

06-03

Fourier i herbergi

1

$$T = 18^\circ\text{C} \rightarrow 25^\circ\text{C}$$

Hvernig breytist heildarösta loftslins i herberginu?

p er fasti \sim ein loft þyngd

$$\text{Kjörgas} \rightarrow p = \frac{1}{3} nm \langle v^2 \rangle \quad (6.15)$$

$$\text{Orkuséðleiki} \quad u = \frac{1}{2} nm \langle v^2 \rangle \quad (6.24)$$

$$\rightarrow p = \frac{2}{3} u \quad (6.25)$$

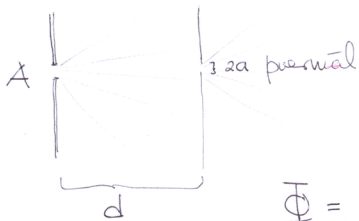
\rightarrow fastur $p \rightarrow$ fast u

heildaröstan $U = uV$ líta fasti!

07-05

Ütsveim

(2)



Sākloti flocisims ar "A"
 sam ķēti ā seina gatiņā

$$\sin\theta \cos\theta = \frac{1}{2} \sin(2\theta)$$

Naktum pui (7.5)

$$\Phi = \frac{1}{2} \int_0^{\infty} \langle v \rangle f(v) \int_0^{\theta_{\max}} d\theta \cos\theta \sin\theta$$

$$\sin\theta_{\max} = \frac{a}{d}, \quad a \ll d \rightarrow \theta_{\max} \approx \frac{a}{d}$$

$$\Phi = \frac{1}{4} \langle v \rangle \int_0^{a/d} d\theta \sin(2\theta) = \frac{1}{4} \langle v \rangle \left[-\frac{\cos(2\theta)}{2} \Big|_0^{a/d} \right]$$

$\left. \begin{array}{l} \cos(ax) \\ \sim -2x^2 + \dots \end{array} \right\}$

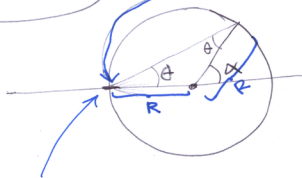
$$= \frac{1}{4} \langle v \rangle \left\{ \frac{1}{2} - \frac{1}{2} \left(1 - 2 \frac{a^2}{d^2} \right) \right\} = \frac{1}{4} \langle v \rangle \frac{a^2}{d^2} = \frac{1}{4} \langle v \rangle \frac{a^2}{d^2}$$

$$\rightarrow A\Phi = \frac{1}{4} \langle v \rangle A \frac{a^2}{d^2}$$

07-06

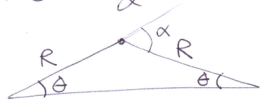
útsveim um í Kúlu

(3)



Hver er dreifingun ef sameindirnar
festast þó sem þóir lenda?

(7.5) hornbreifingun er $\cos\theta \sin\theta = \frac{1}{2} \sin(2\theta)$
 út um gatið
 jafnarma þríhyrnungur



$$\rightarrow \theta + \theta + (\pi - \alpha) = \pi \quad \rightarrow \alpha = 2\theta$$

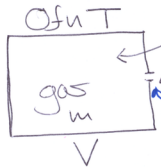
$$\text{Rannkomid milli } \alpha \text{ og } \alpha + d\alpha \sim \sin\alpha d\alpha$$

$$\sim \sin(2\theta) d\theta$$

Dreifingun á horn út ur gatinu er sama
 og flötur kúlu yfirborðsins í kúlunni undir sama
 horni \rightarrow jafnheft

07-08

4



finna $p(t)$

fjöldi einda sem letur

$$\Phi A$$

inni í ofni fættar þá sendum um

$$V \frac{dn}{dt}$$

útsveim

→ verðveita senda

$$V \frac{dn}{dt} = - \Phi A$$

kjörgas → $p = nk_B T$ → $n = \frac{p}{k_B T}$

fast T → $\frac{dn}{dt} = \frac{dp}{dt} \cdot \frac{1}{k_B T}$

og $\Phi = \frac{p}{\sqrt{2\pi m k_B T}}$

$$\frac{V}{k_B T} \frac{dp}{dt} = - A \frac{p}{\sqrt{2\pi m k_B T}}$$

$$\rightarrow \frac{dp}{dt} = - \frac{A}{V} \left(\frac{k_B T}{2\pi m} \right)^{1/2} p$$

$$\frac{dp}{dt} + \frac{A}{V} \sqrt{\frac{R_B T}{2\pi m}} p = 0$$

med värd $\frac{1}{\tau}$, källan

$$\tau = \frac{V}{A} \sqrt{\frac{2\pi m}{R_B T}}$$

$$\rightarrow \frac{dp}{dt} + \frac{1}{\tau} p = 0 \rightarrow \frac{dp}{p} = - \frac{dt}{\tau}$$

$$\rightarrow \int_{p(0)}^{p(t)} \frac{dp'}{p'} = - \frac{1}{\tau} \int_0^t dt'$$

$$\rightarrow \ln(p(t)) - \ln(p(0)) = - \frac{t}{\tau} \quad \text{då} \quad \ln\left[\frac{p(t)}{p(0)}\right] = - \frac{t}{\tau}$$

$$\frac{p(t)}{p(0)} = e^{-t/\tau}$$

$$p(t) = p(0) e^{-t/\tau}$$

τ är nättnings tidskonstant påstängs-brytningssvinnar

08-01

finna λ fyrir N_2 -sameind $\bar{v} = 10^{-10}$ mbar

⑤

Hollidss með $d = 0,5$ m

$$\lambda = \frac{1}{\sqrt{2} n \bar{v}} \quad \text{Ex 8.1} \rightarrow \pi d^2 \bar{v} = 4,3 \cdot 10^{-19} \text{ m}^2$$

Gerum ráð fyrir $T \approx 300$ K

$$n = \frac{p}{k_B T} \quad p = 10^{-10} \text{ mbar} = 10^{-10} \cdot 10^2 \text{ Pa}$$

$$\rightarrow \lambda = \frac{k_B T}{\sqrt{2} p \pi d^2} = \frac{1,38 \cdot 10^{-23} \text{ J K}^{-1} \cdot 300 \text{ K}}{\sqrt{2} \cdot 10^{-8} \text{ Pa} \cdot 4,3 \cdot 10^{-19} \text{ m}^2}$$

$$= \underline{6,8 \cdot 10^5 \text{ m}}$$

$$\langle v \rangle = \sqrt{\frac{8 k_B T}{\pi m}} = \sqrt{\frac{8 \cdot 1,38 \cdot 10^{-23} \text{ J K}^{-1} \cdot 300 \text{ K}}{\pi \frac{0,028 \text{ kg}}{6,022 \cdot 10^{23}}}} \approx 476 \text{ m/s}$$

$$\rightarrow \tau = \frac{\lambda}{\langle v \rangle} \approx \frac{6,8 \cdot 10^5 \text{ m}}{476 \text{ m/s}} \approx 1428 \text{ s} \approx 24 \text{ min}$$

(7)

Þæðal fjöldi ættsta við vaggi / ættstar við samandi

$$\approx \frac{6,8 \cdot 10^5 \text{ m}}{0,6 \text{ m}} \approx 10^6 \text{ milljón sinna flæm}$$