



№9. Escaping powder

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Team of Russia

[Conditions]

- When a hot wire is plunged into a beaker of water with powder (e.g. lycopodium) floating on the surface, the powder moves rapidly. Investigate the parameters that alter the speed of movement of the powder.

Plan

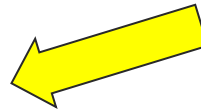
consider the phenomenon



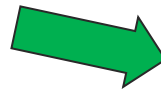
consider the reasons of the movement of the powder



Determine the effectiveness of each reason



make experiments with each of the parameters and get the results of research



analyze results, and make conclusion

Phenomenon



[Unit]



Reasons

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graph TD; A[Reasons] --- B[Convection currents]; A --- C[Surface tension]; A --- D[Steam]
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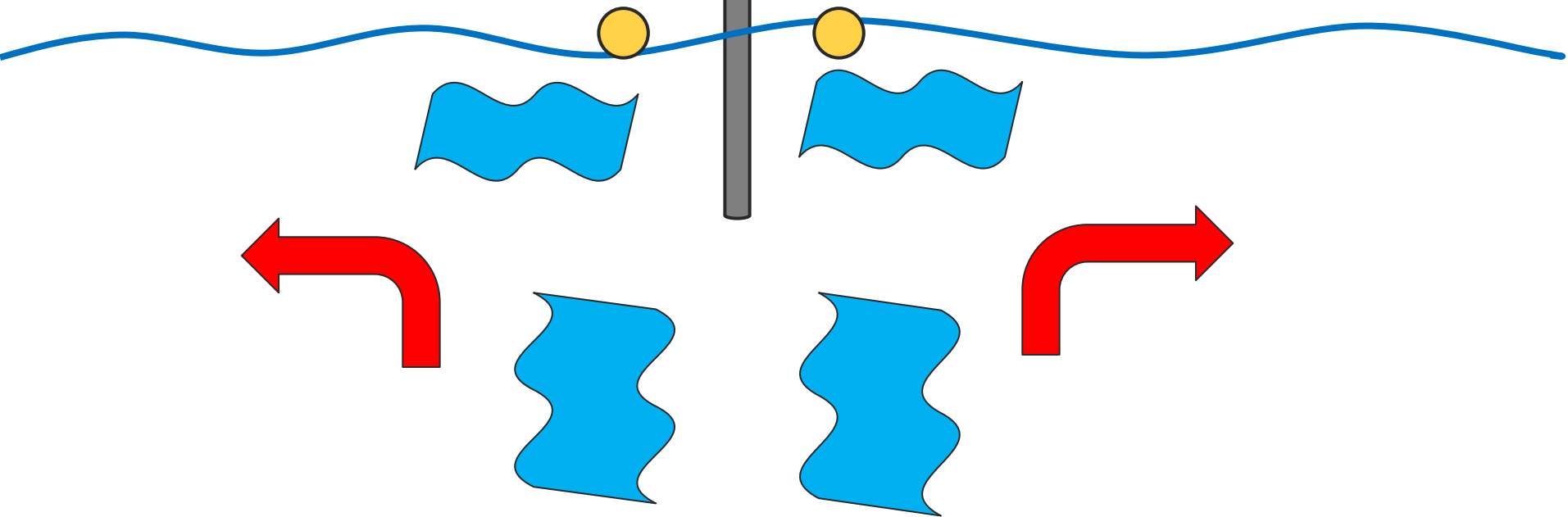
Convection
currents

