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RESEARCH QUESTION: How does the sugar concentration of a sample of water affect its refractive index?

I wanted to know how and the extent to which the concentration of sugar in a sample of water affects its refractive index. My mode of inquiry will be experimentation.

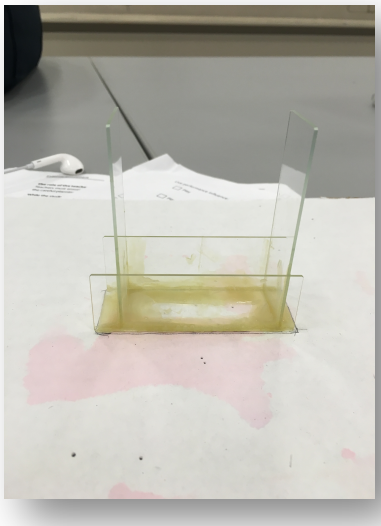
MATERIALS REQUIRED:

- Four Glass Slides
- Water
- Sugar
- Pins
- Ruler
- Protractor

METHODS:

Preparation:

1) Create rectangular container out of glass slides using waterproof glue.



Own photo

2) Create water samples with varying amounts of sugar.

Experiment:

1) Place container with water on a sheet of paper and put two pins at an angle of 30º from a normal coming out of the edge of the container.
2) On the other side of the container, put two pins in view line of the former from under the water.
3) Remove container and draw lines connecting the four dots left behind from the pins. Measure the angle of refraction inside the rectangle.
4) Using the equation $n = \frac{sini}{sinr}$, find refractive index.
5) Repeat with other water samples with varying amounts of sugar.

1) Calculating The Refractive Index without any sugar.

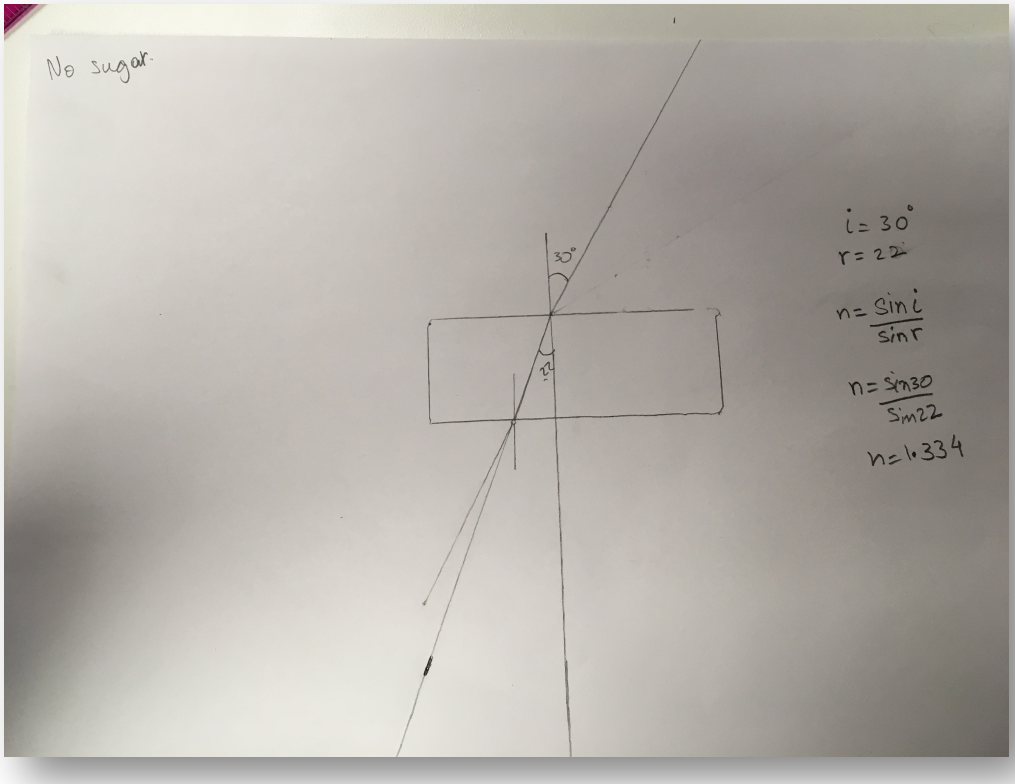


Fig. 1

i= 30º

r=22º

$$n = \frac{sini}{sinr},$$

$$n = \frac{sin30}{sin22},$$

n= 1.334

2) Calculating The Refractive Index With One Teaspoon of Sugar.

