64. $\quad x = 5\,mm$

$Pb, \quad \rho_{Pb} = 11{,}3\,\frac{g}{cm^3}, \quad z = 82$

$E = 42\,MeV$

$$E = E_0 \cdot e^{-\frac{x}{x_{rad}}} \approx E_0 \cdot e^{-1}$$

$$\frac{\Delta E_{rad}}{\Delta E_{ion}} = \frac{z \cdot E}{800} = \frac{82 \cdot 42}{800} \approx 5$$

$$42 = 0{,}3678 \cdot E_0$$

$$E_0 = 114\,MeV$$

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27. $\quad r = 4\,fm = 4 \cdot 10^{-15}\,m \qquad Q(SFERA) = 0$

$1p$ — jedan proton

$$Q_2 = Q_2(SFERA) + Q_2(p) = Q_2(p)$$

$$\rho = \frac{Q}{V} = \frac{e}{V} \quad (\text{naboj protona})$$

$$\dot{\theta} = \frac{\Pi}{2}$$

$$Q_2 = \frac{1}{e} \cdot \frac{e}{V} \cdot r^2 \left(\frac{3}{2} \cos^2 \frac{\Pi}{2} - \frac{1}{2} \right) \cdot V$$

$$Q_2 = -\frac{r^2}{2} = -\frac{1}{2} \cdot 16 \cdot 10^{-30}\,m^2 = -8 \cdot 10^{-30}\,m^2$$

28. $\quad {}^{209}_{33}Bi \qquad r_0 = 1{,}07 \cdot 10^{-15}$

$$Q_2 = -\frac{r_0^2 \cdot A^{1/3}}{2} = -\frac{1}{2} \cdot (1{,}07)^2 \cdot 10^{-30} \cdot 209^{1/3} = 29{,}2\,fm^2$$

29. $\quad {}^{176}_{21}Lu$

$Q_2 = 700\,fm^2$

$\eta z = ?$ (efektivni broj protona)

$$Q_2 = \frac{4}{5} Z \eta R^2 \qquad R = 1{,}2 \cdot A^{1/3} \cdot 10^{-15} \Rightarrow R^2 (1{,}2)^2 \cdot 176^{2/3} \cdot 10^{-30}$$

$$\eta z = \frac{5}{4} Q_2 \cdot \frac{1}{R^2} = \frac{5}{4} \cdot 700 \cdot \frac{1}{(1{,}2)^2 \cdot 176^{2/3}} = 20$$