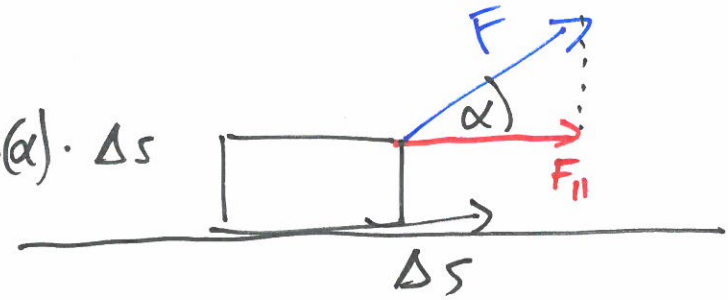
5. Mechanika, munka, energia

mechanikai munka

$$W_{mech} = F_{||} \cdot \Delta s = F \cdot \cos(\alpha) \cdot \Delta s$$



$[W] = [E] = [F] \cdot [\Delta s] =$

$= N \cdot m = kg \frac{m}{s^2} \cdot m =$

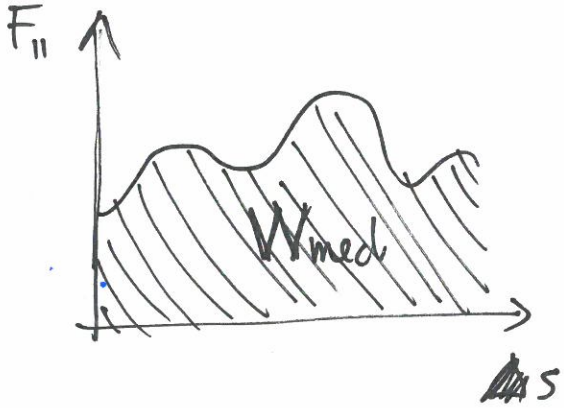
$= kg \cdot \frac{m^2}{s^2} = J$ joule

$$\cos(\alpha) = \frac{F_{||}}{F}$$

$$F_{||} = F \cdot \cos(\alpha)$$

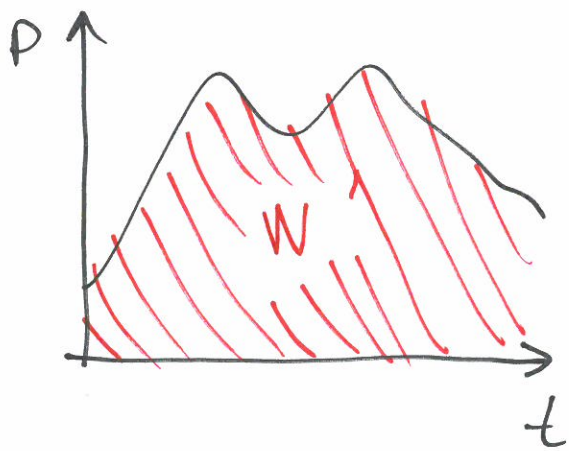
munka = energia megváltozás, átadás

$$W = \Delta E$$



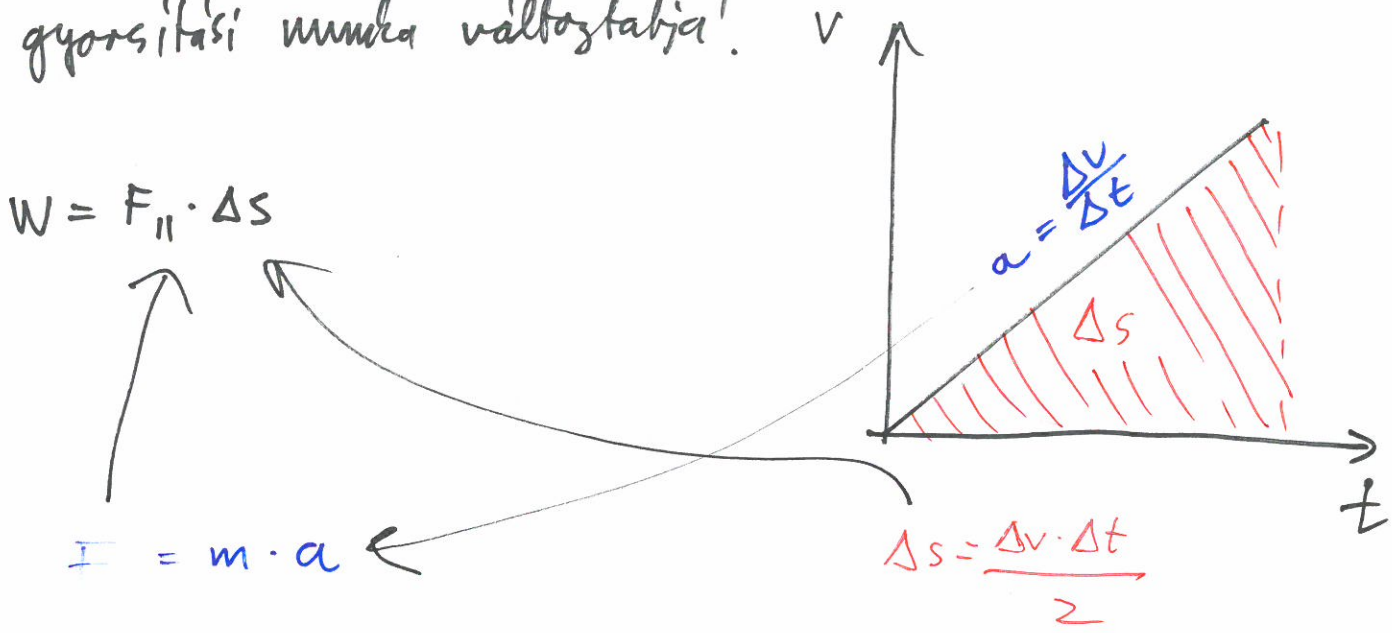
teljesítmény: időegység alatt végzett munka

$$P = \frac{W}{\Delta t} \longrightarrow W = P \cdot \Delta t$$



Kinetikus (mozgási) energia $E_{kin} = \frac{1}{2}mv^2$

gyorsítási munka változtatja!



$$W_{\parallel} = F_{\parallel} \cdot \Delta s = m \cdot a \cdot \Delta s = m \cdot \frac{\Delta v}{\Delta t} \cdot \frac{\Delta v \cdot \Delta t}{2} =$$

