Kísérletek és magyarázatok
Biztosan úgy van?

Baranyai Klára

Bata Márton, Szabó Kristóf, Szabó Roland, Popescu Barnabás 11.b,

Gyüre-Garami Blanka, Hajna Ádám, Sipos Ferenc, Pirity Márton 11.c,

Farkas Ábel, Mike Gergő 12.c

Berzsenyi Dániel Gimnázium, Budapest

ELTE Atomcsill 2026. február 12.

Rézlemez a vízen

A. Luzin: An unsinkable disk

Quantum 1999. szeptember/október
V.10. N.1., 42. oldal

Minden cikk elérhető:
https://www.nsta.org/quantum-magazine-math-and-science

Rézlemez:

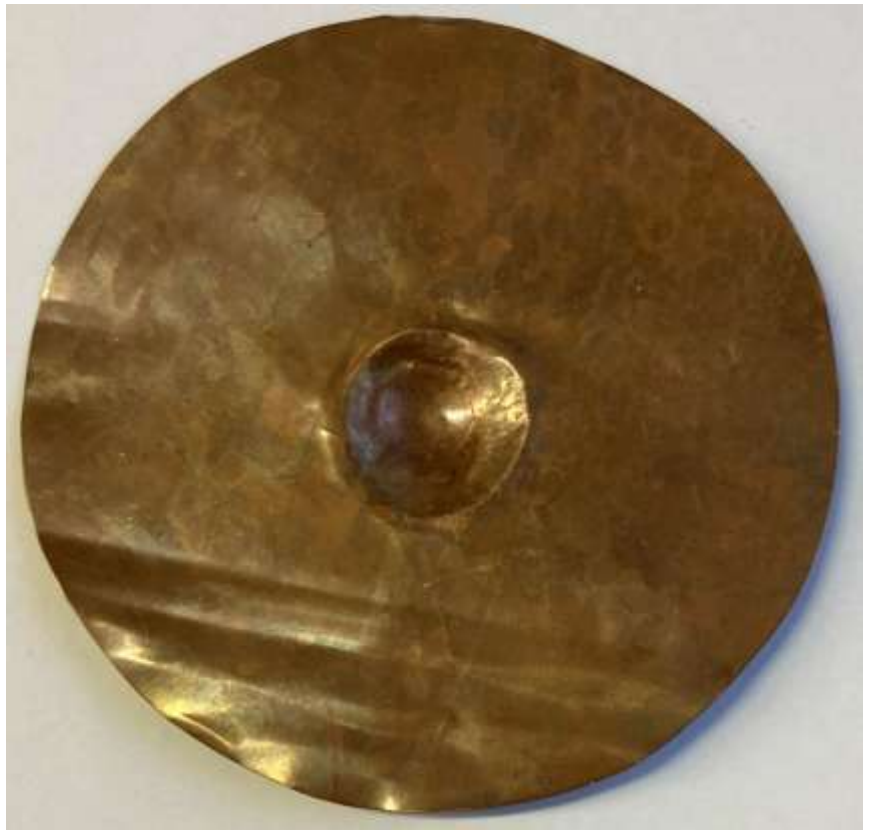
Kör alakú, közepén 1 cm sugarú, kis mélyedés

Tömege 14 gramm

Sugara 5 cm

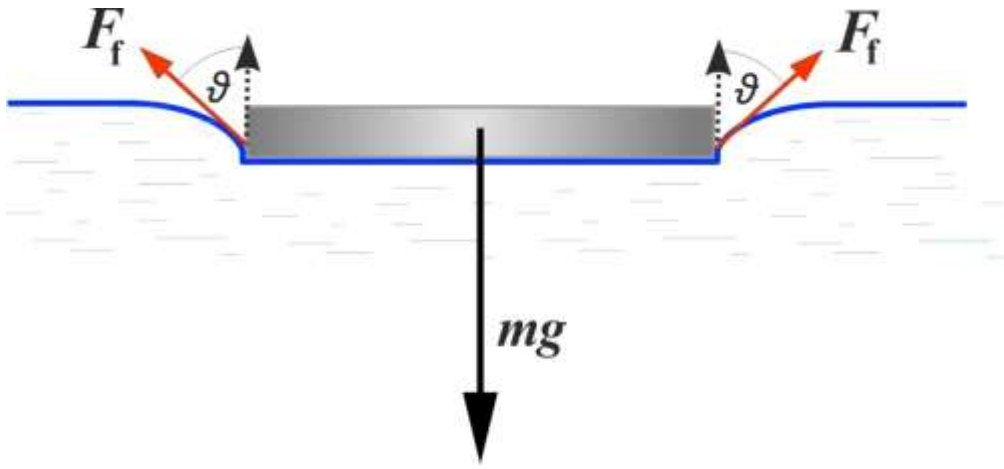
Vastagsága 0,2 mm

Sűrűsége 8,94 g/cm^3



Rézlemez a vízen

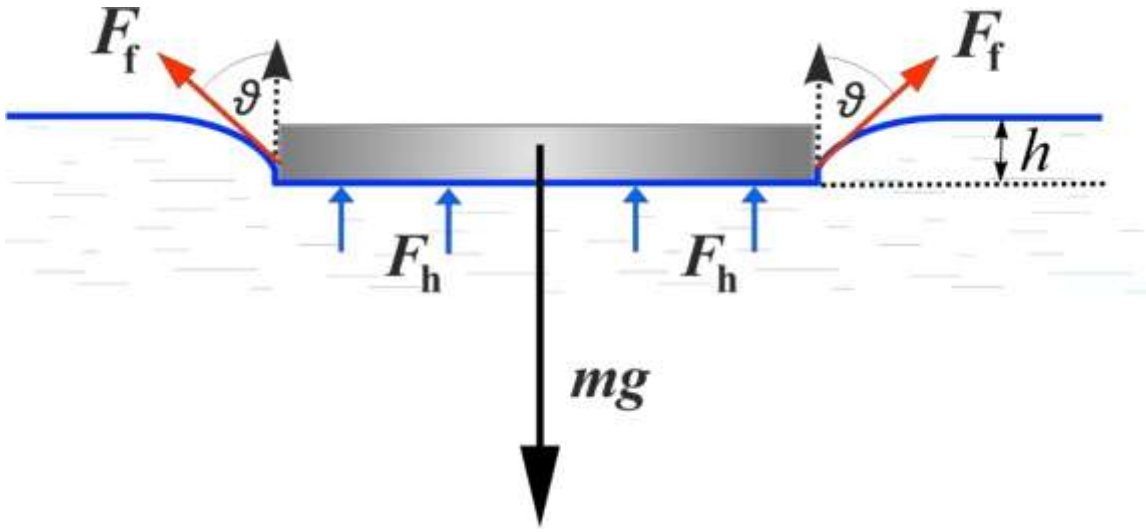
A felületi feszültség !



$$mg = 0{,}014\text{kg} \cdot 9{,}81\frac{\text{m}}{\text{s}^2} = \mathbf{0,137N}$$

???

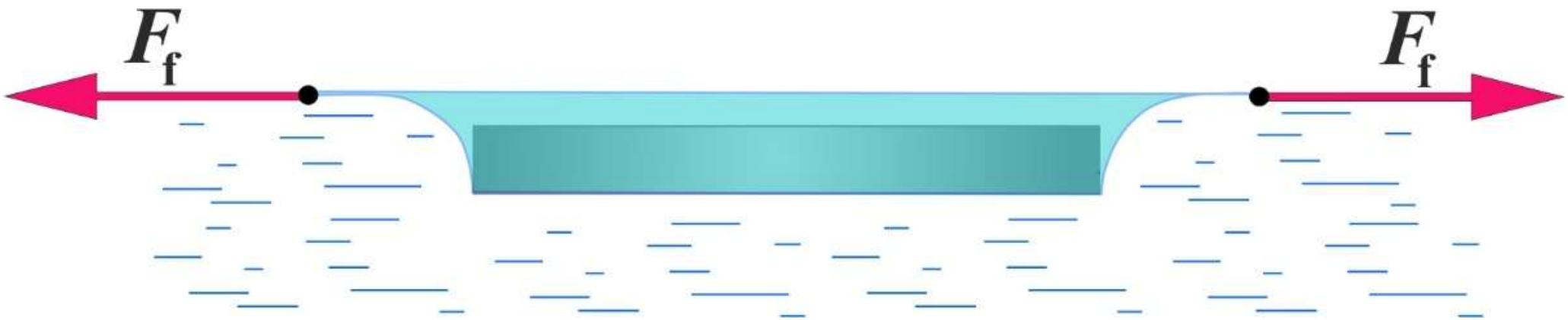
$$F_{max} = \alpha \cdot 2r\pi = 0{,}073\frac{\text{N}}{\text{m}} \cdot 0{,}314\text{m} \approx \mathbf{0,023N}$$



