Problem 5
After the tempest

IYNT 2019
edition

Problem Task

- Take two beakers of water and use a spoon to stir water clockwise in one beaker and counterclockwise in the other beaker. Observe the beakers after a sufficiently long time when the water flow has slowed down. Is it possible to determine the original direction of water flow after 1 hour? 1 day? 1 week?

About The problem

- We want to see what is the biggest amount of time after which you can still know for sure what was the original direction of the water.

Presentation Plan:

1. Experiment
2. Ideas for determining the original flow of the water
3. Final Results
4. Conclusion
5. References

1.Experiment

Required Materials:

- Two beakers
- A spoon
- Food coloring
- A flashlight
- Polen
- A micro-scope
- A UV light
- String

Supplies used

2.Ideas of how to determine the original water flow:

2.A

Looking on the inner-side of the glass
for patterns or waves left by the water

2.A Looking For Patterns

When the water is stirred it will create a vortex in the middle so the water will reach a higher part of the glass. Some water will remain there and mark its "trajectory", so after the water slows down we hope to observe the same "wave pattern" but in different directions.

*note: we can use food coloring for better observation

2.B

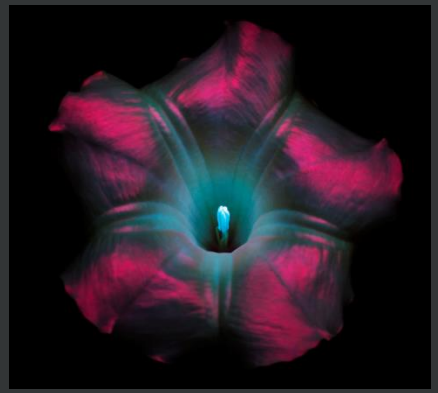
Pouring pollen in the water then observe it under a microcope

2.B Pouring Pollen

Pollen is a fine to coarse powdery substance that consists of pollen grains which are male microgametophytes.

2.B Pouring Pollen

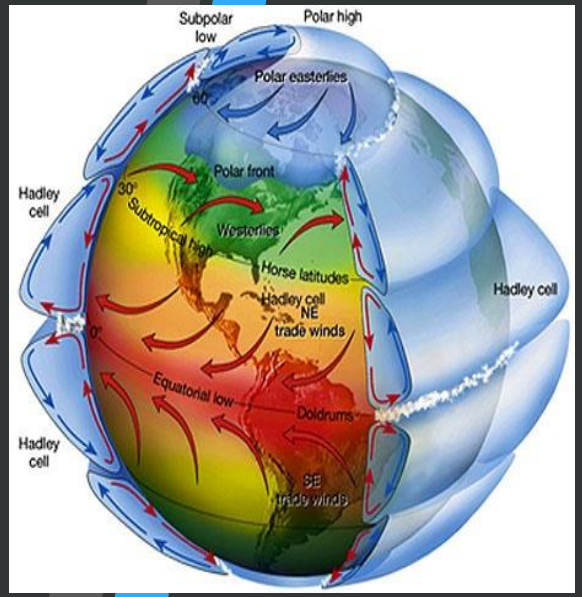
To facilitate the observation of the pollen under the microscope we will shine a UV light on the glass.
Here are some pictures of flowers under ultra-violet light:



