



# **Problem №1 Adhesive tape**

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# [ Terms of the problem ]

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- Determine the force necessary to remove a piece of adhesive tape from a horizontal surface. Investigate the influence of relevant parameters.

# Plan

Nature of cohesive forces



Parameters



Investigate the dependence on initial pressure



Investigate dependence on square of area



Investigate the dependence on applied force angle



Conclusion

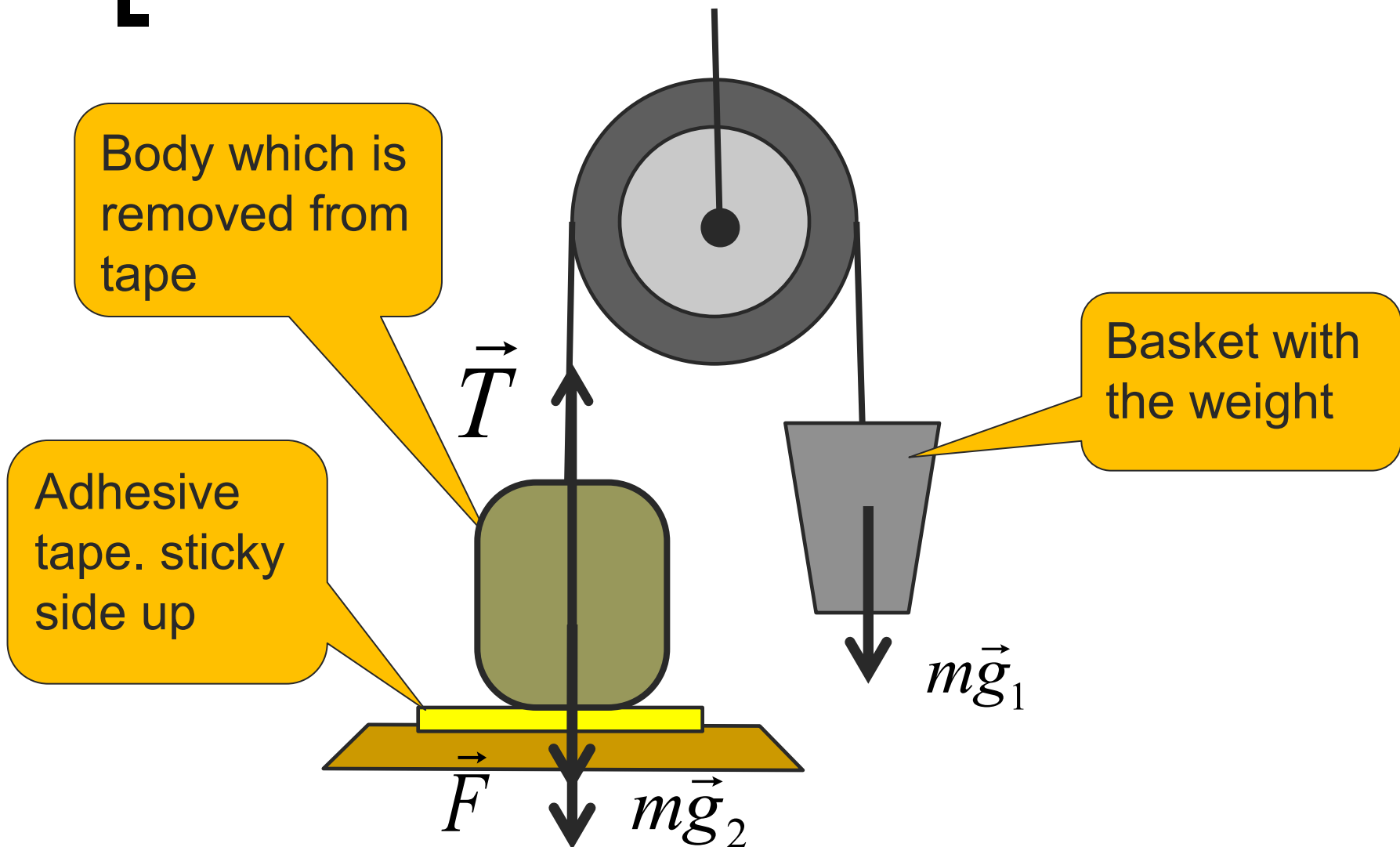


# [ Parameters ]

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- 1) surface square
- 2) angle of force application
- 3) initial pressure