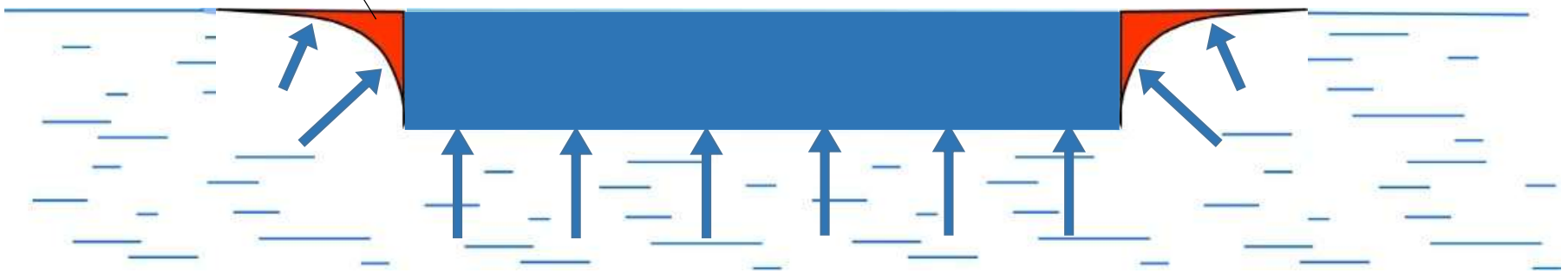
333+ furfangos feladat fizikából

Gnädig Péter – Honyek Gyula – Vigh Máté

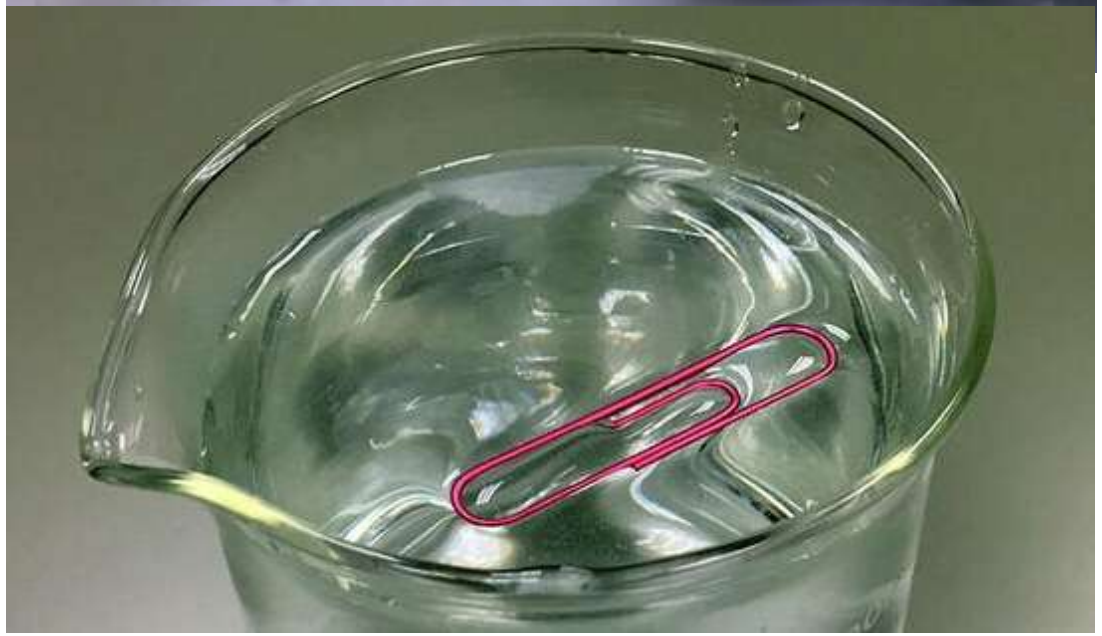
175. feladat


F_f
F_f

Kerülettel arányos felületi feszültségből származó erő

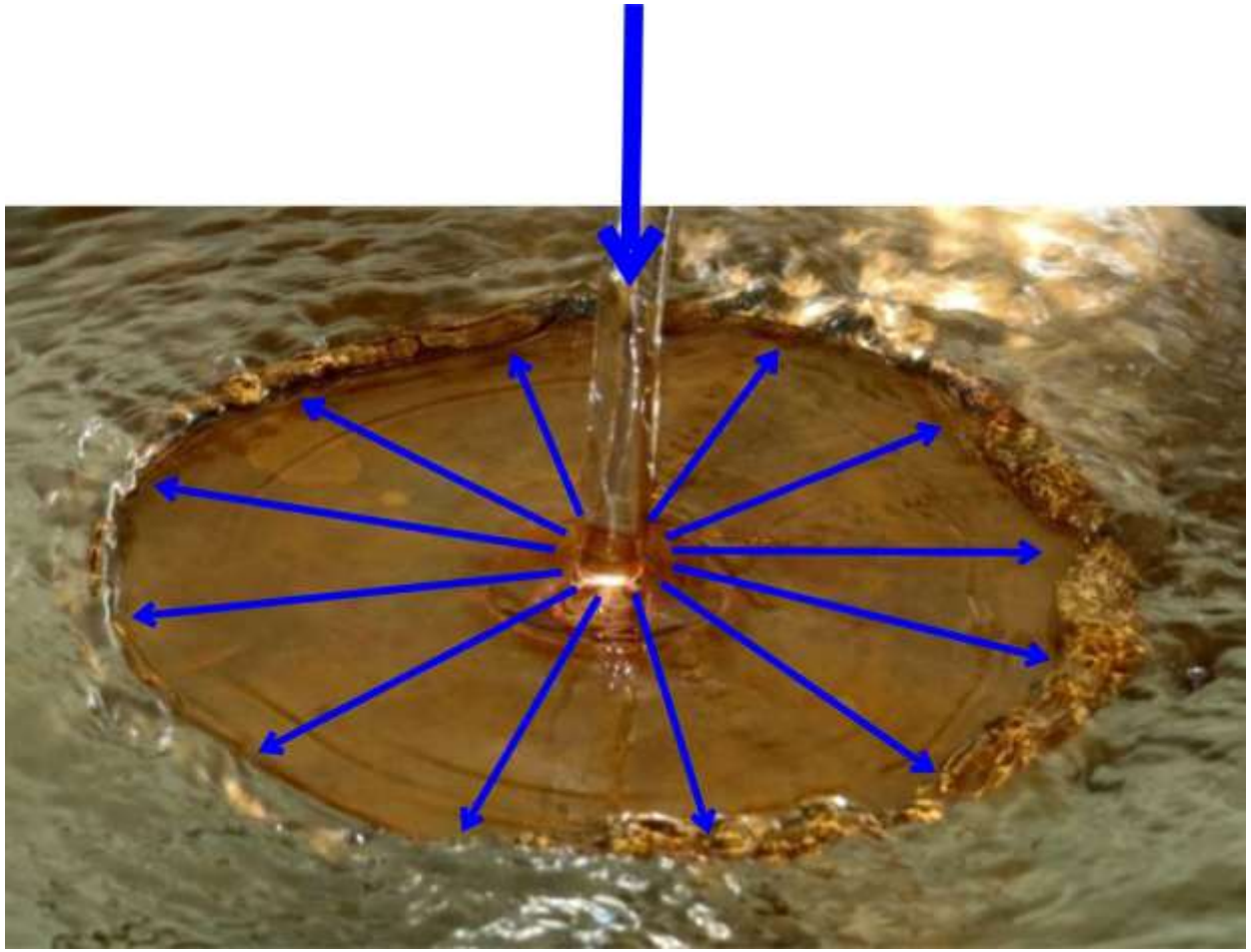


A vízszintes vetület **területével** arányos hidrosztatikai nyomóerő

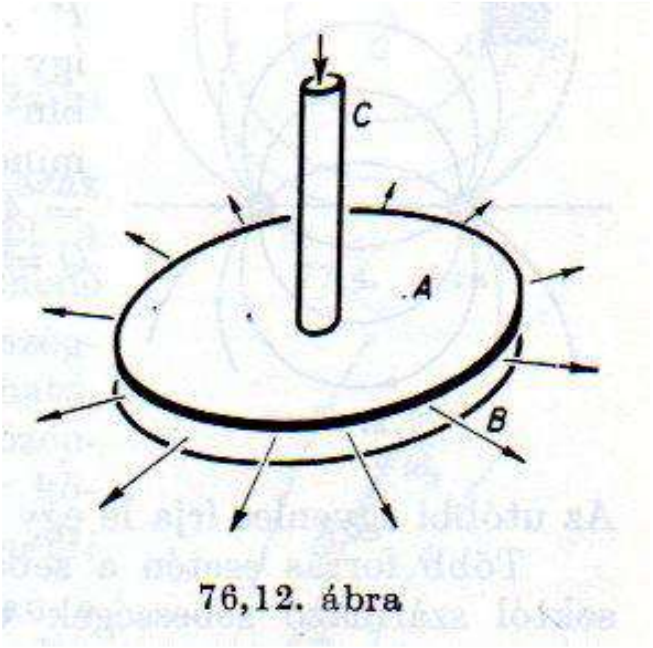


Ha víz kerül fölé, elsüllyed

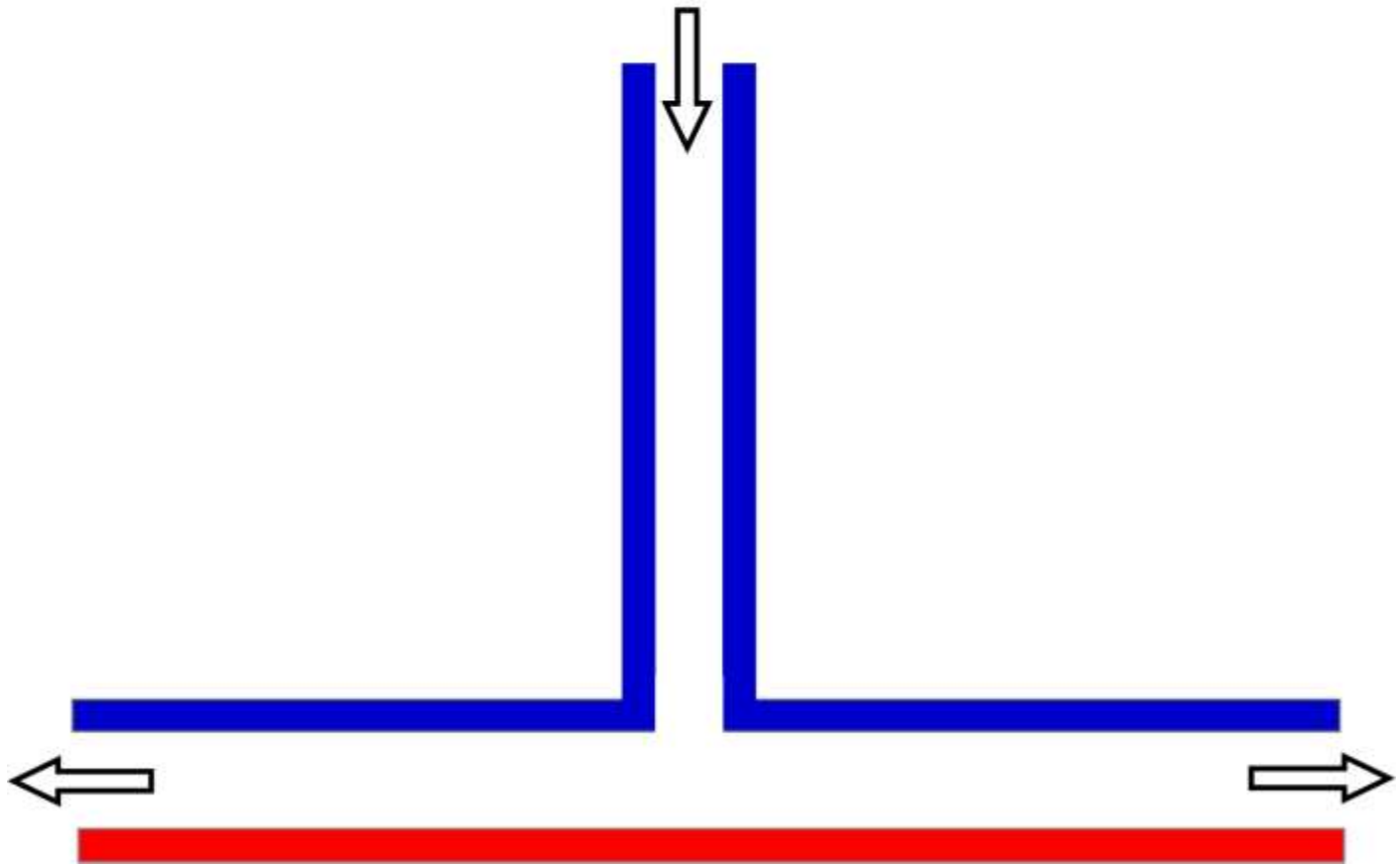
Mégsem süllyed el!!



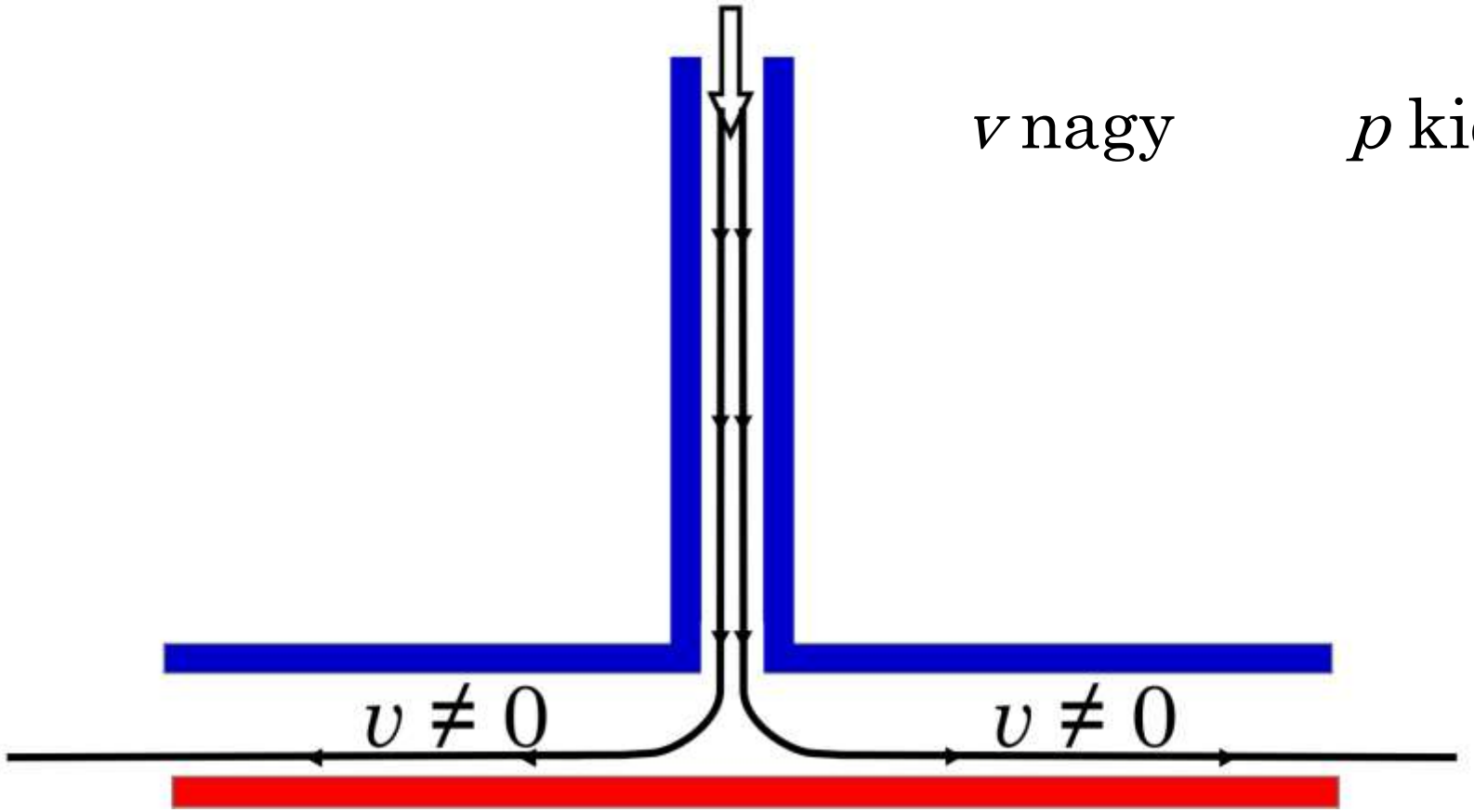
Aerodinamikai paradoxon?