Surface
tension

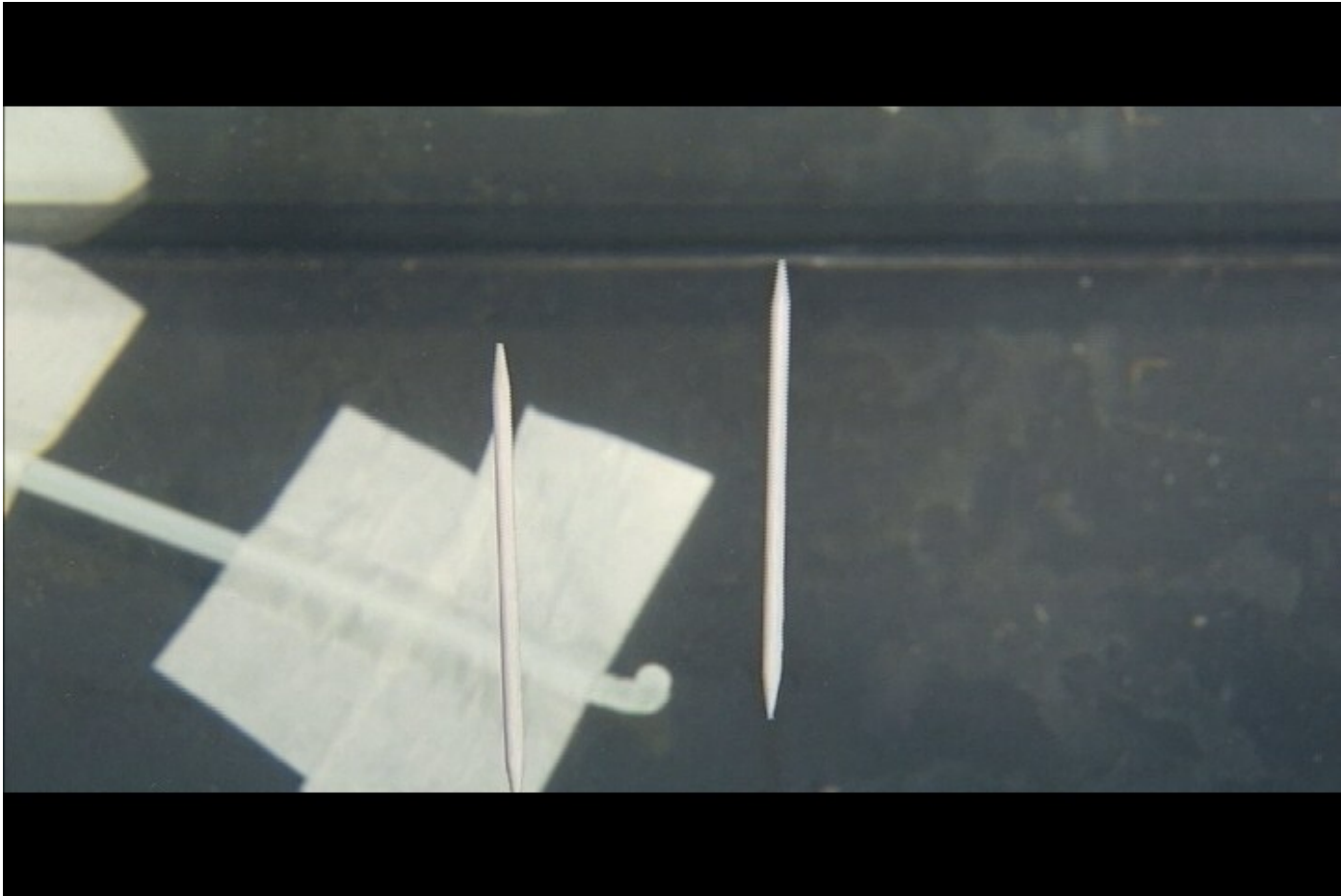
Steam

[Convection

currents]



