

A photograph of three brown horses running through a snowy landscape. The horses are in motion, kicking up snow. The background shows snow-covered evergreen trees. The word "Drying" is overlaid in the center in a large, black, sans-serif font.

Drying

9. Drying

Investigate the drying process of a vertical wet paper sheet. How does the boundary of drying move?

Aims

- To make a physics model of drying
- To investigate how does the boundary of drying move in different kinds of paper for different conditions?
- To explain the experimental dependences



2009/3/1



2009/3/1

2009/2/24

Видео скапывання

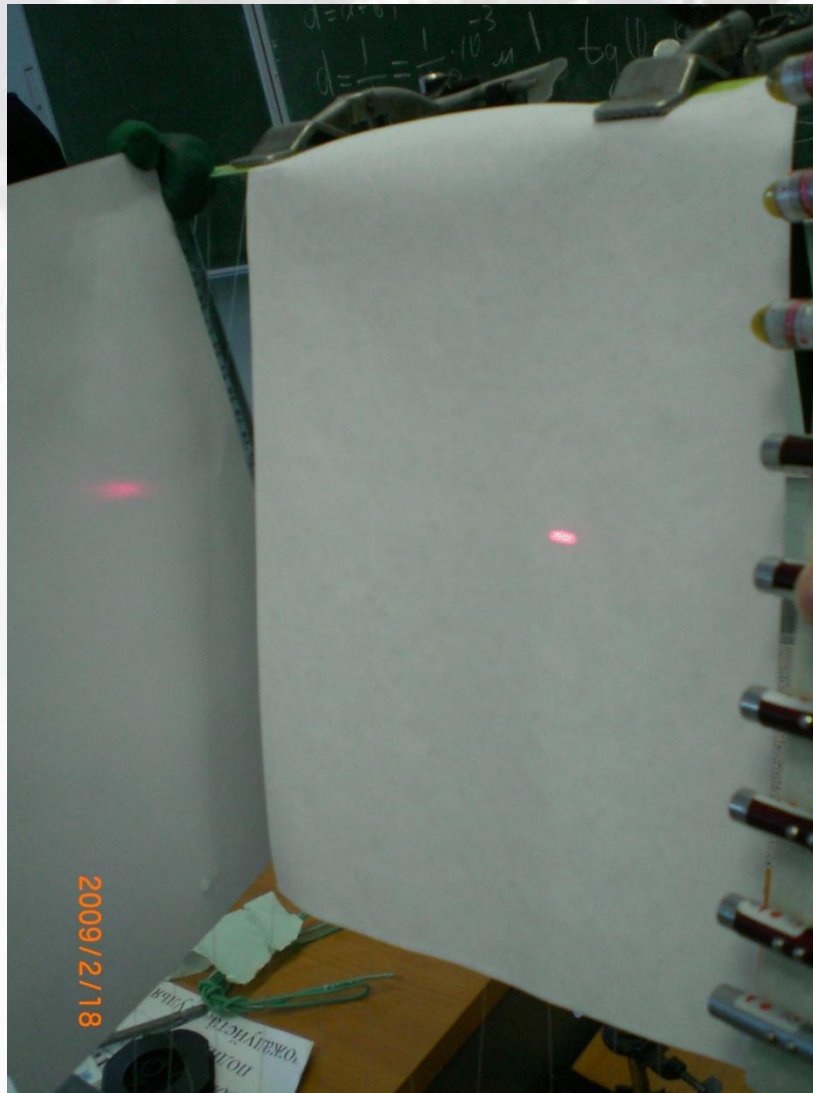


The boarder definition

1. Surface boarder
2. Inside boarder



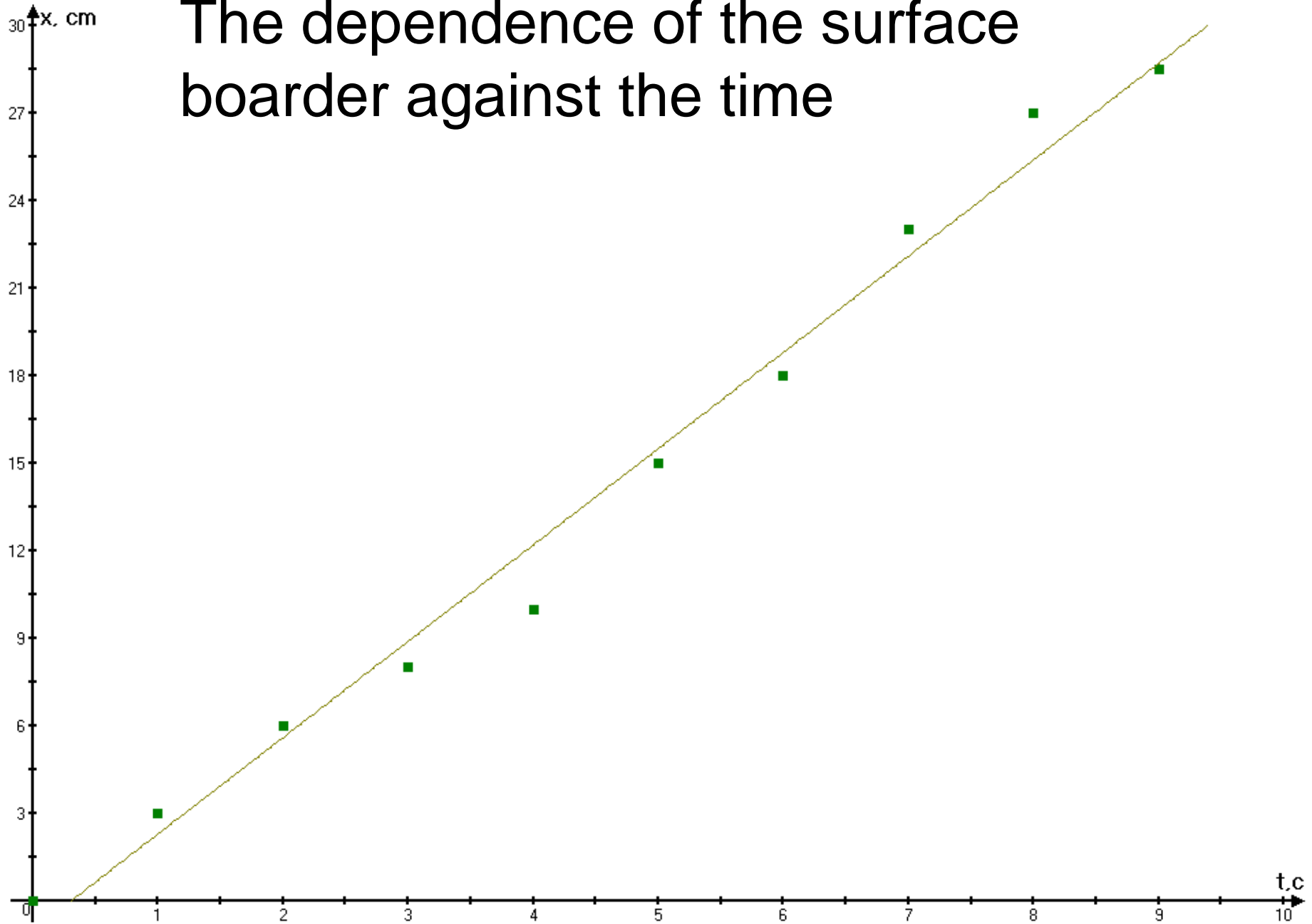
The way to measure surface boarder



Demonstration in the darkness



The dependence of the surface boarder against the time

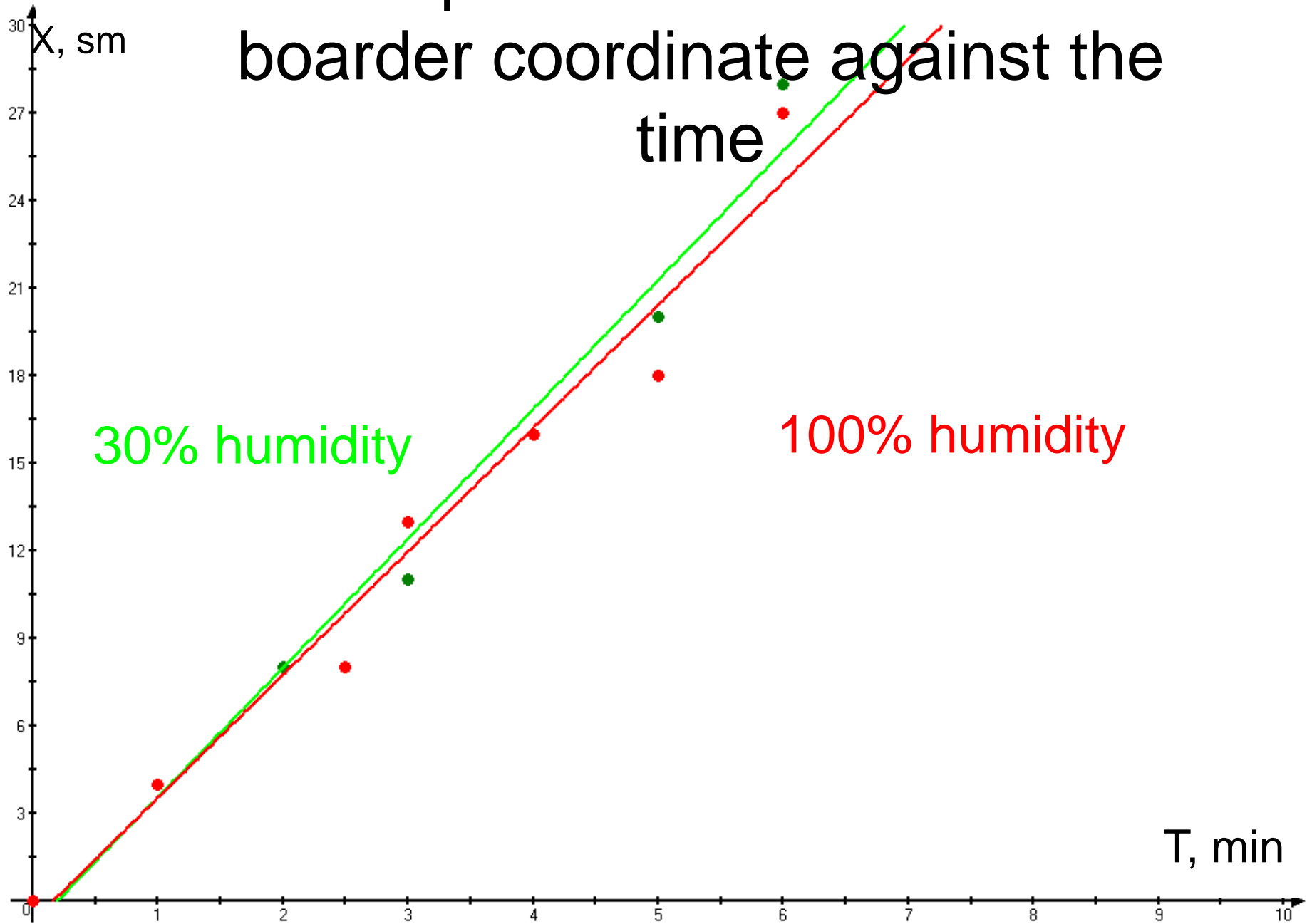


The experimental setup for high humidity



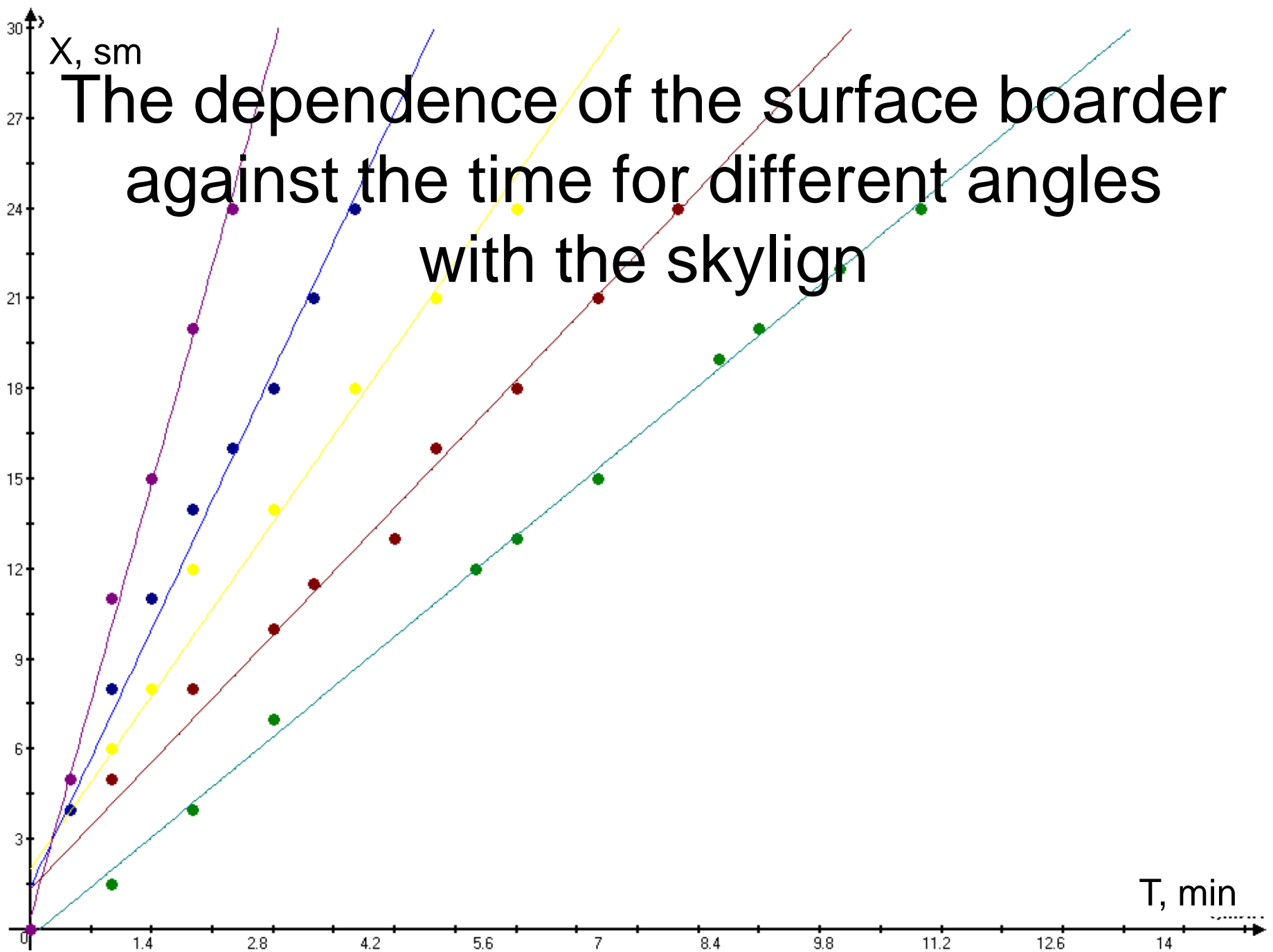
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The dependence of the surface boarder coordinate against the time

