



International Young Naturalists' Tournament



Problem №8

«Why dumplings go up »

Team:
«Unartificial Intelligence»

Reporter:
Titorenko Alexandra

Almaty 2021

The task :

Frozen dumplings sink in water. However, when cooked in boiling water, they rise to the surface. Are the dumplings ready when they float to the surface? Explore this effect.

Solution plan:

- **Cook dumplings**
- **Take measurements.**
- **Build a physical model.**
- **Study this effect.**

Equipment



Thermometer for products with a probe
(from -30°C to $+250^{\circ}\text{C}$)



- **Water**
- **Salt**
- **Stopwatch**



Experimental technique

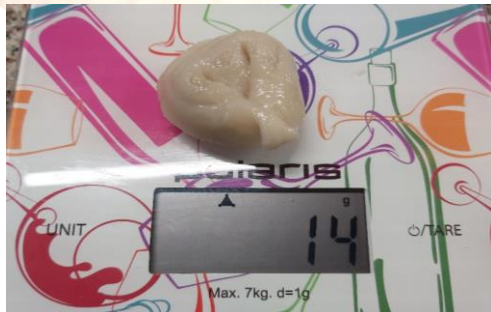


1. Dumplings of the same size -
in boiling water

Every minute for one dumpling:

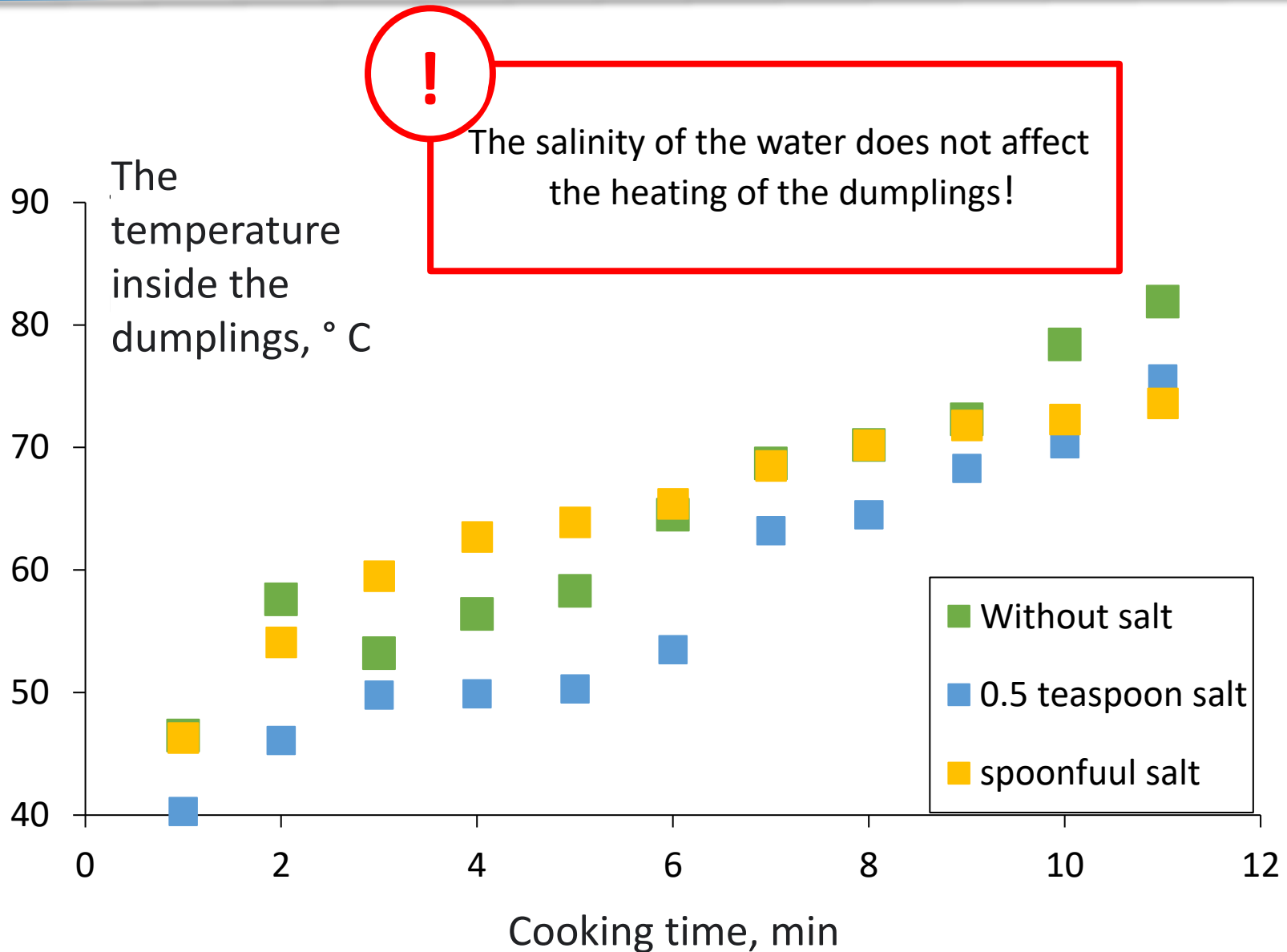


2. Temperature measurement