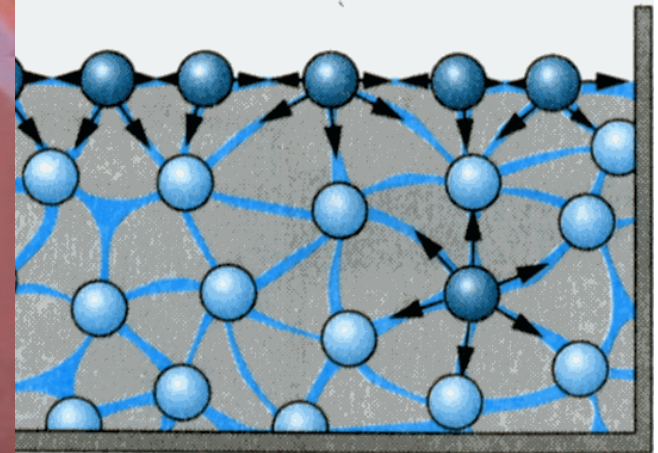
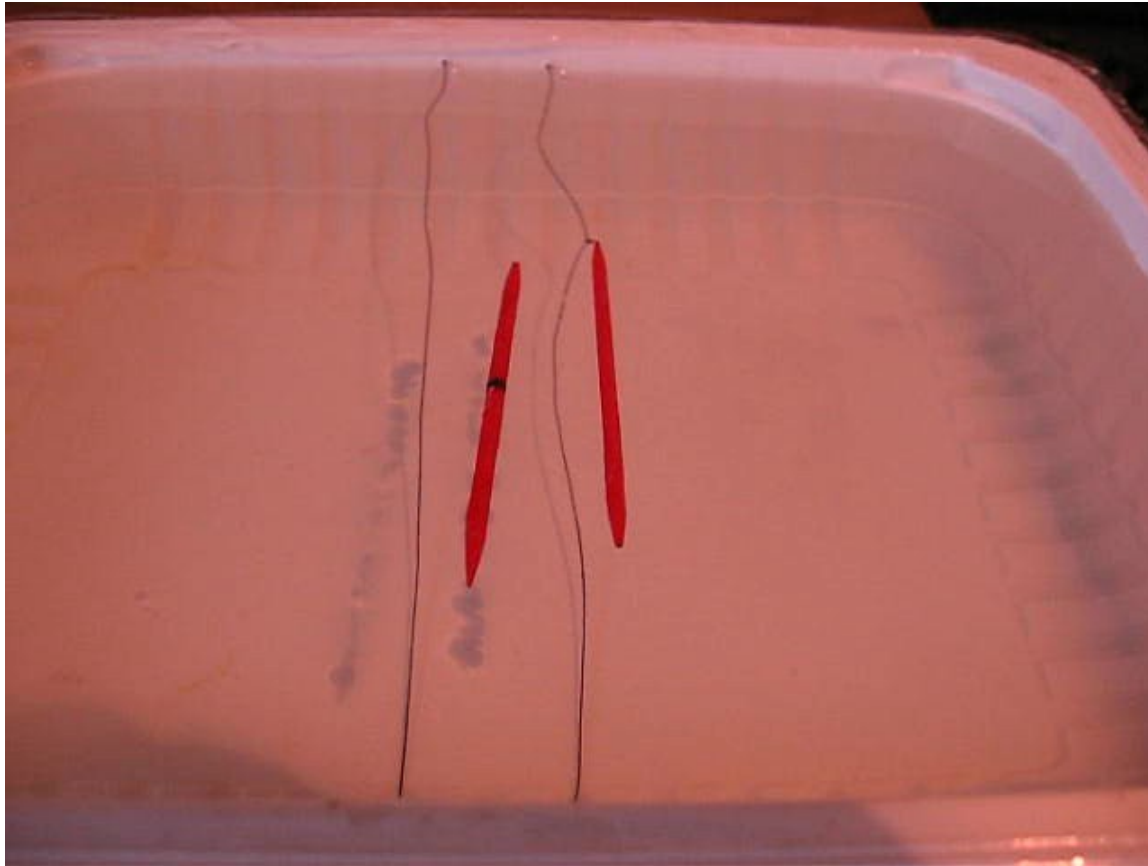
Convection currents



