KT1 Taavi Tammemäe

1

~~4.0 MeV =~~ $T_{töö} = \int F \cdot dr$

^{7}Li jääb seisma kui ta on andnud kõik oma kineetilise energia tööks et ületada vastu ^{238}U tuuma elektriväljа.

$$\int F \cdot dr = 4MeV$$

$$\int_{\infty}^{x} \frac{k q^2 Q}{r^2} \hat{r}\, dr = 4MeV \qquad \int_{\infty}^{x} \frac{8{,}99 \cdot 10^9 \cdot 2 \cdot 92}{r^2}$$

$$2{,}48 \cdot 10^{12} \int_{\infty}^{x} \frac{1}{r^2} dr = 2{,}48 \cdot 10^{12} \left(-\frac{1}{r}\right)\Big|_{\infty}^{x}$$

$$= 2{,}48 \cdot 10^{12} \left(-\frac{1}{x}\right) = 4MeV$$

$$x = \frac{+2{,}48 \cdot 10^{12}}{4MeV}$$

~~$x = +0{,}62 \cdot 10^{12}$~~

~~$x = 6{,}2 \cdot 10^{11}$~~

$x = 6{,}2 \cdot 10^{5} \cdot e$

$x = 9{,}9 \cdot 10^{-14}\ m$

$9{,}9 \cdot 10^{14}$ meetri kaugusele

2.

$p_1 = \sqrt{2mE_{k1}}$ $\quad p_2 = 0$ $\quad \begin{cases} x_0 y_0^2 = x_1 y_1^2 + x_2 y_2^2 \\ x_0 \cdot y_0 = x_1 y_1 + x_2 y_2 \end{cases}$

$E_1 = 5\ MeV$ $\quad E_2 = 0$

~~$v_1 + v_2 = v_3 + v_4$~~

$m_1 \cdot v_1 + m_2 \cdot v_2 = m_3 \cdot v_3 + m_4 \cdot v_4$

$$\begin{cases} m_1 \cdot v_1^2 = m_3 \cdot v_3^2 + m_4 \cdot v_4^2 \\ m_1 \cdot v_1 = m_3 \cdot v_3 + m_4 \cdot v_4 \end{cases}$$

Selle võrrandisüsteemis on kaks tundmatut st. v_3 ja v_4 ja kaks võrrandi + ehk võrrandisüsteem on lahendatav

lahendame esmane kineetiline energia jaoks

$$E_{k_3} = \frac{m_1 v_3^2}{2} = \frac{E_{k_1} m_1^2 - 2 E_{k_1} m_1 m_2 + E_{k_1} m_2^2}{m_1^2 + 2 m_1 m_2 + m_2^2}$$

arvutame väärtused: $E_{k3} = 4{,}6\ MeV$

$E_{k_4} = E_{k1} - E_{k3}$ $\quad E_{k4} = 0{,}4\ MeV$

Vastus: alfaosakese kineetiline energia pärast on 4,6 MeV ja 0,4 MeV

3.

a) $U = \frac{3 \cdot (1,6 \cdot 10^{-19} \cdot 94)^2}{20\pi \cdot 6,64 \cdot 10^{-15} \cdot 8,854 \cdot 10^{-12}}$

$U = 1,83709 \cdot 10^{-10}\ J$

b) ~~$U = 3 \cdot 11$~~ $U = \frac{1,83709 \cdot 10^{-10}\ J}{94^2}$

$U = 2,079 \cdot 10^{-14}\ J$

c) $^{239}_{94}Pu$

$B = \left((A-Z)m_n + Zm(H) - m\left({}^{A}_{Z}X\right)\right)c^2$

$B = (145 m_n + 94 m_n - 239,05216)c^2$

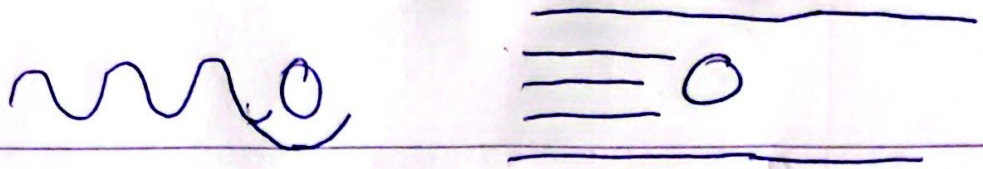
$B = (146,256 + 94,684 - 239,052)c^2$

$B = 1,888\, c^2$

$= 1,888 \cdot 931,49\ MeV = 1758,65\ MeV$

d) $\frac{B}{A} = \frac{1758,65}{239} = $ ~~$7,549\ MeV$~~ $7,358\ MeV$

e) —



4.

a) $\lambda = \frac{hc}{E}$ $\lambda = \frac{1240\ nm \cdot eV}{100\ MeV} = 1{,}240 \cdot 10^{-14}\ m$

b) kuime võtdleme kõige väikesema tuumaga

^1H nii saame

$^1H \Rightarrow 10^{15}\ m$

^1H diameeter $< 1{,}24 \cdot 10^{-14}$

seega elektronide lainepikkus on liiga suur.

5.

prootoni mass $m_p = 1{,}00727647$

$B = (m_n + m_p - m_D)c^2$

$2{,}2233\ MeV = (m_n + 1{,}00727647 - 2{,}01355321)uc^2$

~~931,49~~ / ~~2~~ $\neq$

$\frac{2{,}2233}{931{,}49} MeV = m_n - 1{,}00627674$

$m_n = 0{,}0023\ 8682 + 1{,}006276474$

$m_n = 1{,}00866356$

neutroni mass on 1,00866356

olgandmete bekanelt 5 tüvenumbrit

$m_n = 1{,}0087$

Scanned with CamScanner

6.

S^{33} neutronid paaritud
17 neutronit
kihis 1d 3/2

tuuma spinn on $I = 3/2$

^{41}K prootonid on paaritud
19 prootonit
kihis 1d 3/2

tuuma spinn on $I = 3/2$

^{43}Ca ~~proo~~ neutronid on paaritud
23 neutronit
kihis 1f 7/2
Tuuma spinn on $I = 7/2$

saadud tulemused on kooskõlas Google'ist leitavate eksperimentaalsete tulemustega.

~~7. 47 aastat   ennene 29 aastega~~
~~jäi alles 0,5~~
~~47 - 29 = 18~~
~~18/29 = 0,62   0,25 · 0,62 = 0,15517~~
~~0,5 - 0,15517 = 0,34483~~

~~34% on alles~~

7.

$$N(t) = N_0 \cdot \left(\frac{1}{2}\right)^{\frac{t}{T}}$$

$$N(47) = 1 \cdot \left(\frac{1}{2}\right)^{\frac{47}{29}}$$

$$N(47) = 0{,}32518$$

OBZu 33% Strontziumi on alles

8.

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9.

kasutame

$E = mc^2$

$Q = (m_u - m_p - m_e) \cdot c^2$

$Q = (1{,}00866492 - 1{,}00727647 - 0{,}00054857991)\,c^2$

$Q = 0{,}00083987013\ c^2u$

$Q = 0{,}00083987013 \cdot 931{,}49\ MeV$

$Q = 0{,}782330599449\ MeV$

ja see ongi maksimaalne kineetiline energia