

Uklon delcev

Podatki: $U = 24$ V, $l = 1$ m, $s = 20$ cm, $\Delta y = 1$ mm, $\Delta N = 2$, $T = 293$ K.

a)

$$\frac{1}{2} m_e v^2 = e_0 U, \quad \lambda = \frac{h}{\sqrt{2m_e e_0 U}} = 0,253 \text{ nm}.$$

$$a \sin \vartheta = \lambda, \quad a = \frac{\lambda}{a \sin \vartheta} \approx \frac{\lambda l}{\Delta y} = 253 \text{ nm}.$$

b)

$$a \sin \vartheta_{\max} = N_{\max} \lambda, \quad N_{\max} = \frac{a \sin \vartheta_{\max}}{\lambda}, \quad \tan \vartheta_{\max} = \frac{s}{2l}$$
$$N_{\max} = 99,5.$$

Celotno število ojačitev:

$$N = 2N_{\max} + 1 = 200 \quad \text{ali} \quad 199.$$

Ker so spremembe majhne, lahko zapišemo:

$$\frac{\Delta N}{N} = -\frac{\Delta \lambda}{\lambda} = \frac{1}{2} \frac{\Delta U}{U}.$$

$$\Delta U = +0,48 \text{ V}.$$

c)

$$\frac{1}{2} m_n v^2 = \frac{3}{2} kT, \quad \lambda_n = \frac{h}{\sqrt{m_n 3kT}} = 0,147 \text{ nm}.$$

$$\Delta y' = \frac{l \lambda_n}{a} = 0,58 \text{ mm}.$$