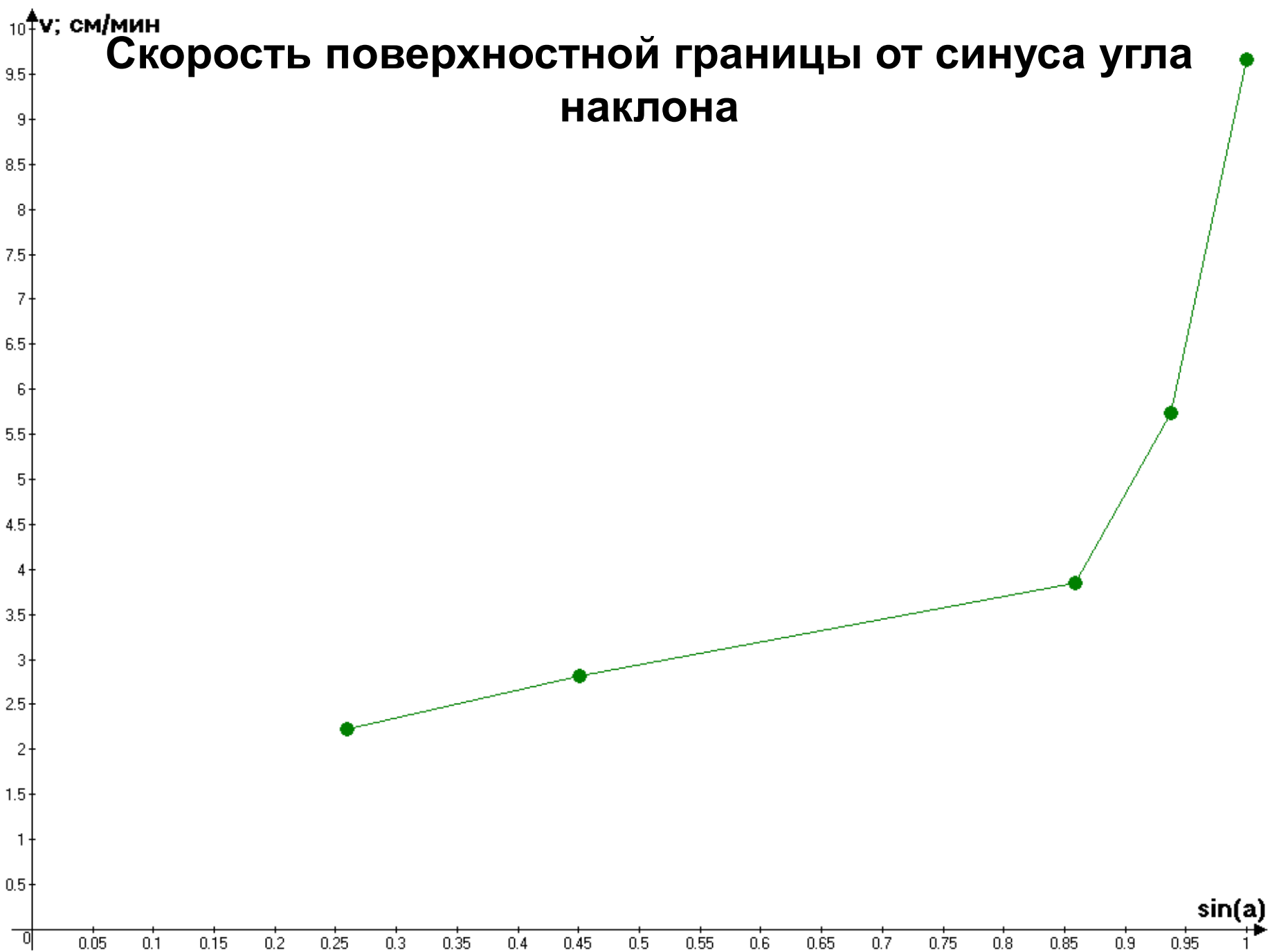


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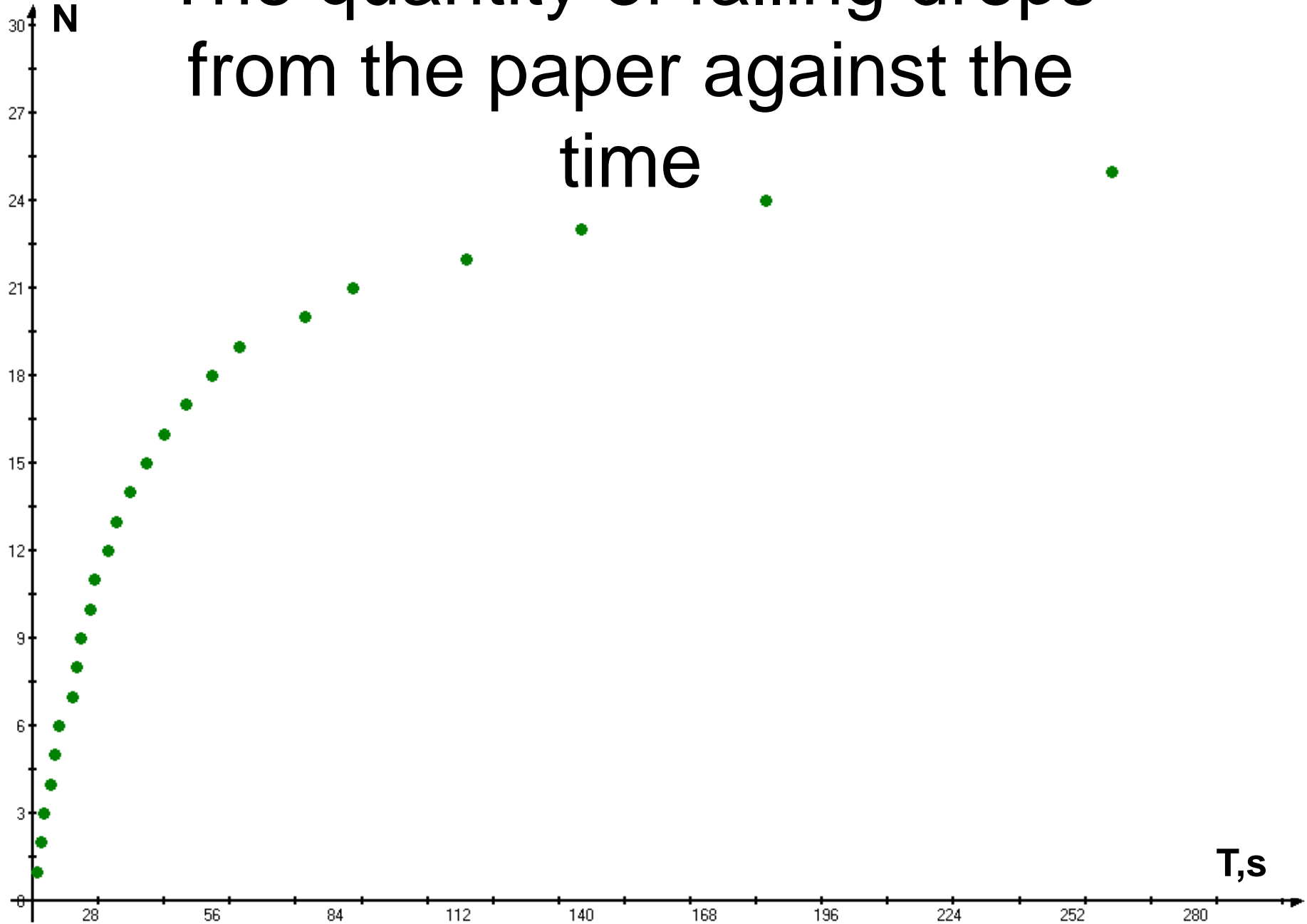
The dependence of the surface boarder
against the time for different angles
with the skylign



Скорость поверхностной границы от синуса угла наклона



The quantity of falling drops
from the paper against the
time



