Blu-tack

And its adhesive abilities at different temperatures

Sophie Howard

26-7-15

Blu-tack - and it's adhesiveness at different temperatures.
By Sophie Howard

Introduction:
The aim of my project is *to discover the temperature at which Blu-tack works best.* I chose this project because all my earlier ideas didn't allow me to measure anything (and my teacher said that the best experiments are the ones with different aspects to measure). However after beginning the actual experiment I found that I quite enjoyed setting everything up and thinking of all the possible variables that come into play to ensure that my experiment is fair. I also liked my experiment because even though I won't change the world in any way with my findings, blu-tack is a product we use everyday and as my science teacher told me it can be very annoying when you have to continuously pick up fallen posters because the blu-tack hasn't worked. I think that if people know how to maximise the use of blu-tack it might just save them a bit of time and in someway make their lives easier.

By doing my experiment I want to find the temperature (or at least an approximation of the temperature) in which blu-tack works best. I will do this through putting pieces of blu-tack in different environments and timing how long the blu-tack in each environment can hold up a wooden board. I will need to consider all the different variables that impact my experiment in order to control them and make my experiment as accurate as possible. I will also need to manage my time so that I can do my experiment consecutively so that the temperatures of my environments won't change.

Some background research I have done about this project is:
I have learnt about the history of blu-tack. First discovered by BOSTIK during the development of a Bostik industrial adhesive it is a widely used removable sealant and is iconic in Australia and the UK. Since 1971 Blu-tack has been a household product used generally for sticking posters on walls- it's not intended for very heavy objects. Blu-tack is found in most general stores and is packaged in sheets covered in plastic. The adhesive specialists at Bostik won't reveal the contents of Blu-tack- they provide information on the material in general but refuse to give details on the ingredients of the product. Blu- tack is a safe substance- it will not cause any damage if swallowed (however Bostik recommends that if discomfort is experienced to seek medical care).

Blu-tack while working well on most dry surfaces (painted surfaces etc.), can get in between the crevices of bricks and in some cases damage the paint or wallpaper on a wall that's why it is not recommended for some surfaces. According to the Bostik Website 0.5 grams of Blu-tack should be able to hold 105 grams. Blu-tack works best for holding up non-laminated posters (which can slide in hot conditions) however if sufficient amounts are used it shouldn't be a problem. Blu-tack softens at around 70˚C- when using Blu-tack surfaces must be free from grease or loose material. Originally Blu-tack was white but was later coloured blue so that children wouldn't mistake it as chewing gum, however this could also be because of the sterilizing fluid used to prevent health problems for those who may accidentally consume it.

Unfortunately after researching online blu-tack and experiments that include blu-tack, I was unable to find anyone who has done any previous research on what temperature blu-tack works best at.
In conclusion, for this experiment I have done extensive research on the main product I'm using for my experiment, I have been able to formulate an aim for my experiment as well as expand what I want to find out about my experiment.

Background Information from- Wikipedia: http://en.wikipedia.org/wiki/Blu-Tack
Bostik: www.blutack.com/

Aim: To discover the temperature at which Blu-tack works best.
Hypothesis: I believe that the blu-tack will stick best in a more heated environment (being put in a microwave). The microwaved blu-tack will stick the longest, as it will make the blu-tack sticky, which will help it to grip the wall more. I think this, as according to my research blu-tack needs pressure and a bit of heat to be activated. I do not think the oven blu-tack will last as long because it will cause the blu-tack to harden and possibly burn giving it less grip on the wall.

Materials:

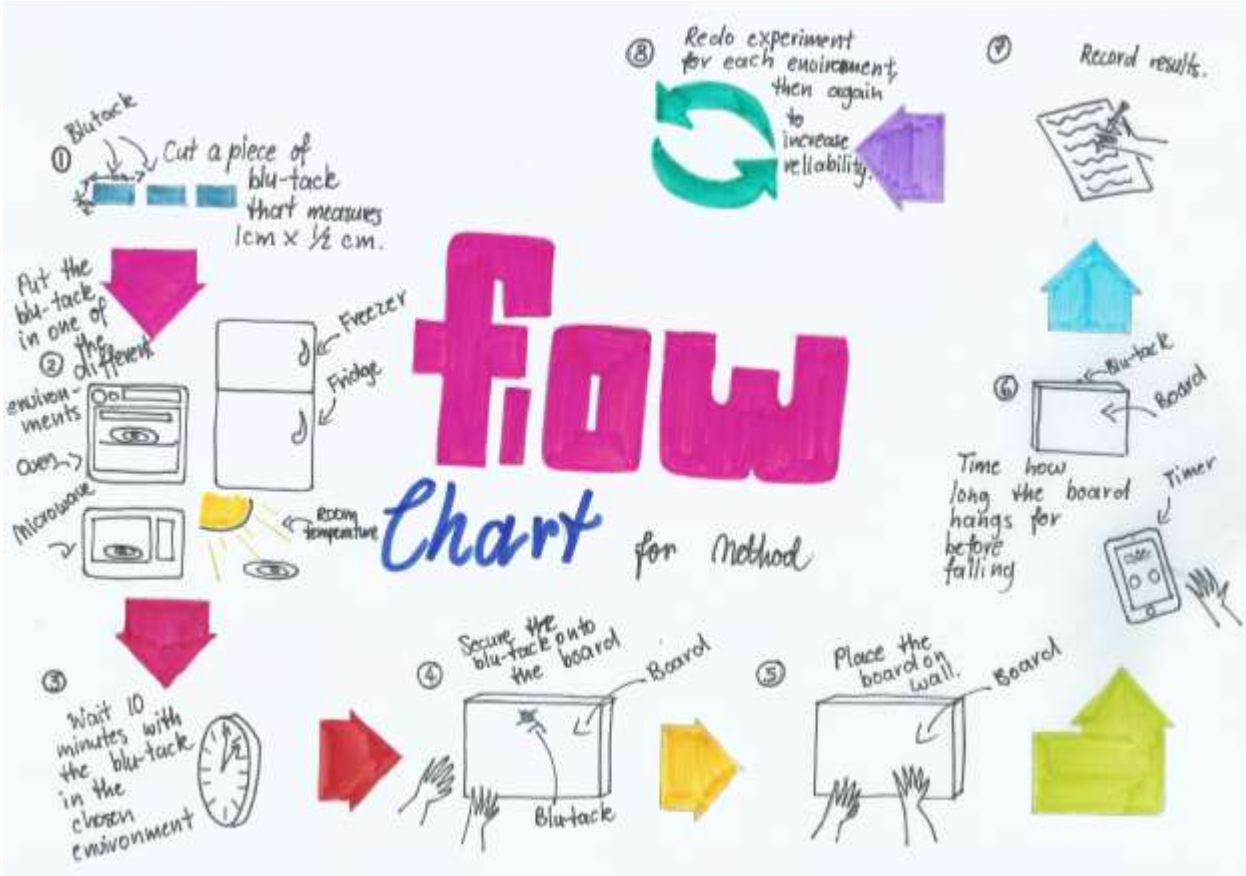
- Blu tack- Bostik- 75 g pack, I purchased two packs of blu-tack one original (for the actual experiment) and one colourful (for the decoration of my poster), this added up to $4.43.
- Wood- From Bunning's warehouse: 15cm x 20cm at 750g.
- Fridge- a Panasonic freezer and fridge in one at 5˚C.
- Freezer- a Panasonic freezer and fridge in one at -20˚C.
- Oven- a Panasonic oven at 150˚C.
- Microwave- A Panasonic Inverter microwave at 100˚C.
- Room temperature- 13˚C.
- Sticky tape- (optional, for sticking boards together).
- Ruler
- Pens
- Paper
- Stopwatch

