32. (a) Since $K = \frac{1}{2}mv^2 = \frac{1}{2}m(2\pi R f_{\text{osc}})^2 \propto m$,

$$K_p = \left(\frac{m_p}{m_d}\right) K_d = \frac{1}{2} K_d = \frac{1}{2}(17\,\text{MeV}) = 8.5 \text{ MeV} .$$

(b) We require a magnetic field of strength

$$B_p = \frac{1}{2} B_d = \frac{1}{2}(1.6\,\text{T}) = 0.80 \text{ T} .$$

(c) Since $K \propto B^2/m$,

$$K_p' = \left(\frac{m_d}{m_p}\right) K_d = 2K_d = 2(17\,\text{MeV}) = 34 \text{ MeV} .$$

(d) Since $f_{\text{osc}} = Bq/(2\pi m) \propto m^{-1}$,

$$f_{\text{osc},\,d} = \left(\frac{m_d}{m_P}\right) f_{\text{osc},\,p} = 2(12 \times 10^6\,\text{s}^{-1}) = 2.4 \times 10^7 \text{ Hz} .$$

(e) Now,

$$\begin{aligned} K_\alpha &= \left(\frac{m_\alpha}{m_d}\right) K_d = 2K_d = 2(17\,\text{MeV}) = 34\,\text{MeV} , \\ B_\alpha &= \left(\frac{m_\alpha}{m_d}\right)\left(\frac{q_d}{q_\alpha}\right) B_d = 2\left(\frac{1}{2}\right)(1.6\,\text{T}) = 1.6\,\text{T} , \\ K_\alpha' &= K_\alpha = 34\,\text{MeV} \qquad (\text{Since } B_\alpha = B_d = 1.6\,\text{T}) , \end{aligned}$$

and

$$f_{\text{osc},\,\alpha} = \left(\frac{q_\alpha}{a_d}\right)\left(\frac{m_d}{m_\alpha}\right) f_{\text{osc, d}} = 2\left(\frac{2}{4}\right)\left(12 \times 10^6\,\text{s}^{-1}\right) = 1.2 \times 10^7 \text{ Hz} .$$