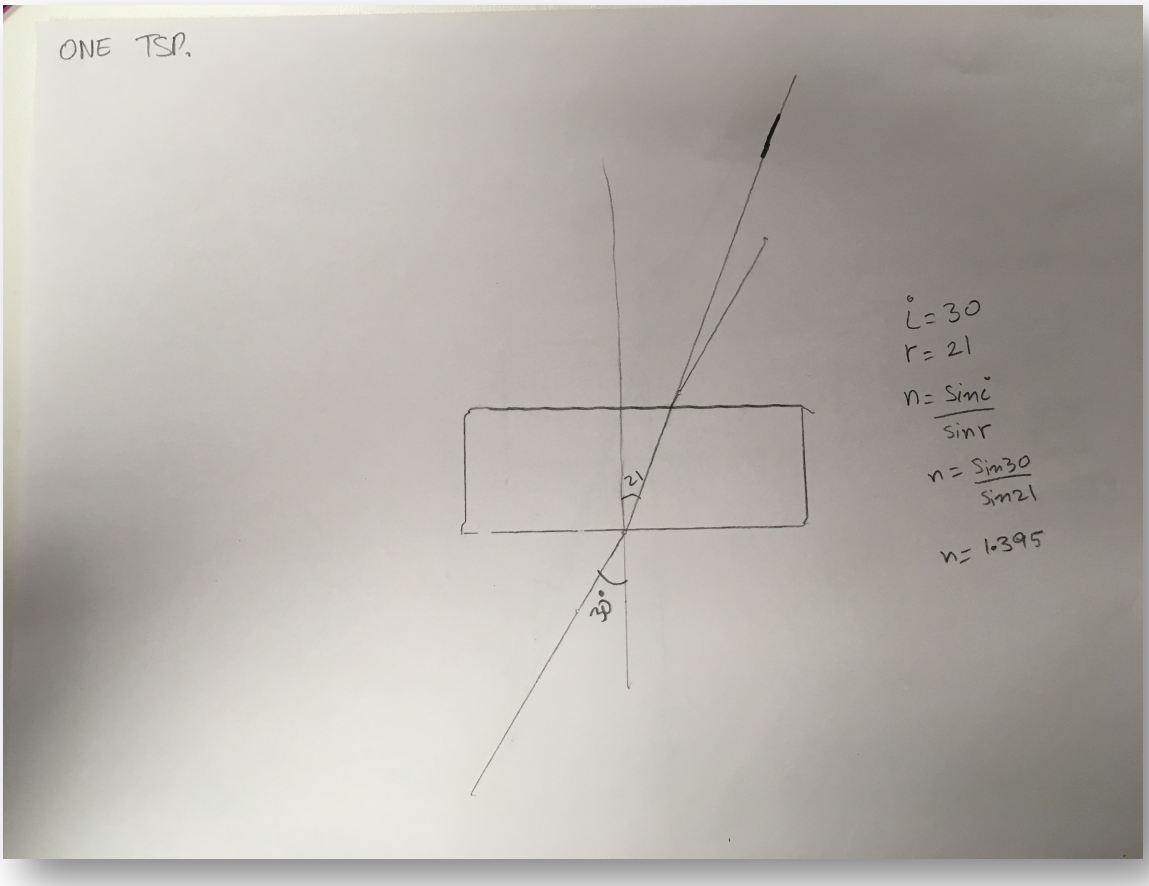


Fig. 2

i= 30º

r=21º

$$n = \frac{sini}{sinr},$$

$$n = \frac{sin30}{sin21},$$

n= 1.395

3) Calculating The Refractive Index With Two Teaspoons of Sugar.