Method:
Step 1: Cut a piece f blu-tack that measures 1cm x ½ cm.
Step 2: Place the blu-tack in one of the five environments (fridge, freezer, room temperature, microwave, oven).
Step 3: Wait exactly 10 minutes before removing the blu-tack from the climate (as quickly as possible in order to be accurate).
Step 4: Secure the blu-tack onto the wooden board (at 750g) in the marked spot.
Step 5: Place the board on the wall and slip the ruler in between before pressing to ensure the same pressure is given to the board on the wall making it a fair experiment.
Step 6: Time how long the board hangs for before dropping (will not take to long as the board is quite heavy and difficult for just blu-tack to hang up).
Step 7: Record results and redo experiment for each different environment, then redo the entire experiment to make it as reliable and accurate as possible.

Variables	
Independent Variable	• The temperature (climate) that the blu-tack is in.
Dependant Variable	• How well the blu-tack sticks to the wall.
Control	• The blu-tack in the natural environment.
Controlled Variables	• The amount of blu-tack used in each climate. • The amount of time the blu-tack is in the climate. • The weight and dimensions of the wood that the blu-tack holds up. • The amount of blu-tack holding up each board. • The wall the board is hung on. • The place where the board is hung on the wall. • The place the blu-tack is stuck on the board. • The pressure that is applied to the board when sticking it on the wall. • The natural temperature for my room temperature environment. • The surface the blu-tack is on in each climate.

Extra Information: http://h2g2.com/edited_entry/a493553

Risk Assessment	
Risk	Safety precautions
The blu-tack may catch fire in the oven.	I will ensure supervision whilst the blu-tack is in the oven and keep proper materials (fire hydrant, water etc.) nearby so that if this does happen appropriate measures can be taken.
The oven results may not be reliable if the same setting isn't used.	I will ensure that the oven is set to a consistent temperature to get more reliable results.
The temperature of the blu-tack set in the room-temperature environment may not be consistent if the temperature of the day changes over time.	I will ensure to complete my experiment within a short period of time so that the temperature does not change making my experiment more accurate.
Younger siblings may be hit by falling pieces of wood.	I will perform my experiment in a safe place far from any of my many siblings so that they will not be injured.
The pressure applied to the wood may be different altering my results.	I will insert a ruler and press so that the same pressure is applied to each board making my experiment consistent.
The wall may be marked by burnt blu-tack.	I will use the kitchen wall, which is made of marble and cannot be burned.
I may burn myself when using the hot oven/ microwave.	I will be careful around the oven and microwave and use a cooking glove when removing the blu-tack from these environments. If a situation where I do burn myself arises, I will remain calm and treat any injuries responsibly.
Someone may open the fridge/freezer/oven/microwave while the blu-tack is in there and this may impact my experiment.	I will stop anyone who might interrupt my experiment (my parents and siblings mainly) from accessing the climates in order to not change the results of my experiment.

