

HOW CAN YOU USE A COOKING TECHNIQUE TO EXPLAIN A SCIENCE CONCEPT?

Lab parts

PART A - Research

ELASTICITY (main choice) Sweet making, crystallization

by definition: *Elasticity, the springiness or stretchiness of a material, is how much an object returns to its original shape after being deformed.*

- sugar is added to water, sugar crystals dissolve, limited sugar crystals dissolve into sugar so when full amount done called saturated, (higher temp, higher saturation)
- cook sweets= cooking sugar, water, etc. at extremely high temp.
- when at high temp. most water boil away, leaving above normal amounts of sugar
- when sugar begin to cool, more sugar than normally possible - Supersaturated w/ sugar
- supersaturation = unstable state, crystalize into a solid at least provocation
- 2 cat. of sweets: Crystalline & noncrystalline (amorphous)
 - crystalline = fudge/fondant
 - noncrystalline = lollipops/taffy/caramels
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ENERGY/TEMP/HEAT & HEAT TRANSFER (second choice) Transfer of energy to modify something

<http://www.exploratorium.edu/cooking/eggs/eggscience.html>

- energy transfer
- HEAT EGGS
 - apply heat = agitate protein in white of egg, begin to bounce about
 - bounce and slam into each other and break weak bonds keep protein curled up
 - egg protein uncurl and bump into other proteins
 - new chem. bonds form, connect one protein to another
 - after enough time, form network of connected proteins
 - network holds water that previous had proteins floating in
 - leave egg for too long, have too many bonds & become rubbery
- marshmallows in microwave (60 sec) - heat water molecules, heat warms sugar molecules which being to soften, heat of microwave heats air molecules, which push harder at soft sugar molecules, allowing marshmallow to expand
- cooking has 3 elements
 - heating element (fire)
 - heat transfer medium (pan)
 - food itself (egg, Pizza, bread, etc.)
 - heat move from heating element, thru tranfer medium to food
- 3 ways to transfer energy
 - Conduction

- heat transfer thru contact of molecules = heat of pan to burnt hand when touched
- Convention
 - heat transfer thru bulk movement of molecules = boiling pot of water, molecules closest to water will be hotter than ones farther away
- Radiation
 - heat transfer thru energy waves = microwave & food
- 3 main terms to describe heat transfer
 - Thermal Conductivity
 - how readily material will take/give in heat
 - Heat capacity
 - how much heat can be given/taken
 - Absorbance
 - specific to radiation heat transfer
 - how the heat is taken in (absorbed)

Fermentation (third choice)

- encouraging growth of 'good microorganisms' whilst preventing growth of 'bad microorganisms'
- preserve foods and change textures/flavours
 - in pickling stuff
 - in salt-brine to allow growth of bacteria
 - bacteria eat veggie's sugars and help preserve food
 - wines
 - yeast to eat grapes sugars and make alcohol
 - bread
 - yeast eat sugar of break, create carbon dioxide which make bread rise

OTHER INFO

- BEAT 'EM (eggs)
 - beating raw egg incorporates air bubbles to make light and fluffy
 - air bubbles unfold proteins like heating them does
 - 2 types of proteins
 - hydrophilic - love water
 - hydrophobic - afraid of water, love air
 - 2 types paired together so one protect other and vice versa.
 - when potines uncurl so one side is in water (water loving) & other isn't (not-water loving)
 - form a net of proteins so each protein stay where comfortable
 - heat air bubbles, expand
 - when expand then pop, structure stay same bc protein net still in place
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PART B - Proposal

Hypothesis: The science of cooking can be shown through Heat Transfer, through making Millionaire Shortbread

Purpose: Make Millionaire Shortbread

After doing my initial research, I would like to propose an experiment. I would like to make Millionaire Shortbread in order to investigate Phase Change and Energy Transfer. To make the top layer of Millionaire Shortbread you must melt chocolate. This consists of heat transfer to make the chocolate phase change from a solid to a liquid. Then, you must solidify the chocolate on top of the caramel. This is done through heat transfer from the chocolate to the air around it, which causes it to phase change back to a solid from being a liquid.

Additionally, to make the caramel that's the second layer, you can look into the science of Elasticity. Caramel is essentially sugar cooked until it becomes brown. You heat it until the sugar becomes a molten sugar substance, and then cool it down in the fridge on top of shortbread.

Finally, to make the last layer of the dessert, you must make the shortbread. To make the shortbread, you beat the butter and sugar together. By doing this, you are incorporating air bubbles into the mixture, so the final result of the mix will be light and fluffy. When you add in the flour, you are making the mixture more dense by mixing it all together. When making the shortbread, you must be careful not to mix for too long, or the final product won't be crumbly. Then there is a heat transfer to cook the mixture, making the dense liquid phase change to a solid.