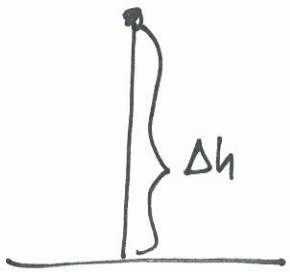
$$= \frac{m \cdot \Delta v^2}{2}$$

$$E = \frac{m \cdot v^2}{2}$$

Helyzeti (potenciális) energia a gravitációs mezőben $E_{pot} = mgh$

$$W_{emel} = F_{\parallel} \cdot \Delta s = m \cdot g \cdot \Delta h$$

$m \cdot g$ $\quad$ Δh

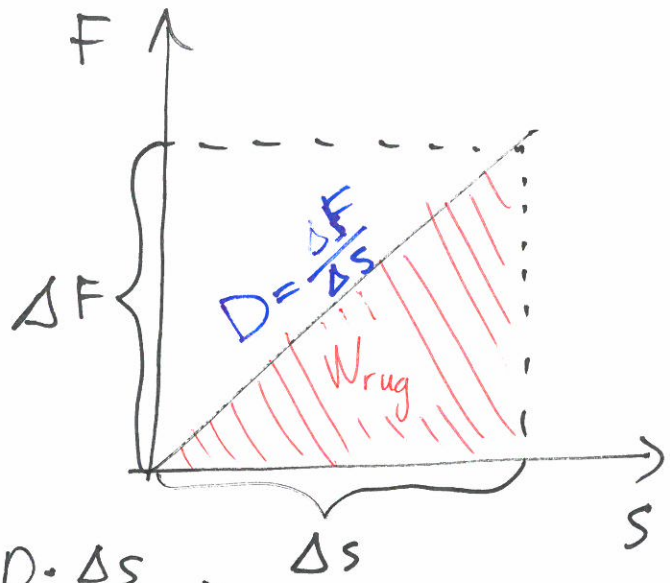


$$E_{pot} = m \cdot g \cdot h$$

Rugalmas (elasztikus) energia: $E_{rug} =$

Hooke: $\Delta F = D \cdot \Delta s$

$W = F \cdot \Delta s$



$$W_{rug} = \frac{\Delta F \cdot \Delta s}{2} =$$

$$= \frac{D \cdot \Delta s \cdot \Delta s}{2} = \frac{D \cdot \Delta s^2}{2}$$

$$E_{rug} = \frac{D \cdot s^2}{2}$$

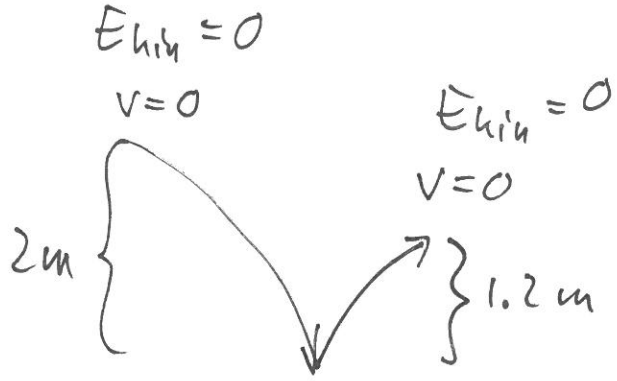
$$E_{mech} = E_{kin} + E_{pot} + E_{rug} = \text{állandó}$$

$$E = m c^2$$

Joule	kalória	elektronvolt
	1 cal = 4,18 J	eV = $1{,}6 \times 10^{-19}$ J
	kcal	
	nagykalória	
	kilokalória	

Házi: BTU (brit)
erg (CGS)

5/9



$E_{pot} \longrightarrow E_{ausgl'b}$

$\Delta E_{mech} = \Delta E_{pot} \Rightarrow \Delta E_{ausgl'b}$

$\downarrow$