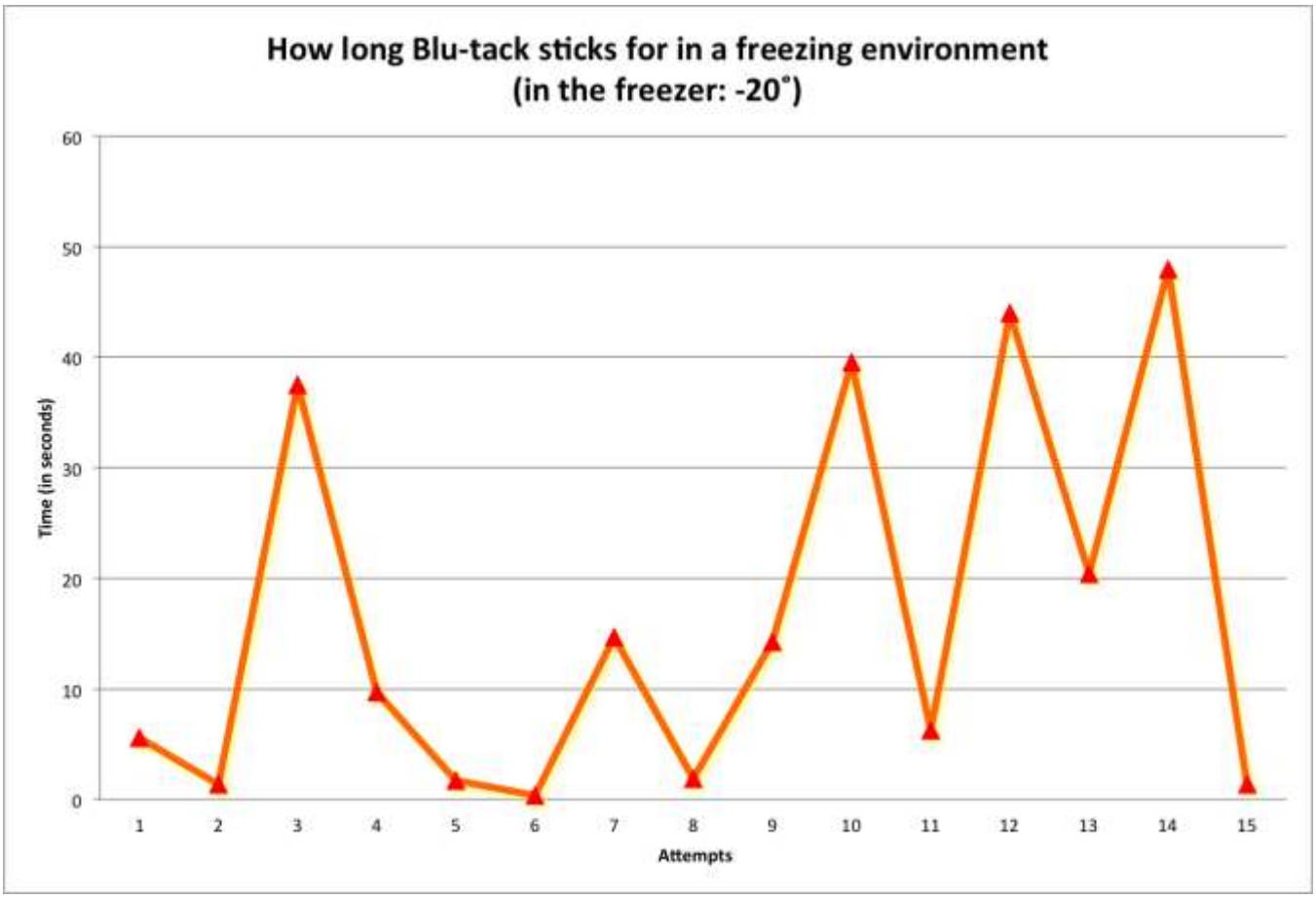


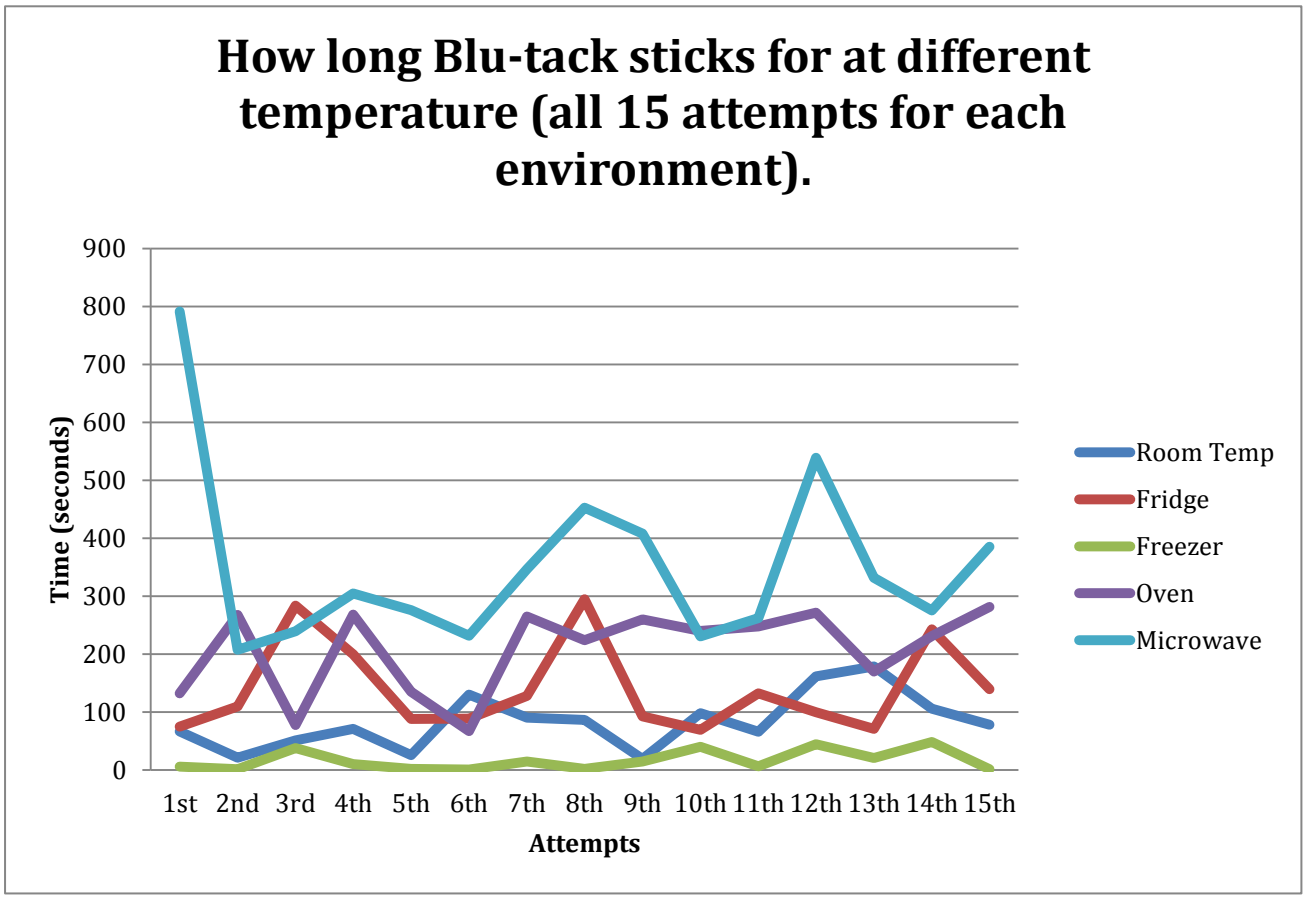
Results: Tables, graphs and diagrams:

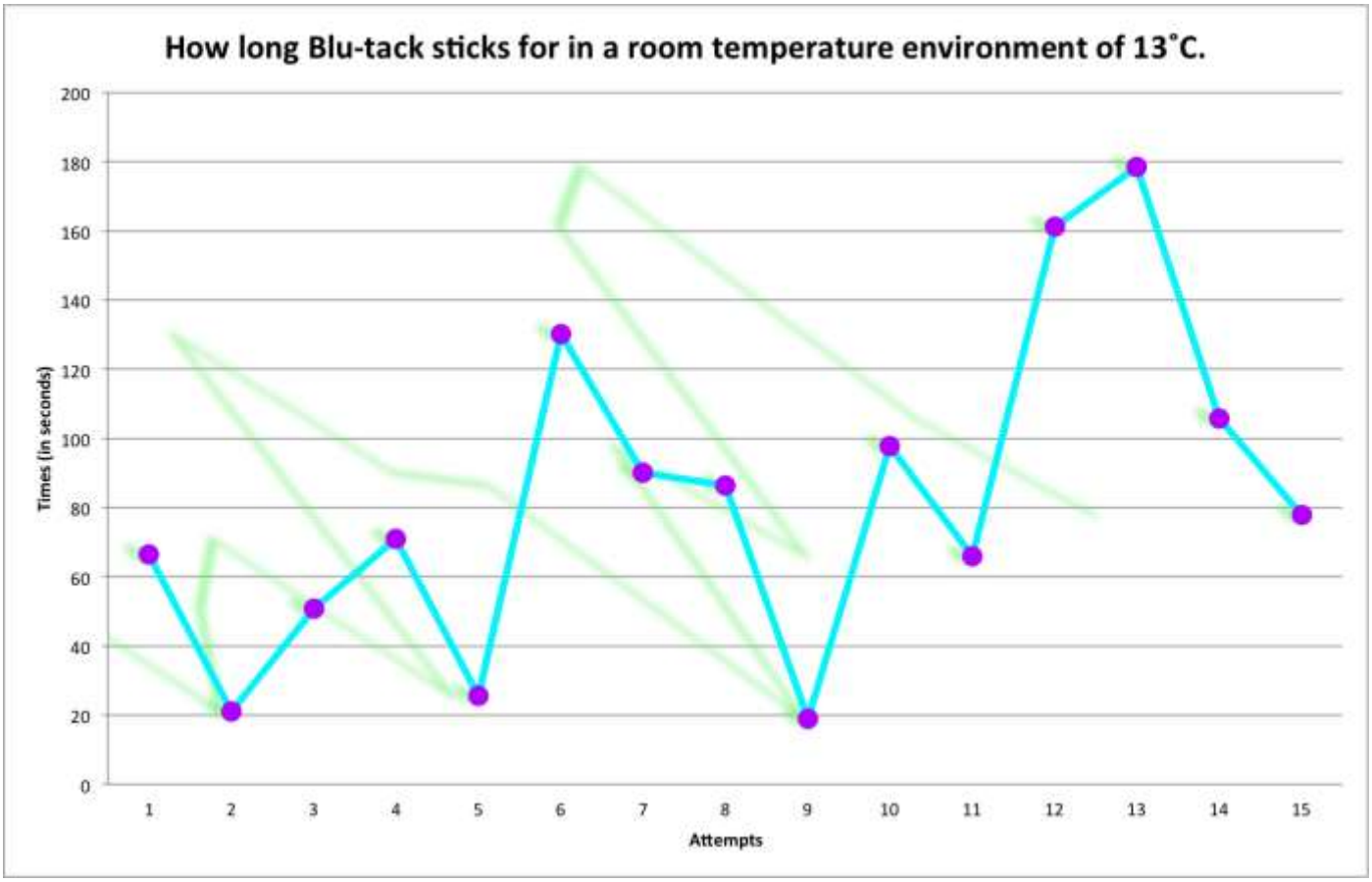
How long Blu-tack sticks for at different temperatures (all attempts including averages).					
	Room Temp (13˚C)	Fridge (5˚C)	Freezer (-20˚C)	Oven (150˚C)	Microwave (100˚C)
1st Attempt	66.36	74.78	5.56	132.31	791.18
2nd	21.16	109.37	1.34	267.21	207.00
3rd	50.74	283.39	37.50	77.48	239.26
4th	70.86	199.35	9.74	268.06	304.38
5th	25.43	87.72	1.76	134.81	275.89
6th	130.06	88.50	0.34	66.96	231.64
7th	90.06	127.88	14.66	264.89	346.35
8th	86.42	294.61	1.85	223.64	452.29
9th	18.83	92.50	14.28	259.62	407.61
10th	97.84	69.08	39.57	239.56	230.44
11th	66.00	131.87	6.28	247.82	261.71
12th	161.32	99.23	44.00	271.09	538.96
13th	178.58	70.51	20.41	169.72	331.78
14th	105.80	242.38	47.93	231.12	275.24
15th	77.83	139.15	1.37	281.02	384.95
Average	83.153	140.668	16.440	209.021	351.912

