Measurement of Extremely small distances

- (liquid molecules, dust particles, bacteria etc.)

Activity size of liquid molecules

- You can do this at home
- Take a dropper with markings to indicate volume
- Use the dropper, to take a known volume of mustard oil
- In a bowl of water kept on a flat surface , drop the oil on the surface of water.
- Observe the circular patch of oil
- It will slowly increase in size and then stabilize.

How can we estimate the size of a liquid molecule?

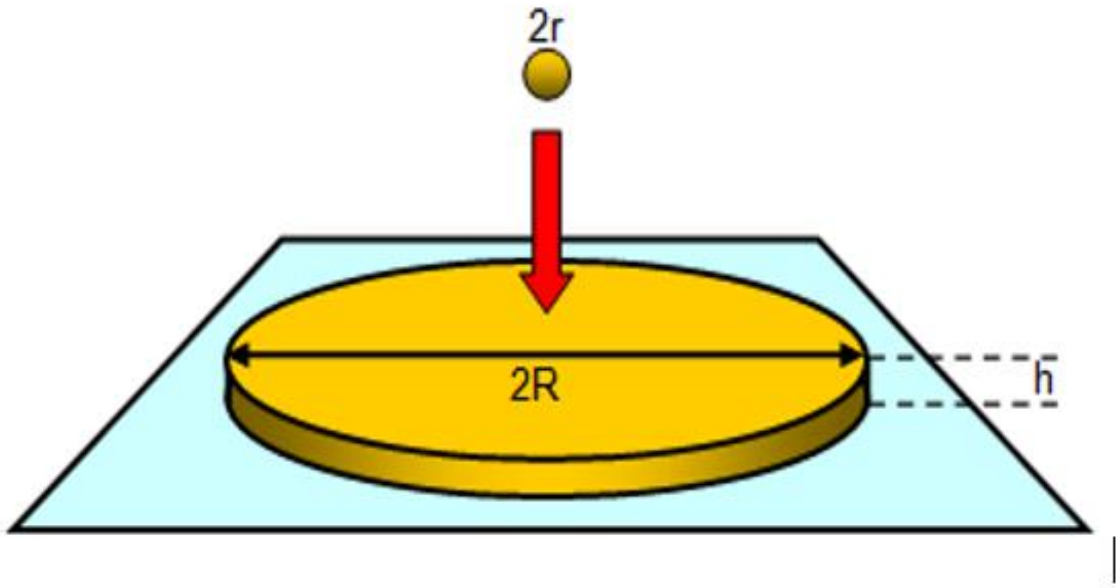
- Usually Electron microscope is used for measuring the distances of the atomic order!!
- Here we take the example of **Oleic acid**
- We make the solution of the Oleic acid with alcohol
- We make a solution of 1/500 concentration by dissolving 1 cm^3 of oleic acid in 500 cm^3 of alcohol.
- Now n drops of this solution is poured on the surface of water contained in a flat vessel.

Oleic acid

Oleic acid is a fatty acid that occurs naturally in various animal and vegetable fats and oils.

It is an odourless, colourless oil, although commercial samples may be yellowish.

The term "oleic" means related to, or derived from, olive oil, which is mostly composed of oleic acid-rich triglycerides



Imagine a drop of oleic acid having radius 2r is falling on the surface of water. This drop of oleic acid is spread on the surface of water, now its radius becomes 2R.

- The film of the oleic acid solution is stretched on the water surface

- The area **A** of the film of oleic acid is measured by using a tracing paper and a graph paper.

- Now if $V = \frac{4}{3}\pi r^3$ is the volume of a drop of oleic acid solution, then the volume of n drops of the solution = $\boldsymbol{nV \times \frac{1}{500}}$

- If $\boldsymbol{A}$ is the surface area of the film of the oleic acid, then

$$\boldsymbol{A \times t = nV \times \frac{1}{500}}$$

Here $\boldsymbol{t}$ is the thickness of the film of oleic acid on the surface of the water

Or

$$Thickness\ of\ film = \frac{volume\ of\ film}{area\ of\ film}$$

- **We assume that the film of the oleic acid was stretched so that it has thickness of one molecule.**

- If the thickness is of one molecule, we will get the diameter of one molecule of oleic acid.

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