	73.6			30	64.7
		45	94.6			45	76.9
		60	100.0			60	91.8
		75				75	100.0
2-F1	14.98	0	22.9	2-F2	14.99	0	22.9
		15	50.7			15	45.3
		30	68.6			30	60.8
		45	83.4			45	70.4
		60	100.0			60	79.3
		75				75	90.7
2-G1	14.98	0	22.8	2-G2	14.99	0	22.8
		15	50.4			15	52.7
		30	68.4			30	70.8
		45	82.6			45	86.5
		60	98.1			60	100.0
		75	100.0			75	
2-H1	15.01	0	23.1	2-H2	15.02	0	22.9
		15	55.6			15	55.8
		30	75.6			30	73.7
		45	94.3			45	91.5
		60	100.0			60	100.0
		75				75	

Table B 47 - Raw data sheet for level 3 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A3	14.99	0	22.8	2-A4	15.01	0	23.1
		15	45.0			15	52.8
		30	60.6			30	72.1
		45	71.5			45	90.7
		60	81.3			60	100.0
		75	97.5			75	
2-B3	15.01	0	22.9	2-B4	15.02	0	22.8
		15	49.4			15	50.2
		30	65.9			30	66.5
		45	79.1			45	80.6
		60	97.1			60	96.5
		75	100.0			75	100.0
2-C3	15.00	0	23.2	2-C4	14.99	0	23.0
		15	46.2			15	50.5
		30	62.0			30	70.3
		45	75.5			45	84.9
		60	94.4			60	100.0
		75	100.0			75	
2-D3	15.02	0	22.9	2-D4	15.00	0	22.8
		15	48.5			15	52.1
		30	65.2			30	65.6
		45	78.0			45	76.5
		60	94.1			60	88.6
		75	100.0			75	100.0
2-E3	14.98	0	23.2	2-E4	15.02	0	22.9
		15	47.3			15	49.4
		30	63.0			30	64.3
		45	76.7			45	77.3
		60	94.2			60	95.3
		75	100.0			75	100.0
2-F3	15.00	0	23.2	2-F4	15.01	0	22.8
		15	48.0			15	50.8
		30	62.6			30	67.5
		45	74.6			45	81.9
		60	87.7			60	100.0
		75	100.0			75	
2-G3	15.00	0	22.9	2-G4	15.02	0	22.8
		15	50.3			15	50.6
		30	64.1			30	70.7
		45	77.5			45	84.6
		60	96.1			60	100.0
		75	100.0			75	
2-H3	15.01	0	22.8	2-H4	15.02	0	23.1
		15	47.6			15	54.8
		30	67.0			30	75.3
		45	79.8			45	95.5
		60	100.0			60	100.0
		75				75	

Table B 48 - Raw data sheet for level 3 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A5	14.99	0	22.9	2-A6	15.01	0	22.8
		15	50.2			15	50.7
		30	68.3			30	67.9
		45	81.5			45	82.7
		60	100.0			60	100.0
		75				75	
2-B5	15.00	0	22.8	2-B6	14.98	0	22.8
		15	49.6			15	48.3
		30	65.6			30	63.9
		45	80.1			45	76.2
		60	100.0			60	89.2
		75				75	100.0
2-C5	15.01	0	23.1	2-C6	15.02	0	22.9
		15	53.3			15	50.1
		30	71.5			30	65.6
		45	93.0			45	80.2
		60	100.0			60	100.0
		75				75	
2-D5	15.00	0	23.1	2-D6	15.00	0	22.8
		15	51.1			15	49.0
		30	67.7			30	66.3
		45	83.3			45	78.6
		60	100.0			60	94.0
		75				75	100.0
2-E5	15.01	0	22.8	2-E6	15.02	0	23.1
		15	51.7			15	50.4
		30	71.3			30	67.8
		45	89.6			45	78.8
		60	100.0			60	91.8
		75				75	100.0
2-F5	14.98	0	23.0	2-F6	15.02	0	22.9
		15	47.1			15	51.1
		30	61.8			30	65.9
		45	74.1			45	79.2
		60	87.3			60	94.3
		75	100.0			75	100.0
2-G5	14.99	0	23.2	2-G6	15.02	0	22.8
		15	52.9			15	49.3
		30	71.2			30	65.5
		45	89.2			45	77.6
		60	100.0			60	92.4
		75				75	100.0
2-H5	14.98	0	22.9	2-H6	15.01	0	23.0
		15	56.1			15	56.5
		30	72.3			30	74.9
		45	85.7			45	92.1
		60	100.0			60	100.0
		75				75	

Table B 49 - Raw data sheet for level 3 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A7	15.01	0	23.1	2-A8	15.01	0	23.0
		15	55.1			15	48.4
		30	75.4			30	66.1
		45	94.3			45	81.3
		60	100.0			60	98.4
		75				75	100.0
2-B7	14.99	0	23.1	2-B8	15.00	0	23.0
		15	50.1			15	50.7
		30	68.6			30	67.6
		45	85.1			45	83.1
		60	100.0			60	100.0
		75				75	
2-C7	15.02	0	23.0	2-C8	14.98	0	23.0
		15	48.1			15	47.6
		30	64.8			30	64.7
		45	81.4			45	80.7
		60	100.0			60	100.0
		75				75	
2-D7	15.01	0	23.1	2-D8	15.01	0	23.1
		15	49.4			15	51.8
		30	67.0			30	71.4
		45	81.0			45	88.2
		60	94.1			60	100.0
		75	100.0			75	
2-E7	15.01	0	23.0	2-E8	15.02	0	23.1
		15	50.1			15	49.9
		30	66.4			30	68.3
		45	78.4			45	82.6
		60	91.6			60	100.0
		75	100.0			75	
2-F7	15.01	0	23.0	2-F8	15.00	0	23.1
		15	48.1			15	49.3
		30	64.3			30	62.6
		45	75.1			45	73.8
		60	89.0			60	88.8
		75	100.0			75	100.0
2-G7	15.00	0	23.0	2-G8	15.00	0	22.9
		15	49.0			15	49.1
		30	64.8			30	66.4
		45	76.1			45	80.4
		60	90.1			60	100.0
		75	100.0			75	
2-H7	15.00	0	22.9	2-H8	15.00	0	22.9
		15	54.7			15	52.6
		30	74.9			30	70.7
		45	93.0			45	92.7
		60	100.0			60	100.0
		75				75	

Table B 50 - Raw data sheet for level 3 replication 2

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A9	14.99	0	23.1	2-A10	14.99	0	23.0
		15	54.2			15	50.7
		30	75.4			30	71.6
		45	100.0			45	91.4
		60				60	100.0
		75				75	
2-B9	14.98	0	23.0	2-B10	15.01	0	22.9
		15	52.4			15	53.6
		30	71.7			30	73.1
		45	89.3			45	91.6
		60	100.0			60	100.0
		75				75	
2-C9	15.01	0	23.0	2-C10	15.01	0	23.1
		15	47.5			15	51.3
		30	64.2			30	67.6
		45	75.4			45	81.3
		60	91.3			60	100.0
		75	100.0			75	
2-D9	15.00	0	23.0	2-D10	15.01	0	23.0
		15	49.1			15	52.4
		30	65.6			30	71.4
		45	74.6			45	88.1
		60	88.1			60	100.0
		75	100.0			75	
2-E9	15.00	0	23.0	2-E10	15.00	0	23.0
		15	48.1			15	52.7
		30	62.4			30	70.3
		45	73.9			45	92.1
		60	86.0			60	100.0
		75	100.0			75	
2-F9	15.01	0	23.1	2-F10	14.99	0	22.9
		15	45.3			15	52.3
		30	60.1			30	67.3
		45	70.3			45	80.4
		60	80.6			60	100.0
		75	94.0			75	
2-G9	15.01	0	22.9	2-G10	15.02	0	23.2
		15	48.4			15	54.5
		30	65.7			30	73.7
		45	78.7			45	93.1
		60	94.8			60	100.0
		75	100.0			75	
2-H9	14.99	0	23.1	2-H10	14.98	0	23.0
		15	50.2			15	52.7
		30	68.6			30	74.7
		45	83.0			45	92.3
		60	100.0			60	100.0
		75				75	

Table B 51 - Raw data sheet for level 3 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A1	14.98	0	23.2	2-A2	15.00	0	23.1
		15	58.1			15	50.3
		30	78.9			30	65.0
		45	100.0			45	75.9
		60				60	86.9
		75				75	100.0
2-B1	14.99	0	22.8	2-B2	15.02	0	23.2
		15	54.1			15	56.7
		30	75.7			30	75.8
		45	100.0			45	100.0
		60				60	
		75				75	
2-C1	15.00	0	22.9	2-C2	15.02	0	22.8
		15	50.1			15	49.3
		30	67.1			30	65.4
		45	79.1			45	77.8
		60	90.2			60	95.6
		75	100.0			75	100.0
2-D1	15.01	0	22.8	2-D2	14.98	0	23.0
		15	50.6			15	47.8
		30	70.0			30	65.5
		45	91.2			45	79.6
		60	100.0			60	97.8
		75				75	100.0
2-E1	15.00	0	22.9	2-E2	15.02	0	22.8
		15	52.3			15	48.5
		30	73.6			30	64.8
		45	94.4			45	76.5
		60	100.0			60	91.5
		75				75	100.0
2-F1	15.01	0	22.9	2-F2	15.02	0	22.9
		15	50.2			15	45.1
		30	68.1			30	60.7
		45	83.0			45	69.9
		60	100.0			60	79.3
		75				75	91.0
2-G1	15.01	0	22.8	2-G2	15.01	0	23.2
		15	50.4			15	52.9
		30	68.6			30	70.8
		45	82.0			45	86.0
		60	97.9			60	100.0
		75	100.0			75	
2-H1	15.02	0	22.8	2-H2	15.00	0	22.9
		15	55.6			15	55.6
		30	75.4			30	73.6
		45	94.0			45	91.3
		60	100.0			60	100.0
		75				75	

Table B 52 - Raw data sheet for level 3 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A3	15.01	0	23.1	2-A4	14.99	0	23.0
		15	45.3			15	52.6
		30	60.7			30	72.7
		45	71.3			45	90.7
		60	81.2			60	100.0
		75	97.0			75	
2-B3	14.99	0	22.9	2-B4	14.98	0	23.0
		15	49.2			15	49.9
		30	65.8			30	66.7
		45	79.4			45	80.8
		60	96.9			60	96.7
		75	100.0			75	100.0
2-C3	15.00	0	23.1	2-C4	15.01	0	22.9
		15	46.2			15	50.9
		30	62.6			30	70.1
		45	75.7			45	85.3
		60	94.5			60	100.0
		75	100.0			75	
2-D3	14.98	0	23.1	2-D4	15.00	0	23.1
		15	48.4			15	52.3
		30	65.3			30	65.1
		45	77.9			45	77.1
		60	94.1			60	88.9
		75	100.0			75	100.0
2-E3	15.02	0	22.9	2-E4	14.98	0	23.0
		15	47.8			15	49.4
		30	62.9			30	64.3
		45	76.5			45	77.6
		60	93.9			60	95.5
		75	100.0			75	100.0
2-F3	14.99	0	22.9	2-F4	14.99	0	23.0
		15	48.1			15	51.3
		30	63.0			30	67.3
		45	74.7			45	81.9
		60	87.7			60	100.0
		75	100.0			75	
2-G3	15.00	0	23.1	2-G4	14.98	0	23.0
		15	50.7			15	50.1
		30	64.7			30	70.4
		45	77.8			45	84.7
		60	96.4			60	100.0
		75	100.0			75	
2-H3	14.99	0	23.2	2-H4	14.98	0	22.9
		15	47.6			15	55.2
		30	66.8			30	75.2
		45	79.8			45	95.7
		60	100.0			60	100.0
		75				75	

Table B 53 - Raw data sheet for level 3 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A5	15.01	0	22.9	2-A6	14.99	0	23.1
		15	50.7			15	50.8
		30	68.4			30	68.1
		45	81.6			45	83.0
		60	100.0			60	100.0
		75				75	
2-B5	15.02	0	23.0	2-B6	15.01	0	23.1
		15	50.0			15	48.4
		30	65.4			30	63.6
		45	80.3			45	77.1
		60	100.0			60	90.0
		75				75	100.0
2-C5	15.01	0	23.2	2-C6	15.01	0	22.9
		15	53.1			15	50.3
		30	71.6			30	65.7
		45	93.1			45	80.0
		60	100.0			60	100.0
		75				75	
2-D5	15.00	0	23.0	2-D6	14.99	0	22.8
		15	50.9			15	48.4
		30	67.6			30	65.7
		45	83.5			45	79.1
		60	100.0			60	94.1
		75				75	100.0
2-E5	15.01	0	23.0	2-E6	14.98	0	23.1
		15	51.6			15	50.4
		30	71.4			30	67.4
		45	89.4			45	79.0
		60	100.0			60	92.0
		75				75	100.0
2-F5	15.02	0	23.1	2-F6	15.01	0	23.1
		15	47.4			15	51.3
		30	61.7			30	66.4
		45	74.3			45	79.3
		60	87.6			60	94.3
		75	100.0			75	100.0
2-G5	15.01	0	23.0	2-G6	15.02	0	23.1
		15	53.0			15	49.4
		30	71.3			30	65.4
		45	89.4			45	77.7
		60	100.0			60	92.6
		75				75	100.0
2-H5	15.01	0	23.0	2-H6	14.99	0	22.9
		15	56.1			15	56.6
		30	72.1			30	74.8
		45	86.0			45	92.7
		60	100.0			60	100.0
		75				75	

Table B 54 - Raw data sheet for level 3 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A7	15.00	0	23.2	2-A8	15.02	0	22.8
		15	54.9			15	48.2
		30	74.5			30	65.6
		45	94.5			45	81.0
		60	100.0			60	98.6
		75				75	100.0
2-B7	15.02	0	22.8	2-B8	15.00	0	23.1
		15	50.5			15	50.5
		30	68.7			30	67.6
		45	85.0			45	83.5
		60	100.0			60	100.0
		75				75	
2-C7	15.00	0	23.1	2-C8	15.02	0	23.1
		15	48.2			15	47.0
		30	64.4			30	65.1
		45	81.3			45	80.4
		60	100.0			60	100.0
		75				75	
2-D7	15.01	0	22.8	2-D8	15.01	0	22.8
		15	49.0			15	51.6
		30	67.2			30	71.0
		45	80.7			45	88.0
		60	94.2			60	100.0
		75	100.0			75	
2-E7	15.01	0	22.8	2-E8	14.98	0	22.8
		15	49.7			15	49.7
		30	66.8			30	68.3
		45	78.2			45	82.1
		60	91.6			60	100.0
		75	100.0			75	
2-F7	14.98	0	22.8	2-F8	14.98	0	22.8
		15	48.1			15	48.8
		30	64.7			30	62.8
		45	75.4			45	74.0
		60	89.2			60	88.3
		75	100.0			75	100.0
2-G7	15.02	0	23.2	2-G8	14.98	0	23.1
		15	49.4			15	48.8
		30	64.6			30	65.7
		45	76.2			45	79.9
		60	89.6			60	100.0
		75	100.0			75	
2-H7	14.99	0	22.9	2-H8	15.02	0	23.2
		15	54.5			15	52.3
		30	74.9			30	70.5
		45	92.8			45	92.5
		60	100.0			60	100.0
		75				75	

Table B 55 - Raw data sheet for level 3 replication 3

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A9	15.02	0	23.1	2-A10	15.02	0	22.8
		15	54.0			15	50.5
		30	75.7			30	71.0
		45	100.0			45	90.8
		60				60	100.0
		75				75	
2-B9	15.02	0	23.0	2-B10	15.02	0	22.8
		15	52.3			15	53.8
		30	71.2			30	73.3
		45	89.0			45	91.1
		60	100.0			60	100.0
		75				75	
2-C9	15.01	0	22.9	2-C10	14.98	0	22.8
		15	47.6			15	51.3
		30	64.1			30	67.9
		45	75.6			45	81.5
		60	90.9			60	100.0
		75	100.0			75	
2-D9	15.02	0	23.2	2-D10	15.01	0	22.8
		15	49.1			15	52.0
		30	65.3			30	71.4
		45	74.7			45	88.3
		60	88.4			60	100.0
		75	100.0			75	
2-E9	15.02	0	23.2	2-E10	15.02	0	23.0
		15	48.0			15	52.7
		30	62.4			30	70.5
		45	73.6			45	91.5
		60	85.4			60	100.0
		75	100.0			75	
2-F9	15.02	0	23.0	2-F10	15.00	0	22.8
		15	45.1			15	52.1
		30	59.9			30	67.5
		45	70.6			45	80.4
		60	80.7			60	100.0
		75	94.5			75	
2-G9	15.02	0	23.0	2-G10	14.98	0	23.1
		15	48.4			15	54.0
		30	65.4			30	73.5
		45	78.7			45	92.7
		60	95.0			60	100.0
		75	100.0			75	
2-H9	15.01	0	22.9	2-H10	15.00	0	23.2
		15	50.4			15	52.9
		30	68.3			30	74.2
		45	82.6			45	92.7
		60	100.0			60	100.0
		75				75	

Table B 56 - Raw data sheet for level 3 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A1	15.01	0	23.0	2-A2	15.02	0	23.1
		15	58.2			15	50.4
		30	78.7			30	65.3
		45	100.0			45	76.0
		60				60	87.0
		75				75	100.0
2-B1	14.99	0	22.8	2-B2	15.01	0	22.9
		15	54.3			15	57.0
		30	75.9			30	76.4
		45	100.0			45	100.0
		60				60	
		75				75	
2-C1	14.98	0	22.9	2-C2	14.99	0	23.0
		15	50.3			15	49.4
		30	67.1			30	65.6
		45	79.4			45	78.0
		60	90.1			60	96.1
		75	100.0			75	100.0
2-D1	15.02	0	22.9	2-D2	15.01	0	23.1
		15	51.0			15	47.6
		30	70.3			30	65.4
		45	91.3			45	79.4
		60	100.0			60	98.0
		75				75	100.0
2-E1	14.90	0	22.8	2-E2	14.99	0	23.1
		15	52.4			15	48.6
		30	73.7			30	64.6
		45	94.5			45	76.7
		60	100.0			60	92.0
		75				75	100.0
2-F1	15.01	0	23.0	2-F2	14.98	0	23.0
		15	50.1			15	45.1
		30	68.4			30	61.0
		45	83.1			45	70.0
		60	100.0			60	79.4
		75				75	90.5
2-G1	15.02	0	23.0	2-G2	14.99	0	23.1
		15	50.2			15	53.2
		30	68.1			30	71.4
		45	82.1			45	86.4
		60	98.0			60	100.0
		75	100.0			75	
2-H1	15.01	0	23.2	2-H2	14.99	0	23.1
		15	55.4			15	55.9
		30	75.3			30	73.7
		45	94.1			45	91.4
		60	100.0			60	100.0
		75				75	

Table B 57 - Raw data sheet for level 3 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A3	15.01	0	23.1	2-A4	15.00	0	22.9
		15	45.2			15	53.0
		30	60.4			30	72.1
		45	71.4			45	91.0
		60	81.4			60	100.0
		75	97.7			75	
2-B3	15.00	0	22.9	2-B4	14.99	0	22.8
		15	49.6			15	50.3
		30	66.0			30	66.3
		45	79.0			45	81.0
		60	97.3			60	97.0
		75	100.0			75	100.0
2-C3	15.01	0	23.0	2-C4	14.98	0	23.0
		15	46.4			15	50.4
		30	62.3			30	70.4
		45	75.4			45	85.0
		60	94.6			60	100.0
		75	100.0			75	
2-D3	15.00	0	23.0	2-D4	15.01	0	23.1
		15	48.6			15	52.1
		30	65.1			30	65.7
		45	78.4			45	77.0
		60	94.3			60	89.3
		75	100.0			75	100.0
2-E3	15.00	0	22.8	2-E4	15.01	0	22.9
		15	47.6			15	49.6
		30	63.2			30	64.7
		45	76.7			45	77.4
		60	94.1			60	96.0
		75	100.0			75	100.0
2-F3	14.99	0	23.1	2-F4	14.99	0	23.1
		15	47.6			15	51.0
		30	62.7			30	67.7
		45	75.0			45	82.1
		60	87.7			60	100.0
		75	100.0			75	
2-G3	15.01	0	23.1	2-G4	15.01	0	23.0
		15	50.5			15	50.7
		30	64.3			30	71.0
		45	77.6			45	84.7
		60	96.2			60	100.0
		75	100.0			75	
2-H3	15.00	0	23.0	2-H4	15.00	0	22.9
		15	48.0			15	55.0
		30	67.4			30	75.4
		45	80.0			45	96.0
		60	100.0			60	100.0
		75				75	

Table B 58 - Raw data sheet for level 3 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A5	15.01	0	23.1	2-A6	14.99	0	22.9
		15	50.6			15	51.0
		30	68.3			30	67.6
		45	81.8			45	82.8
		60	100.0			60	100.0
		75				75	
2-B5	15.00	0	23.0	2-B6	15.02	0	23.0
		15	49.8			15	48.4
		30	66.0			30	63.6
		45	80.3			45	76.6
		60	100.0			60	89.6
		75				75	100.0
2-C5	14.99	0	23.1	2-C6	15.01	0	22.9
		15	53.1			15	50.6
		30	71.6			30	65.1
		45	92.8			45	79.9
		60	100.0			60	100.0
		75				75	
2-D5	15.00	0	23.1	2-D6	15.00	0	22.9
		15	51.1			15	48.9
		30	68.0			30	66.1
		45	83.3			45	78.9
		60	100.0			60	94.3
		75				75	100.0
2-E5	14.99	0	22.9	2-E6	14.98	0	23.1
		15	51.8			15	50.6
		30	71.3			30	67.6
		45	89.7			45	78.9
		60	100.0			60	92.3
		75				75	100.0
2-F5	15.02	0	23.1	2-F6	14.98	0	22.9
		15	47.6			15	50.8
		30	62.0			30	65.8
		45	74.0			45	79.1
		60	87.4			60	94.7
		75	100.0			75	100.0
2-G5	15.01	0	23.1	2-G6	14.98	0	23.2
		15	52.7			15	49.6
		30	71.7			30	65.4
		45	89.3			45	77.8
		60	100.0			60	92.8
		75				75	100.0
2-H5	15.02	0	22.8	2-H6	14.99	0	22.9
		15	55.9			15	56.9
		30	72.0			30	74.7
		45	85.8			45	92.3
		60	100.0			60	100.0
		75				75	

Table B 59 - Raw data sheet for level 3 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A7	14.99	0	23.0	2-A8	14.98	0	22.9
		15	55.0			15	48.6
		30	75.1			30	66.1
		45	94.3			45	81.4
		60	100.0			60	99.0
		75				75	100.0
2-B7	15.01	0	23.1	2-B8	15.00	0	22.8
		15	50.6			15	50.4
		30	68.7			30	67.4
		45	84.6			45	83.1
		60	100.0			60	100.0
		75				75	
2-C7	15.00	0	23.1	2-C8	15.02	0	23.1
		15	48.3			15	47.4
		30	65.0			30	65.1
		45	81.4			45	81.0
		60	100.0			60	100.0
		75				75	
2-D7	15.00	0	23.0	2-D8	15.00	0	23.1
		15	48.7			15	51.7
		30	67.1			30	71.1
		45	81.1			45	88.4
		60	94.1			60	100.0
		75	100.0			75	
2-E7	15.00	0	23.0	2-E8	15.00	0	23.1
		15	49.6			15	50.0
		30	66.6			30	68.4
		45	78.3			45	82.8
		60	91.7			60	100.0
		75	100.0			75	
2-F7	15.01	0	23.2	2-F8	15.01	0	23.1
		15	48.0			15	49.0
		30	65.0			30	62.6
		45	75.6			45	74.3
		60	89.1			60	88.7
		75	100.0			75	100.0
2-G7	14.98	0	23.1	2-G8	15.01	0	23.0
		15	49.3			15	49.0
		30	65.0			30	66.0
		45	76.1			45	80.2
		60	89.4			60	100.0
		75	100.0			75	
2-H7	14.99	0	23.0	2-H8	15.01	0	23.0
		15	54.6			15	52.4
		30	74.5			30	71.0
		45	93.1			45	93.1
		60	100.0			60	100.0
		75				75	