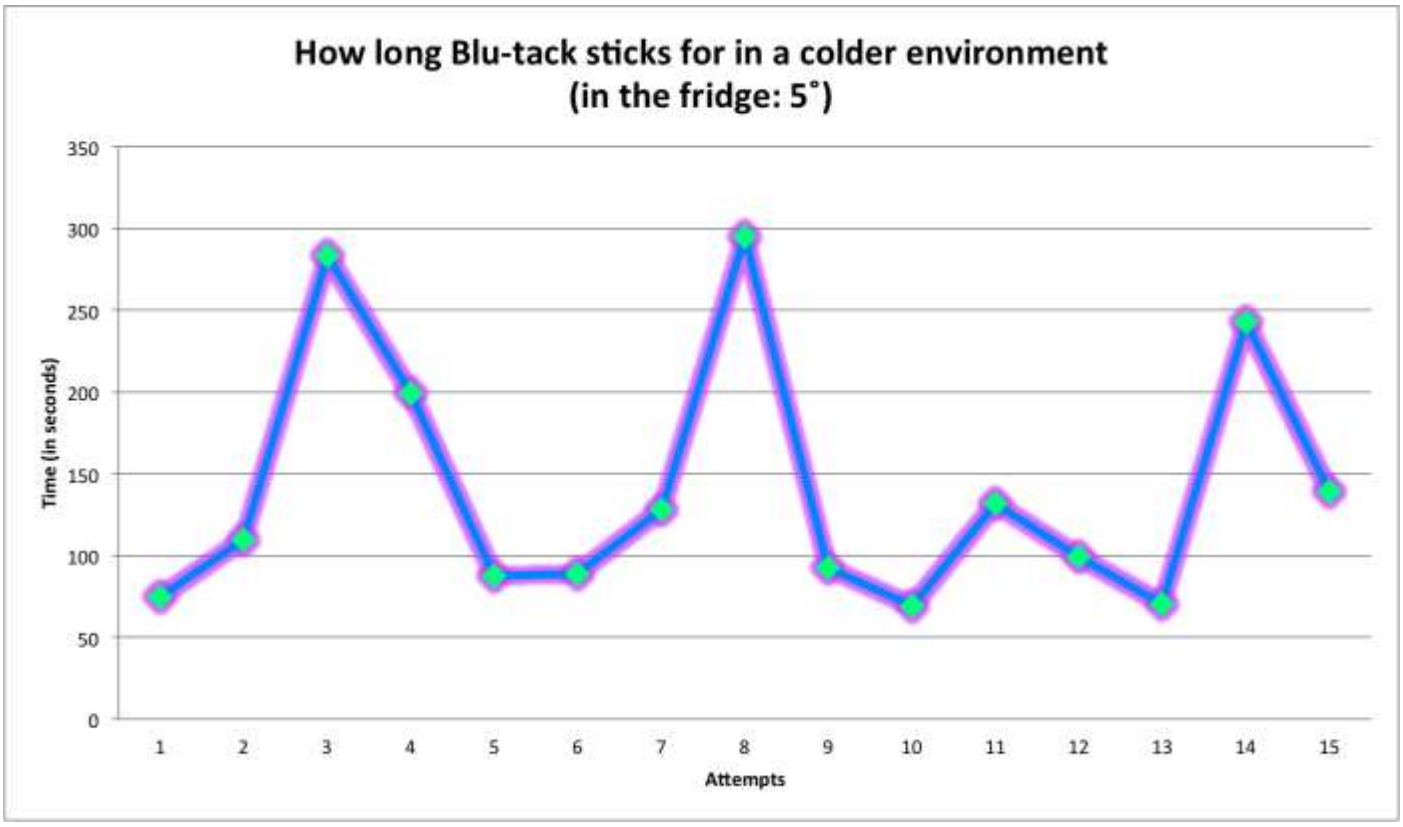
Most of my results for this experiment were as expected - the microwaved blu-tack as I predicted lasted the longest in holding up the wood. I had also thought that the freezer blu-tack wouldn't have had much success because the colder blu-tack wouldn't have as much a grip on the wall and because blu-tack is activated by heat. I was surprised that the fridge blu-tack actually had a higher average than the room temperature blu-tack; I suppose that the colder blu-tack was able to grip the wall better than the normal temperature blu-tack. I was also surprised that the oven came second in holding up the wood. I thought that it would become too hard to grip the wall and would fall off or would become too stretchy and not have enough grip - I was proven wrong.