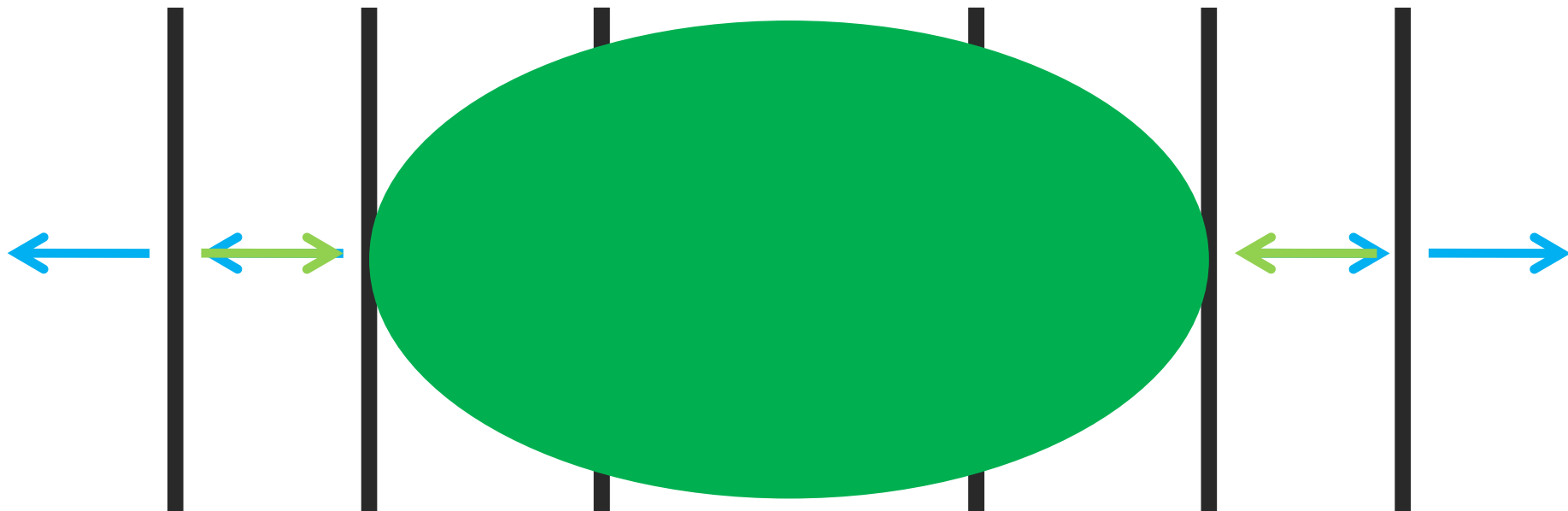
[Testing



Surface tension



$$[F = \sigma l]$$



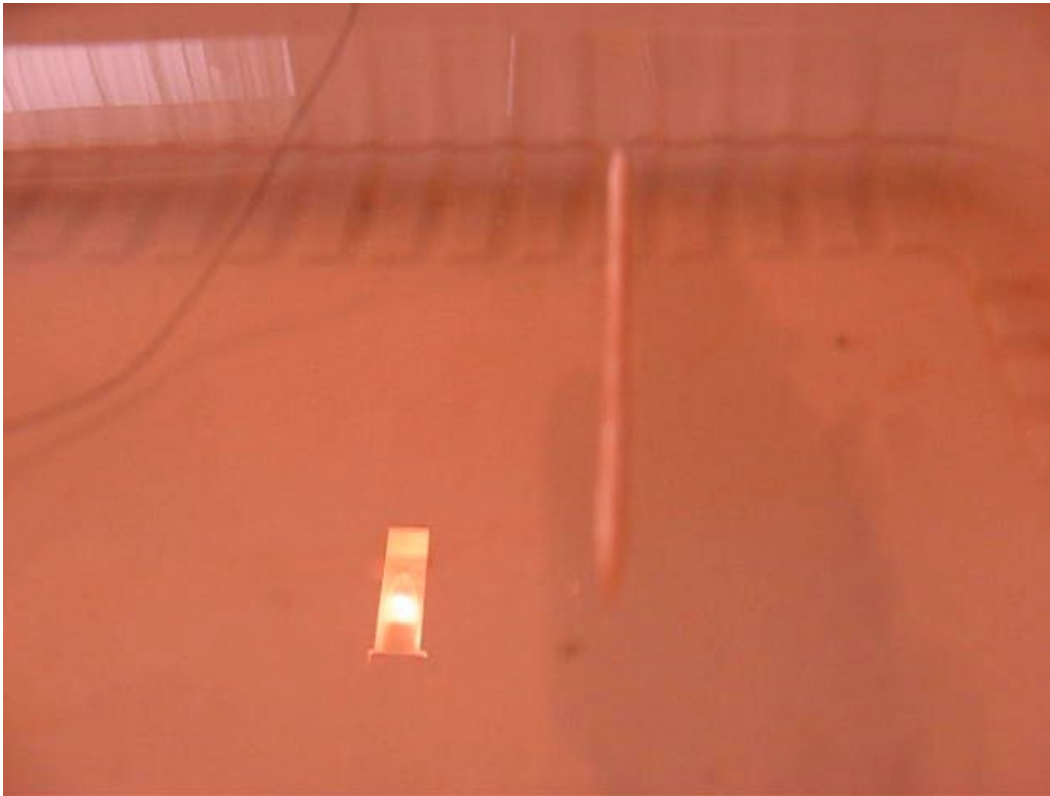