$m \cdot g \cdot \Delta h = 0{,}8\,kg \cdot 9{,}81 \frac{m}{s^2} \times (2m - 1{,}2m) = 6.278$

$kg \frac{m}{s^2} m$

$=$

J

5/8 $m = 0{,}3\,kg$ $\qquad da = dh$

$\Delta h = 20m$

a) $v_0 = 0 \longrightarrow E_{kin_0} = 0$

$E_{pot_0} = mg\Delta h = 0{,}3\,kg \cdot 9{,}81 \frac{m}{s^2} \cdot 20m =$ ———

b) $\Delta E_{pot} = \Delta E_{kin} = E_{pot_0}$ $\qquad h_1 = 0$

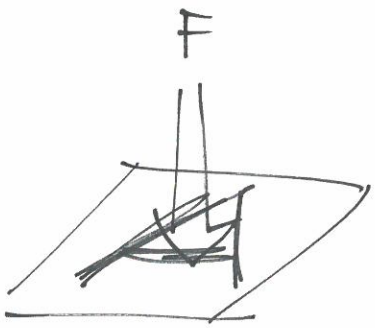
$58{,}86\,J$

$E_{pot_1} = 0$

c) $E_{kin} = \frac{1}{2} m v^2 \longrightarrow v = \sqrt{\frac{2 E_{kin}}{m}} = 19{,}8 \frac{m}{s}$

$71{,}28 \frac{km}{h}$

6. Nyomás



felületre merőlegesen ható erő (komponens)
osztva
felület

$$p = \frac{F_1}{A}$$

$$[p] = \frac{[F]}{[A]} = \frac{N}{m^2} = \frac{kg \cdot \frac{m}{s^2}}{m^2} = \frac{kg}{m \cdot s^2} = Pa$$

pascal

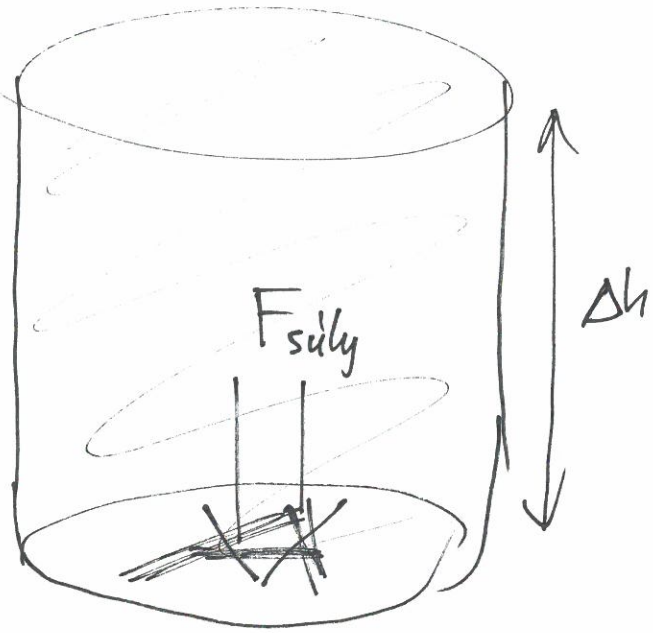
atmoszféra atm = 101 325 Pa +
(technikai atmoszféra at) =
bar bar = 100 000 Pa +
higany milliméter mmHg = +
mikron = μmHg = $\frac{1\ mmHg}{1000}$
vízcentiméter $cm H_2O$ = +
font súly / négyzethüvelyk psi =