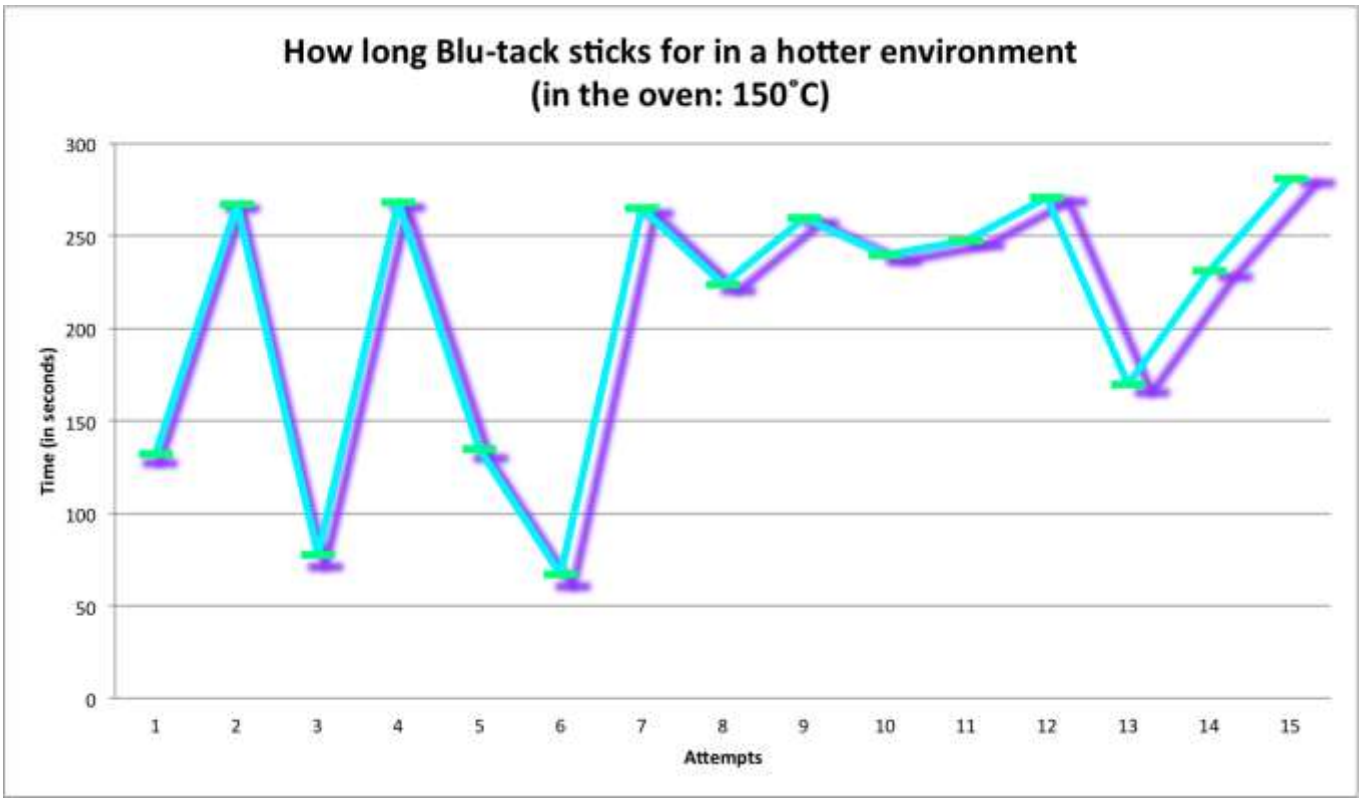
When comparing all the results in my graphs, I found that throughout the different attempts for each of the different environments the results were varied - however it was the averages of each of the environments that let me compare the times. According to my graphs the microwaved blu-tack (at 100˚C) was the longest hanging blu-tack on the wall it's average being 351.912 while the oven came in a distant second hanging on the wall for an average of 209.021 seconds (rounded). The fridge surprisingly came third holding the wood on the wall for an average of 140.688 seconds; the room temperature blu-tack came fourth with an average of 83.153 seconds (rounded). The freezer came last with an average of 16.440 seconds (rounded). I was overall pleased with my results as they showed that there is a difference between the adhesiveness of blu-tack depending on the temperature and they also proved that my hypothesis was correct.

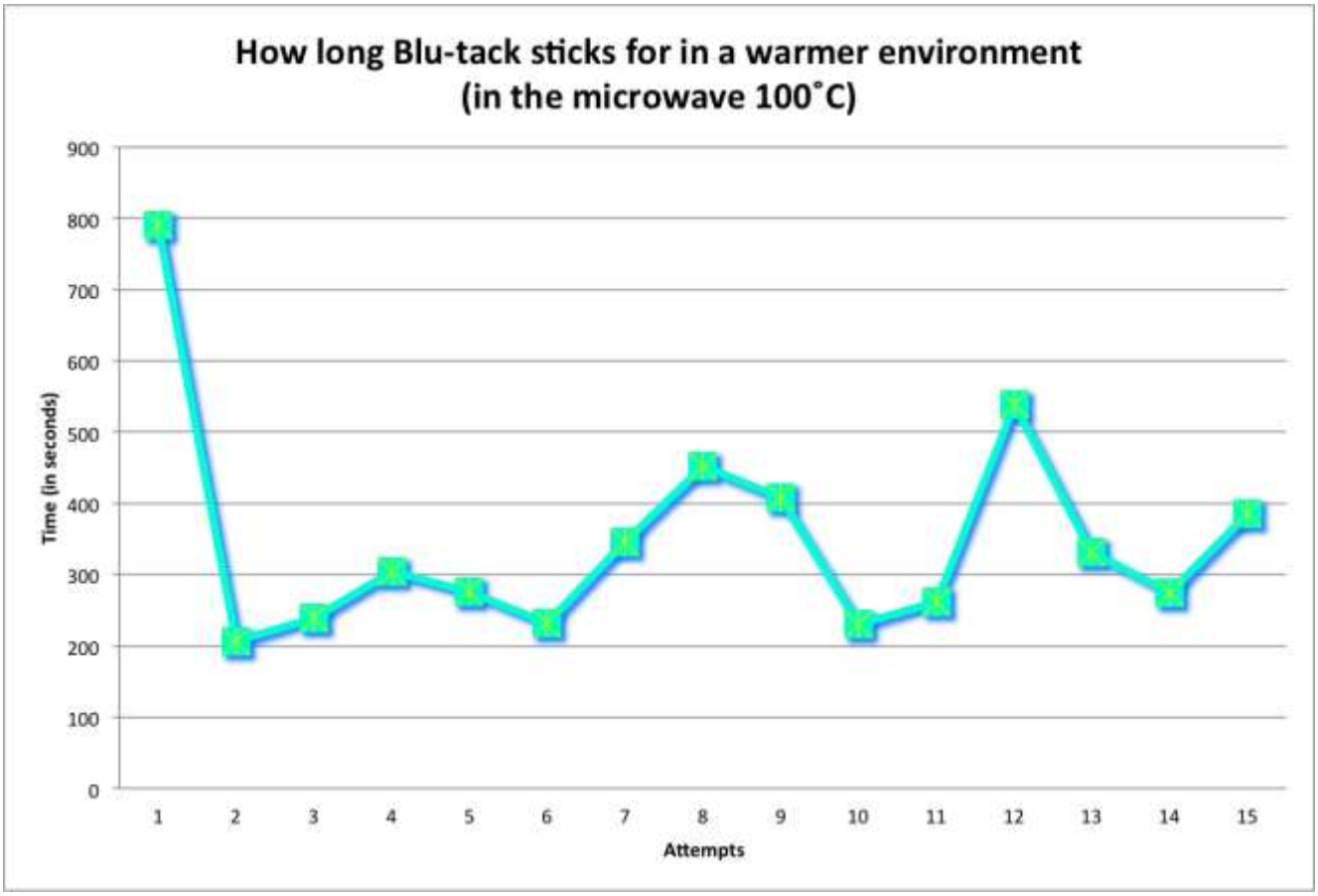

How long Blu-tack sticks for in a freezing environment
(in the freezer: -20˚)
Time (in seconds)
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Attempts