Table B 60 - Raw data sheet for level 3 replication 4

Location	DI water (g)	Time (s)	Temperature (°C)	Location	DI water (g)	Time (s)	Temperature (°C)
2-A9	15.00	0	23.1	2-A10	15.01	0	23.2
		15	54.1			15	51.0
		30	76.0			30	71.3
		45	100.0			45	91.0
		60				60	100.0
		75				75	
2-B9	14.98	0	23.0	2-B10	14.99	0	23.0
		15	52.1			15	53.6
		30	71.1			30	73.1
		45	89.4			45	91.7
		60	100.0			60	100.0
		75				75	
2-C9	15.01	0	23.0	2-C10	15.02	0	22.9
		15	47.7			15	51.4
		30	64.1			30	67.8
		45	75.7			45	81.4
		60	91.0			60	100.0
		75	100.0			75	
2-D9	15.00	0	22.9	2-D10	15.00	0	22.8
		15	49.3			15	52.3
		30	65.4			30	71.6
		45	74.6			45	88.8
		60	88.3			60	100.0
		75	100.0			75	
2-E9	15.01	0	23.1	2-E10	15.00	0	23.1
		15	48.2			15	52.6
		30	62.1			30	70.1
		45	74.0			45	92.0
		60	85.1			60	100.0
		75	100.0			75	
2-F9	14.99	0	23.1	2-F10	15.01	0	23.1
		15	45.2			15	52.4
		30	59.8			30	68.0
		45	70.1			45	80.8
		60	81.0			60	100.0
		75	94.6			75	
2-G9	14.99	0	23.2	2-G10	14.98	0	23.1
		15	48.3			15	54.3
		30	65.3			30	73.6
		45	78.6			45	93.0
		60	95.1			60	100.0
		75	100.0			75	
2-H9	15.01	0	23.1	2-H10	15.01	0	23.0
		15	50.3			15	53.0
		30	68.7			30	74.6
		45	82.7			45	92.4
		60	100.0			60	100.0
		75				75	

APPENDIX C

SPSS output data for mean and standard deviation

Only data for time = 0 and level 1 is shown, the rest is computed the same way

Table C 1 - Descriptive Statistics 0-A1 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.050	.1291
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 1

Table C 2 - Descriptive Statistics 0-A2 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.100	.0816
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 2

Table C 3 - Descriptive Statistics 0-A3 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.075	.1258
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 3

Table C 4 - Descriptive Statistics 0-A4 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	22.975	.0500
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 4

Table C 5 - Descriptive Statistics 0-A5 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.050	.0577
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 5

Table C 6 - Descriptive Statistics 0-A6 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	22.975	.1708
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 6

Table C 7 - Descriptive Statistics 0-A7 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.100	.0816
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 7

Table C 8 - Descriptive Statistics 0-A8 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.025	.1500
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 8

Table C 9 - Descriptive Statistics 0-A9 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.025	.0957
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 9

Table C 10 - Descriptive Statistics 0-A10 Time=0 seconds

Descriptive Statistics^a

	N	Mean	Std. Deviation
Temperature (°C)	4	23.025	.1258
Valid N (listwise)	4		

a. Time (s) = 0, LOCLEV = 1, LOCFR = 1, LOCLR = 10

APPENDIX D

Color coded mean and standard deviations of grid squares

Table D 1 - Mean and standard deviations of grid squares level 1, time= 0 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 23.025	Mean: 23.100	Mean: 23.075	Mean: 22.975	Mean: 23.100	Mean: 22.900	Mean: 23.050	Mean: 23.050	Mean: 23.075	Mean: 23.025
Std Dev: 0.1258	Std Dev: 0.0816	Std Dev: 0.1258	Std Dev: 0.1500	Std Dev: 0.1414	Std Dev: 0.1155	Std Dev: 0.1291	Std Dev: 0.0577	Std Dev: 0.1893	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 23.075	Mean: 23.125	Mean: 22.925	Mean: 23.050	Mean: 23.075	Mean: 23.050	Mean: 22.925	Mean: 22.925	Mean: 23.100	Mean: 23.100
Std Dev: 0.1258	Std Dev: 0.0957	Std Dev: 0.1258	Std Dev: 0.1291	Std Dev: 0.0500	Std Dev: 0.1000	Std Dev: 0.1258	Std Dev: 0.0957	Std Dev: 0.1155	Std Dev: 0.1414
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 23.000	Mean: 23.100	Mean: 23.075	Mean: 23.000	Mean: 23.075	Mean: 22.975	Mean: 22.950	Mean: 23.000	Mean: 23.075	Mean: 23.100
Std Dev: 0.0816	Std Dev: 0.0816	Std Dev: 0.1500	Std Dev: 0.1826	Std Dev: 0.1258	Std Dev: 0.1708	Std Dev: 0.1732	Std Dev: 0.1414	Std Dev: 0.0500	Std Dev: 0.0816
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 23.075	Mean: 23.175	Mean: 22.950	Mean: 23.025	Mean: 22.950	Mean: 23.025	Mean: 23.025	Mean: 23.000	Mean: 23.000	Mean: 22.975
Std Dev: 0.0957	Std Dev: 0.0500	Std Dev: 0.1732	Std Dev: 0.1258	Std Dev: 0.1915	Std Dev: 0.1500	Std Dev: 0.1258	Std Dev: 0.0816	Std Dev: 0.1414	Std Dev: 0.0500
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 23.100	Mean: 23.025	Mean: 23.100	Mean: 23.025	Mean: 23.075	Mean: 23.050	Mean: 22.900	Mean: 23.100	Mean: 22.875	Mean: 23.000
Std Dev: 0.0816	Std Dev: 0.0957	Std Dev: 0.0816	Std Dev: 0.0957	Std Dev: 0.1258	Std Dev: 0.0577	Std Dev: 0.0816	Std Dev: 0.0816	Std Dev: 0.0957	Std Dev: 0.0816
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 23.125	Mean: 23.050	Mean: 23.025	Mean: 23.025	Mean: 22.975	Mean: 23.075	Mean: 23.100	Mean: 23.000	Mean: 23.025	Mean: 23.025
Std Dev: 0.0500	Std Dev: 0.1291	Std Dev: 0.1258	Std Dev: 0.1708	Std Dev: 0.0500	Std Dev: 0.1500	Std Dev: 0.1414	Std Dev: 0.1155	Std Dev: 0.1500	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 23.125	Mean: 23.075	Mean: 23.000	Mean: 23.000	Mean: 22.975	Mean: 23.000	Mean: 22.950	Mean: 22.950	Mean: 23.025	Mean: 22.975
Std Dev: 0.0957	Std Dev: 0.0957	Std Dev: 0.0816	Std Dev: 0.1826	Std Dev: 0.1500	Std Dev: 0.1414	Std Dev: 0.1291	Std Dev: 0.1000	Std Dev: 0.0957	Std Dev: 0.1708
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 23.050	Mean: 23.100	Mean: 23.075	Mean: 22.975	Mean: 23.050	Mean: 22.975	Mean: 23.100	Mean: 23.025	Mean: 23.025	Mean: 23.025
Std Dev: 0.1291	Std Dev: 0.0816	Std Dev: 0.1258	Std Dev: 0.0500	Std Dev: 0.0577	Std Dev: 0.1708	Std Dev: 0.0816	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 2 - Mean and standard deviations of grid squares level 1, time= 15 seconds

Location: H1 Mean: 53.325 Std Dev: 0.3304 n= 4	Location: H2 Mean: 54.700 Std Dev: 0.3651 n= 4	Location: H3 Mean: 50.900 Std Dev: 0.2582 n= 4	Location: H4 Mean: 52.475 Std Dev: 0.2630 n= 4	Location: H5 Mean: 57.500 Std Dev: 0.4546 n= 4	Location: H6 Mean: 55.575 Std Dev: 0.3403 n= 4	Location: H7 Mean: 57.500 Std Dev: 0.2828 n= 4	Location: H8 Mean: 51.875 Std Dev: 0.1708 n= 4	Location: H9 Mean: 57.075 Std Dev: 0.3304 n= 4	Location: H10 Mean: 50.500 Std Dev: 0.4163 n= 4
Location: G1 Mean: 53.975 Std Dev: 0.3500 n= 4	Location: G2 Mean: 53.000 Std Dev: 0.2160 n= 4	Location: G3 Mean: 55.300 Std Dev: 0.1826 n= 4	Location: G4 Mean: 56.925 Std Dev: 0.2062 n= 4	Location: G5 Mean: 57.400 Std Dev: 0.3651 n= 4	Location: G6 Mean: 54.550 Std Dev: 0.3697 n= 4	Location: G7 Mean: 57.675 Std Dev: 0.2500 n= 4	Location: G8 Mean: 56.050 Std Dev: 0.1915 n= 4	Location: G9 Mean: 53.725 Std Dev: 0.1258 n= 4	Location: G10 Mean: 49.700 Std Dev: 0.2582 n= 4
Location: F1 Mean: 58.925 Std Dev: 0.2500 n= 4	Location: F2 Mean: 58.450 Std Dev: 0.4203 n= 4	Location: F3 Mean: 57.950 Std Dev: 0.1915 n= 4	Location: F4 Mean: 59.750 Std Dev: 0.3416 n= 4	Location: F5 Mean: 55.225 Std Dev: 0.3304 n= 4	Location: F6 Mean: 49.150 Std Dev: 0.1915 n= 4	Location: F7 Mean: 57.450 Std Dev: 0.3109 n= 4	Location: F8 Mean: 55.550 Std Dev: 0.2380 n= 4	Location: F9 Mean: 59.050 Std Dev: 0.1291 n= 4	Location: F10 Mean: 53.550 Std Dev: 0.2646 n= 4
Location: E1 Mean: 52.950 Std Dev: 0.3416 n= 4	Location: E2 Mean: 57.275 Std Dev: 0.3096 n= 4	Location: E3 Mean: 51.450 Std Dev: 0.3416 n= 4	Location: E4 Mean: 60.550 Std Dev: 0.3416 n= 4	Location: E5 Mean: 57.350 Std Dev: 0.1732 n= 4	Location: E6 Mean: 50.900 Std Dev: 0.3162 n= 4	Location: E7 Mean: 57.675 Std Dev: 0.2217 n= 4	Location: E8 Mean: 52.425 Std Dev: 0.3862 n= 4	Location: E9 Mean: 56.550 Std Dev: 0.3109 n= 4	Location: E10 Mean: 51.600 Std Dev: 0.2582 n= 4
Location: D1 Mean: 48.900 Std Dev: 0.2582 n= 4	Location: D2 Mean: 54.250 Std Dev: 0.3416 n= 4	Location: D3 Mean: 57.725 Std Dev: 0.2754 n= 4	Location: D4 Mean: 60.975 Std Dev: 0.2500 n= 4	Location: D5 Mean: 52.775 Std Dev: 0.2986 n= 4	Location: D6 Mean: 53.400 Std Dev: 0.2944 n= 4	Location: D7 Mean: 57.550 Std Dev: 0.2380 n= 4	Location: D8 Mean: 50.600 Std Dev: 0.2582 n= 4	Location: D9 Mean: 55.125 Std Dev: 0.2217 n= 4	Location: D10 Mean: 50.525 Std Dev: 0.2754 n= 4
Location: C1 Mean: 57.975 Std Dev: 0.2217 n= 4	Location: C2 Mean: 56.325 Std Dev: 0.4031 n= 4	Location: C3 Mean: 58.500 Std Dev: 0.4163 n= 4	Location: C4 Mean: 61.980 Std Dev: 0.1483 n= 4	Location: C5 Mean: 54.650 Std Dev: 0.3416 n= 4	Location: C6 Mean: 56.200 Std Dev: 0.2160 n= 4	Location: C7 Mean: 59.800 Std Dev: 0.3916 n= 4	Location: C8 Mean: 52.225 Std Dev: 0.2062 n= 4	Location: C9 Mean: 59.950 Std Dev: 0.3317 n= 4	Location: C10 Mean: 59.725 Std Dev: 0.3862 n= 4
Location: B1 Mean: 50.800 Std Dev: 0.2449 n= 4	Location: B2 Mean: 50.350 Std Dev: 0.3697 n= 4	Location: B3 Mean: 55.475 Std Dev: 0.4349 n= 4	Location: B4 Mean: 62.050 Std Dev: 0.3109 n= 4	Location: B5 Mean: 58.800 Std Dev: 0.3162 n= 4	Location: B6 Mean: 61.925 Std Dev: 0.4193 n= 4	Location: B7 Mean: 56.575 Std Dev: 0.3202 n= 4	Location: B8 Mean: 55.400 Std Dev: 0.4320 n= 4	Location: B9 Mean: 54.650 Std Dev: 0.2082 n= 4	Location: B10 Mean: 51.725 Std Dev: 0.2630 n= 4
Location: A1 Mean: 46.650 Std Dev: 0.3697 n= 4	Location: A2 Mean: 48.200 Std Dev: 0.2944 n= 4	Location: A3 Mean: 54.900 Std Dev: 0.2582 n= 4	Location: A4 Mean: 55.800 Std Dev: 0.2582 n= 4	Location: A5 Mean: 57.475 Std Dev: 0.3304 n= 4	Location: A6 Mean: 58.600 Std Dev: 0.3464 n= 4	Location: A7 Mean: 54.950 Std Dev: 0.2380 n= 4	Location: A8 Mean: 52.400 Std Dev: 0.4761 n= 4	Location: A9 Mean: 50.075 Std Dev: 0.1708 n= 4	Location: A10 Mean: 45.700 Std Dev: 0.3162 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 3 - Mean and standard deviations of grid squares level 1, time= 30 seconds

Location: H1 Mean: 73.050 Std Dev: 0.3873 n= 4	Location: H2 Mean: 72.475 Std Dev: 0.2986 n= 4	Location: H3 Mean: 66.025 Std Dev: 0.2217 n= 4	Location: H4 Mean: 70.550 Std Dev: 0.3416 n= 4	Location: H5 Mean: 76.800 Std Dev: 0.3162 n= 4	Location: H6 Mean: 72.400 Std Dev: 0.2582 n= 4	Location: H7 Mean: 78.700 Std Dev: 0.3266 n= 4	Location: H8 Mean: 66.375 Std Dev: 0.3304 n= 4	Location: H9 Mean: 78.775 Std Dev: 0.2062 n= 4	Location: H10 Mean: 69.225 Std Dev: 0.2217 n= 4
Location: G1 Mean: 72.625 Std Dev: 0.4113 n= 4	Location: G2 Mean: 69.600 Std Dev: 0.3367 n= 4	Location: G3 Mean: 71.725 Std Dev: 0.2363 n= 4	Location: G4 Mean: 76.600 Std Dev: 0.4163 n= 4	Location: G5 Mean: 76.450 Std Dev: 0.4203 n= 4	Location: G6 Mean: 73.475 Std Dev: 0.4113 n= 4	Location: G7 Mean: 78.475 Std Dev: 0.3304 n= 4	Location: G8 Mean: 75.575 Std Dev: 0.2217 n= 4	Location: G9 Mean: 71.800 Std Dev: 0.2160 n= 4	Location: G10 Mean: 68.500 Std Dev: 0.3559 n= 4
Location: F1 Mean: 83.575 Std Dev: 0.2217 n= 4	Location: F2 Mean: 78.800 Std Dev: 0.2582 n= 4	Location: F3 Mean: 78.350 Std Dev: 0.1915 n= 4	Location: F4 Mean: 78.025 Std Dev: 0.3304 n= 4	Location: F5 Mean: 75.600 Std Dev: 0.3651 n= 4	Location: F6 Mean: 64.725 Std Dev: 0.1708 n= 4	Location: F7 Mean: 81.575 Std Dev: 0.4031 n= 4	Location: F8 Mean: 75.875 Std Dev: 0.4031 n= 4	Location: F9 Mean: 79.800 Std Dev: 0.4082 n= 4	Location: F10 Mean: 78.425 Std Dev: 0.3096 n= 4
Location: E1 Mean: 69.650 Std Dev: 0.3317 n= 4	Location: E2 Mean: 77.925 Std Dev: 0.3304 n= 4	Location: E3 Mean: 67.175 Std Dev: 0.2630 n= 4	Location: E4 Mean: 81.175 Std Dev: 0.2500 n= 4	Location: E5 Mean: 77.250 Std Dev: 0.3416 n= 4	Location: E6 Mean: 67.050 Std Dev: 0.3317 n= 4	Location: E7 Mean: 78.725 Std Dev: 0.4113 n= 4	Location: E8 Mean: 71.000 Std Dev: 0.2944 n= 4	Location: E9 Mean: 74.075 Std Dev: 0.1708 n= 4	Location: E10 Mean: 68.675 Std Dev: 0.2500 n= 4
Location: D1 Mean: 64.375 Std Dev: 0.3304 n= 4	Location: D2 Mean: 71.975 Std Dev: 0.2986 n= 4	Location: D3 Mean: 77.950 Std Dev: 0.2887 n= 4	Location: D4 Mean: 83.600 Std Dev: 0.3367 n= 4	Location: D5 Mean: 71.100 Std Dev: 0.3464 n= 4	Location: D6 Mean: 71.800 Std Dev: 0.1414 n= 4	Location: D7 Mean: 80.575 Std Dev: 0.2217 n= 4	Location: D8 Mean: 68.450 Std Dev: 0.4123 n= 4	Location: D9 Mean: 72.725 Std Dev: 0.2986 n= 4	Location: D10 Mean: 68.475 Std Dev: 0.3304 n= 4
Location: C1 Mean: 79.550 Std Dev: 0.3109 n= 4	Location: C2 Mean: 74.175 Std Dev: 0.3594 n= 4	Location: C3 Mean: 77.700 Std Dev: 0.2944 n= 4	Location: C4 Mean: 91.650 Std Dev: 0.2082 n= 4	Location: C5 Mean: 73.975 Std Dev: 0.2630 n= 4	Location: C6 Mean: 75.000 Std Dev: 0.2160 n= 4	Location: C7 Mean: 81.125 Std Dev: 0.3775 n= 4	Location: C8 Mean: 70.025 Std Dev: 0.2986 n= 4	Location: C9 Mean: 79.600 Std Dev: 0.4243 n= 4	Location: C10 Mean: 77.600 Std Dev: 0.2449 n= 4
Location: B1 Mean: 67.125 Std Dev: 0.2986 n= 4	Location: B2 Mean: 67.375 Std Dev: 0.3862 n= 4	Location: B3 Mean: 74.000 Std Dev: 0.2582 n= 4	Location: B4 Mean: 85.975 Std Dev: 0.2872 n= 4	Location: B5 Mean: 82.700 Std Dev: 0.3367 n= 4	Location: B6 Mean: 91.250 Std Dev: 0.3109 n= 4	Location: B7 Mean: 78.950 Std Dev: 0.2887 n= 4	Location: B8 Mean: 73.375 Std Dev: 0.2500 n= 4	Location: B9 Mean: 72.450 Std Dev: 0.3000 n= 4	Location: B10 Mean: 70.450 Std Dev: 0.3416 n= 4
Location: A1 Mean: 62.425 Std Dev: 0.2754 n= 4	Location: A2 Mean: 65.400 Std Dev: 0.3916 n= 4	Location: A3 Mean: 73.675 Std Dev: 0.2986 n= 4	Location: A4 Mean: 78.675 Std Dev: 0.2630 n= 4	Location: A5 Mean: 81.450 Std Dev: 0.3416 n= 4	Location: A6 Mean: 87.800 Std Dev: 0.3162 n= 4	Location: A7 Mean: 75.550 Std Dev: 0.3109 n= 4	Location: A8 Mean: 70.400 Std Dev: 0.4243 n= 4	Location: A9 Mean: 68.350 Std Dev: 0.2646 n= 4	Location: A10 Mean: 60.675 Std Dev: 0.2363 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 4 - Mean and standard deviations of grid squares level 1, time= 45 seconds