The mass of falling drops from the paper

At writing paper A4 – 43%

At toilet paper – 37%



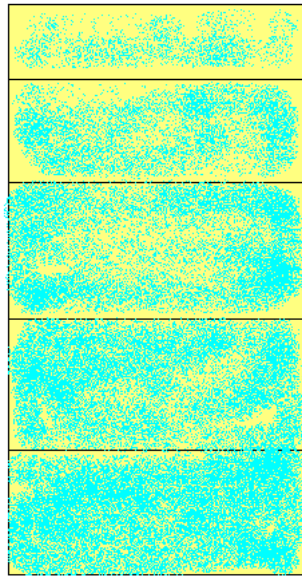
The first stage is moving the surface boarder

Drippage of the surface film is not connected with vaporization

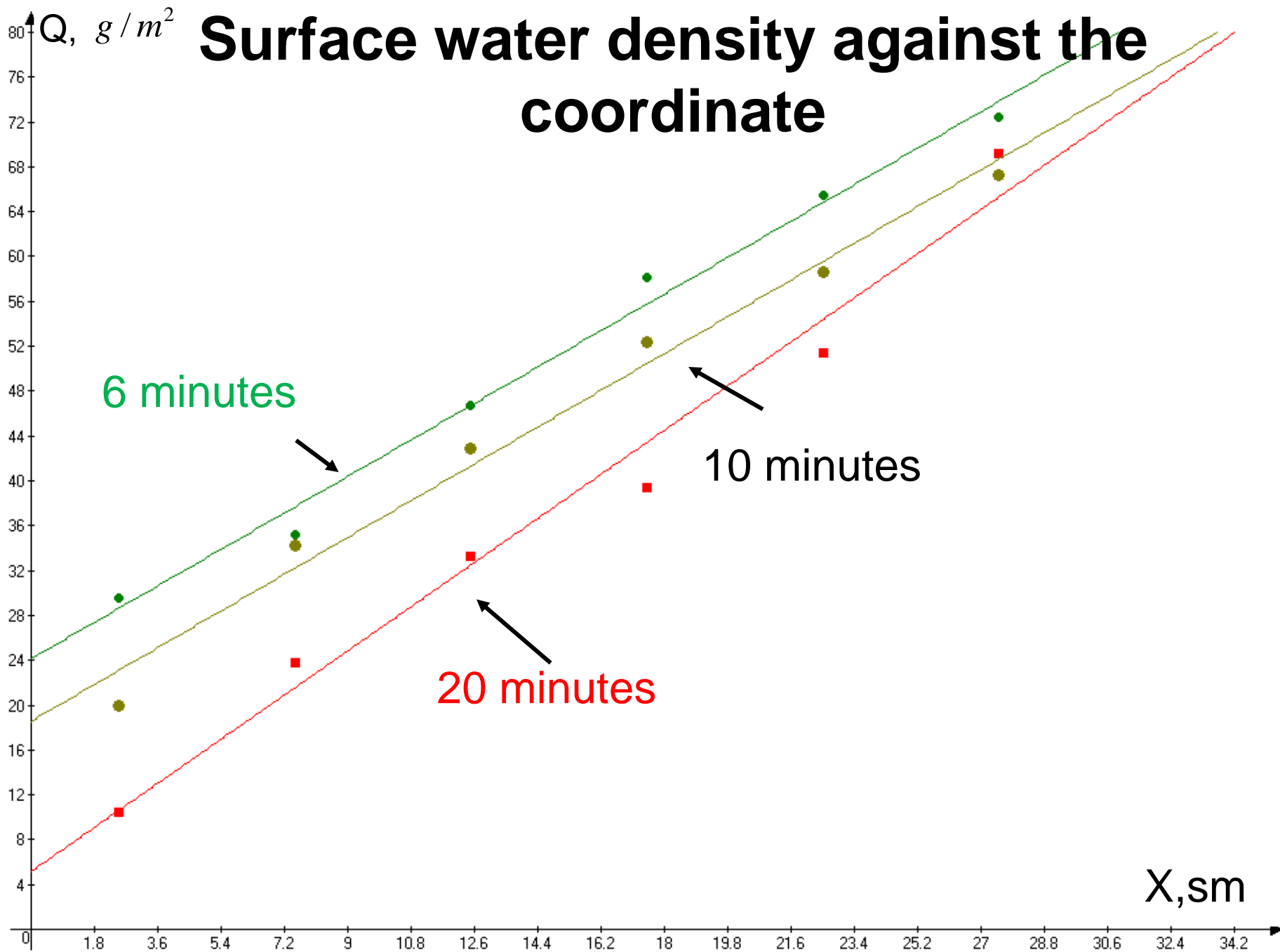
The drippage is a constant and it depends only on the angle