Maximal temperature of
water surface



$$t_{\max} \approx 50^{\circ} \text{C}$$

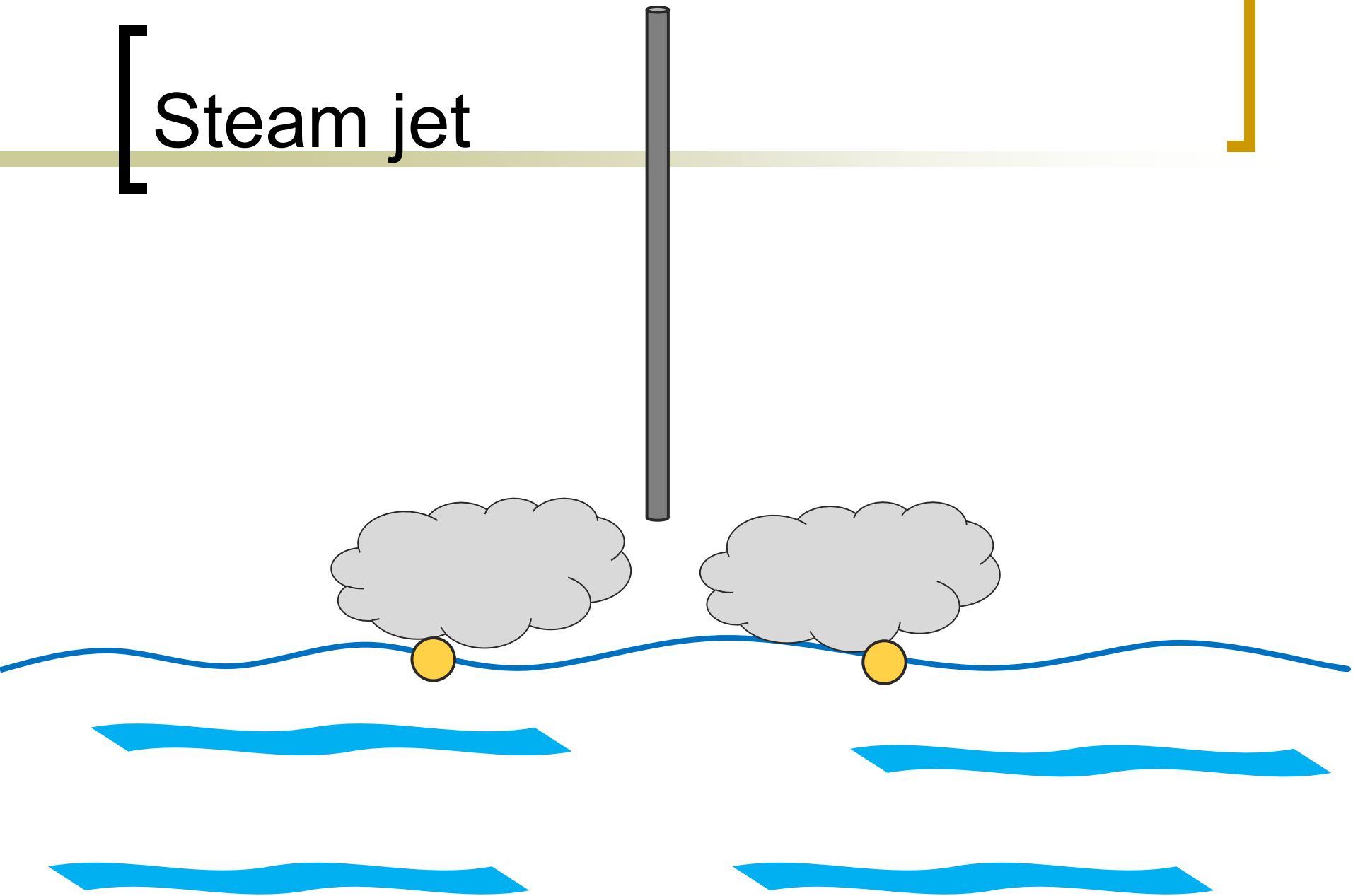
[Dropping heated water]