Location: H1 Mean: 95.675 Std Dev: 0.4031 n= 4	Location: H2 Mean: 89.875 Std Dev: 0.3403 n= 4	Location: H3 Mean: 77.500 Std Dev: 0.3830 n= 4	Location: H4 Mean: 86.950 Std Dev: 0.2887 n= 4	Location: H5 Mean: 96.850 Std Dev: 0.4203 n= 4	Location: H6 Mean: 93.850 Std Dev: 0.3109 n= 4	Location: H7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: H8 Mean: 79.800 Std Dev: 0.2944 n= 4	Location: H9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: H10 Mean: 82.925 Std Dev: 0.0957 n= 4
Location: G1 Mean: 93.375 Std Dev: 0.2630 n= 4	Location: G2 Mean: 82.975 Std Dev: 0.3775 n= 4	Location: G3 Mean: 88.025 Std Dev: 0.2630 n= 4	Location: G4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: G5 Mean: 94.525 Std Dev: 0.2754 n= 4	Location: G6 Mean: 91.925 Std Dev: 0.4031 n= 4	Location: G7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: G8 Mean: 93.825 Std Dev: 0.2217 n= 4	Location: G9 Mean: 88.075 Std Dev: 0.2217 n= 4	Location: G10 Mean: 86.875 Std Dev: 0.2217 n= 4
Location: F1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F5 Mean: 93.500 Std Dev: 0.4243 n= 4	Location: F6 Mean: 78.650 Std Dev: 0.3416 n= 4	Location: F7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: E1 Mean: 83.925 Std Dev: 0.3304 n= 4	Location: E2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E3 Mean: 80.950 Std Dev: 0.2887 n= 4	Location: E4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E6 Mean: 81.150 Std Dev: 0.3109 n= 4	Location: E7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E8 Mean: 93.425 Std Dev: 0.2363 n= 4	Location: E9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E10 Mean: 83.675 Std Dev: 0.2363 n= 4
Location: D1 Mean: 77.975 Std Dev: 0.3775 n= 4	Location: D2 Mean: 90.400 Std Dev: 0.4546 n= 4	Location: D3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D5 Mean: 88.625 Std Dev: 0.3304 n= 4	Location: D6 Mean: 89.025 Std Dev: 0.3403 n= 4	Location: D7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D8 Mean: 88.375 Std Dev: 0.2630 n= 4	Location: D9 Mean: 88.500 Std Dev: 0.3559 n= 4	Location: D10 Mean: 83.525 Std Dev: 0.3500 n= 4
Location: C1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C2 Mean: 90.600 Std Dev: 0.3916 n= 4	Location: C3 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C5 Mean: 93.450 Std Dev: 0.3109 n= 4	Location: C6 Mean: 91.000 Std Dev: 0.2944 n= 4	Location: C7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C8 Mean: 86.575 Std Dev: 0.3775 n= 4	Location: C9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C10 Mean: 95.425 Std Dev: 0.4193 n= 4
Location: B1 Mean: 81.300 Std Dev: 0.3916 n= 4	Location: B2 Mean: 78.500 Std Dev: 0.4320 n= 4	Location: B3 Mean: 90.675 Std Dev: 0.4924 n= 4	Location: B4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B8 Mean: 89.975 Std Dev: 0.3304 n= 4	Location: B9 Mean: 90.850 Std Dev: 0.2380 n= 4	Location: B10 Mean: 92.000 Std Dev: 0.0816 n= 4
Location: A1 Mean: 74.650 Std Dev: 0.3416 n= 4	Location: A2 Mean: 77.750 Std Dev: 0.3697 n= 4	Location: A3 Mean: 91.500 Std Dev: 0.4243 n= 4	Location: A4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A8 Mean: 88.725 Std Dev: 0.3304 n= 4	Location: A9 Mean: 88.375 Std Dev: 0.3096 n= 4	Location: A10 Mean: 72.750 Std Dev: 0.2646 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 5 - Mean and standard deviations of grid squares level 1, time= 60 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 100.00	Mean: 100.00	Mean: 88.900	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 96.750	Mean: 100.00	Mean: 96.625
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.3742	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.2646	Std Dev: 0.0000	Std Dev: 0.2217
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 96.325	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.4349	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 94.100	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.3266	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 100.00	Mean: 91.550	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.3416	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 90.000	Mean: 91.575	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 88.125
Std Dev: 0.3367	Std Dev: 0.3096	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.2217
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 7 - Mean and standard deviations of grid squares level 2, time= 0 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 23.000	Mean: 23.075	Mean: 23.025	Mean: 23.050	Mean: 23.050	Mean: 23.075	Mean: 23.050	Mean: 23.000	Mean: 23.125	Mean: 23.050
Std Dev: 0.1155	Std Dev: 0.0957	Std Dev: 0.1258	Std Dev: 0.1732	Std Dev: 0.1732	Std Dev: 0.0957	Std Dev: 0.1915	Std Dev: 0.1414	Std Dev: 0.0957	Std Dev: 0.1291
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 23.075	Mean: 23.025	Mean: 22.850	Mean: 22.950	Mean: 22.975	Mean: 23.000	Mean: 23.025	Mean: 23.025	Mean: 23.000	Mean: 23.025
Std Dev: 0.1258	Std Dev: 0.1500	Std Dev: 0.0577	Std Dev: 0.1000	Std Dev: 0.0957	Std Dev: 0.1414	Std Dev: 0.0957	Std Dev: 0.1500	Std Dev: 0.1414	Std Dev: 0.1708
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 23.050	Mean: 22.950	Mean: 23.050	Mean: 23.000	Mean: 22.925	Mean: 23.100	Mean: 23.025	Mean: 23.100	Mean: 23.000	Mean: 22.900
Std Dev: 0.0577	Std Dev: 0.1732	Std Dev: 0.1291	Std Dev: 0.0816	Std Dev: 0.1500	Std Dev: 0.0816	Std Dev: 0.1258	Std Dev: 0.1155	Std Dev: 0.1414	Std Dev: 0.0816
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 23.100	Mean: 23.000	Mean: 22.950	Mean: 23.050	Mean: 22.925	Mean: 23.050	Mean: 23.000	Mean: 23.100	Mean: 22.950	Mean: 23.050
Std Dev: 0.1414	Std Dev: 0.1826	Std Dev: 0.1732	Std Dev: 0.0577	Std Dev: 0.1893	Std Dev: 0.1291	Std Dev: 0.1414	Std Dev: 0.1414	Std Dev: 0.0577	Std Dev: 0.1732
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 22.975	Mean: 23.100	Mean: 23.075	Mean: 23.075	Mean: 22.900	Mean: 23.050	Mean: 22.900	Mean: 23.025	Mean: 22.950	Mean: 23.000
Std Dev: 0.1500	Std Dev: 0.0816	Std Dev: 0.0500	Std Dev: 0.0957	Std Dev: 0.0816	Std Dev: 0.1291	Std Dev: 0.0816	Std Dev: 0.2062	Std Dev: 0.0577	Std Dev: 0.1414
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 23.050	Mean: 22.975	Mean: 22.900	Mean: 22.950	Mean: 23.025	Mean: 23.000	Mean: 23.025	Mean: 22.975	Mean: 23.075	Mean: 23.050
Std Dev: 0.1732	Std Dev: 0.0957	Std Dev: 0.0000	Std Dev: 0.1915	Std Dev: 0.1500	Std Dev: 0.1633	Std Dev: 0.1708	Std Dev: 0.1708	Std Dev: 0.0957	Std Dev: 0.1291
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 22.975	Mean: 22.950	Mean: 23.025	Mean: 22.925	Mean: 23.000	Mean: 22.950	Mean: 22.950	Mean: 23.075	Mean: 22.925	Mean: 23.025
Std Dev: 0.1500	Std Dev: 0.1732	Std Dev: 0.1500	Std Dev: 0.0500	Std Dev: 0.0816	Std Dev: 0.1291	Std Dev: 0.1732	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.0957
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 23.050	Mean: 23.025	Mean: 23.075	Mean: 23.000	Mean: 23.000	Mean: 23.125	Mean: 23.025	Mean: 23.050	Mean: 23.050	Mean: 23.025
Std Dev: 0.0577	Std Dev: 0.1258	Std Dev: 0.0957	Std Dev: 0.0816	Std Dev: 0.0816	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.1732	Std Dev: 0.1291	Std Dev: 0.1708
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 8 - Mean and standard deviations of grid squares level 2, time= 15 seconds

Location: H1 Mean: 54.825 Std Dev: 0.2754 n= 4	Location: H2 Mean: 49.600 Std Dev: 0.2582 n= 4	Location: H3 Mean: 52.525 Std Dev: 0.2217 n= 4	Location: H4 Mean: 51.625 Std Dev: 0.0957 n= 4	Location: H5 Mean: 47.475 Std Dev: 0.2986 n= 4	Location: H6 Mean: 51.100 Std Dev: 0.2582 n= 4	Location: H7 Mean: 52.525 Std Dev: 0.2217 n= 4	Location: H8 Mean: 47.975 Std Dev: 0.3775 n= 4	Location: H9 Mean: 49.475 Std Dev: 0.1708 n= 4	Location: H10 Mean: 46.000 Std Dev: 0.2160 n= 4
Location: G1 Mean: 50.450 Std Dev: 0.3000 n= 4	Location: G2 Mean: 51.225 Std Dev: 0.1708 n= 4	Location: G3 Mean: 50.550 Std Dev: 0.4435 n= 4	Location: G4 Mean: 50.975 Std Dev: 0.2872 n= 4	Location: G5 Mean: 48.800 Std Dev: 0.1826 n= 4	Location: G6 Mean: 51.925 Std Dev: 0.3594 n= 4	Location: G7 Mean: 49.375 Std Dev: 0.1708 n= 4	Location: G8 Mean: 48.775 Std Dev: 0.2217 n= 4	Location: G9 Mean: 48.050 Std Dev: 0.1915 n= 4	Location: G10 Mean: 51.000 Std Dev: 0.1633 n= 4
Location: F1 Mean: 58.650 Std Dev: 0.2887 n= 4	Location: F2 Mean: 55.250 Std Dev: 0.3109 n= 4	Location: F3 Mean: 46.325 Std Dev: 0.2986 n= 4	Location: F4 Mean: 48.825 Std Dev: 0.4031 n= 4	Location: F5 Mean: 53.500 Std Dev: 0.4163 n= 4	Location: F6 Mean: 53.000 Std Dev: 0.4082 n= 4	Location: F7 Mean: 57.425 Std Dev: 0.1708 n= 4	Location: F8 Mean: 52.275 Std Dev: 0.2363 n= 4	Location: F9 Mean: 50.850 Std Dev: 0.1291 n= 4	Location: F10 Mean: 49.925 Std Dev: 0.2217 n= 4
Location: E1 Mean: 56.975 Std Dev: 0.2217 n= 4	Location: E2 Mean: 57.975 Std Dev: 0.3304 n= 4	Location: E3 Mean: 49.925 Std Dev: 0.1708 n= 4	Location: E4 Mean: 54.300 Std Dev: 0.3162 n= 4	Location: E5 Mean: 50.625 Std Dev: 0.2630 n= 4	Location: E6 Mean: 52.375 Std Dev: 0.2217 n= 4	Location: E7 Mean: 48.775 Std Dev: 0.1708 n= 4	Location: E8 Mean: 49.675 Std Dev: 0.2500 n= 4	Location: E9 Mean: 51.350 Std Dev: 0.1732 n= 4	Location: E10 Mean: 51.675 Std Dev: 0.1708 n= 4
Location: D1 Mean: 56.850 Std Dev: 0.3873 n= 4	Location: D2 Mean: 55.475 Std Dev: 0.2630 n= 4	Location: D3 Mean: 52.550 Std Dev: 0.1291 n= 4	Location: D4 Mean: 51.800 Std Dev: 0.1826 n= 4	Location: D5 Mean: 50.125 Std Dev: 0.3403 n= 4	Location: D6 Mean: 47.175 Std Dev: 0.4031 n= 4	Location: D7 Mean: 48.975 Std Dev: 0.3304 n= 4	Location: D8 Mean: 42.500 Std Dev: 0.2000 n= 4	Location: D9 Mean: 49.350 Std Dev: 0.2517 n= 4	Location: D10 Mean: 51.175 Std Dev: 0.2062 n= 4
Location: C1 Mean: 55.375 Std Dev: 0.2500 n= 4	Location: C2 Mean: 54.250 Std Dev: 0.3512 n= 4	Location: C3 Mean: 49.525 Std Dev: 0.3403 n= 4	Location: C4 Mean: 55.550 Std Dev: 0.1291 n= 4	Location: C5 Mean: 53.925 Std Dev: 0.1708 n= 4	Location: C6 Mean: 51.225 Std Dev: 0.2217 n= 4	Location: C7 Mean: 49.575 Std Dev: 0.3096 n= 4	Location: C8 Mean: 51.300 Std Dev: 0.2944 n= 4	Location: C9 Mean: 55.950 Std Dev: 0.1291 n= 4	Location: C10 Mean: 51.175 Std Dev: 0.1708 n= 4
Location: B1 Mean: 51.275 Std Dev: 0.2754 n= 4	Location: B2 Mean: 57.875 Std Dev: 0.3775 n= 4	Location: B3 Mean: 48.650 Std Dev: 0.2517 n= 4	Location: B4 Mean: 53.625 Std Dev: 0.1708 n= 4	Location: B5 Mean: 51.150 Std Dev: 0.2380 n= 4	Location: B6 Mean: 50.750 Std Dev: 0.2082 n= 4	Location: B7 Mean: 53.450 Std Dev: 0.1291 n= 4	Location: B8 Mean: 46.275 Std Dev: 0.1500 n= 4	Location: B9 Mean: 48.225 Std Dev: 0.1708 n= 4	Location: B10 Mean: 50.700 Std Dev: 0.0816 n= 4
Location: A1 Mean: 52.400 Std Dev: 0.3559 n= 4	Location: A2 Mean: 52.900 Std Dev: 0.3916 n= 4	Location: A3 Mean: 46.325 Std Dev: 0.2630 n= 4	Location: A4 Mean: 49.875 Std Dev: 0.3862 n= 4	Location: A5 Mean: 53.450 Std Dev: 0.0577 n= 4	Location: A6 Mean: 54.925 Std Dev: 0.2986 n= 4	Location: A7 Mean: 61.250 Std Dev: 0.2380 n= 4	Location: A8 Mean: 48.575 Std Dev: 0.3096 n= 4	Location: A9 Mean: 48.725 Std Dev: 0.2754 n= 4	Location: A10 Mean: 53.500 Std Dev: 0.1826 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 9 - Mean and standard deviations of grid squares level 2, time= 30 seconds

Location: H1 Mean: 72.925 Std Dev: 0.2217 n= 4	Location: H2 Mean: 69.450 Std Dev: 0.2646 n= 4	Location: H3 Mean: 73.000 Std Dev: 0.4320 n= 4	Location: H4 Mean: 71.325 Std Dev: 0.2872 n= 4	Location: H5 Mean: 67.425 Std Dev: 0.3304 n= 4	Location: H6 Mean: 70.700 Std Dev: 0.1826 n= 4	Location: H7 Mean: 78.050 Std Dev: 0.4933 n= 4	Location: H8 Mean: 65.400 Std Dev: 0.2582 n= 4	Location: H9 Mean: 68.075 Std Dev: 0.1708 n= 4	Location: H10 Mean: 62.975 Std Dev: 0.2217 n= 4
Location: G1 Mean: 64.725 Std Dev: 0.2062 n= 4	Location: G2 Mean: 66.575 Std Dev: 0.3304 n= 4	Location: G3 Mean: 67.350 Std Dev: 0.2887 n= 4	Location: G4 Mean: 69.650 Std Dev: 0.3000 n= 4	Location: G5 Mean: 69.475 Std Dev: 0.3775 n= 4	Location: G6 Mean: 70.475 Std Dev: 0.2217 n= 4	Location: G7 Mean: 69.150 Std Dev: 0.3317 n= 4	Location: G8 Mean: 66.275 Std Dev: 0.3096 n= 4	Location: G9 Mean: 67.700 Std Dev: 0.2160 n= 4	Location: G10 Mean: 74.275 Std Dev: 0.2217 n= 4
Location: F1 Mean: 76.525 Std Dev: 0.3500 n= 4	Location: F2 Mean: 73.525 Std Dev: 0.3862 n= 4	Location: F3 Mean: 60.350 Std Dev: 0.2380 n= 4	Location: F4 Mean: 68.600 Std Dev: 0.3162 n= 4	Location: F5 Mean: 71.825 Std Dev: 0.1708 n= 4	Location: F6 Mean: 72.700 Std Dev: 0.4546 n= 4	Location: F7 Mean: 80.700 Std Dev: 0.2160 n= 4	Location: F8 Mean: 73.250 Std Dev: 0.2380 n= 4	Location: F9 Mean: 69.025 Std Dev: 0.2500 n= 4	Location: F10 Mean: 68.950 Std Dev: 0.2646 n= 4
Location: E1 Mean: 74.750 Std Dev: 0.2646 n= 4	Location: E2 Mean: 77.750 Std Dev: 0.2380 n= 4	Location: E3 Mean: 66.325 Std Dev: 0.3304 n= 4	Location: E4 Mean: 75.875 Std Dev: 0.2986 n= 4	Location: E5 Mean: 73.850 Std Dev: 0.2646 n= 4	Location: E6 Mean: 74.400 Std Dev: 0.5228 n= 4	Location: E7 Mean: 71.725 Std Dev: 0.2217 n= 4	Location: E8 Mean: 71.625 Std Dev: 0.1708 n= 4	Location: E9 Mean: 71.450 Std Dev: 0.1291 n= 4	Location: E10 Mean: 72.325 Std Dev: 0.0957 n= 4
Location: D1 Mean: 76.350 Std Dev: 0.3000 n= 4	Location: D2 Mean: 73.850 Std Dev: 0.1291 n= 4	Location: D3 Mean: 70.200 Std Dev: 0.3651 n= 4	Location: D4 Mean: 75.350 Std Dev: 0.2082 n= 4	Location: D5 Mean: 72.850 Std Dev: 0.1732 n= 4	Location: D6 Mean: 64.025 Std Dev: 0.4573 n= 4	Location: D7 Mean: 71.900 Std Dev: 0.2708 n= 4	Location: D8 Mean: 58.875 Std Dev: 0.1258 n= 4	Location: D9 Mean: 80.950 Std Dev: 0.1291 n= 4	Location: D10 Mean: 70.625 Std Dev: 0.0957 n= 4
Location: C1 Mean: 70.550 Std Dev: 0.5196 n= 4	Location: C2 Mean: 72.325 Std Dev: 0.3304 n= 4	Location: C3 Mean: 66.650 Std Dev: 0.2082 n= 4	Location: C4 Mean: 75.525 Std Dev: 0.3096 n= 4	Location: C5 Mean: 71.725 Std Dev: 0.1258 n= 4	Location: C6 Mean: 68.650 Std Dev: 0.1000 n= 4	Location: C7 Mean: 67.825 Std Dev: 0.1708 n= 4	Location: C8 Mean: 68.700 Std Dev: 0.0816 n= 4	Location: C9 Mean: 73.675 Std Dev: 0.1708 n= 4	Location: C10 Mean: 71.850 Std Dev: 0.2082 n= 4
Location: B1 Mean: 69.000 Std Dev: 0.2944 n= 4	Location: B2 Mean: 77.525 Std Dev: 0.3775 n= 4	Location: B3 Mean: 63.250 Std Dev: 0.1732 n= 4	Location: B4 Mean: 73.050 Std Dev: 0.1291 n= 4	Location: B5 Mean: 68.100 Std Dev: 0.2944 n= 4	Location: B6 Mean: 67.975 Std Dev: 0.3775 n= 4	Location: B7 Mean: 75.425 Std Dev: 0.4193 n= 4	Location: B8 Mean: 62.325 Std Dev: 0.3594 n= 4	Location: B9 Mean: 64.125 Std Dev: 0.1258 n= 4	Location: B10 Mean: 66.200 Std Dev: 0.1826 n= 4
Location: A1 Mean: 69.100 Std Dev: 0.4546 n= 4	Location: A2 Mean: 70.425 Std Dev: 0.3096 n= 4	Location: A3 Mean: 60.700 Std Dev: 0.2582 n= 4	Location: A4 Mean: 69.925 Std Dev: 0.4113 n= 4	Location: A5 Mean: 75.575 Std Dev: 0.2754 n= 4	Location: A6 Mean: 74.150 Std Dev: 0.3416 n= 4	Location: A7 Mean: 89.575 Std Dev: 0.3096 n= 4	Location: A8 Mean: 63.725 Std Dev: 0.3862 n= 4	Location: A9 Mean: 66.450 Std Dev: 0.2887 n= 4	Location: A10 Mean: 69.775 Std Dev: 0.1708 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 10 - Mean and standard deviations of grid squares level 2, time= 45 seconds

Location: H1 Mean: 87.025 Std Dev: 0.4031 n= 4	Location: H2 Mean: 82.025 Std Dev: 0.2630 n= 4	Location: H3 Mean: 91.625 Std Dev: 0.2986 n= 4	Location: H4 Mean: 90.600 Std Dev: 0.3367 n= 4	Location: H5 Mean: 80.550 Std Dev: 0.2646 n= 4	Location: H6 Mean: 91.500 Std Dev: 0.3559 n= 4	Location: H7 Mean: 93.625 Std Dev: 0.1708 n= 4	Location: H8 Mean: 79.400 Std Dev: 0.2944 n= 4	Location: H9 Mean: 85.475 Std Dev: 0.3862 n= 4	Location: H10 Mean: 81.375 Std Dev: 0.0957 n= 4
Location: G1 Mean: 76.225 Std Dev: 0.2062 n= 4	Location: G2 Mean: 76.750 Std Dev: 0.2380 n= 4	Location: G3 Mean: 80.700 Std Dev: 0.2449 n= 4	Location: G4 Mean: 86.450 Std Dev: 0.1732 n= 4	Location: G5 Mean: 87.750 Std Dev: 0.1732 n= 4	Location: G6 Mean: 88.675 Std Dev: 0.3403 n= 4	Location: G7 Mean: 84.050 Std Dev: 0.4203 n= 4	Location: G8 Mean: 80.100 Std Dev: 0.2582 n= 4	Location: G9 Mean: 80.250 Std Dev: 0.2380 n= 4	Location: G10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: F1 Mean: 95.200 Std Dev: 0.1633 n= 4	Location: F2 Mean: 86.650 Std Dev: 0.2887 n= 4	Location: F3 Mean: 72.650 Std Dev: 0.2517 n= 4	Location: F4 Mean: 88.400 Std Dev: 0.4082 n= 4	Location: F5 Mean: 91.975 Std Dev: 0.3096 n= 4	Location: F6 Mean: 96.225 Std Dev: 0.2754 n= 4	Location: F7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: F9 Mean: 90.150 Std Dev: 0.1291 n= 4	Location: F10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: E1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E3 Mean: 81.450 Std Dev: 0.3697 n= 4	Location: E4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E6 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E7 Mean: 93.575 Std Dev: 0.1708 n= 4	Location: E8 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: E10 Mean: 100.00 Std Dev: 0.0000 n= 4
Location: D1 Mean: 95.925 Std Dev: 0.2872 n= 4	Location: D2 Mean: 93.025 Std Dev: 0.4193 n= 4	Location: D3 Mean: 88.575 Std Dev: 0.2062 n= 4	Location: D4 Mean: 97.400 Std Dev: 0.3162 n= 4	Location: D5 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D6 Mean: 79.975 Std Dev: 0.3304 n= 4	Location: D7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D8 Mean: 72.775 Std Dev: 0.1500 n= 4	Location: D9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: D10 Mean: 97.150 Std Dev: 0.1291 n= 4
Location: C1 Mean: 83.908 Std Dev: 0.2256 n= 4	Location: C2 Mean: 85.575 Std Dev: 0.3500 n= 4	Location: C3 Mean: 79.725 Std Dev: 0.2754 n= 4	Location: C4 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: C5 Mean: 88.650 Std Dev: 0.2517 n= 4	Location: C6 Mean: 86.275 Std Dev: 0.1500 n= 4	Location: C7 Mean: 83.000 Std Dev: 0.2944 n= 4	Location: C8 Mean: 85.200 Std Dev: 0.3651 n= 4	Location: C9 Mean: 90.350 Std Dev: 0.1291 n= 4	Location: C10 Mean: 89.875 Std Dev: 0.2217 n= 4
Location: B1 Mean: 79.375 Std Dev: 0.2062 n= 4	Location: B2 Mean: 97.125 Std Dev: 0.2754 n= 4	Location: B3 Mean: 75.650 Std Dev: 0.4041 n= 4	Location: B4 Mean: 93.475 Std Dev: 0.3775 n= 4	Location: B5 Mean: 81.625 Std Dev: 0.2872 n= 4	Location: B6 Mean: 82.025 Std Dev: 0.2986 n= 4	Location: B7 Mean: 96.525 Std Dev: 0.2630 n= 4	Location: B8 Mean: 73.600 Std Dev: 0.1155 n= 4	Location: B9 Mean: 77.350 Std Dev: 0.2082 n= 4	Location: B10 Mean: 78.825 Std Dev: 0.2217 n= 4
Location: A1 Mean: 80.075 Std Dev: 0.2217 n= 4	Location: A2 Mean: 84.425 Std Dev: 0.3096 n= 4	Location: A3 Mean: 72.750 Std Dev: 0.2082 n= 4	Location: A4 Mean: 87.975 Std Dev: 0.2986 n= 4	Location: A5 Mean: 96.275 Std Dev: 0.3096 n= 4	Location: A6 Mean: 93.175 Std Dev: 0.5123 n= 4	Location: A7 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A8 Mean: 75.475 Std Dev: 0.0957 n= 4	Location: A9 Mean: 81.500 Std Dev: 0.1826 n= 4	Location: A10 Mean: 87.275 Std Dev: 0.1258 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 11 - Mean and standard deviations of grid squares level 2, time= 60 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 92.55	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.1732	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 87.750	Mean: 88.575	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.2380	Std Dev: 0.3096	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00	Mean: 100.00	Mean: 82.950	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.3109	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 95.450	Mean: 100.00	Mean: 87.525	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 83.750	Mean: 88.900	Mean: 96.950
Std Dev: 0.1732	Std Dev: 0.0000	Std Dev: 0.3775	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.1915	Std Dev: 0.1826	Std Dev: 0.1291
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 96.825	Mean: 100.00	Mean: 82.800	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 87.625	Mean: 100.00	Mean: 100.00
Std Dev: 0.1500	Std Dev: 0.0000	Std Dev: 0.1826	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.3862	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 13 - Mean and standard deviations of grid squares level 3, time= 0 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 23.025	Mean: 22.975	Mean: 22.975	Mean: 23.000	Mean: 22.875	Mean: 22.925	Mean: 22.950	Mean: 23.050	Mean: 23.025	Mean: 23.025
Std Dev: 0.1708	Std Dev: 0.0957	Std Dev: 0.1708	Std Dev: 0.1155	Std Dev: 0.0957	Std Dev: 0.0500	Std Dev: 0.0577	Std Dev: 0.1291	Std Dev: 0.0957	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 22.925	Mean: 23.075	Mean: 23.025	Mean: 23.000	Mean: 23.075	Mean: 23.050	Mean: 23.075	Mean: 23.000	Mean: 23.025	Mean: 23.075
Std Dev: 0.1500	Std Dev: 0.1893	Std Dev: 0.0957	Std Dev: 0.1633	Std Dev: 0.0957	Std Dev: 0.1732	Std Dev: 0.0957	Std Dev: 0.0816	Std Dev: 0.1258	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 22.975	Mean: 22.975	Mean: 23.050	Mean: 23.000	Mean: 23.050	Mean: 23.000	Mean: 23.025	Mean: 23.000	Mean: 23.050	Mean: 22.925
Std Dev: 0.0957	Std Dev: 0.0957	Std Dev: 0.1291	Std Dev: 0.1414	Std Dev: 0.0577	Std Dev: 0.1155	Std Dev: 0.1708	Std Dev: 0.1414	Std Dev: 0.0577	Std Dev: 0.1258
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 22.925	Mean: 23.025	Mean: 22.950	Mean: 22.925	Mean: 22.950	Mean: 23.100	Mean: 22.925	Mean: 22.975	Mean: 23.050	Mean: 23.000
Std Dev: 0.0957	Std Dev: 0.1500	Std Dev: 0.1732	Std Dev: 0.0500	Std Dev: 0.1291	Std Dev: 0.0000	Std Dev: 0.0957	Std Dev: 0.1500	Std Dev: 0.1291	Std Dev: 0.0816
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 22.975	Mean: 23.050	Mean: 23.025	Mean: 22.975	Mean: 23.025	Mean: 22.825	Mean: 23.000	Mean: 23.000	Mean: 23.025	Mean: 22.875
Std Dev: 0.1500	Std Dev: 0.1291	Std Dev: 0.0957	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.0500	Std Dev: 0.1414	Std Dev: 0.1414	Std Dev: 0.1258	Std Dev: 0.0957
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 22.875	Mean: 22.875	Mean: 23.050	Mean: 22.925	Mean: 23.050	Mean: 22.900	Mean: 23.025	Mean: 23.075	Mean: 22.975	Mean: 22.950
Std Dev: 0.0500	Std Dev: 0.0957	Std Dev: 0.1291	Std Dev: 0.0957	Std Dev: 0.1732	Std Dev: 0.0000	Std Dev: 0.0957	Std Dev: 0.0500	Std Dev: 0.0500	Std Dev: 0.1291
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 22.850	Mean: 23.025	Mean: 22.950	Mean: 22.925	Mean: 22.925	Mean: 23.000	Mean: 22.950	Mean: 23.000	Mean: 22.975	Mean: 22.925
Std Dev: 0.0577	Std Dev: 0.2062	Std Dev: 0.1000	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.1414	Std Dev: 0.1732	Std Dev: 0.1414	Std Dev: 0.0500	Std Dev: 0.0957
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 23.100	Mean: 23.100	Mean: 22.975	Mean: 22.975	Mean: 23.000	Mean: 22.950	Mean: 23.050	Mean: 22.925	Mean: 23.075	Mean: 23.025
Std Dev: 0.0816	Std Dev: 0.0000	Std Dev: 0.1500	Std Dev: 0.0957	Std Dev: 0.1155	Std Dev: 0.1291	Std Dev: 0.1291	Std Dev: 0.0957	Std Dev: 0.0500	Std Dev: 0.1708
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 14 - Mean and standard deviations of grid squares level 3, time= 15 seconds

