1) $\beta = \left[1 - \frac{m_0c^2}{m_0c^2 + (E/A)}\right]^{1/2} = \left[1 - \frac{931.5}{931.5 + 10}\right]^{1/2} = 0.1031$

$\gamma = \frac{1}{(1-\beta^2)^{1/2}} = \frac{1}{(1 - 0.1031^2)^{1/2}} = 1.0005$

2) $-\frac{dE}{dx} = 0.3071 \frac{MeV\,cm^2}{g} \rho \frac{Z_t}{A} \frac{q^2}{\beta^2} \left[\ln\left(\frac{W_{max}}{I}\right) - \beta^2\right]$

$= 0.3071 \frac{MeV\,cm^2}{g} \left(1.85 \frac{g}{cm^3}\right) \frac{4 \times 2.0^2}{9.0 (0.103)^2} \left[\ln\left(\frac{W_{max}}{I}\right) - 0.1031^2\right]$

$= 9502 \frac{MeV}{cm} \left[\ln\left(\frac{2 * 0.511 + (1.005 \times 0.103)^2 \times 10^6\ eV}{(7 + 12\times4)\ eV}\right) - 0.0106\right]$

($(7 + 12\times4)\ eV = 55 eV$)

$= 9502\ MeV/cm \left[\ln(199.1) - 0.0106\right] = 5.02 \times 10^4 \frac{MeV}{cm}$

($\ln(199.1) = 5.2933$)

3) $\Delta E = \frac{dE}{dx} \Delta x = 5.02 \times 10^4 \frac{MeV}{cm} \times 10 \mu m \times 10^{-4} \frac{cm}{\mu m} = 50.2\ MeV$

4) $\frac{\Delta E}{\Delta t} = \Delta E * \frac{Part}{sec} = 50.2 MeV \times 1.00 \times 10^{-9} \frac{Coul}{sec} \times \frac{1\ particle}{20 \times 1.602 \times 10^{-19} coul}$

(3.12×10^8 P/s; $20 \times 1.602 \times 10^{-19} coul = 3.20 \times 10^{-18} coul$)

$= 1.57 \times 10^{10}\ MeV/s = 1.57 \times 10^{16} \frac{eV}{s}$

5) $Power = \frac{\Delta E}{\Delta t} = 1.57 \times 10^{16} \frac{eV}{s} \times 1.602 \times 10^{-19} \frac{J}{eV} = 2.51 \times 10^{-3} \frac{J}{s}$ or Watts

6) $\frac{\Delta T}{\Delta t} = \frac{Power}{C_p} = \frac{2.51 \times 10^{-3} W}{1.82 \frac{J}{gK} \times 1.85 \frac{g}{cm^3} \times 5 \times 2.5 \times 10^{-3} cm} = \frac{2.51 \times 10^{-3} J/s}{4.22 \times 10^{-2} J/K}$

($1.85 \frac{g}{cm^3} \times 5 \times 2.5 \times 10^{-3} cm = 2.31 \times 10^{-2} g$)

$= 5.95 \times 10^{-2}\ K/s$

or $3.6\ K/min$ or $214\ K/hr$