



Prize Winner

Scientific Inquiry

Year 3-4

Zoe Dowdall

Grange Primary School



Effects of Climate on Marshmallows

Zoe Dowdall
Grange Primary School
Word Count: 1037

Question

What happens to marshmallows in different environments? To know whether marshmallows will be good to eat under the effects of different climates such as high air pressure, low air pressure, warm, humid and sealed in zip-lock bag.

Predictions

I predicted that in high air pressure the marshmallow would go fluffy, in low air pressure the marshmallow would shrink, in warmth there would be no change, in humidity the marshmallow would melt, and no change in the zip-lock bag

Planning

I planned to expose the marshmallows to different environments for a week to allow time for changes. To compare homemade and store bought marshmallows I put 2 of each type in each environment, in case one was a bit dodgy. There are 5 different environments so I needed 10 of each type. I used the pink store bought marshmallows and white homemade marshmallows so I could tell them apart.

The variables in my experiment were:

Humidity, temperature, air pressure, and store bought versus homemade.

I researched atmospheric pressure and found it is 14.7psi (*Britannica, The Editors of Encyclopaedia. "Atmospheric pressure"*) so I chose to double this.

Creating the Environments

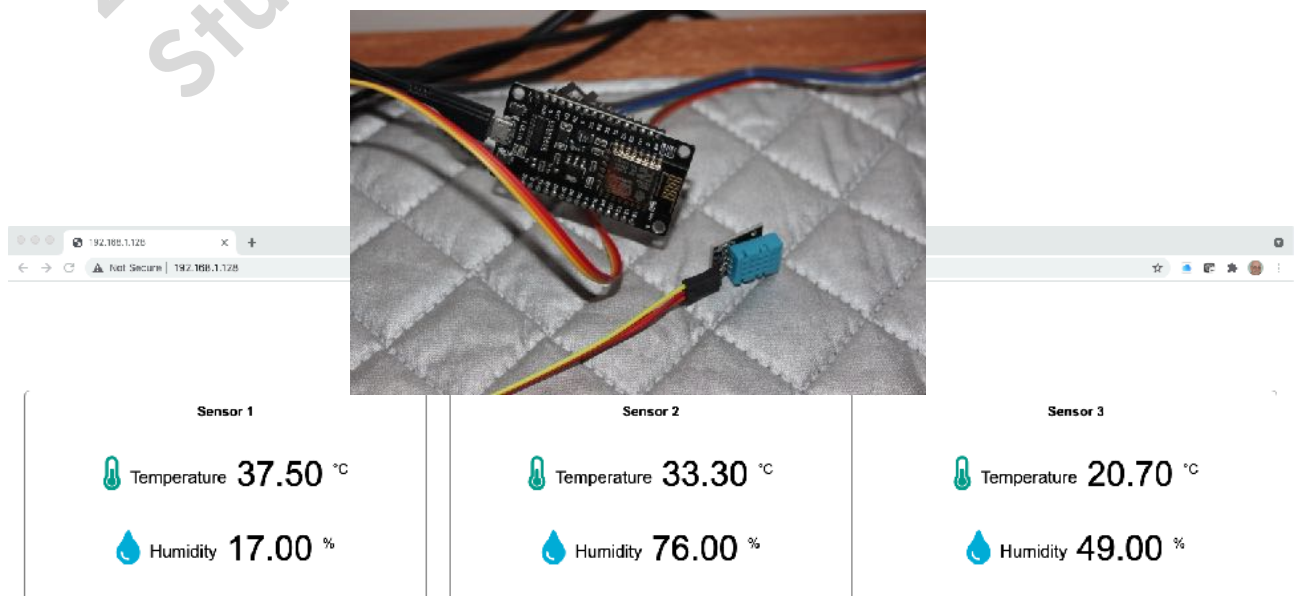
Temperature and humidity

I planned to use a reptile heat lamp to create a warm environment but found that would be expensive. Mum suggested a seed propagation heat mat, these were cheaper and mum is happier to propagate seeds than get a reptile.

I put the heat mat under the Saxon Mini Greenhouse to make a warm environment.

I put another heat mat under a second Saxon Mini Greenhouse with a bowl of water in to make a humid environment.

Dad made a device to measure the temperature and humidity in the room and both the Saxon Mini Greenhouses, and display them on a web page.



Air Pressure

We tried to use a vacuum food storage bag for the low pressure but the bag collapsed and squished the marshmallow. Mum found a valve that allows the air to be sucked out a bottle but not let it back in so I could create a low pressure environment. I used this with a soda-stream bottle to create a low air pressure environment.



Dad drilled the lid of a soda-stream bottle to put in a needle used to pump up balls so we could attach a compressor (see safety assessment). I used this to create a high air pressure environment.



I made a table to record my results.

Conduct

Mum looked up how to make marshmallows and I helped make them.

We shut the blinds in the toy room to make sure the heat doesn't increase or decrease depending on the weather outside.

We set up the environments to see how they go and also allow time to make sure the sensors work.

I counted out 10 homemade and 10 store bought marshmallows.