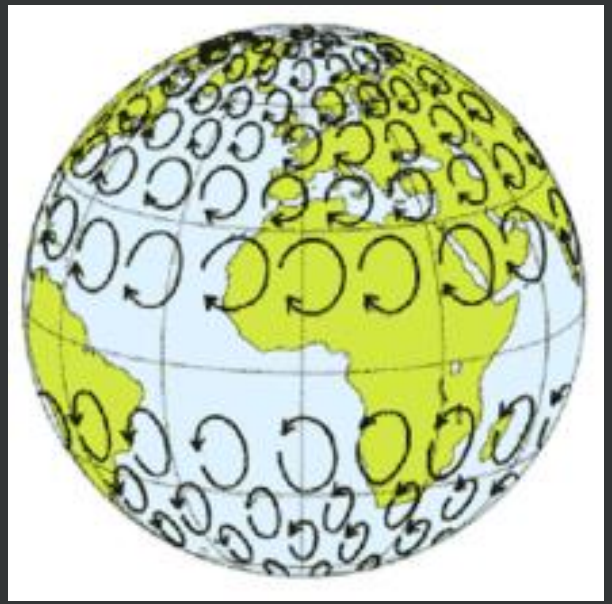
2.C

Observing the speed and direction of the water after some time

2.C The Coriolis Effect



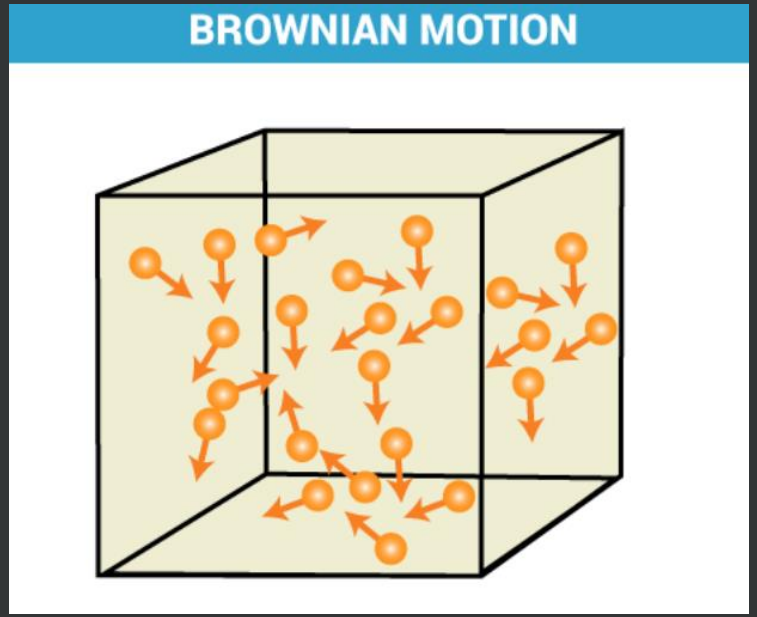
The Coriolis force is an inertial force that seems to act on objects that are in motion within a frame that spins with respect to an inertial frame.



Note: the Coriolis effect will not affect our measurements

2.C Brownian Motion

Brownian motion represents the random motion of the particules suspended in a fluid resulting from the colilision with the fast-moving molecules

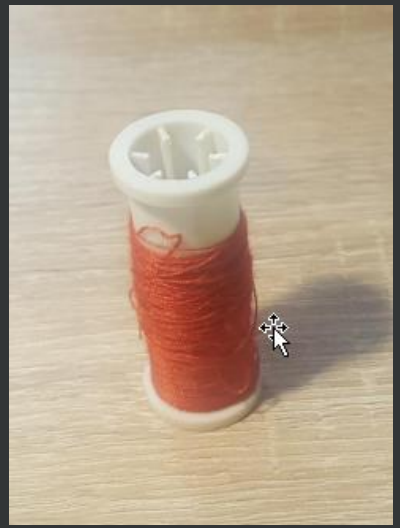


2.D

Putting an object/substance in the water that will reveal the original direction

2.D Curled String

If we put a piece of string inside the water when it is still moving it will begin to curl and form a spiral. If we look at outer end we will be able to see the original direction of the water. There may appear some problems such as the string being submerged or it getting matted, but we can fix them by using hydrophobic string and stirring a bit slower.



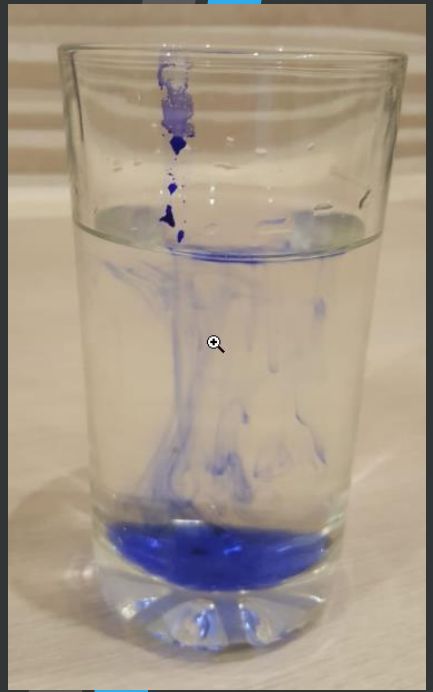
note* we used red for counter-clockwise and blue for clockwise