# Setup

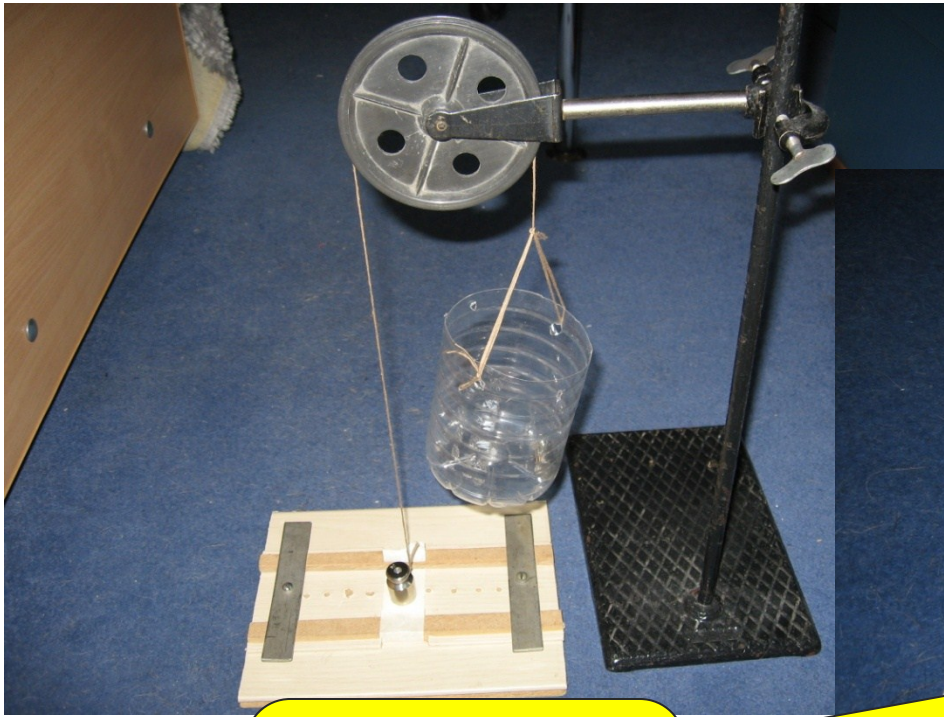


Body which is removed from tape

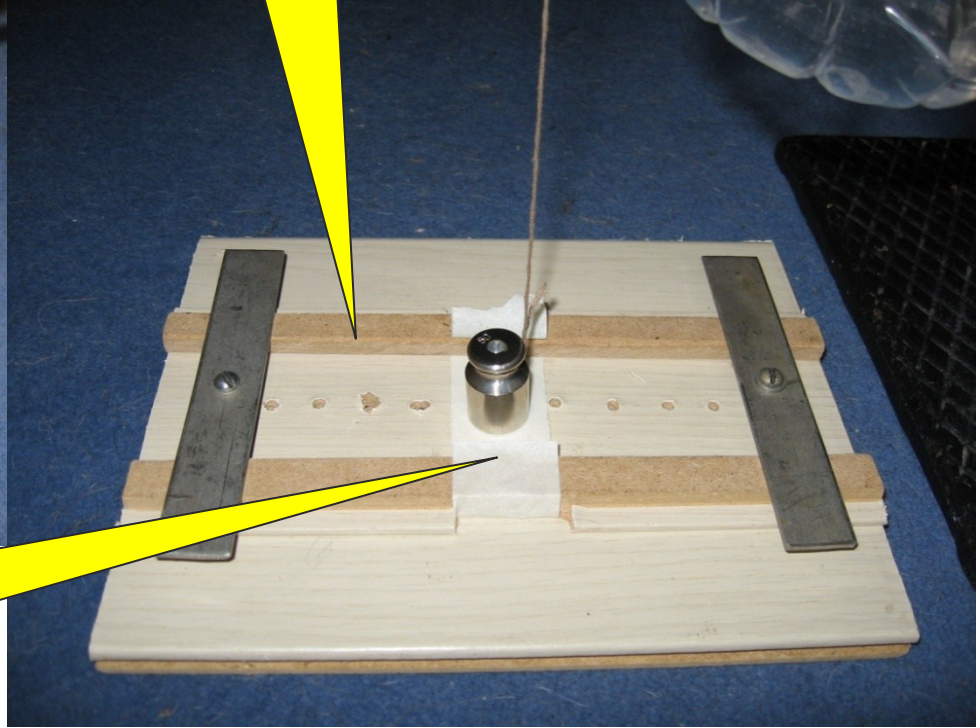
Adhesive tape. sticky side up

Basket with the weight