(plazma)
gáz → fluidum
kondenzált ← folyadék → fluidum
← szilárd

Hidrosztatikai nyomás: fluidumok által (mindenekelőtt folyadékok) kifejtett nyomás

$p_{hidr.}$

folyadékok esetén:



density

$d = \rho = \frac{m}{V} \Rightarrow m = \rho \cdot V$

$V = A \cdot \Delta h$

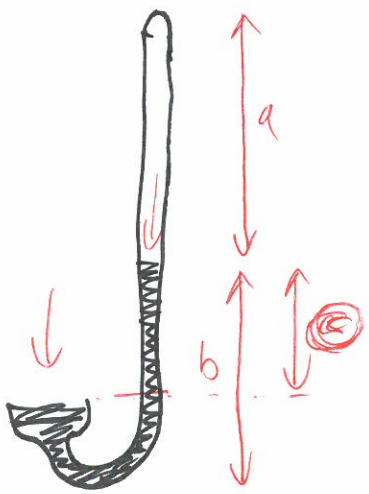
$m = \rho \cdot A \cdot \Delta h$

$$p = \frac{F_\perp}{A} = \frac{m \cdot g}{A} = \frac{\rho \cdot A \cdot \Delta h \cdot g}{A} = \rho \cdot \Delta h \cdot g$$

$1\ mmHg = 13{,}7\ g/cm^3 \times 1\ mm \times 9{,}81\ \frac{m}{s^2} =$

$= 13700\ kg/m^3 \times 10^{-3}\ m \times 9{,}81\ \frac{m}{s^2} = 134{,}4\ Pa$

$1\ atm = 101\,325\ Pa = 760\ mmHg$



Milyen mélyről lehet egy búvalpalackkal vizet felszívni?

$p_{hidr} = \rho \cdot g \cdot \Delta h$

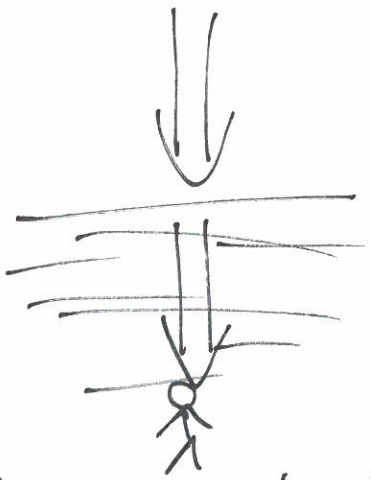
$\Delta h = \frac{p_{hidr}}{\rho \cdot g} = \frac{101\,325\ Pa}{1000\ kg/m^3 \cdot 9{,}81\ \frac{m}{s^2}} = 10{,}329\ m$

$$Pa \left(\frac{kg}{m\,s^2} \right) \Big/ \left(\frac{kg}{m^3} \cdot \frac{m}{s^2} \right) = \frac{kg}{m\,s^2} \cdot \frac{m^3 \cdot s^2}{kg \cdot m} =$$

$$= m$$

6./7, $\rho = 1080\ \frac{kg}{m^3}$

$\Delta h = 1\ km = 1000\ m$



$p_{összes} = p_{atm} + p_{hidr} = p_{atm} + \rho \cdot g \cdot \Delta h$

$= 101\,325\ Pa + 1080\ \frac{kg}{m^3} \cdot 9{,}81\ \frac{m}{s^2} \cdot 1000\ m = 1\,069\,6125\ Pa$

$10{,}7\ MPa$