About 40% of water goes from the paper sheet because of drippaging

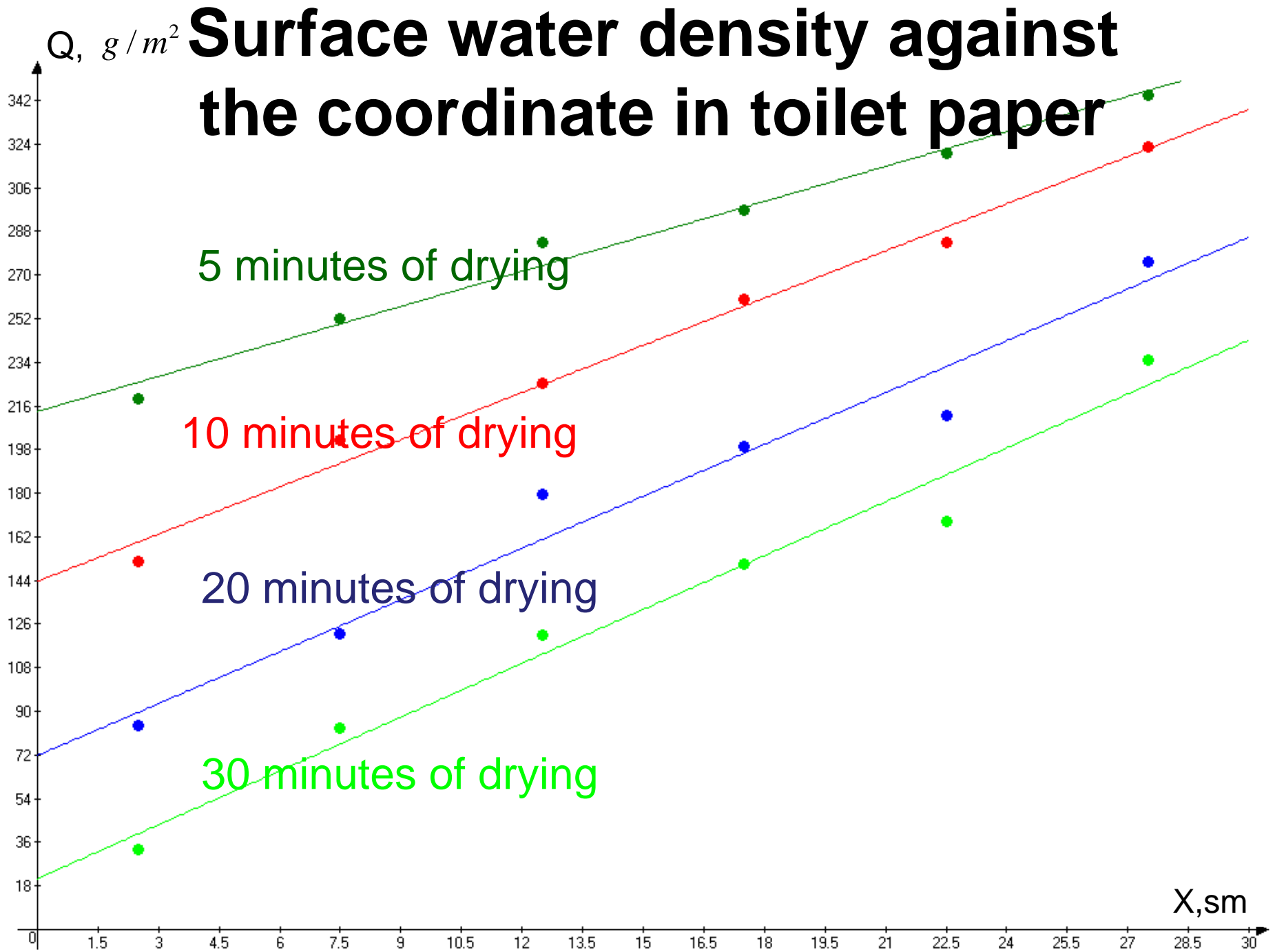
Inside boarder

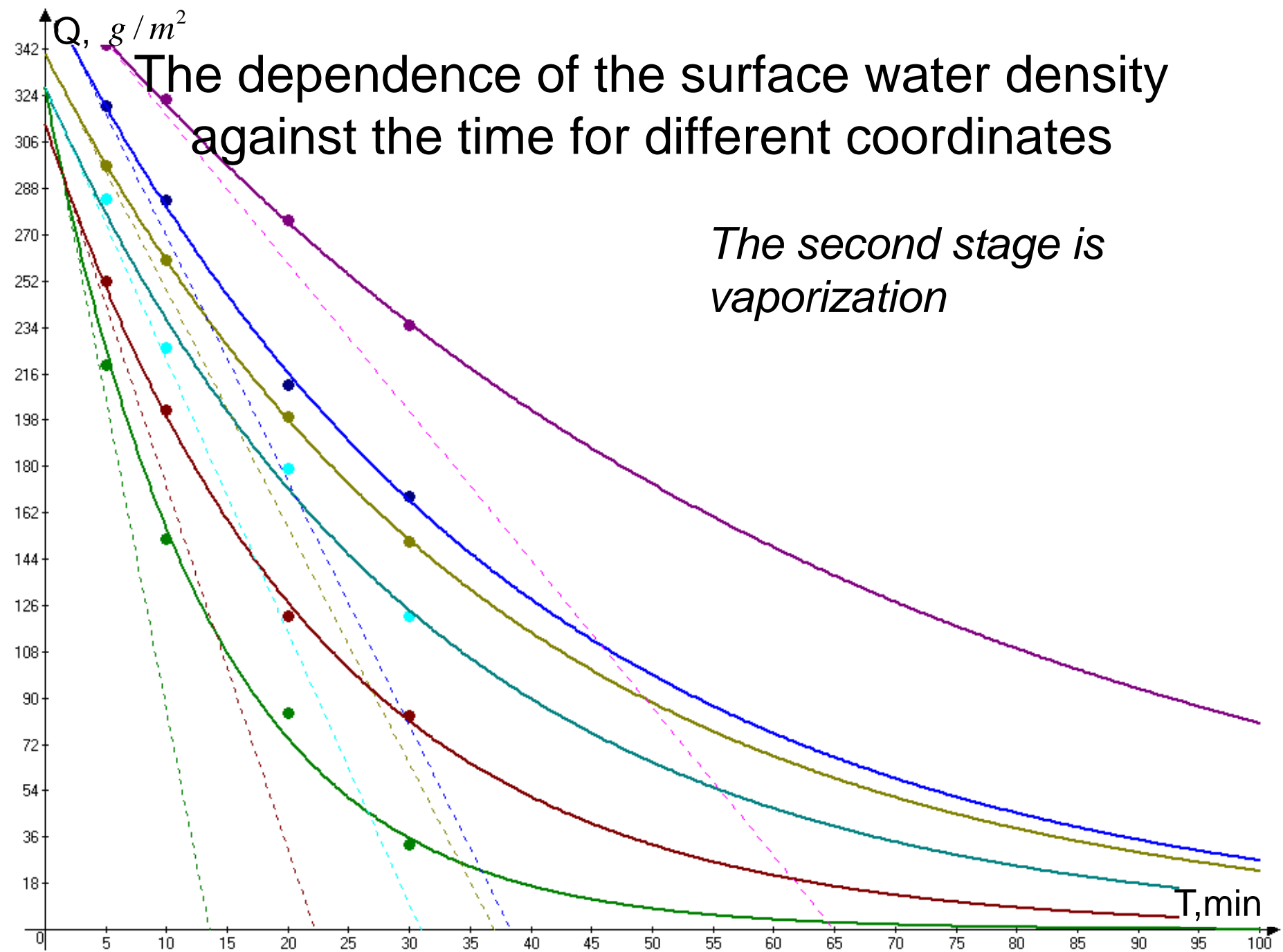


Surface water density against the coordinate

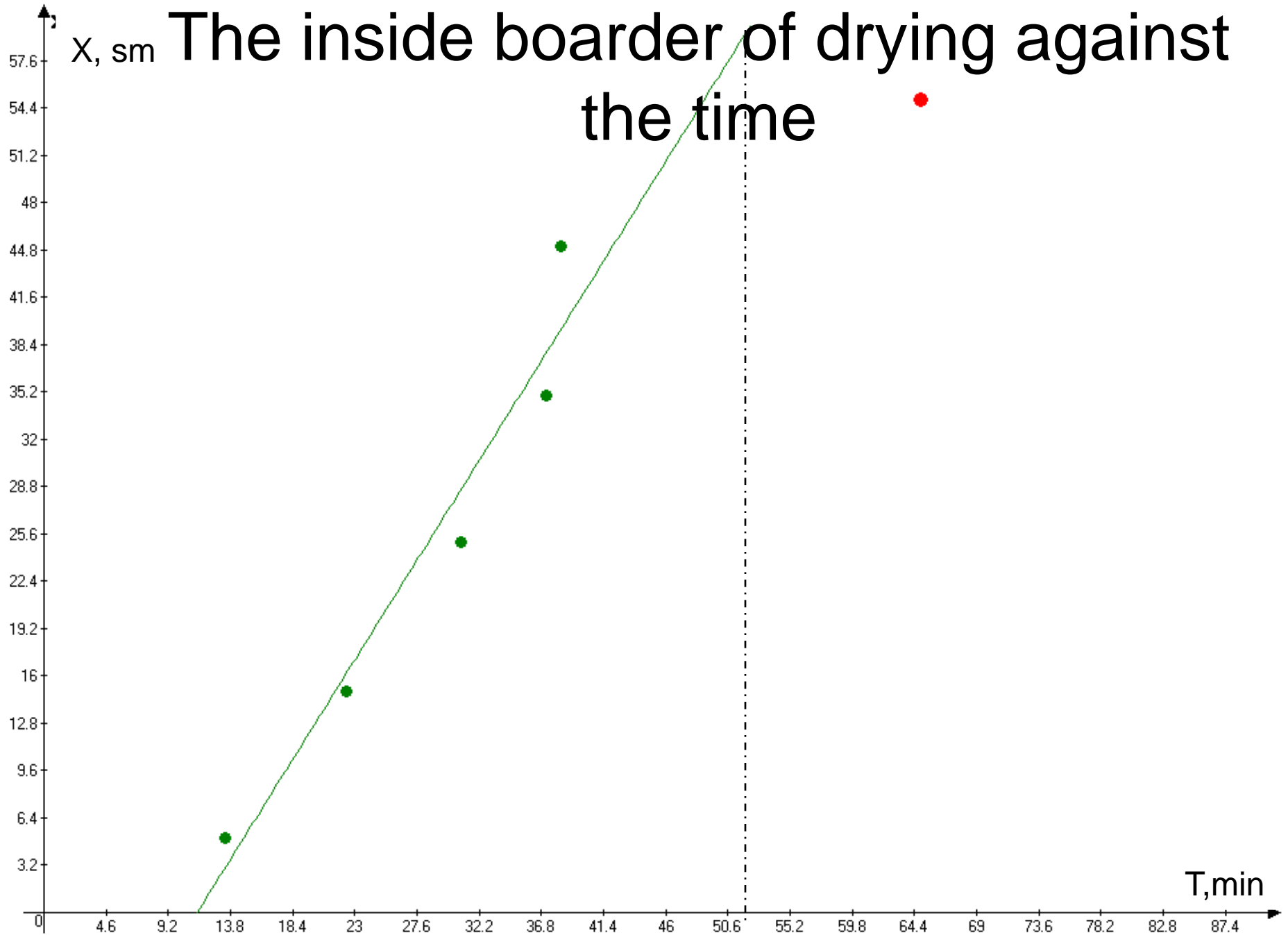


Surface water density against the coordinate in toilet paper