# [ Dependence on pressure ]

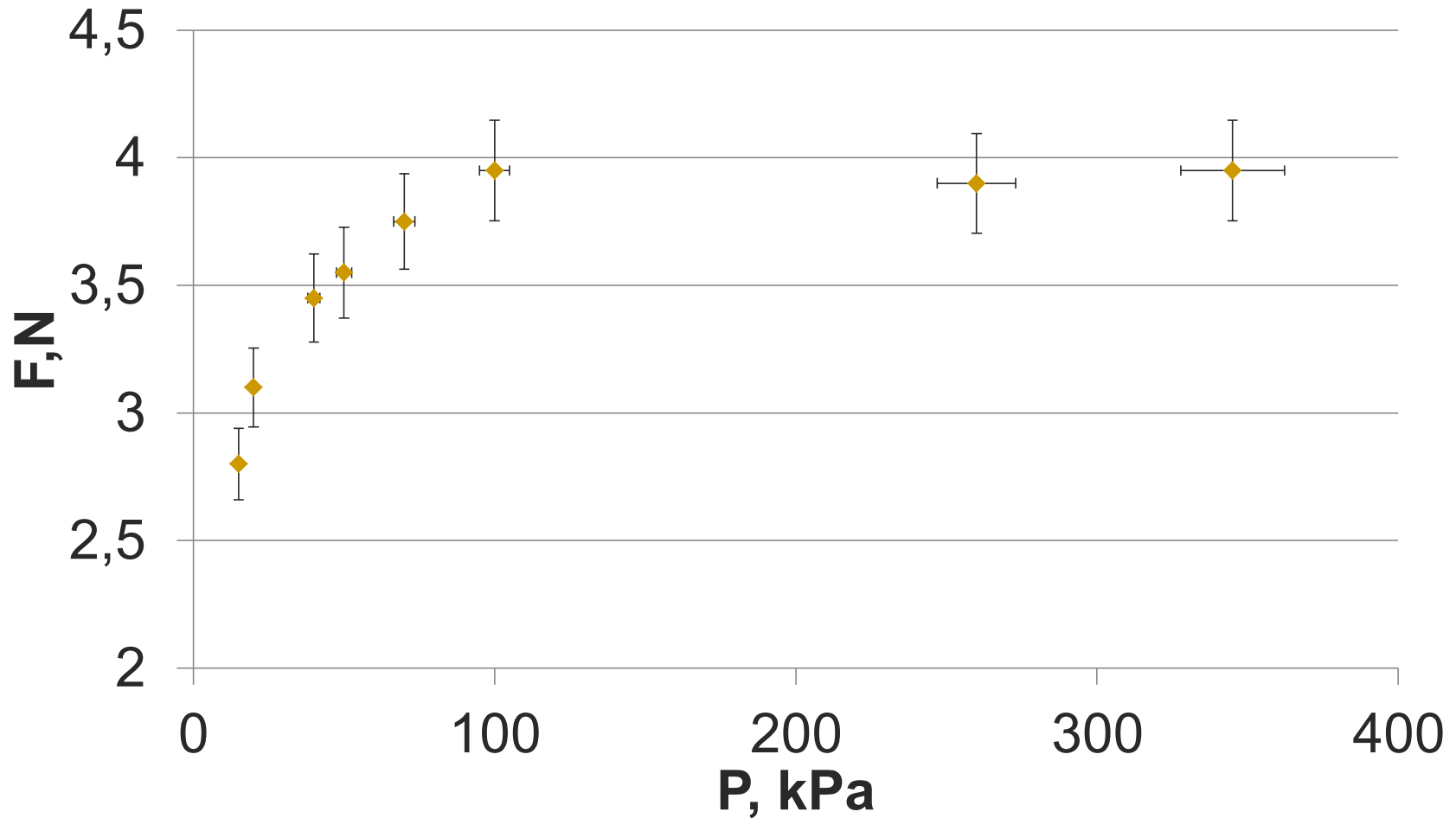


Adhesive tape. sticky side up



Pressing bars

# Dependence the removing force on the initial pressure



# Explanation



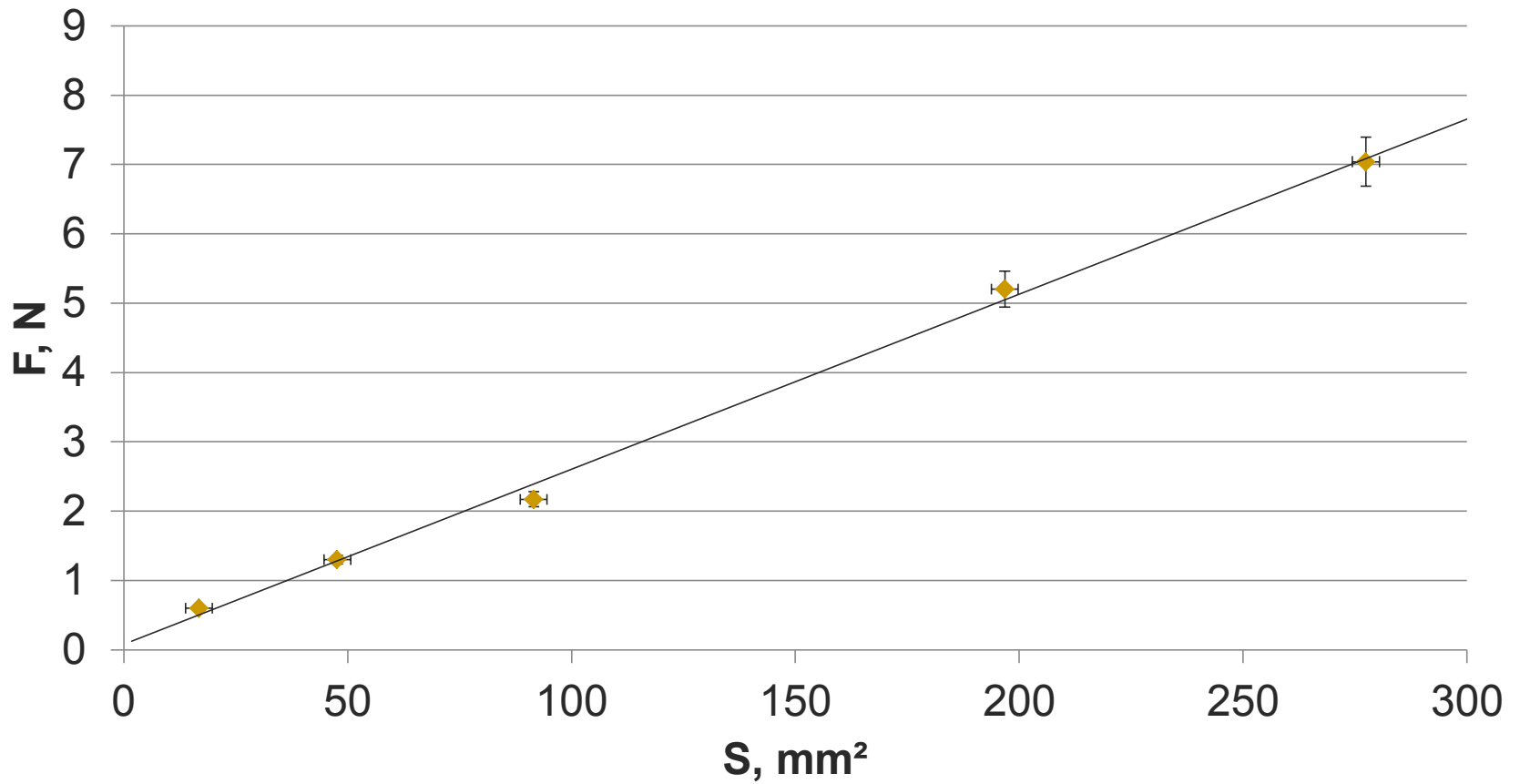
