To study the size of Uranium nucleus, we bombard the $_{92}U$ by α-particle, namely ^4_2He nucleus. How much energy of α-particle is required such that it can just reach the surface of the big Uranium nucleus without smashing the system?

$$R(^{238}U) = R_0 (238)^{\frac{1}{3}} = 1.07\,fm \cdot 238^{\frac{1}{3}} = 6.63\ fm$$

K.E. (initial α) + zero P.E (initial) = zero K.E (turning point) + P.E. (shortest pt.)

$$K.E. + 0 = 0 + \frac{kZ \cdot 2e^2}{R}$$

$$K.E. = \frac{9\times10^{9} \times 92 \times 2 (1.6\times10^{-19})}{6.63\times10^{-15}}\ eV = 4\times10^{7} eV = 40\ MeV$$

$$^4_2He + ^{14}_7N \longrightarrow ^{17}_8O + ^1_1H$$

What is the threshold energy of α-particle ?

^4_2He 4.00260 u

$^{14}_2N$ 14.00307 u

18.00567 u

$^{17}_8O = 16.99913 u$

$^1_1H = 1.00783 u$

18.00696 u

descrepancy

$0.00129 u = 1.20 MeV/c^2$

α particle must have at least 1.2 MeV to initiate the process.