Lecture notes

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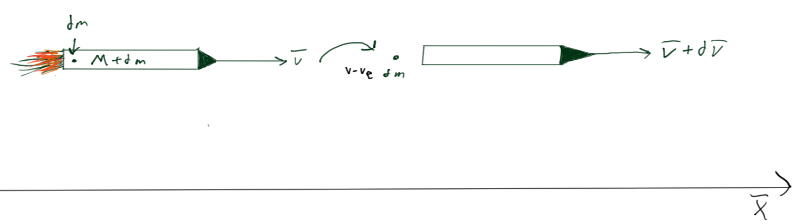
Lite repition
- raket ekv
- värmelära
- Mekanik problem

Problemlösnings metoder

1. Newtons 2:a lag, a
2. Mek energi, v
3. $\bar{P}$ bevaras

repition

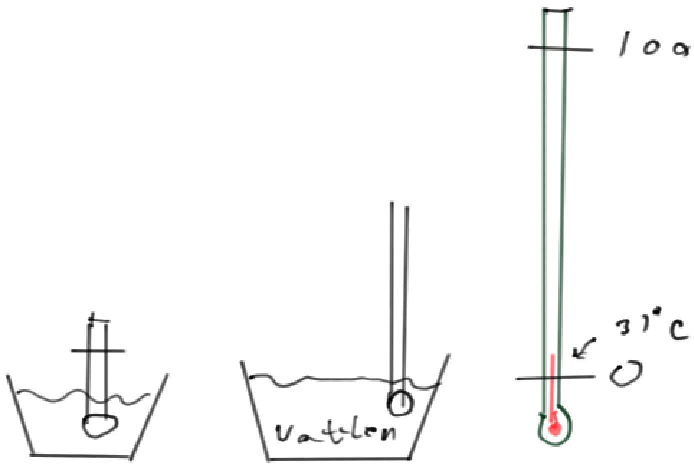
Raketekvationen



$$P_i = (M + dm)V$$
$$P_f = M(v + dv) + dm(v - v_e)$$
$$P_i = P_f, \text{ Inga externa krafter}$$
$$(M + dm)v = M(v + dv) + dm(v - v_e)$$
$$\rightarrow Mdv = dmv_e, dm = -dM \rightarrow Mdv = -dMV_e$$
$$\rightarrow \int_{v_i}^{v_f} dv = -V_e \int_{M_i}^{M_f} \frac{dM}{M} \rightarrow v_f - v_i = v_e \ln\left(\frac{M_i}{M_f}\right)$$

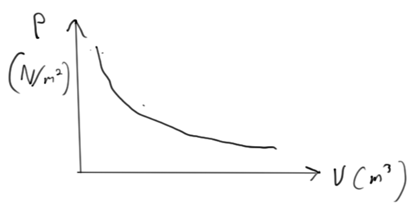
Värmelära

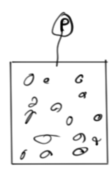
Temperatur

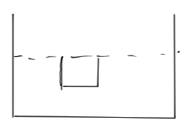


Dålig för höjd över havet, och utvigdningen av vätskan påverkar

Gastermometer







$PV = \underline{\text{konst}}T$

Vid 1 mol gas: konst $= 8,31$

$PV = nRT, R = 8.31J/K, n =$ Antal mol

Avrogadostal $N_A = 6,023 \cdot 10^23$st

Enheter för tryck

1. $1\ M/m^2 = 1Pa$
2. 1 bar $= 10^5 N/m^2$
3. $1\ atm = 1,013 \cdot 10^5 N/m^2$

1dim:

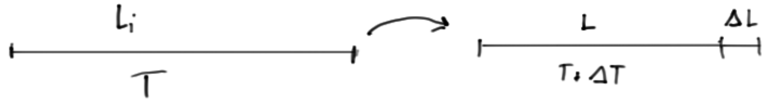
Millimeter kvicksilver:

$P(Ah)\rho g/A$

$P = \rho g h$

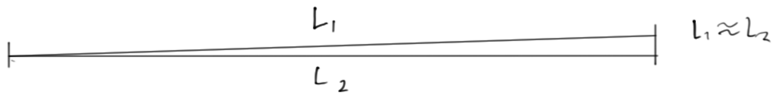
$13,6 * 10^3 * 0,700 * 9.81 = 1.013 * 10^5$

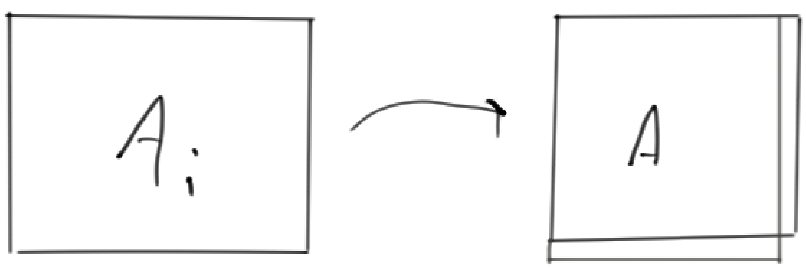
Termsik utvidning



α: linjära längdutvecklingskoeff, typiskt värde: $\alpha = 10^{-6}$

$$\Delta L = L_i \alpha \Delta T$$





2 dim:

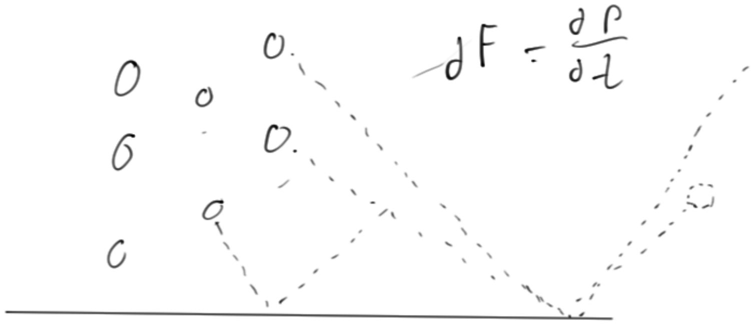
$$A = A_i + \Delta A, \Delta A = A_i \beta \Delta T.$$

Tillbaka till ideala gaslagen

$$PV = \frac{N}{N_A} RTP = \left(\frac{N}{V}\right)\left(\frac{R}{N_A}\right) T \rightarrow P = \left(\frac{N}{V}\right) k_B T$$

Boltzmans konstant: $k_B = 1,23 * 10^-23 J/K$

Vad är egentligen temperatur?



Medelenergin ges av

$$E^{\text{medel}}_{\text{kinetisk energi}} = \frac{3}{2}k_B T$$

$\frac{1}{2}k_B T$ i medelenergi per frihetsgrad

Värme – inre energi - Arbete

Inre energi E^{int}

$$E^{int} = N\left(\frac{3}{2}k_B T\right) =$$

$$= N\frac{3}{2}\frac{R}{N_A}T = \frac{N}{N_A}\left(\frac{3}{2}R\right)T \to E^{int} =$$

$$= n\left(\frac{3}{2}R\right)T$$

Enatomiga molekyler (He,Ne,Ar,..) har 3 frihetgrader$\left(E_{medel} = \frac{3}{2}k_B T\right)$. Tvåatomiga molekyler ($H_2, 0_2, N_2, ...$) har 5frihetsgrader, $E_int = \frac{5}{2}k_B T \to E_{int} = n\left(\frac{5}{2}R\right)T$

$dE^{int} = n\left(\frac{3}{2}R\right)dT$