3. Mass measurement

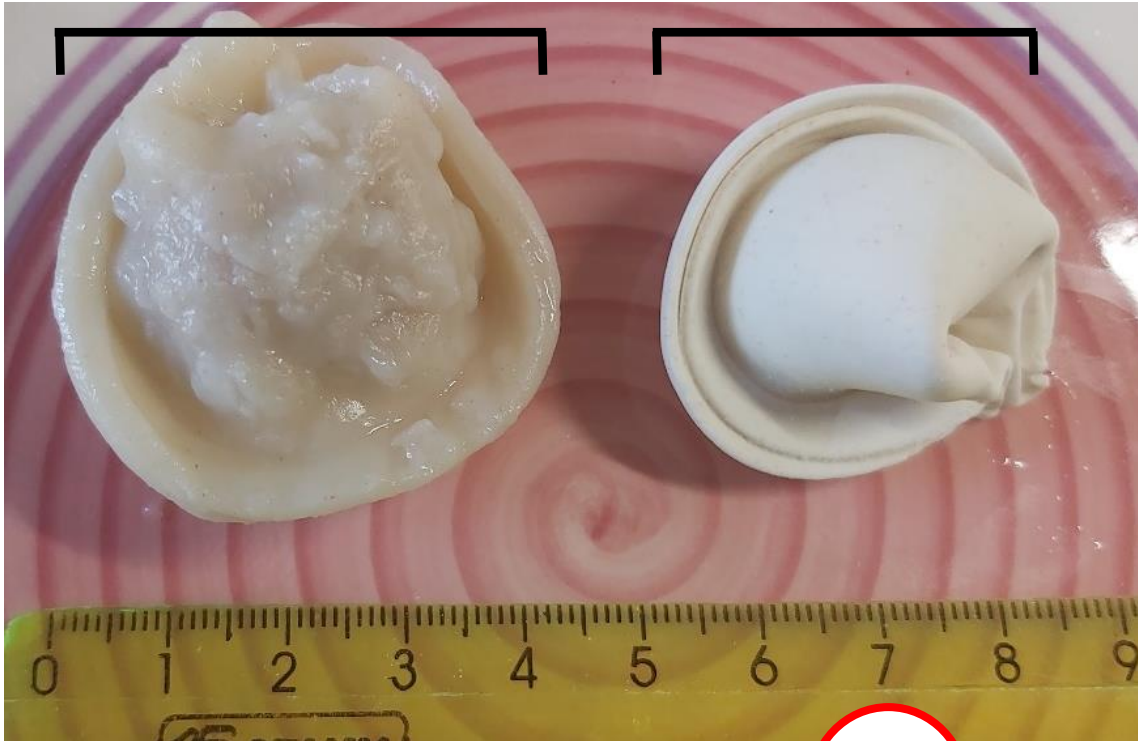
Heating dumplings



Check weighing

$$M = 14 \pm 1 \text{ g}$$
$$D = 4,0 \pm 0,2 \text{ sm}$$

$$m = 8 \pm 1 \text{ g}$$
$$d = 3,0 \pm 0,2 \text{ sm}$$



The size of the finished dumplings increased by $\sim 30\%$.

Mass increased by $\sim 75\%$

density

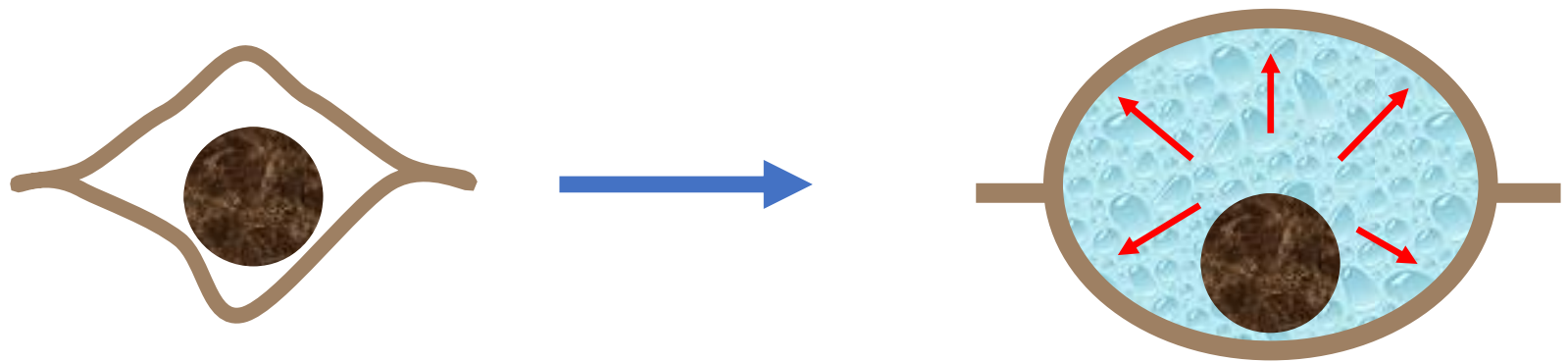
$$\rho = \frac{m}{V}$$

weight
volume

!