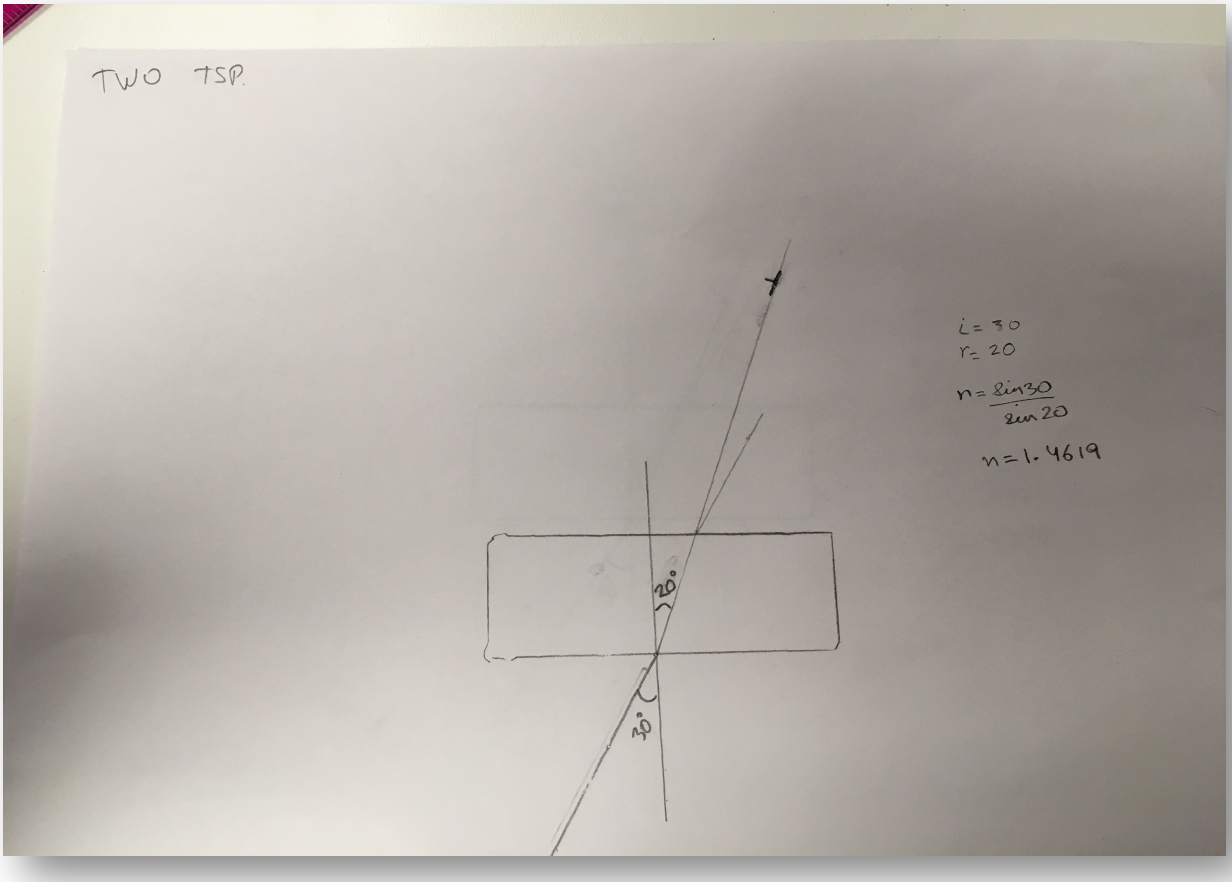


Fig. 3

i= 30º

r=20º

$$n = \frac{sini}{sinr},$$

$$n = \frac{sin30}{sin20},$$

n= 1.4619

4) Calculating The Refractive Index With Three Teaspoons of Sugar.

