

Secondary: Glass and Food

Lesson: Glass Properties Explored through Food	
Age Group: Yr:7-10	Lesson duration: 1.5 hours
<p>Aim: The application of glass in food technology has enabled us to store and cook food in increasingly safe ways. It has antibacterial and heat resistance properties that we rely on every day. However, we can also use food itself to mimic glass manufacturing processes to appreciate its complexity and its properties.</p>	
<p>Safety considerations: Glass vessels are used in this activity. It is recommended that teachers undertake a Curriculum Activity Risk Assessment (CARA) process. It is recommended that teachers also review the CARA guideline for Biological activities and for Food experimentation. It is recommended that students are briefed as to the heat risks and the use of gloves when handling materials should be considered. It is recommended to conduct the activity in smaller groups where appropriate.</p>	
<p>Links with Curriculum (KLAs): Y7: Measure and control variables, select equipment appropriate to the task and collect data with accuracy (AC SIS126) Y8: Chemical change involves substances reacting to form new substances (ACSSU225) Y8: Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (AC SIS139) Y10: Different types of chemical reactions are used to produce a range of products and can occur at different rates (ACSSU187) Y10: Formulate questions or hypotheses that can be investigated scientifically (AC SIS198)</p>	
<p>Key Vocabulary: Insulation Properties Tempered</p>	
Content	Resources
<p>Focus Questions:</p> <ul style="list-style-type: none"> • How is glass made? • What types of glass are there? • What role does temperature play in making glass? • How does temperature change the properties of material? • How does mixing materials change its physical properties? • What are the physical properties of glass? • How do these physical properties make glass useful in everyday life? 	<p>Activity One: Melting and Tempering Chocolate</p> <ul style="list-style-type: none"> • Thermometer • <u>Pure Milk, Dark and White Chocolate</u> (not cooking chocolate chips or other vegetable gum chocolate) • Microwave Safe Bowl/s (clean and dry) • Silicon spatula or metal spoon (clean and dry) • Baking Paper <p>Activity Two: Comparing insulators</p> <ul style="list-style-type: none"> • Glass Cup (x 3) • Plastic Cup (x 3) • Paper Cup (x 3) • Kettle • Fridge • Thermometers • Tap Water
Activity	
<p>Introduction Ask students</p> <ul style="list-style-type: none"> • What is glass made from? • How is it made? • What types of glass are there? • What glass can we see in this room? <p>Introduce topic</p>	

This lesson will discuss how glass is made and how, using other materials, we can understand some of its unique properties. Glass manufacture and the role and relationship with temperature will be a key theme of this lesson.

Discuss Safety

Students will be interacting with hot surfaces, hot liquids, potentially in a kitchen environment.

Main Lesson

What is glass made from and how? Glass is manufactured by combining raw (and some recycled) materials in at high temperatures to form the hard, clear and very beautiful material that we see in our everyday lives.

Watch the video: <https://www.visy.com.au/packaging/glass/how-glass-bottles-and-jars-are-made> to learn how recycled glass is used to remake glass in Australia and New Zealand
What types of Glass are there? In our every day lives we often come across three kinds of glass Annealed, Tempered glass, and Borosilicate glass.

Annealed Glass Before glass can be tempered, float glass needs to be made. This is done by pouring molten glass from the furnace onto a bed of molten tin in a temperature-controlled chamber. It is then cooled under controlled conditions in an oven called a lehr. This process is called annealing and is a process that was perfected in 1959 by Pilkington Brothers, Ltd of England.

Tempered Glass Once the annealed glass is made it is inspected for flaws. Bubbles and cracks are not desirable for the tempering process. The glass is also washed, as dirt or dust will interfere with the tempering process. Glass is then placed into a furnace and heated to over 600 degrees Celsius and then cooled using cold air that is blasted at high pressures from many angles. This cools the surface of the glass down faster than the center making the glass very strong. Tempered glass is much stronger, more durable and safer to use. It does not shatter into sharp shards like a glass bottle, but into much smaller, rounded pieces. This is why tempered glass is used for Car windows, shower screens and trays in the fridge.

Borosilicate Glass This kind of glass has at least 5% boric oxide added to the raw materials. This is often the kind of glass used in cookware and chemical laboratory glassware. It has a high resistance to corrosion and thermal 'shock'.

Activity One: Cooking Glass!

Activity One students temper chocolate to demonstrate how a single substance can be made to have different properties depending on its treatment. Milk, Dark and White chocolate will temper at different temperatures.

High quality chocolate is made of Cocoa Butter and Cocoa Solids. Tempering chocolate is the process of allowing liquified chocolate to reform its crystals in a structure that we want. The best kind of chocolate crystal (Type 5) is solid at just below body temperature but will melt in your mouth. Yum!

Watch: https://youtu.be/lmCnErnT3_E

1. Melt the first type of chocolate in 30 sec intervals and then 15 sec intervals until half of the chocolate is liquid and half is still in pieces. If you melt the chocolate too much, add some more solid pieces until half solid, half liquid.
2. Once you have half and half, mix chocolate until all pieces are melted.
3. Dip a small piece of baking paper into the chocolate and start timer
4. Determine how long it takes for the chocolate to set and leave for the required amount of time.
5. Do a snap test! Does the chocolate snap nicely, or is it flexible?
6. Repeat this process with the other two kinds of chocolate

If your chocolate didn't snap, why do you think that might have happened? What is the air temperature in the classroom or kitchen?

Additional Step! Try mixing a white chocolate and dark chocolate in a light marbled pattern (not completely combined) and see if mixing it means that some temper differently?

Discussion

Tempering chocolate relates to glass in that it demonstrates that even though you have the same apparent kind of material, how it is made and its mixture are very important for how we can use it. Drinking glassware is different to a glass beverage bottle, therefore if they are mixed in the recycling process, the glass does not come back together and recycle in the same way as they melt at different temperatures. This would leave you with chunks of drinking glass in amongst the soft drink bottle glass as the furnace is set to a specific temperature.

Activity Two: Properties of Glass

Students will look at the insulating properties of glass in comparison to other products in food cold storage and cooking.

Allow students to create a hypothesis and identify the aims of this experiment.

Students will compare the temperature of water and three different temperatures over time in a plastic cup, a glass cup and a paper cup. Which has the better insulating properties? Which one heats up or cools down the fastest?

1. Heat water in the kettle and allow time to cool slightly for safety
2. Fill each container type with heated water, tap water and water from the fridge
3. Measure the temperature immediately in each of the nine containers
4. Measure the temperature at 2-minute intervals for 20 minutes
5. Enter results in a data sheet like the one below

		minutes										
*C		0	2	4	6	8	10	12	14	16	18	20
Cold Water	Paper											
	Plastic											
	Glass											
Tap Water	Paper											
	Plastic											
	Glass											
Warm Water	Paper											
	Plastic											
	Glass											

Discussion

Did the glass insulate as well as paper and plastic?
 Is the glass more likely to withstand greater heat when used in cooking?
 How does that make it useful in cooking and in cleaning up?
 Is there a compromise to be reached in product effectiveness vs durability?

Evaluation

- Students can identify the process in which glass is made.
- Students can list the 3 types of glass and how they are made.
- Students can identify what material type is best for holding hot liquids.