I then did a quality test of the remaining marshmallows to make sure they were ok, they were delicious.

I put 2 homemade and 2 store bought marshmallows in each environment. I sucked the air out of the low pressure environment and used the compressor to pump air into the high pressure environment.

I recorded the results in a log - see seperate file.



Quality control



Constant Warmth
High Humidity

Constant Warmth



Creating Low Pressure

In Low Pressure



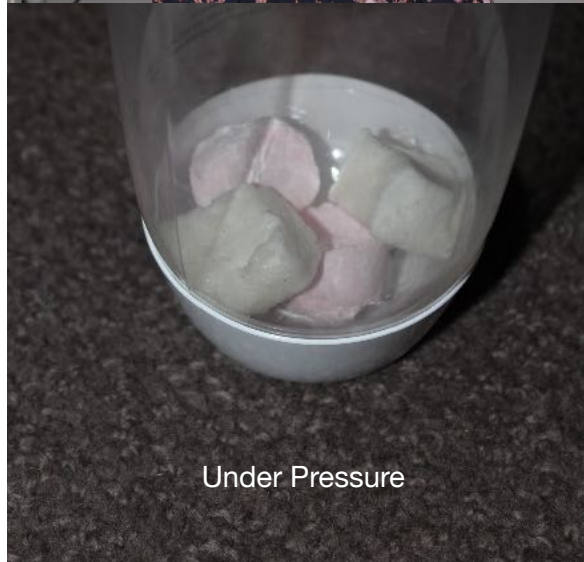
Zip-lock Bag



Wearing My PPE



Under Pressure



Equipment and Materials



- NodeMCU ESP 8266 Development Board x1
- Temperature and Humidity Sensors (DHT11) x 3
- USB power adaptor x 1
- Power board x 1
- Store bought Marshmallows x 1 pkt.
- 1 Batch of homemade Marshmallows.
- Heat resistant mat
- Mr Fothergills seed propagation mat x 2
- Saxon Mini Greenhouse x 2
- Small pyrex bowls x 5
- Towels x 2 to cover greenhouse
- Soda-stream bottles x 2
- Vacu-Vin wine pump and stopper
- Ball pump needle
- Super Glue
- Drill with small drill bit same size as needle to drill whole in top of 1 soda-steam lid.
- Air compressor
- PPE- Goggles
- Zip-lock bags x 2

Processing and analysing data and information

I predicted that in high air pressure the marshmallow would go fluffy where as they shrunk and that, in low air pressure(vacuum) the marshmallow would shrink where as they expanded. I now know this is because of Boyles law which states that volume increases as pressure decreases.

Marshmallows are made of of lots of tiny air pockets. These are at normal atmospheric pressure but when you change the pressure the marshmallow in stored in it changes these air pockets. When you increase the pressure in the bottle the pressure on the marshmallow increases and that makes the air inside the marshmallow compress. When you decrease air pressure in the bottle it causes the marshmallows to increase in size as the air inside the marshmallow is now at a higher pressure than the air in the bottle.

The marshmallows in warmth I predicted there would be no change where as they dried out, in humidity the marshmallow I predicted they would melt they didn't melt but they did become softer and squishy, the coating on the store bought ones disappeared and they became bright pink in colour. I predicted that there would be no change in the zip-lock bag stood ones and there wasn't.

MARSHMALLOWS ARE DELICIOUS I'm not happy that out of the 20 marshmallows we used for this experiment mum will only allow me to eat the 4 that were stored in the zip-lock bags. I was looking forward to eating them all and having a marshmallow night.



After 1 week in low air pressure



After 1 week in Constant Warmth



After 1 week in Constant Warmth



After 1 week in Constant Warmth
High Humidity



After 1 week in Constant Warmth
High Humidity



After 1 week in Zip-Lock Bag



After 1 week in Zip-Lock Bag

Evaluating

I think we should have weighed the marshmallows before putting them into the containers for the week and weighed when the week was over. We should have also measured the home made ones and made sure they were all exactly the same size.

I think we should have had the marshmallows that were in the bottles separated so we weren't mixing store bought and homemade as the effect on one might have influenced the effect on the other.

I think we need to find a way to have kept them under constant increased air pressure for the week as we couldn't get the bottle to stay at 30 PSI as that might change the results.

My finding could be useful to others because they will know what environment is best to keep their marshmallows in.

References

Britannica, The Editors of Encyclopaedia. "Atmospheric pressure". Encyclopedia Britannica, 11 Jan. 2021, <https://www.britannica.com/science/atmospheric-pressure>. Accessed 10 July 2021.