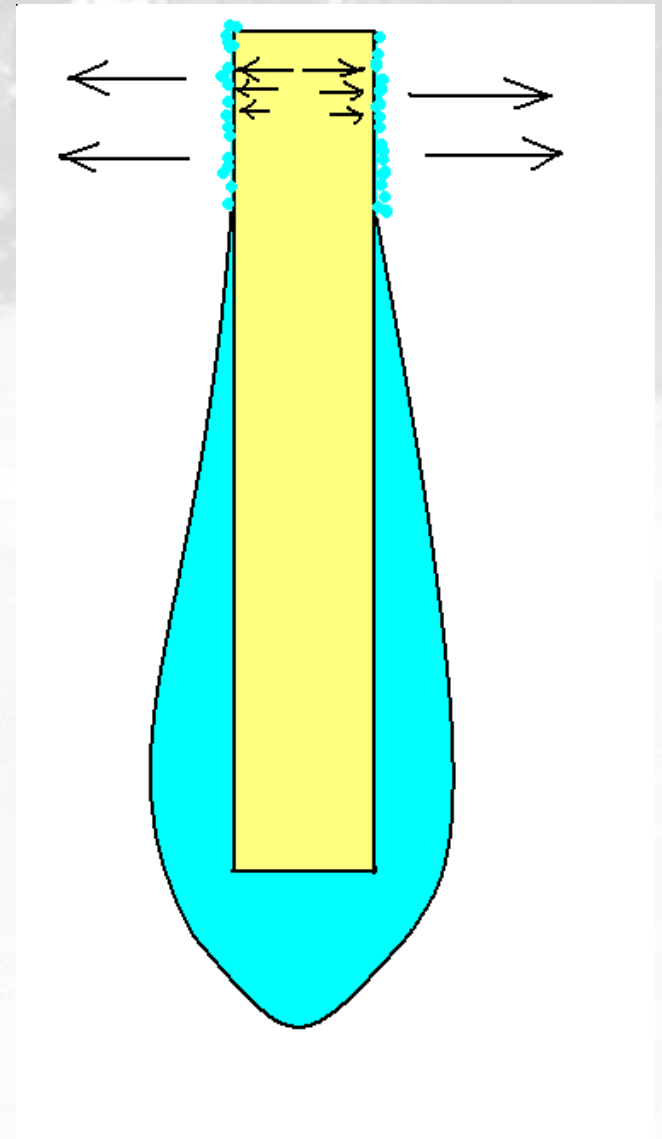


The inside boarder of drying against the time

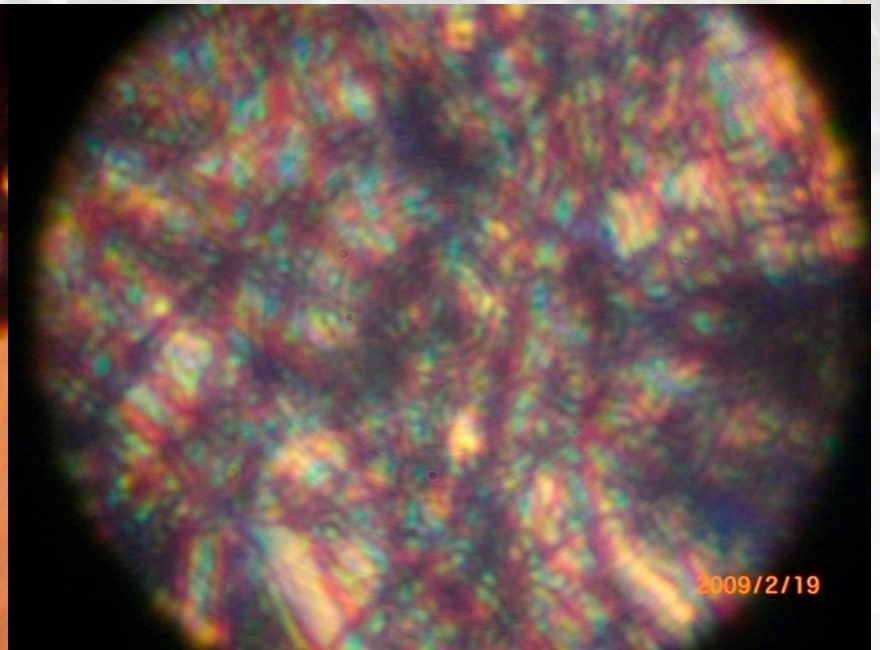
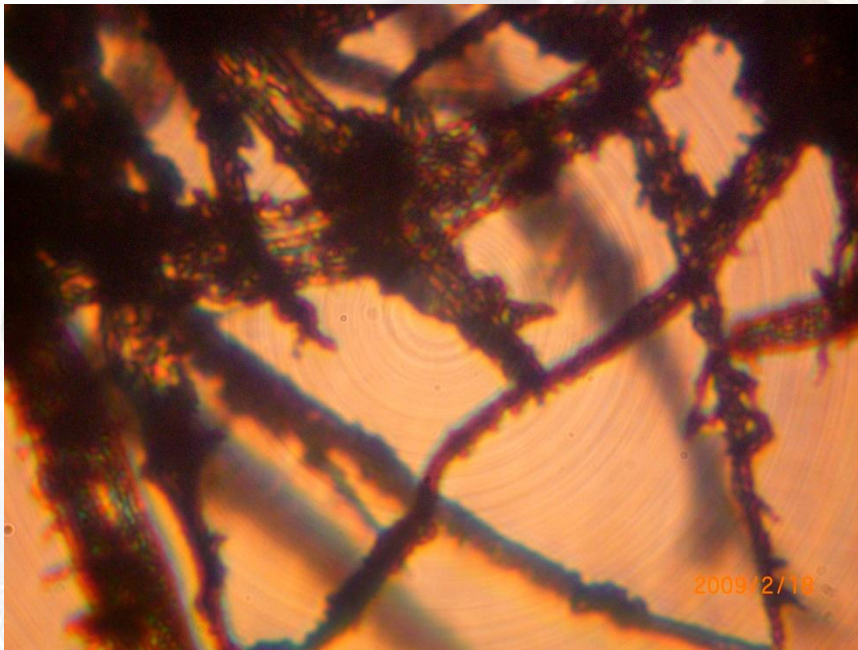


The physics processes in a paper sheet

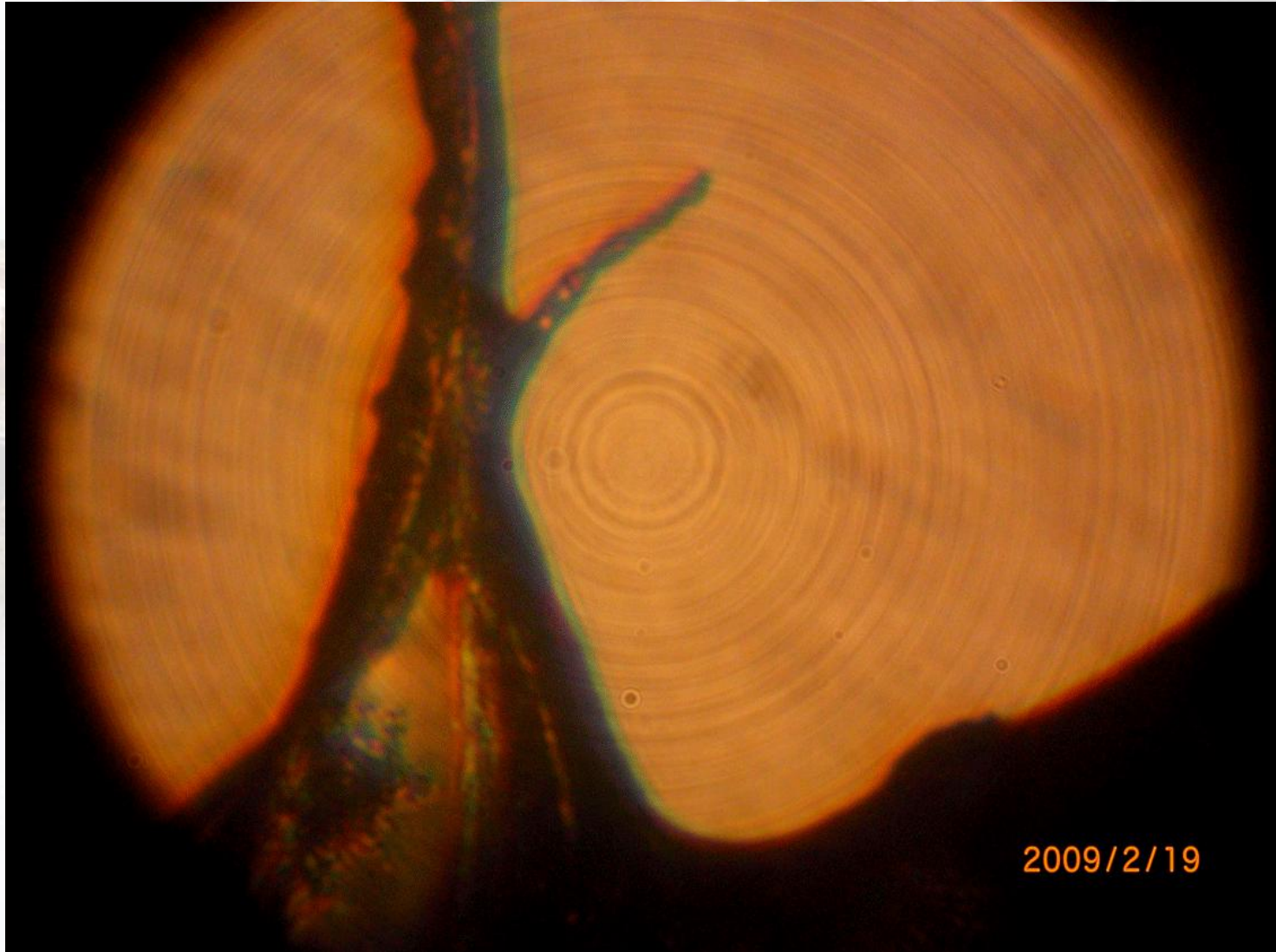
1. After the surface boarder moved the little droplets appear. Because of the droplets the useful vaporization area increases
2. Because of active vaporization the difference in gradient appears inside the paper. And water start move out of paper because of diffusion
3. Because of gravity forcens water move down
4. In the end of sheet the drops fall down from the paper