$P_1$



$P_2$

$$P_1 < P_2$$

# Dependence the removing force on the area of surface



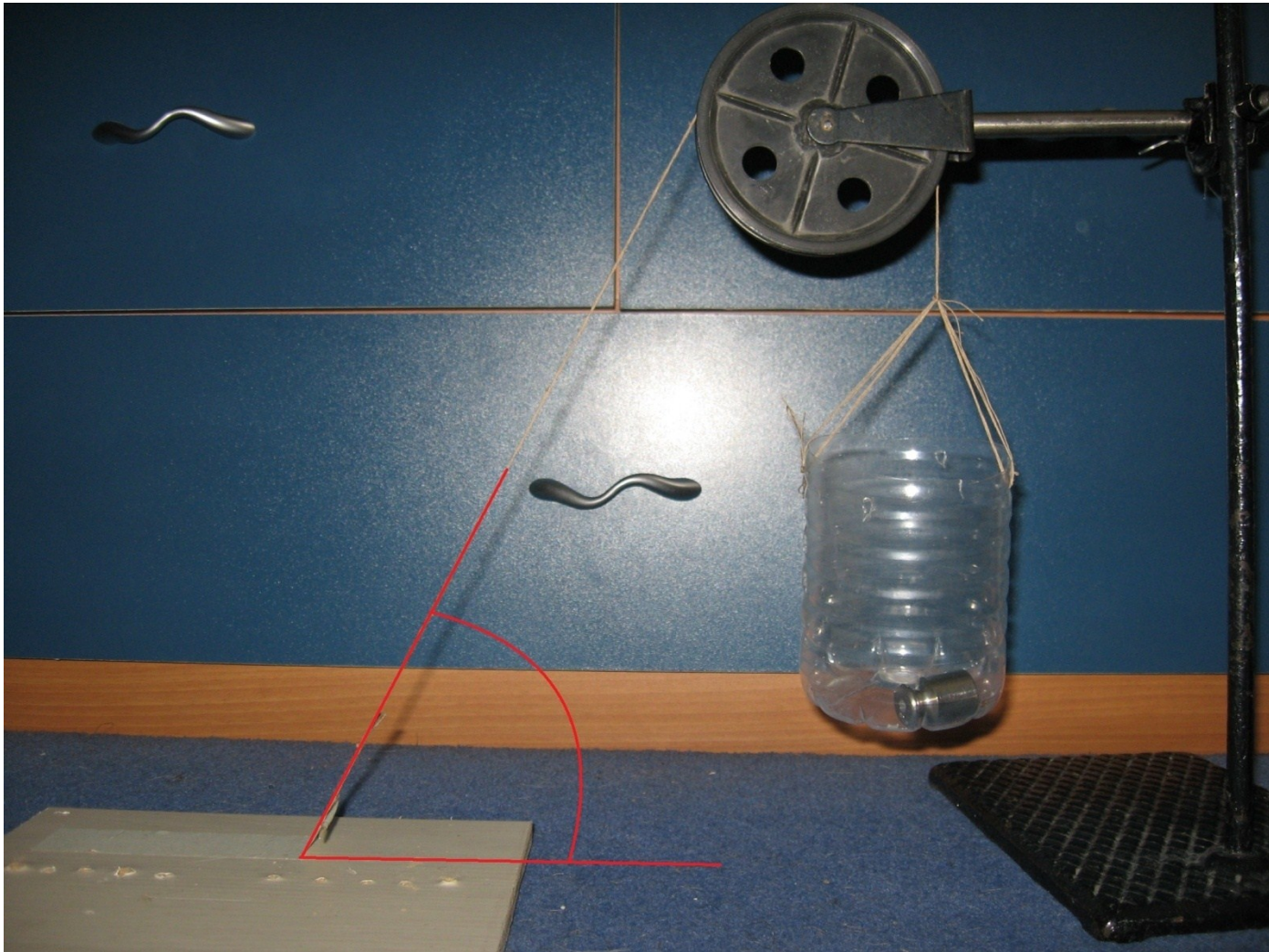
Force necessary to remove  
1mm<sup>2</sup> area.

