Raport-Interdisciplinary project

Work plan:

1. Take 3 measurements of time for every 5°, from 5° to 85°.
2. Calculate the average time and the velocity.
3. Calculate the uncertainty of measurement.
4. Make a graph of the dependence of the velocity on the angle.
5. Analyze the hypothesis using the findings from the experiment.
6. Make a final product using all measurements and the graph.
7. Make a presentation about the process, the aim and the findings of the experiment

Goal:

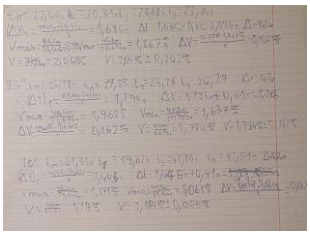
The aim of my interdisciplinary project was to solve if a tilt angle affects velocity.
The goal of the experiment was to check if the air bubble velocity in the long straight tube depends on the tilt angle of the tube.

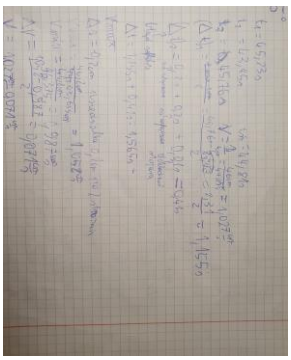
Method:

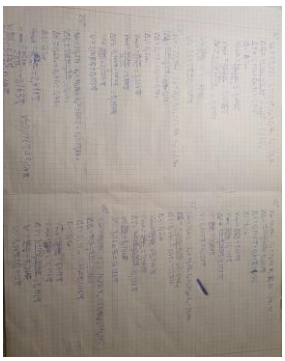
I built a test station to lean the tube against it at the right angle so that it was supported by it during the whole experiment. I measured all the obtained times with a stopwatch app and the angles with the level app, both on my phone. The angle measurement uncertainty was 1° because it was difficult to measure, so I had to round it off when there was a maximum 1° difference. I also used a ruler to check what the length of the tube is and it amounted to 46cm. The length measurement uncertainty amounts to 0,2cm because the compartment is 0,1 cm and the tube has 2 sides. To calculate average times I just calculated the arithmetic average from the 3 times on each 5°. I calculated the time measurement uncertainty and added a reflex error which amounts to 0,41s because reaction time amounts to 0,2s for starting and stopping so a total of 0,4s but I added 0,01s to it because in the stopwatch compartment amounts to 0,01. I used average time and length to calculate the velocity with the velocity formula. With the measurement uncertainties above I could calculate Vmin and Vmax that are needed to get the ΔV. In the table I rounded Velocities off to 3rd denial place but for the graph purpose I rounded them off into second decimal places.

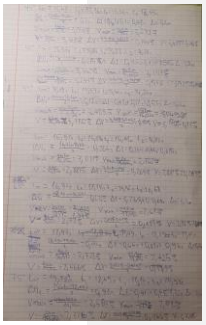
Z komentarzem [1]: Measurement uncertainty is 0,1 cm. It doesn't matter that there are two sides.

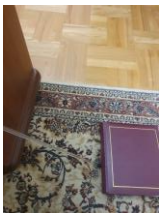
Z komentarzem [2]: I wish I could see the calcuations. Photos are too small to check anything.





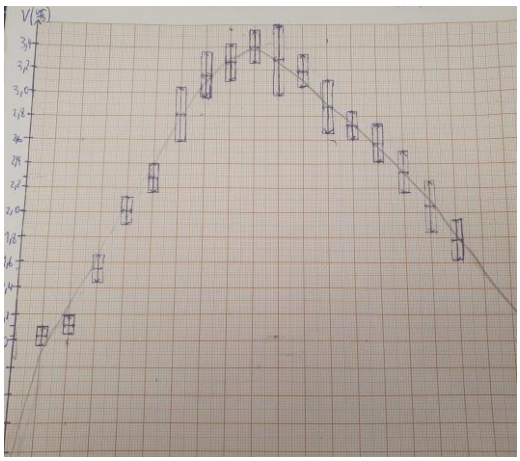






Results:

	time measurements	average time	prędkość
5°	45,23s;43,45s;45,76s	44,81s	1,027cm/s±0,071cm/s
10°	39,62s;41,80s;42,51s	41,31s	1,114cm/s±0,055cm/s
15°	28,67s;31,34s;29,16s	29,72s	1,548cm/s±0,097cm/s
20°	22,57s;23,90s,22,34s	22.94s	2,005cm/s±0,113cm/s
25°	19,76s;20,02s;20,84s	20,21s	2,276cm/s±0,124cm/s
30°	16,90s;15,30s;16,97s	16,39s	2,807cm/s±0,227cm/s
35°	14,30s;15,09s;14,46s	14,62s	3,146cm/s±0,188cm/s
40°	14,28s;13,91s;14,15s	14,11s	3,260cm/s±0,152cm/s
45°	13,36s;13,56s;13,55s	13,49s	3,410cm/s±0,144cm/s
50°	13,85s;13,88s;14,20s	13,97s	3,293cm/s±0,305cm/s
55°	14,59s;14,54s;14,35s	14,49s	3,175cm/s±0,130cm/s
60°	15,89s;15,61s;16,42s	15,97s	2,882cm/s±0,269cm/s



65°	17,14s;16,92s;16,68s	16,91s	2,720cm/s±0,115cm/s
70°	17,49s;18,59s;17,72s	17,93s	2,566cm/s±0,149cm/s
75°	18,69s;20,15s;20,51s	19,78s	2,326cm/s±0,166cm/s
80°	20,31s;23,68s;23,34s	22,44s	2,050cm/s±0,202cm/s
85°	27,83s;24,24s;25,27s	25,78s	1,784cm/s±0,162cm/s

analysis and summary:

Z komentarzem [3]: The angle musn't bee greater than 90 degrees.

According to the results the velocity changes when angle changes too and it has a major role in velocity. Buoyant force and resistive force equilibrate and make the air bubble move in uniform linear motion.

bibliography:

- Maria Fiałkowska, Barbara Sagnowska, Jadwiga Salach, Fizyka, zakres rozszerzony, WSiP 2019.
- my own knowledge
- https://mfiles.pl/pl/index.php/Czas_r