76,12. ábra

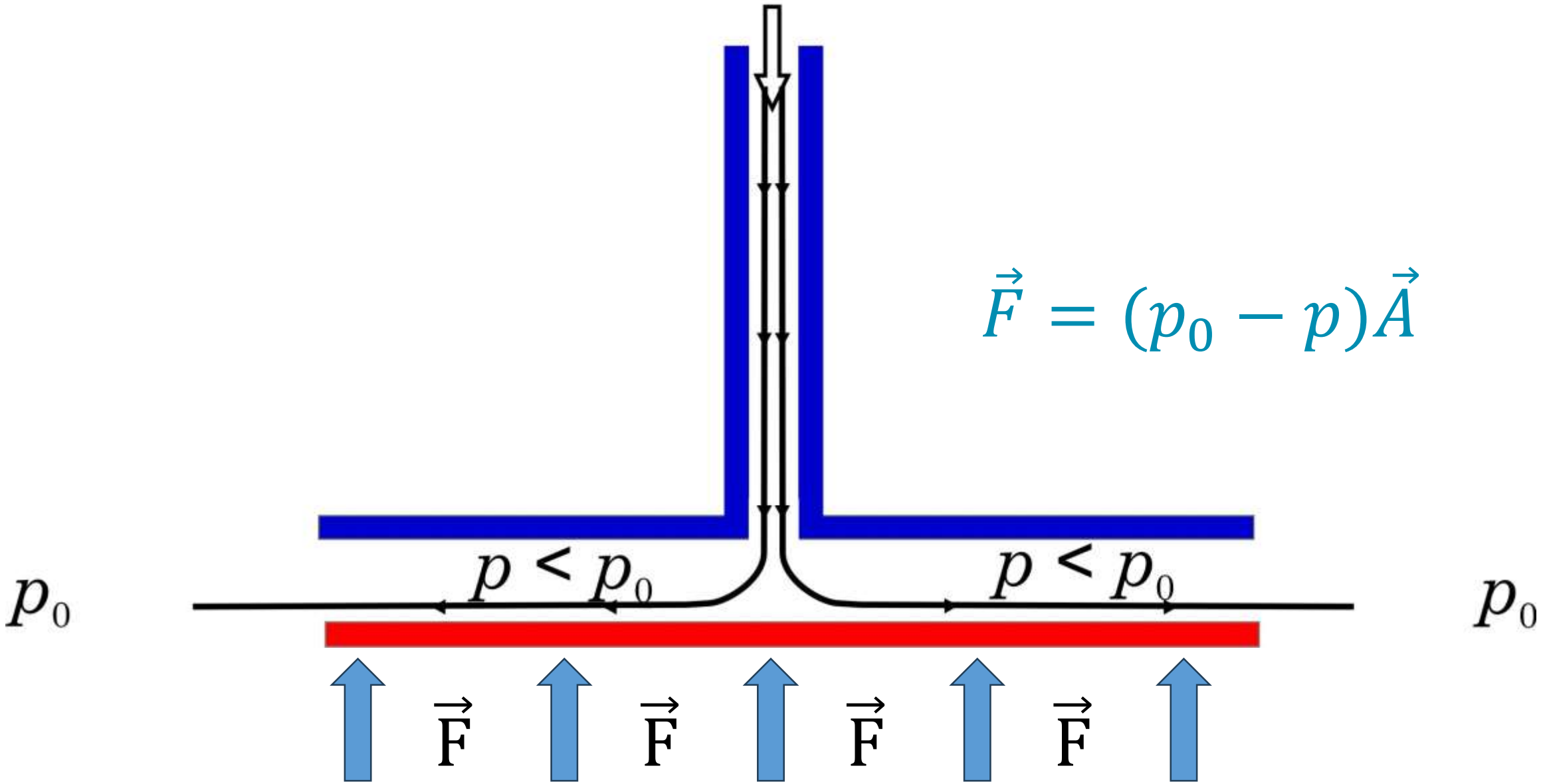


Bernoulli-törvény: $\frac{1}{2}\rho v_0^2 + p_0 = \frac{1}{2}\rho v_1^2 + p_1$

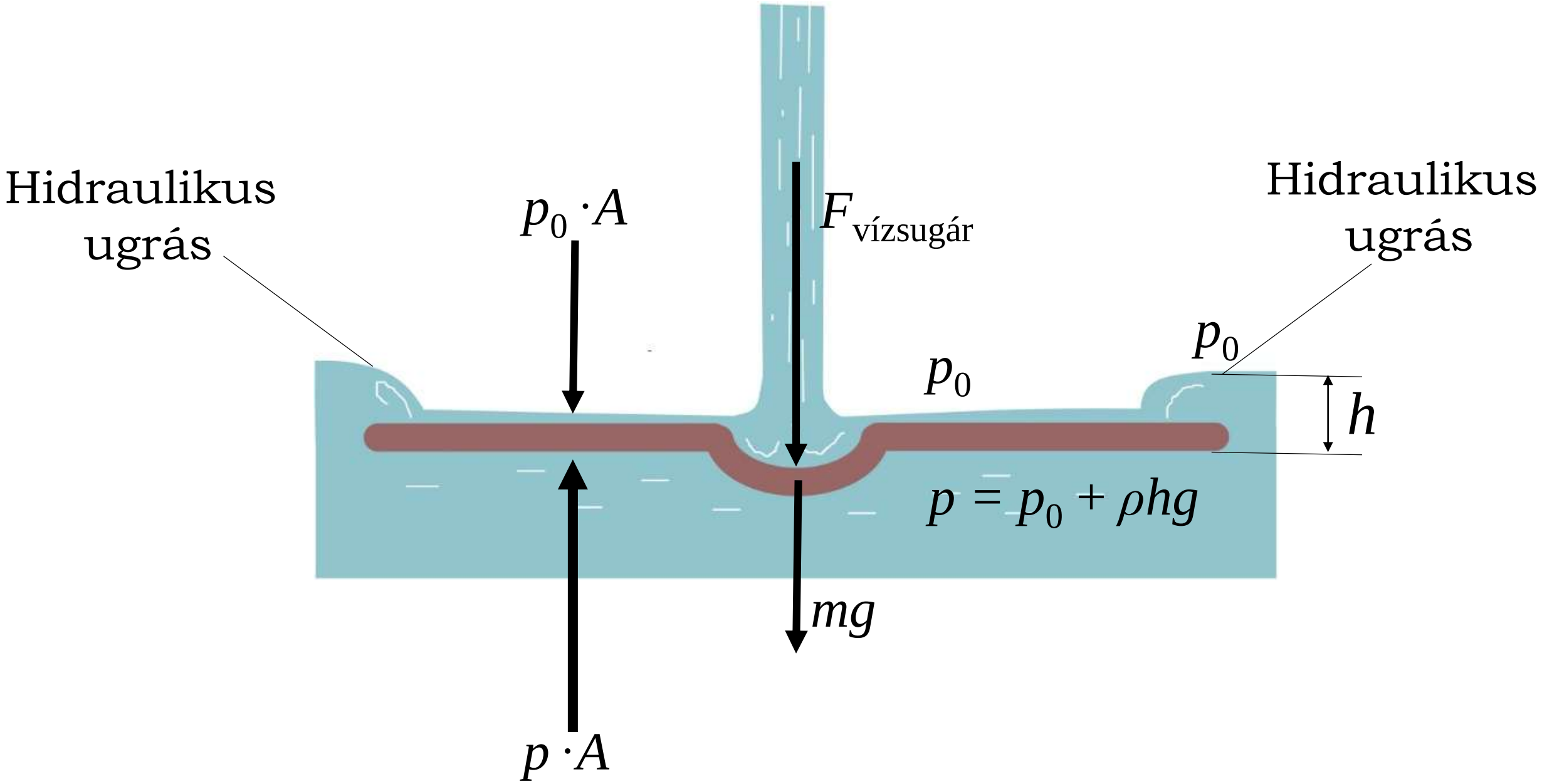


v nagy p kicsi

$$\vec{F} = (p_0 - p)\vec{A}$$



Hidraulikus ugrás

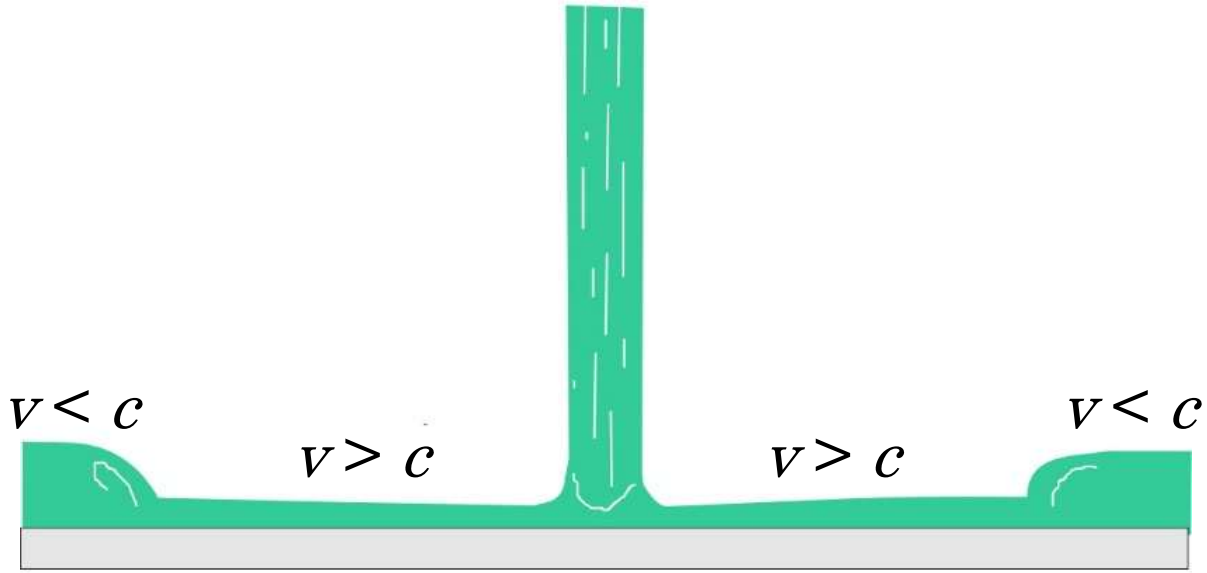

Hidraulikus ugrás
$p_0 \cdot A$
$F_{\text{vízsugár}}$
Hidraulikus ugrás
p_0
p_0
h
$p = p_0 + \rho hg$
mg
$p \cdot A$

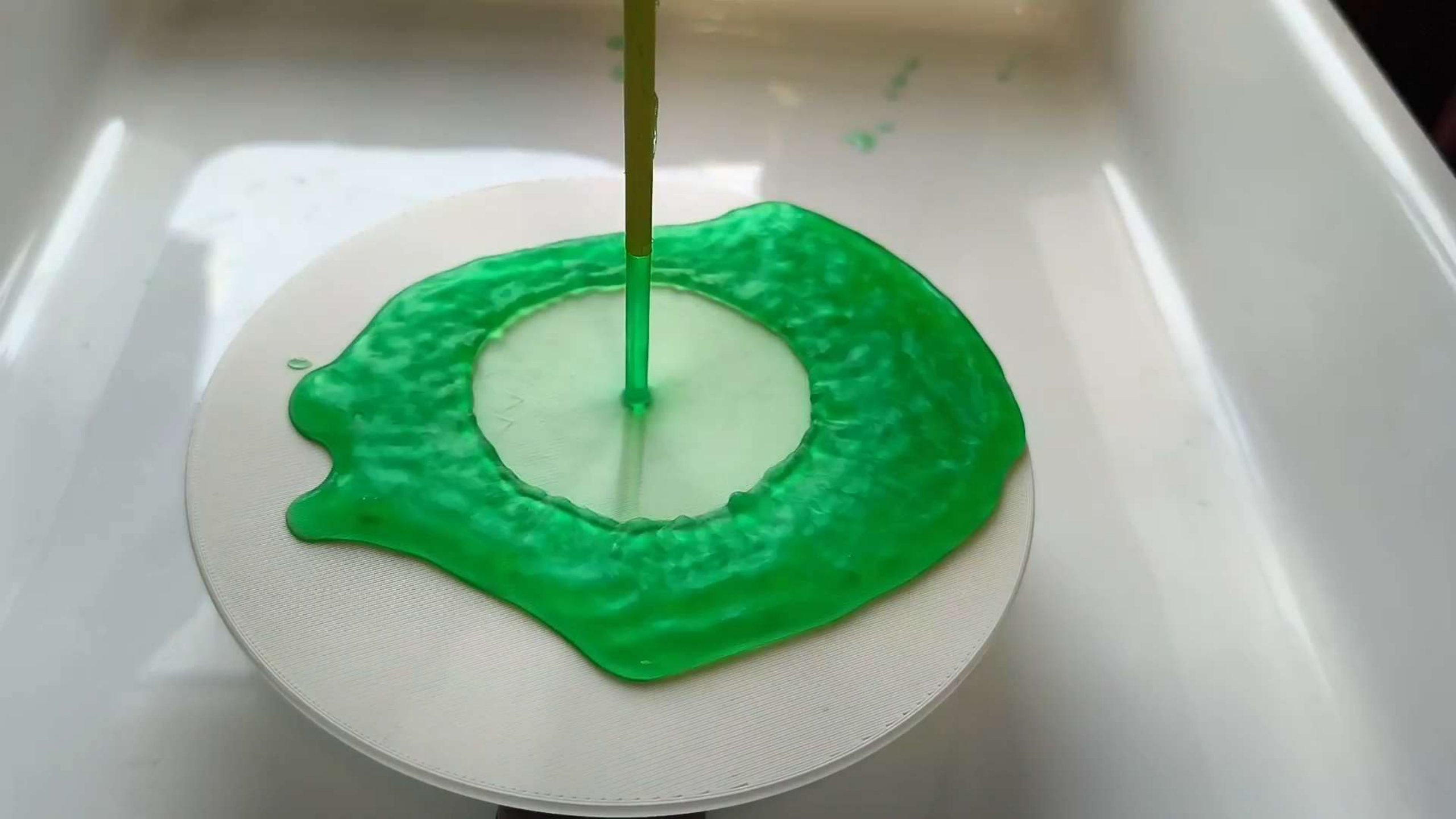
A felszíni hullámok terjedési sebessége: c
Az áramlás sebessége v

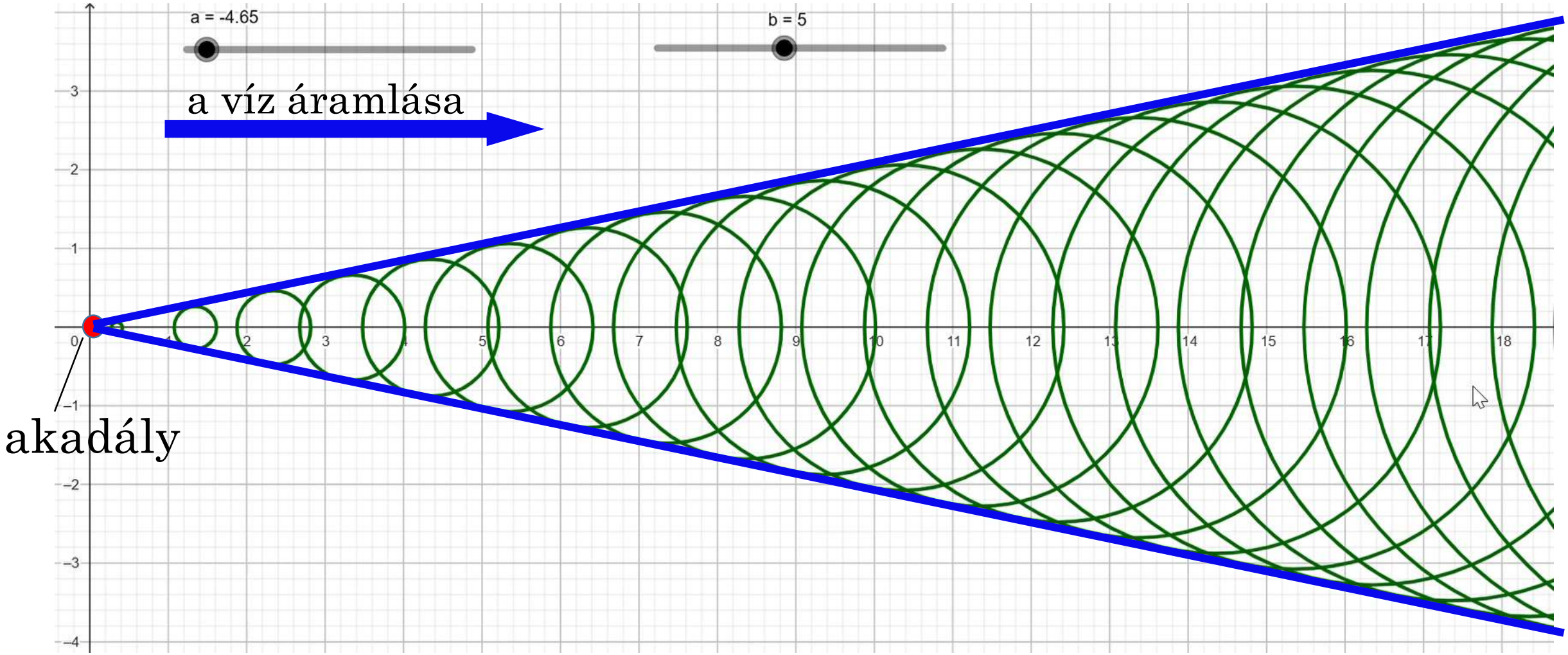
$v < c \quad \rightarrow \quad$ szubkritikus