The Kids Should See This. "What happens when you put marshmallows in a vacuum?" <https://thekidshouldseethis.com/post/what-happens-when-you-put-marshmallows-in-a-vacuum>. Accessed 10 July 2021

Effects of Climate on Marshmallows: Log

11/07/2021 Day 1

Ambient room temperature 21.1 humidity 45%

	Store bought	Homemade
Normal storage	No change	No change
vacuum	Got bigger Cracked	Got bigger
Air pressure (30psi)	Shrunk Collapsed in	Shrunk Collapsed in
Constant Warmth Temp 35.2 Humidity 17%	No change	No change
Constant Warmth & humidity Temp 34.7 Humidity 66%	No change	No change

12/07/2021 Day 2

Ambient room temperature 19.7 humidity 49%

	Store bought	Homemade
Normal storage	No change	No change
vacuum	All stuck together still fluffy	All stuck together still fluffy
Air pressure (30psi)air pressure was down to 6 psi more air added	Grown back to normal size re shrunk more then yesterday when air pressure taken back to 30psi	Grown back to normal size re shrunk more then yesterday when air pressure taken back to 30psi
Constant Warmth Temp -35 Humidity -31%	Normal	Normal
Constant Warmth & humidity Temp 32.9 Humidity 78%	Flour coating no longer there surface looks really wet and a brighter pink colour	Flour coating no longer there surface looks wet

13/07/2021 Day 3

Ambient room temperature 20.3 humidity 50%

	Store	Homemade
Normal storage	No change	Shrunk collapsed at edges
vacuum	Cracks have rounded off, slightly shiny	Starting to crack
Air pressure (30psi) down to 6 taken back to 30	Grown back to 3/4 normal size re shrunk more then yesterday when air pressure taken back to 30psi	Grown back to 3/4 normal size re shrunk more then yesterday when air pressure taken back to 30psi
Constant Warmth Temp - 32.7 Humidity -25%	No change	No change
Constant Warmth & humidity Temp 33.8 Humidity 74%	No change from day 2	No change from day 2

14/07/2021 Day 4

Ambient room temperature 22.9 humidity 50%

	Store bought	Homemade
Normal storage	Normal	Shrunk and collapsed a little bit at the edges
vacuum	Stuck together shiny	Struck together gone fluffy at edges
Air pressure (30psi) was down to 5 psi more air added	Have grown but not as big as originally. Went smaller with extra air added	Have grown but not as big as originally. Went smaller with extra air added
Constant Warmth Temp - 34.7 Humidity -26%	No change	No change
Constant Warmth & humidity Temp 35.3 Humidity 73%	Shinier and the surface touching the glass bowl is starting to shape to bowl	No change

15/07/2021 Day 5

Ambient room temperature 22.6 humidity 49%

	Store	Homemade
Normal storage	Normal	No change from day 4
vacuum	Looking wetter shrinking	Looking wetter shrinking
Air pressure (30psi) down to 10 re taken to 30	Have grown but not as big as originally. Went smaller with extra air added	Have grown but not as big as originally. Went smaller with extra air added
Constant Warmth Temp - 32.7 Humidity -27%	No change	No change
Constant Warmth & humidity Temp 32.6 Humidity 76%	Shinier and the surface touching the glass bowl is starting to shape to bowl	Starting to look shiny

16/07/2021 Day 6

Ambient room temperature 22.3 humidity 46%

	Store	Homemade
Normal storage	No change	No change
vacuum	Looking glossy	No change
Air pressure (30psi) down to 9 re taken to 30	Have grown but not as big as originally. Went smaller with extra air added	Have grown but not as big as originally. Went smaller with extra air added
Constant Warmth Temp 32.3 Humidity 26%	No change	No change
Constant Warmth & humidity Temp 31.8 Humidity 77%	No change	No change

17/07/2021 Day 7

Ambient room temperature 20.2 humidity 43.0%

	Store	Homemade
Normal storage	No change	No change
vacuum	No change	No change
Air pressure (30psi) down to 7 re taken to 30	Have grown but not as big as originally. Went smaller with extra air added	Have grown but not as big as originally. Went smaller with extra air added
Constant Warmth Temp 32.5 Humidity 21%	Corn flour visible at bottom of marshmallow	No change
Constant Warmth & humidity Temp 29.4 Humidity 87%	No change	No change

Feel of Marshmallows at end

	Store	Homemade
Normal storage	Felt normal	Felt normal
vacuum	Disintegrated when taking out of bottle, mushy	Soft but kept shape
Air pressure (30psi)	Disintegrated when taking out of bottle, very mushy	Soft but kept shape
Constant Warmth Temp 32.5 Humidity 21%	Hard outer but soft inside, could squish with lots of hand force.	Rock hard
Constant Warmth & humidity Temp 29.4 Humidity 87%	Very squishy	Squishy

Effects of Climate on Marshmallows - Acknowledgements

Zoe Dowdall
Grange Primary School

Acknowledgement of Assistance

To complete my Effects of Climate on Marshmallows experiment I was helped by:

- Mum
 - Found the Saxon Mini Greenhouse and Mr Fothergills seed propagation.
 - Showed me how to make homemade marshmallows.
 - Found the Vacu-Vin worked on a soda-stream bottle.
 - Helped me set up the experiment.
- Dad
 - Made the temperature and humidity sensing system.
 - Drilled and glued the needle into soda-stream bottle.
 - Helped me take the pictures.
 - Typed up the report.

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