

Young Scientist



By Eddi Budrodeen

Which liquid freezes fastest

Question

Does sugar affect the melting rate of different liquids?

Research

Using the internet link provided by other internet sites, I have come up with the following hypothesis.

Hypothesis

I think sugar does affect the melting rate of different liquids.

One example I give is a cube of frozen ice cream melts faster than an ice cube.

Materials and Equipment - Test method 1

- three different types of liquids (orange juice, milk and water)
- three of 140 ml plastic containers
- three plastic straws
- fridge freezer
- a cooking pot
- a kettle
- a LCD probe thermometer
- 1 ice cube
- cube of frozen ice cream
- a stopwatch
- pen and paper

Procedure/Method

- Fill ice cube container with 3 tea spoons of ice cream
- Also fill ice cube container with water
- Fill 140 ml containers - one with orange juice, one with milk, and one with water. In each 140ml container I have inserted a straw. This is to hold the probe thermometer while the liquid is melting.

- Place ice cube container and other three 140ml plastic containers into a freezer and leave for 24 hours.
- Boil water in a kettle, then tip the boiled water into a cooking pot.
- Very carefully place the probe thermometer into the straw in the top of the container.
- With the help of an adult, place the container with the thermometer inserted in straw into the boiled water inside the cooking pot.
- Monitor the thermometer every thirty seconds and record readings for a total of twenty minutes.

Observations during the experiment

Experiment 1 - Orange juice

The orange juice was very slushy when taken out of the freezer. The temperature probe could slide through the ice and sit within it properly.

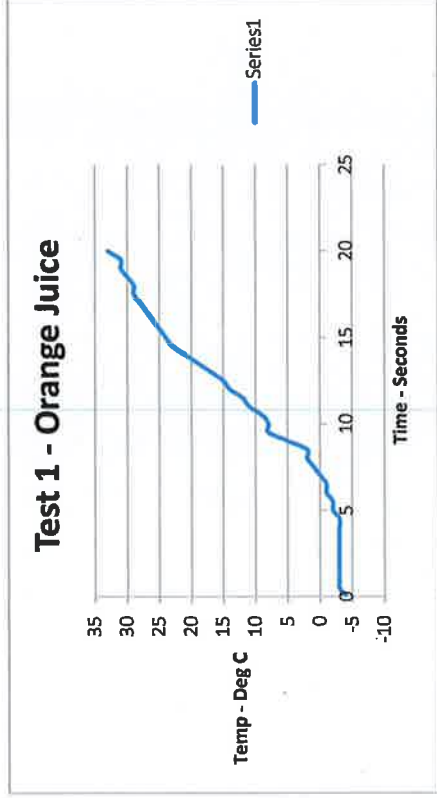
My results supports this.

Test Method # 1

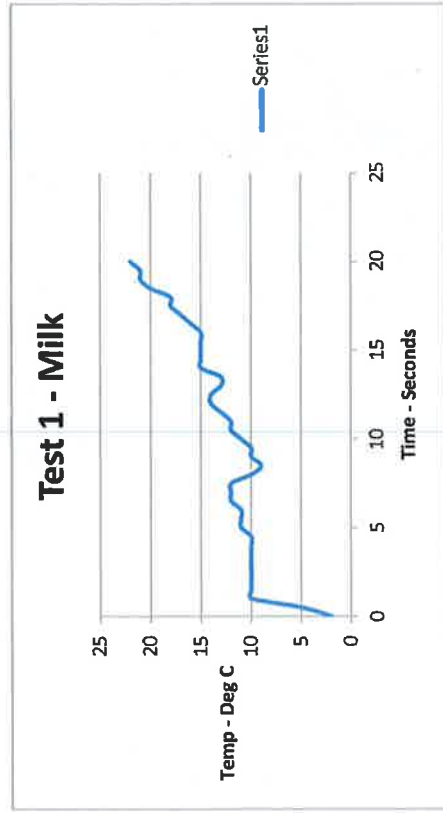


This test method did not work properly because the straw moved too much when the liquid started to melt.