2.D Curled String

Clock Wise

Counter Clock Wise

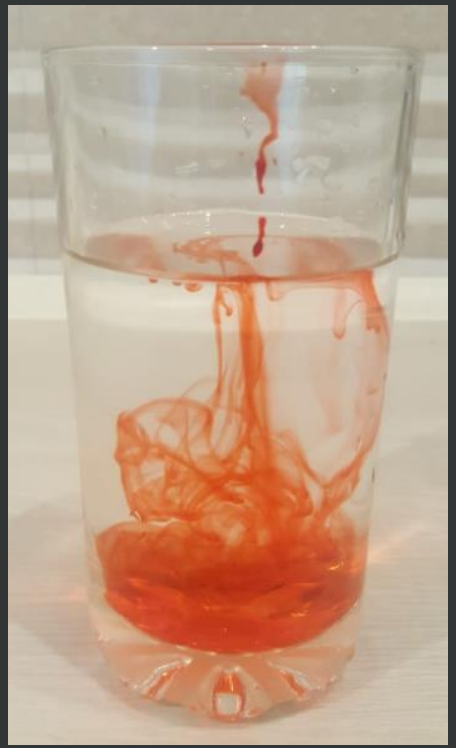
2.D Pouring Ink

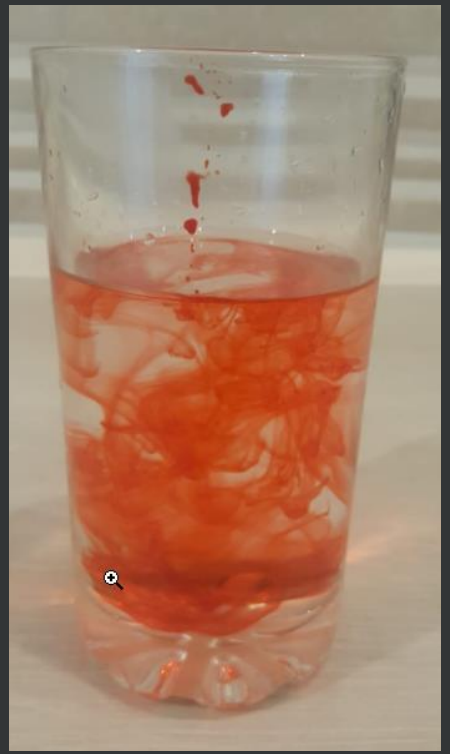


Clock Wise

Counter Clock Wise

2.D Pouring Ink





Clock Wise

Counter Clock Wise

3.Final Results

The different types of methods used provided different results:

-Pouring Ink in the water:~6 minutes 30 seconds

-Pouring pollen:46 minutes

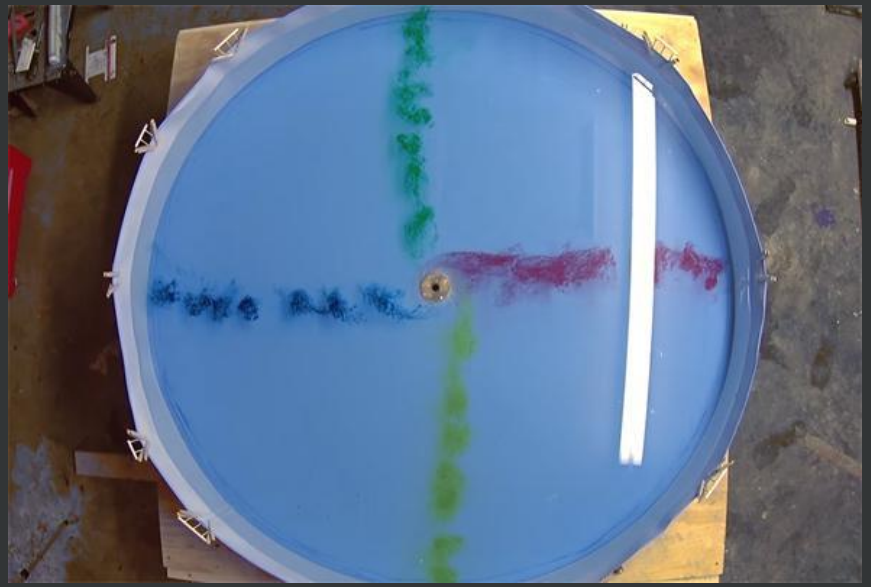
-String: forever

Possible Errors

- Inaccurate time measurement
- Not always stiring with the same speed
- Instrument defections/malfunctions
- Human error

Conclusion:

In conclusion it is possible to determine the original flow of water for a long time even after it has slowed down considerably.



References:

Photos:

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References:

Materials:

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Thank you!