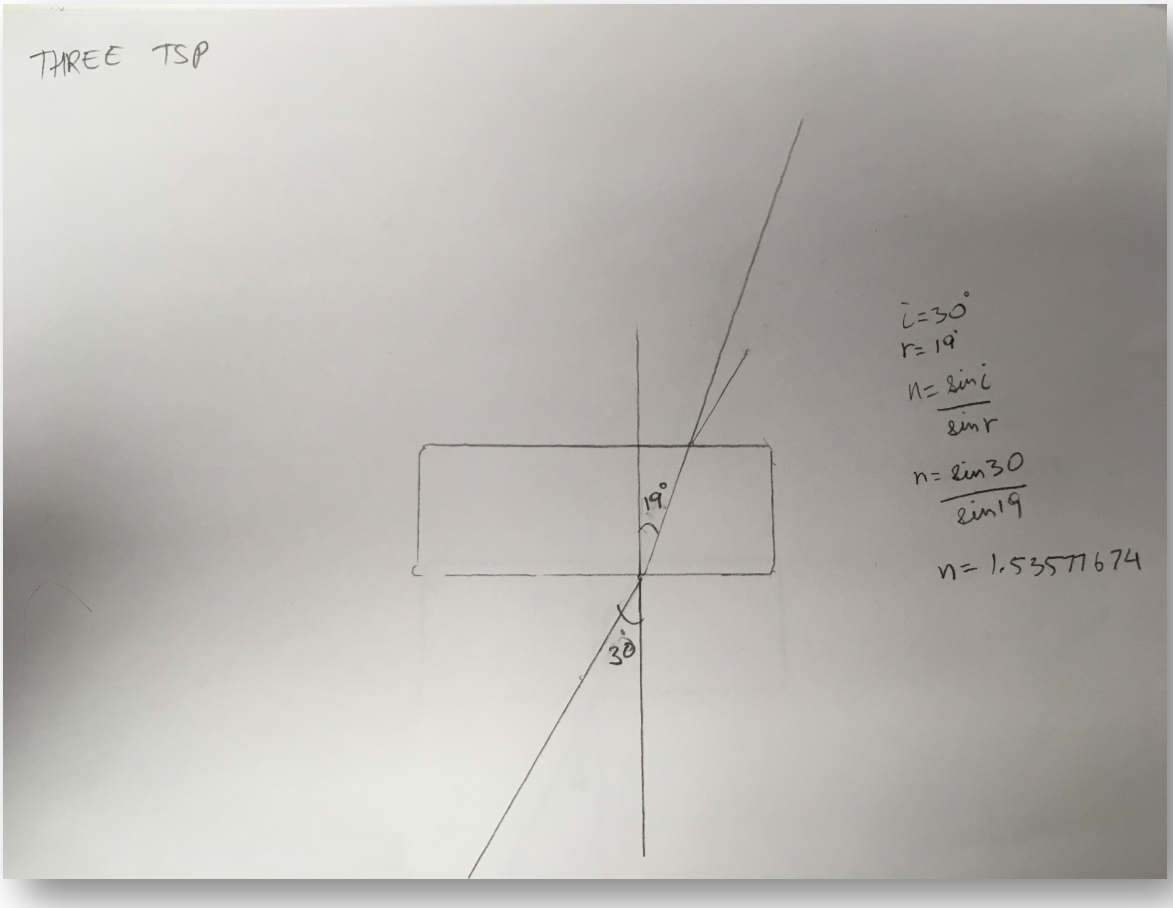


Fig. 4

i= 30º

r=19º

$$n = \frac{sini}{sinr},$$

$$n = \frac{sin30}{sin19},$$

n= 1.53577674

5) Calculating The Refractive Index With Four Teaspoons of Sugar.