Procedure: "The Hairy Bikers' Family Cookbook: Mums Know Best Xxx"

Part One – Materials

To perform this experiment, we used the following tools and materials:

- Base
 - 125g of butter, room temperature
 - 50g of caster sugar
 - 175g of plain flour
- Toppings
 - 400g condensed milk
 - 50g butter
 - 50g soft brown sugar
 - 150g of your favourite chocolate

Once all the materials have been assembled and the safety equipment has been put on, the experiment may commence.

Part Two – The Base

1. Mix the butter, sugar and flour to form a dough
2. Press this into greased container(s)
3. Put into oven to bake at 190°C/Gas 5 for 20 minutes
4. Leave to cool when finished

Part Three – Caramel

1. Pour the condensed milk into a heavy bottomed pan
2. Add in butter and sugar
3. Bring to the boil
4. Boil gently for 5 minutes whilst stirring continuously
5. Pour mixture over shortbread
6. Place in fridge to set

Part Four – Chocolate

1. Wait until caramel is set, then begin to make the top layer
2. Melt the chocolate in a bowl above a pan of simmering water
3. Pour the melted chocolate on top of the caramel
4. Leave to set

Bibliography

1. Fine Cooking Editor. "The Science of Caramel." *FineCooking.com*. N.p., 22 Aug. 2014. Web. 13 Nov. 2014. <<http://www.finecooking.com/item/60729/the-science-of-caramel>>.
2. "Melting Chocolate." *Science Kids*. Science Kids, n.d. Web. 13 Nov. 2014. <<http://www.sciencekids.co.nz/experiments/chocolate.html>>.
3. Skehan, Donal. "How to Make Shortbread." *BBC Food*. BBC, n.d. Web. 13 Nov. 2014. <http://www.bbc.co.uk/food/recipes/butter_shortbread_74896>.
4. Myers, Dave, and Si King. "Millionaire's Shortbread." *Mums Know Best: The Hairy Bikers' Family Cookbook* Xxx. London: Weidenfeld & Nicolson, 2010. 41. Print.

PART C - The Lab

Actual Procedure:

PART C : Due 4th December. 15 points.

Carry out your Procedure with Adult supervision.

Gather and record all data,

Use Data Tables and Graphs in Laboratory report format.

Video your efforts.

Complete Project Lab report.

Work on presentation.

Info:

3 trials

- 1st = 19-11-14

Sites total

Part A = 1-5

Part B = 6-9

Part C = 10-

1. "Science of Eggs." *Science of Cooking*. Exploratorium: the Museum of Science, Art and Human Perception, n.d. Web. 09 Nov. 2014.
2. "Stretch Your Mind to Understand Elasticity." *Science Fare*. N.p., n.d. Web. 11 Nov. 2014. <<http://sciencefare.org/2011/06/01/stretch-your-mind-to-understand-elasticity/>>.
3. "Heat Transfer and Cooking." *Cooking For Engineers*. Atom 10, n.d. Web. 11 Nov. 2014. <<http://www.cookingforengineers.com/article/224/Heat-Transfer-and-Cooking>>.
4. "What Is Sugar." *Science of Cooking*. Exploratorium: the Museum of Science, Art and Human Perception, n.d. Web. 11 Nov. 2014. <<https://www.exploratorium.edu/cooking/candy/sugar.html>>.
5. "Fermentation and Food." *Science of Cooking*. Exploratorium: the Museum of Science, Art and Human Perception, n.d. Web. 11 Nov. 2014. <<https://www.exploratorium.edu/cooking/pickles/fermentation.html>>.
6. Fine Cooking Editor. "The Science of Caramel." *FineCooking.com*. N.p., 22 Aug. 2014. Web. 13 Nov. 2014. <<http://www.finecooking.com/item/60729/the-science-of-caramel>>.
7. "Melting Chocolate." *Science Kids*. Science Kids, n.d. Web. 13 Nov. 2014. <<http://www.sciencekids.co.nz/experiments/chocolate.html>>.
8. Skehan, Donal. "How to Make Shortbread." *BBC Food*. BBC, n.d. Web. 13 Nov. 2014. <http://www.bbc.co.uk/food/recipes/butter_shortbread_74896>.
9. Myers, Dave, and Si King. "Millionaire's Shortbread." *Mums Know Best: The Hairy Bikers' Family Cookbook*. London: Weidenfeld & Nicolson, 2010. 41. Print.

10.

Well done so far -- 15/15