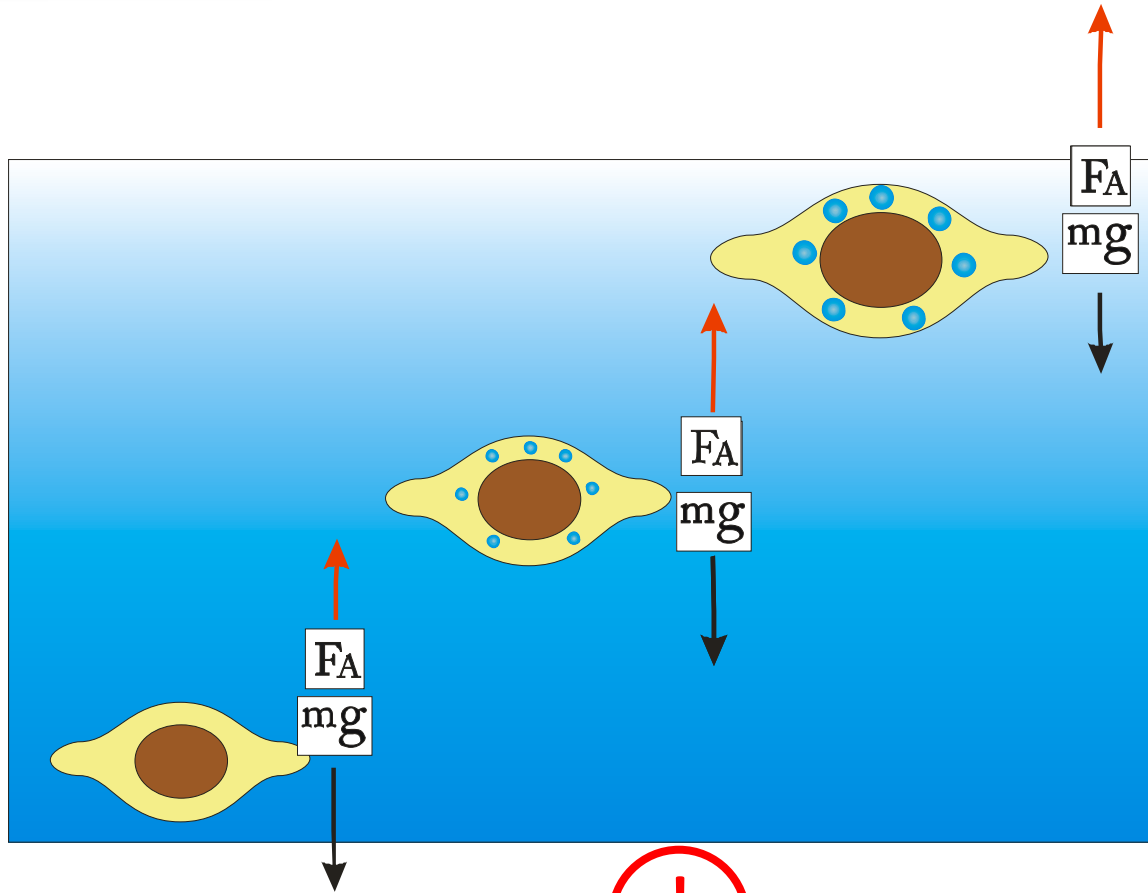
Density of dumplings changes during cooking

Density



Hot steam and air expand the dumpling, its volume increases, the density decreases.

Qualitative model



The density decreases, the Archimedean force becomes higher than the force of gravity, and the dumpling floats.

Other reasons why dumplings go up

➤ **Starch.**

Contained in flour. It swells and becomes lighter than water.

➤ **Collagen. Found in meat. When heated, it turns into gelatin, which is also lighter than water.**

When the dumplings are go up

1. Meat dumplings



2. Salty water.



3. Gluten free dough



4. Chicken dumplings



5. Potato dumplings



Conclusion:

- Raising dumplings to the surface of the water explains Archimedes' law. At high temperatures, the juices in which the meat is cooked are evaporated, the water boils and fills the dumplings with small bubbles of steam. Which, in turn, change the density of the dumplings, increase its volume. It is the change (decrease) in density that raises the product to the water surface according to the Archimedes law. Other properties are attached to the small bubbles, such as the transformation of collagen into gelatin and starch into paste. All factors together contribute to the float of the dumplings in the pan.

Conclusion:

- The ascent rate and cooking time depend on the degree of salinity of the water, the filling and the composition of the dough. The properties of the products and their density are different.
- Dumplings floated most quickly in highly salty water. Then gluten-free dumplings, just meat dumplings, chicken dumplings, and finally dumplings with potatoes.
- When the dumplings just surfaced, they are not yet ready for use. Until fully cooked, they should boil for about 10 minutes.

List of sources used

- Site "Yaklass", section "Theory" on the topics: "Density", "Archimedean force", "Gravity".
- Article "Why dumplings come up"
- <https://www.vokrugsveta.ru/quiz/229433/>
- Article "Why do dumplings come up? Description, reasons, illustration and video "
<https://kipmu.ru/pochemu-pelmeni-vsplyvayut/>

Thanks for your attention! 😊