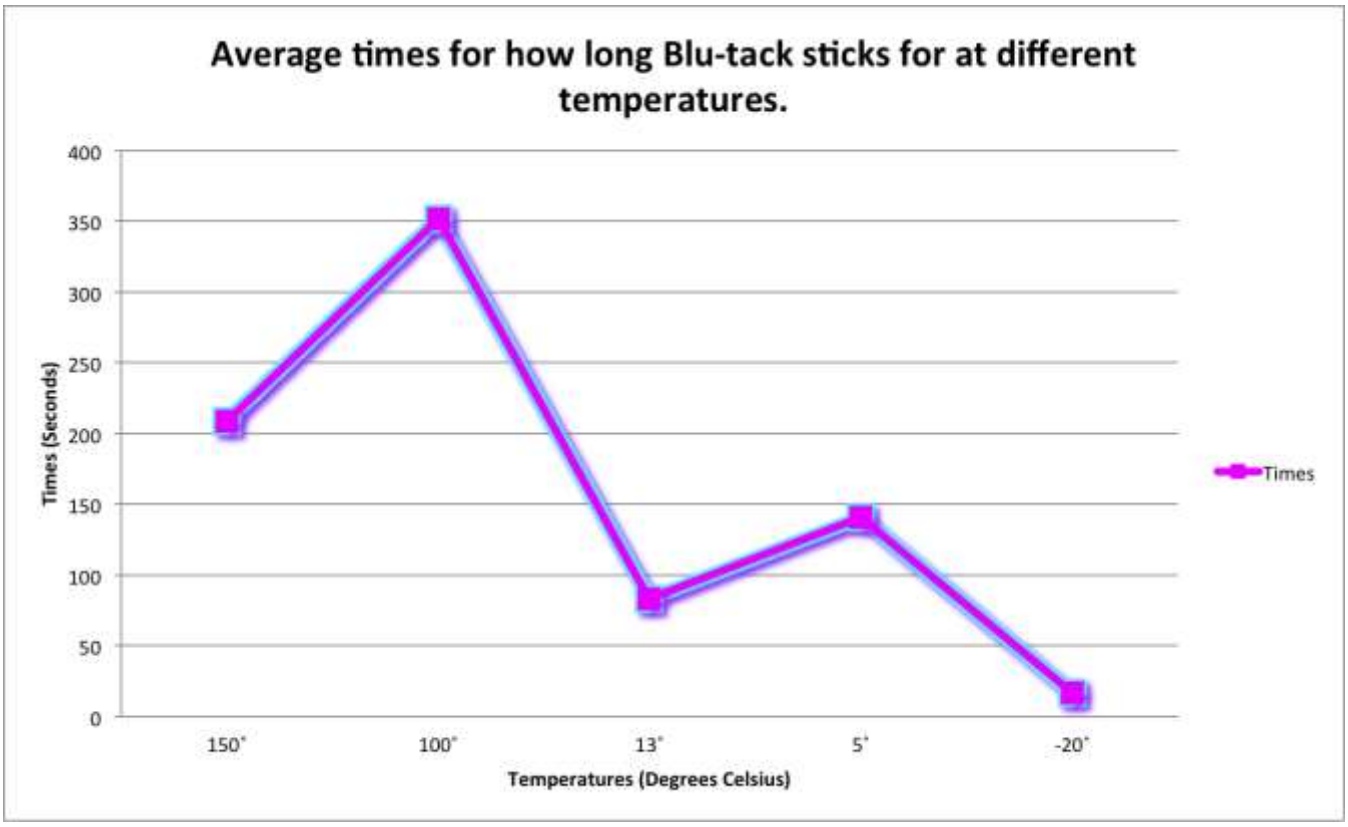

How long Blu-tack sticks for at different temperature (all 15 attempts for each environment).
Time (seconds)
900
800
700
600
500
400
300
200
100
0
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
11th
12th
13th
14th
15th
Attempts
Room Temp
Fridge
Freezer
Oven
Microwave

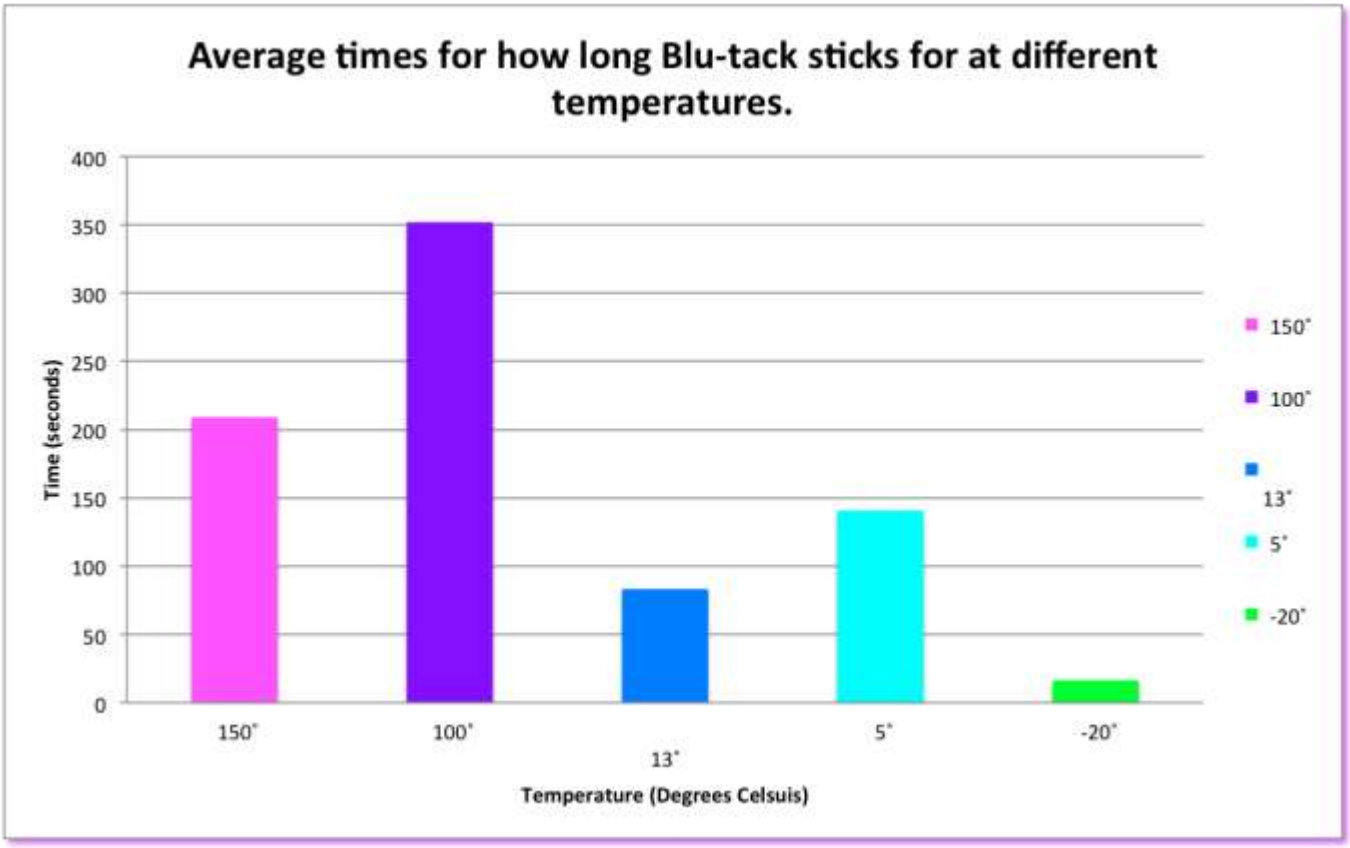

How long Blu-tack sticks for in a room temperature environment of 13˚C.
Times (in seconds)
0
20
40
60
80
100
120
140
160
180
200
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Attempts