Force necessary  
to remove 1mm<sup>2</sup>  
area of tape

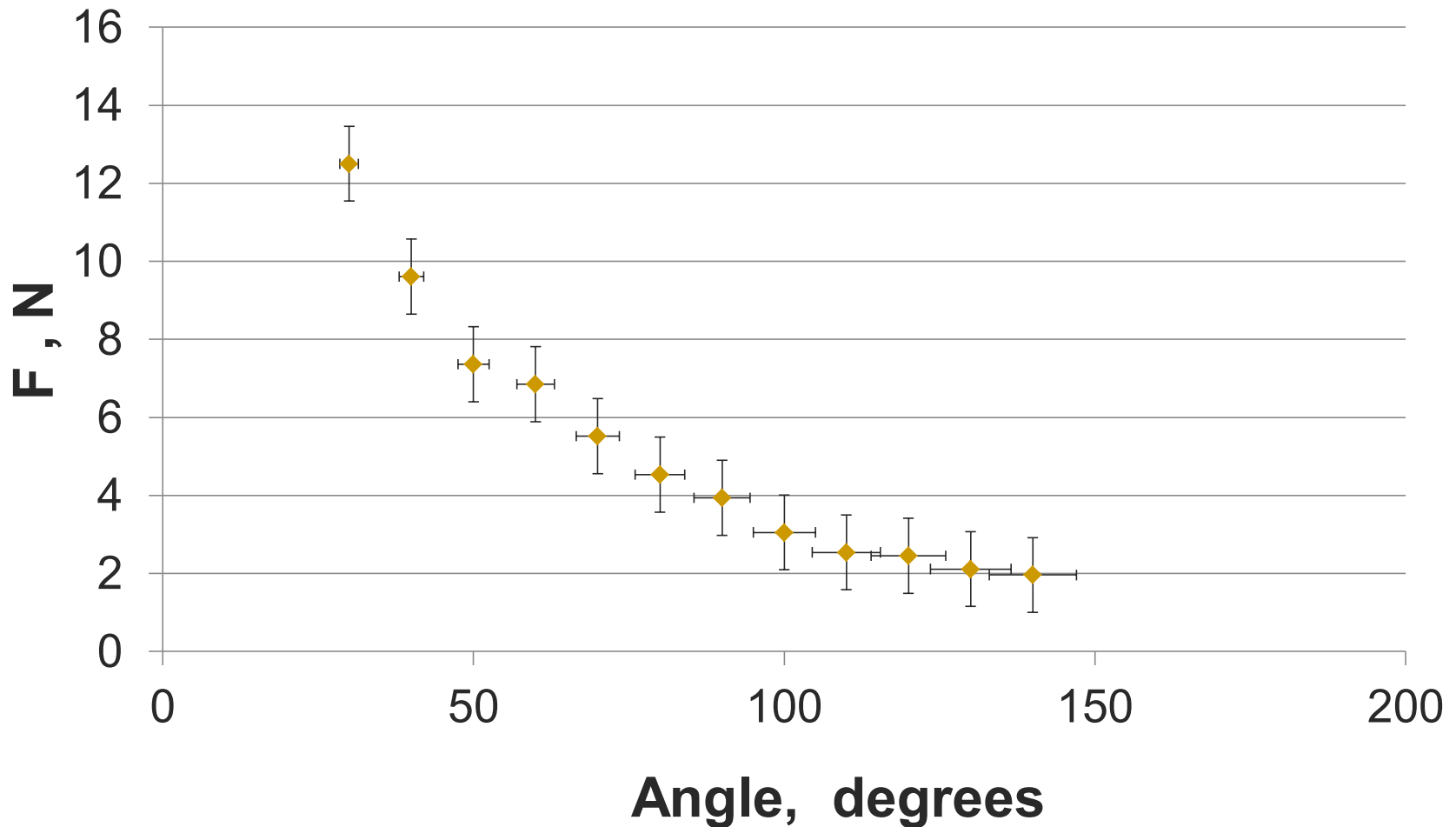
$$F_d = \frac{F}{S}$$

$$F_d = 0,027 \frac{N}{mm^2}$$

# [ Dependence on removal angle ]



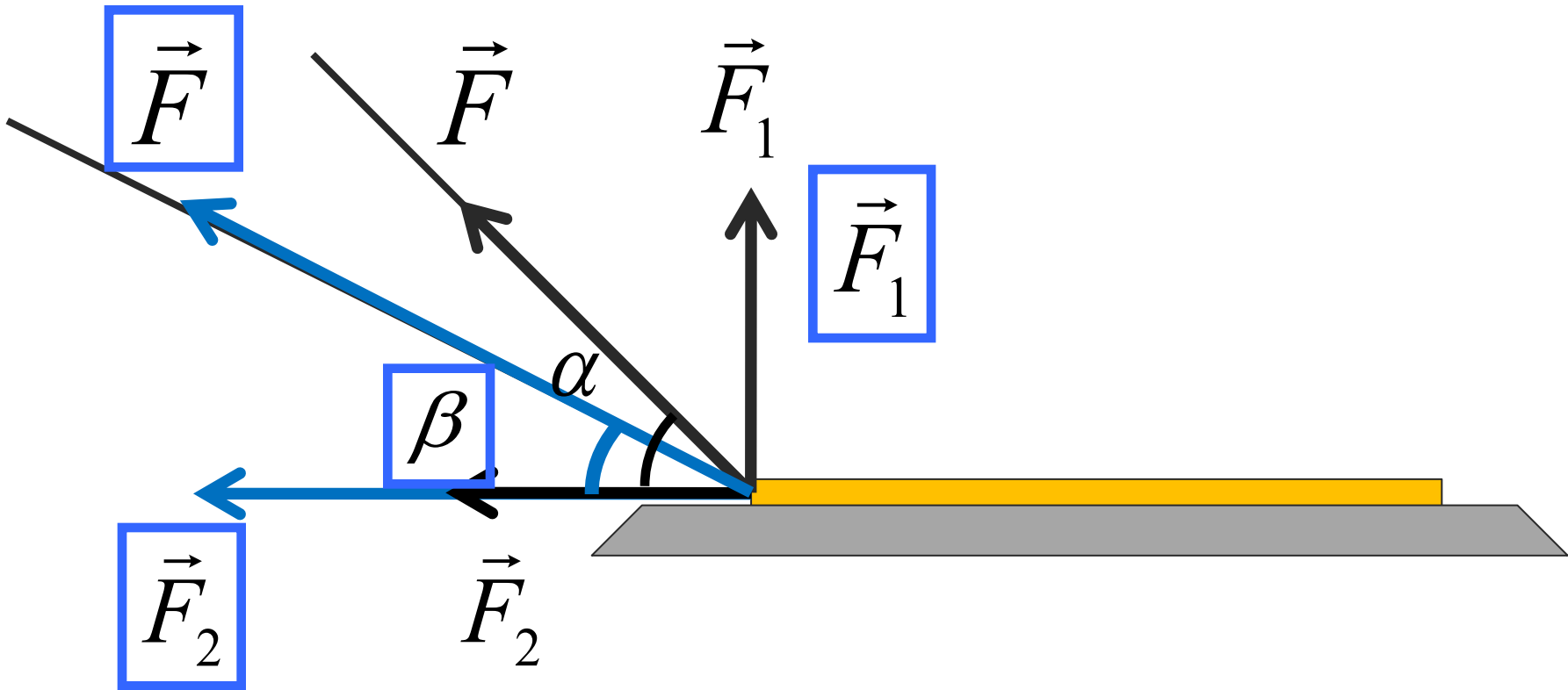
# Dependence the removing force on the application angle