$$a_i = 2mm / s^2$$

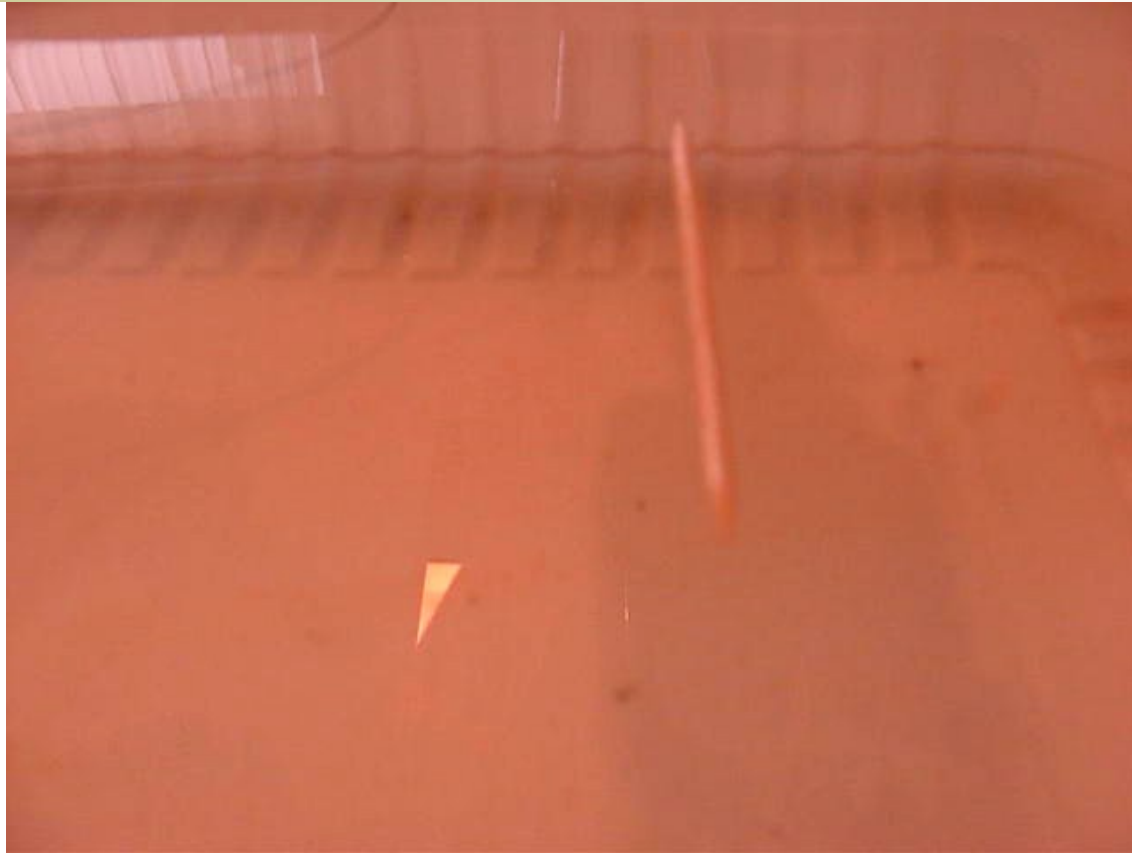


Temperature of heated water is 100°C

[Steam jet]

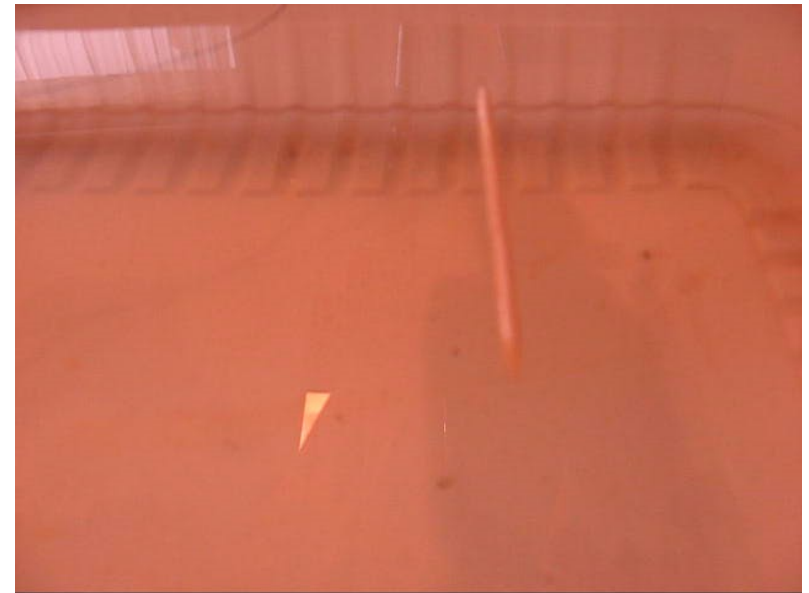
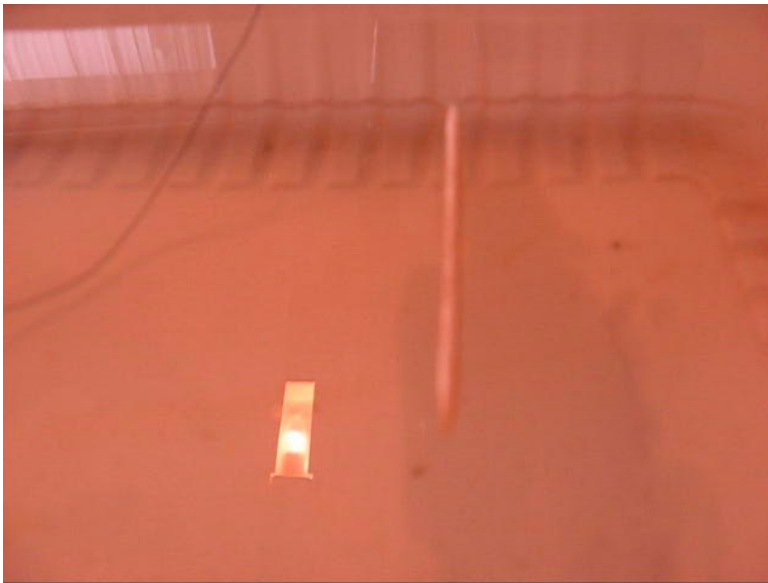


