\[ a, b) \Delta \omega c = \omega \left( \frac{\Delta \omega}{c} \right) = 2 \omega \frac{\Delta \omega}{c} \]

\[ = (3727.38 - 2 \times 1875.61) \text{MeV} \]

\[ = -22.8 \text{ MeV} \]

\[ 1 \text{u} = 931.5 \text{MeV/c}^2 \quad \therefore \Delta m = -0.025 \text{u} \]

c) \[ P = E = \frac{N \Delta \omega c^2}{\hbar} \]

\[ N = \frac{P c}{\Delta \omega c^2} = \frac{1 \text{J}}{23.8 \text{MeV}} \times 23.8 \text{MeV} \]

\[ = \frac{1 \text{J}}{1.6 \times 10^{-19} \text{J}} \times 23.8 \times 10^6 \text{eV} \]

\[ = 2.6 \times 10^{11} \]

\[ \text{d, g) } P = 500 \text{ MeV/c} \]

\[ E = 17.46 \text{ MeV} \]

\[ E = P c^2 + \omega c^4 \quad \therefore \Delta \omega c^2 = \sqrt{E^2 - P c^2} = 1673 \text{ MeV} \]

\[ E = \frac{m \omega c^2}{\gamma} \quad \therefore \gamma = \frac{17.46}{1673} \]

\[ \frac{\omega c}{\gamma} = \sqrt{1 - \frac{1}{\gamma^2}} = 0.25 \]