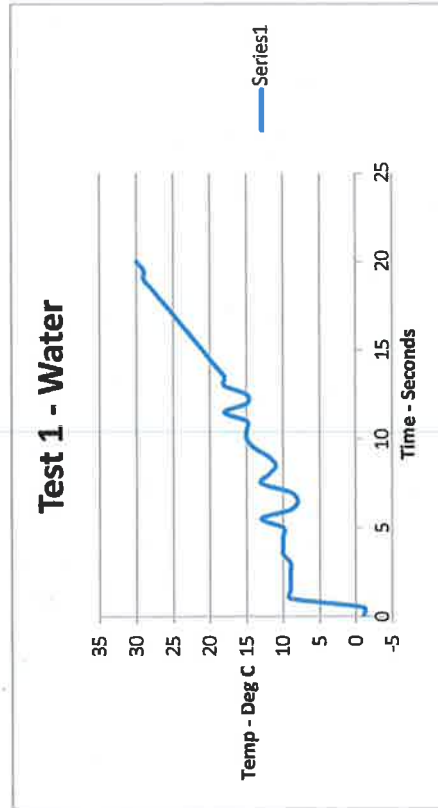
Time	Temp
0	-4
0.5	-3
1	-3
1.5	-3
2	-3
2.5	-3
3	-3
3.5	-3
4	-3
4.5	-3
5	-2
5.5	-2
6	-1
6.5	-1
7	0
7.5	1
8	2
8.5	2
9	5
9.5	8
10	8
10.5	9
11	11
11.5	12
12	14
12.5	15
13	17
13.5	19
14	21
14.5	23
15	24
15.5	25
16	26
16.5	27
17	28
17.5	29
18	29
18.5	30
19	31
19.5	31
20	33



Time	Temp
0	2
0.5	5
1	10
1.5	10
2	10
2.5	10
3	10
3.5	10
4	10
4.5	10
5	11
5.5	11
6	11
6.5	12
7	12
7.5	12
8	10
8.5	9
9	10
9.5	10
10	11
10.5	12
11	12
11.5	13
12	14
12.5	14
13	13
13.5	13
14	15
14.5	15
15	15
15.5	15
16	15
16.5	16
17	17
17.5	18
18	18
18.5	20
19	21
19.5	21
20	22



<u>Time</u>	<u>Temp</u>
0	-1
0.5	-1
1	9
1.5	9
2	9
2.5	9
3	9
3.5	10
4	10
4.5	10
5	10
5.5	13
6	9
6.5	8
7	9
7.5	13
8	12
8.5	11
9	12
9.5	14
10	15
10.5	15
11	15
11.5	18
12	15
12.5	15
13	18
13.5	18
14	19
14.5	20
15	21
15.5	22
16	23
16.5	24
17	25
17.5	26
18	27
18.5	28
19	29
19.5	29
20	30



Experiment 2 - Milk

The frozen milk was not slushy at all and the probe didn't sit properly within it. This is why the results are different.

Experiment 3 - Water

Like experiment 2, the probe didn't sit properly in the frozen liquid and the result shows this. I will have to carry out more tests using a different test method.

Materials and equipment - Test method 2

3 different types of liquids (orange juice, milk and water)

Equipment

1 x 600ml drink bottle

1 x screwdriver

fridge freezer

cooking pot

kettle

1 x LCD probe thermometer

orange juice

milk
water
frozen cubes
stopwatch
pen and paper

Procedure for Test Method 2

- Using a 600ml water bottle filled with liquid, place a screwdriver inside the bottle with the liquid in it.
- Put bottle with liquid and screwdriver in freezer. The liquid will freeze around the screwdriver.
- Once the screwdriver is removed from the frozen liquid, a cavity is formed to put the thermometer in.
- 24 hours later, take the frozen liquid from the freezer and remove the screwdriver.
- Put the thermometer into the cavity.
- Boil 5 litres of water in a pot on the stovetop.

Test Method #2



Above is orange juice being melted in pot.
Using thermometer to check temperature.



