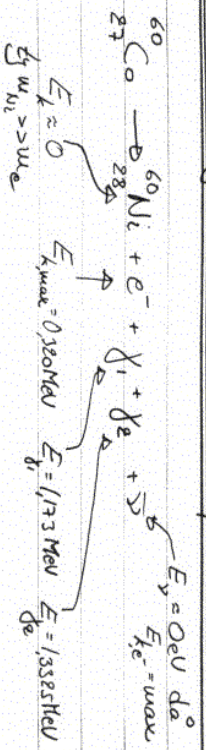


Lösningarna till FYSIK del II för E2 (990821)

1.



Energikonservering:

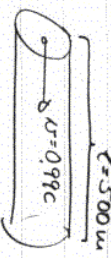
$W_{\text{Co}} = W_{\text{Ni}} + W_e + W_{\nu} + W_{\bar{\nu}}$

$W_{\text{Co}} = 59,933880 \text{ u} = \frac{(0,320 + 1,173 + 1,332) \text{ MeV}}{931,48 \text{ MeV/u}}$

$= 59,933880 \text{ u} - \frac{2,825 \text{ MeV}}{931,48} = 59,930797 \text{ u}$

$0,003083 \text{ u}$

2.



Räkna i trets system:

$E = \frac{Q^2}{2C}$ $N = N_0 e^{-\frac{t}{\tau}}$ $\frac{N_0}{N} = 0,60$

$\Rightarrow t_{1/2} = -\ln \frac{N}{N_0} \cdot \tau = -\ln 0,60 \cdot \tau = 2,28 \mu\text{s}$

för halvd i vila så transformera till parhloras rätssystem:

$t_{1/2} = \frac{t_{1/2}'}{\sqrt{1 - \beta^2}}$ $\Rightarrow t_{1/2}' = \sqrt{1 - 0,99^2} \cdot 2,28 \mu\text{s} = 0,32 \mu\text{s}$

3.

- i) a, d
- ii) b, d
- iii) a, c, f
- iv) a, c, e

4.

se litteraturen

5.

$n = n_0 e^{-\frac{t}{\tau}}$

$P = P_0 e^{-\frac{t}{\tau}}$

$n P = n_0 P_0 e^{-\frac{2t}{\tau}} = 2,1 \cdot 10^{21} \text{ u}^{-3} \text{ vid rumstemp.}$

P-dopn: $P = n + N_a^-$ men vkt lag jonskivarengi och rumstemp $\Rightarrow N_a^- = N_a$

end. uppfatt: $P = 2N_a$ $\Rightarrow n = \frac{N_a}{2} = \frac{1}{2} N_a$

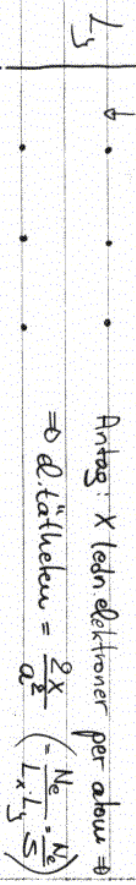
$\therefore N_a = P - n = 2N_a - \frac{1}{2} N_a = \frac{3}{2} N_a = \frac{3}{2} \sqrt{2,1 \cdot 10^{21}} = 6,9 \cdot 10^{15} \text{ u}^{-3}$

6.

Reella rummet: kristall med dimensioner $L_x \cdot L_y \cdot L_z = S$

\Rightarrow valörer per gitterpunkt \propto

\Rightarrow atomtäteten $= \frac{Z}{a^3}$



reciproka rummet

antal el. i Fermiskivan $= N_e$

$N_e = \frac{\text{ytan av stivan}}{\text{ytan per k-punkt}} \cdot \text{antal el. i k-punkt}$

$= \frac{\pi k_F^2}{2\pi^2} \cdot \frac{2}{2\pi} = \frac{k_F^2}{2\pi}$

$\Rightarrow k_F = \sqrt{2\pi} \left(\frac{N_e}{S} \right)^{1/2}$ (avståndet till Fermiskivan)

B-zonen

$\circledast k_F = \frac{\pi}{a} \Rightarrow 2\pi \frac{N_e}{S} = \frac{\pi^2}{a^2} \Rightarrow \left\{ \frac{N_e}{S} = \frac{2\pi^2}{a^2} \right\} \Rightarrow$

$X = \frac{\pi}{4} = 0,79$ ledn. av atom $= S$