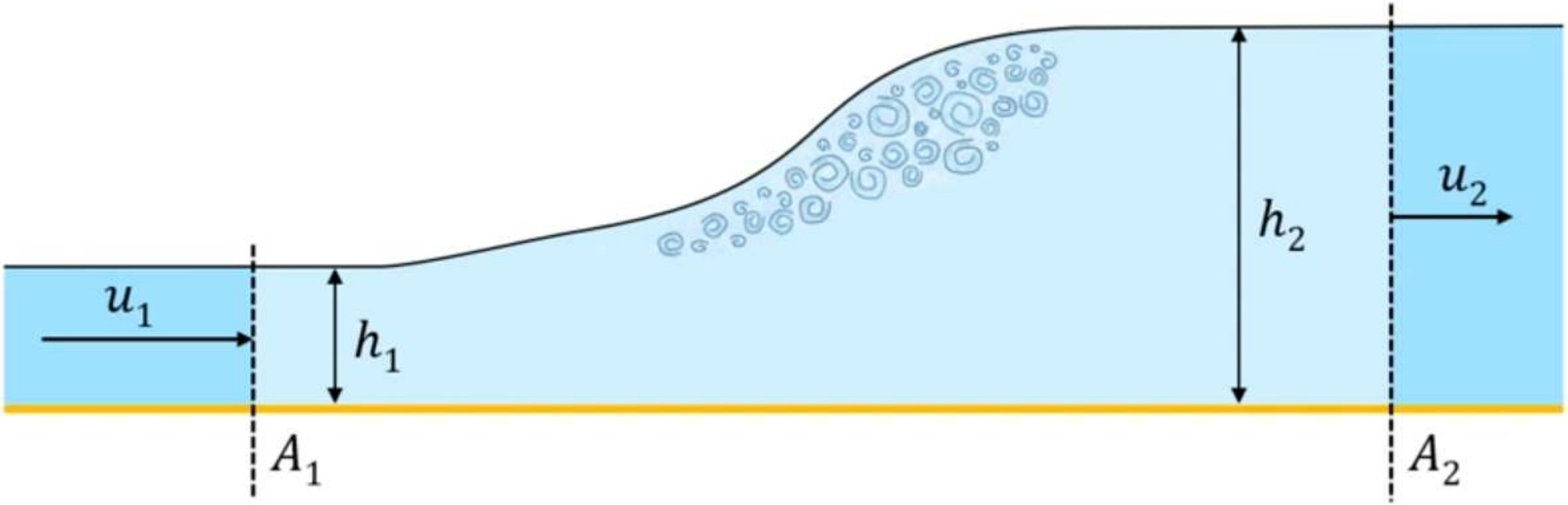
$v > c \quad \rightarrow \quad$ szuperkritikus

$v = c \quad \rightarrow \quad$ kritikus






a = -4.65
b = 5
a víz áramlása
akadály



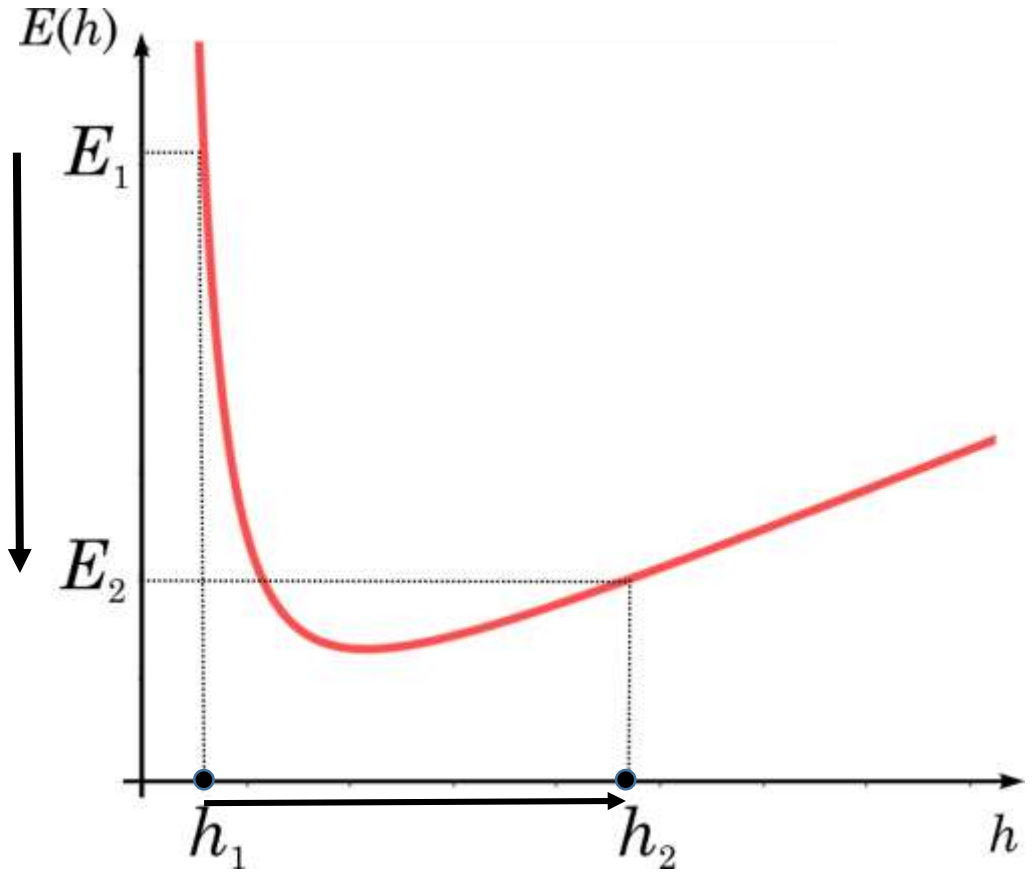
Kontinuitási törvénnyel és az

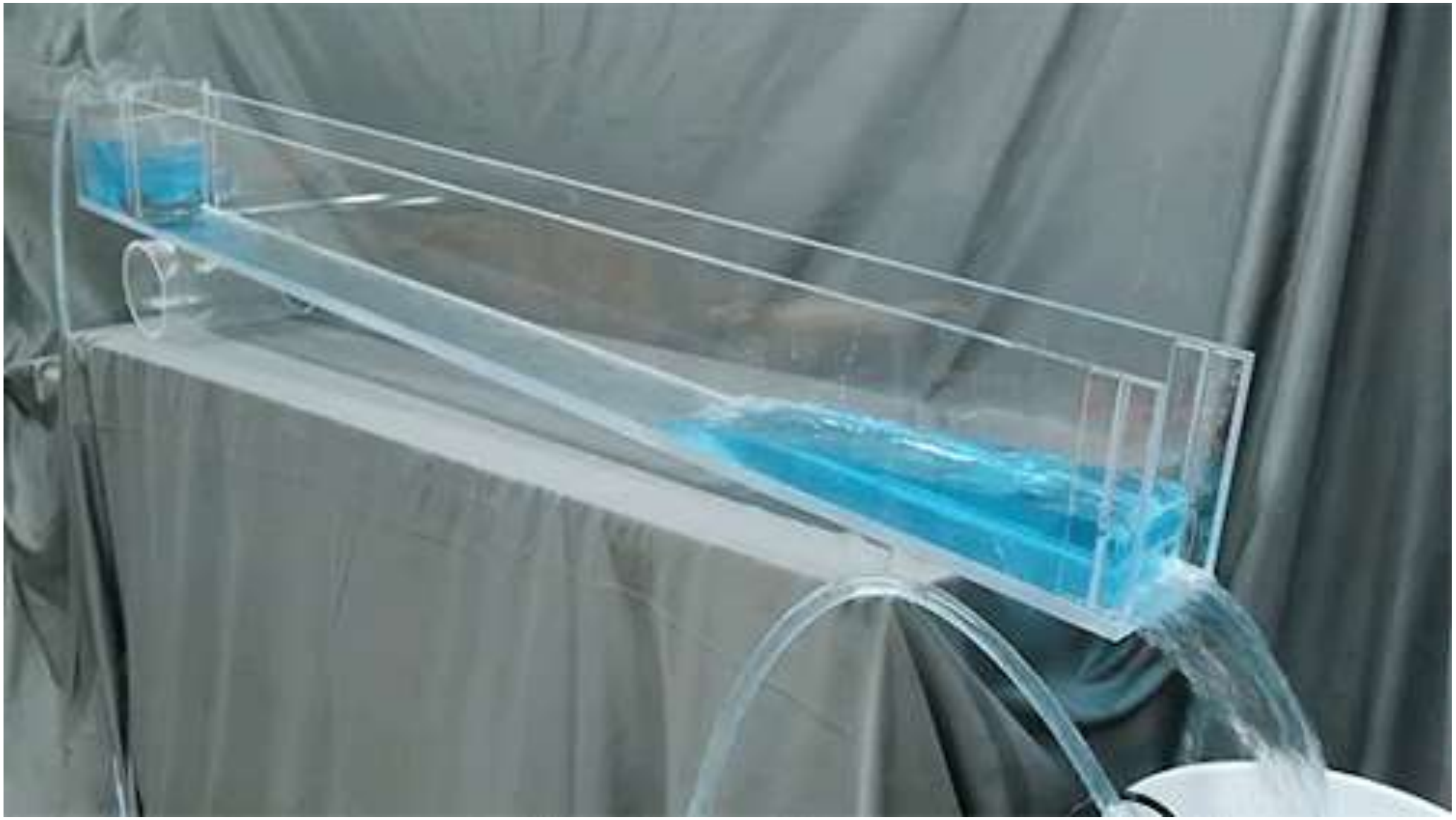
Impulzusmegmaradással h_2 kiszámolható:

$$h_2 = \frac{h_1}{2}\left(\sqrt{1 + 8\frac{{u_1}^2}{g h_1}} - 1\right)$$

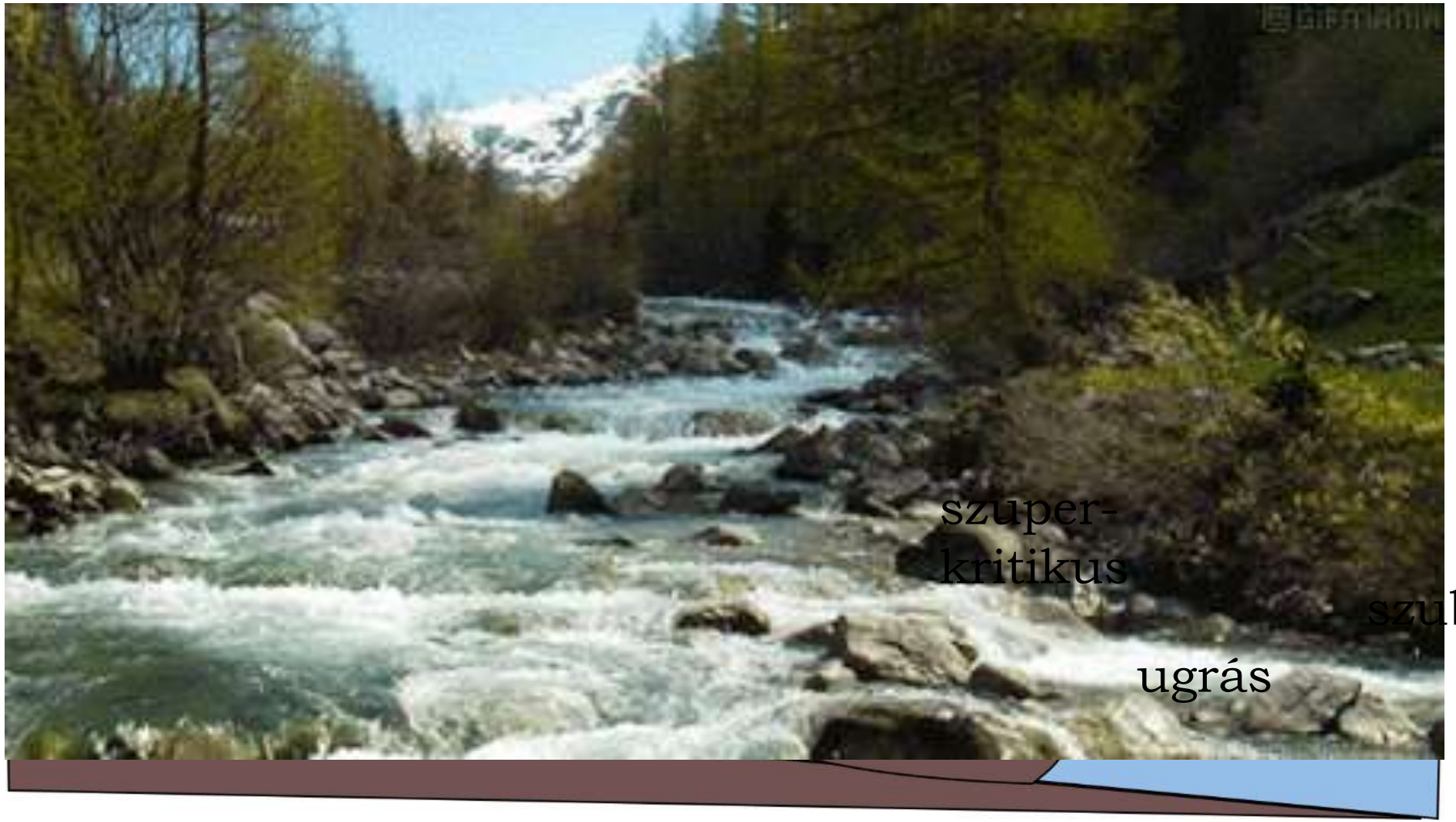
A térfogategységre jutó energia:

$$E(h) = E_{helyzeti} + E_{mozgási} = \rho g h + \frac{\rho q^2}{2b^2}\frac{1}{h^2}$$





