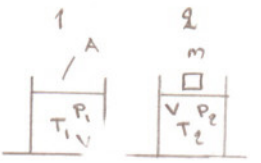
Lösningar till tentamen i FYSIK del 1 för E2 2008-08-27

① V oförändrad ideal gas



$p_1 V = nRT_1$ (1)

$p_2 V = nRT_2$

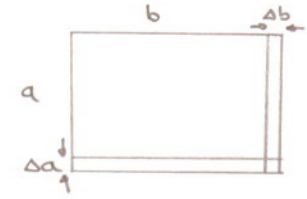
$p_2 = p_1 + \frac{mg}{A}$ $\Rightarrow \left(p_1 + \frac{mg}{A}\right)V = nRT_2$ (2)

$\Rightarrow$ (2) − (1) : $\frac{mg}{A} V = nR(T_2 - T_1)$

$$\Rightarrow V = \frac{nR(T_2 - T_1)\cdot A}{mg} = \frac{0{,}2 \cdot 8{,}31 (80-20)\cdot 70\cdot 10^{-4}}{0{,}500 \cdot 9{,}81}\ m^3$$

$$= 0{,}14\ m^3$$

②



$A = a \cdot b$

$A + \Delta A = (a + \Delta a)(b + \Delta b)$

$\Delta a = a \cdot \alpha \cdot \Delta T$

$\Delta b = b \cdot \alpha \cdot \Delta T$

förlumns

$\Rightarrow A + \Delta A = ab + \Delta a \cdot b + \Delta b \cdot a + \Delta a \cdot \Delta b \approx$

$\approx ab + (a \cdot \alpha \cdot \Delta T)b + (b \cdot \alpha \cdot \Delta T)a =$

$= ab + 2\alpha \cdot ab \cdot \Delta T$ (ab = A)

$\Rightarrow \Delta A = 2\alpha\, ab\, \Delta T = \underline{\underline{2\alpha A \Delta T}}$

③ För Carnotprocessen gäller

$$\eta = \frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1} = \frac{W}{Q_1}$$

$$\eta_1 = \frac{T_1 - T_2}{T_1} = \frac{Q_1 - Q_2}{Q_1} = \frac{W}{Q_1} \quad (1)$$

$$\eta_2 = \frac{T_3 - T_4}{T_3} = \frac{Q_3 - Q_4}{Q_3} = \frac{W}{Q_3} \quad (2)$$

(2) vidend med (1) ger $\frac{W/Q_3}{W/Q_1} = \frac{\frac{T_1 - T_2}{T_1}}{\frac{T_3 - T_4}{T_3}}$

$$\Rightarrow \frac{Q_3}{Q_1} = \frac{T_3(T_1 - T_2)}{T_1(T_3 - T_4)} = \frac{325(400-150)}{400(325-225)} =$$

$$= \underline{\underline{2{,}03}}$$

④

a) $\Psi(x = 2\text{Å}) = 0$

b) $\frac{1}{5} = \frac{1}{\frac{10}{2}}$

c) $5\frac{\lambda}{2} = L \Rightarrow \lambda = \frac{2L}{5} = 4\text{Å}$

d) $E_{n=5} = 5^2 \frac{(6{,}63\cdot 10^{-34})^2}{8 \cdot 9{,}11\cdot 10^{-31} (10^{-9})^2 \cdot 1{,}6\cdot 10^{-19}} =$

$= 9{,}1\ \text{eV}$

⑤

$d \cdot \sin\theta = \frac{\lambda}{2}$ $\qquad I = \text{konst}\ A^2$

alla spalter öppna $= I_{tot} = \underline{I}$

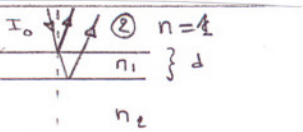
maximal intensitet uppnås genom att blockera spalt 2 och 4.

1, 3, 5 interfererar konstruktivt

total amplitud $= 3A$

$I_{tot} = \text{konst} \cdot (3A)^2 = \underline{9I}$

⑥ Båda strålarna reflekt. mot tätare medium.



maxvillkor : $2n_2 d = m\lambda$

minvillkor : $2n_2 d = (m + \frac{1}{2})\lambda$

$\lambda_S = 700$ nm (max) : $2n_2 d = m\lambda_S$ (1)

$\lambda_L = 600$ nm (min) : $2n_2 d = (m + \frac{1}{2})\lambda_L$

$\Rightarrow m = \frac{\lambda_L}{2(\lambda_S - \lambda_L)} = 3$ (1) ger : $d = \frac{m\lambda_S}{2n_2} = \underline{\underline{840\ \text{nm}}}$

Vinkelrätt infall : $R = \left(\frac{n_A - n_B}{n_A + n_B}\right)^2$ ($R_1 = \frac{n_1 - 1}{n_1 + 1}$)

$$I_1 = I_0 \left(\frac{1 - n_1}{1 + n_2}\right)^2 = I_0 \left(\frac{1 - 1{,}25}{1 + 1{,}25}\right)^2 = I_0\, 0{,}0123$$

$$I_2 = (1 - R_1)\left(\frac{n_1 - n_2}{n_1 + n_2}\right)^2 (1 - R_1)\, I_0 = I_0 \cdot 0{,}00806$$

$\Rightarrow I_2 / I_1 = \underline{0{,}66}$