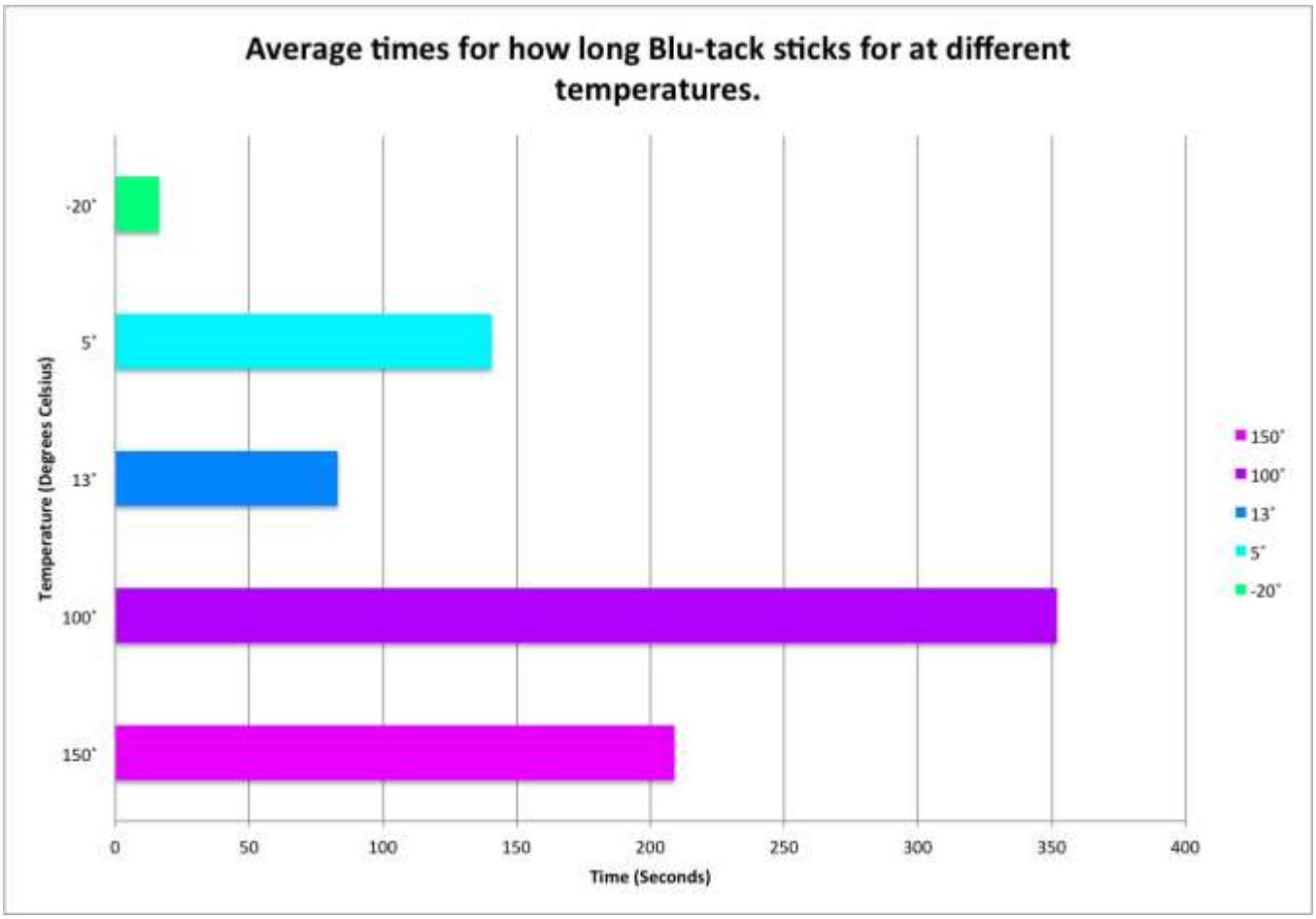

How long Blu-tack sticks for in a colder environment
(in the fridge: 5˚)
Time (in seconds)
0
50
100
150
200
250
300
350
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Attempts


How long Blu-tack sticks for in a hotter environment
(in the oven: 150˚C)
Time (in seconds)
300
250
200
150
100
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Attempts


How long Blu-tack sticks for in a warmer environment
(in the microwave 100˚C)
Time (in seconds)
900
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Attempts


Average times for how long Blu-tack sticks for at different temperatures.
400
350
300
250
200
150
100
50
0
Times (Seconds)
150˚
100˚
13˚
5˚
-20˚
Temperatures (Degrees Celsius)
Times


Average times for how long Blu-tack sticks for at different temperatures.
400
350
300
250
200
150
100
50
0
Time (seconds)
150˚
100˚
13˚
5˚
-20˚
Temperature (Degrees Celsuis)
150˚
100˚
13˚
5˚
-20˚



Discussion:
In effort to discover the temperature at which blu-tack works best, I conducted an experiment to put pieces of blu-tack in different environments before timing how long they hold up a piece of wooden board. Before starting my experiment I wrote up a hypothesis that briefly stated that I thought the blu-tack would stick the best in a more heated environment (the microwave) as it will make the blu-tack more sticky which will help it to grip the wall better, I did not think the blu-tack in the oven would stick as well as the blu-tack in the microwave as it would probably harden and burn and wouldn't have enough grip on the board to stick for very long.

After performing my experiment fifteen times (for reliability and accuracy) I found that my hypothesis was indeed correct - the microwaved blu-tack did prove to be the strongest in holding up the wooden board for the longest amount of time with an average of 351.912 seconds. I witnessed how the microwave blu-tack hardened on the wood helping it to keep a grip on the wall and because of how sticky it was I think that may have helped it to last longer. I found that contrary to what I thought the oven blu-tack actually was the second strongest - holding up the wooden board for and average of 209.021 seconds. According to my results I was wrong in thinking that the blu-tack would burn and harden in the oven and wouldn't be able to grip the wall as well. However, while observing my experiment I found that the blu-tack can be affected very quickly by different temperatures, after just 10 minutes in the oven the blu-tack was scoldingly hot (I know this as I burnt my hand several times) and black flakes started to appear on the tack.

In the microwave the blu-tack became extremely versatile in that it was more stretchy and easier to mould (however it was still extremely hot). The fridge blu-tack came third with an average of 140.668 seconds-which again surprised me as I thought blu-tack needed to be more heated to get a good grip on the wall. The room temperature blu-tack came second last with an average of 83.153 seconds. I noticed that the room temperature blu-tack remained the same as normal blu-tack, while the fridge blu-tack remained quite normal however slightly cooler to the touch. The freezer blu-tack came last, holding up

the wooden board for only 16.440 seconds average - the freezer blu-tack began to harden and had a more icy appearance and was colder than the fridge blu-tack (which is expected as the freezer has a 15˚ lower temperature).

My results imply that blu-tack sticks best in a more heated environment (of 100˚C), and once reaching the 150˚C point it starts to harden. Blu-tack doesn't work very well in cooler environments (of around -20˚C and lower) however it is able to function in slightly warmer environments (of 5˚C). Blu-tack also doesn't seem to work very well at normal temperatures - according to my results it needs a slightly more heated environment for it to reach it's full adhesiveness.