https://fyfluiddynamics.com/wp-content/uploads/2019/10/Hydraulic-Jump-1.gif

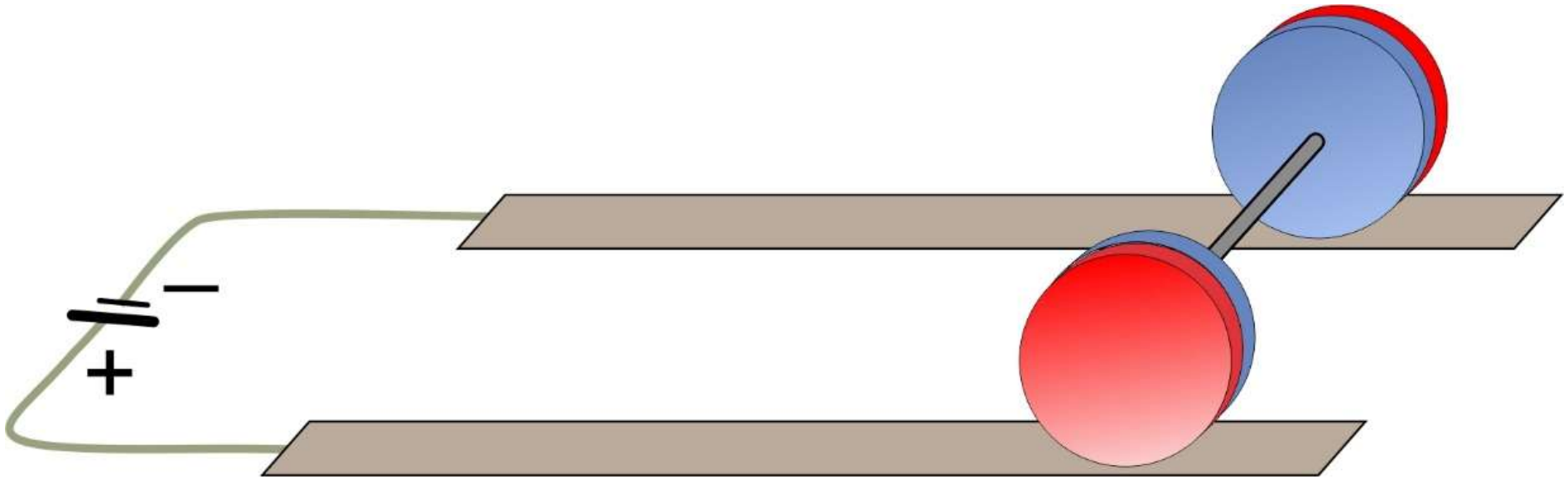

szuper-
kritikus
szubkritikus
ugrás

https://commons.wikimedia.org/wiki/File:Saint_Anthony_Falls-20060617.jpg

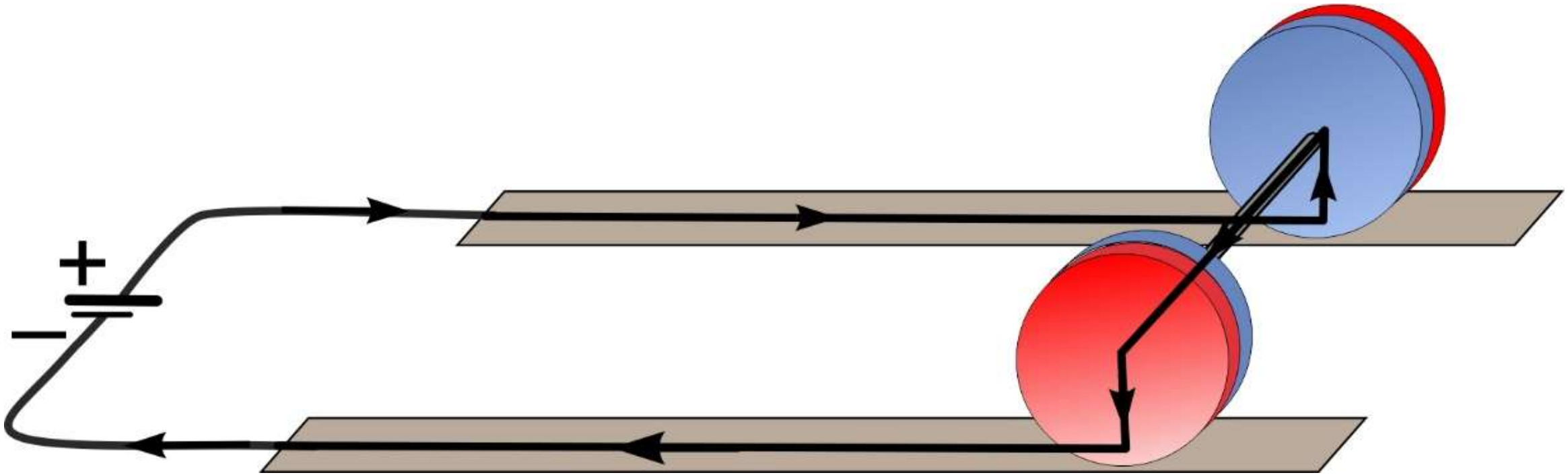
Tamalpais State Park, San Francisco mellett

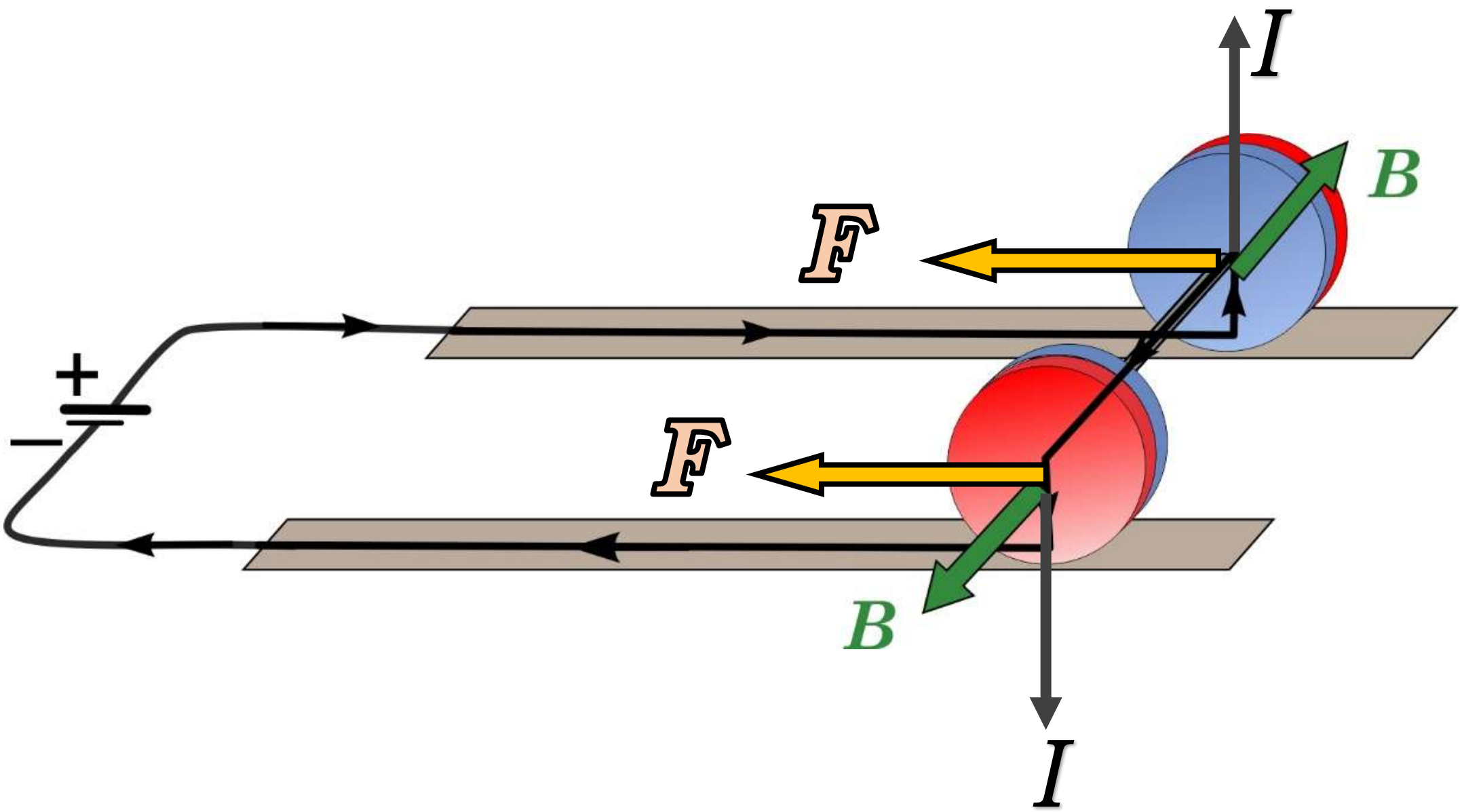
https://fyfluiddynamics.com/2017/12/when-viewed-at-the-right-pace-clouds-can-flow/

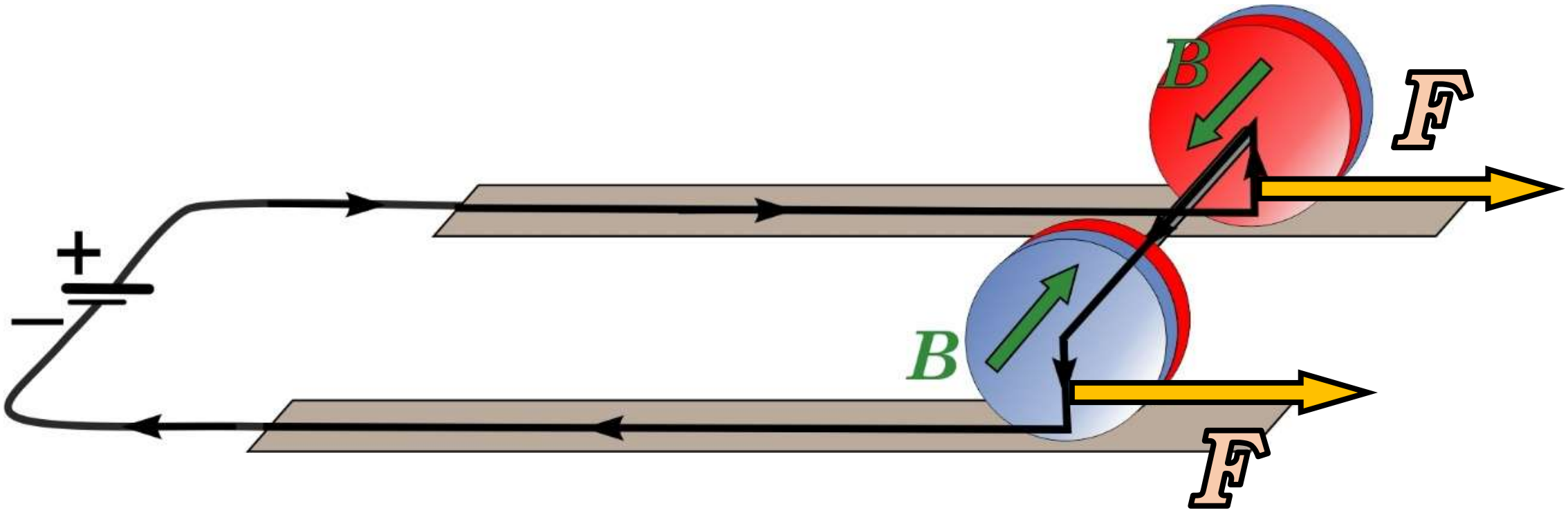
Guruló mágnesek



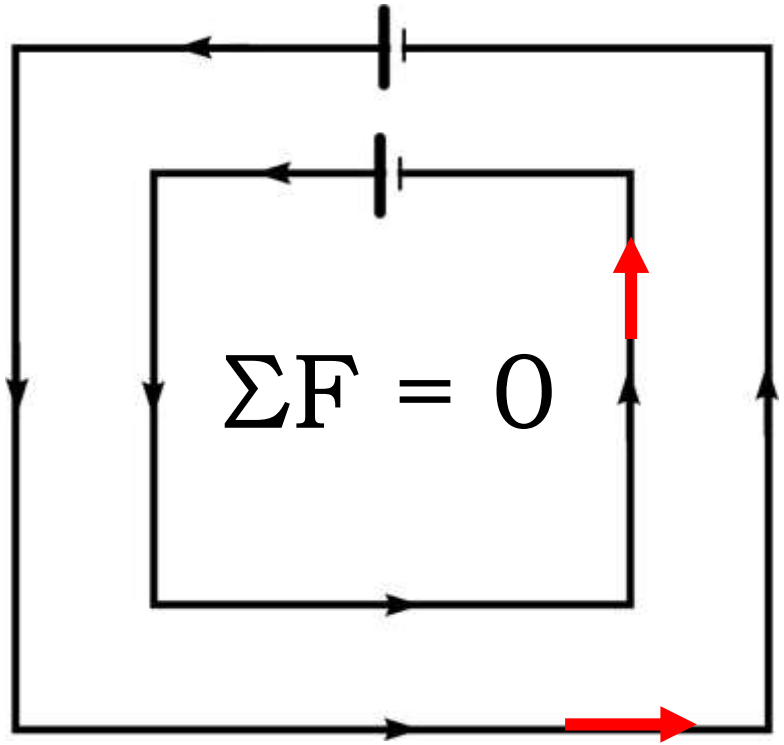

−
+
HOCHSTROM-NE



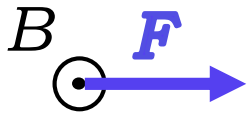

I
B
F
F
B
I


B
F
B
F

Biot-Savart-törvény



$$\Delta B = \frac{\mu_0}{4\pi}\frac{I\Delta l}{r^2}\sin\alpha$$



Erő-ellenerő??

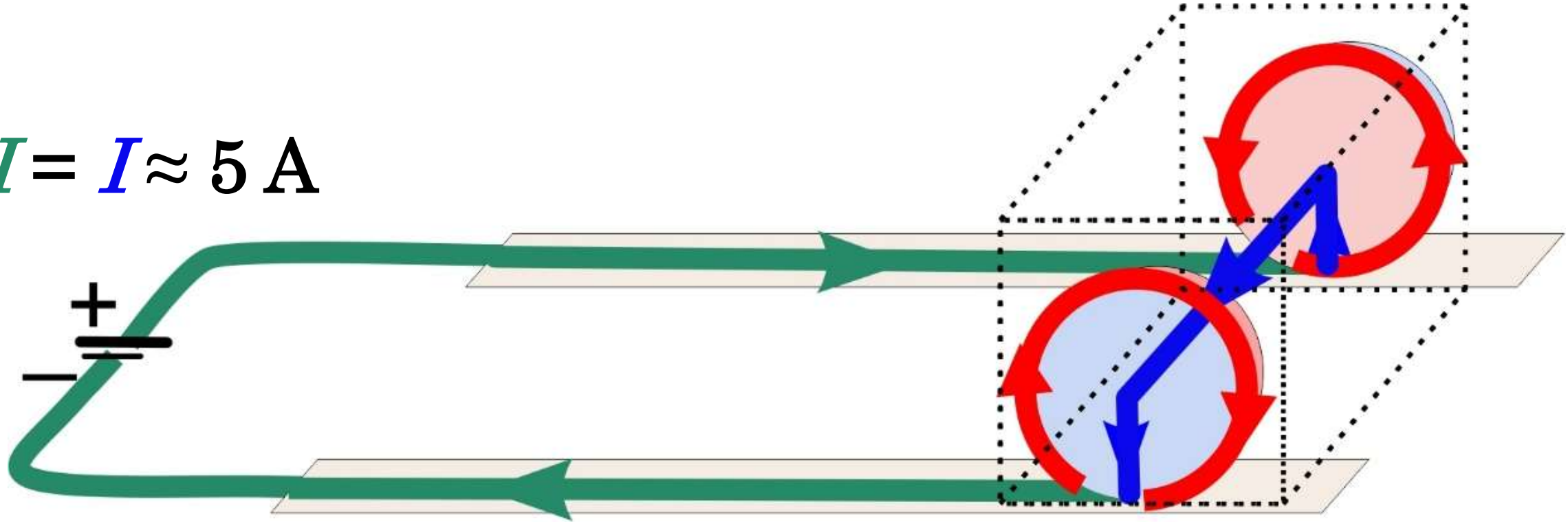
Impulzusmegmaradás?