Location: H1 Mean: 55.575 Std Dev: 0.1258 n= 4	Location: H2 Mean: 55.800 Std Dev: 0.1414 n= 4	Location: H3 Mean: 47.775 Std Dev: 0.2062 n= 4	Location: H4 Mean: 55.025 Std Dev: 0.1708 n= 4	Location: H5 Mean: 56.075 Std Dev: 0.1258 n= 4	Location: H6 Mean: 56.600 Std Dev: 0.2160 n= 4	Location: H7 Mean: 54.475 Std Dev: 0.2630 n= 4	Location: H8 Mean: 52.475 Std Dev: 0.1500 n= 4	Location: H9 Mean: 50.250 Std Dev: 0.1291 n= 4	Location: H10 Mean: 52.925 Std Dev: 0.1708 n= 4
Location: G1 Mean: 50.450 Std Dev: 0.2517 n= 4	Location: G2 Mean: 52.850 Std Dev: 0.2646 n= 4	Location: G3 Mean: 50.450 Std Dev: 0.1915 n= 4	Location: G4 Mean: 50.450 Std Dev: 0.2646 n= 4	Location: G5 Mean: 52.875 Std Dev: 0.1258 n= 4	Location: G6 Mean: 49.500 Std Dev: 0.1826 n= 4	Location: G7 Mean: 49.200 Std Dev: 0.1826 n= 4	Location: G8 Mean: 49.033 Std Dev: 0.1758 n= 4	Location: G9 Mean: 48.425 Std Dev: 0.1258 n= 4	Location: G10 Mean: 54.275 Std Dev: 0.2062 n= 4
Location: F1 Mean: 50.400 Std Dev: 0.2944 n= 4	Location: F2 Mean: 45.375 Std Dev: 0.4272 n= 4	Location: F3 Mean: 47.900 Std Dev: 0.2160 n= 4	Location: F4 Mean: 51.125 Std Dev: 0.2754 n= 4	Location: F5 Mean: 47.350 Std Dev: 0.2082 n= 4	Location: F6 Mean: 51.050 Std Dev: 0.2082 n= 4	Location: F7 Mean: 48.200 Std Dev: 0.2708 n= 4	Location: F8 Mean: 48.975 Std Dev: 0.2363 n= 4	Location: F9 Mean: 45.325 Std Dev: 0.2630 n= 4	Location: F10 Mean: 52.350 Std Dev: 0.2082 n= 4
Location: E1 Mean: 52.500 Std Dev: 0.1826 n= 4	Location: E2 Mean: 48.725 Std Dev: 0.2630 n= 4	Location: E3 Mean: 47.575 Std Dev: 0.2062 n= 4	Location: E4 Mean: 49.525 Std Dev: 0.1500 n= 4	Location: E5 Mean: 51.700 Std Dev: 0.0816 n= 4	Location: E6 Mean: 50.375 Std Dev: 0.2062 n= 4	Location: E7 Mean: 49.925 Std Dev: 0.3304 n= 4	Location: E8 Mean: 49.850 Std Dev: 0.1291 n= 4	Location: E9 Mean: 48.150 Std Dev: 0.1291 n= 4	Location: E10 Mean: 52.600 Std Dev: 0.1414 n= 4
Location: D1 Mean: 50.825 Std Dev: 0.1708 n= 4	Location: D2 Mean: 47.700 Std Dev: 0.1155 n= 4	Location: D3 Mean: 48.450 Std Dev: 0.1291 n= 4	Location: D4 Mean: 52.150 Std Dev: 0.1000 n= 4	Location: D5 Mean: 51.175 Std Dev: 0.2986 n= 4	Location: D6 Mean: 48.750 Std Dev: 0.2646 n= 4	Location: D7 Mean: 49.050 Std Dev: 0.2887 n= 4	Location: D8 Mean: 51.750 Std Dev: 0.1291 n= 4	Location: D9 Mean: 49.100 Std Dev: 0.1633 n= 4	Location: D10 Mean: 52.325 Std Dev: 0.2500 n= 4
Location: C1 Mean: 50.375 Std Dev: 0.2500 n= 4	Location: C2 Mean: 49.375 Std Dev: 0.0957 n= 4	Location: C3 Mean: 46.225 Std Dev: 0.1258 n= 4	Location: C4 Mean: 50.650 Std Dev: 0.2380 n= 4	Location: C5 Mean: 53.200 Std Dev: 0.1155 n= 4	Location: C6 Mean: 50.350 Std Dev: 0.2082 n= 4	Location: C7 Mean: 48.200 Std Dev: 0.0816 n= 4	Location: C8 Mean: 47.350 Std Dev: 0.2517 n= 4	Location: C9 Mean: 47.550 Std Dev: 0.1291 n= 4	Location: C10 Mean: 51.325 Std Dev: 0.0500 n= 4
Location: B1 Mean: 54.325 Std Dev: 0.1708 n= 4	Location: B2 Mean: 56.925 Std Dev: 0.1708 n= 4	Location: B3 Mean: 49.475 Std Dev: 0.2217 n= 4	Location: B4 Mean: 50.050 Std Dev: 0.2380 n= 4	Location: B5 Mean: 49.875 Std Dev: 0.2217 n= 4	Location: B6 Mean: 48.300 Std Dev: 0.1414 n= 4	Location: B7 Mean: 50.375 Std Dev: 0.2217 n= 4	Location: B8 Mean: 50.625 Std Dev: 0.2217 n= 4	Location: B9 Mean: 52.350 Std Dev: 0.2082 n= 4	Location: B10 Mean: 53.600 Std Dev: 0.1633 n= 4
Location: A1 Mean: 58.050 Std Dev: 0.1291 n= 4	Location: A2 Mean: 50.500 Std Dev: 0.1826 n= 4	Location: A3 Mean: 45.150 Std Dev: 0.1291 n= 4	Location: A4 Mean: 52.800 Std Dev: 0.1633 n= 4	Location: A5 Mean: 50.425 Std Dev: 0.2630 n= 4	Location: A6 Mean: 50.850 Std Dev: 0.1291 n= 4	Location: A7 Mean: 54.950 Std Dev: 0.1291 n= 4	Location: A8 Mean: 48.450 Std Dev: 0.1915 n= 4	Location: A9 Mean: 54.050 Std Dev: 0.1291 n= 4	Location: A10 Mean: 50.750 Std Dev: 0.2082 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 15 - Mean and standard deviations of grid squares level 3, time= 30 seconds

Location: H1 Mean: 75.500 Std Dev: 0.1826 n= 4	Location: H2 Mean: 73.600 Std Dev: 0.1414 n= 4	Location: H3 Mean: 66.950 Std Dev: 0.3416 n= 4	Location: H4 Mean: 75.250 Std Dev: 0.1291 n= 4	Location: H5 Mean: 72.050 Std Dev: 0.2082 n= 4	Location: H6 Mean: 74.750 Std Dev: 0.1291 n= 4	Location: H7 Mean: 74.850 Std Dev: 0.2517 n= 4	Location: H8 Mean: 70.775 Std Dev: 0.2217 n= 4	Location: H9 Mean: 68.675 Std Dev: 0.3304 n= 4	Location: H10 Mean: 74.400 Std Dev: 0.2944 n= 4
Location: G1 Mean: 68.350 Std Dev: 0.2082 n= 4	Location: G2 Mean: 70.975 Std Dev: 0.2872 n= 4	Location: G3 Mean: 64.450 Std Dev: 0.3000 n= 4	Location: G4 Mean: 70.675 Std Dev: 0.2500 n= 4	Location: G5 Mean: 71.425 Std Dev: 0.2217 n= 4	Location: G6 Mean: 65.500 Std Dev: 0.1414 n= 4	Location: G7 Mean: 64.775 Std Dev: 0.1708 n= 4	Location: G8 Mean: 66.100 Std Dev: 0.3162 n= 4	Location: G9 Mean: 65.500 Std Dev: 0.1826 n= 4	Location: G10 Mean: 73.600 Std Dev: 0.0816 n= 4
Location: F1 Mean: 68.375 Std Dev: 0.2062 n= 4	Location: F2 Mean: 60.800 Std Dev: 0.1414 n= 4	Location: F3 Mean: 62.850 Std Dev: 0.2380 n= 4	Location: F4 Mean: 67.650 Std Dev: 0.3416 n= 4	Location: F5 Mean: 61.975 Std Dev: 0.3096 n= 4	Location: F6 Mean: 66.050 Std Dev: 0.2646 n= 4	Location: F7 Mean: 64.675 Std Dev: 0.2872 n= 4	Location: F8 Mean: 62.675 Std Dev: 0.0957 n= 4	Location: F9 Mean: 59.950 Std Dev: 0.1291 n= 4	Location: F10 Mean: 67.575 Std Dev: 0.2986 n= 4
Location: E1 Mean: 73.575 Std Dev: 0.1258 n= 4	Location: E2 Mean: 64.600 Std Dev: 0.2160 n= 4	Location: E3 Mean: 63.075 Std Dev: 0.1500 n= 4	Location: E4 Mean: 64.400 Std Dev: 0.2000 n= 4	Location: E5 Mean: 71.350 Std Dev: 0.0577 n= 4	Location: E6 Mean: 67.600 Std Dev: 0.1633 n= 4	Location: E7 Mean: 66.675 Std Dev: 0.2217 n= 4	Location: E8 Mean: 68.400 Std Dev: 0.1414 n= 4	Location: E9 Mean: 62.350 Std Dev: 0.1732 n= 4	Location: E10 Mean: 70.325 Std Dev: 0.1708 n= 4
Location: D1 Mean: 70.325 Std Dev: 0.2500 n= 4	Location: D2 Mean: 65.400 Std Dev: 0.2160 n= 4	Location: D3 Mean: 65.325 Std Dev: 0.2630 n= 4	Location: D4 Mean: 65.325 Std Dev: 0.3862 n= 4	Location: D5 Mean: 67.775 Std Dev: 0.1708 n= 4	Location: D6 Mean: 66.000 Std Dev: 0.2582 n= 4	Location: D7 Mean: 67.175 Std Dev: 0.1708 n= 4	Location: D8 Mean: 71.175 Std Dev: 0.1708 n= 4	Location: D9 Mean: 65.500 Std Dev: 0.1826 n= 4	Location: D10 Mean: 71.500 Std Dev: 0.1155 n= 4
Location: C1 Mean: 67.375 Std Dev: 0.3775 n= 4	Location: C2 Mean: 65.350 Std Dev: 0.2082 n= 4	Location: C3 Mean: 62.325 Std Dev: 0.2500 n= 4	Location: C4 Mean: 70.425 Std Dev: 0.3403 n= 4	Location: C5 Mean: 71.600 Std Dev: 0.0816 n= 4	Location: C6 Mean: 65.450 Std Dev: 0.2646 n= 4	Location: C7 Mean: 64.700 Std Dev: 0.2582 n= 4	Location: C8 Mean: 65.000 Std Dev: 0.2000 n= 4	Location: C9 Mean: 64.200 Std Dev: 0.1414 n= 4	Location: C10 Mean: 67.850 Std Dev: 0.2082 n= 4
Location: B1 Mean: 75.675 Std Dev: 0.2062 n= 4	Location: B2 Mean: 76.050 Std Dev: 0.2646 n= 4	Location: B3 Mean: 65.850 Std Dev: 0.1291 n= 4	Location: B4 Mean: 66.525 Std Dev: 0.1708 n= 4	Location: B5 Mean: 65.675 Std Dev: 0.2500 n= 4	Location: B6 Mean: 63.800 Std Dev: 0.2449 n= 4	Location: B7 Mean: 68.725 Std Dev: 0.1258 n= 4	Location: B8 Mean: 67.550 Std Dev: 0.1000 n= 4	Location: B9 Mean: 71.225 Std Dev: 0.3403 n= 4	Location: B10 Mean: 73.275 Std Dev: 0.2363 n= 4
Location: A1 Mean: 78.775 Std Dev: 0.1500 n= 4	Location: A2 Mean: 65.375 Std Dev: 0.2986 n= 4	Location: A3 Mean: 60.475 Std Dev: 0.2217 n= 4	Location: A4 Mean: 72.325 Std Dev: 0.2872 n= 4	Location: A5 Mean: 68.350 Std Dev: 0.0577 n= 4	Location: A6 Mean: 67.750 Std Dev: 0.3109 n= 4	Location: A7 Mean: 74.975 Std Dev: 0.3775 n= 4	Location: A8 Mean: 65.800 Std Dev: 0.3559 n= 4	Location: A9 Mean: 75.700 Std Dev: 0.2449 n= 4	Location: A10 Mean: 71.325 Std Dev: 0.2500 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 16 - Mean and standard deviations of grid squares level 3, time= 45 seconds

Location: H1 Mean: 94.150 Std Dev: 0.1291 n= 4	Location: H2 Mean: 91.475 Std Dev: 0.1708 n= 4	Location: H3 Mean: 79.750 Std Dev: 0.2517 n= 4	Location: H4 Mean: 95.725 Std Dev: 0.2062 n= 4	Location: H5 Mean: 85.725 Std Dev: 0.2500 n= 4	Location: H6 Mean: 92.425 Std Dev: 0.2754 n= 4	Location: H7 Mean: 92.900 Std Dev: 0.1826 n= 4	Location: H8 Mean: 92.725 Std Dev: 0.2630 n= 4	Location: H9 Mean: 82.875 Std Dev: 0.2754 n= 4	Location: H10 Mean: 92.550 Std Dev: 0.2380 n= 4
Location: G1 Mean: 82.350 Std Dev: 0.3512 n= 4	Location: G2 Mean: 86.300 Std Dev: 0.2160 n= 4	Location: G3 Mean: 77.650 Std Dev: 0.1291 n= 4	Location: G4 Mean: 84.650 Std Dev: 0.0577 n= 4	Location: G5 Mean: 89.375 Std Dev: 0.1708 n= 4	Location: G6 Mean: 77.700 Std Dev: 0.0816 n= 4	Location: G7 Mean: 76.150 Std Dev: 0.0577 n= 4	Location: G8 Mean: 80.150 Std Dev: 0.2082 n= 4	Location: G9 Mean: 78.650 Std Dev: 0.0577 n= 4	Location: G10 Mean: 92.825 Std Dev: 0.2754 n= 4
Location: F1 Mean: 83.300 Std Dev: 0.3162 n= 4	Location: F2 Mean: 70.150 Std Dev: 0.2380 n= 4	Location: F3 Mean: 74.850 Std Dev: 0.2380 n= 4	Location: F4 Mean: 81.900 Std Dev: 0.1633 n= 4	Location: F5 Mean: 74.200 Std Dev: 0.1826 n= 4	Location: F6 Mean: 79.250 Std Dev: 0.1291 n= 4	Location: F7 Mean: 75.300 Std Dev: 0.2449 n= 4	Location: F8 Mean: 74.175 Std Dev: 0.3500 n= 4	Location: F9 Mean: 70.375 Std Dev: 0.2217 n= 4	Location: F10 Mean: 80.550 Std Dev: 0.1915 n= 4
Location: E1 Mean: 94.550 Std Dev: 0.1291 n= 4	Location: E2 Mean: 76.725 Std Dev: 0.1708 n= 4	Location: E3 Mean: 76.575 Std Dev: 0.1500 n= 4	Location: E4 Mean: 77.500 Std Dev: 0.1826 n= 4	Location: E5 Mean: 89.675 Std Dev: 0.2500 n= 4	Location: E6 Mean: 78.950 Std Dev: 0.1291 n= 4	Location: E7 Mean: 78.225 Std Dev: 0.1708 n= 4	Location: E8 Mean: 82.500 Std Dev: 0.2944 n= 4	Location: E9 Mean: 73.800 Std Dev: 0.1826 n= 4	Location: E10 Mean: 91.875 Std Dev: 0.2630 n= 4
Location: D1 Mean: 91.375 Std Dev: 0.1708 n= 4	Location: D2 Mean: 79.500 Std Dev: 0.1155 n= 4	Location: D3 Mean: 77.975 Std Dev: 0.3304 n= 4	Location: D4 Mean: 76.875 Std Dev: 0.2630 n= 4	Location: D5 Mean: 83.400 Std Dev: 0.1155 n= 4	Location: D6 Mean: 78.825 Std Dev: 0.2217 n= 4	Location: D7 Mean: 80.925 Std Dev: 0.1708 n= 4	Location: D8 Mean: 88.125 Std Dev: 0.2217 n= 4	Location: D9 Mean: 74.500 Std Dev: 0.2708 n= 4	Location: D10 Mean: 88.375 Std Dev: 0.2986 n= 4
Location: C1 Mean: 79.400 Std Dev: 0.2944 n= 4	Location: C2 Mean: 77.850 Std Dev: 0.1291 n= 4	Location: C3 Mean: 75.575 Std Dev: 0.1500 n= 4	Location: C4 Mean: 85.000 Std Dev: 0.2160 n= 4	Location: C5 Mean: 93.075 Std Dev: 0.2500 n= 4	Location: C6 Mean: 80.050 Std Dev: 0.1291 n= 4	Location: C7 Mean: 81.350 Std Dev: 0.0577 n= 4	Location: C8 Mean: 80.675 Std Dev: 0.2500 n= 4	Location: C9 Mean: 75.400 Std Dev: 0.3559 n= 4	Location: C10 Mean: 81.300 Std Dev: 0.2160 n= 4
Location: B1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B2 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: B3 Mean: 79.200 Std Dev: 0.1826 n= 4	Location: B4 Mean: 80.850 Std Dev: 0.1915 n= 4	Location: B5 Mean: 80.275 Std Dev: 0.1258 n= 4	Location: B6 Mean: 76.675 Std Dev: 0.3775 n= 4	Location: B7 Mean: 84.950 Std Dev: 0.2380 n= 4	Location: B8 Mean: 83.175 Std Dev: 0.2217 n= 4	Location: B9 Mean: 89.125 Std Dev: 0.2754 n= 4	Location: B10 Mean: 91.450 Std Dev: 0.2646 n= 4
Location: A1 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A2 Mean: 75.925 Std Dev: 0.1708 n= 4	Location: A3 Mean: 71.400 Std Dev: 0.0816 n= 4	Location: A4 Mean: 90.800 Std Dev: 0.1414 n= 4	Location: A5 Mean: 81.650 Std Dev: 0.1291 n= 4	Location: A6 Mean: 82.775 Std Dev: 0.1708 n= 4	Location: A7 Mean: 94.400 Std Dev: 0.1155 n= 4	Location: A8 Mean: 81.200 Std Dev: 0.1826 n= 4	Location: A9 Mean: 100.00 Std Dev: 0.0000 n= 4	Location: A10 Mean: 91.100 Std Dev: 0.2582 n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 17 - Mean and standard deviations of grid squares level 3, time= 60 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 97.900	Mean: 100.00	Mean: 96.250	Mean: 100.00	Mean: 100.00	Mean: 92.625	Mean: 89.750	Mean: 100.00	Mean: 95.025	Mean: 100.00
Std Dev: 0.2160	Std Dev: 0.0000	Std Dev: 0.1291	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.1708	Std Dev: 0.3109	Std Dev: 0.0000	Std Dev: 0.1708	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00	Mean: 79.250	Mean: 87.675	Mean: 100.00	Mean: 87.575	Mean: 94.350	Mean: 89.000	Mean: 88.600	Mean: 80.800	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.1732	Std Dev: 0.0500	Std Dev: 0.0000	Std Dev: 0.3096	Std Dev: 0.2517	Std Dev: 0.2160	Std Dev: 0.2160	Std Dev: 0.1826	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 100.00	Mean: 91.700	Mean: 94.100	Mean: 95.625	Mean: 100.00	Mean: 92.000	Mean: 91.500	Mean: 100.00	Mean: 85.550	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.2449	Std Dev: 0.1414	Std Dev: 0.2986	Std Dev: 0.0000	Std Dev: 0.2160	Std Dev: 0.2708	Std Dev: 0.0000	Std Dev: 0.3873	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 100.00	Mean: 97.825	Mean: 94.175	Mean: 88.900	Mean: 100.00	Mean: 94.275	Mean: 94.225	Mean: 100.00	Mean: 88.275	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.1258	Std Dev: 0.0957	Std Dev: 0.2944	Std Dev: 0.0000	Std Dev: 0.3096	Std Dev: 0.1893	Std Dev: 0.0000	Std Dev: 0.1258	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 90.150	Mean: 95.725	Mean: 94.550	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 90.975	Mean: 100.00
Std Dev: 0.1291	Std Dev: 0.2986	Std Dev: 0.1291	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.2500	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 100.00	Mean: 100.00	Mean: 97.100	Mean: 96.650	Mean: 100.00	Mean: 89.550	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.1633	Std Dev: 0.2646	Std Dev: 0.0000	Std Dev: 0.3416	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 100.00	Mean: 86.850	Mean: 81.375	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 98.650	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.1291	Std Dev: 0.1708	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.2517	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