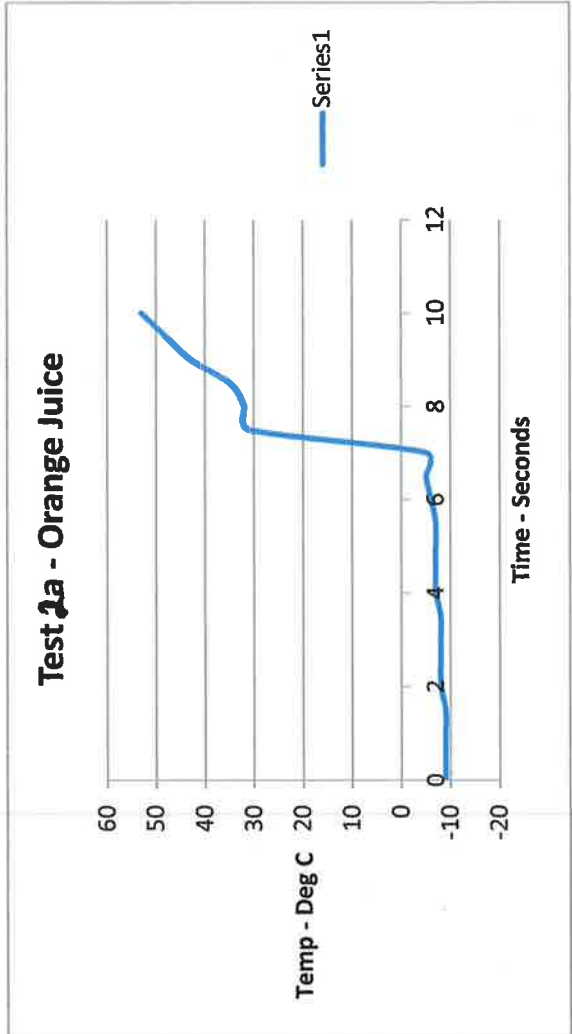
Above is frozen water taken from
freezer with screwdriver to make cavity.

- Carefully place bottle with frozen liquid and thermometer inside it into the boiling water. This is where the experiment begins.
- On a sheet of paper, I have marked a table with time versus temperature.
- Every 30 seconds I take a temperature reading and write it down on the sheet of paper. Each experiment will take 10 minutes to do.

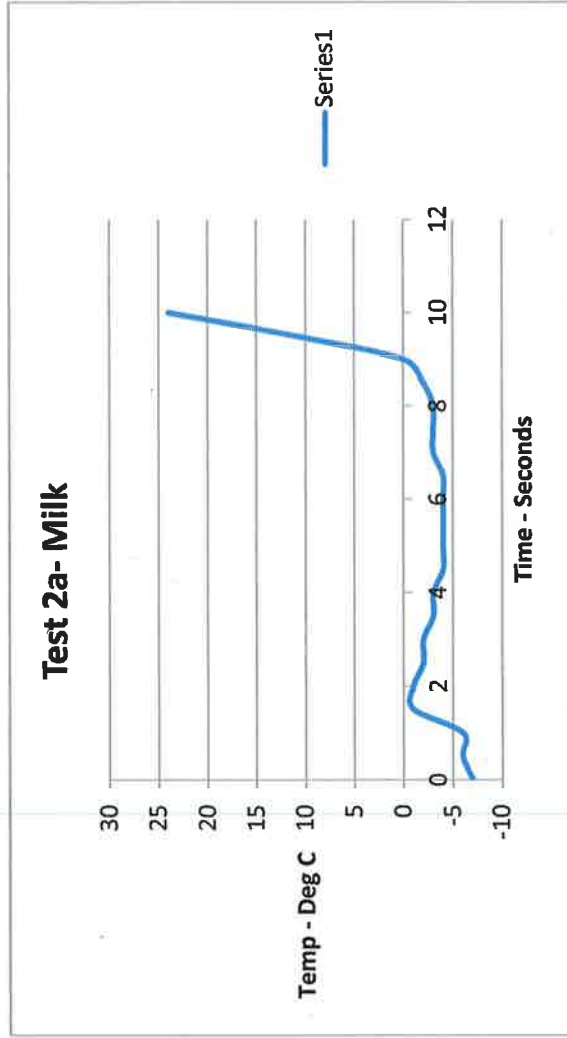
Observations

- The frozen water/ice started to melt after 5 seconds.
- The frozen milk started to melt after 9.5 seconds.
- The frozen orange juice started to melt after 7.5 seconds.
- Tip boiling water into a pot and leave for 5 minutes. Tip hot water out of pot. Carefully place frozen cubes of milk, water and orange juice into the warm pot.
- I now watch the frozen cubes melt.
- After 15 seconds, the ice cubes started to melt first.