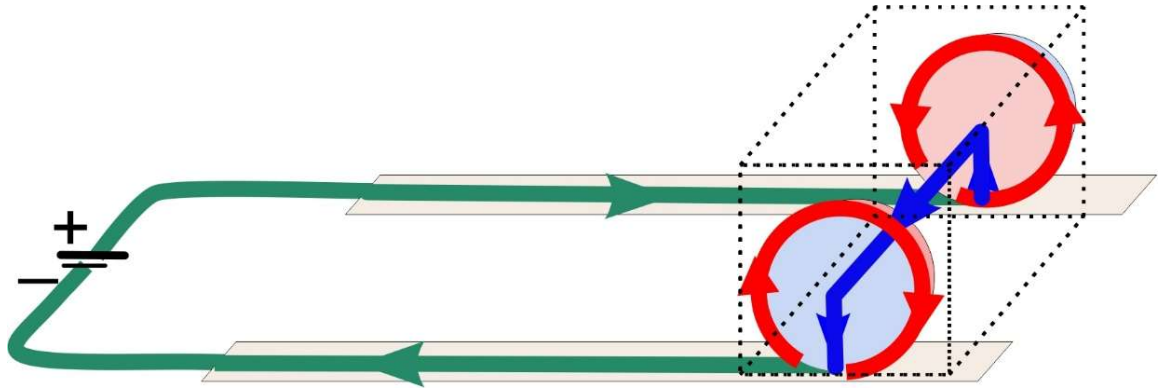
$F = 0$

$B = 0$

$I \approx 1000\ \mathrm{A}$

$I = I \approx 5\ \mathrm{A}$





Erő-ellenerő a két áramkörre:

$$\boldsymbol{F}_{KZ\to P} + \boldsymbol{F}_{P\to KZ} = 0$$

$$\boxed{\boldsymbol{F}_{K\to P} + \boldsymbol{F}_{Z\to P} + \boldsymbol{F}_{P\to K}} + \boldsymbol{F}_{P\to Z} = 0$$

$$\boldsymbol{F}_{K\to P} + \boldsymbol{F}_{Z\to P} + \boldsymbol{F}_{P\to K} = -\boldsymbol{F}_{P\to Z}$$

A mozgó részre ható erő:

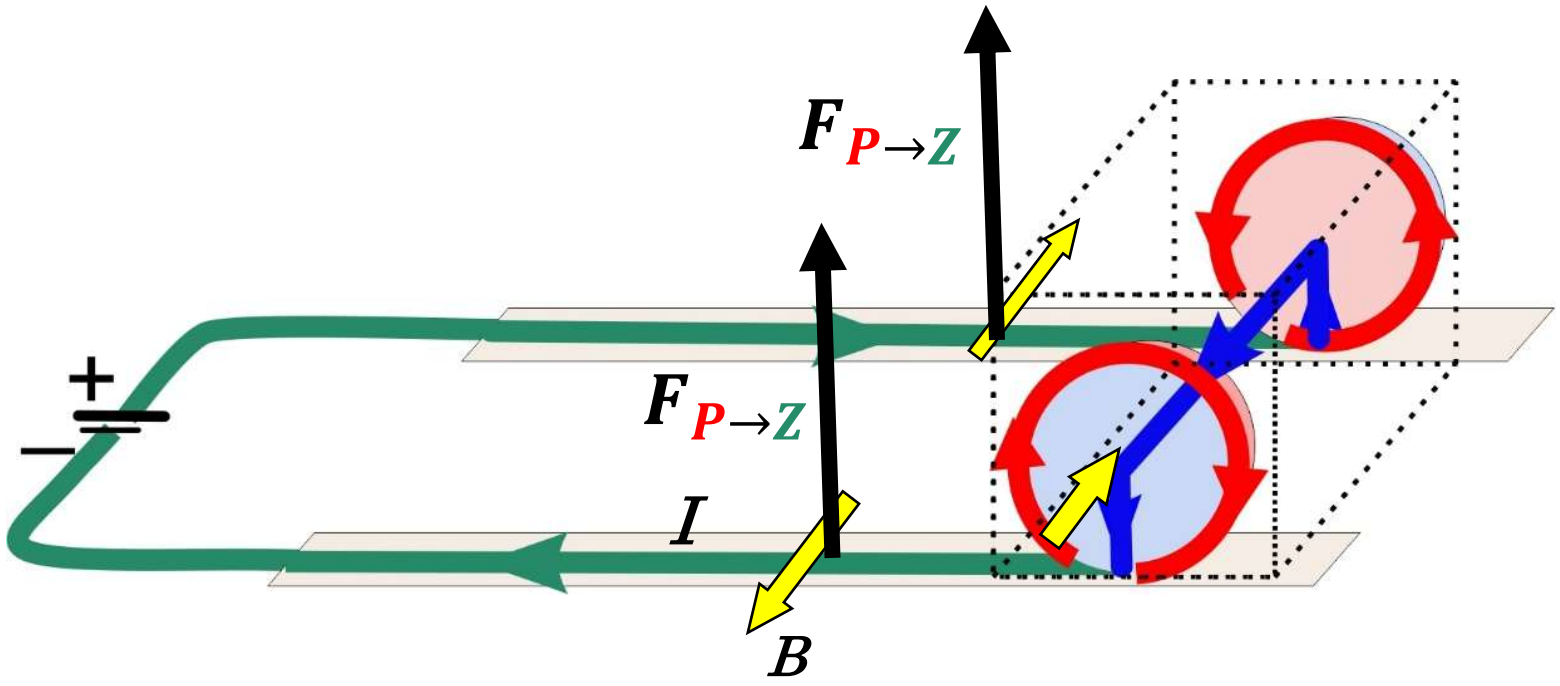
$$\boldsymbol{F} = \boldsymbol{F}_{KZ\to P} + \boldsymbol{F}_{PZ\to K}$$

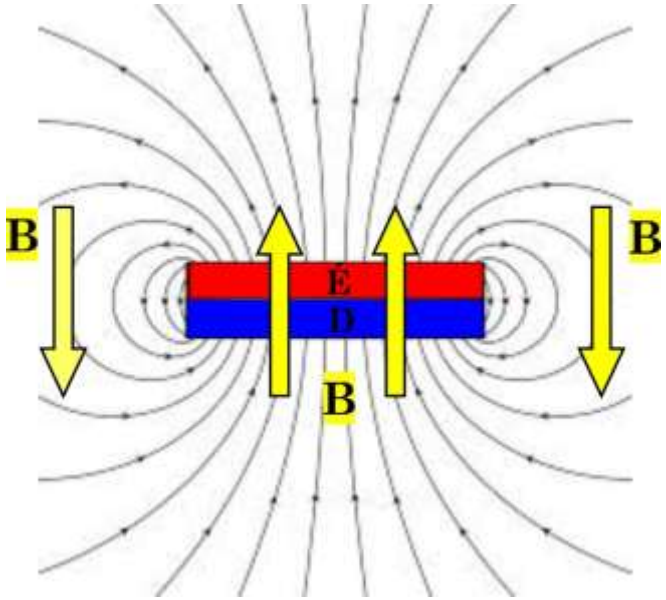
$$\boldsymbol{F} = \boxed{\boldsymbol{F}_{K\to P} + \boldsymbol{F}_{Z\to P} + \boldsymbol{F}_{P\to K}} + \boldsymbol{F}_{Z\to K}$$

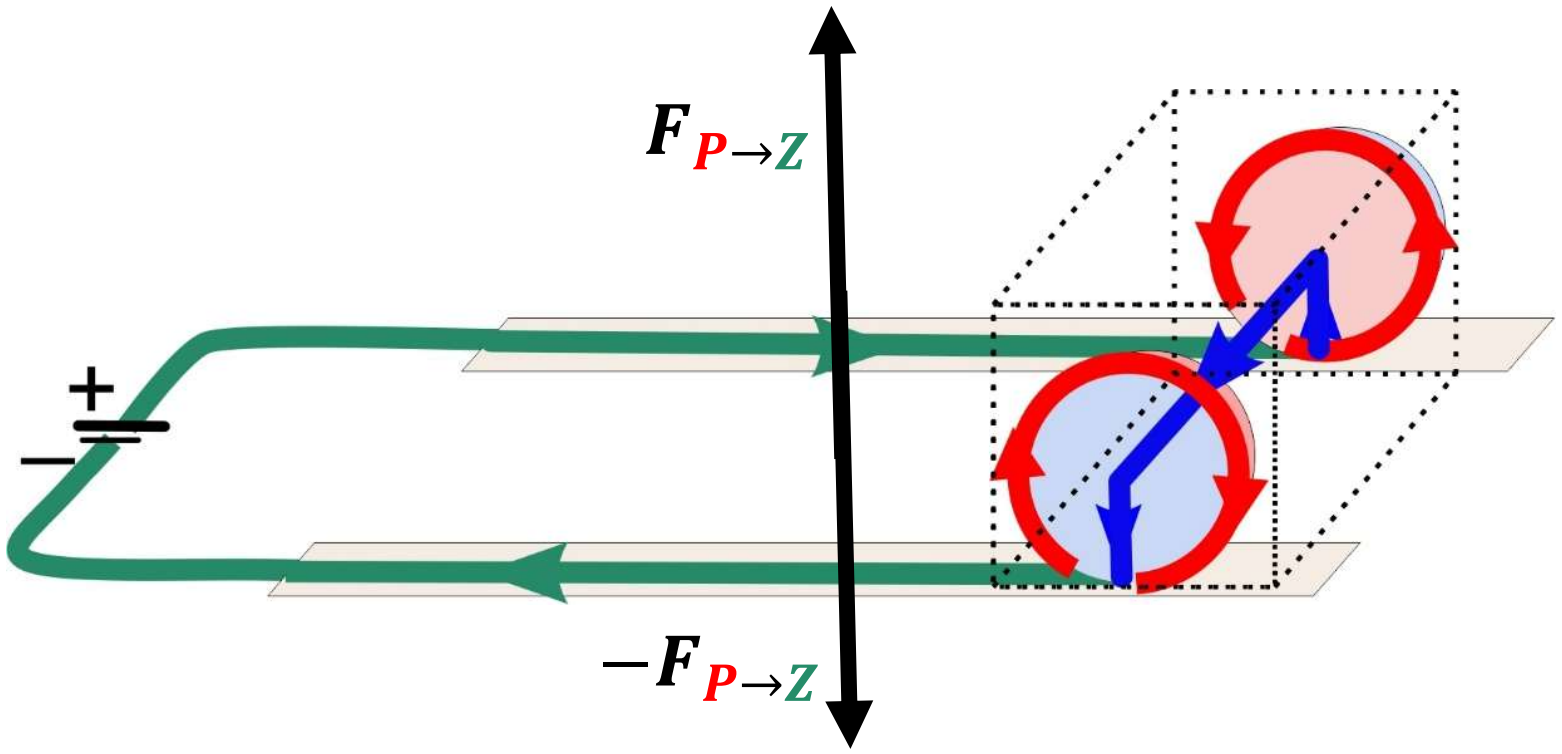
$$\boxed{\boldsymbol{F} = -\boldsymbol{F}_{P\to Z} + \boldsymbol{F}_{Z\to K}}$$