Table D 18 - Mean and standard deviations of grid squares level 3, time= 75 seconds

Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00	Mean: 90.775	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 94.325	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.2217	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.2754	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4
Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Mean: 100.00	Mean: 100.00	Mean: 97.350	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00	Mean: 100.00
Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.3109	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000	Std Dev: 0.0000
n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4	n= 4

	Boiling
	Mean temperature of 90°C to 99.999°C
	Mean temperature of 80°C to 89.999°C
	Mean temperature of 70°C to 79.999°C
	Mean temperature of 60°C to 69.999°C
	Mean temperature of 50°C to 59.999°C

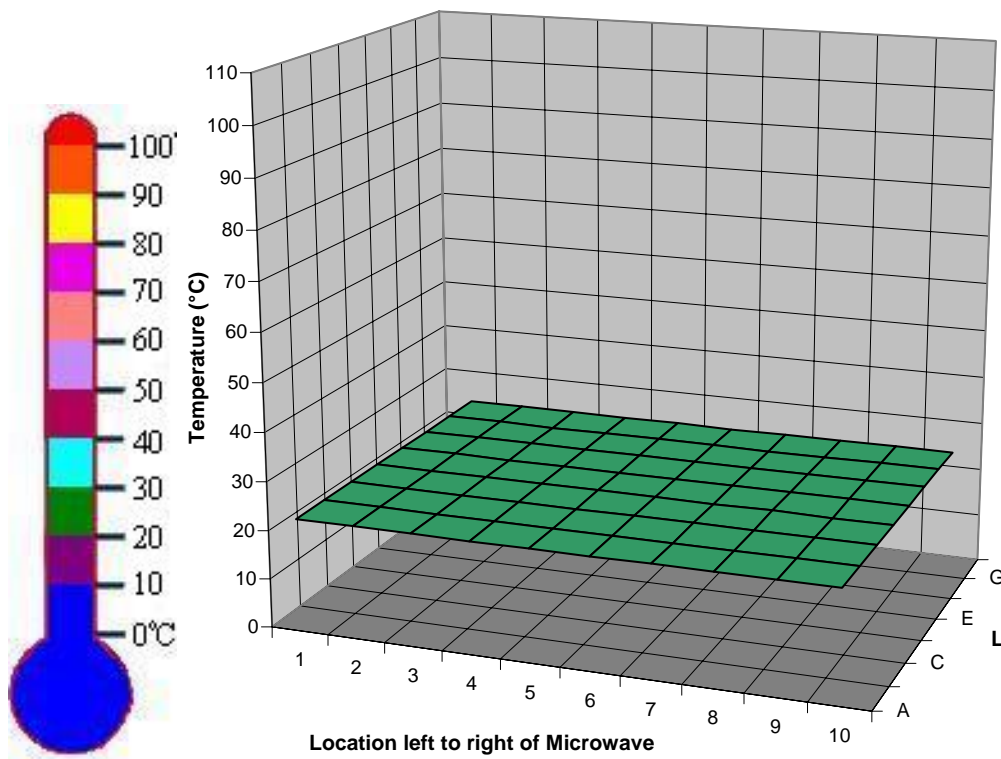
	Mean temperature of 40°C to 49.999°C
	Mean temperature of 30°C to 39.999°C
	Mean temperature of 20°C to 29.999°C
	Mean temperature of 10°C to 19.999°C
	Mean temperature of 0°C to 9.999°C

APPENDIX E

3-D Maps of temperature profile

Figure E 1 - 3-D map of level 1, time= 0 seconds

Temperature Profile Level 1 0 Seconds



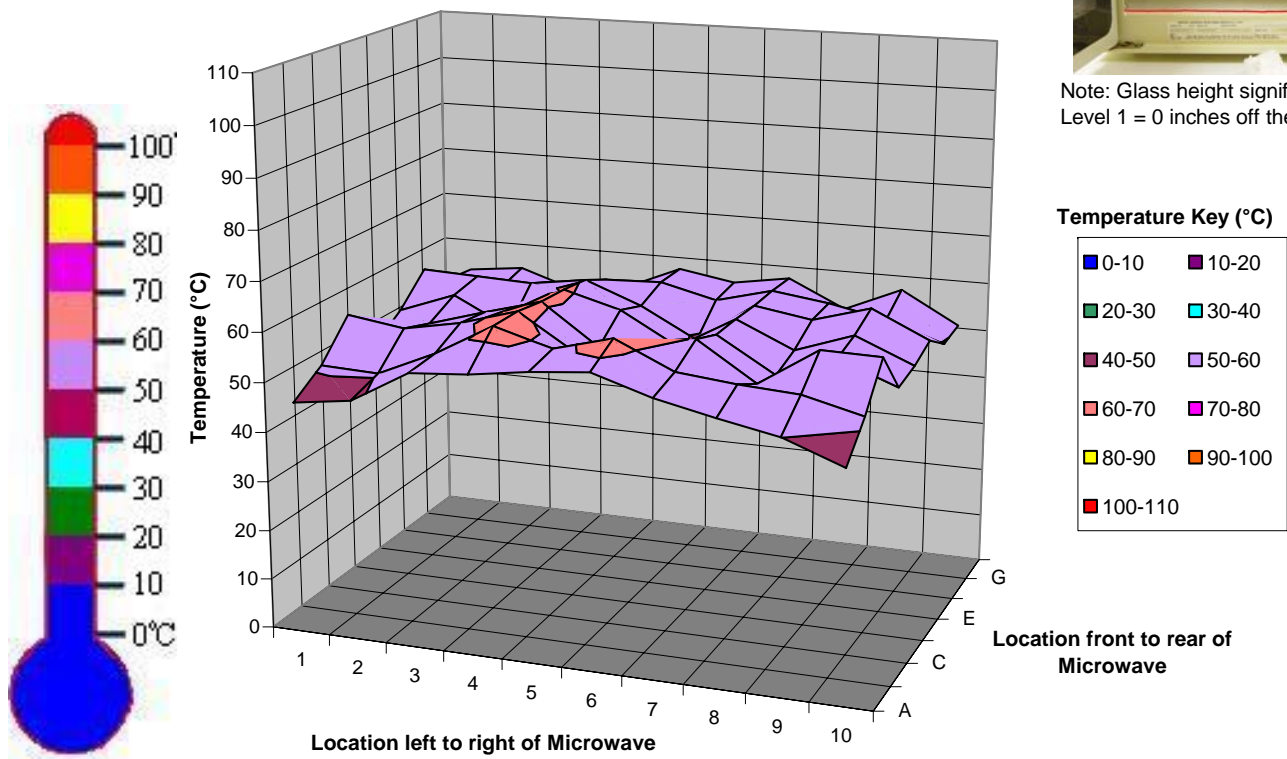
Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 2 - 3-D map of level 1, time= 15 seconds

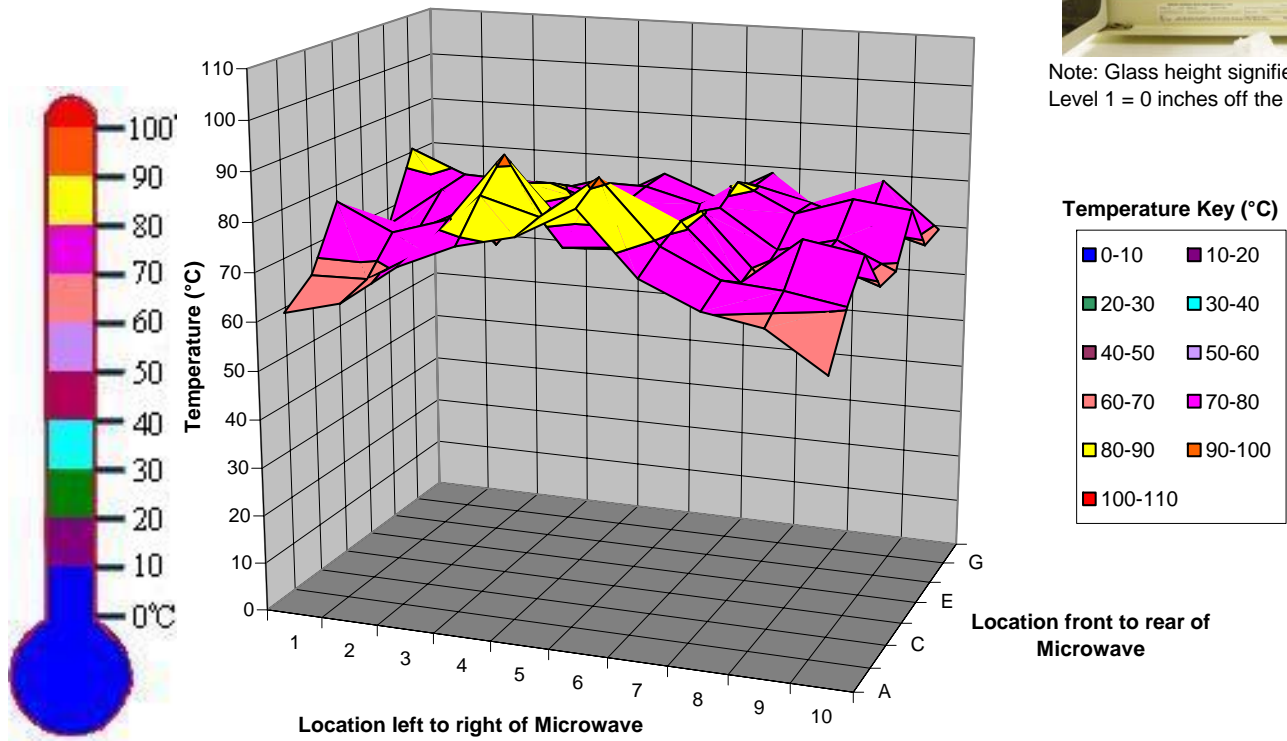
Temperature Profile Level 1 15 Seconds



Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Figure E 3 - 3-D map of level 1, time= 30 seconds

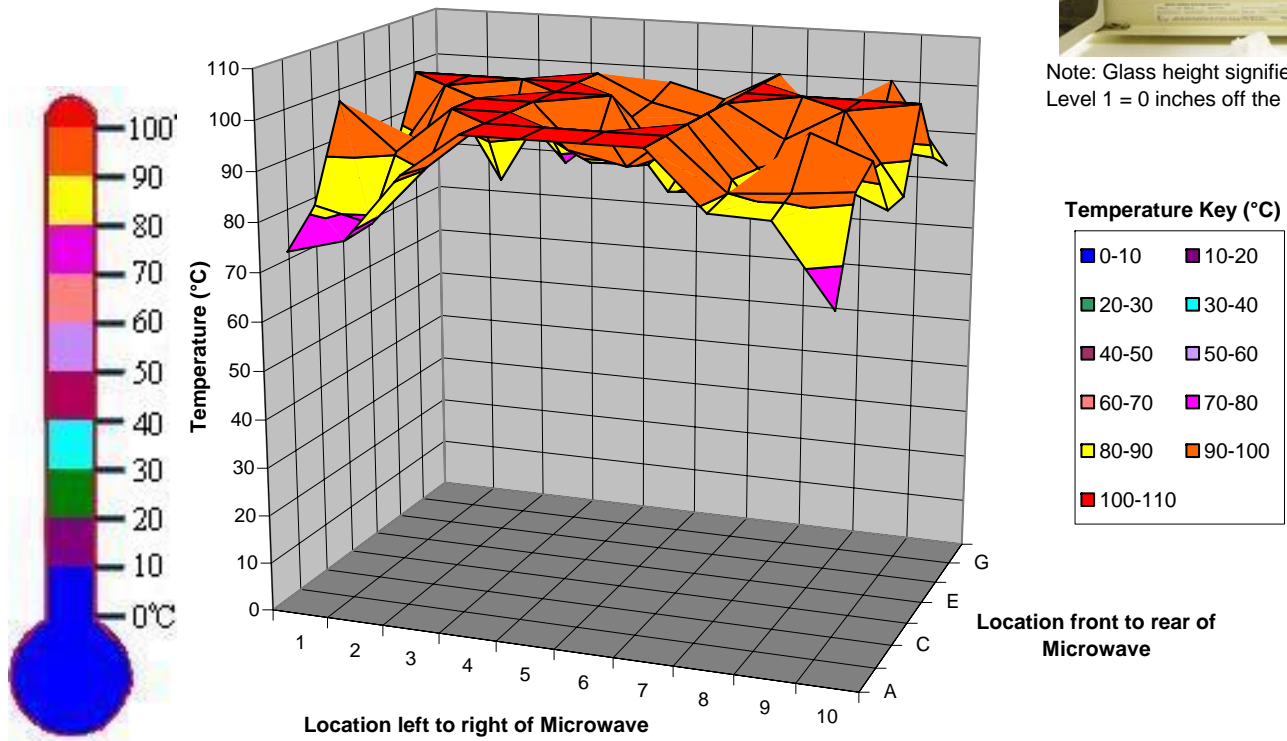
Temperature Profile Level 1 30 Seconds



Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Figure E 4 - 3-D map of level 1, time= 45 seconds

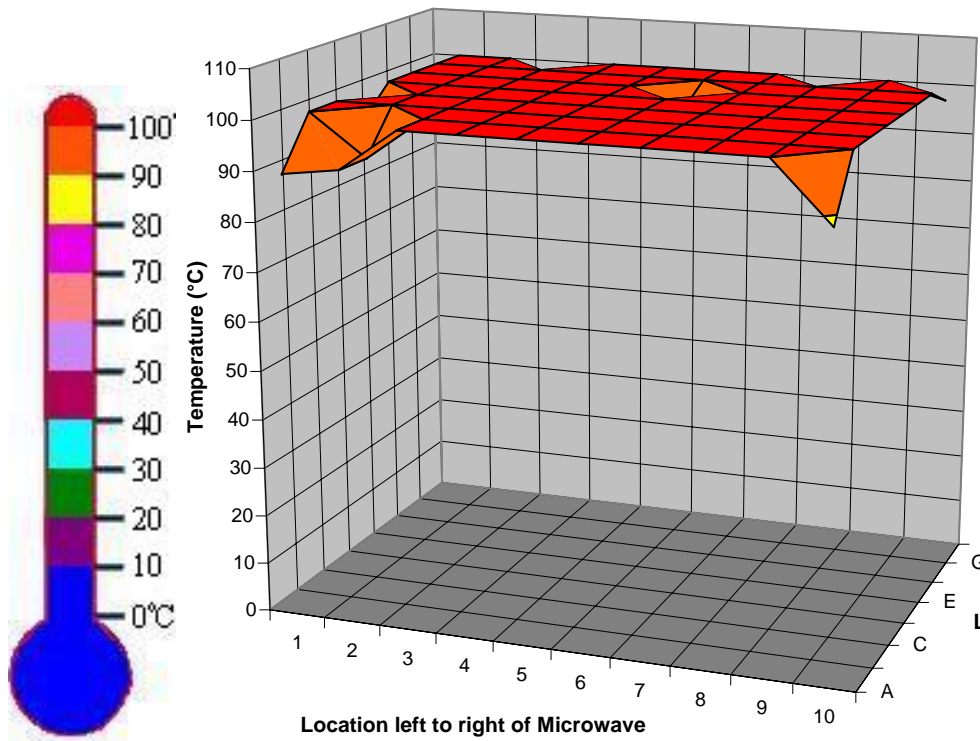
Temperature Profile Level 1 45 Seconds



Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Figure E 5 - 3-D map of level 1, time= 60 seconds

Temperature Profile Level 1 60 Seconds



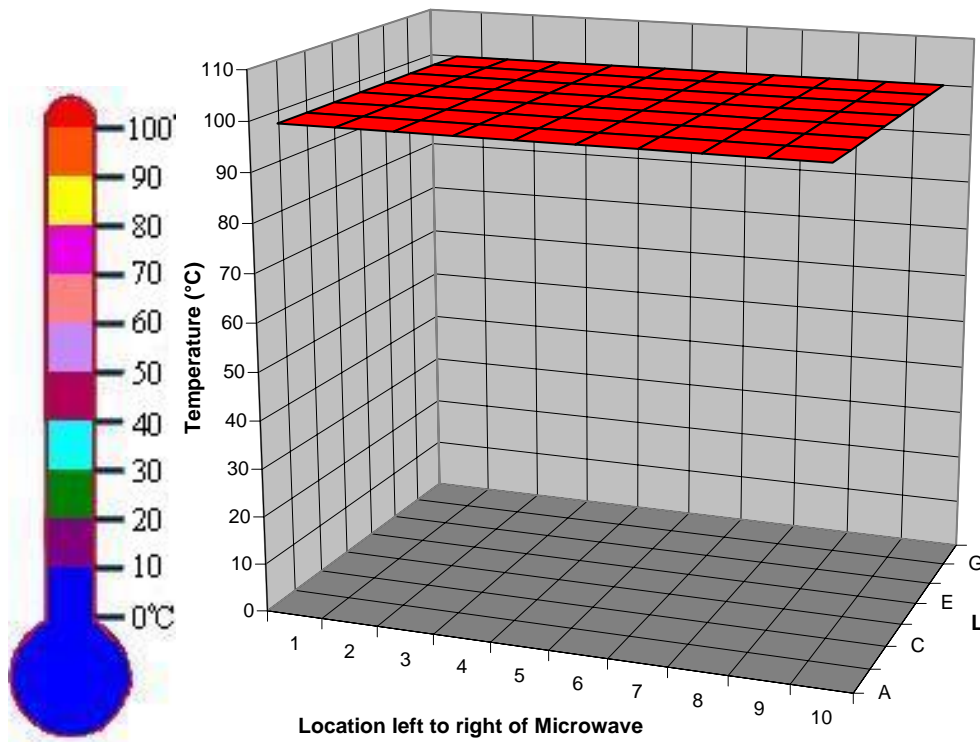
Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 6 - 3-D map of level 1, time= 75 seconds

Temperature Profile Level 1 75 Seconds



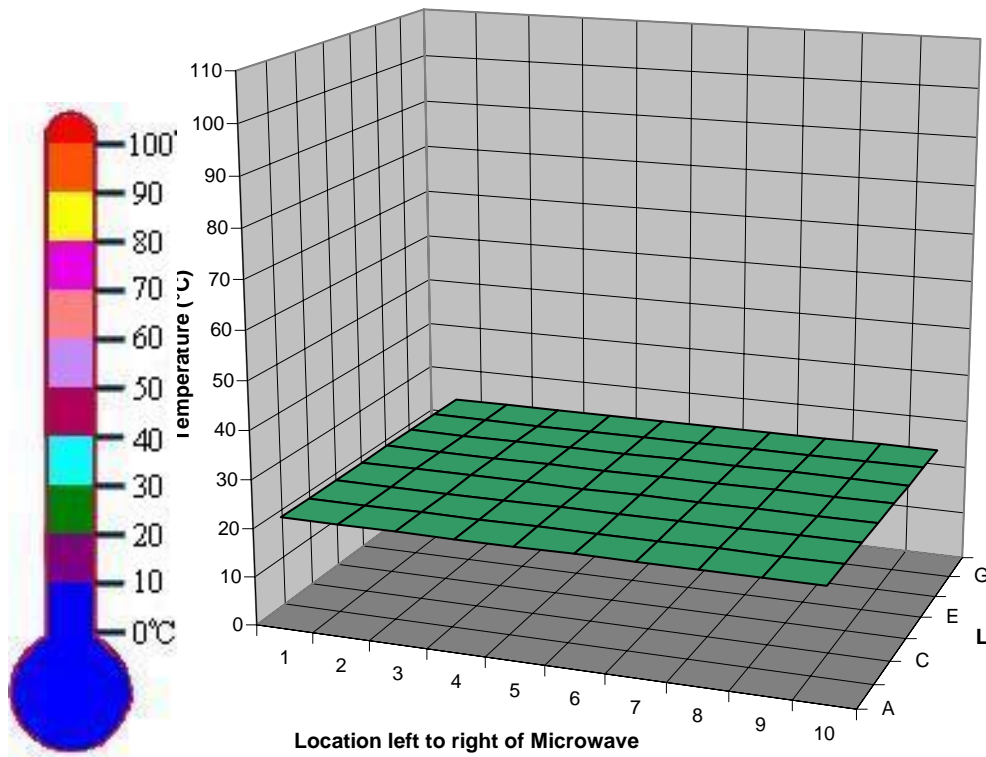
Note: Glass height signified by red line
Level 1 = 0 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 7 - 3-D map of level 2, time= 0 seconds

Temperature Profile Level 2 0 Seconds



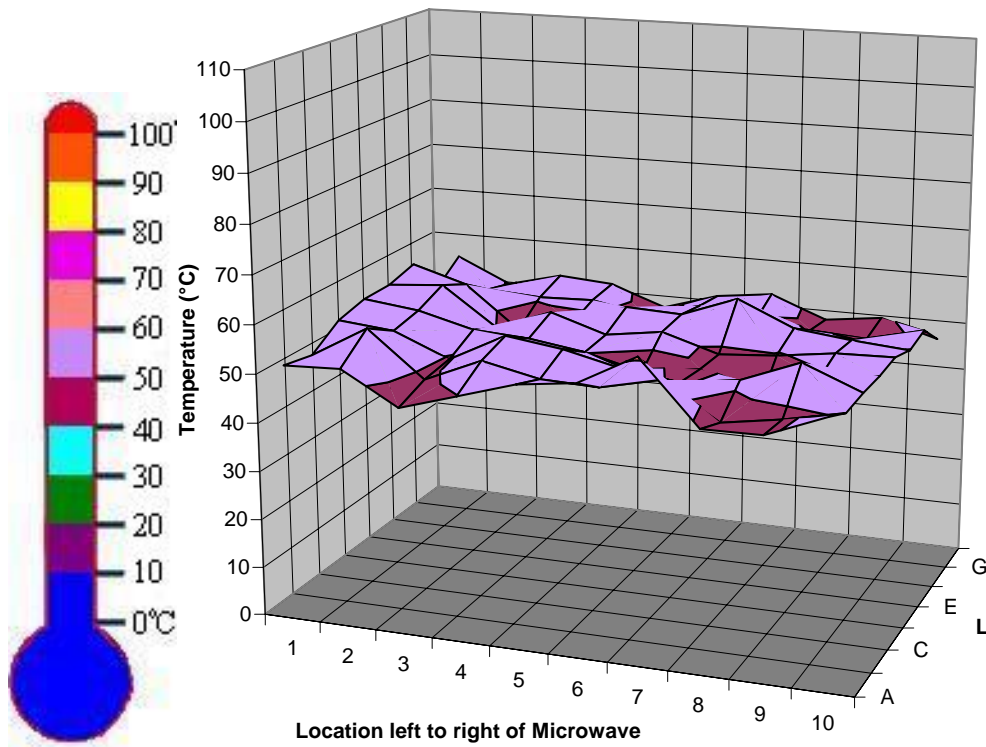
Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 8 - 3-D map of level 2, time= 15 seconds