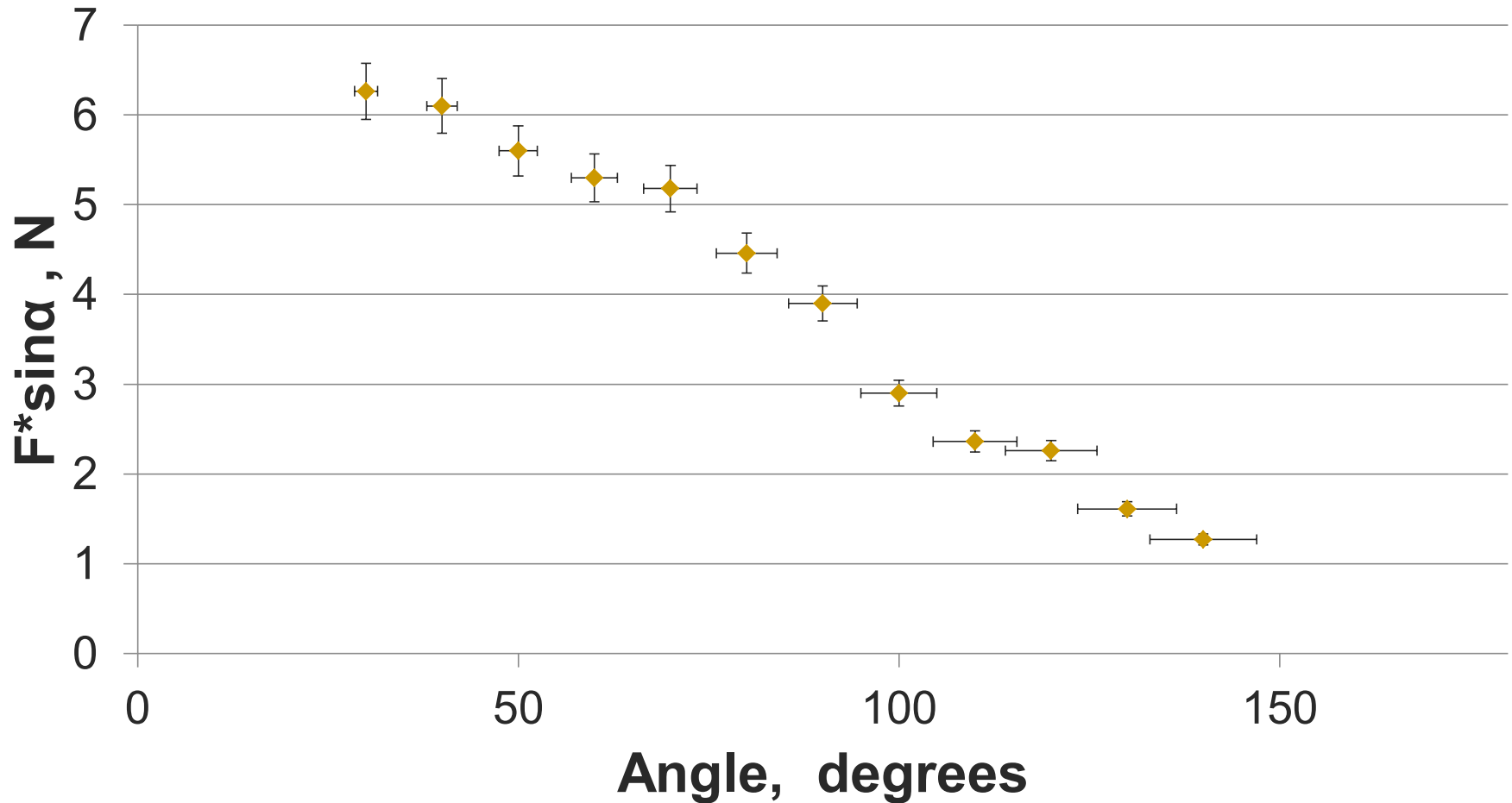
[

$$F_1 = F \times \sin \alpha$$

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# Dependence the vertical part of removing force on the application angle



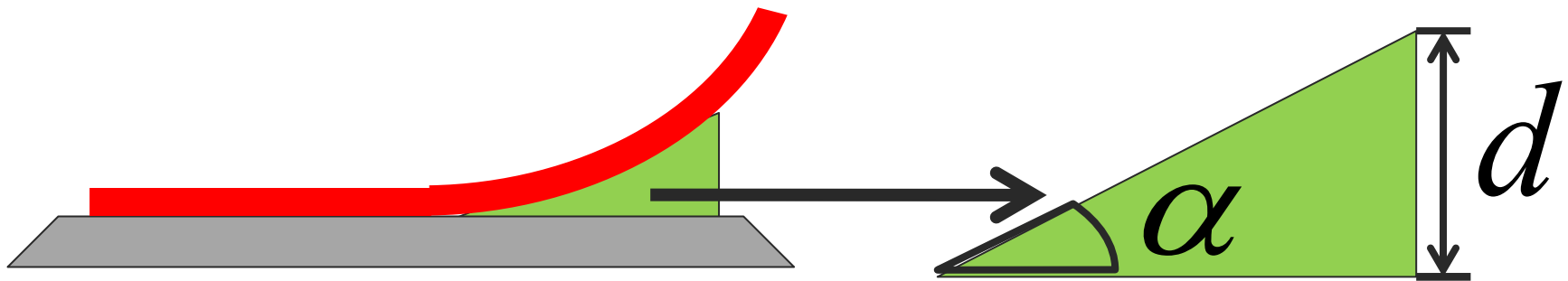
# Derivation of the formula working area tape

$$F_1 = S_w \cdot F_d$$

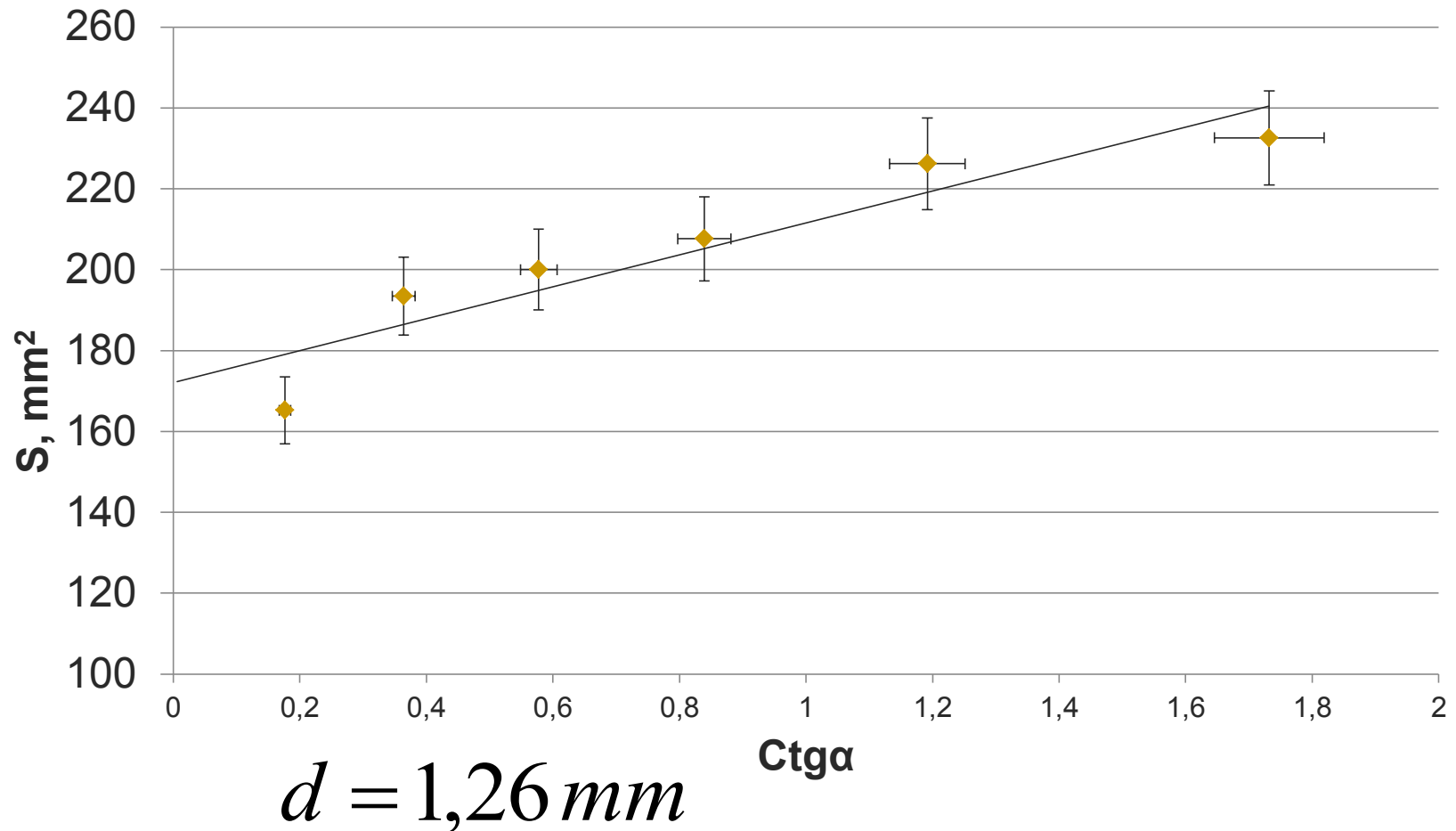
$$S_w = \frac{F_1}{F_d}$$

[ Maximal distance ]