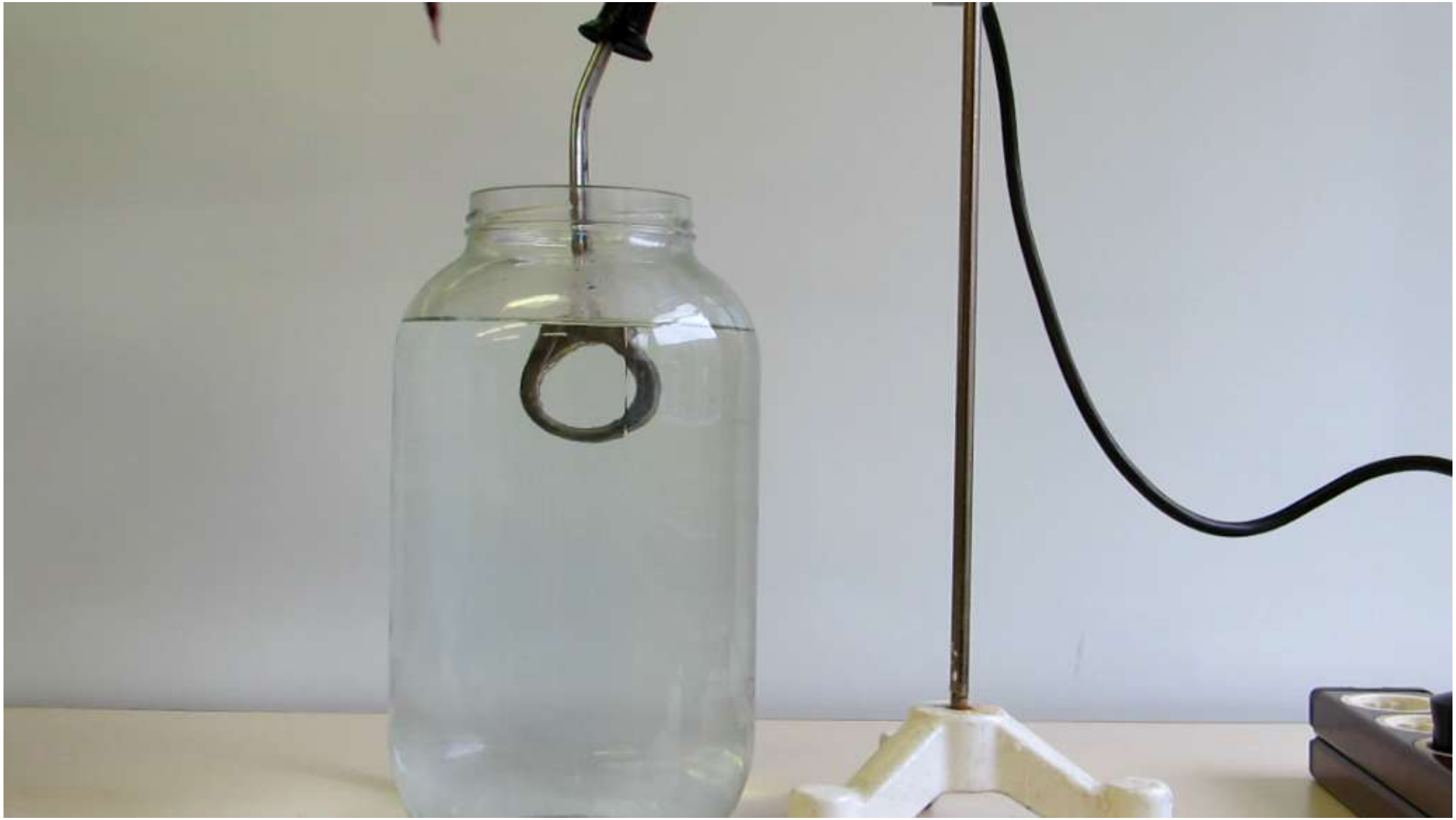
$$F = -F_{P \to Z} + F_{Z \to K}$$

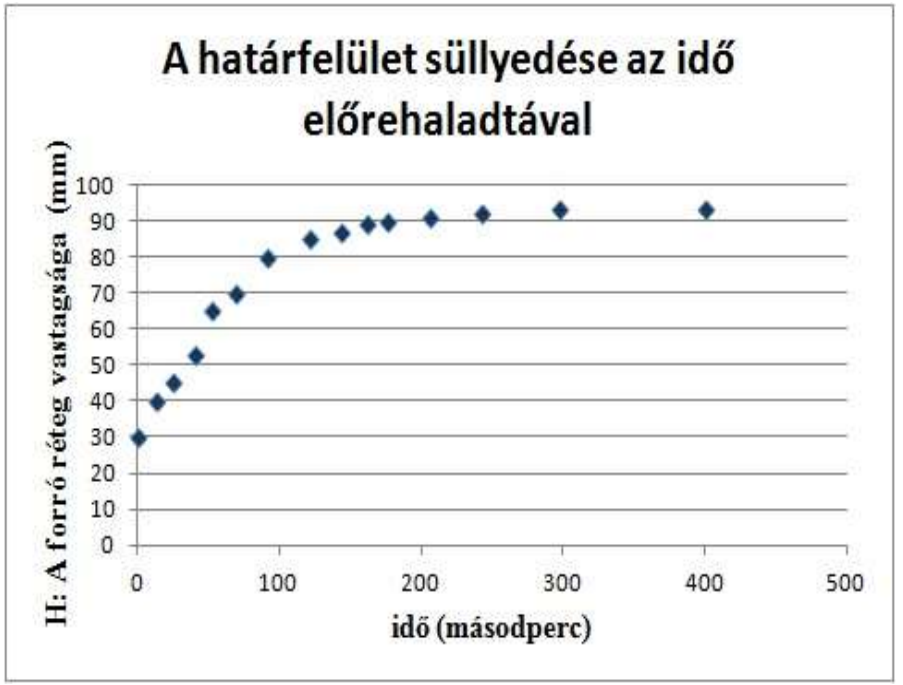
picike

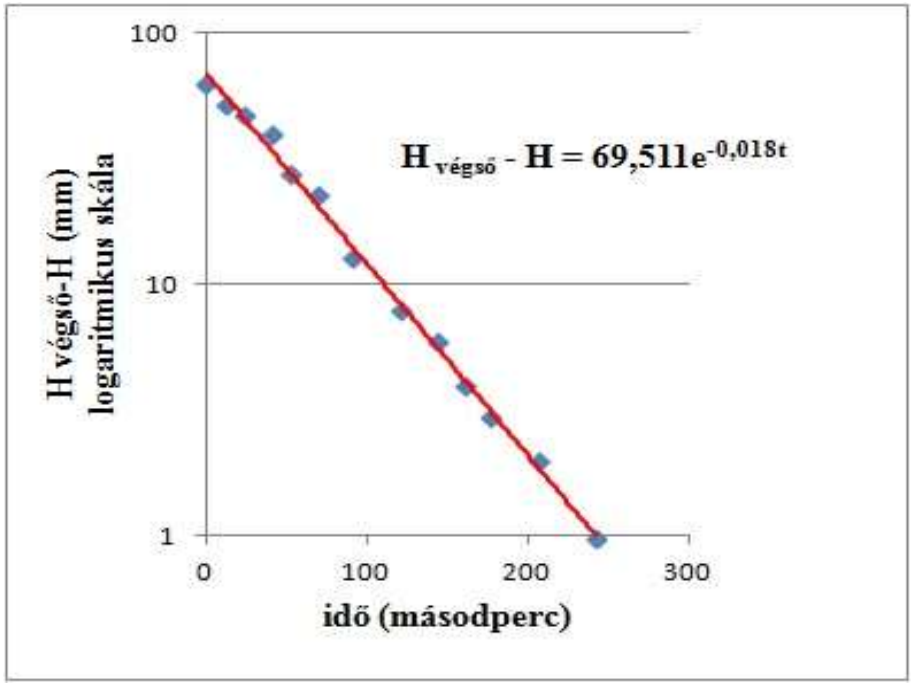


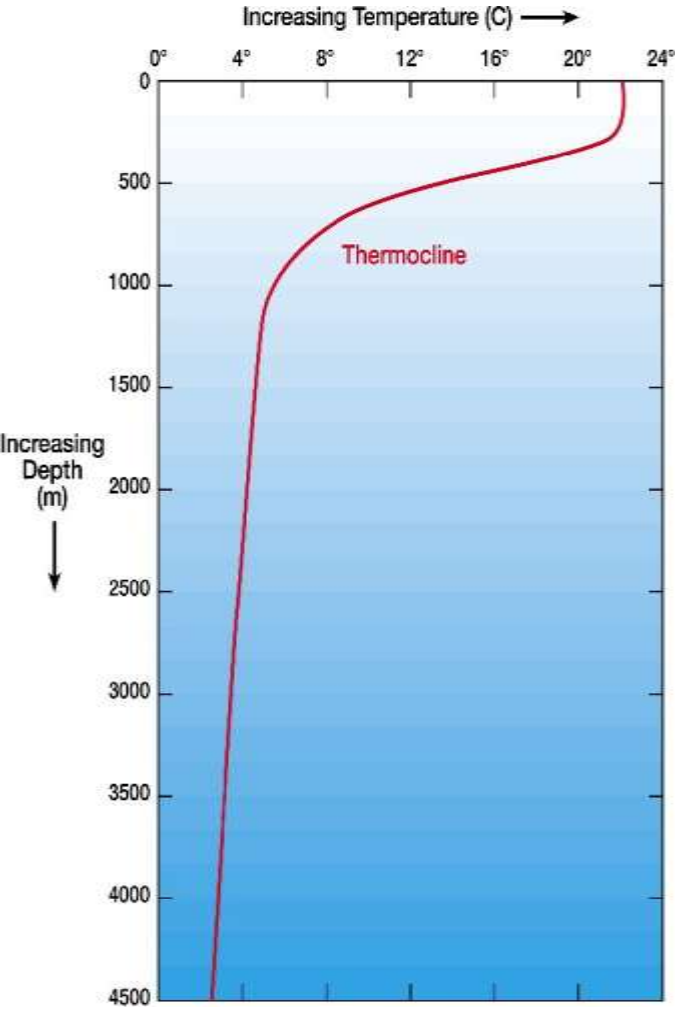


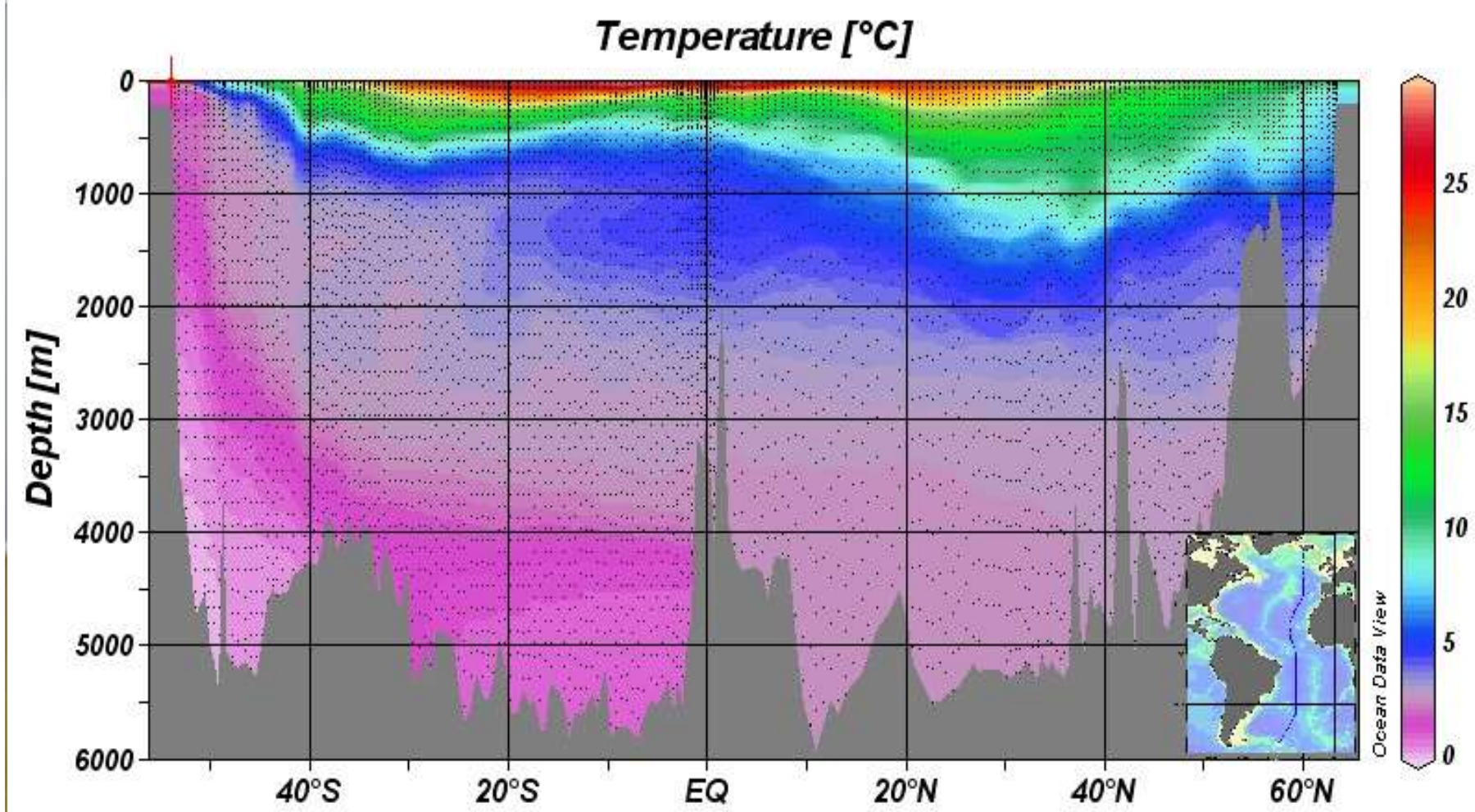

$F_{P \to Z}$
$-F_{P \to Z}$
+
−



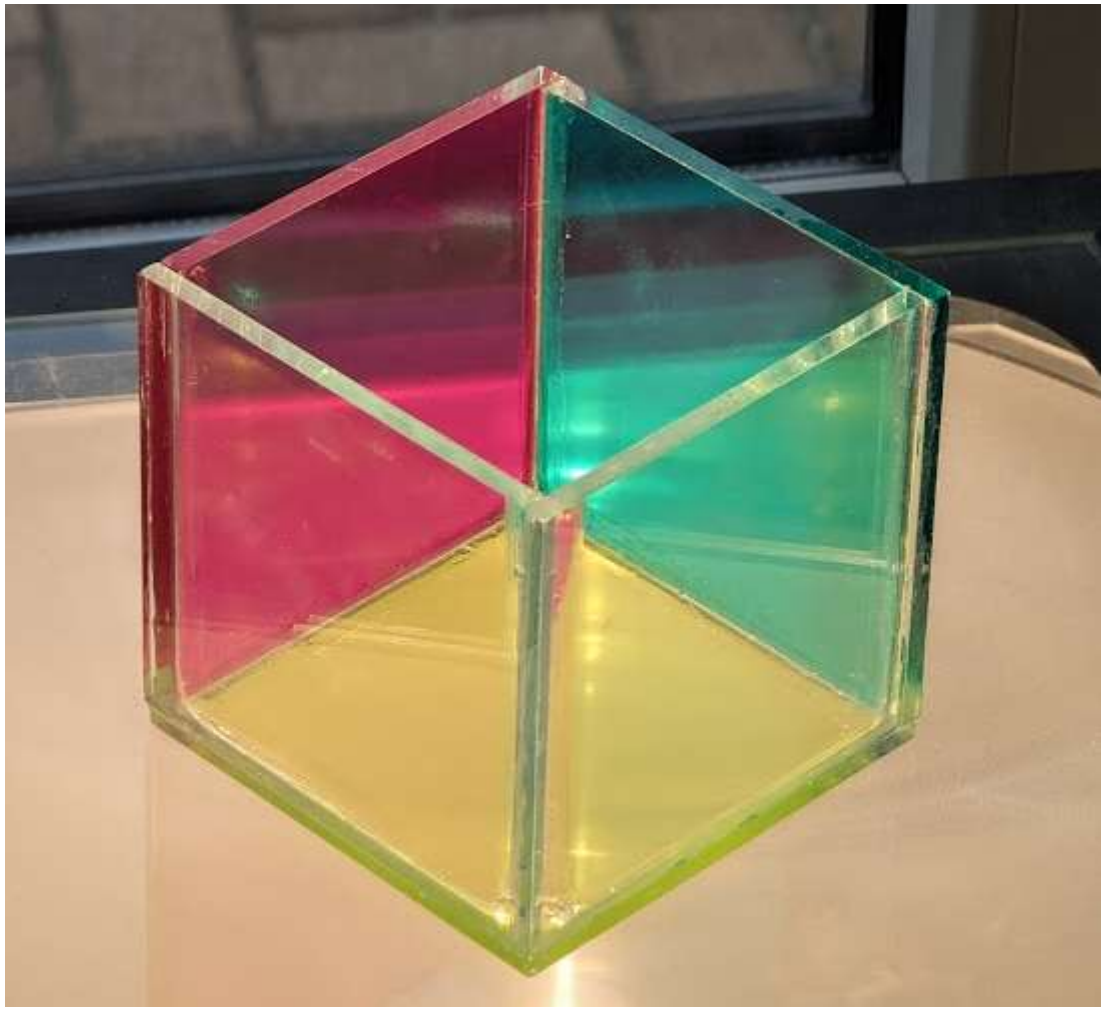

A határfelület süllyedése az idő előrehaladtával
H: A forró réteg vastagsága (mm)
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
400
500
idő (másodperc)