Temperature Profile Level 2 15 Seconds



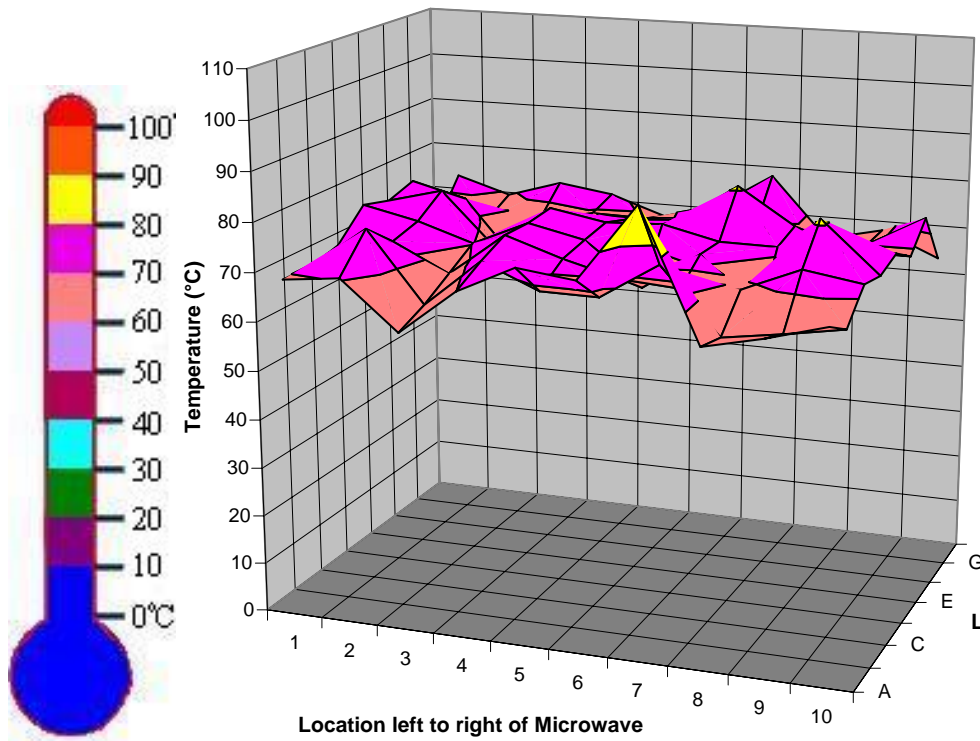
Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 9 - 3-D map of level 2, time= 30 seconds

Temperature Profile Level 2 30 Seconds



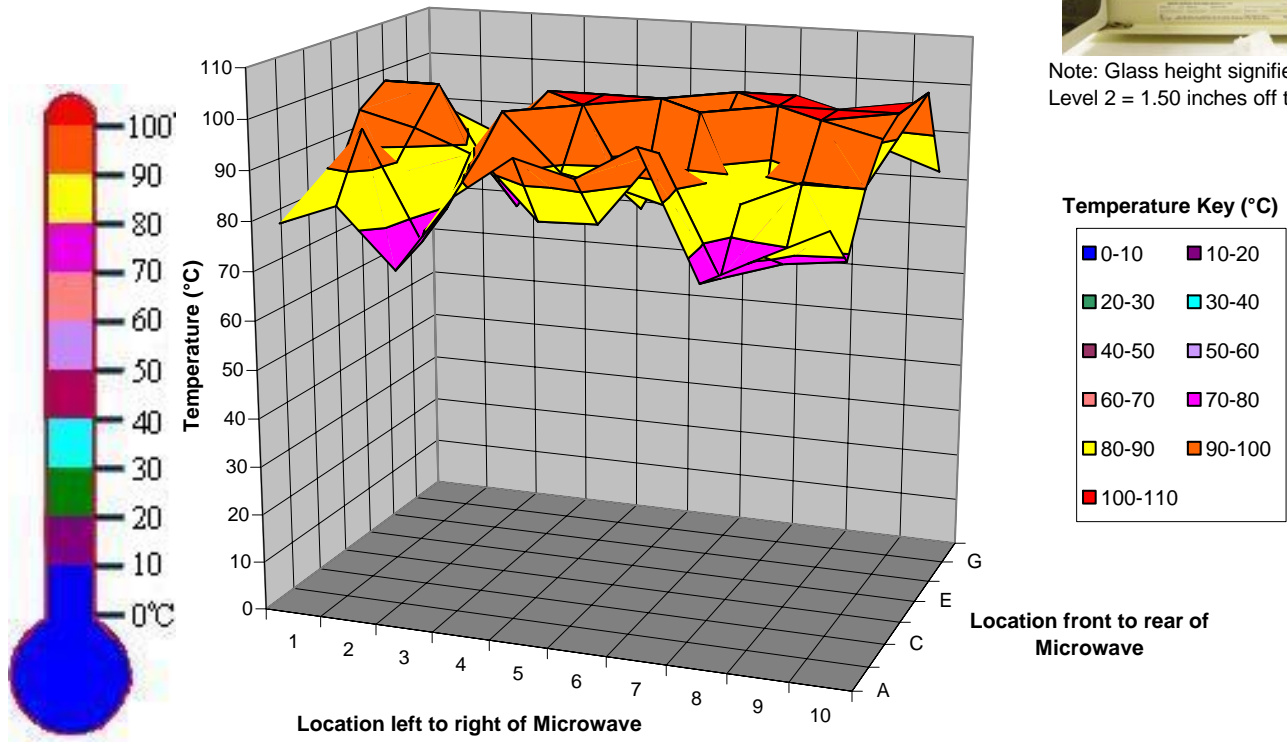
Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 10 - 3-D map of level 2, time= 45 seconds

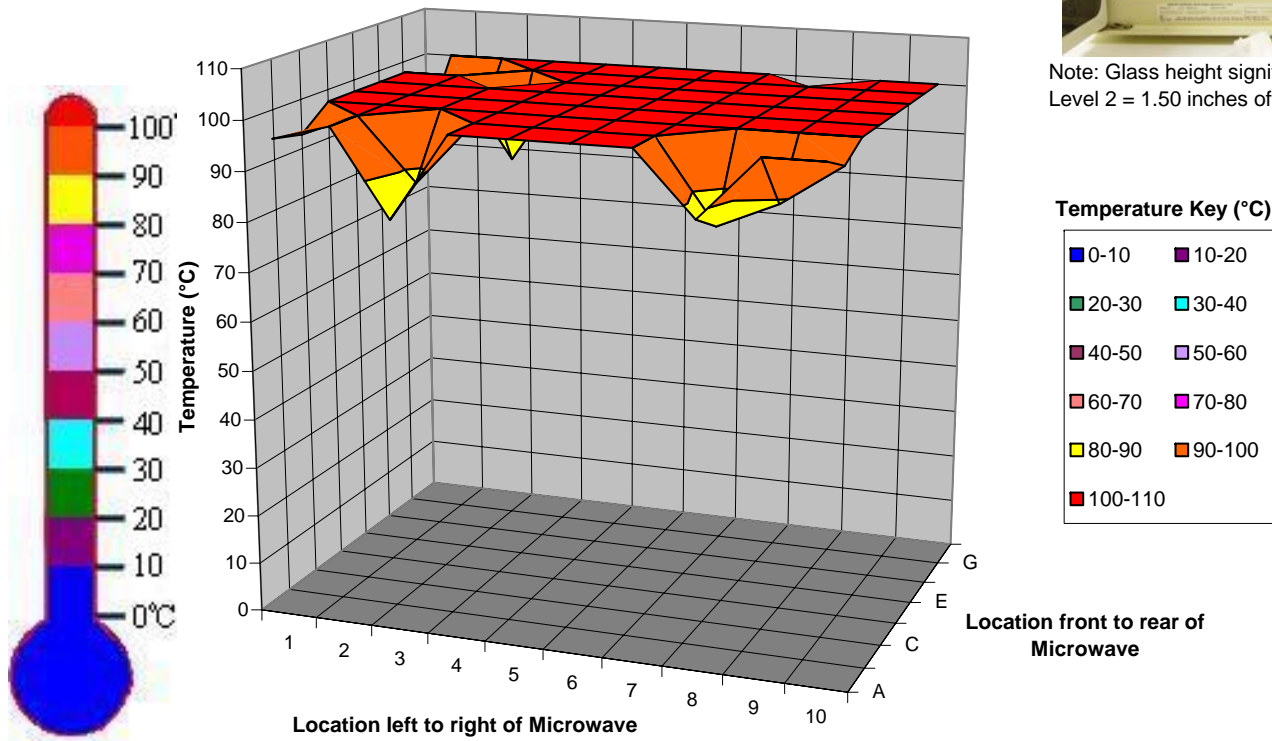
Temperature Profile Level 2 45 Seconds



Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Figure E 11 - 3-D map of level 2, time= 60 seconds

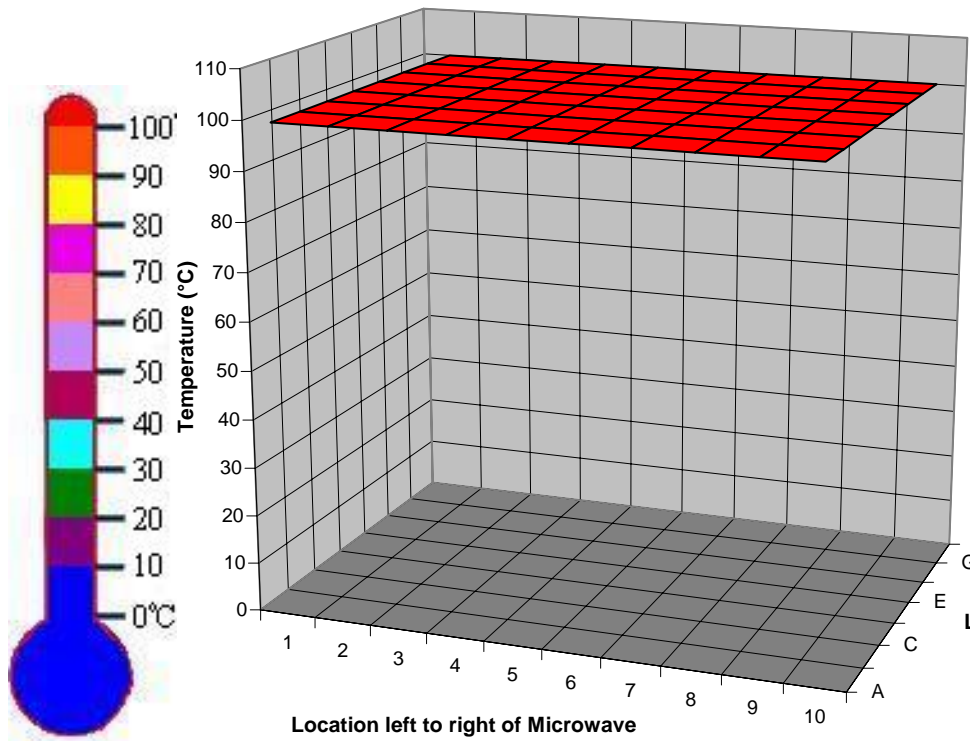
Temperature Profile Level 2 60 Seconds



Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Figure E 12 - 3-D map of level 2, time= 75 seconds

Temperature Profile Level 2 75 Seconds



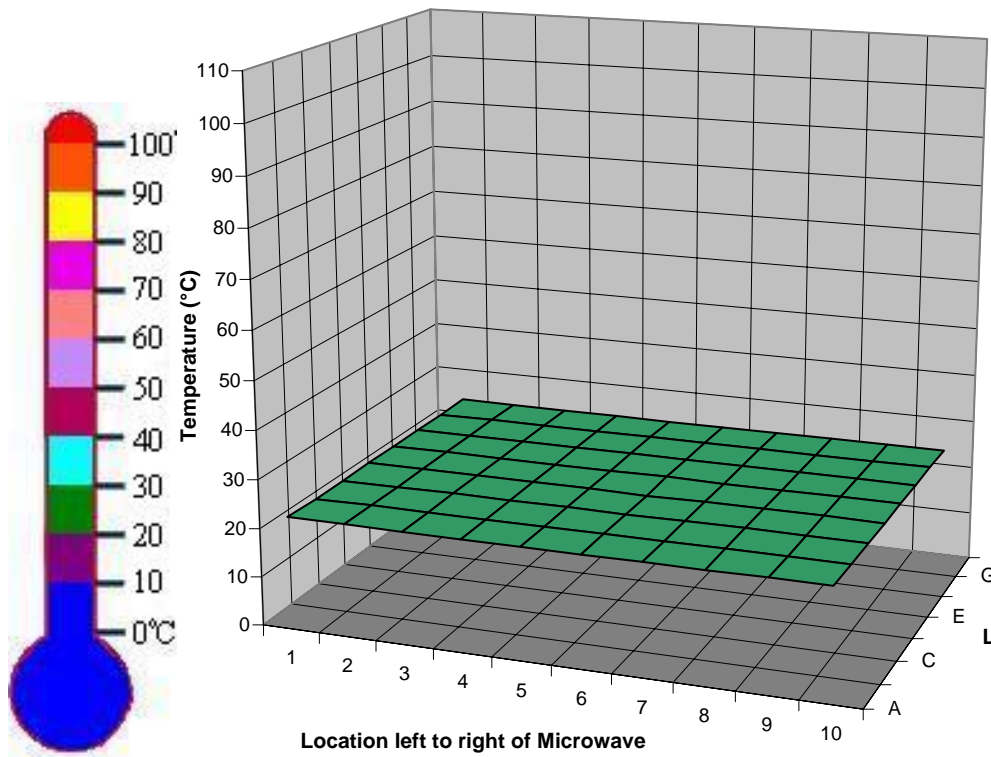
Note: Glass height signified by red line
Level 2 = 1.50 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 13 - 3-D map of level 3, time= 0 seconds

Temperature Profile Level 3 0 Seconds



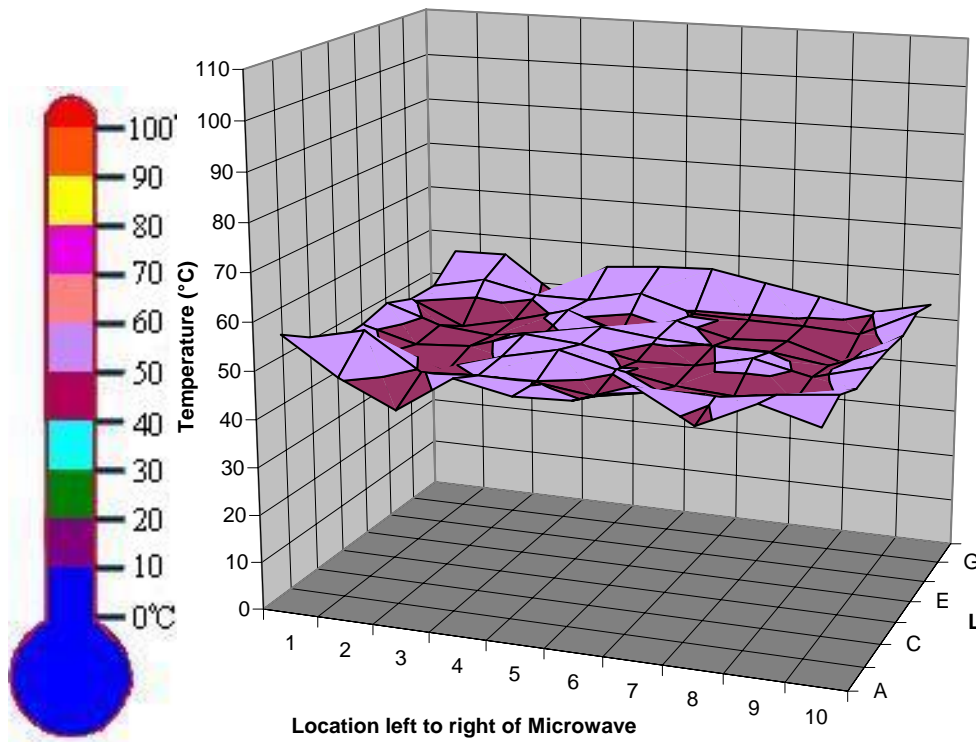
Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 14 - 3-D map of level 3, time= 15 seconds

Temperature Profile Level 3 15 Seconds



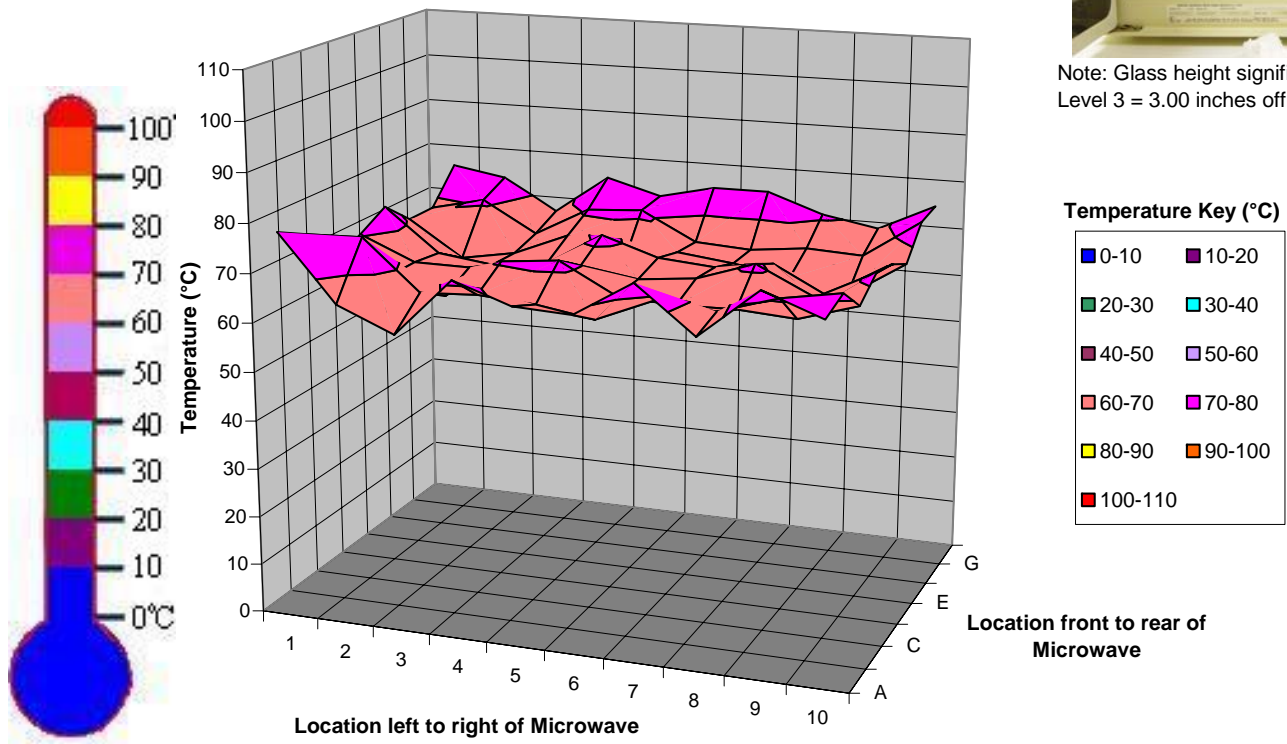
Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

Figure E 15 - 3-D map of level 3, time= 30 seconds

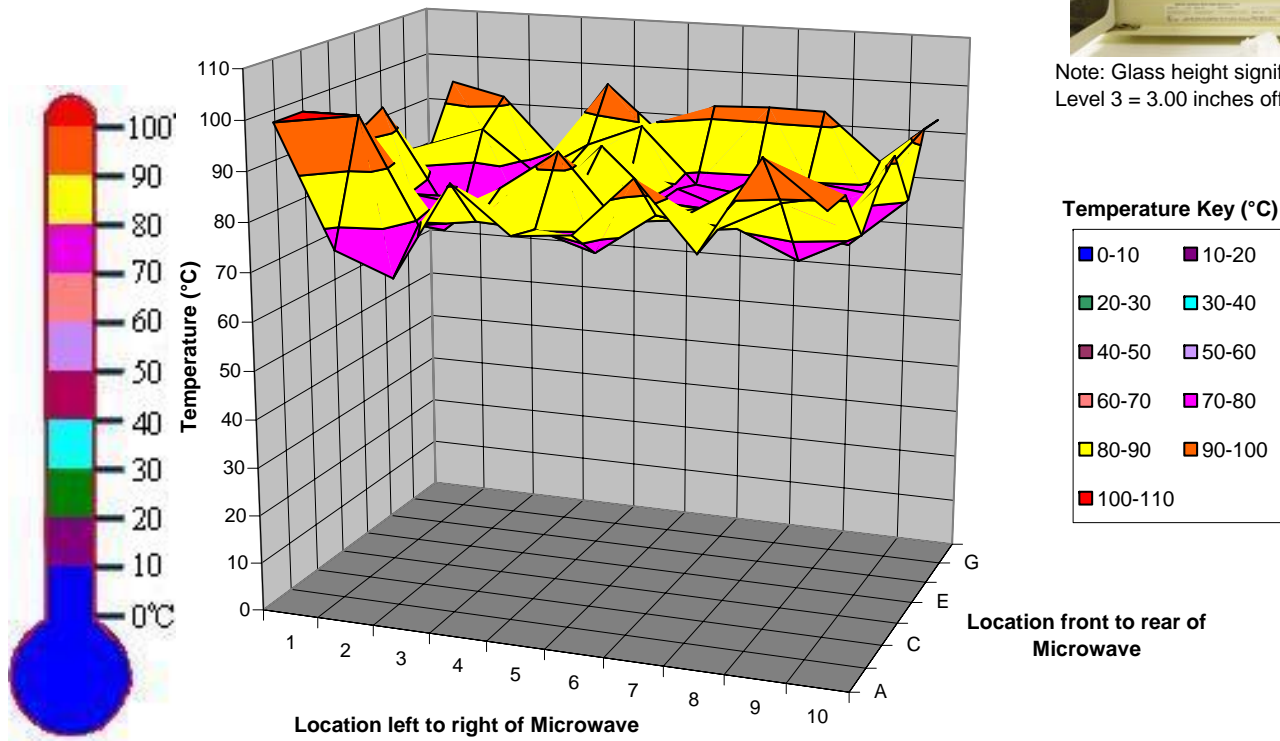
Temperature Profile Level 3 30 Seconds



Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Figure E 16 - 3-D map of level 3, time= 45 seconds

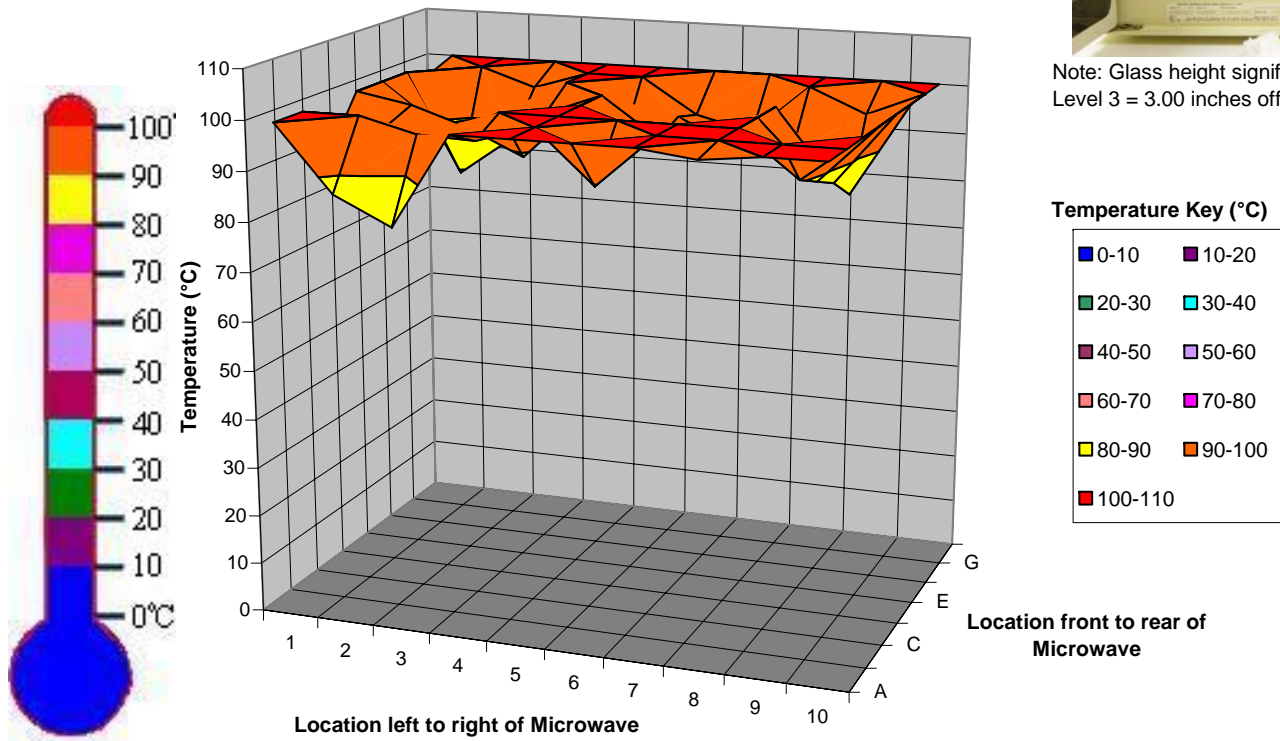
Temperature Profile Level 3 45 Seconds



Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Figure E 17 - 3-D map of level 3, time= 60 seconds