$$S_w = d \cdot l \cdot \operatorname{ctg} \alpha + b$$



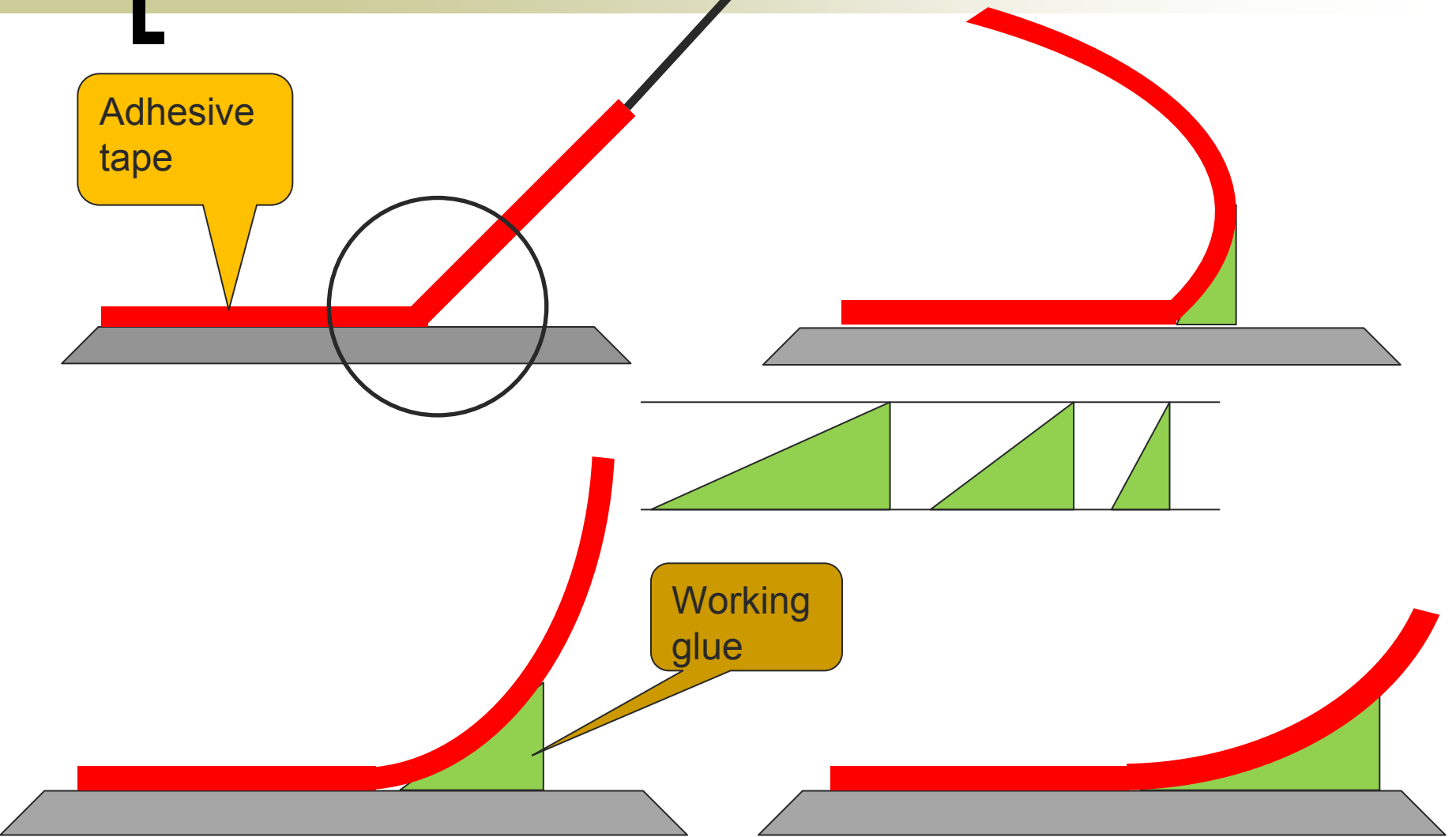
# Dependence the working area on the cotangent of application angle