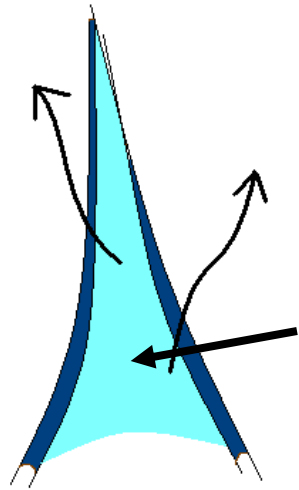
The structure of paper



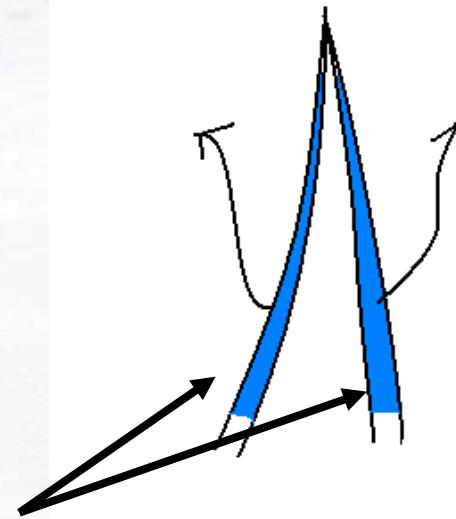
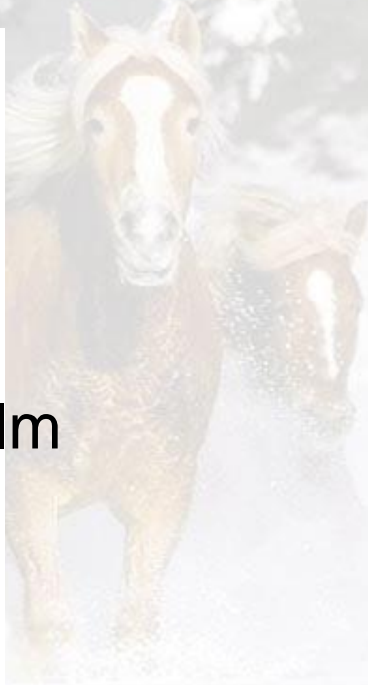
Accelerated experiment



The principle scheme of the event

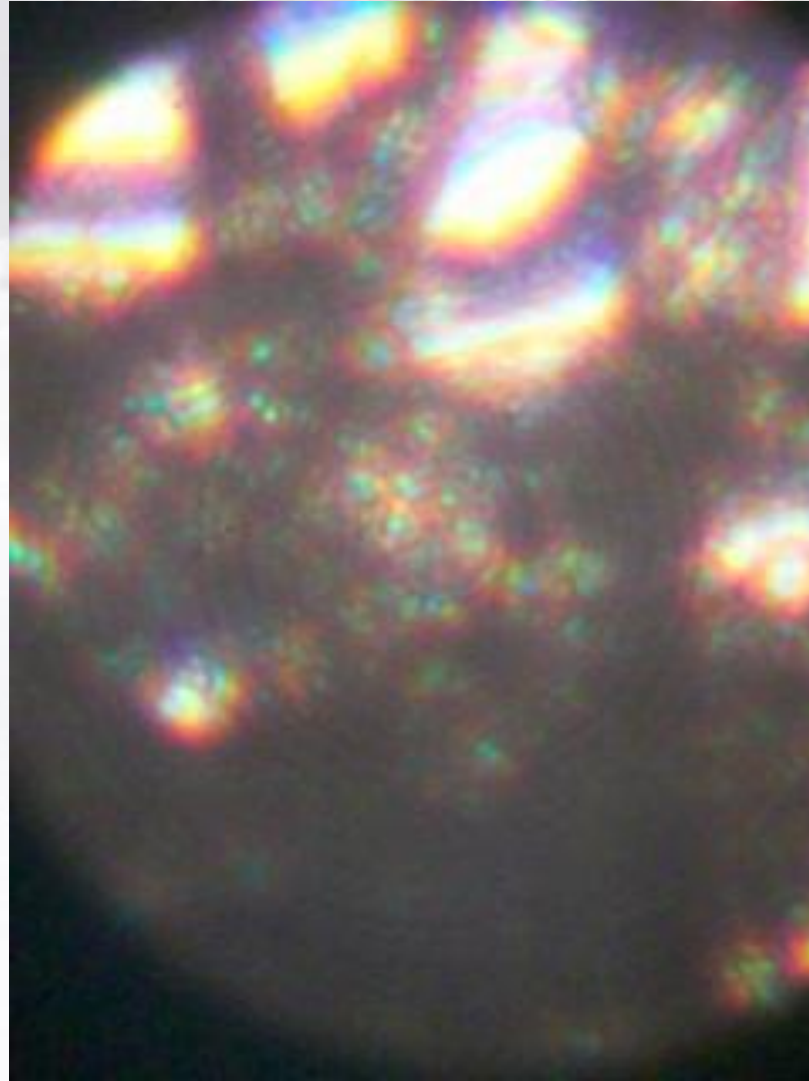


Water film



capillaries

Paper distortion



Conclusions

- We can't see a boarder of drying in paper sheet
- The process of drying are divided into 2 stages:
 1. Droppaging of the surface film
 2. Vaporization
 - a. Vaporization of the water film between capillaries
 - b. Water vaporization from capillaries
 - c. The last drop vaporization

Conclusions

- ✓ The droppaging velocity of the surface water film depends on the sheet angle
- ✓ There are processes of paper distortion when the paper is vaporizationing
- ✓ About 40% of water go out of the sheet because of droppaging

Summary

- We have found the way to describe the surface and inside borders
- We have made a research with different kinds of paper sheets in different conditionals
- We have explained our experimental grafs
- We have found a very interesting process that appears at the end of drying. It is paper destortion

A group of brown horses running through a snowy field. The horses are in motion, kicking up snow. In the background, there are evergreen trees covered in snow. The overall scene is bright and wintry.

Thank you for your attention