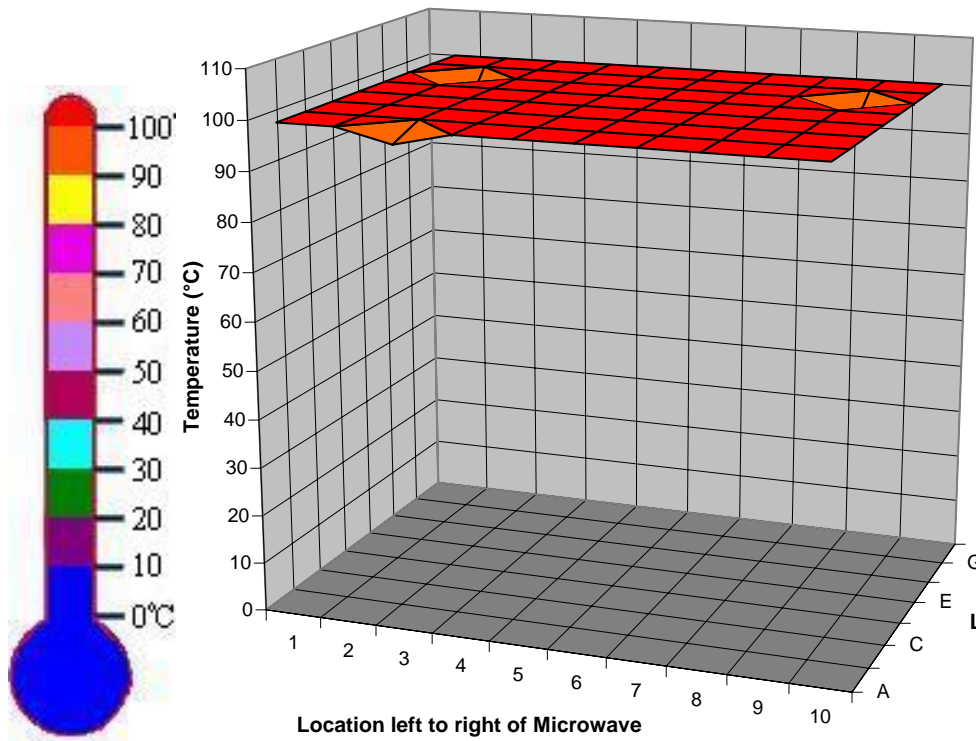
Temperature Profile Level 3 60 Seconds



Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Figure E 18 - 3-D map of level 3, time= 75 seconds

Temperature Profile Level 3 75 Seconds



Note: Glass height signified by red line
Level 3 = 3.00 inches off the bottom

Temperature Key (°C)

0-10	10-20
20-30	30-40
40-50	50-60
60-70	70-80
80-90	90-100
100-110	

APPENDIX F

Mean and standard deviations of grid columns and rows with statistical significance at
0.05 level noted

Table F 1 - Mean and standard deviations of grid columns and rows level 1, time= 0 seconds

		Level = 1					Time = 0 seconds				
		Mean: 23.072	Mean: 23.094	Mean: 23.028	Mean: 23.009	Mean: 23.034	Mean: 23.006	Mean: 23.000	Mean: 23.006	Mean: 23.025	Mean: 23.028
		Std Dev: 0.0991	Std Dev: 0.0914	Std Dev: 0.1280	Std Dev: 0.1280	Std Dev: 0.1210	Std Dev: 0.1320	Std Dev: 0.1340	Std Dev: 0.1080	Std Dev: 0.1270	Std Dev: 0.1140
		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32
Mean: 23.038		Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Std Dev: 0.1270											
n= 40											
Mean: 23.035		Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Std Dev: 0.1250											
n= 40											
Mean: 23.035		Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Std Dev: 0.1270											
n= 40											
Mean: 23.020		Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Std Dev: 0.1290											
n= 40											
Mean: 23.025		Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Std Dev: 0.1100											
n= 40											
Mean: 23.043		Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Std Dev: 0.1200											
n= 40											
Mean: 23.008		Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Std Dev: 0.1250											
n= 40											
Mean: 23.040		Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Std Dev: 0.1080											
n= 40											

	Statistically significant from all other bands
	Statistically significant from all other bands except red band
	Statistically significant from all other bands except red and orange band

Table F 2 - Mean and standard deviations of grid columns and rows level 1, time= 15 seconds

Level = 1					Time = 15 seconds					
Mean: 52.938	Mean: 54.069	Mean: 55.275	Mean: 58.909	Mean: 56.241	Mean: 55.037	Mean: 57.397	Mean: 53.316	Mean: 55.775	Mean: 51.628	
Std Dev: 3.9900	Std Dev: 3.3140	Std Dev: 2.7380	Std Dev: 3.2550	Std Dev: 1.8640	Std Dev: 3.8870	Std Dev: 1.3010	Std Dev: 1.9570	Std Dev: 2.9880	Std Dev: 3.7880	
n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	
Mean: 54.142 Std Dev: 2.6160 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 54.830 Std Dev: 2.3320 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 56.505 Std Dev: 3.1310 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 54.873 Std Dev: 3.2570 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 54.183 Std Dev: 3.6260 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 57.837 Std Dev: 2.8490 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 55.700 Std Dev: 4.0280 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 52.425 Std Dev: 4.3660 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 3 - Mean and standard deviations of grid columns and rows level 1, time= 30 seconds

		Level = 1				Time = 30 seconds					
		Mean: 71.453 Std Dev: 6.8210 n= 32	Mean: 72.216 Std Dev: 4.5050 n= 32	Mean: 73.325 Std Dev: 4.5500 n= 32	Mean: 80.812 Std Dev: 6.0870 n= 32	Mean: 76.916 Std Dev: 3.5790 n= 32	Mean: 75.456 Std Dev: 8.8910 n= 32	Mean: 79.209 Std Dev: 1.8430 n= 32	Mean: 71.416 Std Dev: 3.2180 n= 32	Mean: 74.697 Std Dev: 4.0200 n= 32	Mean: 70.253 Std Dev: 5.3620 n= 32
Mean: 72.438 Std Dev: 4.4280 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 73.483 Std Dev: 3.1260 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 77.475 Std Dev: 4.8840 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 73.285 Std Dev: 5.0090 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 73.102 Std Dev: 5.6980 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 77.965 Std Dev: 5.5940 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 76.390 Std Dev: 7.7870 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 72.465 Std Dev: 8.3540 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 4 - Mean and standard deviations of grid columns and rows level 1, time= 45 seconds

		Level = 1					Time = 45 seconds				
		Mean: 88.363 Std Dev: 9.6090 n= 32	Mean: 88.747 Std Dev: 8.2190 n= 32	Mean: 91.081 Std Dev: 8.3160 n= 32	Mean: 98.369 Std Dev: 4.3860 n= 32	Mean: 95.869 Std Dev: 3.9080 n= 32	Mean: 90.700 Std Dev: 7.3980 n= 32	Mean: 100.000 Std Dev: 0.0000 n= 32	Mean: 90.087 Std Dev: 5.6430 n= 32	Mean: 94.475 Std Dev: 5.6720 n= 32	Mean: 87.147 Std Dev: 8.0960 n= 32
Mean: 90.343 Std Dev: 7.9300 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 91.960 Std Dev: 5.3490 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 97.215 Std Dev: 6.5690 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 92.313 Std Dev: 8.4470 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 90.643 Std Dev: 7.0960 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 95.705 Std Dev: 4.8510 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 92.330 Std Dev: 7.5750 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 89.362 Std Dev: 10.5700 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 5 - Mean and standard deviations of grid columns and rows level 1, time= 60 seconds

	Level = 1					Time = 60 seconds				
	Mean: 98.012 Std Dev: 3.6520 n= 32	Mean: 97.859 Std Dev: 3.7720 n= 32	Mean: 98.613 Std Dev: 3.7320 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 99.509 Std Dev: 1.3310 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 99.594 Std Dev: 1.0950 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 98.094 Std Dev: 3.9900 n= 32
	Mean: 98.227 Std Dev: 3.4190 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 99.608 Std Dev: 1.2030 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 99.410 Std Dev: 1.7950 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 99.130 Std Dev: 2.6470 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 96.970 Std Dev: 4.7540 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 6 - Mean and standard deviations of grid columns and rows level 1, time= 75 seconds

		Level = 1					Time = 75 seconds				
		Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 7 - Mean and standard deviations of grid columns and rows level 2, time= 0 seconds

		Level = 2					Time = 0 seconds				
		Mean: 23.034 Std Dev: 0.1210 n= 32	Mean: 23.012 Std Dev: 0.1340 n= 32	Mean: 22.994 Std Dev: 0.1270 n= 32	Mean: 23.000 Std Dev: 0.1140 n= 32	Mean: 22.975 Std Dev: 0.1270 n= 32	Mean: 23.044 Std Dev: 0.1270 n= 32	Mean: 23.000 Std Dev: 0.1320 n= 32	Mean: 23.044 Std Dev: 0.1460 n= 32	Mean: 23.009 Std Dev: 0.1150 n= 32	Mean: 23.016 Std Dev: 0.1320 n= 32
Mean: 23.050 Std Dev: 0.1260 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 22.995 Std Dev: 0.1260 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 23.010 Std Dev: 0.1240 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 23.018 Std Dev: 0.1410 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 23.005 Std Dev: 0.1240 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 23.003 Std Dev: 0.1370 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 22.980 Std Dev: 0.1240 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 23.043 Std Dev: 0.1130 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 8 - Mean and standard deviations of grid columns and rows level 2, time= 15 seconds

	Level = 2					Time = 15 seconds				
	Mean: 54.600	Mean: 54.319	Mean: 49.578	Mean: 52.103	Mean: 51.194	Mean: 51.559	Mean: 52.731	Mean: 48.419	Mean: 50.247	Mean: 50.644
	Std Dev: 2.8150	Std Dev: 2.8440	Std Dev: 2.2960	Std Dev: 2.2070	Std Dev: 2.3430	Std Dev: 2.1240	Std Dev: 4.3730	Std Dev: 2.8990	Std Dev: 2.4620	Std Dev: 2.0380
	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32
Mean: 50.312 Std Dev: 2.6070 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 50.113 Std Dev: 1.2480 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 52.603 Std Dev: 3.6870 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 52.365 Std Dev: 2.9960 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 50.598 Std Dev: 3.9320 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 52.785 Std Dev: 2.4060 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 51.298 Std Dev: 3.1950 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 52.243 Std Dev: 4.0640 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 9 - Mean and standard deviations of grid columns and rows level 2, time= 30 seconds

		Level = 2					Time = 30 seconds				
		Mean: 71.772 Std Dev: 3.9560 n= 32	Mean: 72.678 Std Dev: 3.6760 n= 32	Mean: 65.978 Std Dev: 4.2060 n= 32	Mean: 72.413 Std Dev: 2.8000 n= 32	Mean: 71.353 Std Dev: 2.7030 n= 32	Mean: 70.384 Std Dev: 3.3280 n= 32	Mean: 75.481 Std Dev: 6.8540 n= 32	Mean: 66.272 Std Dev: 4.5610 n= 32	Mean: 70.181 Std Dev: 4.9840 n= 32	Mean: 69.622 Std Dev: 3.4360 n= 32
Mean: 69.958 Std Dev: 4.1530 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 68.540 Std Dev: 2.5880 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 71.545 Std Dev: 5.2100 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 73.008 Std Dev: 3.0060 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 71.473 Std Dev: 6.0200 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 70.747 Std Dev: 2.6890 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 68.698 Std Dev: 4.9730 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 70.940 Std Dev: 7.5990 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 10 - Mean and standard deviations of grid columns and rows level 2, time= 45 seconds

		Level = 2					Time = 45 seconds				
		Mean: 87.217 Std Dev: 8.4060 n= 32	Mean: 88.197 Std Dev: 7.4960 n= 32	Mean: 80.391 Std Dev: 6.5860 n= 32	Mean: 93.037 Std Dev: 5.2440 n= 32	Mean: 90.853 Std Dev: 7.2210 n= 32	Mean: 89.575 Std Dev: 6.6740 n= 32	Mean: 93.847 Std Dev: 6.5730 n= 32	Mean: 83.319 Std Dev: 10.4920 n= 32	Mean: 88.134 Std Dev: 8.1940 n= 32	Mean: 91.813 Std Dev: 8.2830 n= 32
Mean: 86.320 Std Dev: 5.0900 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 84.095 Std Dev: 6.8050 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 92.125 Std Dev: 8.1000 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 97.503 Std Dev: 5.7570 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 92.482 Std Dev: 8.9910 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 87.131 Std Dev: 5.3930 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 83.558 Std Dev: 8.4570 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 85.893 Std Dev: 8.4920 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 11 - Mean and standard deviations of grid columns and rows level 2, time= 60 seconds

		Level = 2					Time = 60 seconds				
		Mean: 97.503 Std Dev: 4.1120 n= 32	Mean: 98.572 Std Dev: 3.8400 n= 32	Mean: 94.159 Std Dev: 7.7830 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 95.491 Std Dev: 6.3270 n= 32	Mean: 98.613 Std Dev: 3.7300 n= 32	Mean: 99.619 Std Dev: 1.0260 n= 32
Mean: 99.255 Std Dev: 2.2640 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 97.633 Std Dev: 4.8000 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 98.295 Std Dev: 5.1810 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 95.258 Std Dev: 5.9760 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 96.725 Std Dev: 6.0080 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 12 - Mean and standard deviations of grid columns and rows level 2, time= 75 seconds

		Level = 2					Time = 75 seconds				
Mean: 100.00 Std Dev: 0.0000 n= 32		Mean: 100.00 Std Dev: 0.0000 n= 32		Mean: 100.00 Std Dev: 0.0000 n= 32		Mean: 100.00 Std Dev: 0.0000 n= 32		Mean: 100.00 Std Dev: 0.0000 n= 32		Mean: 100.00 Std Dev: 0.0000 n= 32	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 13 - Mean and standard deviations of grid columns and rows level 3, time= 0 seconds

		Level = 3					Time = 0 seconds				
		Mean: 22.956	Mean: 23.013	Mean: 23.000	Mean: 22.966	Mean: 22.994	Mean: 22.969	Mean: 23.000	Mean: 23.003	Mean: 23.025	Mean: 22.975
		Std Dev: 0.1270	Std Dev: 0.1360	Std Dev: 0.1240	Std Dev: 0.1150	Std Dev: 0.1190	Std Dev: 0.1230	Std Dev: 0.1220	Std Dev: 0.1150	Std Dev: 0.0880	Std Dev: 0.1240
		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32
Mean: 22.982		Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Std Dev: 0.1150											
n= 40											
Mean: 23.033		Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Std Dev: 0.1270											
n= 40											
Mean: 23.005		Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Std Dev: 0.1110											
n= 40											
Mean: 22.982		Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Std Dev: 0.1170											
n= 40											
Mean: 22.978		Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Std Dev: 0.1270											
n= 40											
Mean: 22.970		Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Std Dev: 0.1140											
n= 40											
Mean: 22.952		Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Std Dev: 0.1240											
n= 40											
Mean: 23.018		Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10
Std Dev: 0.1150											
n= 40											

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 14 - Mean and standard deviations of grid columns and rows level 3, time= 15 seconds

		Level = 3					Time = 15 seconds				
Mean: 52.813		Mean: 50.906	Mean: 47.875	Mean: 51.472	Mean: 51.584	Mean: 50.722	Mean: 50.547	Mean: 49.813	Mean: 49.400	Mean: 52.519	
Std Dev: 2.7590		Std Dev: 3.8090	Std Dev: 1.6050	Std Dev: 1.7140	Std Dev: 2.4640	Std Dev: 2.4470	Std Dev: 2.5560	Std Dev: 1.6440	Std Dev: 2.6360	Std Dev: 1.0920	
n= 32		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	
Mean: 53.698	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Std Dev: 2.7490											
n= 40											
Mean: 50.751	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Std Dev: 1.8740											
n= 40											
Mean: 48.805	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Std Dev: 2.3380											
n= 40											
Mean: 50.092	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Std Dev: 1.6770											
n= 40											
Mean: 50.127	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Std Dev: 1.6410											
n= 40											
Mean: 49.460	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Std Dev: 2.0480											
n= 40											
Mean: 51.590	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Std Dev: 2.5600											
n= 40											
Mean: 51.597	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	
Std Dev: 3.4480											
n= 40											

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 15 - Mean and standard deviations of grid columns and rows level 3, time= 30 seconds

		Level = 3					Time = 30 seconds				
Mean: 72.244		Mean: 67.769	Mean: 63.913	Mean: 69.072	Mean: 68.775	Mean: 67.112	Mean: 68.319	Mean: 67.184	Mean: 66.638	Mean: 71.231	
Std Dev: 4.0100		Std Dev: 4.9380	Std Dev: 2.0250	Std Dev: 3.5560	Std Dev: 3.4000	Std Dev: 3.1720	Std Dev: 4.1020	Std Dev: 2.7570	Std Dev: 4.8100	Std Dev: 2.4320	
n= 32		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	
Mean: 72.680	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Std Dev: 2.8760											
n= 40											
Mean: 68.135	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Std Dev: 3.1790											
n= 40											
Mean: 64.257	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Std Dev: 2.9270											
n= 40											
Mean: 67.235	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Std Dev: 3.5780											
n= 40											
Mean: 67.550	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Std Dev: 2.4420											
n= 40											
Mean: 66.428	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Std Dev: 2.7740											
n= 40											
Mean: 69.435	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Std Dev: 4.2030											
n= 40											
Mean: 70.085	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	
Std Dev: 5.3530											
n= 40											

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 16 - Mean and standard deviations of grid columns and rows level 3, time= 45 seconds

		Level = 3					Time = 45 seconds				
Mean: 90.641		Mean: 82.241	Mean: 76.559	Mean: 84.163	Mean: 84.672	Mean: 80.831	Mean: 83.025	Mean: 82.841	Mean: 80.591	Mean: 88.753	
Std Dev: 7.6420		Std Dev: 9.2320	Std Dev: 2.5110	Std Dev: 6.1430	Std Dev: 5.7790	Std Dev: 4.7680	Std Dev: 6.8910	Std Dev: 5.2790	Std Dev: 9.3210	Std Dev: 4.7770	
n= 32		n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	n= 32	
Mean: 89.980	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Std Dev: 5.2240											
n= 40											
Mean: 82.580	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Std Dev: 5.3630											
n= 40											
Mean: 76.405	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Std Dev: 4.4420											
n= 40											
Mean: 82.038	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Std Dev: 7.0370											
n= 40											
Mean: 81.988	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Std Dev: 5.4030											
n= 40											
Mean: 80.968	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Std Dev: 4.9270											
n= 40											
Mean: 86.570	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Std Dev: 8.0390											
n= 40											
Mean: 86.925	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	
Std Dev: 9.4480											
n= 40											

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 17 - Mean and standard deviations of grid columns and rows level 3, time= 60 seconds

		Level = 3					Time = 60 seconds				
		Mean: 98.506 Std Dev: 3.2850 n= 32	Mean: 93.981 Std Dev: 7.2270 n= 32	Mean: 93.153 Std Dev: 5.6200 n= 32	Mean: 97.647 Std Dev: 3.7580 n= 32	Mean: 98.447 Std Dev: 4.1760 n= 32	Mean: 95.350 Std Dev: 3.9280 n= 32	Mean: 95.559 Std Dev: 4.7400 n= 32	Mean: 98.406 Std Dev: 3.7940 n= 32	Mean: 92.266 Std Dev: 7.1100 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32
Mean: 100.000 Std Dev: 0.0000 n= 40	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10	
Mean: 96.905 Std Dev: 4.0010 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10	
Mean: 90.725 Std Dev: 7.3610 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10	
Mean: 95.047 Std Dev: 4.7820 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10	
Mean: 95.818 Std Dev: 4.4110 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10	
Mean: 97.140 Std Dev: 3.8540 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10	
Mean: 98.330 Std Dev: 3.2200 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10	
Mean: 96.688 Std Dev: 6.5000 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10	

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

Table F 18 - Mean and standard deviations of grid columns and rows level 3, time= 75 seconds

	Level = 3					Time = 75 seconds				
	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 98.863 Std Dev: 3.0580 n= 32	Mean: 99.650 Std Dev: 0.9410 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32	Mean: 99.275 Std Dev: 1.9490 n= 32	Mean: 100.00 Std Dev: 0.0000 n= 32
	Location: H1	Location: H2	Location: H3	Location: H4	Location: H5	Location: H6	Location: H7	Location: H8	Location: H9	Location: H10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: G1	Location: G2	Location: G3	Location: G4	Location: G5	Location: G6	Location: G7	Location: G8	Location: G9	Location: G10
Mean: 98.510 Std Dev: 3.1090 n= 40	Location: F1	Location: F2	Location: F3	Location: F4	Location: F5	Location: F6	Location: F7	Location: F8	Location: F9	Location: F10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: E1	Location: E2	Location: E3	Location: E4	Location: E5	Location: E6	Location: E7	Location: E8	Location: E9	Location: E10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: D1	Location: D2	Location: D3	Location: D4	Location: D5	Location: D6	Location: D7	Location: D8	Location: D9	Location: D10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: C1	Location: C2	Location: C3	Location: C4	Location: C5	Location: C6	Location: C7	Location: C8	Location: C9	Location: C10
Mean: 100.00 Std Dev: 0.0000 n= 40	Location: B1	Location: B2	Location: B3	Location: B4	Location: B5	Location: B6	Location: B7	Location: B8	Location: B9	Location: B10
Mean: 99.720 Std Dev: 0.8510 n= 40	Location: A1	Location: A2	Location: A3	Location: A4	Location: A5	Location: A6	Location: A7	Location: A8	Location: A9	Location: A10

	Statistically Significant from all other bands
	Statistically Significant from all other bands except red band
	Statistically Significant from all other bands except red and orange band

APPENDIX G

SPSS output data for rows and columns statistical significance

Only the first level at time = 0 seconds is shown,

The rest are the same type of calculation tables

Table G 1 - Descriptive statistics of rows at time = 0 seconds and level 1

Dependant Variable Temperature (°C)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1*	40	23.040	.108	1.710E-02	23.005	23.075	22.8	23.2
2*	40	23.008	.125	1.974E-02	22.968	23.047	22.8	23.2
3*	40	23.043	.120	1.891E-02	23.004	23.081	22.8	23.2
4*	40	23.025	.110	1.745E-02	22.990	23.060	22.8	23.2
5*	40	23.020	.129	2.032E-02	22.979	23.061	22.8	23.2
6*	40	23.035	.127	2.011E-02	22.994	23.076	22.8	23.2
7*	40	23.035	.125	1.979E-02	22.995	23.075	22.8	23.2
8*	40	23.038	.127	2.016E-02	22.997	23.078	22.8	23.2
Total	320	23.030	.121	6.754E-03	23.017	23.044	22.8	23.2

*Note: 1 = row A, 2 = row B...