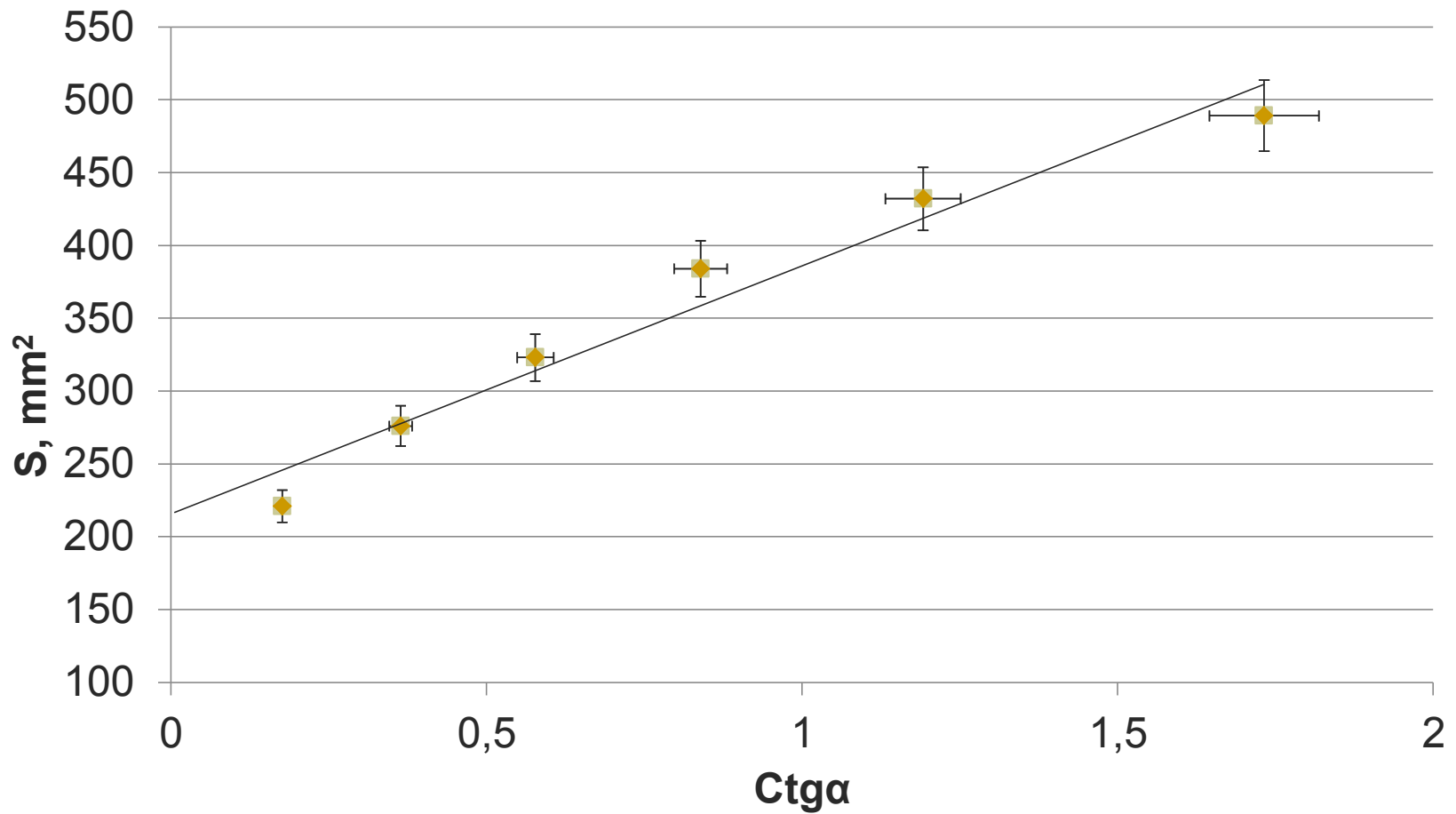


# Scheme

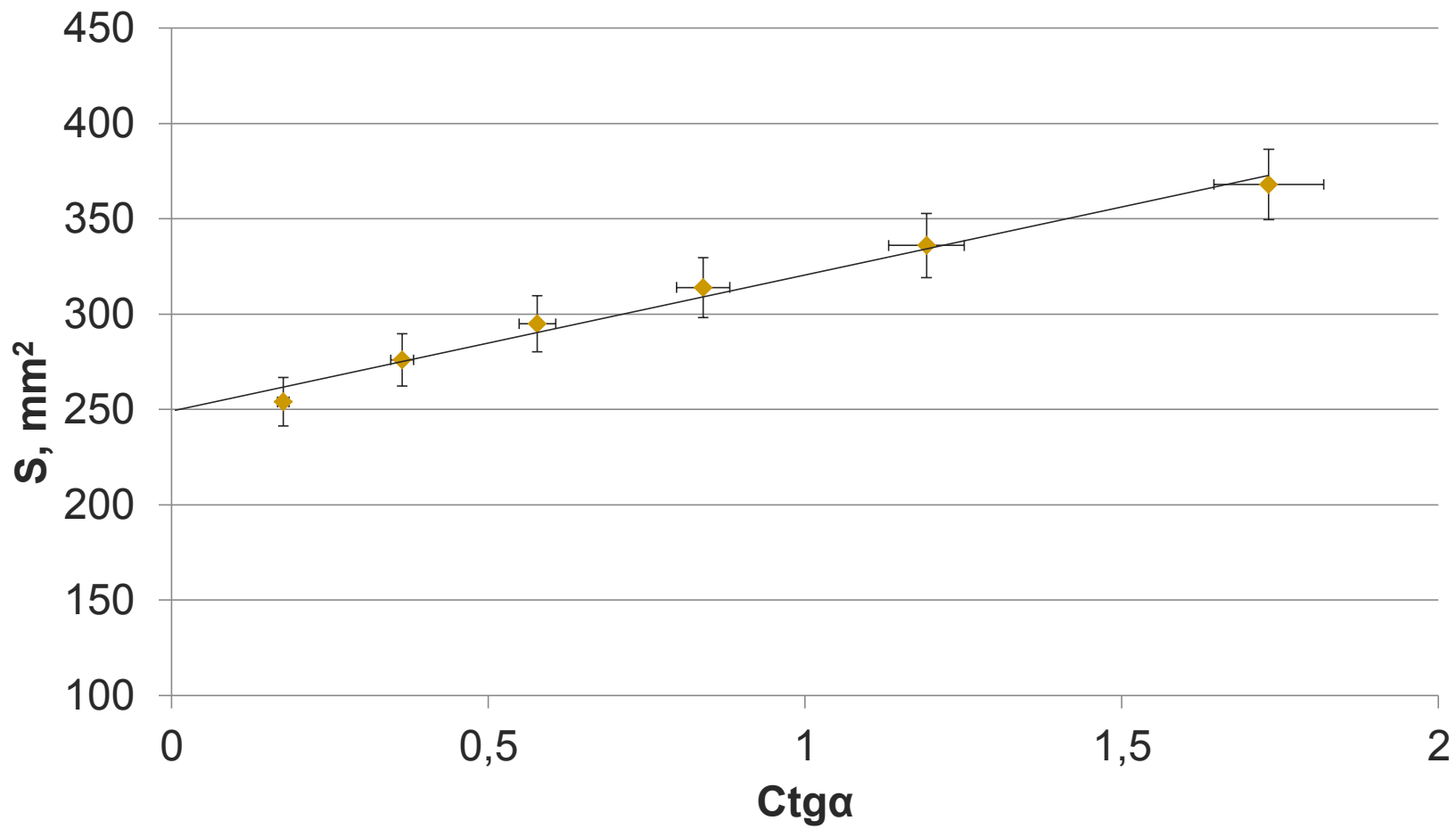
Adhesive  
tape

Working  
glue





$$d = 2,88 \text{ mm}$$



$d = 1,77 \text{ mm}$

# Results and conclusion:

- The force increases while the initial pressure rises until the force becomes saturated. In this case, it will remain constant
- The force increases linearly while the area increases
- The force required to remove the tape increases while the angle decreases
- Tape has the working area
- Maximal distance between tape and surface found

# [References]

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- «*Nature: a weekly journal of science*»
- academic journal “**Science**”