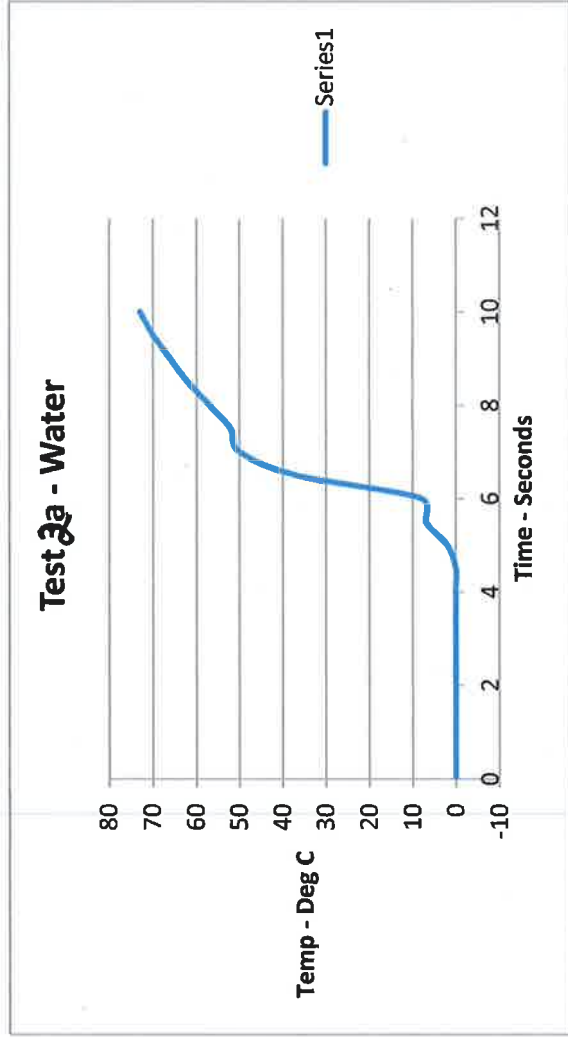
<u>Time</u>	<u>Temp</u>
0	-9
0.5	-9
1	-9
1.5	-9
2	-8
2.5	-8
3	-8
3.5	-8
4	-7
4.5	-7
5	-7
5.5	-7
6	-6
6.5	-5
7	-5
7.5	31
8	32
8.5	35
9	43
9.5	48
10	53



<u>Time</u>	<u>Temp</u>
0	-7
0.5	-6
1	-6
1.5	-1
2	-1
2.5	-2
3	-2
3.5	-3
4	-3
4.5	-4
5	-4
5.5	-4
6	-4
6.5	-4
7	-3
7.5	-3
8	-3
8.5	-2
9	0
9.5	11
10	24



<u>Time</u>	<u>Temp</u>
0	0
0.5	0
1	0
1.5	0
2	0
2.5	0
3	0
3.5	0
4	0
4.5	0
5	2
5.5	7
6	8
6.5	37
7	50
7.5	52
8	57
8.5	62
9	66
9.5	70
10	73



- After 20 seconds, the orange juice cubes started to melt.
- After 23 seconds, the milk cubes started to melt.
- This experiment and my first experiment show that water with no sugar melts faster than milk and orange juice which have sugar in them.

Conclusion

After my two different experiments, it showed that the sugar in different liquids does affect the melting rate. My results show this.

Recommendations

Instead of using a screwdriver to make a cavity, I would use a straw and put it through the lid. I would drill a hole through the lid and put the straw through it. Because it is hard to tell how much sugar there is in orange juice and milk, next time I would add a little bit of sugar to some water and freeze it in an ice cube. I would compare the sugar cube with the plain water cube.