My results were obtained through all the different variables that were involved in my experiment. I had to ensure I controlled all my variables in order to make my experiment fair- and so that if anyone else was to do the experiment, they would get the same results. If someone were to do the experiment again - in order to get the same results among other things, they would need the same temperatures for all the environments- particularly the room temperature environment that I had at 13˚C.

From looking at my many different graphs I concluded that blu-tack generally (disregarding the fridge environment results) needs at least some heat to be able to stick objects onto walls. I found that all the results for each different environment were noticeably varied - with a range of different times for each environment. However when comparing my averages in graphs it was easily concluded what temperature blu-tack needs in order to function the best. From comparing graphs I also discovered that there is a relationship between the temperature of the environments and the average time each environment holds the board for. The smaller the difference in temperature between two environments, the smaller the difference in the time the blu-tack holds the board for. For example the smallest gap in temperature between two environments is 8˚C between the room temperature environment (13˚C) and the fridge environment (5˚C) and the gap in time between the two environments is 57.515 seconds which is noticeably less than the gap in time between any two other environments. The opposite is true as well - the larger the gap in temperature between two environments, the larger the gap in time between the two environments.

Some issues I had with my experiment include gathering resources. Initially I had trouble collecting all the different materials I needed for my experiment - particularly the wooden boards that were an integral part of my experiment and all this affected the time I had to complete my experiment, over the holidays. I eventually made the decision to time how long the blu-tack held up the pieces of wood separately- as I was only able to find one board of suitable weight to use and doing this would also allow me to be more accurate in timing. I also had some problems with controlling my variables- I became aware (after starting my experiment) that the amount of pressure I put when sticking the board with the blu-tack to the wall would affect my results. I eventually solved this problem by when sticking the board to the wall sliding a ruler in between and pressing so the same pressure is applied to each part of the experiment.

I also (after beginning my experiment) reduced the amount of blu-tack I put on each board so that the board would take less time to fall and my experiment would be faster and more efficient as I realised that I did not have enough time to wait around for the board to fall. This decision helped me to perform my experiment multiple times in order to make it more reliable. I found another problem when considering which wall I should use for my experiment. I eventually settled for the kitchen wall is it was conveniently close to my different environments and would be harder to mark or burn as it is made of marble.

I believe my experiment was reliable, as I made sure to control all my different variables so that my experiment was fair. I also repeated my experiment 15 times in order to find an average and get a more reliable result. Some of my results for each different environment were quite varied - which is why I did my experiment so many times to find the most common result. My results are reproducible, as long as

all the variables are controlled and all times are measured accurately. When completing my experiment, I tried to be as accurate as possible with my timing- I used my iPhone to time everything (as it measures everything to 2 decimal places of a second) and ensured that I pressed the button as soon as my hands let go of the board on the wall. If I weren't sure a certain time was as accurate as possible I would redo that part of the experiment to make it more reliable.

My experiment was valid and did set out to do what I wanted it to - it tested my hypothesis in proving that the microwaved blu-tack (or the blu-tack in an environment of 100˚C) is the most reliable temperature for your blu-tack when sticking an object to a wall using blu-tack. I ensured when completing my experiment that I was aware of which variables needed to be controlled and that I had a suitable independent variable and a dependant variable that could be measured (as a good experiment is one with things to measure).

I could improve my experiment by using more wood - originally I had planned to use larger pieces of wood but I couldn't find any, so I settled with buying a plank of wood which I cut up - however it wasn't heavy enough so I eventually taped three pieces together and did each temperature one by one rather than doing it all in one go. If I had more wood I would have been able to complete my experiment faster and more efficiently.

I think I could also improve my experiment by having more people help- I struggled with having everything ready and being able to use the stopwatch as accurately as possible. If I were to have more people helping me I would be able to finish my experiment faster and more efficiently. I could also improve my experiment by managing my time more wisely- I should probably have started it sooner into the holidays, this would give me more time to work on my written assignment. If I were to do this experiment again I would try to be more careful around the oven- I had a few nasty burns from touching the plates and one time I tried to cool my hand and accidentally knocked over my glass of water. I would also try my experiment with a larger range of temperatures - however I didn't have the facilities to super heat it or super freeze it. One would assume that if you were to super heat the blu-tack (as all solids generally become liquid at high temperatures) the blu-tack wouldn't function. Similarly if you were to super freeze the blu-tack (and you would probably need liquid nitrogen, which I wouldn't be able to obtain) the blu-tack also wouldn't be able to function. Unfortunately as I do not have the proper tools to do this, I wouldn't be able to test my hypothesis.

I believe if I wanted to I could extend my project more by completing more experiments on different types of blu-tack; possibly testing different coloured blu-tack and testing if different surfaces affect how well blu-tack works. I would also be able to do further research on blu-tack itself, maybe by researching into some of the known ingredients in blu-tack. I could also expand on what happens when you change the temperature of the blu-tack while it is on the wall.

Conclusion:
In conclusion, the blu-tack put in the microwave (at 100˚C) was proven to be the best sticking blu-tack, proving my hypothesis. The microwaved blu-tack held the wooden board for an average of 351.912 seconds, while the oven came in a distant second holding the board for merely and average of 209.021 seconds. I found based on the results I obtained that blu-tack at the temperature of 100˚C works best for sticking posters and other objects on walls. I found that blu-tack at -20˚C (the blu-tack in the freezer) lasts the shortest amount of time at 16.440 seconds average. The blu-tack in the fridge (at 5˚C) came in third after the oven and microwave holding the board for 140.668 seconds average and the room temperature blu-tack (at 13˚C) came in second last in front of the freezer with an average of 83.153 seconds. Overall, my advice to anyone using blu-tack is that it works best in more heated environments- so if available you should put the blu-tack in the microwave for around 10 minutes and the resulting blu-tack should be able to hold up your poster or choice object for longer. Alternatively, according to my findings, blu-tack will be able to work better in hotter environments – which would mean it would work better in the hotter months of the year- so I wouldn't recommend people in very cold places in the world to use blu-tack as it probably won't work for a very long time.

Bibliography:

Works Cited: References

"Bostik™ Official Website Australia." *Bostik Australia*. BOSTIK, n.d. Web.

"Bostik™ Official Website UK." *Bostik Innovations*. BOSTIK, n.d. Web.

"EXPLORE PANASONIC." *Panasonic Online Store*. N.p., n.d. Web. 24 July 2015.

"Frequently Asked Questions." *Frequently Asked Questions*. BOSTIK, n.d. Web. 24 July 2015.

"H2g2 - Blu-Tack - Edited Entry." *H2g2 - Blu-Tack - Edited Entry*. N.p., n.d. Web. 24 July 2015.

"How to Use Blutack." *How to Use Blutack- Bostik*. BOSTIK, n.d. Web.

"Official Blutack Website." *Blutack.com*. BOSTIK, n.d. Web.

"Packaging Details of Blutack™." *Blutack.com*. BOSTIK, n.d. Web.

"Small & Medium Businesses." *Excel.com*. N.p., n.d. Web. 24 July 2015.

Wikipedia. Wikimedia Foundation, n.d. Web. 24 July 2015.

Acknowledgements:

- My mother- for letting me use the kitchen.
- My father- for helping me to use excel with my tables and partially my graphs.
- My uncle- who helped me to think of a way to apply the same pressure to the boards of my experiment to make it fairer.
- My teachers- who helped me to come up with an idea and who answered all my questions about this project.