Table G 2 - ANOVA of rows at time = 0 seconds and level 1

Dependant Variable Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.972E-02	7	5.674E-03	.383	.912
Within Groups	4.616	312	1.480E-02		
Total	4.656	319			

Table G 3 - Posthoc comparisons between rows at time = 0 seconds and level 1

Dependent Variable: Temperature (°C)

(I) LOCFR	(J) LOCFR	Mean Difference (I-J)	Std. Error	Sig.*	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	3.250E-02	2.720E-02	.233	-2.102E-02	8.602E-02
	3	-2.500E-03	2.720E-02	.927	-5.602E-02	5.102E-02
	4	1.500E-02	2.720E-02	.582	-3.852E-02	6.852E-02
	5	2.000E-02	2.720E-02	.463	-3.352E-02	7.352E-02
	6	5.000E-03	2.720E-02	.854	-4.852E-02	5.852E-02
	7	5.000E-03	2.720E-02	.854	-4.852E-02	5.852E-02
	8	2.500E-03	2.720E-02	.927	-5.102E-02	5.602E-02
2	1	-3.250E-02	2.720E-02	.233	-8.602E-02	2.102E-02
	3	-3.500E-02	2.720E-02	.199	-8.852E-02	1.852E-02
	4	-1.750E-02	2.720E-02	.520	-7.102E-02	3.602E-02
	5	-1.250E-02	2.720E-02	.646	-6.602E-02	4.102E-02
	6	-2.750E-02	2.720E-02	.313	-8.102E-02	2.602E-02
	7	-2.750E-02	2.720E-02	.313	-8.102E-02	2.602E-02
	8	-3.000E-02	2.720E-02	.271	-8.352E-02	2.352E-02

3	1	2.500E-03	2.720E-02	.927	-5.102E-02	5.602E-02
	2	3.500E-02	2.720E-02	.199	-1.852E-02	8.852E-02
	4	1.750E-02	2.720E-02	.520	-3.602E-02	7.102E-02
	5	2.250E-02	2.720E-02	.409	-3.102E-02	7.602E-02
	6	7.500E-03	2.720E-02	.783	-4.602E-02	6.102E-02
	7	7.500E-03	2.720E-02	.783	-4.602E-02	6.102E-02
	8	5.000E-03	2.720E-02	.854	-4.852E-02	5.852E-02
4	1	-1.500E-02	2.720E-02	.582	-6.852E-02	3.852E-02
	2	1.750E-02	2.720E-02	.520	-3.602E-02	7.102E-02
	3	-1.750E-02	2.720E-02	.520	-7.102E-02	3.602E-02
	5	5.000E-03	2.720E-02	.854	-4.852E-02	5.852E-02
	6	-1.000E-02	2.720E-02	.713	-6.352E-02	4.352E-02
	7	-1.000E-02	2.720E-02	.713	-6.352E-02	4.352E-02
	8	-1.250E-02	2.720E-02	.646	-6.602E-02	4.102E-02
5	1	-2.000E-02	2.720E-02	.463	-7.352E-02	3.352E-02
	2	1.250E-02	2.720E-02	.646	-4.102E-02	6.602E-02
	3	-2.250E-02	2.720E-02	.409	-7.602E-02	3.102E-02
	4	-5.000E-03	2.720E-02	.854	-5.852E-02	4.852E-02
	6	-1.500E-02	2.720E-02	.582	-6.852E-02	3.852E-02
	7	-1.500E-02	2.720E-02	.582	-6.852E-02	3.852E-02
	8	-1.750E-02	2.720E-02	.520	-7.102E-02	3.602E-02
6	1	-5.000E-03	2.720E-02	.854	-5.852E-02	4.852E-02
	2	2.750E-02	2.720E-02	.313	-2.602E-02	8.102E-02
	3	-7.500E-03	2.720E-02	.783	-6.102E-02	4.602E-02
	4	1.000E-02	2.720E-02	.713	-4.352E-02	6.352E-02
	5	1.500E-02	2.720E-02	.582	-3.852E-02	6.852E-02
	7	.000	2.720E-02	1.000	-5.352E-02	5.352E-02
	8	-2.500E-03	2.720E-02	.927	-5.602E-02	5.102E-02
7	1	-5.000E-03	2.720E-02	.854	-5.852E-02	4.852E-02
	2	2.750E-02	2.720E-02	.313	-2.602E-02	8.102E-02
	3	-7.500E-03	2.720E-02	.783	-6.102E-02	4.602E-02
	4	1.000E-02	2.720E-02	.713	-4.352E-02	6.352E-02
	5	1.500E-02	2.720E-02	.582	-3.852E-02	6.852E-02
	6	.000	2.720E-02	1.000	-5.352E-02	5.352E-02
	8	-2.500E-03	2.720E-02	.927	-5.602E-02	5.102E-02
8	1	-2.500E-03	2.720E-02	.927	-5.602E-02	5.102E-02
	2	3.000E-02	2.720E-02	.271	-2.352E-02	8.352E-02
	3	-5.000E-03	2.720E-02	.854	-5.852E-02	4.852E-02
	4	1.250E-02	2.720E-02	.646	-4.102E-02	6.602E-02
	5	1.750E-02	2.720E-02	.520	-3.602E-02	7.102E-02
	6	2.500E-03	2.720E-02	.927	-5.102E-02	5.602E-02
	7	2.500E-03	2.720E-02	.927	-5.102E-02	5.602E-02

* The mean difference is significant at the .05 level.

Table G 4 - Descriptive statistics of columns at time = 0 seconds and level 1

Dependant Variable Temperature (°C)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	32	23.072	9.914E-02	1.753E-02	23.036	23.108	22.9	23.2
2	32	23.094	9.136E-02	1.615E-02	23.061	23.127	22.9	23.2
3	32	23.028	.128	2.256E-02	22.982	23.074	22.8	23.2
4	32	23.009	.128	2.261E-02	22.963	23.055	22.8	23.2
5	32	23.034	.121	2.135E-02	22.991	23.078	22.8	23.2
6	32	23.006	.132	2.330E-02	22.959	23.054	22.8	23.2
7	32	23.000	.134	2.376E-02	22.952	23.048	22.8	23.2
8	32	23.006	.108	1.902E-02	22.967	23.045	22.8	23.2
9	32	23.025	.127	2.245E-02	22.979	23.071	22.8	23.2
10	32	23.028	.114	2.020E-02	22.987	23.069	22.8	23.2
Total	320	23.030	.121	6.754E-03	23.017	23.044	22.8	23.2

Table G 5 - ANOVA of columns at time = 0 seconds and level 1

Dependant Variable Temperature (°C)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.266	9	2.959E-02	2.089	.030
Within Groups	4.390	310	1.416E-02		
Total	4.656	319			

Table G 6 - Posthoc comparisons between columns at time = 0 seconds and level 1

Dependent Variable: Temperature (°C)

(I) LOCLR	(J) LOCLR	Mean Difference (I-J)	Std. Error	Sig.*	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-2.187E-02	2.975E-02	.463	-8.041E-02	3.666E-02
	3	4.375E-02	2.975E-02	.142	-1.479E-02	.102
	4	6.250E-02	2.975E-02	.036	3.964E-03	.121
	5	3.750E-02	2.975E-02	.208	-2.104E-02	9.604E-02
	6	6.563E-02	2.975E-02	.028	7.089E-03	.124
	7	7.188E-02	2.975E-02	.016	1.334E-02	.130
	8	6.563E-02	2.975E-02	.028	7.089E-03	.124
	9	4.688E-02	2.975E-02	.116	-1.166E-02	.105
	10	4.375E-02	2.975E-02	.142	-1.479E-02	.102
2	1	2.187E-02	2.975E-02	.463	-3.666E-02	8.041E-02
	3	6.562E-02	2.975E-02	.028	7.089E-03	.124
	4	8.437E-02	2.975E-02	.005	2.584E-02	.143
	5	5.937E-02	2.975E-02	.047	8.390E-04	.118
	6	8.750E-02	2.975E-02	.004	2.896E-02	.146
	7	9.375E-02	2.975E-02	.002	3.521E-02	.152
	8	8.750E-02	2.975E-02	.004	2.896E-02	.146
	9	6.875E-02	2.975E-02	.021	1.021E-02	.127
	10	6.562E-02	2.975E-02	.028	7.089E-03	.124
3	1	-4.375E-02	2.975E-02	.142	-.102	1.479E-02
	2	-6.562E-02	2.975E-02	.028	-.124	-7.089E-03
	4	1.875E-02	2.975E-02	.529	-3.979E-02	7.729E-02
	5	-6.250E-03	2.975E-02	.834	-6.479E-02	5.229E-02
	6	2.188E-02	2.975E-02	.463	-3.666E-02	8.041E-02
	7	2.813E-02	2.975E-02	.345	-3.041E-02	8.666E-02
	8	2.188E-02	2.975E-02	.463	-3.666E-02	8.041E-02
	9	3.125E-03	2.975E-02	.916	-5.541E-02	6.166E-02
	10	-3.553E-15	2.975E-02	1.000	-5.854E-02	5.854E-02
4	1	-6.250E-02	2.975E-02	.036	-.121	-3.964E-03
	2	-8.437E-02	2.975E-02	.005	-.143	-2.584E-02
	3	-1.875E-02	2.975E-02	.529	-7.729E-02	3.979E-02
	5	-2.500E-02	2.975E-02	.401	-8.354E-02	3.354E-02
	6	3.125E-03	2.975E-02	.916	-5.541E-02	6.166E-02
	7	9.375E-03	2.975E-02	.753	-4.916E-02	6.791E-02
	8	3.125E-03	2.975E-02	.916	-5.541E-02	6.166E-02
	9	-1.563E-02	2.975E-02	.600	-7.416E-02	4.291E-02
	10	-1.875E-02	2.975E-02	.529	-7.729E-02	3.979E-02
5	1	-3.750E-02	2.975E-02	.208	-9.604E-02	2.104E-02
	2	-5.937E-02	2.975E-02	.047	-.118	-8.390E-04
	3	6.250E-03	2.975E-02	.834	-5.229E-02	6.479E-02
	4	2.500E-02	2.975E-02	.401	-3.354E-02	8.354E-02
	6	2.813E-02	2.975E-02	.345	-3.041E-02	8.666E-02
	7	3.438E-02	2.975E-02	.249	-2.416E-02	9.291E-02
	8	2.813E-02	2.975E-02	.345	-3.041E-02	8.666E-02
	9	9.375E-03	2.975E-02	.753	-4.916E-02	6.791E-02
	10	6.250E-03	2.975E-02	.834	-5.229E-02	6.479E-02
6	1	-6.563E-02	2.975E-02	.028	-.124	-7.089E-03

	2	-8.750E-02	2.975E-02	.004	-.146	-2.896E-02
	3	-2.188E-02	2.975E-02	.463	-8.041E-02	3.666E-02
	4	-3.125E-03	2.975E-02	.916	-6.166E-02	5.541E-02
	5	-2.813E-02	2.975E-02	.345	-8.666E-02	3.041E-02
	7	6.250E-03	2.975E-02	.834	-5.229E-02	6.479E-02
	8	.000	2.975E-02	1.000	-5.854E-02	5.854E-02
	9	-1.875E-02	2.975E-02	.529	-7.729E-02	3.979E-02
	10	-2.188E-02	2.975E-02	.463	-8.041E-02	3.666E-02
7	1	-7.188E-02	2.975E-02	.016	-.130	-1.334E-02
	2	-9.375E-02	2.975E-02	.002	-.152	-3.521E-02
	3	-2.813E-02	2.975E-02	.345	-8.666E-02	3.041E-02
	4	-9.375E-03	2.975E-02	.753	-6.791E-02	4.916E-02
	5	-3.438E-02	2.975E-02	.249	-9.291E-02	2.416E-02
	6	-6.250E-03	2.975E-02	.834	-6.479E-02	5.229E-02
	8	-6.250E-03	2.975E-02	.834	-6.479E-02	5.229E-02
	9	-2.500E-02	2.975E-02	.401	-8.354E-02	3.354E-02
	10	-2.813E-02	2.975E-02	.345	-8.666E-02	3.041E-02
8	1	-6.563E-02	2.975E-02	.028	-.124	-7.089E-03
	2	-8.750E-02	2.975E-02	.004	-.146	-2.896E-02
	3	-2.188E-02	2.975E-02	.463	-8.041E-02	3.666E-02
	4	-3.125E-03	2.975E-02	.916	-6.166E-02	5.541E-02
	5	-2.813E-02	2.975E-02	.345	-8.666E-02	3.041E-02
	6	.000	2.975E-02	1.000	-5.854E-02	5.854E-02
	7	6.250E-03	2.975E-02	.834	-5.229E-02	6.479E-02
	9	-1.875E-02	2.975E-02	.529	-7.729E-02	3.979E-02
	10	-2.188E-02	2.975E-02	.463	-8.041E-02	3.666E-02
9	1	-4.688E-02	2.975E-02	.116	-.105	1.166E-02
	2	-6.875E-02	2.975E-02	.021	-.127	-1.021E-02
	3	-3.125E-03	2.975E-02	.916	-6.166E-02	5.541E-02
	4	1.563E-02	2.975E-02	.600	-4.291E-02	7.416E-02
	5	-9.375E-03	2.975E-02	.753	-6.791E-02	4.916E-02
	6	1.875E-02	2.975E-02	.529	-3.979E-02	7.729E-02
	7	2.500E-02	2.975E-02	.401	-3.354E-02	8.354E-02
	8	1.875E-02	2.975E-02	.529	-3.979E-02	7.729E-02
	10	-3.125E-03	2.975E-02	.916	-6.166E-02	5.541E-02
10	1	-4.375E-02	2.975E-02	.142	-.102	1.479E-02
	2	-6.562E-02	2.975E-02	.028	-.124	-7.089E-03
	3	3.553E-15	2.975E-02	1.000	-5.854E-02	5.854E-02
	4	1.875E-02	2.975E-02	.529	-3.979E-02	7.729E-02
	5	-6.250E-03	2.975E-02	.834	-6.479E-02	5.229E-02
	6	2.188E-02	2.975E-02	.463	-3.666E-02	8.041E-02
	7	2.813E-02	2.975E-02	.345	-3.041E-02	8.666E-02
	8	2.188E-02	2.975E-02	.463	-3.666E-02	8.041E-02
	9	3.125E-03	2.975E-02	.916	-5.541E-02	6.166E-02

* The mean difference is significant at the .05 level.

APPENDIX H

Homogeneity tests

Table H 1 - Test for homogeneity of variances on level 1 at 30 seconds

Levene Statistic	df1	df2	Sig.
.145	2	317	.865

Note: * indicates significance at .05 level.

Table H 2 - Test for homogeneity of variances on level 1 at 45 seconds

Levene Statistic	df1	df2	Sig.
64.232	3	316	.000*

Note: * indicates significance at .05 level.

Table H 3 - Test for homogeneity of variances on level 2 at 45 seconds

Levene Statistic	df1	df2	Sig.
32.225	3	316	.000*

Note: * indicates significance at .05 level.

Table H 4 - Test for homogeneity of variances on level 3 at 45 seconds

Levene Statistic	df1	df2	Sig.
19.700	3	316	.000*

Note: * indicates significance at .05 level.

APPENDIX I

Syntax for recoding individual cells into regions

```
/*This will create a title for the output.
/*All other "title" commands will create the subheadings.
```

```
TITLE "Computation of Hotspots in Microwave Project".
```

```
/*This recodes the original arbitrary location variable into a usable location variable.
```

```
STRING rlocat (A8).
COMPUTE rlocat = SUBSTR(location,3,3) .
EXECUTE .
```

```
/*This is where we start computing miracle, coded this way because the syntax was
difficult
/*This is for miracle for level 1 at 30 seconds.
/*1=hotspot1, 2=hotspot2, 3=rest of area.
```

```
TITLE 'Hotspots for Level One at 30 seconds' .
```

```
USE ALL.
COMPUTE filter_$(loclev=1 & time=30).
VARIABLE LABEL filter_$(loclev=1 & time=30 (FILTER)'.
VALUE LABELS filter_$(0 'Not Selected' 1 'Selected'.
FORMAT filter_$(f1.0).
FILTER BY filter_$.
EXECUTE .
```

```
IF (loclev=1) & (time=30) mk1130 = 3 .
IF (loclev=1) & (time=30) & (rlocat='B4') mk1130= 1.
IF (loclev=1) & (time=30) & (rlocat='C3') mk1130= 1.
IF (loclev=1) & (time=30) & (rlocat='C4') mk1130= 1.
IF (loclev=1) & (time=30) & (rlocat='D4') mk1130= 1.
IF (loclev=1) & (time=30) & (rlocat='E4') mk1130= 1.
IF (loclev=1) & (time=30) & (rlocat='A5') mk1130= 2.
IF (loclev=1) & (time=30) & (rlocat='A6') mk1130= 2.
IF (loclev=1) & (time=30) & (rlocat='B5') mk1130= 2.
IF (loclev=1) & (time=30) & (rlocat='B6') mk1130= 2.
IF (loclev=1) & (time=30) & (rlocat='B7') mk1130= 2.
VARIABLE LABELS mk1130 'Miracles at level 1 time 30'.
EXECUTE .
```

```
FILTER OFF.
USE ALL.
EXECUTE .
```

ONEWAY

```

temperat BY mkl130
/STATISTICS HOMOGENEITY
/MISSING ANALYSIS
/POSTHOC = LSD T2 ALPHA(.05).

```

/*Remember the level of significance for the test of homogeneity will determine which post-hoc you should look at.

/*If it is not significant, you can look at the least-significant difference test.

/*If it is significant, you will need to look at Tamhane's T2.

/*This is where we compute the miracle for level 1 at 45 seconds.

TITLE 'Hotspots for Level One at 45 seconds'.

USE ALL.

```

COMPUTE filter_$(loclev=1 & time=45).
VARIABLE LABEL filter_$(loclev=1 & time=45 (FILTER)'.
VALUE LABELS filter_$(0 'Not Selected' 1 'Selected'.
FORMAT filter_$(f1.0).
FILTER BY filter_$.
EXECUTE .

```

/*Remember, 4=hotspot1, 5=hotspot2, 6=hotspot3, 7=rest of area

```

IF (loclev=1) & (time=45) mkl145 = 7.
IF (loclev=1) & (time=45) & (rlocat='F1') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='F2') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='F3') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='F4') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='G4') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='E2') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='E4') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='E5') mkl145= 4.
IF (loclev=1) & (time=45) & (rlocat='A4') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='A5') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='A6') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='A7') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='B4') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='B5') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='B6') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='B7') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='C3') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='C4') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='D3') mkl145= 5.

```

```

IF (loclev=1) & (time=45) & (rlocat='D4') mkl145= 5.
IF (loclev=1) & (time=45) & (rlocat='E7') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='E9') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='F7') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='F8') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='F9') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='F10') mkl145= 6.
IF (loclev=1) & (time=45) & (rlocat='G7') mkl145= 6.
VARIABLE LABELS mkl145 'Miracles at level 1 at 45 seconds'.
EXECUTE.

```

```

FILTER OFF.
USE ALL.
EXECUTE.

```

```

ONEWAY
  temperat BY mkl145
  /STATISTICS HOMOGENEITY
  /MISSING ANALYSIS
  /POSTHOC = LSD T2 ALPHA(.05).

```

/*This is where we compute the miracle for level 2 at 45 seconds.

```

TITLE 'Hotspots for Level Two at 45 seconds' .

```

```

USE ALL.
COMPUTE filter_$(loclev=2 & time=45).
VARIABLE LABEL filter_$(loclev=1 & time=45 (FILTER)'.
VALUE LABELS filter_$(0 'Not Selected' 1 'Selected'.
FORMAT filter_$(f1.0).
FILTER BY filter_$.
EXECUTE .

```

```

IF (loclev=2) & (time=45) mkl245 = 11 .
IF (loclev=2) & (time=45) & (rlocat='D1') mkl245= 8.
IF (loclev=2) & (time=45) & (rlocat='D2') mkl245= 8.
IF (loclev=2) & (time=45) & (rlocat='E1') mkl245= 8.
IF (loclev=2) & (time=45) & (rlocat='E2') mkl245= 8.
IF (loclev=2) & (time=45) & (rlocat='F1') mkl245= 8.
IF (loclev=2) & (time=45) & (rlocat='D9') mkl245= 9.
IF (loclev=2) & (time=45) & (rlocat='E8') mkl245= 9.
IF (loclev=2) & (time=45) & (rlocat='E9') mkl245= 9.
IF (loclev=2) & (time=45) & (rlocat='E10') mkl245= 9.
IF (loclev=2) & (time=45) & (rlocat='F10') mkl245= 9.
IF (loclev=2) & (time=45) & (rlocat='D4') mkl245= 10.

```

```

IF (loclev=2) & (time=45) & (rlocat='D5') mkl245= 10.
IF (loclev=2) & (time=45) & (rlocat='E4') mkl245= 10.
IF (loclev=2) & (time=45) & (rlocat='E5') mkl245= 10.
IF (loclev=2) & (time=45) & (rlocat='E6') mkl245= 10.
VARIABLE LABELS mkl245 'Miracles at level 2 at 45 seconds' .
EXECUTE .

```

```

FILTER OFF.
USE ALL.
EXECUTE .

```

```

ONEWAY
  temperat BY mkl245
  /STATISTICS HOMOGENEITY
  /MISSING ANALYSIS
  /POSTHOC = LSD T2 ALPHA(.05).

```

/*This is where we compute your miracle for level 3 at 45 seconds.

```

TITLE 'Hotspots for Level Three at 45 seconds' .

```

```

USE ALL.
COMPUTE filter_$(loclev=3 & time=45).
VARIABLE LABEL filter_$(loclev=1 & time=45 (FILTER)'.
VALUE LABELS filter_$(0 'Not Selected' 1 'Selected'.
FORMAT filter_$(f1.0).
FILTER BY filter_$.
EXECUTE .

```

```

IF (loclev=3) & (time=45) mkl345 = 15 .
IF (loclev=3) & (time=45) & (rlocat='A1') mkl345= 12.
IF (loclev=3) & (time=45) & (rlocat='A2') mkl345= 12.
IF (loclev=3) & (time=45) & (rlocat='B1') mkl345= 12.
IF (loclev=3) & (time=45) & (rlocat='B2') mkl345= 12.
IF (loclev=3) & (time=45) & (rlocat='C1') mkl345= 12.
IF (loclev=3) & (time=45) & (rlocat='A8') mkl345= 13.
IF (loclev=3) & (time=45) & (rlocat='A9') mkl345= 13.
IF (loclev=3) & (time=45) & (rlocat='A10') mkl345= 13.
IF (loclev=3) & (time=45) & (rlocat='B9') mkl345= 13.
IF (loclev=3) & (time=45) & (rlocat='B10') mkl345= 13.
IF (loclev=3) & (time=45) & (rlocat='H4') mkl345= 14.
IF (loclev=3) & (time=45) & (rlocat='H5') mkl345= 14.
IF (loclev=3) & (time=45) & (rlocat='H6') mkl345= 14.
IF (loclev=3) & (time=45) & (rlocat='H7') mkl345= 14.
IF (loclev=3) & (time=45) & (rlocat='H8') mkl345= 14.
VARIABLE LABELS mkl345 'Miracles at level 3 at 45 seconds' .

```

EXECUTE .

FILTER OFF.

USE ALL.

EXECUTE .

ONEWAY

temperat BY mkl345

/STATISTICS HOMOGENEITY

/MISSING ANALYSIS

/POSTHOC = LSD T2 ALPHA(.05).