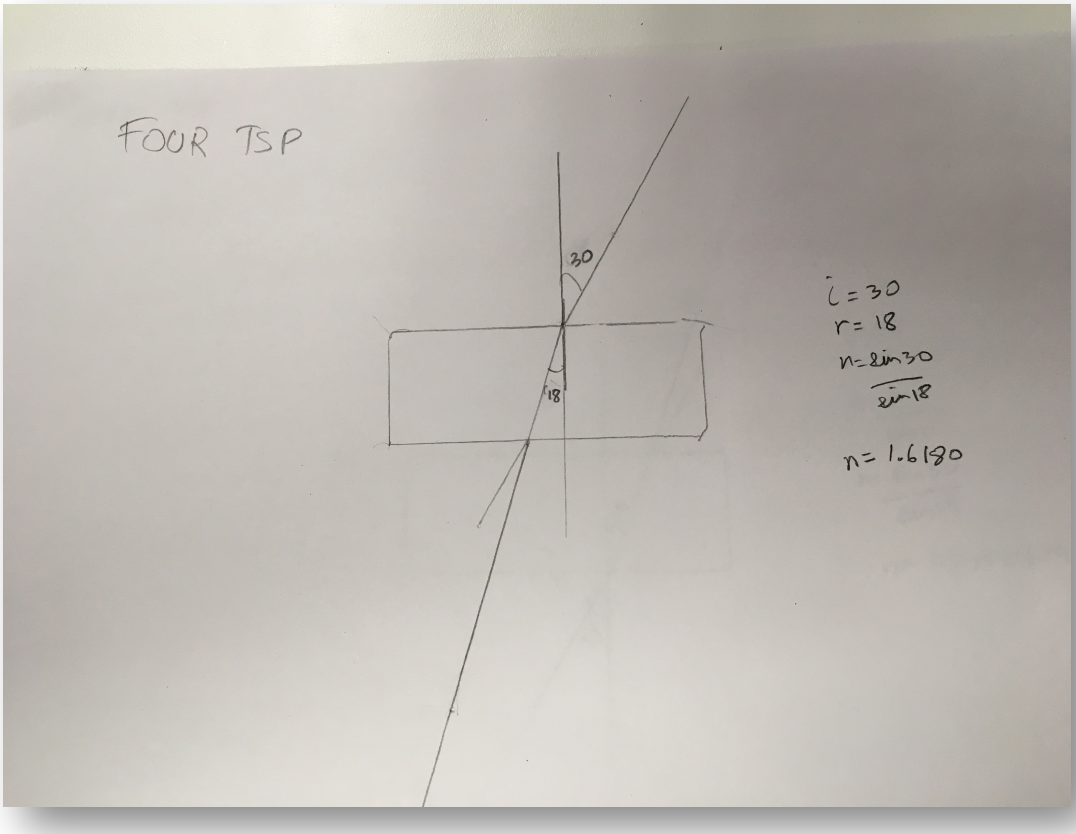


Fig. 5

i= 30º

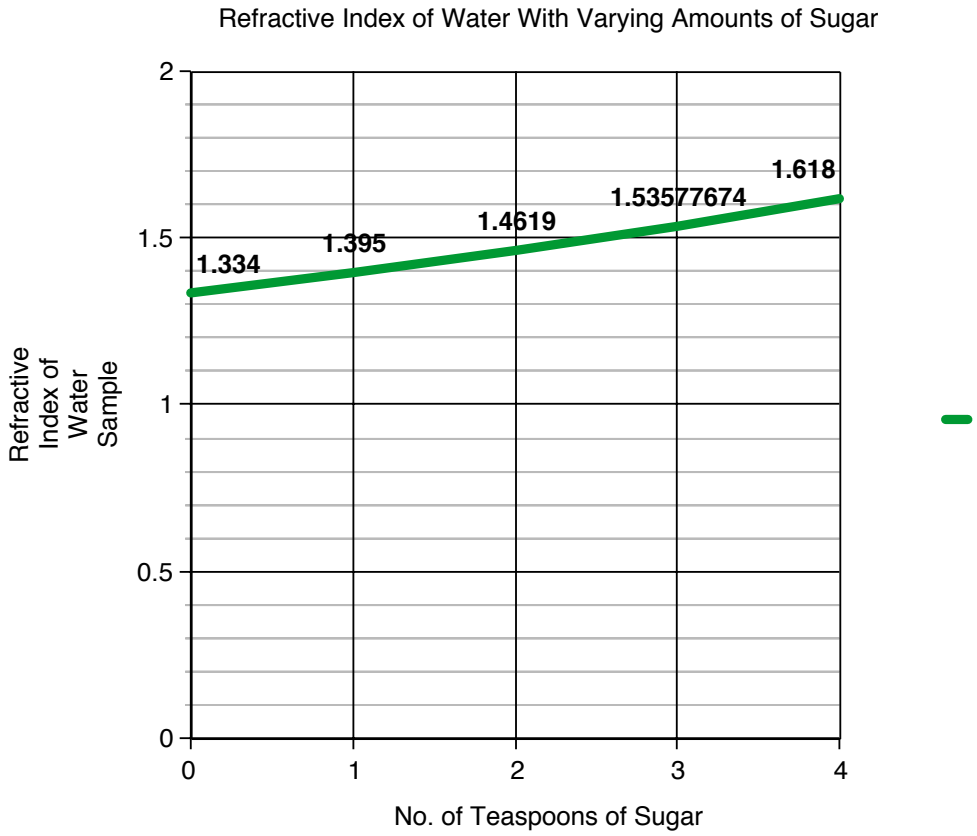
r=18º

$$n = \frac{sini}{sinr},$$

$$n = \frac{sin30}{sin18},$$

n= 1.6180

i	*r*	No. of Tsp. of Sugar	Refractive Index
30º	22	0	1.33
30º	21	1	1.40
30º	20	2	1.46
30º	19	3	1.54
30º	18	4	1.61



As seen in the graph, there is an obvious direct correlation between the amount of sugar in the water sample and the refractive index of the water sample; the higher the amount of sugar, the higher the refractive index. However, because of the minimally varying amounts of the sugar in the water sample, the differences between the refractive indexes are miniscule. Perhaps with larger difference between the amounts of sugar, the results would have been more observable, with a steeper graph.