Steam



Steam blows the sticks

Comperison



$$a_{i1} = 2\text{mm} / \text{s}^2$$

$$a_{i2} = 12\text{mm} / \text{s}^2$$

Steam

Submerging wire depth

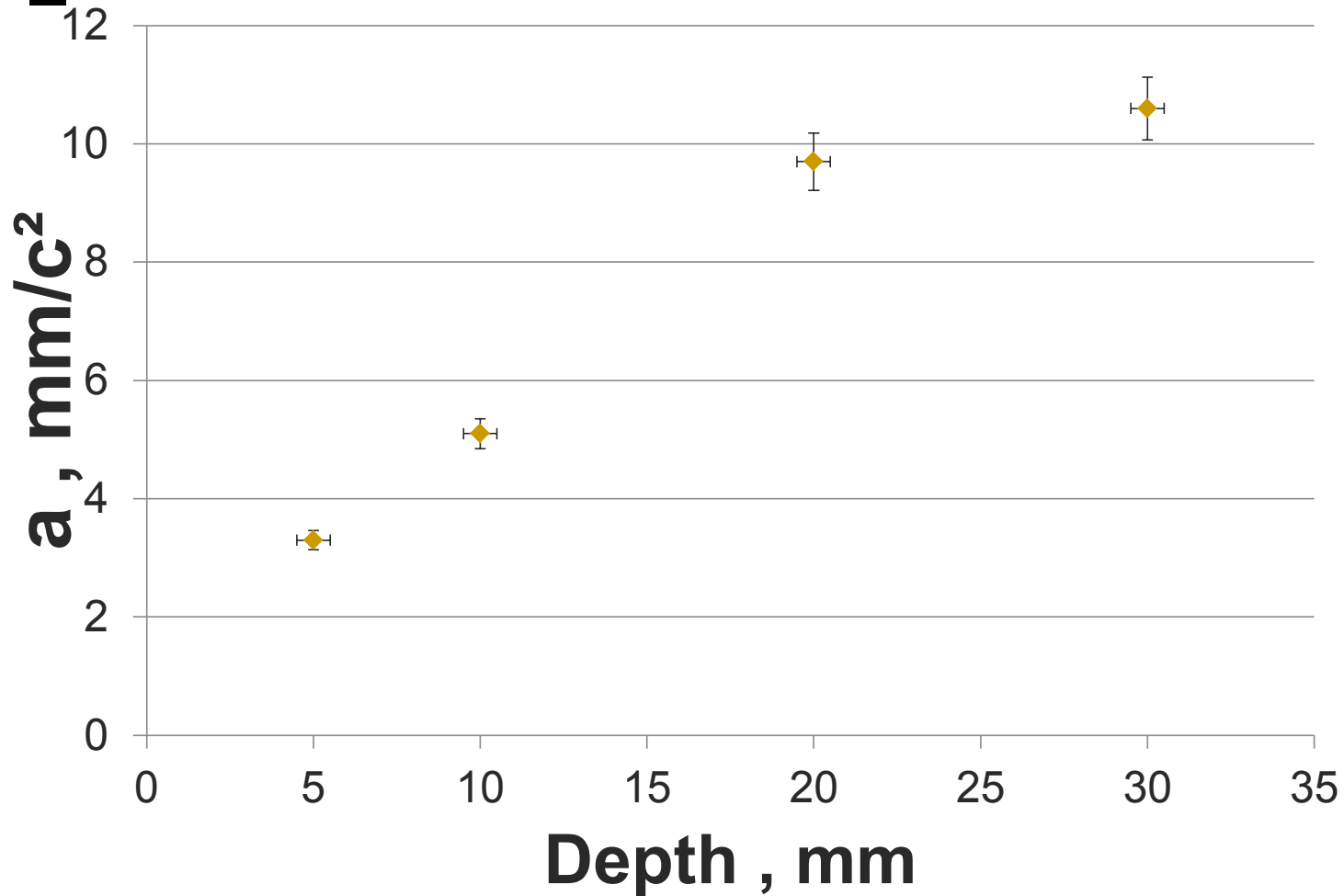
Submerging wire diameter

Wire submerging speed

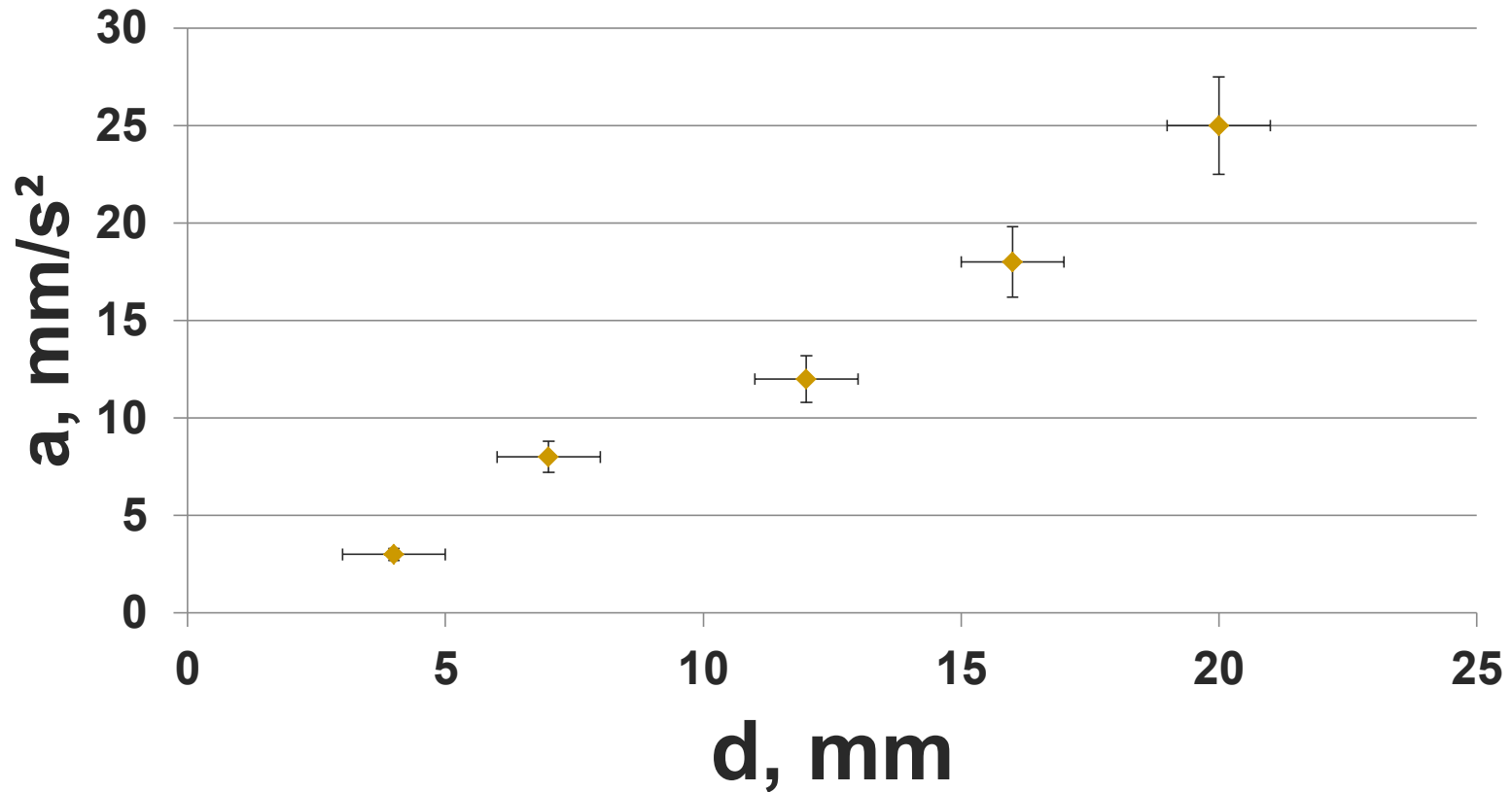
Convection
cur

Surface
tension

Depth of submerging



Dependence acceleration on diameter of wire



Wire submerging speed

$$a_{slow} = 19 \text{ mm} / \text{s}^2$$

■ 3 s

$$a_{fast} = 23 \text{ mm} / \text{s}^2$$

■ 0,5 s

Diameter of wire is 16 mm

temperature of water 20 °C

Conclusion

- The main reason of movement is the steam jet
- Acceleration rises while the depth of wire submerging increases
- If the diameter of wire increases the velocity of the sticks rises linear
- Acceleration increases while the speed of wire submerging rises