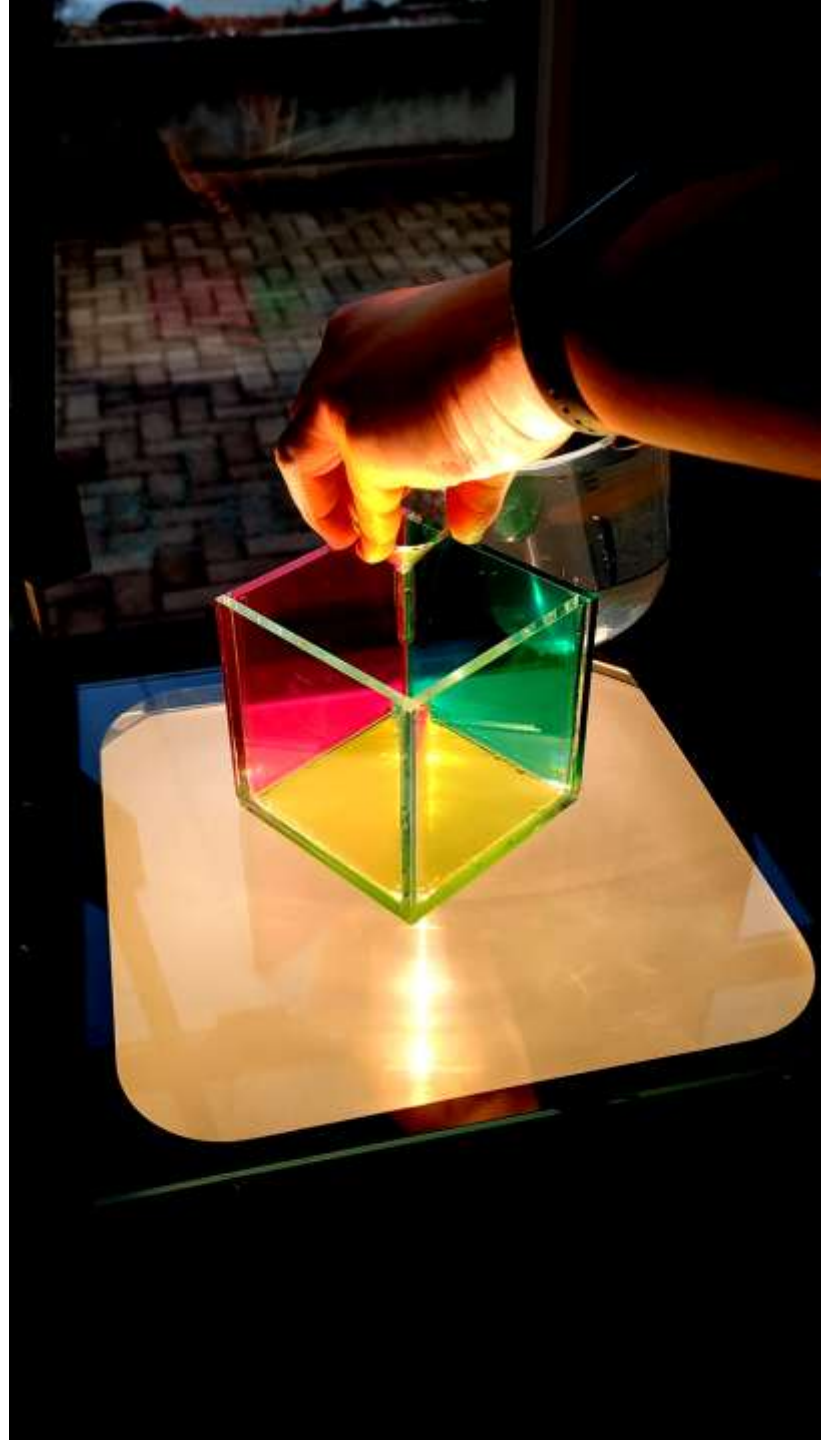

H végső-H (mm) logaritmikus skála
100
10
1
$H_{végső} - H = 69{,}511e^{-0{,}018t}$
0
100
200
300
idő (másodperc)

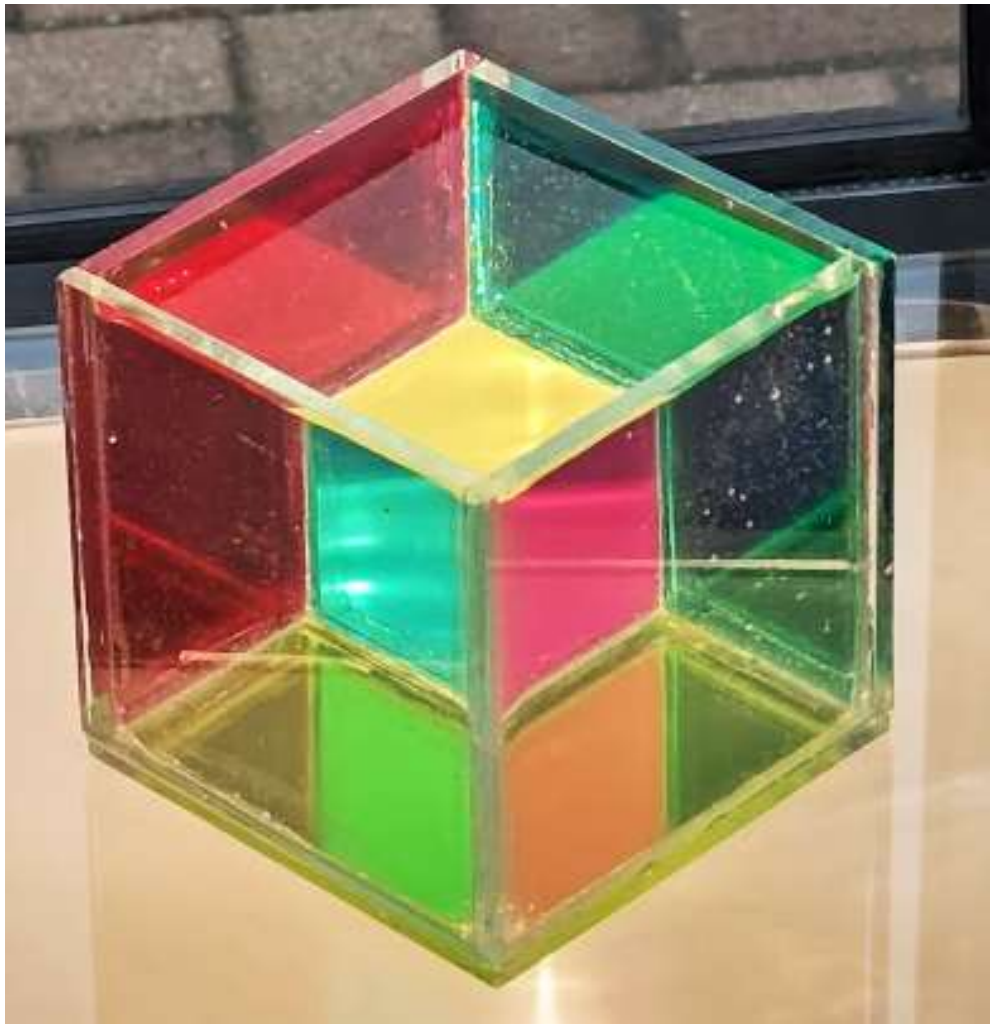

Increasing Temperature (C) →
0°
4°
8°
12°
16°
20°
24°
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Thermocline
Increasing Depth (m)

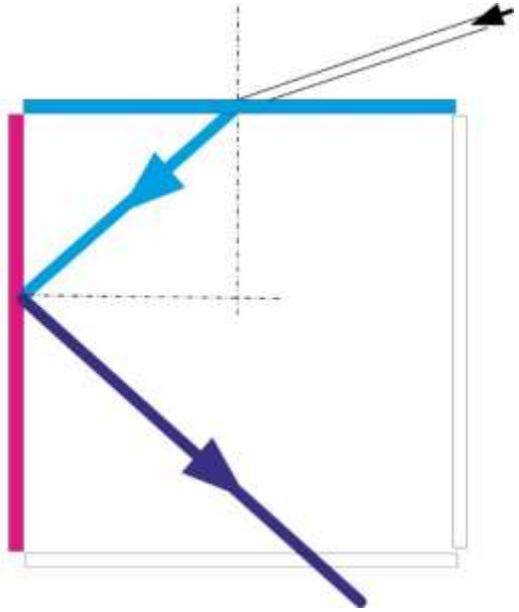

Temperature [°C]
Depth [m]
0
1000
2000
3000
4000
5000
6000
40°S
20°S
EQ
20°N
40°N
60°N
25
20
15
10
5
0
Ocean Data View

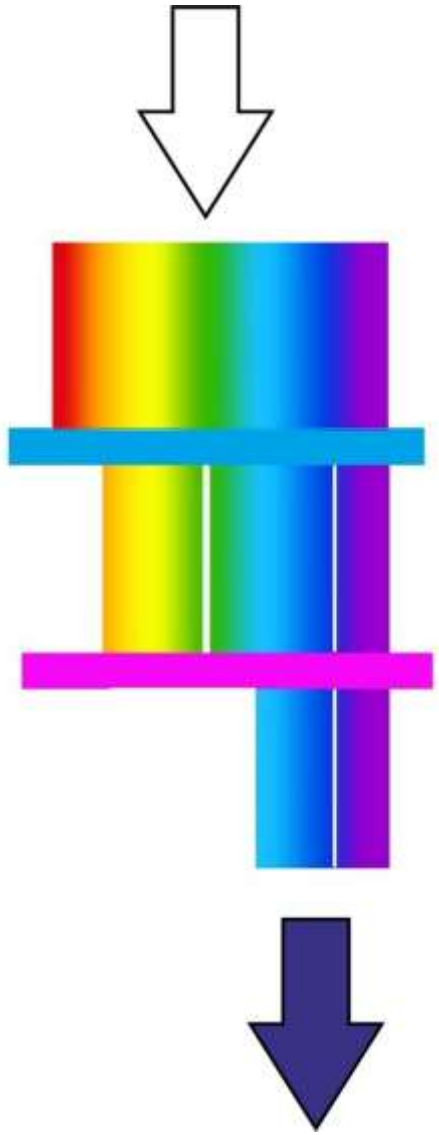
Színes kocka

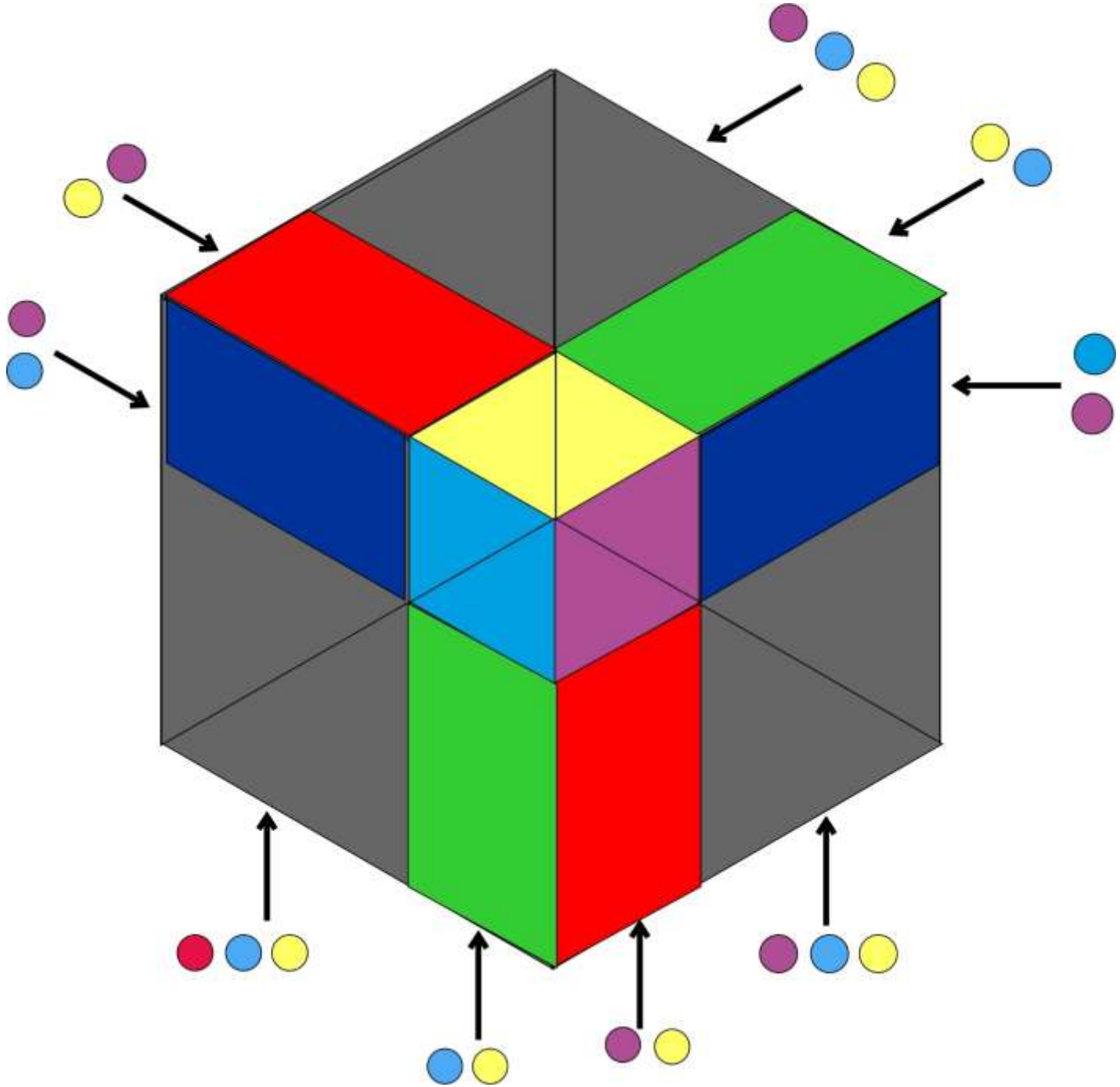












Köszönjük a figyelmet!